

BOARD STAFF INTERROGATORY #47

INTERROGATORY

ISSUE: B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

a. Is the depreciation amount appropriate?

Evidence Ref: D1/T5/S1

Do the proposed depreciation rates contain an excess amount that will continue to increase the long-term liability for SRC on the corporation's balance sheet?

RESPONSE

No. The portion of the proposed depreciation rates that is applicable to the funding of the SRC is the amount that is considered to be the appropriate level of funding at this time. However, it should be noted that the depreciation rate do include the level of funding that is considered to be appropriate at this time.

Witnesses: B. Yuzwa
L. Kennedy - Gannett Fleming

BOARD STAFF INTERROGATORY #48

INTERROGATORY

ISSUE: B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?

Evidence Ref: D1/T5/S1

Will the proposed depreciation rates recover only the underlying economic value of the related fixed assets during the rate period? Please explain.

RESPONSE

The depreciation rates are structured to recover only the estimated annual consumption of service value over the rate period. The service value is defined as the original installed cost of assets adjusted for the estimated cost of removal and site restoration calculated in accordance with the CDNS method.

Witnesses: B. Yuzwa
L. Kennedy - Gannett Fleming

BOARD STAFF INTERROGATORY #49

INTERROGATORY

ISSUE: B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

a. Is the depreciation amount appropriate?

Evidence Ref: D1/T5/S1

[EB-2011-0354/D2/T2/S1/Page 40]

Please discuss the choice of average service life procedure ("ASL") by Enbridge, versus equal life group procedure ("ELG"), since Gannett Fleming, in its depreciation study as of December 31, 2010, has stated that "the ELG procedure provides a superior match of the consumption of service values of the assets in service to the depreciation expense".

RESPONSE

Gannett Fleming believes that the ELG procedure does provide for a superior matching of the consumption of service values of assets in service to the depreciation expense component of the revenue requirement. However, conversion to the ELG procedure will result in an increase to the depreciation rates when implemented in utilities with a mature asset base. Furthermore, the practices of the regulatory jurisdiction and practices of the utility must be considered. Utilities in Ontario and a number of other jurisdictions have had a long standing history of use of the ASL life method. In the preparation of the Gannett Fleming depreciation studies as of December 31, 2010, Gannett Fleming was not aware of any specific regulatory, operational or legislative reason to recommend a change to the ELG procedure at that time. Consistent with this long standing EGD and Board practice, Gannett Fleming has incorporated the use of the ASL procedure in the calculation of the depreciation rates.

Witnesses: B. Yuzwa
L. Kennedy - Gannett Fleming

BOARD STAFF INTERROGATORY #50

INTERROGATORY

ISSUE: B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

Evidence Ref: D1/T3/S1/ Para 7 O&M Budget Components Table 1

Please provide a table showing actual O&M for the years 2002 through 2012, 2013 Board-approved, 2013 latest forecast available, and the 2014 to 2018 forecast.

RESPONSE

Please see the table on the next page. For the years 2002 to 2006, Enbridge did not report O&M budgets in this structure, hence only the total net utility O&M expense is available for those years.

Witnesses: S. Kancharla
R. Lei
M. Torriano

Witnesses:

S. Kancharla
R. Lei
M. Torriano

Enbridge Gas Distribution
Summary of Operating and Maintenance Expense by Category
From 2007 Actuals to 2018 Budget

Line No.	Categories (\$ Millions)		Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16	Col. 17	Col. 18
			Actual 2002	Actual 2003	Actual 2004	Actual 2005	Actual 2006	Actual 2007	Actual 2008	Actual 2009	Actual 2010	Actual 2011	Actual 2012	Board Approved 2013	Forecast 2013	Budget 2014	Budget 2015	Budget 2016	Budget 2017	Budget 2018
1.	Customer Care/CIS Service Charges							\$84.4	\$82.5	\$87.5	\$87.5	\$79.2	\$85.8	\$89.4	\$83.7	\$92.6	\$96.5	\$100.4	\$104.4	\$108.5
2.	Demand Side Management ("DSM") ⁽¹⁾						22.0	23.1	24.3	25.5	26.7	28.1	31.6	31.6	31.6	32.2	32.8	33.5	34.2	34.9
4.	Pension and OPEB Costs						4.3	4.7	5.9	7.2	6.5	24.3	24.3	42.8	42.9	37.2	33.8	30.9	28.5	26.2
3.	Regulatory Cost Allocation Methodology("RCAM")						18.1	19.1	21.2	24.3	26.7	31.6	32.1	32.1	32.1	35.3	34.0	33.8	34.8	35.9
5.	Other O&M						193.2	194.0	198.2	202.2	221.4	224.0	224.0	219.2	235.3	228.0	231.5	241.0	248.5	256.3
6.	Total Net Utility O&M Expense		\$246.4	\$282.8	\$295.9	\$295.5	\$311.5	\$322.0	\$323.4	\$337.0	\$346.7	\$360.5	\$393.8	\$415.1	\$425.5	\$425.3	\$428.5	\$439.5	\$450.5	\$461.8

⁽¹⁾ 2013 DSM reflects the final Board approved amount

BOARD STAFF INTERROGATORY #51

INTERROGATORY

ISSUE: B17f: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

f. Is the Other Revenues amount appropriate?

Evidence Ref: C1/T4/S1/ Late Payment Revenues

Please provide an update of 2013 Late Payment Revenues showing the 2013 Board approved amount and the latest 2013 full year forecast of LPP revenue.

RESPONSE

Please see the Company's response to VECC Interrogatory #15 found at Exhibit I.B17.EGDI.VECC.15, parts (a) and (b).

Witnesses: S. McGill
M. Torriano

CCC INTERROGATORY #20

INTERROGATORY

Issue B17 – Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate including:

Operating Costs

(Ex. A2/T1/S2/p. 5) The evidence states that the passage and implementation of Bill 8 – the Underground Infrastructure Notification System Act – is expected to drive higher requests for locates and that the costs for locates escalated by inflation may not be adequate to cover the increasing demand. Please explain the nature of this legislation and how it impact EGD's demand for locates. What is the current level of costs for locates included in 2013 rates? What is the expected level in each year 2014-2016?

RESPONSE

The *Ontario Underground Infrastructure Notification System Act* establishes Ontario One Call Inc. as the mandatory One Call centre for Ontario. It requires all owners of underground infrastructure in or near the public right-of-way to become members of Ontario One Call and provide whatever mapping and other information is required by Ontario One Call. When a member of Ontario One Call receives information about a proposed excavation or dig the member is required to mark the location of its underground infrastructure that may be affected by the dig, or indicate that its underground infrastructure will not be affected by the excavation or dig. The Act also requires excavators to obtain information respecting underground infrastructure before beginning an excavation or dig. The Act creates offences for failure to comply with the Act or regulations made under it.

The primary objective of the Act is to improve public and worker safety by reducing the frequency of instances where an excavator does not call for locates before an excavation or dig. Excavators are not only incented to comply due to the punitive measures in the Act, but also by its creation of a streamlined process with a single phone number. Thus, there are expected costs pressures caused by an increasing number of calls to Ontario One Call, and an increasing number of locates provided due to these calls. This is because the Act is compelling previously non-compliant excavators to start requesting locates.

Witnesses: L. Lawler
J. Sanders

The following table identifies the expected level of O&M spend within the budget associated with external locate service providers from 2014 to 2016:

<u>2013</u> (\$ 000)	<u>2014 Forecast</u> (\$ 000)	<u>2015 Forecast</u> (\$ 000)	<u>2016 Forecast</u> (\$ 000)
13,050	14,166	14,482	14,809

There is, however, a concern that actual costs will be higher. That will have to be accommodated through productivity savings elsewhere.

Witnesses: L. Lawler
J. Sanders

CCC INTERROGATORY #21

INTERROGATORY

Issue B17 – Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate including:

Operating Costs

(Ex. A2/T1/S3/p. 8) For each year 2014-2016 EGD has established Operating Cost budgets. The evidence indicates that productivity savings are embedded in each of those budgets. Please provide the forecasts of O&M in each of those years excluding the productivity savings.

RESPONSE

Please refer to the following table for the forecasts of O&M in each of those years excluding the savings.

Line No.	Categories (\$ Millions)	Col. 1	Col. 2	Col. 3
		Budget <u>2014</u>	Budget <u>2015</u>	Budget <u>2016</u>
1.	Customer Care/CIS Service Charges	\$92.6	\$96.5	\$100.4
2.	Demand Side Management ("DSM")	32.2	32.8	33.5
3.	Pension and OPEB Costs	37.2	33.8	30.9
4.	Regulatory Cost Allocation Methodology("RCAM")	35.3	34.0	33.8
5.	Other O&M (Excluding Productivity Savings)	252.1	261.6	276.6
6.	Total Net Utility O&M Expense	<u>\$449.4</u>	<u>\$458.6</u>	<u>\$475.1</u>

The budget process did not isolate amounts from prioritization pacing and productivity for identifying the O&M savings. The savings for each year included within Line 5 are:

2014: \$24.1 million

2015: \$30.1 million

2016: \$35.6 million

Details of these savings are set out in the response to Board Staff Interrogatory #19 found at Exhibit I.A2.EGDI.STAFF.19.

Witnesses: R. Fischer
S. Kancharla
M. Lister

CCC INTERROGATORY #22

INTERROGATORY

Issue B17 – Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate including:

Operating Costs

(Ex. D1/T3/S1/p. 7) Outside Services are increasing significantly from 2015 to 2016. Please provide an explanation for this increase.

RESPONSE

The Work and Asset Management Solution (“WAMS”) is expected to go-live in December 2015. The Company plans to internally operate, host and support the application, similar to, what Enbridge did with the Customer Information System (“CIS”) application. Therefore, the Company will incur \$4.1 million for WAMS hosting and support cost as part of O&M costs in 2016. The details can be found in evidence at Exhibit D1, Tab 14, Schedule 1, page 3, paragraph 11.

Witnesses: S. Kancharla
R. Lei
M. Torriano

CCC INTERROGATORY #23

INTERROGATORY

Issue B17 – Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate including:

Operating Costs

(Ex. D1/T3/S1/p. 9) Please provide the O&M budgets that were presented to the EMT in April 2013.

RESPONSE

The 1st iteration initial budget in Column 1 on Table 3 at Exhibit D1, Tab 3, Schedule 1, page 11 are the O&M budgets that were presented to the EMT in April 2013.

Witnesses: S. Kancharla
R. Lei
M. Torriano

CCC INTERROGATORY #24

INTERROGATORY

Issue B17 – Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate including:

Operating Costs

(Ex. D1/T18.S1/p. 7) Please provide a detailed budget for all items included in the Sponsorships, donations and memberships component of the Regulatory and Government and Public Affairs Budget. Please provide the actual numbers for each item incurred in each year 2007-2013.

RESPONSE

The attached Table-A outlines the sponsorships, donations and memberships components within the Regulatory and Government and Public Affairs budgets for each of 2007 to 2012 actuals and a 2013 9+3 estimate.

The donation amounts shown in Table-A, are eliminated in determining Utility Income and Allowed Revenue, as can be seen within Exhibits D3, D4 and D5, Tabs 1, Schedules 1, page 5 for 2014, 2015 and 2016. Similar elimination of donation costs occurs in all annual calculations of Utility Income and Allowed revenue whether budget, forecast or actual.

For annual trade memberships, prior to 2012 Government and Public Affairs were not grouped from an organization perspective with Regulatory Affairs. For 2012 to 2016 the items within trade memberships are found within the response to FRPO Interrogatory #6, found at Exhibit I.B17.EGDI.FRPO.6.

Major elements included within the category of sponsorships are, Low income Energy Assistance Program funding, United Way, Environment (Pollution Probe, Energy Probe Smart Commute), Junior Achievement and Healthcare & Community.

Witnesses: A. Creery
K. Culbert
R. Small

Table-A

Regulatory Affairs & Government and Public Affairs	2007	2008	2009	2010	2011	2012	2013 (9&3)	2014B	2015B	2016B
	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)
CORPORATE DONATIONS	638,957	423,017	354,826	1,178,998	2,770,916	896,676	688,500	698,725	714,284	730,400
POLITICAL DONATIONS	74,510	39,468	52,655	46,794	28,945	14,333	50,000	50,000	51,115	52,270
SPONSORSHIPS	1,157,107	1,298,080	1,752,816	1,784,252	2,127,847	1,149,605	2,805,250	2,808,450	2,871,064	2,935,933
TRADE AND CIVIC MEMBERSHIPS	25,063	(4,808)	19,481	12,589	16,144	540,971	722,662	722,662	738,769	755,456
	1,895,637	1,755,757	2,179,778	3,022,633	4,943,852	2,601,585	4,266,412	4,279,837	4,375,232	4,474,059

Witnesses: A. Creery
K. Culbert
R. Small

CME INTERROGATORY #13

INTERROGATORY

Issue: B17

Reference: Exhibit F1, Tab 1, Schedule 1, page 3

The "Board Approved Revenue Requirement" for 2013 and "Revenue Requirements" for the years 2014, 2015 and 2016 are shown at line 10 of Table 1. Revenue at Existing Rates for each of those years is shown at line 1 of the Table. In connection with this evidence, please provide the following:

- (a) Please provide the actual revenue (deficiency) / sufficiency calculation for 2013 using nine (9) months actual and three (3) months forecast information. If there is a revenue sufficiency for 2013, then please explain its causes.
- (b) Please explain how the Revenue at Existing Rates in line 1, column (a) of \$2,364.1M increases to \$2,572.3M in 2014.
- (c) Please explain how the Revenue at Existing Rates for 2014 of \$2,572.3M at line 1, column (b) less the Revenue Sufficiency at line 11, column (b) of \$9.7M operates to produce a Revenue at Existing Rates in 2015 of \$2,635.8M at line 1, column (c).
- (d) Please explain how the Revenue at Existing Rates for 2015 of \$2,635.8M at line 1, column (c) plus the Revenue Deficiency of \$29.1M at line 11, column (c) operates to produce a Revenue at Existing Rates in 2016 of \$2,683.4M at line 1, column (d).

RESPONSE

- a) EGD is not in a position to complete a 2013 9+3 forecast Utility earnings and related revenue requirement calculation.
- b) 2013 Board Approved revenues at existing rates, of \$2,364.1M, increases to \$2,572.3M in the originally filed 2014 results due to the following:

Witness: K. Culbert

- 2014 forecast revenues at existing rates were calculated utilizing 2013 approved rates established in the April 1, 2013 Quarterly Rate Adjustment Mechanism (“QRAM”) proceeding, EB-2013-0045, which approved a Purchased Gas Variance Account (“PGVA”) reference price of \$182.930 per 10^3m^3 , whereas 2013 Board Approved revenues were calculated utilizing 2012 approved rates established in the April 1, 2012 QRAM proceeding, EB-2012-0054, which approved a PGVA reference price of \$157.882 per 10^3m^3 . Therefore the commodity component of revenues is priced at a higher rate in the 2014 forecast.
 - 2014 forecast revenues at existing rates are based on a higher average number of customers, due to 2014 forecast customer additions. A higher number of customers results in additional revenues recovered through the monthly fixed charge component of rates.
 - 2014 forecast revenues at existing rates also reflects a further migration of T-service customers to Sales customers. The migration combined with customer additions results in additional commodity (volume) revenues in 2014, as compared to 2013 Board Approved revenues.
- c) Revenue at existing rates for 2014, of \$2,572.3M, increases to \$2,635.8M in 2015 as a result of a higher average number of customers, due to forecast 2015 customer additions, and higher commodity (volume) revenues, due to customer additions and further forecast migration from T-service to sales customers. Revenues in both years of the originally filed evidence are based on 2013 approved rates established in the April 1, 2013 QRAM proceeding, EB-2013-0045, which approved a (“PGVA”) reference price of \$182.930 per 10^3m^3 . The 2015 forecast of revenue at existing rates, in Exhibit F1, Tab, 1, Schedule 1, page 3, does not reflect or account for the forecast 2014 sufficiency of \$9.7M, and as such the 2015 deficiency of \$29.1M is a cumulative amount.
- d) Revenue at existing rates for 2015, of \$2,635.8M, increases to \$2,683.4M in 2016 as a result of a higher average number of customers, due to forecast 2016 customer additions, and higher commodity (volume) revenues, due to customer additions and further forecast migration from T-service to sales customers. Revenues in both years of the originally filed evidence are based on 2013 approved rates established in the April 1, 2013 QRAM proceeding, EB-2013-0045, which approved a (“PGVA”) reference price of \$182.930 per 10^3m^3 . The 2016 forecast of revenue at existing rates, in Exhibit F1, Tab, 1, Schedule 1, page 3, does not reflect or account for the forecast 2015 deficiency of \$29.1M, and as such the 2016 deficiency of \$119.7M is a cumulative amount.

Notes regarding Updated Exhibit F1, Tab 1, Schedule 1:

- 2014 forecast revenues at existing rates decline to \$2,497.9M, in Updated Exhibit F1, Tab 1, Schedule 1, as compared to the \$2,572.3M shown in the originally filed exhibit because they are now calculated utilizing 2013 approved rates equivalent to those established in the October 1, 2013 ("QRAM") proceeding, EB-2013-0295, which approved a ("PGVA") reference price of \$176.606 per 10^3m^3 . Therefore the commodity component of the updated 2014 revenues is priced at a lower rate than in the originally filed 2014 forecast.
- 2015 through 2018 forecast revenues at existing rates continue to be calculated utilizing 2013 approved rates equivalent to those established in the April 1, 2013 ("QRAM") proceeding, EB-2013-0045, which approved a ("PGVA") reference price of \$182.930 per 10^3m^3 .
- The increase in 2017 forecast revenues at existing rates, over 2016 forecast revenues (\$2,693.2M vs. \$2,683.4M), is due to forecast 2017 customer additions and the corresponding increase in revenues from monthly fixed charges. The increase in 2018 forecast revenues at existing rates, over 2017 forecast revenues (\$2,703.3M vs. \$2,693.2M), is due to the same reason. 2017 and 2018 volumes were held constant with 2016.

CME INTERROGATORY #14

INTERROGATORY

Issue: B17

Reference: Exhibit FI, Tab 1, Schedule 1, page 3
Exhibit FI, Tab 1, Schedule 3, Appendix A, pages 1 to 4

The evidence indicates that the revenue deficiencies for 2015 to 2018 inclusive are \$29.1M, \$119.7M, \$166.1M and \$215.7M respectively. We calculate the total rate increases EGDI is seeking over the four (4) years 2015 to 2018, before adjustments and updates, to be \$530.6M, or, on average, about \$132.65M per year.

- (a) Please list and briefly describe the causes of these escalating year-over-year revenue deficiencies for 2015 over 2014, 2016 over 2015, 2017 over 2016 and 2018 over 2017.
- (b) Do these amounts include or exclude the credit for Site Restoration Costs ("SRC")?

RESPONSE

- a) Table A on the following page, shows the cumulative Allowed Revenue sufficiency or (deficiency) major elements or causes.
- b) The amounts shown exclude the proposed SRC-related amount of \$259.8 million to be credited directly as a rate rider. However, the amounts do include the impacts of the proposed change in depreciation rates as per the Gannett Fleming Net Salvage study at Exhibit D2, Tab 1, Schedule 1, and include the impact of tax deductions associated with the rate rider credit proposal.

Witness: K. Culbert

TABLE A -----EGD UPDATED ALLOWED REVENUE
AND SUFFICIENCY / (DEFICIENCY)
2014 - 2018 FISCAL YEARS

	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Line No.	2014 Total	2015 Total	2016 Total	2017 Total	2018 Total
	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)
<u>Elements of sufficiency / (deficiency)</u>					
1. CIS/Customer Care Agreement	(3.9)	(8.5)	(13.3)	(18.4)	(23.6)
2. GTA project revenue requirement	-	(7.0)	(58.8)	(58.7)	(58.6)
3. WAMS revenue requirement	-	8.6	(6.3)	(15.9)	(18.1)
4. Ottawa reinforcement revenue requirement	(5.0)	(4.8)	(4.8)	(4.8)	(4.8)
5. Constant Dollar Depr. Method / SRC change impacts (excl. rate rider)	61.9	55.9	52.2	44.2	27.2
6. ROE increase (gross) on base rate base	(6.8)	(15.9)	(23.9)	(24.9)	(26.9)
7. ROE increase (gross) on other rate base growth (excl. other major drivers)	(8.2)	(16.1)	(23.6)	(31.2)	(38.2)
8. Cost of capital (excl. ROE) change on base rate base	6.3	5.9	6.7	7.3	5.8
9. Cost of capital (excl. ROE) on other rate base growth (excl. other major drivers)	(6.2)	(11.8)	(16.5)	(21.5)	(26.5)
<u>O&M increases (excl. Customer Care)</u>					
10. DSM	(0.8)	(1.4)	(2.1)	(2.8)	(3.5)
11. Pension and OPEB	5.6	9.0	11.9	14.3	16.6
12. Other O&M	(12.0)	(14.2)	(23.5)	(32.1)	(40.9)
13. Municipal taxes	(1.9)	(3.8)	(6.2)	(8.6)	(11.1)
14. Fixed financing charges	0.4	0.4	0.4	0.4	0.4
15. Depreciation increase on "other" rate base growth (excl. other major drivers)	(11.7)	(24.4)	(35.1)	(45.7)	(56.0)
16. All other incl. changes in volumes, margin, supply mix, tax adds, tax deducts, interest tax shield, etc.	13.5	(1.0)	23.2	32.3	42.5
17. Sufficiency / (Deficiency) -cumulative	<u>31.2</u>	<u>(29.1)</u>	<u>(119.7)</u>	<u>(166.1)</u>	<u>(215.7)</u>

Witness: K. Culbert

ENERGY PROBE INTERROGATORY #13

INTERROGATORY

Ref: Exhibit A2, Tab 1, Schedule 1, page 25

Please compare EGD's forecasted O&M budget for 2014 through 2016 to the budget level that would be expected under the I - X framework that existed for 2008 through 2012 if it only applied to O&M expenses. In particular, please use the most recent actual GDPIPIFDD figures from 2013 for 2014 (as would have been used under the 2008 through 2012 plan) and assume a 2% increase in the inflation factor for each of 2015 and 2016. Please also use the inflation coefficient of 0.45 that was used in 2012 to determine the total I - X factor. Please provide the results on a year to year basis as an additional line to the table provided on page 22.

RESPONSE

Please see the table below.

Witnesses: R. Fischer
M. Lister

Line		Board	Budget	Budget	Budget	2014 vs.	2015 vs.	2016 vs.
No.	Categories (Millions)	2013	2014	2015	2016	2013	2014	2015
A	<u>As filed</u>							
1.	Customer Care/CIS Service Charges	89.4	92.6	96.5	100.4	3.2	3.9	3.9
2.	Demand Side Management (DSM)	31.6	32.2	32.8	33.5	0.6	0.6	0.7
3.	Pension and OPEB costs	42.8	37.2	33.8	30.9	(5.6)	(3.5)	(2.9)
4.	Regulatory Cost Allocation Methodology	32.1	35.3	34.0	33.8	3.2	(1.3)	(0.2)
5.	Other O&M	219.2	228.0	231.5	241.0	8.8	3.5	9.5
6.	Total Net Utility O&M Expense	415.1	425.3	428.5	439.5	10.2	3.2	11.0
B	<u>O&M Budget level that would be expected under I-X framework</u>							
1.	Customer Care/CIS Service Charges	89.4	92.6	96.5	100.4	3.2	3.9	3.9
2.	Demand Side Management (DSM)	31.6	32.2	32.8	33.5	0.6	0.6	0.7
3.	Pension and OPEB costs	42.8	37.2	33.8	30.9	(5.6)	(3.5)	(2.9)
4.	Regulatory Cost Allocation Methodology	32.1	35.3	34.0	33.8	3.2	(1.3)	(0.2)
5.	Other O&M	219.2	220.9	222.9	224.9	1.7	2.0	2.0
6.	Total Net Utility O&M Expense	415.1	418.2	419.9	423.4	3.1	1.7	3.5
C	Variance (B-A)	-	(7.1)	(8.6)	(16.1)	(7.1)	(1.5)	(7.5)
Assumptions:								
<u>I-X Escalation</u>								
GDPIPI (assume 2% increase in 2015 & 2016)			1.70%	2.00%	2.00%			
Inflation coefficient			0.45	0.45	0.45			
Net Escalation			0.77%	0.90%	0.90%			
Escalation applied to other O&M only								

Witnesses: R. Fischer
M. Lister

ENERGY PROBE INTERROGATORY #14

INTERROGATORY

Ref: Exhibit C1, Tab 4, Schedule 1

- a) Please provide a version of Table 1 that includes actual data for 2011, 2012 and updates the 2013 Board Approved forecast to reflect the most recent year-to-date figures for 2013, along with a forecast for the remainder of 2013. Please also include the forecasts for 2015 and 2016 in the requested table.
- b) Please provide the most recent year-to-date late payment penalty for 2013 and the figure for the corresponding period for 2012.

RESPONSE

- a) Please see the Company's response to VECC Interrogatory #15, found at Exhibit I.B17.EGDI.VECC.15a, part (a).
- b) The Company's 2013 9 & 3 Estimate for Late Payment Penalty Revenues is \$10.2 million. The corresponding figure for 2012 was \$9.5 million.

Witnesses: S. McGill
M. Torriano

ENERGY PROBE INTERROGATORY #15

INTERROGATORY

Ref: Exhibit C1, Tab 5, Schedule 1

- a) Please update the evidence, including appendices, to reflect the latest proposals affecting Rate 332.
- b) How has EGD reflected the forecast of revenues from Rate 332 in 2015 and 2016?

RESPONSE

- a) As per Board Staff Interrogatory #43, found at Exhibit I.A12.EGDI.STAFF.43, the Company proposes to update its evidence concerning the GTA project once the Board has issued a Decision within the EB-2012-0451 Leave-to-Construct proceeding.
- b) The forecast of revenues from Rate 332 have been included in the Revenue Requirement as shown at Exhibit H3, Tab 1, Schedule 1, paragraph 3 outlines the 2015 Allowed Revenue and paragraph 7 outlines the 2016 Allowed Revenue estimate.

Witnesses: K. Culbert
C. Fernandes
A. Kacicnik

ENERGY PROBE INTERROGATORY #16

INTERROGATORY

Ref: Exhibit D1, Tab 3, Schedule 1

There are numerous references to the rate of inflation in setting O&M costs. Please provide the forecast of inflation used for budgeting purposes for each of 2013 through 2016.

RESPONSE

Please see response to CME Interrogatory #6, found at I.A2.EGDI.CME.6.

Witnesses: S. Kancharla
R. Lei
M. Torriano

ENERGY PROBE INTERROGATORY #17

INTERROGATORY

Ref: Exhibit D1, Tab 3, Schedule 1

- a) Please add a column to Table 2 that shows actual expenditures in 2012.
- b) Please provide the most recent year-to-date actual expenditures for 2013 in the same level of detail as found in Table 2. Please also provide the 2012 expenditures for the same year-to-date period.

RESPONSE

a and b) Please see the tables provided on the following pages.

Witnesses: S. Kancharla
R. Lei
M. Torriano

Enbridge Gas Distribution
Other Operating and Maintenance Expense by Cost Type
2012 Actuals to 2016 Budget

Line No.	Particulars (\$ millions)	Board					2013 vs. 2012	2014 vs. 2013	2015 vs. 2014	2016 vs. 2015
		Actuals	Approved	Budget	Budget	Budget				
		<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>				
		(a)	(b)	(c)	(d)	(e)	(b)-(a)	(c)-(b)	(d)-(c)	(e)-(d)
1.	Salaries and Wages	\$153.7	\$167.7	\$170.6	\$174.6	\$179.0	\$13.9	\$2.9	\$4.0	\$4.4
2.	Benefits	23.5	25.3	25.8	26.4	26.9	1.8	0.5	0.6	0.6
3.	Short Term Incentive Program	23.2	20.7	21.2	21.6	22.1	(2.5)	0.5	0.5	0.5
4.	Employee Training and Development	4.7	4.8	5.0	4.8	4.8	0.1	0.2	(0.2)	0.0
5.	Materials and Supplies	4.2	5.3	5.2	5.2	5.3	1.1	(0.1)	0.1	0.1
6.	Outside Services	83.4	83.7	86.1	85.7	91.2	0.3	2.4	(0.4)	5.5
7.	Consulting	6.2	5.1	4.7	4.9	5.2	(1.1)	(0.4)	0.1	0.3
8.	Repairs and Maintenance	3.7	2.3	2.4	2.4	2.4	(1.3)	0.0	0.0	0.0
9.	Fleet	9.4	10.2	10.4	10.5	10.7	0.8	0.1	0.2	0.2
10.	Rents and Leases	7.2	7.3	7.4	7.5	7.8	0.1	0.0	0.1	0.3
11.	Telecommunications	3.5	3.6	3.7	3.8	3.9	0.1	0.1	0.1	0.1
12.	Travel and Other Business Expenses	3.9	5.4	5.0	5.1	5.1	1.5	(0.3)	0.0	0.0
13.	Memberships	3.7	5.0	5.0	5.1	5.2	1.3	0.0	0.1	0.1
14.	Claims, Damages and Legal Fees	0.1	0.9	0.9	1.0	1.0	0.8	0.1	0.0	0.0
15.	Interest on Security Deposits	0.9	0.8	1.3	2.0	2.5	(0.1)	0.5	0.7	0.5
16.	Provision for Uncollectibles	9.5	9.5	9.5	9.5	9.5	-	-	-	-
17.	Legal Fees	3.2	2.7	2.8	2.8	2.9	(0.5)	0.1	0.1	0.1
18.	Audit Fees	1.6	1.6	1.6	1.6	1.7	(0.0)	0.0	0.0	0.0
19.	Other	5.2	4.5	4.6	4.9	5.0	(0.7)	0.1	0.3	0.1
20.	Internal Allocations and Recoveries	(26.8)	(29.9)	(29.5)	(29.6)	(30.1)	(3.1)	0.4	(0.1)	(0.6)
21.	Capitalization (A&G)	(32.5)	(37.8)	(35.5)	(36.4)	(37.1)	(5.3)	2.3	(0.9)	(0.7)
22.	Capitalization	(64.7)	(75.5)	(76.8)	(78.7)	(80.7)	(10.7)	(1.4)	(1.9)	(1.9)
23.	Regulatory Eliminations	(2.9)	(4.0)	(3.3)	(3.2)	(3.3)	(1.1)	0.8	0.1	(0.1)
24.	Other O&M	<u>\$224.0</u>	<u>\$219.2</u>	<u>\$228.0</u>	<u>\$231.5</u>	<u>\$241.0</u>	<u>(\$4.8)</u>	<u>\$8.8</u>	<u>\$3.5</u>	<u>\$9.5</u>

Witnesses: S. Kancharla
R. Lei
M. Torriano

Enbridge Gas Distribution
Other Operating and Maintenance Expense by Cost Type
2012 to 2013 September Year To Date Actuals

Line	Actuals	Actuals	2013
No. Particulars (\$ millions)	<u>2012</u>	<u>2013</u>	vs.
	(a)	(b)	<u>2012</u>
			(b) - (a)
1. Salaries and Wages	\$115.2	\$126.8	\$11.6
2. Benefits	23.2	20.7	(2.4)
3. Short Term Incentive Program	17.0	17.7	0.7
4. Employee Training and Development	2.1	2.3	0.2
5. Materials and Supplies	4.1	3.7	(0.4)
6. Outside Services	56.7	66.0	9.3
7. Consulting	7.4	4.4	(3.1)
8. Repairs and Maintenance	1.6	1.5	(0.1)
9. Fleet	6.9	8.2	1.2
10. Rents and Leases	4.9	4.8	(0.1)
11. Telecommunications	2.6	2.7	0.1
12. Travel and Other Business Expenses	2.6	2.6	0.0
13. Memberships	2.0	2.8	0.9
14. Claims, Damages and Legal Fees	(0.1)	0.8	0.9
15. Interest on Security Deposits	0.7	0.6	(0.0)
16. Provision for Uncollectibles	8.6	6.3	(2.3)
17. Legal Fees	1.2	2.2	1.0
18. Audit Fees	1.1	1.3	0.2
19. Other	1.8	1.7	(0.1)
20. Internal Allocations and Recoveries	(19.5)	(24.0)	(4.5)
21. Capitalization (A&G)	(24.3)	(29.2)	(4.9)
22. Capitalization	(47.4)	(52.4)	(5.0)
23. Regulatory Eliminations	(2.3)	(2.0)	0.3
24. Other O&M	<u>\$166.2</u>	<u>\$169.6</u>	<u>\$3.4</u>

Witnesses: S. Kancharla
R. Lei
M. Torriano

ENERGY PROBE INTERROGATORY #18

INTERROGATORY

Ref: Exhibit D1, Tab 3, Schedule 1

Please provide the interest rates used in the calculation of interest on security deposits for 2013, 2014, 2015 and 2016 (paragraph 19d).

RESPONSE

Enbridge Gas Distribution
2013 to 2016 Interest on Security Deposits

	Board			
	Approved	Budget	Budget	Budget
	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>
Interest Rate	4.0%	2.0%	3.1%	3.9%

The short term rates used for 2014 and 2016 were based on the treasury forecast in March 2013, which are expected to go up in the next few years driven by the banks' consensus.

Witnesses: S. Kancharla
R. Lei
M. Torriano

ENERGY PROBE INTERROGATORY #19

INTERROGATORY

Ref: Exhibit D1, Tab 3, Schedule 1

- a) What is the estimate for the FTEs in 2013 in Table 4 based on and when was it done?
- b) Please update the 2013 estimate in Table 4 to reflect the most recent actual level of FTEs in the company.
- c) What was the 2013 test year forecast of FTEs in the EB-2011-0354 filing (in the same level of detail as shown in Table 4)? Please explain any difference between the 2013 figures from EB-2011-0354 and those shown in Table 4.

RESPONSE

- a) The estimate for the FTEs in 2013 in Table 4 was based on input from departments when the budget for 2013 to 2016 was prepared in May 2013.
- b) Set out below is the 9+3 estimate for FTEs.

Enbridge Gas Distribution
Full Time Equivalents (FTE's)
2013 Forecast Year

<u>Salary Bands</u>	2013 Forecast <u>FTE</u> (a)
1. Management	152
2. Supervisory	1,464
3. Unionized	674
4. Total	2,290

Witnesses: S. Kancharla
R. Lei
M. Torriano

c)

Enbridge Gas Distribution Full Time Equivalents (FTE's) 2013 Test Year		
<u>Salary Bands</u>	2011-0354 2013 Test Year	2012-0459 As-Filed 2013 Forecast
	<u>FTE</u>	<u>FTE</u>
1. Management	140	157
2. Supervisory	1,452	1,492
3. Unionized	695	739
4. Total	2,287	2,388

The differences arise from the fact that the Company had a different understanding of its 2013 operational requirements in spring 2013 when the 2014 filing was prepared, as compared to what was forecast in late 2011 when the 2013 filing was prepared.

Witnesses: S. Kancharla
R. Lei
M. Torriano

ENERGY PROBE INTERROGATORY #20

INTERROGATORY

Ref: Exhibit E2, Tab 1, Schedule 2

- a) Please provide the February, 2013 data and source of the consensus representing projections from seven financial institutions used to create the figures in Table 1.
- b) Please provide the data and models used in the mean reversion models referred to in paragraph 6.

RESPONSE

a)

30-Year GOC		2013	2014	2015	2016	2017	2018	2019	2020
	RBC	2.6%	3.3%	4.2%	5.5%	5.5%	5.5%	5.5%	5.5%
	BMO	2.8%	3.5%	4.2%	4.5%	4.8%	4.8%	4.8%	4.8%
	TD	2.8%	3.3%	4.2%	5.0%	5.0%	5.0%	5.0%	5.0%
	CIBC	2.8%	3.2%	3.5%	3.8%	3.8%	3.8%	3.8%	3.8%
	National Bank	2.9%	3.2%	3.6%	3.9%	4.2%	4.4%	4.1%	4.6%
	RBS	3.2%	3.8%	4.3%	4.6%	5.1%	6.0%	6.5%	7.1%
	HSBC	2.2%	2.4%	3.5%	4.8%	5.3%	5.3%	5.3%	5.3%
	Proposed								
	Percentage	2.7%	3.2%	3.9%	4.6%	4.8%	5.0%	5.0%	5.1%

b)

	Term	2013	2014	2015	2016	2017
Step 1: 2012 Forecast ¹	10 Yrs	1.10%	1.10%	1.30%	1.40%	1.30%
Step 2: Curve Adjustment			0.0%	0.2%	0.1%	-0.1%
Step 3: 1 Year Average (2013 Mar) ²	30 Yrs	1.50%				
Step 4: Curve Adjustment			0.0%	0.2%	0.1%	-0.1%
2013 Forecast Spreads	30 Yrs	1.50%	1.50%	1.70%	1.80%	1.70%
Check: Mean Reverted Spreads (2013 Mar)	30 Yrs	1.48%	1.47%	1.44%	1.52%	1.66%
Rounding		1.50%	1.50%	1.45%	1.55%	1.70%
Variance		0.00%	0.00%	0.25%	0.25%	0.00%
Within Threshold of 0.25% Check	0.25%	OK	OK	OK	OK	OK

1. Average of weekly spread estimates received from BMO, CIBC, HSBC, National Bank, RBC, Scotia Capital and TD. 2013 to 2017 averages reflects 1-year, 2-year, 3-year, 4-year and 5-year historical averages respectively.
2. 1-year historical average of weekly spread estimates received from BMO, CIBC, HSBC, National Bank, RBC, Scotia Capital and TD.

Witnesses: P. Bhatia
M. Suarez

FRPO INTERROGATORY #1

INTERROGATORY

ISSUE B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

REF: D1, TAB 17, Page 10

Please confirm that Enbridge has been a member of Ontario One Call for several years by indicating the year of first membership?

RESPONSE

The first year of Enbridge's membership was 1996.

Witnesses: J. Briggs
L. Lawler

FRPO INTERROGATORY #2

INTERROGATORY

ISSUE B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

REF: D1, TAB 17, Page 10

Please confirm that most expected new members are electricity, water and sewer utilities.

RESPONSE

It is assumed that this question relates to Ontario One Call which is discussed at Exhibit D1, Tab 17 Schedule 1, page 8 rather than page 10.

It is confirmed that most new members are electricity and water and sewer utilities. Under the Ontario Underground Infrastructure Notification System Act, all owners of underground infrastructure in the public right of way or in the vicinity of the public right of way must be members of Ontario One Call Inc. The deadline for non-municipal owners was June 2013. The deadline for municipal owners is June 2014. This would include all electricity and all operators of sewer and water utilities. Enbridge has been a member of Ontario One Call Inc. since 1996.

Witnesses: J. Briggs
L. Lawler

FRPO INTERROGATORY #3

INTERROGATORY

ISSUE B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

REF: D1, TAB 17, Page 10

What technologies has the utility added in the past 5 years to add efficiency to the engineering analysis? Please be specific in providing the technology and the internal justification for its implementation including expected cost savings.

RESPONSE

The technologies referenced in Exhibit D1, Tab 17, Schedule 1, involve the In-Line Inspection ("ILI") technologies utilized to inspect the higher stress pipelines operating over 30% SMYS. The improved sensitivities of the technologies enhance the safety and reliability of these pipelines by identifying features or defects that could potentially cause pipeline failure. The use of these technologies was not intended for cost savings purposes and may actually increase the short term costs associated with the mitigation program as more defects or features are found. Note that such additional costs are considered "variable" between 2014 and 2016, and are not included in the Capital Budgets for those years. This approach mitigates the risk of a pipeline failure. The Company is not able to estimate cost avoidance that results from having mitigated potential events before they occur, however, savings could potentially be realized associated with the controlled pipeline repairs versus the emergency response costs associated with such a failure.

Over time, ILI technology has evolved and become more sophisticated. Enbridge has sought to utilize newer ILI technology as it has become available, in an effort to understand the condition of its high stress pipelines in as meaningful a way as possible. In 2003, EGD started conducting ILIs utilizing Magnetic Flux Leakage ("MFL") tools which detected metal loss anomalies. Later Caliper tools to detect deformation, and Mapping tools to obtain GPS data were added to the ILI tool portfolio. By 2012, advancement of ILI technologies allowed EGD to utilize Electro Magnetic Acoustic Transducer ("EMAT") tools to detect crack-like anomalies and coating disbondment, and

Witnesses: J. Briggs
L. Lawler

Circumferential MFL ("C-MFL") to detect axial metal loss anomalies in addition to the MFL, Caliper, and Mapping tools used previously.

The evolution of ILI technology provides Enbridge with a comprehensive means to determine the condition of pipelines with respect to corrosion, cracks, mechanical damage and manufacturing defects to a high level of accuracy. The information collected through these ILI technologies allows the Company to better understand the condition of the assets and to manage the mitigation programs in a way that ensures the safety and reliability of the pipelines.

The following table describes the number of lines inspected in each year from 2003 to 2012, as well as the tool technologies used. The inspections, and subsequent investigative digs, have uncovered various pipeline defects or features such as corrosion, gouges, arc burns, selective seam corrosion ("SSC"), cracks, long seam anomalies, stress corrosion cracking ("SCC"), dents, and close metal objects. The features are classified as "immediate" and "scheduled" which refers to the timeline required for remediation, based on the criticality of the feature. Some of the features that were identified would not have been identified without the more advanced technologies. As an example, the NPS 30 Transmission A and B pipelines were inspected in 2003 with the original MFL tool, and were then re-inspected in 2012 with multiple tools, namely the MFL/Caliper/IMU, C-MFL, EMAT tools. This inspection revealed 4 features that may have been present in 2003 but were not identifiable using the using the MFL tool alone.

Witnesses: J. Briggs
L. Lawler

Pipeline Name	Length (KM)	ILI Technology	Number of Immediate Features	Number of Scheduled Features
2003	38.4		0	0
NPS 30 Transmission System A Pipeline	19.2	MFL	0	0
NPS 30 Transmission System B Pipeline	19.2	MFL	0	0
2004	15.2		0	0
NPS 16 Wilkesport Transmission Pipeline	15.2	MFL/Caliper, CMFL	0	0
2005	98.03		2	41
NPS 16 Corunna Transmission Pipeline	3.76	MFL/Caliper	0	0
NPS 16 Sekerton Transmission Pipeline	2.94	MFL/Caliper	0	0
NPS 20 Sekerton Gathering Pipeline	0.43	MFL/Caliper	0	0
NPS 30 Don Valley	35.5	MFL	0	18
NPS 8 Barrie to Collingwood	55.4	MFL	2	23
2006	39.92		0	0
NPS 24 Mid Kimball-Colinville Transmission Pipeline	0.82	MFL	0	0
NPS 36 Parkway North	39.1	MFL/Caliper/IMU	0	0
2007	60.663		0	8
NPS 12 Ottawa South - Fallowfield Rd	24.8	MFL/Caliper/IMU	0	5
NPS 30 Don Valley	35.5	MFL/Caliper/IMU	0	3
2009	47.083		6	34
NPS 12 Ottawa North - Ottawa Gate Stn to St Laurent Dst	5.9	MFL/Caliper/IMU	2	5
NPS 12 Ottawa South - Ottawa Gate Stn to Riverside Dr	9.1	MFL/Caliper/IMU	2	15
NPS 12 Victoria Square North	24.1	MFL/Caliper/IMU	2	14
NPS 16 Ottawa South - Rideau River Crossing	0.583	MFL/Caliper/IMU, CPCM	0	0
NPS 24 Dow Moore Transmission Pipeline	7.4	MFL/Caliper	0	0
2010	17.41		3	5
NPS 16 Ottawa East - Blackburn Lateral	1.51	MFL	0	0
NPS 16 Ottawa East - OGS to Blackburn Bypass	11.7	MFL/Caliper/IMU, CPCM	3	5
2011	31.19		7	4
NPS 16 Mid/South Kimball-Colinville Gathering Pipeline	1.2	MFL/Caliper	0	0
NPS 16 Ottawa East - OGS to Blackburn Bypass	11.7	MFL/Caliper/IMU, CPCM	0	0
NPS 20 Mid Kimball-Colinville Gathering Pipeline	3.08	MFL/Caliper	0	0
NPS 12 Oshawa	3.91	MFL/Caliper/IMU, CPCM	3	4
2012	159.55		16	24
NPS 16 Coveny Gathering Pipeline	0.33	MFL/Caliper/IMU	0	0
NPS 16 Coveny Transmission Pipeline	6.74	MFL/Caliper/IMU	0	0
NPS 16 Ladysmith Transmission Pipeline	8.7	MFL/Caliper/IMU	0	0
NPS 16 Sombra Transmission Pipeline	6.58	MFL/Caliper/IMU	0	0
NPS 26 Parkway North	13.9	MFL/Caliper/IMU	0	8
NPS 8 Barrie to Collingwood	55.4	MFL/Caliper/IMU, CPCM	12	4
NPS 30 Transmission System A Pipeline	19.2	MFL/Caliper/IMU, C-MFL, EMAT	0	4
NPS 30 Transmission System B Pipeline	19.2	MFL/Caliper/IMU, C-MFL, EMAT	0	0
2013	143.5		7	37
NPS 8 - Collingwood ILI	17.3	CMFL	0	0
NPS 36 - Parkway North**	39	MFL/Caliper/IMU Combo	0	5
NPS 30 - DVP**	35.5	MFL/Caliper/IMU, C-MFL, EMAT	1	19
NPS 8 - Greenbank	3.2	MFL/Caliper/IMU, C-MFL, EMAT	2	TBD
NPS 12 - Cornwall	27.3	CMFL	2	10
NPS 20 - South Kimball	3.6	Bi-Di MFL	0	3
NPS 16 - Wilkesport Transmission	15.6	MFL/Caliper/IMU, C-MFL, EMAT	2	TBD
NPS 16 - Wilkesport Gathering	1.6	MFL/Caliper/IMU, C-MFL, EMAT	0	TBD
TecDow # 6	0.062	Bi-Di MFL	0	0
TecDow # 19	0.021	Bi-Di MFL	0	0
TecDow # 20	0.056	Bi-Di MFL	0	0
TecDow # 23	0.07	Bi-Di MFL	0	0
TecDow # 24	0.02	Bi-Di MFL	0	0
TecDow # 25	0.128	Bi-Di MFL	0	0

Witness

FRPO INTERROGATORY #4

INTERROGATORY

ISSUE B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

REF: D1, TAB 17, Page 15

What budgetary compensations have been made for the reductions in Legal or Operations as a result of less damages expected through increased line locates diligence?

RESPONSE

In terms of O&M expenditures related to the Legal and Corporate Services areas, there is an expected reduction of approximately \$390,000 over the 2014 to 2016 period. This is due to diminishing bad debt write-offs when billing 3rd parties for damaging EGD's buried plant. Operations is reimbursed for costs to repair damages via the Legal and Corporate Services group, so the Operations Group's net expenses will not change.

Witness: T. Tuck

FRPO INTERROGATORY #5

INTERROGATORY

ISSUE B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

REF: D1, TAB 17, Page 15

Please provide the projected reductions of costs and increases in capital investment that will result from the elimination of repair work on 200 and 400 series meters?

RESPONSE

The projected reductions of repair costs and increases in capital investment as result of the elimination of repair work on 200 and 400 series meters are as follows:

2014

Reduction of Operating Cost = \$667K
Increase in Capital Investment = \$485K

2015

Reduction of Operating Cost = \$684K
Increase in Capital Investment = \$513K

2016

Reduction of Operating Cost = \$701K
Increase in Capital Investment = \$541K

It is important to note that these reductions and increases are not incremental year over year but rather projections based on comparison to the last full year of repair work in 2012.

Witnesses: C. Egan
T. Vuong

FRPO INTERROGATORY #6

INTERROGATORY

ISSUE B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

REF: D1, Tab 18, Schedule 1, Page 2

Please provide the annual memberships to Enbridge's respective industry associations (e.g., OEA, CoLD, CGA, etc.).

RESPONSE

The respective industry association annual membership fees for the 2014, 2015 and 2016 are \$714,611, \$730,547 and \$747,057, respectively. A detailed breakdown of the total membership costs are listed below.

	2014	2015	2016
	\$	\$	\$
Canadian Gas Association ("CGA")	463,705	474,046	484,759
Ontario Energy Association ("OEA")	75,000	76,672	78,405
American Gas Association ("AGA")	130,406	133,314	136,327
Toronto Board of Trade ("TBOT")	16,500	16,868	17,249
Electricity Distributors Association ("EDA")	29,000	29,647	30,317
Total - Industry Memberships	714,611	730,547	747,057
Other - Professional and Civic Memberships	8,051	8,222	8,399
Total - Memberships	\$ 722,662	\$ 738,769	\$ 755,456

Witnesses: A. Creery
K. Culbert
R. Small

FRPO INTERROGATORY #7

INTERROGATORY

ISSUE B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

REF: D1, Tab 18, Schedule 1, Page 3

Please provide the costs associated with NEB proceedings on behalf of affiliates.

- a. Please provide an assurance that the costs are transferred to the respective affiliated organizations.

RESPONSE

The budgeted costs for work to be done on behalf of affiliates associated with NEB proceedings for 2014, 2015 and 2016 are \$3,000, \$3,100 and \$3,200, respectively.

Regulatory Affairs provides services to Niagara Gas Transmission Ltd. and 2193914 Canada Limited for the purpose of determining any required toll changes to be filed with the NEB. These costs are budgeted in O&M and as offsets to O&M through recoveries within costs charged to affiliates.

Witnesses: A. Creery
K. Culbert
R. Small

FRPO INTERROGATORY #8

INTERROGATORY

ISSUE B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

REF: D1, Tab 18, Schedule 1, Page 5

Please provide survey results and corrective actions that demonstrate EGD is on the right track.

- a. Please provide a summary of the initiatives that EGD's has undertaken to address significant issues identified in its surveys.
- b. Please provide any analysis EGD has undertaken to correlate survey results with SQI's to determine if the Board has the correct measurements in place to measure service quality.

RESPONSE

- a) Research has identified customer communication as a key improvement priority. This includes increasing customers' understanding of the monthly Enbridge bill, information provided with the bill, information on the Enbridge website, social media and billboards. Ease of using the automated telephone system has also been identified as a priority, as customers report finding it difficult to navigate through the phone menu.

Surveys also indicate that Enbridge needs to improve the effectiveness of safety messages, as safety awareness is low on key safety issues such as identifying a natural gas leak by smell and safety measures to prevent carbon monoxide poisoning.

The following are key Communication initiatives being planned or undertaken:

- i. A complete redesign of Enbridge's Bill to improve ease of understanding. Implementation scheduled for late 2014.

Witnesses: A. Creery
K. Lakatos-Hayward

- ii. Bill Inserts. Revised safety related bill inserts with simple clean imagery to support concise copy. Designed to stand alone or be assembled as a safety package. Quarterly Rate (QRAM) Notices: Content was revised to improve clarity and tone. Use of plain language while remaining consistent with terminology on the bill. Added Q&A's to increase customer understanding of the bill components.
 - iii. Customer Correspondence Refresh: Updates to customer correspondence to improve clarity of information and/or actions required of customers.
 - iv. Leverage Social Media: Established a Twitter presence and utilized this medium to pro-actively communicate quick tips, events and information about active incidents. Enbridge also monitors for customer related issues and ensure appropriate follow up.
 - v. Safety information campaigns to educate and inform customers about common safety issues, such as, carbon monoxide safety, calling before you dig, blocked sewer safety and how to identify a gas leak and what actions to take.
 - vi. A redesign of the automated phone system and a refresh of the Enbridge Gas Distribution Inc. website is scheduled for 2014.
- b) The Company has not undertaken customer research with the specific objective of correlating survey results with SQI's. The SQI's were designed to measure key aspects of the services that drive effectiveness and in turn customer satisfaction. For example, one of the main drivers of bill complaints is estimated consumption volumes. The Consecutive Estimate SQI is designed to make sure that meter readings are actually taken, reducing the Company's reliance on estimated consumption for billing purposes. The other SQI's have been designed with the same principle in mind.

However, one area where an analysis was conducted in 2012 does closely relate to the Service Appointment SQI. This analysis sought to understand customer perceptions of the duration of service appointments windows. The findings are:

- 45% of residential customers said they prefer a 4-hour service appointment window. 32% prefer two hours and 9% prefer three hours.

Witnesses: A. Creery
K. Lakatos-Hayward

FRPO INTERROGATORY #9

INTERROGATORY

ISSUE B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

REF: D1, Tab 18, Schedule 1, Page 5

Please provide an internal report that captures the results of the Ombudsman's office efforts including significant issues addressed and resulting changes in customer service policy or procedure.

RESPONSE

Attached is a copy of the internal Ombudsman report summarizing activity within the Office of the Ombudsman for the period of January 2013 through to October 2013.

The purpose of the Ombudsman's office is to provide our customers a point of escalation to address unresolved issues. Enbridge also uses these individual and aggregate cases to identify process improvements. Activities are consolidated under the categories of Billing, Collections, Field Operations and Open Bill.

Billing

The major themes identified in the Billing category include enquiries around Budget Billing Plan amounts, high bill complaints, doubtful and crossed meters, and landlord/tenant disputes.

Some select examples of customer experience improvements made as a result of these escalated issues include:

- Changes to Enbridge's policy and practice regarding retroactive billing adjustments:
 - o Residential – reduced from two years to 13 months
 - o Commercial – reduced from six years to two years
- Repeat callers are identified and routed to billing specialists to avoid further escalation.
- Instituted a requirement for landlords to provide account direction between tenants.

Witness: A. Creery

- Enbridge has made system enhancements to the Budget Billing Plan to ensure it is more accurately calculated at year end to avoid large debit or credit balances at the end of the season.
- Provided subject matter expertise on Enbridge Gas Distribution's bill redesign to be implemented in 2014, based on customer issues experienced with the current bill.

Collections

The themes identified in the Collections category include disconnections for non-payment and meter tampering.

Some customer experience improvements include:

- Payment arrangements are now clearly displayed on customer bills.
- Enbridge updated its process in 'meter tampering' situations to highlight the safety issue. Enbridge now requires a release form to have the gas reconnected.

Field Operations

The themes in Field Operations include disputes concerning infraction tags and general communication around compliance work.

Some customer experience improvements include:

- Updating reminder call message regarding outstanding infractions to better explain what customers are required to do.
- Updating 'Backgrounder' communications distributed prior to compliance work (Government Inspection - meter exchanges and Warning Tags) to advise customers on what the work will entail and what they will be required to do.

Open Bill

The themes in the Open Bill category include the dispute process and misrepresentation.

Some customer experience improvements include:

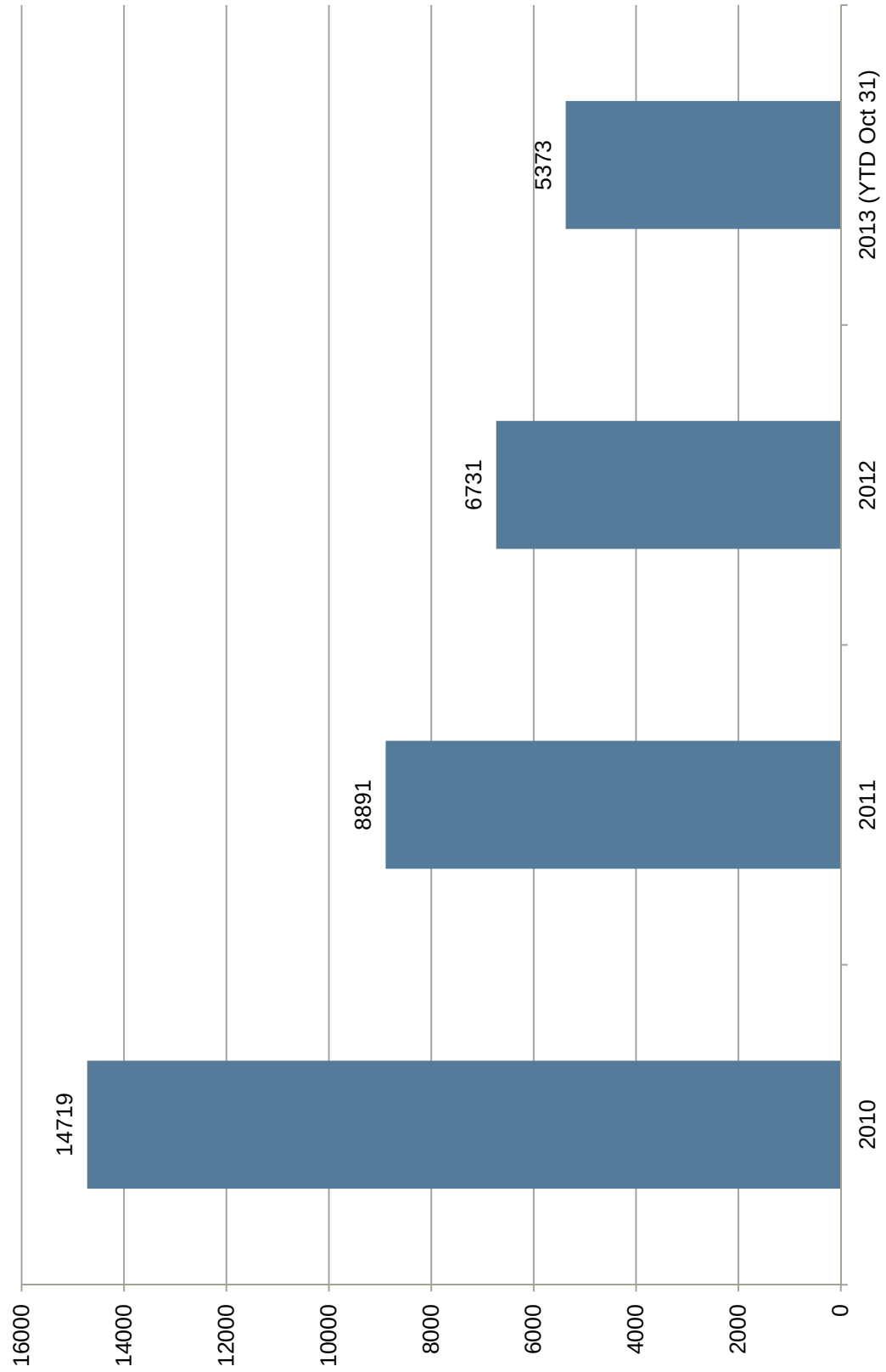
- Improved turnaround time for Open Bill disputes, from 60 days to 45 days for water heater and billing disputes.
- Improved turnaround time for misrepresentation issues, from 60 days to 15 days.

Witness: A. Creery

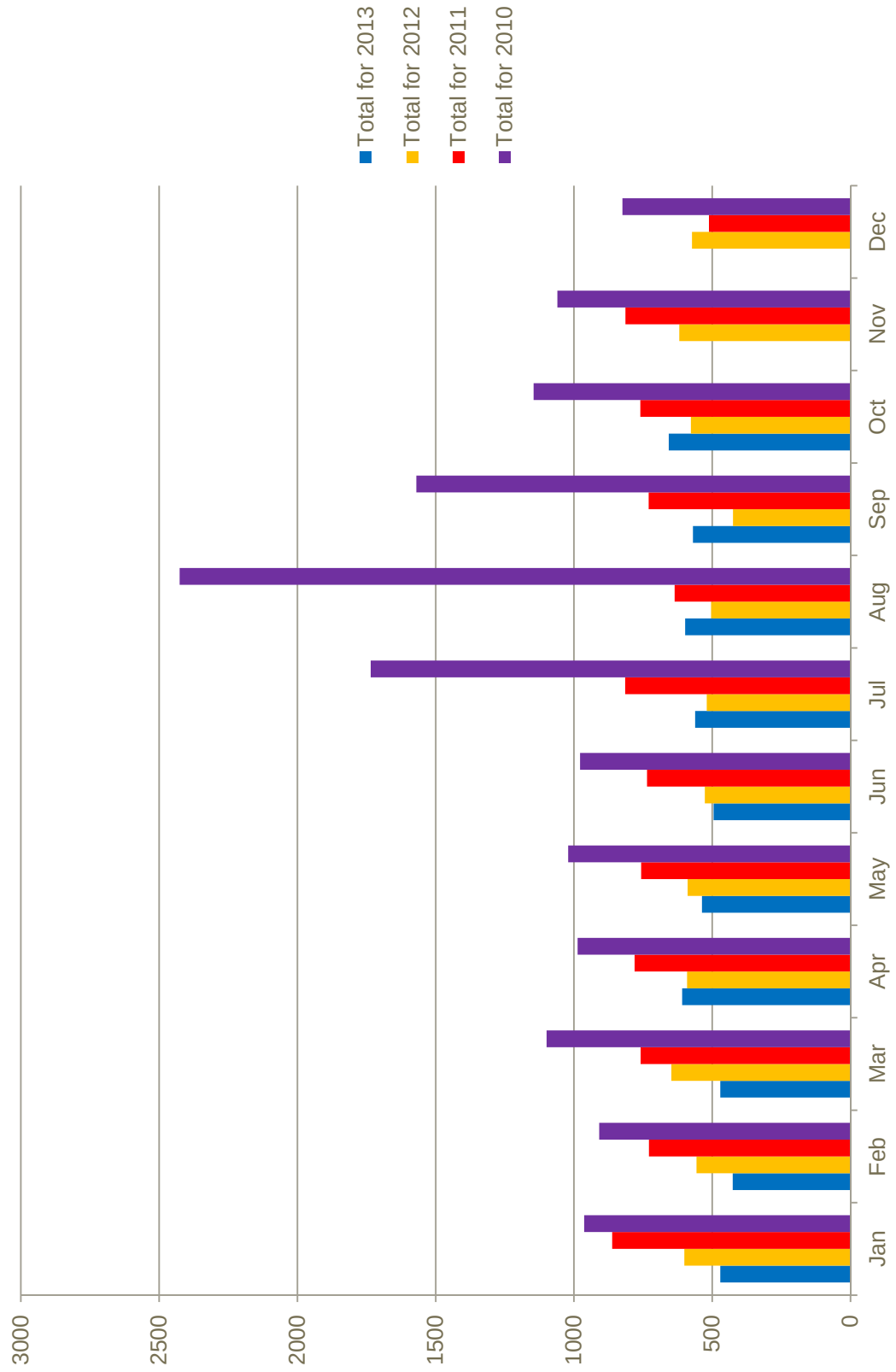
Ombudsman's Office - 2013



Total Ombudsman Contacts



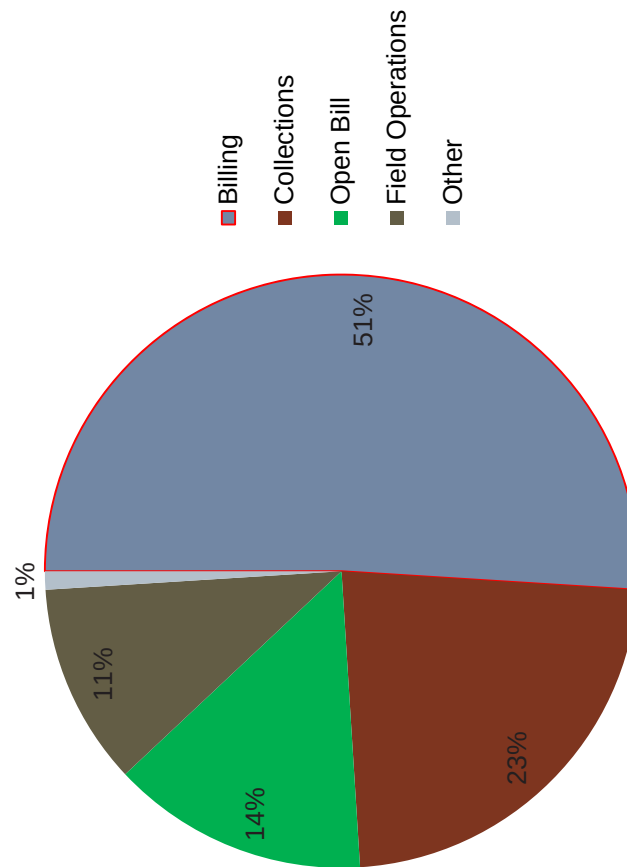
Total Contacts - Monthly



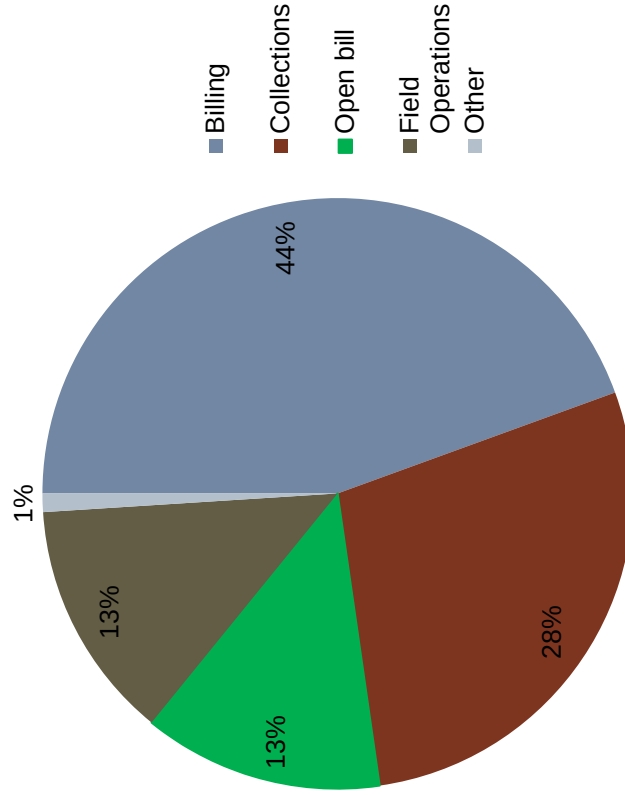
Escalation Issues



2012



2013



Top Trends 2013



Billing

- Budget Billing Plan
 - set up/cancel/explain
- High bill complaints
- Meter reading disputes
 - Doubtful and crossed meters
- Landlord/tenant disputes

- **Collections**

- Non-payment disconnections
- Payment arrangements/assistance
- Meter tampering/meter removal

Field Operations

- Infraction tags
- Late/missed appointments
- Restoration issues

Open Billing

- Billing disputes
- Misrepresentation
- Unauthorized charges

FRPO INTERROGATORY #10

INTERROGATORY

ISSUE B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

REF: D1, Tab 20, Schedule 1, Page 2

Please provide your support for a 4% increase in 2014 in Non-Departmental Operating and Maintenance Expense.

RESPONSE

The 4% increase in 2014 in Non-Departmental Operating and Maintenance Expense is attributed to increases in the Salaries and Wages component. The increase in Salaries and Wages is a result of the Company implementing organizational changes to ensure prudent and due-diligent design and execution of the proposed capital program.

As described in the Capital Overview evidence, Exhibit B2, Tab 1, Schedule 1, the Company is undertaking the GTA Replacement project, WAMS project and several System Integrity and Reliability initiatives.

To help ensure prudent execution of these initiatives, the Company has assigned a new Vice President role accountable for the GTA project (approximately \$700 million of expenditure) and created a Senior Vice President of Operations role which has four Operations and Engineering Vice Presidents that are accountable for governance, design and execution of the core capital (approximately \$450 million annually) expenditures.

These two roles account for the majority of the 4% increase in Non-Departmental Operating and Maintenance Expense.

Witnesses: M. Lee
S. Trozzi

FRPO INTERROGATORY #11

INTERROGATORY

ISSUE B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

REF: D1, Tab 2, Schedule 1, Page 9

Preamble: Enbridge states: "During 2013 the Company will be required to issue an RFP for a storage contract that will expire March 31, 2014. For purposes of the 2014 forecast, the cost impacts of the current contract are assumed to be continued in the forecast for 2014 gas costs.

Please clarify the above statement in terms of assumptions regarding price, ratepayer cost and rate-making implications over the term of the proposal.

RESPONSE

EGD has two third party storage contracts totaling 5,000,000 GJ's of storage capacity that will expire March 31, 2014. At the time the evidence was prepared EGD had not as yet issued an RFP for replacement of an equivalent volume of storage capacity to become effective April 1, 2014. Since the cost of those replacement storage contracts was unknown it was decided to follow past practice of assuming for gas cost purposes a continuation of the cost impacts of the existing contracts. This was done with the understanding that any variation between the forecast cost of storage and the cost of storage agreed upon through the RFP process would be captured within the Storage & Transportation Deferral Account ("S&TDA").

The actual cost of the replacement storage will be included as part of the Company's 2015 gas cost forecast.

Witnesses: J. Denomy
D. Small

FRPO INTERROGATORY #12

INTERROGATORY

ISSUE B17b: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

b. Is the Operating cost amount appropriate?

REF: D1, Tab 2, Schedule 1, Page 9

Preamble: Enbridge states: "During 2013 the Company will be required to issue an RFP for a storage contract that will expire March 31, 2014. For purposes of the 2014 forecast, the cost impacts of the current contract are assumed to be continued in the forecast for 2014 gas costs.

Using the current differentials between summer and winter prices, appropriately adjusted for basis differential, please provide the price that the market is communicating regarding these storage values.

a. Please provide the ratepayer cost and ratemaking implications of using these values in the alternative.

RESPONSE

The storage contracts that are scheduled to expire on March 31, 2014 have an average unit rate of \$0.79/GJ. The replacement contracts that EGD has entered into have an average value of \$0.40/GJ. On an overall basis this will lower storage costs by approximately \$1.4 million in 2014. As described in the response to FRPO Interrogatory #11, found at Exhibit I.B17.EGDI.FRPO.11 the difference will be captured in the 2014 S&TDA. When the Company prepares its gas cost forecast for 2015 the updated storage costs will be included.

Witnesses: J. Denomy
D. Small

FRPO INTERROGATORY #13

INTERROGATORY

ISSUE B17c: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?

REF: D3, Tab 4, Schedule 1 and EB-2011-0354 Exhibit JT2.1

Please delineate the costs attributed to non-utility storage for Lost and Accounted for Gas.

RESPONSE

There are no costs for Lost and Unaccounted for ("LUF") gas allocated to non-utility storage. This was explained within EB-2011-0354 in Exhibit JT2.1, which is attached. Briefly, LUF volumes are based on a 2007 engineering study, which was undertaken before the implementation of the unregulated storage business. As a result, none of these volumes can be said to relate to the unregulated storage business, and no associated costs are allocated to that business. While EGD is now undertaking a new engineering study to assess LUF associated with the storage business, the study has not been finalized. Thus, the results of that study were not known at the time that the volume forecasts filed within this proceeding were prepared.

Please see also the response to FRPO Interrogatory #15 found at Exhibit I.B17.EGDI.FRPO.15.

Witnesses: K. Culbert
J. Denomy
D. Small

UNDERTAKING JT2.1

UNDERTAKING

TR 2, page 38

To provide an explanation of how non-utility storage is paying for LUF, and an explanation of how Enbridge utility is paying for LUF.

RESPONSE

The last engineering study conducted for determining the level of Lost and Unaccounted for Gas ("LUF") was done prior to the 2007 fiscal year. Based upon that study a provision for 23,763.5 10^3m^3 for LUF has been included in the derivation of the Company gas costs forecast. The value or cost of that provision is based upon the current QRAM Reference Price. Please see EB-2012-0238, Exhibit Q3-3, Tab 2, Schedule 1, Line #4 as an example how the revenue requirement is impacted by the QRAM process. The QRAM process brings the cost of the LUF provision up to the current QRAM Reference price. The associated cost of the provision is then collected from all of EGD's customers as part of rates.

Because the provision of 23,763.5 10^3m^3 was based upon the Utility storage capacity prior to the implementation of the unregulated storage business there is no additional cost being incurred by the Utility customers because of the unregulated storage business. Therefore, there is no need to allocate any of these costs to the unregulated storage business.

FRPO INTERROGATORY #14

INTERROGATORY

ISSUE B17c: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?

REF: D3, Tab 4, Schedule 1 and EB-2011-0354 Exhibit JT2.1

Please provide the cost causality principles that underpin this approach.

RESPONSE

As stated in the response to FRPO Interrogatory #13, found at Exhibit I.B17.EGDI.FRPO.13, the Lost and Unaccounted For ("LUF") volumetric provision is based solely on the Utility storage capacity and the associated costs should be recovered from Utility ratepayers.

Witnesses: K. Culbert
J. Denomy
D. Small

FRPO INTERROGATORY #15

INTERROGATORY

ISSUE B17c: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?

REF: EB-2011-0354 Exhibit JT2.31

Please provide an update on the assessment of this concern and cost implications.

RESPONSE

The undertaking reference should have been EB-2011-0354 Exhibit JT2.30 (see attached) which asked whether or not the migration of gas to the A1 structure should be recognized as Lost and Unaccounted For ("LUF") gas.

The determinant of whether or not there had been any migration of gas to the A1 structure and the associated impact on LUF would be an outcome of an engineering study. As discussed in response to FRPO Interrogatory #13, found at Exhibit I.B17.EGDI.FRPO.13 the final results of the engineering study were not known at the time of the preparation of the 2014 forecast and as such the LUF provision was not adjusted for any amount associated with the potential migration of gas to the A1 structure. To the extent that the outcome of the engineering study creates a new LUF forecast that will be reflected in the 2015 volume forecast as part of the 2015 Rate adjustment proceeding.

Witnesses: K. Culbert
J. Denomy
D. Small

UNDERTAKING JT2.30

UNDERTAKING

TR 1, page 201

To provide a response to the following question: To the extent that the Enbridge 3-D seismic program determines there has been a migration of gas to the A1 structure, would Enbridge recognize that the gas that has migrated would have been lost and unaccounted for, and, therefore, funded by ratepayers and not the shareholder?

RESPONSE

No. If there has been migration to any A1 structure, only one component of the LUF provision would have been attributable to migration. The LUF provision for EGD storage was put in place in the 1990's while any A1 migration could have started at the beginning of the storage operations in 1964. The information and the process to reach any conclusions on this issue is not currently available and is not going to be available for at least one year.

Witnesses: I. Chan
K. Culbert
A. Kacicnik
S. Kancharla
J. Sanders
M. Suarez

FRPO INTERROGATORY #16

INTERROGATORY

ISSUE B17c: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?

REF: EB-2011-0354 Exhibit JT2.31

Please explain how the cost of base pressure gas is allocated to the non-utility storage. Please provide the cost causality principles behind that approach.

RESPONSE

The cost of the base pressure gas pertains solely to the Utility storage capacity and therefore the associated costs should be recovered from Utility ratepayers.

Witnesses: K. Culbert
J. Denomy
D. Small

SEC INTERROGATORY #65

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[A2/1/1, p. 22] Please expand the table set out on this page to add columns for 2007 through 2012 actual, and 2013 forecast (9+3 or 10+2).

RESPONSE

Please refer to the response to Board Staff Interrogatory #50 at Exhibit I.B17.EGDI.STAFF.50

Witnesses: S. Kancharla
R. Lei
M. Torriano

SEC INTERROGATORY #66

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[A2/1/1, p. 22] Please confirm that the Applicant is proposing to increase Other O&M by 9.9%, or 3.3% per year for three years.

RESPONSE

The Compound Annual Growth Rate ("CAGR") of Other O&M is 3.2% per year for three years. By normalizing out \$4.1M in 2016 for the Work and Asset Management Solution ("WAMS") hosting and support cost, the CAGR would be 2.6% per year.

Witnesses: S. Kancharla
R. Lei
M. Torriano

SEC INTERROGATORY #67

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[A2/1/1, p. 24 and A2/1/2, p. 3] *"The 2014-2016 O&M Budget is substantially lower than the grass-roots budget that was originally prepared and proposed to Enbridge's management."* Please provide the "grass-roots budget" referred to. Please provide the grassroots (i.e. first requests) and final O&M budgets of the Applicant for each of 2010, 2011, and 2012. Please provide a comparison of the amount of reductions from first to final budgets, and identify the material differences in the 2014-2016 process.

RESPONSE

The Company does not preserve the iterations of the O&M budget process from prior years. Please refer to the following table for the final utility O&M budget in 2010, 2011, and 2012.

Enbridge Gas Distribution
Summary of Operating and Maintenance Expense by Category
From 2010 Budget to 2012 Budget

Line No.	Categories (\$ Millions)	Budget 2010	Budget 2011	Budget 2012
1.	Customer Care/CIS Service Charges	\$95.1	\$89.9	\$90.1
2.	Demand Side Management ("DSM")	26.7	26.7	28.1
3.	Pension and OPEB Costs	7.2	6.5	24.3
4.	Regulatory Cost Allocation Methodology("RCAM")	24.3	26.7	31.6
5.	Other O&M	192.6	208.4	228.1
6.	Total Net Utility O&M Expense	<u>\$345.8</u>	<u>\$358.2</u>	<u>\$402.2</u>

Witnesses: S. Kancharla
R. Lei
M. Torriano

The O&M budget process for 2014 to 2016 was substantially similar to prior years. It involved a grass-roots buildup of required costs, followed by a top-down review to arrive at a final budget.

Witnesses: S. Kancharla
R. Lei
M. Torriano

SEC INTERROGATORY #68

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[D1/3/1, p. 7] Please expand Table 2 to add columns for 2007 through 2012 actual, and 2013 forecast (9+3 or 10+2).

RESPONSE

The table below expands the actuals for 2007 to 2012 actuals. The 2013 forecast (9+3) for Other O&M is \$235.3M. However, it is not available by cost type as the forecast is conducted at a high level.

Witnesses: S. Kancharla
R. Lei
M. Torriano

Enbridge Gas Distribution
Other Operating and Maintenance Expense by Cost Type
2007 Actuals to 2016 Budget

Line	Actuals	Actuals	Actuals	Actuals	Actuals	Actuals	Board	Budget	Budget	Budget
No. Particulars (\$ millions)	2007	2008	2009	2010	2011	2012	Approved	2014	2015	2016
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
1. Salaries and Wages	\$127.1	\$127.0	\$125.1	\$133.8	\$141.6	\$153.7	\$167.7	\$170.6	\$174.6	\$179.0
2. Benefits	21.6	19.0	19.5	19.7	21.0	23.5	25.3	25.8	26.4	26.9
3. Short Term Incentive Program	20.1	19.1	25.3	19.7	25.2	23.2	20.7	21.2	21.6	22.1
4. Employee Training and Development	2.0	2.7	3.0	2.9	5.6	4.7	4.8	5.0	4.8	4.8
5. Materials and Supplies	4.9	5.7	4.5	5.1	5.2	4.2	5.3	5.2	5.2	5.3
6. Outside Services	59.7	58.1	62.0	67.9	68.4	83.4	83.7	86.1	85.7	91.2
7. Consulting	2.5	4.8	3.7	6.4	5.0	6.2	5.1	4.7	4.9	5.2
8. Repairs and Maintenance	2.8	0.7	2.0	1.7	1.6	3.7	2.3	2.4	2.4	2.4
9. Fleet	9.4	9.9	8.3	8.1	9.0	9.4	10.2	10.4	10.5	10.7
10. Rents and Leases	7.6	7.2	6.7	5.8	7.3	7.2	7.3	7.4	7.5	7.8
11. Telecommunications	3.4	3.1	3.4	3.5	3.1	3.5	3.6	3.7	3.8	3.9
12. Travel and Other Business Expenses	2.7	3.1	2.7	3.4	3.5	3.9	5.4	5.0	5.1	5.1
13. Memberships	2.5	2.5	2.6	3.6	4.0	3.7	5.0	5.0	5.1	5.2
14. Claims, Damages and Legal Fees	1.6	1.2	2.0	1.7	1.6	0.1	0.9	0.9	1.0	1.0
15. Interest on Security Deposits	1.7	1.7	1.0	0.5	1.0	0.9	0.8	1.3	2.0	2.5
16. Provision for Uncollectibles	15.2	16.7	17.8	11.5	21.5	9.5	9.5	9.5	9.5	9.5
17. Legal Fees	-	-	-	-	2.9	3.2	2.7	2.8	2.8	2.9
18. Audit Fees	-	-	-	-	-	1.6	1.6	1.6	1.6	1.7
19. Other	7.4	12.1	5.3	5.0	5.4	5.2	4.5	4.6	4.9	5.0
20. Internal Allocations and Recoveries	(20.9)	(26.1)	(23.8)	(24.7)	(25.7)	(26.8)	(29.9)	(29.5)	(29.6)	(30.1)
21. Capitalization (A&G)	(21.2)	(21.6)	(23.9)	(24.3)	(24.5)	(32.5)	(37.8)	(35.5)	(36.4)	(37.1)
22. Capitalization	(53.8)	(51.8)	(50.1)	(52.6)	(55.3)	(64.7)	(75.5)	(76.8)	(78.7)	(80.7)
23. Conservation Services	0.2	2.1	4.0	9.4	7.3	7.5	2.7	2.0	-	-
24. To eliminate Conservation Services	-	-	-	-	(7.3)	(7.5)	(2.7)	(2.0)	-	-
25. Incremental O&M Allocated to Unregulated	-	-	-	-	(0.2)	-	-	-	-	-
26. Regulatory Eliminations	(3.3)	(3.1)	(2.8)	(5.6)	(6.0)	(2.9)	(4.0)	(3.3)	(3.2)	(3.3)
27. Other O&M	\$193.2	\$194.0	\$198.2	\$202.2	\$221.4	\$224.0	\$219.2	\$228.0	\$231.5	\$241.0

Witnesses: S. Kancharla
R. Lei
M. Torriano

SEC INTERROGATORY #69

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[D1/3/2, p. 1] Please provide any reports, plans, or other such documents dealing with the aging workforce issue at Enbridge. Please provide a table showing the average age of employee, by category, for each of the last 20 years.

RESPONSE

We are unable to break down the employee categories over the past 20 years as our employee classifications have changed several times over the years and we would not be able to reconcile with the current break down. However, below is a table outlining the average age of all permanent employees and the percentage of these employees that are over the age of 55 from 1993 to current. The evidence submitted as Exhibit D1, Tab 3, Schedule 2 incorporated numbers for the entire employee population including temporary and contract employees. The table below represents only current permanent employees, which is felt to be a better representation of the issue regarding our aging workforce. There are no formal plans in place to deal with this issue however leaders have ongoing discussions with employees to plan for upcoming retirements, which require knowledge transfer, training plans and/or recruitment activities.

Witnesses: M. Lee
S. Trozzi

Year	Average Employee Age	Percentage of Workforce Over the Age of 55
1993	40.9	11.4
1994	41.4	11.3
1995	41.8	10
1996	42.1	11
1997	42.3	10.7
1998	42.3	10.4
1999	43.8	10.6
2000	45.4	13.9
2001	45.5	13.2
2002	45.9	14.1
2003	46.1	15.4
2004	45.9	16.3
2005	45.5	17.3
2006	45.5	18.3
2007	45.5	19.2
2008	46	20.2
2009	46.2	22
2010	46	22.6
2011	45.5	21.8
2012	44.9	21
2013	44.2	19.7

Witnesses: M. Lee
S. Trozzi

SEC INTERROGATORY #70

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[D1/3/2, p. 4] Please confirm that the shareholder, as well as the Applicant and the ratepayers, benefits from the LTIP. Please explain why the shareholder does not contribute any part of the cost of the LTIP. Please provide any studies, reports, memoranda, or similar documents dealing in whole or in part with the appropriate sharing of the cost of LTIP.

RESPONSE

The LTIP is a component of the compensation package for key EGD employees. The compensation package is designed to attract and retain a highly effective leadership team and workforce. This promotes the safe and efficient operation of the utility to the benefit of all stakeholders. The shareholder does not contribute to any part of the LTIP cost because LTIP is part of the EGD Total Compensation package that is a necessary operating cost for EGD. There are no studies or reports that address sharing of the cost of LTIP.

Witnesses: M. Lee
S. Trozzi

SEC INTERROGATORY #71

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[D1/3/2, p. 7] Please provide the budget, planning document, and any business case or cost-benefit analysis, for the new leadership development framework referred to.

RESPONSE

The new leadership development framework is an enterprise-wide initiative for all Enbridge business units. The charges for EGD are based on the number of employee participants in the program. Below is the annual budget for EGD. As indicated, it is forecast to be flat for the 2014 to 2016 period.

Enbridge Gas Distribution (EGD) Leadership Development (LD) Budget (2014 to 2016)

	<u>2014</u>	<u>2015</u>	<u>2016</u>
Staffing	\$140,000	\$140,000	\$140,000
Consulting	25,000	25,000	25,000
Design of Program Elements	10,000	10,000	10,000
Program Delivery	415,000	415,000	415,000
Coaching Services	105,000	105,000	105,000
Total for EGD	\$695,000	\$695,000	\$695,000

Witnesses: M. Lee
S. Trozzi

While a specific business case is not available for the leadership development framework, attached are presentations made to the Enbridge and EGD Leadership teams in support of implementing this new program both at the Enterprise level and EGD level.

Witnesses: M. Lee
S. Trozzi

Maximizing Potential

March 2013



Leadership matters



INTENSE FOCUS ON SAFETY

- Marshall turning point
- Behavioral change
- Process safety

DEMOGRAPHIC SHIFT

- 48% < 5 years
- 22% can retire
- 20% of Directors+
green successors

CHANGING BUSINESS LANDSCAPE

- Largest capital program
- Intense scrutiny
- Competitive environment
- Increased complexity

Leadership matters



45%

Difference in market cap growth between top and bottom clusters based on leadership quality

40%

40% of internal promotions find the transition a challenge; 20% rate it as a disappointment

1/2

New managers continued to operate as individual contributors

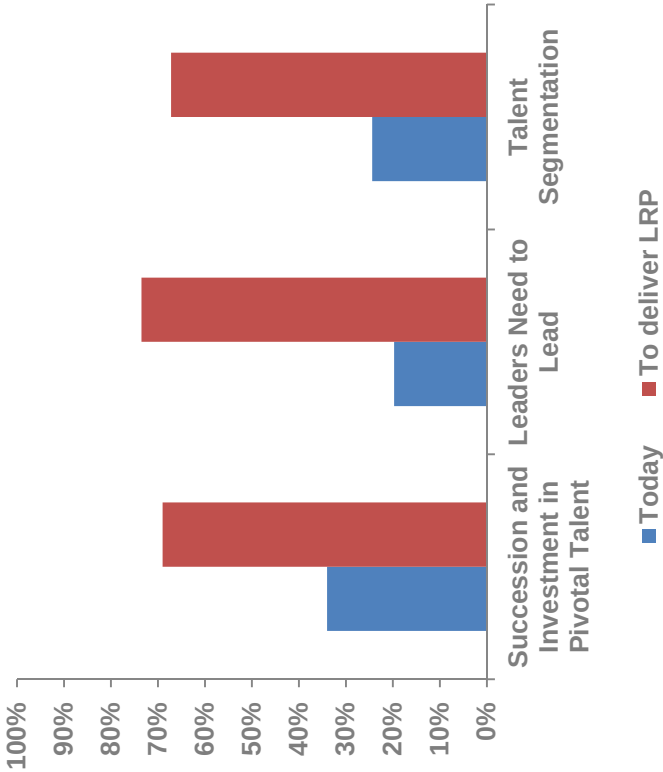
8X

Companies the focus on leadership are 8X better at implementing a performance-based culture; and creating a strong bench

Leadership matters



TOP 200 LEADERS



ALL EMPLOYEES WANT

- Open communication
- Transparency
- Mentoring
- Performance management

LEADING WITH ENERGY ASKED

- Clear accountabilities
- Empowerment
- Communications

We have a tremendous opportunity



TOP 200

ALL EMPLOYEES

360's ON SENIOR LEADERS

• Hire well • Retain 'A' players • 'A' players improve	• Proud of CSR • Enbridge University • Strong ELT leadership	• Strong work ethic • Set high personal standards • Accountable for results

Our Strategy: “Maximizing Potential”



- 1 Living our Enbridge Values**
- 2 Driving Excellence Through Leadership**
- 3 Attracting, Developing & Retaining People**
- 4 Executing with Discipline—HR Effectiveness**

Our Strategy: “Maximizing Potential”



1 Living our Enbridge Values

2 Driving Excellence Through Leadership

3 Attracting, Developing & Retaining People

4 Executing with Discipline—HR Effectiveness

Our strategy for driving excellence through leadership



Develop a leadership program
+
Strengthen leadership practices
+
Differentiate on potential & performance
=
Strong leadership talent pool

Excellence through leadership action plan



DEVELOP LEADERSHIP PROGRAM

WHERE DO WE STAND?

- Differs by business unit
- Strong role models
- Strong technical leaders
- Emphasis on experience
- Competencies not linked to strategy or processes

WHAT WE NEED TO DO:

- Define leadership and behaviors
- Measure our leaders on these behaviors
- Align behaviors to strategic plan

TOP TACTICS:

- Create model for leadership
- Develop behaviors /competencies by talent pool
- Link development plan to competencies

Excellence through leadership action plan



STRENGTHEN LEADERSHIP PRACTICES

WHERE DO WE STAND?

- On the job training
- Mentoring program
- Select executive coaching
- Classroom training

WHAT WE NEED TO DO:

- Implement cross BU leadership training
- Integrate training (formal, on the job, self) to competencies
- Make development a priority

TOP TACTICS:

- Launch senior leadership forum
- Launch Leader led Forums
- Implement boot camps
- Case based competency learning
- Grow ENB University

Excellence through leadership action plan



DIFFERENTIATE ON POTENTIAL & PERFORMANCE

WHERE DO WE STAND?

- 50% development plans
- 360 used well
- Embedded values
- Basic succession planning
- Succession risk



WHAT WE NEED TO DO:

- Build leadership tools that link to competencies and strategy
- Integrate tools in current processes
- Provide role clarity

TOP TACTICS:

- Develop VP and director profiles
- Build development plans for each level
- Enhance succession management
 - Implement 9 box
 - Review panels
 - Career pathing
 - External successors
 - Ready successor before moves
- Link leadership to performance mgt
- Mandatory development plans

When we are successful



DEVELOP LEADERSHIP PROGRAM

- Formal program launched - senior and front line leader program
- Enbridge University is enhanced
- Competencies rolled out and integrated

STRENGTHEN LEADERSHIP PRACTICES

- 100% of leaders have development plans by 2015
- Development plans are inspected so enhancements can be made
- All leaders have leadership objectives

DIFFERENTIATE ON POTENTIAL & PERFORMANCE

- 100% of VP have 2 green successors by 2014
- 100% Director and above have 2 green successors by 2015
- 1 in 4 high potentials increase from yellow to green in two years
- 80% of leaders find an improvement on 360s – 2015

Q&A



How do we stack up?



	Define Leadership	Leadership Competencies	Build the Tools	Create Opportunities	Integrate with Processes
TransCanada			Dev Plans, Assessment	No pre-defined #days expected	In progress
Suncor				✓ 6 days per year	
EPCOR				✓ 2 weeks per year	
Dow Chemicals				✓ Variable time commitment	
Sysco Foods				✓ 2 weeks per year	
Enbridge			IDP, 360		

Enbridge Accelerated Leadership Development Strategy

Presented to:
Executive Leadership Team

April 12, 2012



Contents



- 1. Business Drivers for Leadership Development**
- 2. Guiding Principles**
- 2. Development Tracks by Enbridge Talent Pools**
- 3. Enbridge Accelerated Leadership Development Strategy**
- 4. Investment Required**

Business Drivers of Leadership Development



- **New Competitive Business Environment**
- **Current Enbridge Workforce Has Less Company Experience**
- **Changing Work Practices and Performance Drivers**
- **Limited Number of “Ready-Now” Successors**
- **Very Business Unit driven versus Enbridge wide approach and talent pool**

Alignment with GD Syntegration Work



- **Executing on our Strategy**

- To become best North American Utility comes from Leadership to uncover, develop and hire best people
- Focus on Performance Management
- Optimize IDP

- **Best People**

- Identify high performance, critical role paths and succession talent pools
- Define skills, attributes and competencies for good leaders - incorporate these into a tool to uncover, develop and/or hire leaders
- Complete 360 assessment, training, mentoring, coaching to address gaps
- Create a leadership forum for leaders from all BU's to share their experiences and inspire others

Alignment with GD Syntegration Work



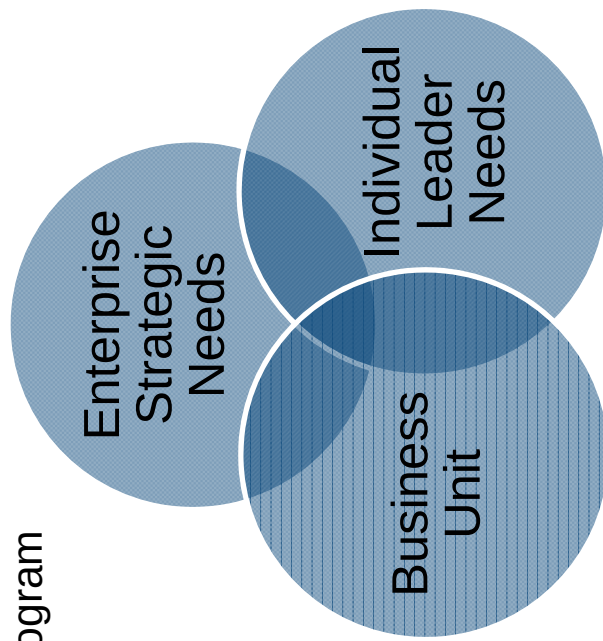
- **Best Customer Experience and Stakeholder Relationships**
 - Grow knowledge of customers/stakeholders through BU – Competency gaps identified for Business Acumen
- **Best Work Practices**
 - Determine skills needed to be a Supervisor and train
 - Give Leaders what they need to lead their people “People who are mentored will mentor. People who are led will lead.”
 - Offer a Leadership Boot Camp

Guiding Principles

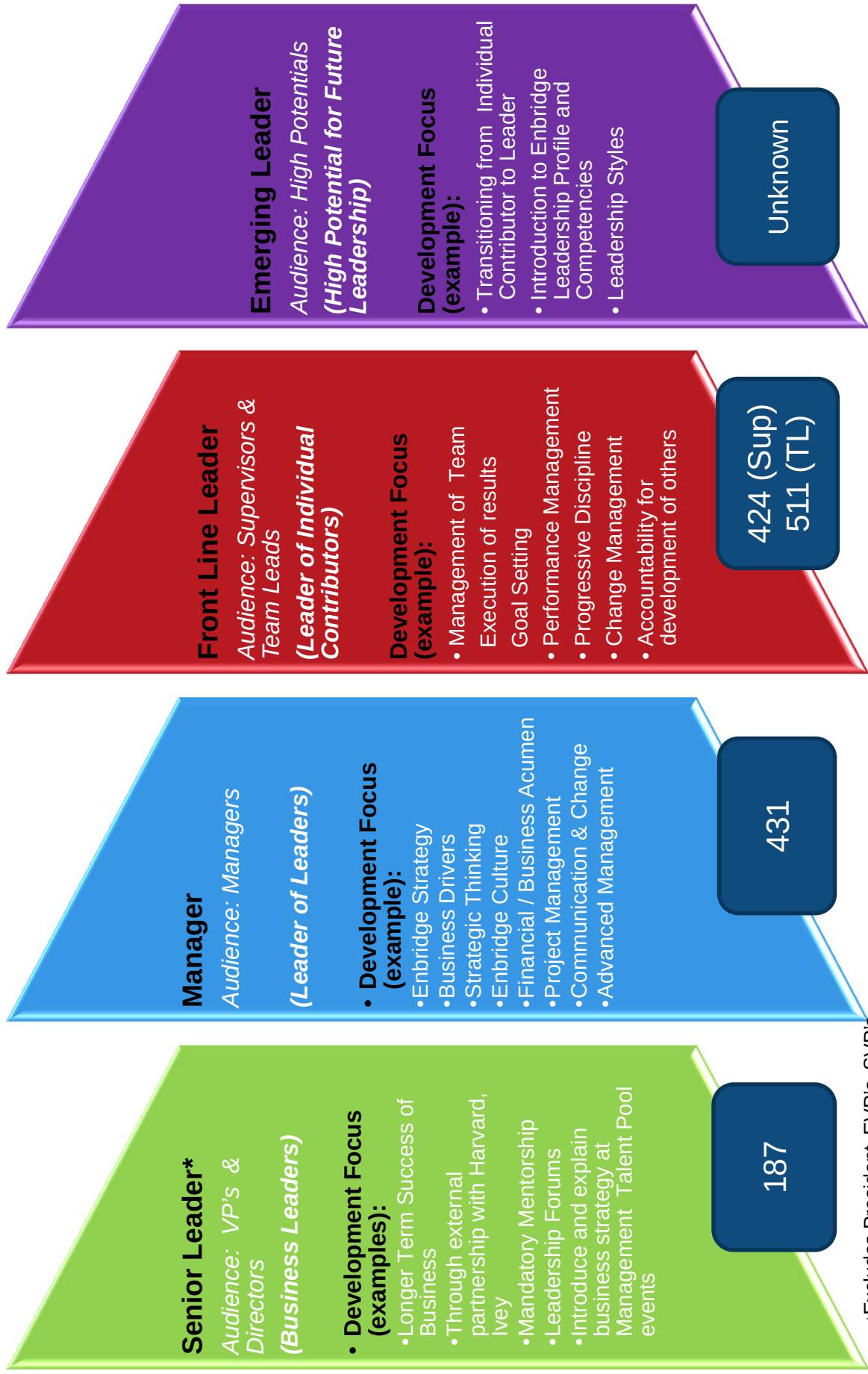


- ELT defines what the standard of leadership is at Enbridge
- Business focused three dimensional assessment (enterprise, BU, leader)
- The leadership development program is designed with action learning focus versus academic focus
- Proactive and nimble; reflective of strategy talent market changes, and learner demands
- Aligned with our values
- Accountability for both the learner and the learner's leader. Evaluation and measurement.
- Use best practice principles in design and development of program
 - (i.e. Leadership Excellence 2011-Top 500)

- Customizable at the design stage to incorporate the needs of the corporation and the business units
- Scalable and flexible at the implementation stage to allow for BU choice in talent pool participation

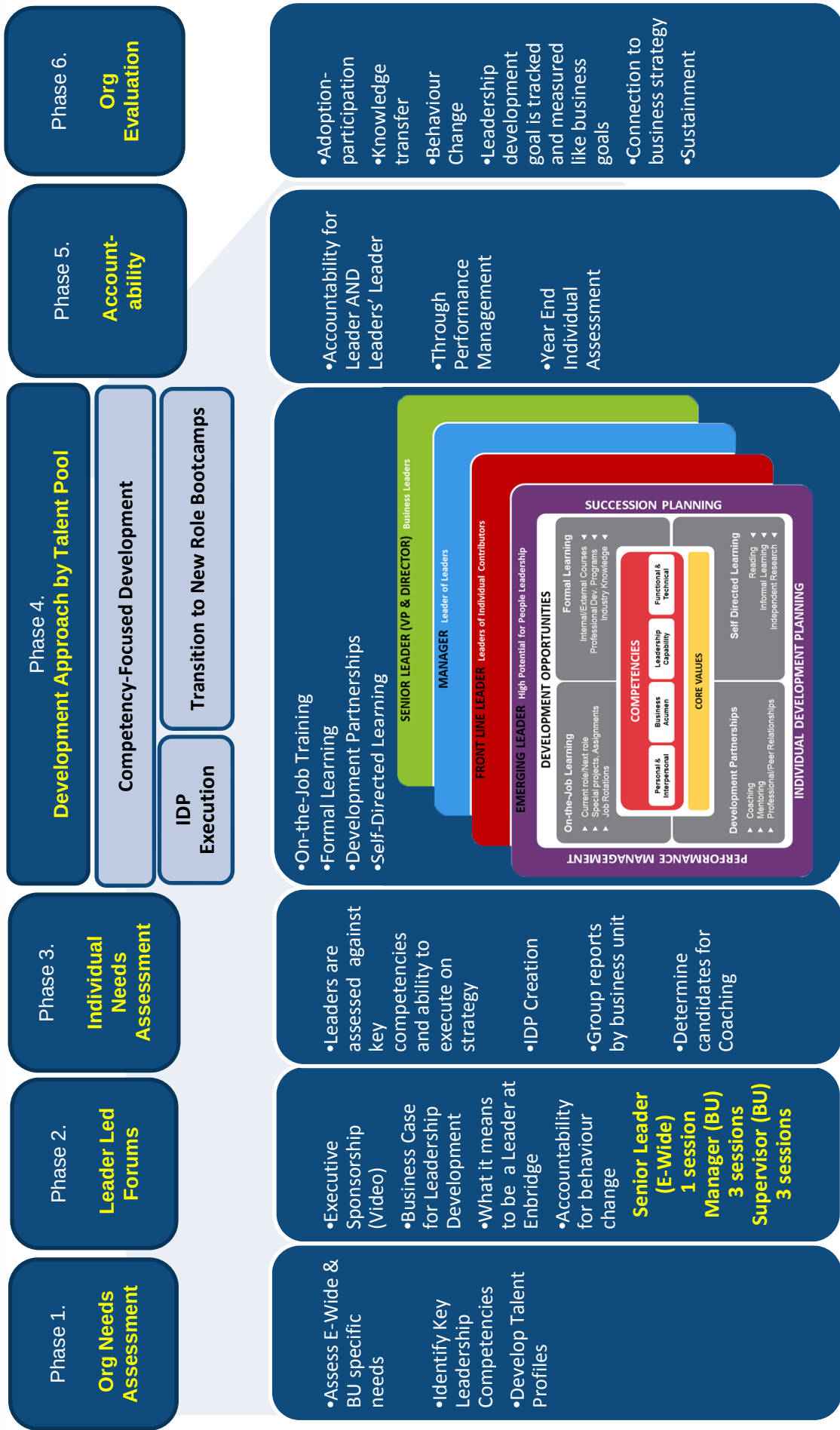


Proposed Development Tracks by Enbridge Talent Pools



*Excludes President, EVP's, SVP's

The Enbridge Accelerated Leadership Development Strategy



Annual Cycle

Investment Required by Year (Estimate)



Items	Year One (2012)	Year Two (2013)	Year Three (2014 & Beyond)
Staffing	\$640,000	\$640,000	\$640,000
Consultation (Assessments, Advice, Evaluations, Communications)	\$250,000	\$125,000	\$125,000
Design of Program Elements (Agenda, Course Materials)	\$120,000	\$60,000	\$60,000
Program Deliveries: (Forums, Bootcamps, Comp Dev Tracks)	\$435/Leader/Day (Forums in Sept, Bootcamps)*	\$865,000 (Bootcamps for New Leaders--300; Comp Dev Tracks)	\$1,875,000 (Forums, Bootcamps for New Leaders, Comp Dev Tracks)
Coaching Services	\$480,000	\$480,000	\$480,000
Total	Scalable	\$2,170,000	\$3,180,000

*May not deliver Bootcamps to all current leaders depending on design approval by Executive Steering Committee

Enbridge Investment in L&ED in 2011



	Industry Best Practice	Current Investment	Future Investment
Total Spend*	N/A	\$9,338,650**	\$12,518,650***
Spend Per Employee (7157 employees)	N/A	\$1,305	\$1,749
Percentage of Salary Costs	2.0 – 4.0%	1.18%	1.59%

* Includes e-wide actuals from Education Refund (60415), Employee Training & Development (60401), Conference Fees/Registration (70511); Executive Dev (60403)

** Includes current investment HR Spend \$3,436,375

***Includes additional \$3,180,000 requested for leadership development

Implementation Plan



Step	Description	Date
1	Confirm Executive Sponsorship & Steering Committee	April 2012
2	Create Change Management Plan to Overcome Resistance	May 2012
3	Organizational Assessment of Leadership Capabilities based on Strategic Priorities	June 2012
4	Design Development Plans by Leadership Talent Pool	Aug 2012
5	Launch New Enbridge Accelerated Leadership Development Program with communications to all Enbridge Leaders	Oct 2012
6	Implement Development Plan by Leadership Talent Pool (beginning with Leader-Led Forum)	Nov 2012
7	Design Leadership Development Metrics and Evaluate Early Results	Dec 2012
8	Adoption of Feedback and Incorporate Revisions	Feb 2013
9	Implementation and Sustainment of Leadership Development (Transition to New Role Boot Camp, Competency Development Day, Leader Ownership, Performance Reviews)	May 2013 – Nov 2013
10	Continuous Improvement and Alignment to Evolving Business Strategy	2013 and beyond

SEC INTERROGATORY #72

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[D1/3/2, p. 8] Please advise where LTIP is included in Table 1.

RESPONSE

Long Term Incentive Program ("LTIP") is not included in Table 1 at Exhibit D1, Tab 3, Schedule 2. Please reference Exhibit D1, Tab 4, Schedule 1, Attachment 1.

Witnesses: M. Lee
S. Trozzi

SEC INTERROGATORY #73

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[D1/3 and 4] Please provide a table showing all compensation forecast to be paid to the Applicant's employees for 2007 through 2016, by category, including all compensation of those employees included in RCAM.

RESPONSE

The table below outlines all compensation forecasts (as set out in the Customized IR Application) and actuals (for previous years) to be paid to the Applicant's employees for 2007 through 2016. Line 1 includes salaries and wages for all employees including those engaged in the DSM and CIS/Customer Care areas of the business. As a result, the amounts in Line 1 differ from the salaries and wages presented at Exhibit D1, Tab 3, Schedule 1, Table 2, because DSM and Customer Care employee costs are part of the overall costs presented for those activities (set out at Table 1 of Exhibit D1, Tab 3, Schedule 1).

		Employee Compensation 2007 - 2012 Actuals and 2013 - 2016 Budget									
Line No.	Particulars	2007 Actuals (\$000's)	2008 Actuals (\$000's)	2009 Actuals (\$000's)	2010 Actuals (\$000's)	2011 Actuals (\$000's)	2012 Actuals (\$000's)	2013 Budget (\$000's)	2014 Budget (\$000's)	2015 Budget (\$000's)	2016 Budget (\$000's)
1	Salaries and Wages (Ex. Stock based comp)	135,549	138,276	137,140	145,216	155,399	168,280	183,846	188,678	192,304	196,943
2	Short Term Incentive Pay	20,086	19,109	25,303	18,881	23,606	23,234	20,700	21,156	21,628	22,116
3	Benefits	25,122	22,854	23,705	23,895	21,550	24,886	25,261	25,756	26,350	26,925
4	Pension & OPEB	1,656	1,901	2,730	4,189	6,409	24,335	42,800	37,248	33,764	30,887
6	RCAM	1,663	3,122	4,262	4,842	6,413	7,549	10,658	10,157	10,505	10,289

Witnesses: M. Lee
S. Trozzi

SEC INTERROGATORY #74

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[D1/4/1, p. 5] Please provide details of the advice given by MNP as referred to in para. 9, including copies of any written advice provided.

RESPONSE

Details of MNP's recommendations can be found in MNP's final report dated May 17, 2012 filed on May 18, 2012 under EB-2011-0354, Exhibit D2, Tab 1, Schedule 1 attached to this response. No other written advice was provided.

Witnesses: S. Chhelavda
L. Liauw
B. Yuzwa

ENBRIDGE GAS DISTRIBUTION INC

INDEPENDENT EVALUATION OF THE 2013 REGULATORY COST ALLOCATION METHODOLOGY RESULTS

FINAL REPORT

Prepared for: Enbridge Gas Distribution Inc.

Prepared By: MNP LLP
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Date : May 17, 2012



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LIST OF ATTACHED APPENDICES

- Appendix A: MNP Scope per Consulting Agreement (Schedule A)
- Appendix B: EGD Service Schedules
- Appendix C: MNP Interview Guides
- Appendix D: MNP Individual Service Analyses
- Appendix E: EGD Intercompany Services Agreement
- Appendix F: MNP Detailed ISA Review
- Appendix G: MNP Curriculum Vitae

**INDEPENDENT EVALUATION OF 2013
REGULATORY COST ALLOCATION METHODOLOGY RESULTS**



1 EXECUTIVE SUMMARY

In the 2010 Earnings Sharing Mechanism (“ESM”) proceeding, EB-2011-0008, Enbridge Gas Distribution (“EGD”) agreed that as part of the evidence in support of its 2013 Application, EGD would work with a third party consultant to prepare and file an updated study addressing the costs sought to be recoverable under the Regulatory Cost Allocation Methodology (“RCAM”) for future years.

EGD selected MNP to conduct an independent review of EGD’s RCAM, and assess the reasonableness and appropriateness of corporate service charges calculated by the RCAM for 2012 and 2013. The foundational framework for this assessment is the Ontario Energy Board (“OEB” or “Board”) Three Prong Test, which is designed for the Board to determine if the corporate shared services costs are in the public interest of ratepayers based upon the prudence of the services as a standalone utility, appropriate allocation based on cost causality and the relative benefits of the service weighed against its cost.

MNP SCOPE AND APPROACH

It was agreed by EGD that MNP would perform the following primary activities in assessing the reasonableness and appropriateness of RCAM allocations:

- Intercorporate Services Agreement (“ISA”) Review.
- RCAM Methodology Review.
- Review of Recommendations from the 2007 MNP Report.
- Conduct a Three Prong Test for RCAM allocated services (Primary Services, Direct Charges and General Expenses).

MNP has based its analysis and conclusions on a combination of information sources, including the following:

- Intercorporate Services Agreement between Enbridge Inc. (“EI”) and EGD.
- EGD Service Schedules and Business Cases.
- Interviews and other Direct Communications.
- Secondary Research – Market Data, Relevant External Reports.
- 2007 MNP Report.
- MNP Experience and Opinion.

KEY FINDINGS

Upon conducting its independent review, MNP made the following key findings:

RCAM METHODOLOGY REVIEW

- a) The ISA is compliant with the Board’s Affiliate Relationships Code (“ARC”) for gas utilities as amended.
- b) The RCAM Methodology remains appropriate for EGD and was adhered to in the development of allocations for 2012 (and 2013 through the escalator).
- c) Further to MNP’s integrity testing on a sample basis, MNP found no calculation errors with the RCAM financial model. The RCAM financial model appears to operate as expected.

**INDEPENDENT EVALUATION OF 2013
REGULATORY COST ALLOCATION METHODOLOGY RESULTS**



COST ALLOCATION REVIEW

The review focussed on relevant services for which there were 2012 RCAM allocations, including 30 Primary Services and 6 General Expense and Direct Charge categories.

- d) With consideration for exclusions and service levels required for EGD 2012 business activity, all services passed the Incurrence component of the Three Prong Test.
- e) All services passed the Allocation component of the Three Prong Test for 2012.
- f) All but three Primary services passed the Cost Benefit component of the Three Prong Test. The three failed Primary services included Capital Market Financing and Access, Employee Development and HRIS Program Management and Development.
- g) The escalation factor selected by EGD to estimate 2013 RCAM allocation is reasonable.

In MNP's opinion, incorporating MNP proposed adjustments based on the failed Prong Three Tests, the 2012 and 2013 RCAM corporate services allocations are being incurred prudently and allocated appropriately with benefits that exceed costs for ratepayers.

RECOMMENDATIONS

ADJUSTMENTS

With the three failed Prong Three Tests, MNP proposes a consolidated downward adjustment to 2012 and 2013 RCAM allocations of \$154,923 and \$158,329, respectively.

IMPROVEMENT OPPORTUNITIES

Based upon observation and investigation, MNP has identified a number of opportunities to improve the RCAM process.

1. Categorize and Roll up Services for Comparison Purposes – MNP recommends that EGD categorize and roll up services to levels more consistent with reporting of other utilities for comparison purposes, and subsequently undertake a more structured benchmarking study to evaluate costs.
2. Business Case Upgrades – MNP recommends that EGD develop two specific upgrades to business cases:
 - a. Criteria for External Estimates of Cost – EGD should develop and implement more refined criteria for Service Recipients to facilitate the development of cost estimates for the provision of external service.
 - b. Variance Analysis – MNP feels it would be prudent to add a section to each business case to track year over year variances in allocation cost.
3. Service Level Evaluation – Leading practices in the area of procurement and vendor management suggest that the service recipient work with the provider to develop agreed-upon performance metrics using a service level agreement or other evaluation mechanism.
4. Recovery Mechanism – MNP feels it would be prudent on behalf of ratepayers to consider employing a new or existing mechanism to recover or otherwise true-up any material discrepancies based on unanticipated differences between budget and actual allocations for the budget year.

**INDEPENDENT EVALUATION OF 2013
REGULATORY COST ALLOCATION METHODOLOGY RESULTS**



LIMITATIONS OF MNP REVIEW

- MNP's review consisted of enquiry, analytical procedures, and discussions related to information supplied to us by EI and EGD. MNP did not perform an audit of this data and did not perform a detailed examination of underlying transactions or validate source records, except where specifically noted in our approach.
- MNP did not conduct a benchmark study for the Cost/Benefit component of the Three Prong Test. Our analysis is a Fair Market Value assessment using comparative market data and MNP's expert opinion on the costs of internal and external provision of services.

**INDEPENDENT EVALUATION OF 2013
REGULATORY COST ALLOCATION METHODOLOGY RESULTS**

2012 AND 2013 RCAM PROPOSED ALLOCATIONS

2013 RCAM - Services Review - (\$)		2012 RCAM Allocation			2013 RCAM Allocation	
Service Function		2012 Agreed under ISA	2012 Prong 3 MNP Proposed Adjustment	2012 MNP Proposed	2013 EGD Proposed	2013 Prong 3 MNP Proposed Adjustment (escalated 2012 Adjustment)
1	Audit & Accounting Advice	91,270	-	91,270	93,278	-
2	Board of Directors Support	769,368	-	769,368	785,892	-
3	Business Development	736,918	-	736,918	753,039	-
4	Capital Market Financing & Access	1,020,173	(28,303)	991,870	1,042,564	(28,924)
5	Cash Management & Banking	481,073	-	481,073	491,656	-
6	Consolidation and Planning System Technical Support	245,089	-	245,089	249,486	-
7	Corporate Compliance	197,202	-	197,202	201,540	-
8	Employee and Labour Relations	478,201	-	478,201	488,722	-
9	Employee Development	1,260,568	(14,945)	1,245,623	1,288,299	(15,274)
10	Enterprise IT Program Management	868,494	-	868,494	887,579	-
11	Enterprise IT Strategy Planning & Management	624,115	-	624,115	637,845	-
12	Expense System Management & Technical Support	95,490	-	95,490	97,384	-
13	External Audit Coordination	103,399	-	103,399	105,673	-
14	Financial and Project Accounting System Technical Support	352,161	-	352,161	358,097	-
15	Government Relations	44,917	-	44,917	45,895	-
16	HRIS Program Management and Development	3,009,273	(111,675)	2,897,598	3,075,443	(114,131)
17	Human Resource Advice	201,779	-	201,779	206,184	-
18	Industry Relations & Corporate Social Responsibility	384,365	-	384,365	392,741	-
19	Insurance Claims Support, Strategy and Management	108,240	-	108,240	109,912	-
20	Investor Services	883,837	-	883,837	903,044	-
21	Legal Advice	514,396	-	514,396	525,600	-
22	Planning, Management, & Execution of Internal Audits	191,528	-	191,528	195,741	-
23	Portal Suite Operations and Technical Support	330,881	-	330,881	338,160	-
24	Rate Regulated Entity Support	253,904	-	253,904	259,490	-
25	Records & Information Management	538,352	-	538,352	550,195	-
26	Risk Assessment & Management	878,461	-	878,461	897,681	-
27	Strategic Planning	327,890	-	327,890	335,020	-
28	Supply Chain Management	39,706	-	39,706	40,580	-
29	Tax Reporting & Planning	55,308	-	55,308	56,525	-
30	Total Compensation & Benefits	1,781,809	-	1,781,809	1,820,969	-
Primary Service Totals		16,868,167	(154,923)	16,713,244	17,234,234	(158,329)
31	Depreciation - Risk Management System	64,951	-	64,951	64,951	-
32	Direct EFS Charge	(2,314,784)	-	(2,314,784)	(2,314,784)	-
33	Directors Fees & Charges	744,819	-	744,819	761,205	-
34	Audit Fees	N/A	N/A	N/A	N/A	N/A
35	EGD Stock Based Compensation	7,549,229	-	7,549,229	7,715,312	-
36	Insurance Premiums	8,483,868	-	8,483,868	8,483,868	-
Direct Charges and General Expenses Total		14,528,083	-	14,528,083	14,710,552	-
Return on Investment		368,896	-	368,896	357,703	-
Total RCAM Allocation		31,765,146	(154,923)	31,610,223	32,302,489	(158,329)

**INDEPENDENT EVALUATION OF 2013
REGULATORY COST ALLOCATION METHODOLOGY RESULTS**



2 BACKGROUND

EI supplies a number of corporate services to its affiliates (one of which is EGD) and determines the respective service cost allocation amongst the service recipients using an internally developed methodology.

EI maintains a Corporate Cost Allocation Methodology (“CAM”) to transfer costs to all its affiliates, including EGD, for internal management and performance measurement purposes. The RCAM has been developed to determine the cost allocations from EI to EGD for regulatory rate making purposes pursuant to filings submitted to the Board. The RCAM methodology has been developed for specific alignment with the ARC, originally issued on July 31, 1999 and last revised on November 25, 2010.

In 2006, the OEB directed EGD to retain an independent third-party to conduct an evaluation of the RCAM and the resultant shared service charges that EI allocated to EGD. EGD chose MNP as the independent evaluator for the review and analysis at that time. MNP prepared an analysis and provided recommendations of all corporate shared services between EI and EGD in 2006 using leading practices and subject matter expertise along with the OEB-defined Three Prong Test (defined in section 10.2).

EGD has asked MNP to conduct an updated review to support its 2013 Rate Application.

3 OVERVIEW & OBJECTIVES

MNP was engaged by EGD to produce this written report and act as an independent expert witness to Enbridge’s 2013 Rate Application, if required.

The objective of the evaluation is to assess the appropriateness of the 2012 and 2013 allocation results generated using the RCAM methodology, which was previously approved by the Board and used to calculate the corporate service charges in the 2007 Rate Case. MNP will also undertake an independent review and determine the status of recommendations made in MNP’s 2007 Independent Evaluation of Enbridge Gas Distribution Inc.’s Regulatory Corporate Cost Allocation Methodology (“2007 MNP Report”). The Study will also review any revisions or updates to RCAM subsequent to the 2007 MNP Report. This report encompasses the methodology and findings for MNP’s independent evaluation.

3.1 SCOPE OF THE 2011 ENGAGEMENT

EGD and MNP determined the following analysis activities to be in scope for this evaluation:

Activity	Description
ISA Review	Determine changes to the Intercompany Service Agreement (“ISA”) between 2006 and 2012 and assess the effect of changes to the cost allocations from EI to EGD. Review for compliance with OEB’s ARC.

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Activity	Description
RCAM Methodology Review	Determine the changes to the RCAM between 2007 and 2012 and comment on the effect of changes to current cost allocations from EI to EGD. Review the model for operational integrity.
Recommendations from 2006 Report	Review the recommendations made by MNP in the 2007 Report and comment on the status of implementation of the recommendations.
OEB Directives	Conduct a review of OEB directives to identify applicable decisions and directives related to EGD or other affiliates regulatory cost allocations.
Primary Service Analysis	Conduct an analysis (including a Three Prong Test) on all Primary Services cost allocations from EI to EGD.
Direct Charge and General Expense Analysis	Conduct an analysis (including the Three Prong Test) on 6 General Expenses and Direct Charges that have cost allocations from EI to EGD.
Return on Investment Analysis	Review the cost allocation to ensure compliance with the ARC.

The scope of the Project as agreed within MNP's Consulting Agreement with EGD may be found in Appendix A.

4 STAKEHOLDERS

In the 2006, OEB directed EGD to conduct an independent assessment and perform a prescribed level of stakeholder engagement¹. EGD has also conducted annual corporate cost allocation consultative sessions with Intervenor pursuant to the Supplementary Settlement Proposal appended to Decision with Reasons EB-2006-0034 of May 20, 2008. While there was no such directive from the OEB for this engagement, EGD and Intervenor agreed an updated study would be prepared.

In order to understand and respond to any questions or concerns relating to the terms of reference for this Study, MNP met with Intervenor and EGD on January 31, 2012. Several concerns were raised by the Intervenor group, including escalating year over year allocations and the integrity and operation of the RCAM financial model. Pursuant to this meeting, MNP expanded the scope of its RCAM financial model review to provide a level of assurance in its estimation commensurate with Intervenor concerns. Year over year escalations are also considered in this Study.

The stakeholder process also included distribution of a draft of this Report to the Intervenor group for review, and a subsequent meeting for discussion. This additional meeting allowed MNP the opportunity to further consider Intervenor questions or concerns prior to finalization of the Report.

¹ Decision with Reasons, EB 2005-0001, February 9, 2006.

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4.1 KEY STAKEHOLDERS

Stakeholder Group	Role	Interest
Enbridge Gas Distribution Inc.	- Regulated Entity and Project Sponsor. 'Service Recipient' of EI corporate services. - Management of operations and delivery of customer service. - Interview participant. - EI budget review.	- Satisfy ARC requirements. - Appropriate application of RCAM process with EI. - Accuracy and completeness of shared services allocations.
Enbridge Inc.	- Corporate services 'Service Provider' to EGD. - Custodian of CAM and RCAM model. - RCAM subject matter expert and source of RCAM knowledge to project team. - Interview participant. - Preparation of budget.	- Appropriate application of RCAM process with EGD. - Accuracy and completeness of shared services allocations.
Intervenor Group	Review and comment on RCAM process, allocation results, and MNP independent evaluation.	Represent the interests of Ontario ratepayers and ratepayer groups.
MNP LLP	Independent evaluator.	Independence and objectiveness of evaluation of RCAM process and cost allocations against established standards.
Ontario Energy Board	- Protect in interest of consumers in the gas distribution market. - Provides regulatory framework and oversight. - Issues regulatory Directives and Decisions.	Ensure interests of the Ontario rate payers are protected while affording EGD an opportunity to earn an acceptable Return on Investment.
Ratepayers	Represented by Intervenor.	Achieve most appropriate level of service for reasonable cost.

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4.2 PROJECT PARTICIPANTS

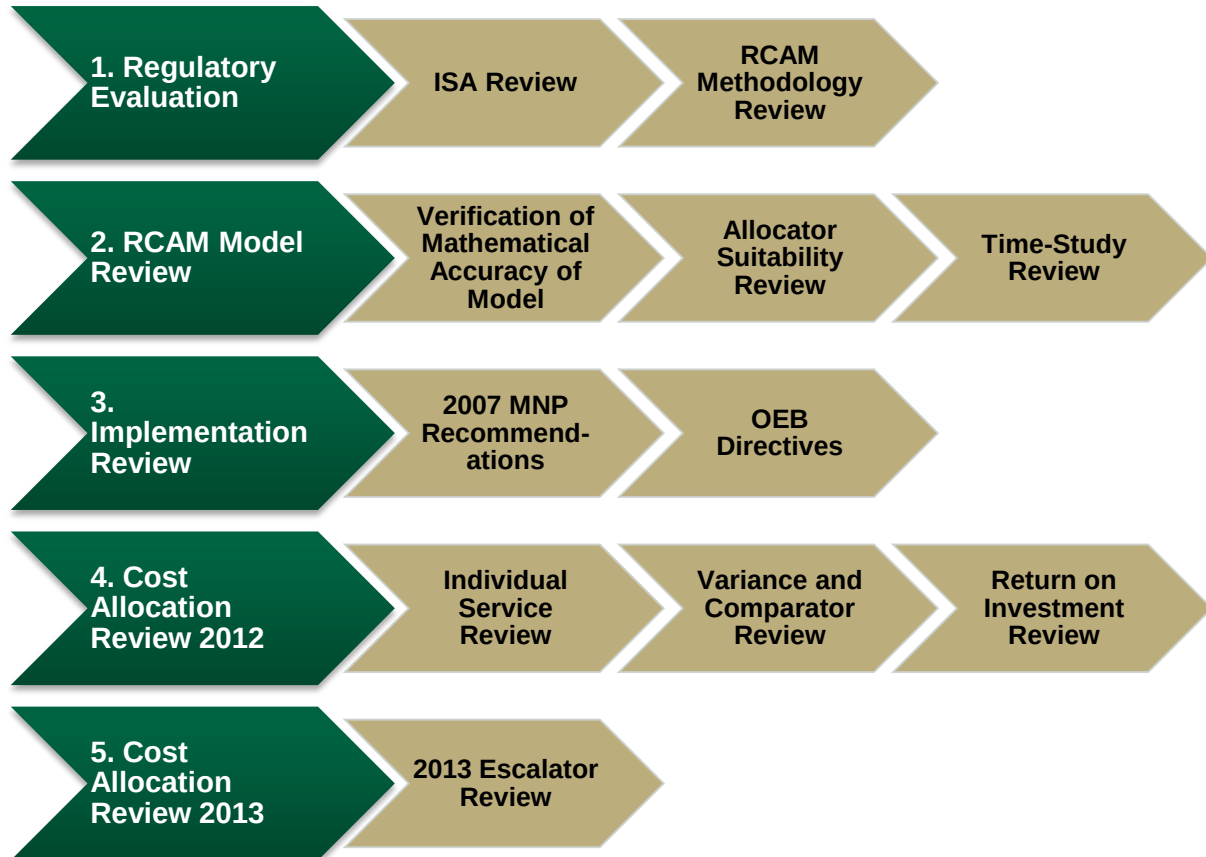
Stakeholder Group	Project Participant(s)
Enbridge Gas Distribution Inc.	Barry Yuzwa, Controller Robert Bourke, Manager Regulatory Proceedings Lee Liauw, RCAM Coordinator Robert Cappadocia, Consultant (Elenchus Research Associates)
EGD Service Recipients	Arunas Pleckaitis, VP, Business Development & Customer Strategy Debbie Boukydis, Director, Public and Government Affairs Henry Wong, Director, Information Technology Jamie Milner, VP Pipeline Integrity and Safety Marc Weil, Director, Human Resources Mark Boyce, VP, Law and Information Technology Mark Sabatini (for Glenn Beaumont), Manager, Supply Chain Narin Kishinchandani, VP, Finance
EI RCAM Coordinators	Fahreen Rattani, CAM Coordinator Jonathan Morgan, (former) RCAM Designer/Developer Ola Olatunde, RCAM Coordinator
Participating Intervenors	Roger Higgin, Vulnerable Energy Consumers Coalition Vincent DeRose, Canadian Manufacturers & Exporters Jay Shepherd, School Energy Coalition Julie Girven, Consumers Council of Canada David MacIntosh, Energy Probe Ian Mondrow, Industrial Gas Users Association
MNP LLP	Jason Hails, Engagement Leader Ysobella Phillipe, Project Manager Chris Balkaran, Core Project Team Member Khalid Abdul Razak, Core Project Team Member Arthur Kao, Core Project Team Member Various other Team Contributors

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5 MNP APPROACH

MNP has structured its approach and findings into the following sequence:



6 INFORMATION SOURCES

MNP has based its analysis and conclusions on a combination of information sources, including the following:

- Intercorporate Services Agreement between EI and EGD, including EGD's Regulatory Cost Allocation Methodology (Schedule 1 to the ISA).
- EGD Regulatory Cost Allocation Methodology Service Schedules.
- EGD Business Cases.
- Primary Research – Interviews and other Direct Communications.
- Consultative sessions with Intervenor.
- Secondary Research – Market Data, Relevant External Reports.
- MNP 2007 Report "Independent Evaluation of Enbridge Gas Distribution Inc.'s Regulatory Corporate Cost Allocation Methodology – Final Report" dated February 28, 2007.
- MNP Experience and Opinion.

6.1 REGULATORY COST ALLOCATION METHODOLOGY (RCAM)

The RCAM is discussed at length in the RCAM Methodology Review Section of this report and details EGD's regulatory design objectives and principles (just and reasonable, cost of service, prudence), regulatory design features (services based approach, multi-step allocation process, service description transparency, demand pull by recipients) and cost drivers and rationale for allocation modelling.

6.2 EGD SERVICE SCHEDULES

EGD Service Schedules provide key information by service, including:

- Service description.
- Services identified by EI supporting departments, at a detailed level, with costs.
- Service recipient.
- Expected deliverables.
- Quantity and quality of service.

6.3 EGD BUSINESS CASES

Business cases prepared by EGD add context for each of the shared services, and provides MNP with EGD's documented account of key characteristics and benefits for each service. Business cases provide the following information:

- Specific service requirement for the operation of EGD.
- Itemized services/deliverables and expected service levels (quantity and quality indicators).
- Identification of EI as a sole or supplemental provider.
- Excluded services based on exclusion criteria (standardization, minding the investment, additional management layer, other).
- Existence of a reasonably competitive market for the required services.
- Estimated cost of services if acquired externally.
- Estimated cost of services if provided internally at EGD.
- Cost breakdown (direct, indirect, primary, support) of EI provided services.
- Cost benefit analysis of EI, External and EGD provision of service.

6.4 PRIMARY RESEARCH

A critical element of information gathering and analysis was the interview process with representatives the Service Recipients (EGD) and the RCAM Coordinators at both EI and EGD. The primary purpose of the Service Recipient interviews was to determine the Service Recipient's understanding of the RCAM process, the services required to manage their business and related costs. These interviews were important to determine the 'demand pull' or needs based provisioning of services, as opposed to provisioning being 'pushed' on EGD by EI.

The primary purpose of the RCAM Coordinator interviews was to verify the RCAM methodology, ascertain the services allocation process and verify the demand pull.

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MNP developed interview guides to facilitate information sharing. In most cases the guides were provided to the interviewees in advance of the interview to enable the participants to provide thoughtful responses to information requests. In each interview, MNP referred to the service schedules and business cases signed off by the Service Recipient, and the interview questions were created to frame the discussion and foster open dialogue for additional context. Follow-on questions typically related to the services provided, management challenges and opportunities, business cases development, and alternative service delivery models.

Over the course of the information gathering phases, MNP conducted 8 interviews with the Service Recipients (EGD) and 4 interviews with the RCAM Coordinators (EI and EGD). Any requirement for further clarification arising from this analysis was followed-up directly with the relevant service recipients. In many cases additional supporting information was provided by the Service Recipients.

Interview question templates are included in Appendix C.

6.5 SECONDARY RESEARCH

Secondary research includes data found in the public sphere, including regulatory reports (e.g. benchmarking, shared services reports, independent assessments), applications, decisions and orders, financial data (e.g. annual reports), white papers, published articles and interviews, etc.

MNP has incorporated footnotes to cite references.

6.6 MNP EXPERIENCE AND OPINION

MNP is a Canadian Accounting, Tax and Consulting firm and has about 300 principal partners and over 1,800 staff. The MNP Consulting services group has 20 partners supported by over 110 consulting professionals. This broad team brings significant senior management and operations subject matter knowledge in finance, accounting, administration, business development, human resources, information technology and various other shared service functions. In addition, MNP has significant experience in operations and consulting for regulated energy and utilities companies.

The MNP team appointed for this assessment includes MNP's national practice leader for Energy & Utilities, and the engagement team has worked with over 20 utilities, regulators, energy related ministries and Intervenors across Canada.

This industry familiarity is augmented by direct experience with shared service allocation models. As noted, MNP was retained by Enbridge in 2006 to conduct an independent evaluation of the RCAM results for EGD's 2007 filing, so the team has the benefit of the file and its working papers for the current exercise. Additionally, the team has hands on experience working with shared services allocation models in a utility environment.

MNP has provided its expert opinion throughout this final report. Opinions have been developed based on the engagement team's experience, supported by primary and secondary research and reference materials noted above.

6.7 LIMITATIONS OF THE MNP REVIEW

As discussed above, MNP's review consisted of enquiry, analytical procedures, and discussions related to information supplied to us by EI and EGD. Given these circumstances, MNP notes the following limitations:

1. Information Reliance on EI and EGD

For financial results and data specific to EI and EGD, MNP relied primarily on information provided by EI and EGD. MNP also relied on the representation of the staff, management, and executives of EI and EGD. EI and EGD therefore retain responsibility for the accuracy and completeness of the data provided.

MNP did not:

- Audit any of the data received.
- Perform a detailed examination of underlying transactions or validate source records, except as specifically noted in our approach. MNP believes however that this update Study is a robust examination of 2012 and 2013 RCAM methodology and results.

2. Not a Benchmarking Study

MNP did not conduct a benchmark study for the Cost/Benefit component of the Three Prong Test. By definition, a benchmark study compares very specifically defined and acquired data from a similar sample of willing participants. For this review, the cost/benefit analysis was based on comparative market data and MNP's expert opinion about the costs of internal and external provision of services.

7 ISA REVIEW

The ISA between EI and EGD presents a code of conduct for the provision of shared services and resources. MNP conducted a review of the 2011 ISA to ensure compliance with the OEB's *Affiliate Relationships Code for Gas Utilities*. The ISA included in the appendices to this report is comprised of the following:

- The main ISA agreement dated 1 January, 2011.
- Schedule 1 Regulatory Cost Allocation Methodology (revised January 2011).
- Appendix A to Schedule 1 RCAM Allocator Definitions (revised January 2011).
- Schedule 2(b) executed RCAM Confirmation Notice for 2012.
- Appendix A to Schedule 2(b) RCAM 2012 Allocations to EGD (financial tables).
- Appendix B to Schedule 2(b) RCAM Service Schedules (effective January 1, 2012).

The main agreement and schedules are included in Appendix E. MNP reviewed the agreement, the supporting schedules and appendices against industry and regulatory standards including compliance with OEB's Affiliate Relationships Code (ARC).

MNP's assessment of ISA compliance with the Affiliate Relationships Code for Gas Utilities (as revised on November 25, 2010) focused on Section 2.2.1 and 2.3 requirements (see below). Recommendations for improvement have been made for Sections 2.3.3. Please refer to Appendix F for the detailed analysis and recommendations.

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MNP ISA Review Conclusion:

The ISA complies with the criteria specified in the ARC and compares favourably against industry standards.

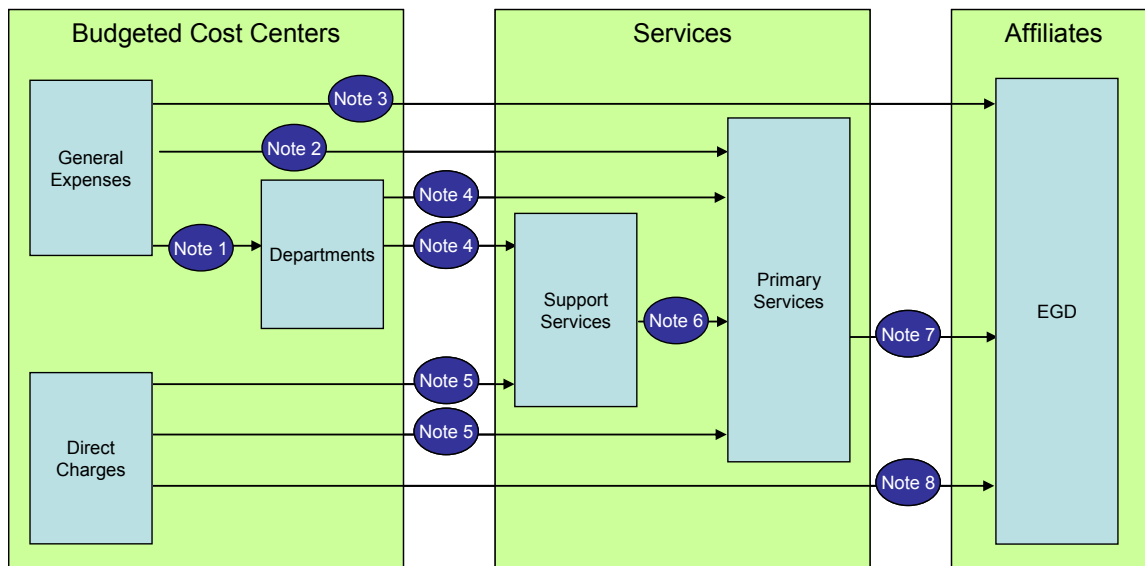
8 RCAM METHODOLOGY REVIEW

MNP understands that the Board and the stakeholder group involved with the 2007 MNP Report accepted the methodology utilized, and MNP has therefore focused its review on integrity of the various process inputs, EGD's application of the methods for 2012 and 2013, proper functioning of the model and any changes to the methodology from 2007 to the present.

8.1 RCAM OVERVIEW

The RCAM forms an integral part of the ISA between EI and EGD and is included in Appendix E to this report. The RCAM is manifested through time study and financial modeling tools. MNP reviewed the mechanics of these tools to evaluate the application of the methodology as documented in the ISA.

RCAM is a services-based approach to allocating shared corporate costs from the parent company (EI) to the affiliate (EGD). The following diagram, reproduced from Appendix E, illustrates the conceptual approach to allocating the shared corporate costs. Detailed descriptions of each step (corresponding to Notes 1 - 8) are included in Appendix E and summarized below:



Step 1, 2, 3: General Expenses are attributed to Departments, Primary Services, or directly to EGD as determined by respective benefit.

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Step 4: Loaded Department costs are allocated to the relevant Primary Services or Support Services.

Step 5 and 8: Direct Charges are allocated to relevant Support Services, Primary Services, or directly to EGD.

Step 6: Support Services are allocated (loaded) to Primary Services.

Step 7: Primary Services are allocated to EGD.

8.2 SERVICE SCHEDULES AND BUSINESS CASES

To further demonstrate the cost-benefit, establish the demand-pull process for services and support the requirement of delivery of services from EI to EGD, EGD independently undertakes preparation of internal business cases for each service. The OEB's Affiliate Relationships Code for Gas Utilities, as revised November 2010, included a requirement that a business case analysis be prepared once every 5 years if a utility wishes to continue to receive services from an affiliate. However, EGD prepares business cases for all service areas on an annual basis.

The business cases are completed by the various business unit managers at EGD following revisions by Service Providers to EI's menu of service offerings entitled "RCAM Time Study Service Descriptions". The Service Recipient determines which of the EI service offerings are required, and Recipients prepare proposals for the level, type, source, description, and cost of service to be provided by EI to EGD for ultimate approval.

The business cases define the nature of the service, the source of the service, the level of the service required, estimated cost of the service and alternate methods of service acquisition and delivery. They provide estimates of provisioning options, including EGD (Internal) and External, and outline strengths and weaknesses to each provisioning option. Each business case indicates which activities the Service Recipients selects for exclusion based on exclusion criteria (beyond the scope of a utility, minding the investment or additional layers of management or other).

The business cases were used by MNP to conduct its review, as the business cases provided insight into the delivery of services from the perspective of the Service Recipients. This information was independently examined by MNP in its estimation of Fair Market Value for both internal and external provisioning estimates.

Service schedules are included in Appendix B.

MNP RCAM Methodology Conclusion:

The RCAM allocation methodology is valid and the allocating factors are reflected appropriately through the respective cost drivers.

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8.3 RCAM MODEL REVIEW

MNP verified the mathematical accuracy of the RCAM, which is developed and executed on Microsoft Excel. The model verification process consisted of two tests:

1. **Structural Comparison** – A comparative analysis of the current RCAM model against the 2007 RCAM by examining formulae differences.
2. **Integrity Test** – An integrity evaluation of calculations within the current RCAM model by verifying the built-in reconciliation “checks” in the model.

Source information:

File Name	Retrieved from
2012 RCAM Allocation Model v10.xlsx	Ola Olatunde, Budget Advisor
2007 RCAM Allocation Model - Master - 11-07-06.xls	Fahreen Rattani, Advisor, Budgets and Forecasts

8.3.1 Model Review Methodology

Structural Comparison

For the structure comparison, MNP analyzed formula groups (blocks of copied formulae in a spreadsheet) for changes. Formulae within a formula group are expected to share the same structure but differ in cell references. Therefore, by using formula group comparison, MNP reduced complexity to identify changes.

Prior to the structural comparison, MNP excluded six new output worksheets that were not present in the 2007 model. Output worksheets have precedents but no dependents, therefore they did not have any effect on model operations and no analysis was required.

Using *Rainbow Analyst* spreadsheet audit software, MNP compared the models on a cell-by-cell basis through formula groups, and subsequently flagged possible changes. MNP manually reviewed the flagged changes through sampling focusing on the critical input, calculation, allocation and summary worksheets outlined in the ‘Model Overview’ tab, to increase the effectiveness and relevance of sampling.

Integrity Test

To ensure the validity of the calculations, the RCAM model has a series of built-in reconciliation worksheets that verify the correctness of the calculations, noting any identified discrepancies.

MNP examined the dependency links between the reconciliation worksheets and the ‘Input’, ‘Allocation’, and ‘Calculation’ worksheet groups. In order for the verification mechanism to be effective, reconciliation worksheets must not be dependent on the calculation being reconciled.

Furthermore, using formula error-checking, MNP inspected the formula construction within the Reconciliation worksheets to identify inconsistencies.

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8.3.2 Model Review Results

Test	Result
Structural Test	MNP noted 1,025 variances in the formula groups between the 2007 and 2012 models. To further examine the differences, MNP used <i>Caseware IDEA</i>, a data analytic and audit software, to randomly sample 140 changes to account for the risk of incorrect acceptance. The risk of incorrect acceptance is defined as the risk of incorrectly inferring the number of changes found is less than an acceptable rate of changes. For this comparison, no deviations were observed in the sampled 140 changes; therefore MNP is at least 99% confident that the changes in the population do not exceed 3%. MNP manually examined the sampled cell formulae on the 2012 model. Most of the changes occurred due to departmental additions and change in constants, therefore causing the cell reference to change. MNP noted there were 20 changes in the "XII. EI SBC Detail" worksheet, resulting from a valuation methodology change. These changes were attributed to previous recommendations and the actual valuation calculation was performed outside of the model.
Integrity Test	MNP analyzed the formula references and found the worksheets to be consistent without references directly to calculation worksheets. MNP did not find any formula inconsistencies that would result in errors of calculation.

MNP Verification of Mathematical Accuracy of Model Conclusion:

The 2012 RCAM model workbook remains consistent with the 2006 version, and MNP found no calculation errors.

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8.3.3 Allocator Suitability Review

MNP's consideration of the appropriateness of cost allocators was based on a detailed analysis of the RCAM model. In order to assess the overall integrity of the allocations to EGD, several sessions with the EI RCAM Coordinators responsible for managing the model were conducted to provide clarification on the allocation process. Where required, MNP requested additional data to provide context for the cost drivers, model calculations, and the mechanics of the model.

Based on its analysis, MNP found that:

- Salary-weighted time estimates were derived from individual salary grades and data gathered in the Time Studies. In addition, total loaded Primary Service costs were allocated directly to specific affiliates and, where activities benefit all affiliates, to the "All" bucket.
- The common costs related to activities attributed to "all affiliates" by the time study participants are costs that cannot be specifically attributed to an individual affiliate. In those instances, an allocator other than time, which best reflects causality, must be selected. The exception is where the time allocated to specific affiliates is a significant proportion (80% or greater) of total time allocated to the Service. In that case, the proportion of direct time is deemed a fair representation of common effort.
- Type of service determines attribution and degree of common activity. Examples of services which are comprised entirely of common activities include IT technical support services. Allocation of service provider time and related costs to "all affiliates" is appropriate due to the general nature of program support activities. In these services, system users or usage best reflect cost causality.

The use of salary-weighted time to allocate direct costs to EGD is still consistent with the OEB's directive (re: salary-weighting) and the principle of causality (time measures effort). MNP's Prong Two analysis focuses on the rationale and appropriateness of the selected allocators.

The following table summarizes the allocators used to determine EGD common charges:

Allocator	Cost Driver	Service / Direct or General Expense
FCER	Number of Meetings	Director Fees and Expenses
	Company Complexity	Audit & Accounting Advice
	Company Complexity	Board of Directors Support
	Financing Activity	Capital Market Financing & Access
	M&A Activity	Investor Services
	Financing Activity	
	Entity Risk	Risk Assessment & Management
	Company & Markets Complexity	Strategic Planning
EGD % of Direct Time	Legal Entities	Tax Reporting & Planning
	M&A Activity	
	Financing	
	M&A Activity	Business & Economic Financial Analysis
	Cash Volume	Cash Management & Banking

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Allocator	Cost Driver	Service / Direct or General Expense
ACER	Raw Materials Volume	Gas Supply, Storage, and Transportation Strategy
	Raw Material Volumes	Supply Chain Management
	Mergers & Acquisitions M&A Activity	Business Development
	Company Complexity	Corporate Compliance
	New Technologies	Emerging Energy Technology Research
	IT Programs	Enterprise IT Program Management
	IT Assets	Enterprise IT Strategy Planning & Management
	Regulations	Government Relations
	Customer Base & Public Interest	Industry Relations and Corporate Social Responsibility (CSR)
	Regulations Contracts M&A Activity	Legal Advice
System Users	Transactions Contracts Documents	Records & Information Management
	IT Asset Usage	Consolidation and Planning System Technical Support (Khalix)
	IT Asset Usage	Expense System Management & Technical Support (Oracle iExpense)
	IT Asset Usage	Financial and Project Accounting System Technical Support (Oracle)
	Portal IT Asset Usage	Portal Suite Operations and Technical Support
AHC	HRIS IT Asset Usage	HRIS Program Management and Development
	Employees Unionized Employees	Employee and Labour Relations
	Employees	Human Resource Advice
	Employees	Total Compensation and Benefits
Non-Union EFTE	Employees	Employee Development
Audit Fees*	Audit Size (hence company complexity)	External Audit Coordination
	Company Complexity	Planning, Management & Execution of Internal Audits
N/A	Regulations Company Complexity	Rate Regulated Entity Support
Insurance Premiums**	Claims Entity Risk	Insurance Claims Support, Strategy and Management
Direct	Risk	Insurance Premiums
	Usage	Direct EFS Charge (Credit)
	Usage/Transactions	Depreciation – Risk Management System
Head Count - Specific	Usage	EGD Stock Based Compensation

* Audit Fees - Percentage of EGD audit allocations of total EI Audit Fees.

** Insurance Premiums - Percentage of EGD insurance premium allocations of total EI Insurance premium budget.

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Section 2.4 of Schedule 1 of the ISA details the basis of allocation and cost drivers used by EI, and is supplemented by an appendix containing RCAM allocator definitions. MNP found that the allocators were reasonable in the context of cost drivers and causality.

ACER and FCER Review

Due to previous concerns expressed by Intervenor, MNP conducted a detailed examination on the Adjusted Capital Employed Ratio (ACER) and Financing Capital Employed Ratio (FCER) allocators to determine method of determination and appropriateness.

FCER is used when the common activities are considered to benefit all EI affiliates in which EI maintains an investment, including minority equity investments. Therefore FCER has the broadest denominator for costs. The cost drivers that best reflect causality for services that use FCER to allocate common costs include company size and complexity as proxies for effort.

ACER represents the respective percentage of capital employed by EI in all affiliates for which EI is responsible for day to day operations. ACER has a smaller denominator to reflect only those affiliates that benefit directly from specific services. The rationale for using ACER is linked to cost incurrence. If the affiliate does not need the service, it is not part of the denominator over which costs are allocated. Similar to FCER, company size and complexity were considered proxies for effort for those services using ACER to allocate common costs to operated affiliates.

A previous concern raised by Intervenor was that common costs allocated to EGD automatically increase as a consequence of EI's growth rather than driven by EGD's need. The table below provides historical data of the percentage of common cost and the related ACER percentage allocated to EGD.

Year	EI % of Common Cost Allocated to EGD	EGD % of EI ACER	EGD % of EI FCER
2007	28	25	20
2008	27	24	20
2009	25	22	18
2010	20	17	15
2011	20	16	14
2012	19	16	14
2013	19	16	14

Across all services in 2012, EGD was allocated 19% of common costs while EGD represented 16% of EI ACER and 14% of FCER. Since 2007, as EGD's ratio of ACER and FCER has dropped, the percentage of EI common costs allocated to EGD has seen a reduction by the same approximate proportion.

In addition, primary service allocations based on ACER and FCER as a group have experienced a compound annual growth rate (CAGR) of 7.6% between 2007 (Board approved) and 2012 (Agreed under the ISA), which compares to an overall CAGR of all primary services of 12.0% for the same period.

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8.3.4 Change in Allocator Review

MNP noted that allocation factors have not changed from 2007.

MNP Allocator Suitability Review Conclusion:

Primary Services were allocated appropriately, based on cost drivers rooted in cost causality.

8.3.5 Time-Study Review

MNP reviewed the methods for allocating time to the services. Through the interview process, MNP verified that time estimation studies are completed quarterly and reviewed the methodology for collating time study information and allocating time to the services. The EI time study process collects corresponding time allocation by categories. The time study categories represent all EI business units and correspond to the segments used for EI financial reporting purposes. Business units are identified as:

1. Enbridge Gas Distribution Only.
2. Enbridge Inc (Corporate Office).
3. Gas Pipelines Segment and all other Distribution Entities, excluding EGD.
4. Liquid Pipelines and Major Projects Segment.
5. Sponsored Investments Segment.
6. International Segment.
7. All Enbridge Inc. Affiliates and Segments (of benefit to all affiliates).

Time estimation is conceptually consistent with the rate application process, which uses prospective (forecast) costs. MNP is satisfied that the time estimation process adequately accounts for the amount of time spent on services and affiliate activities.

MNP acknowledges that while there is an opportunity to implement a more automated time tracking and collation system, incorporating a system to potentially improve the accuracy of data collection would involve significant implementation and administration costs. The Board's consultative on its own costs stated "the cost of time tracking and cost allocation should not exceed the benefit derived"², and MNP feels it would be difficult to demonstrate a benefit that exceeds costs for such an implementation.

MNP Time-Study Review Conclusion:

MNP is satisfied that the time estimation process adequately accounts for the amount of time spent on services and affiliate activities.

² Navigant Consulting Ltd., "Ontario Energy Board Cost Assessment Model "prepared by Navigant Consulting Ltd., October 28, 2004.

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9 IMPLEMENTATION REVIEW

The Implementation Review component consists of two parts:

1. 2007 Recommendations

As part of the evolution of the RCAM, EI and EGD were encouraged by MNP to implement recommendations from the 2007 MNP Report. MNP reviewed each recommendation, determined the status of its implementation, and identified the reasoning and potential completion timelines for unimplemented recommendations.

2. OEB Directives

MNP reviewed OEB directives to identify applicable decisions and directives related to EGD or other affiliates regulatory cost allocations.

MNP reviewed each recommendation, determined the status of its implementation, and identified the reasoning and potential completion timelines for unimplemented recommendations.

9.1 IMPLEMENTATION OF 2007 RECOMMENDATIONS

The following table details the 2007 MNP recommendations, implementation status, and outcomes.

2007 Recommendation	Implemented	Outcomes
Adjustment: MNP recommended a downward adjustment of \$1.33 million be made to the 2007 Corporate Cost Allocation determined under the revised RCAM.	Yes	EGD accepted all adjustments proposed by MNP for the 2007 allocations. These adjustments were approved by the Board
Service Schedules: MNP recommended that service descriptions be amended to be more service-specific, and distinguish between activities that are EGD-specific and common activities benefiting all EI affiliates.	No	Review of the current Service Schedules shows that this recommendation was not implemented. Service descriptions remain reasonably similar to the 2007 state, with no clear distinction between activities that are EGD-specific and common activities benefiting all EI affiliates.
Service Schedules: MNP also recommended that the services schedules are adjusted to explicitly state activities which relate to the service, but which are to be excluded from the allocation for rate-making purposes.	Yes	Review of the current Service Schedule shows that this recommendation was not implemented within the Service Schedules, however this recommendation is satisfied within the business cases.
Service Refinement: For the purposes of cost comparison, leading practices analysis, and	No	Review of the current Service Schedules shows that this recommendation was not

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2007 Recommendation	Implemented	Outcomes
organization structure, it would be more useful to all stakeholders for EGD to identify services by related functions, consistent with the overall accountabilities of the service recipients.		implemented. The level of granularity in services remains relatively similar to that in 2007. EGD provides information consistent with the essence of the RCAM service-based methodology as approved by the Board.
Service Refinement: MNP recommended further refining the number of services to reflect functional categories consistent with the ARC definition of shared core corporate services, being “business functions that provide shared strategic management and policy support to the corporate group of which the utility is a member, relating to legal, finance, tax, treasury, pensions, risk management, audit services, corporate planning, human resources, health and safety, communications, investor relations, trustee, or public affairs.	No	- Review of the current Service Schedules shows that this recommendation was not implemented. The number of service functions remains very similar to that when the 2007 evaluation was conducted. - EGD provides information consistent with the essence of the RCAM service-based methodology as approved by the Board.
Business Case Quality: MNP recommended that EGD initiate a quality assurance process to enhance the quality and completeness of the business cases.	Yes	EGD has enhanced the business case process (consistency/completeness, quality control and rigour) and EGD has dedicated resources to perform RCAM quality control and coordination.
Business Case Review: MNP recommended that an independent review of business cases, with particular attention to alternative service provision and the associated costs, be completed in 2008 and then again on renewal of the prevailing ISA which expires December 31, 2010.	No	
Business Case Enhancement: Additional enhancements to the business case process should include more consistent review and editing, additional critical analysis of EGD capabilities where EI is the sole provider of a service and inclusion of costs and application of budget data where EI provides a service on a supplementary basis.	Yes	

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2007 Recommendation	Implemented	Outcomes
Use of Business Cases: MNP recommended that EGD use the business case as a key element of annual service and performance review.	No	EGD does not currently use a performance measurement process with EI. EGD weighed costs against the benefits, and determined that this recommendation was not beneficial. Performance is managed through the annual review process which is conducted informally through discussions between EGD service recipients and EI service providers.

Implementation Review Findings:

Although all recommendations were not adopted, MNP generally found an increased level of quality and detail in the business cases.

MNP Recommendation:

Despite alignment with RCAM methodology, MNP recommends that EGD categorize and roll up services to levels more consistent with reporting of other utilities for comparison purposes.

9.2 OEB DIRECTIVES

In February 2006, Enbridge Gas Distribution Inc. (EGD) was directed by the Ontario Energy Board (OEB) to have an independent evaluation of corporate service charges calculated by an amended Regulatory Cost Allocation Methodology (RCAM) and have the evaluation make the necessary adjustments to the allocations for the assessment of need, scope, allocation and cost/benefit³. MNP considered the 2006 directives of the Board in conducting this review for EGD's 2013 test year. No other current directive exists.

MNP has found no significant directive or decision issued by the OEB that impacts the RCAM or the resultant allocated costs.

³ Paragraph 10.5.18 of the OEB's EB-2005-0001 Decision with Reasons dated February 9, 2006.

10 COST ALLOCATION REVIEW

The objective of this cost allocation review was to assess the reasonableness of RCAM corporate services charges by independently analyzing, assessing and providing proposed adjustments where necessary to the RCAM corporate services charges allocated from EI to EGD. Corporate services are broken down into two categories:

1. **Primary Services** – Defined by EGD as a service provided by the Service Provider to the Service Recipient either as the sole provider where EGD relies solely on EI for this service or as a supplemental provider (where EGD performs a component of the required activities of the service).
2. **Direct Charges and General Expenses** – Direct Charges are defined by EGD as a service related item separately included in the Service Providers budgets that can be specifically attributed to the Service Recipient without loading. Defined by EGD as significant costs that benefit the Service Recipient, these costs require allocation on a basis separate from the Primary Services because the driver of the cost is different, or because the cost is a large, third party cost.⁴

10.1 COST ALLOCATION REVIEW METHODOLOGY

The OEB requires that a standard of prudence be met, whereby customers are charged only for prudently incurred costs of the utility. Where there is normally a presumption of management prudence in the operation of its business, for affiliate transactions the OEB has applied what is referred to as a Three Prong Test to avoid a potential conflict between affiliates in the delivery of intercorporate services. This test serves as the foundational framework for MNP's assessment of the RCAM results for 2012 and 2013.

Using the Three Prong Test as a basis for our review, MNP has chosen two primary methods to establish prudence of 2012 RCAM allocation results:

1. Individual Service Reviews for 2012.
2. Variance and Comparator Review.

Each of these methods is described in detail in this section.

⁴ Regulatory Cost Allocation Methodology Service Schedules, Effective January 1, 2012 – Appendix "B" to the Regulatory Cost Allocation Methodology Confirmation Notice between Enbridge Inc. and Enbridge Gas Distribution Inc., for the year 2012.

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List of 2012 Services Reviewed

Service / Function		
Primary Services	1	Audit & Accounting Advice
	2	Board of Directors Support
	3	Business Development
	4	Capital Market Financing & Access
	5	Cash Management & Banking
	6	Consolidation and Planning System Technical Support
	7	Corporate Compliance
	8	Employee and Labour Relations
	9	Employee Development
	10	Enterprise IT Program Management
	11	Enterprise IT Strategy Planning & Management
	12	Expense System Management & Technical Support
	13	External Audit Coordination
	14	Financial and Project Accounting System Technical Support
	15	Government Relations
	16	HRIS Program Management and Development
	17	Human Resource Advice
	18	Industry Relations & Corporate Social Responsibility
	19	Insurance Claims Support, Strategy and Management
	20	Investor Services
	21	Legal Advice
	22	Planning, Management, & Execution of Internal Audits
	23	Portal Suite Operations and Technical Support
	24	Rate Regulated Entity Support
	25	Records & Information Management
	26	Risk Assessment & Management
	27	Strategic Planning
	28	Supply Chain Management
	29	Tax Reporting & Planning
	30	Total Compensation & Benefits
Direct Charges and General Expenses	31	Depreciation - Risk Management System
	32	Direct EFS Charge
	33	Directors Fees & Charges
	34	Audit Fees
	35	EGD Stock Based Compensation
	36	Insurance Premiums

Note that 3 services have been excluded from analysis within this Study due to zero RCAM allocations having been calculated for 2012 and 2013. These services include:

- Emerging Energy Technology Research – This service had been allocated relatively small amounts in prior years, with a zero allocation for 2012 and 2013.

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- Gas Supply, Storage, and Transportation Strategy – This service is provided by corporate groups outside of the RCAM (except for the CEO department), and has not been allocated costs via the RCAM since 2010.
- Insurance Claims Support – This service has been rolled into Insurance Strategy and Management, entitled “Insurance Claims Support, Strategy and Management” for 2012.

10.2 FOUNDATION ASSESSMENT FRAMEWORK – OEB THREE PRONG TEST

The ‘Three Prong Test’ is a method defined in the OEB Decision with Reasons dated March 20, 1997 (EBRO 493/494)⁵ to help with cost allocation decisions. Each prong is assessed only in the event of a ‘passing’ grade for the previous prong.

Prong One: Cost Incurrence

Are the proposed charges prudently incurred by, or on behalf of, the companies for the provision of a service required by Ontario ratepayers? In the Board’s view, costs will not pass this test if they relate to activities which:

- Go beyond the scope required for a utility;
- Are associated with overall governance from a shareholder perspective or “minding the investment”; or
- Represent additional and superfluous management layers.⁶

Prong Two: Cost Allocation

If properly incurred, are the proposed corporate centre charges allocated appropriately to the companies, based on the application of cost drivers/allocation factors supported by principles of cost causality?

Prong Three: Cost Benefit

Do the benefits to the company’s Ontario ratepayers equal or exceed the costs? For the third test, Cost/Benefit, the Board has accepted the [following] four categories ... as a basis for assessing quantifiable benefits:

1. Replacement benefits – the services provided replace an equivalent service at equal or lower cost;
2. Synergistic or linkage benefits – the services allow the Companies to reduce costs by means of being part of the larger ... group and operating in concert for the procurement of products and services;
3. Revenue enhancement or cost recovery benefits – the Companies’ activities and capabilities provide value to other affiliates for which payment in cash or kind is received; and
4. Stand-alone benefits – strategic actions and activities instituted by the Corporate Centre that produce direct value to the Companies.

⁵ Paragraph 5.5.14 and 5.5.17 EBRO 493/494 Decision with Reasons dated March 20, 1997

⁶ Paragraph 10.9.1 EB-2005-0001 Decision with Reasons dated February 9, 2006

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10.3 METHOD ONE - INDIVIDUAL SERVICE REVIEW

Method one incorporates a detailed assessment of each allocated service identified through the 2012 RCAM. MNP developed the mock template below to present key service informational components, form the basis for its assessment and present findings. Explanations in **blue** font provide some context for the content that appears in each completed service review. Completed service reviews and detailed consolidated results of these reviews may be found in Appendix D.

Appendix D Template for Each Service

Service Name – 2012 RCAM Analysis																																												
EGD Service Recipient	Name, Title (as of Feb 29, 2012)																																											
Service Definition	Borrowed from EGD Service Schedule																																											
Cost of Service	<table border="1"> <thead> <tr> <th colspan="3">Direct Costs</th> <th colspan="3">Common Costs</th> <th rowspan="2">EGD Total Allocation</th> </tr> <tr> <th>EI Cost</th> <th>EGD Allocation %</th> <th>EGD Total Cost</th> <th>All Affiliates</th> <th>Allocator Type</th> <th>EGD Allocation%</th> <th>EGD Total Cost</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>B</td> <td>C=AxB</td> <td>D</td> <td></td> <td>E</td> <td>F=DxE</td> <td>G=C+F</td> </tr> <tr> <td>\$X</td> <td>X%</td> <td>\$X</td> <td>\$X</td> <td>XXX</td> <td>X%</td> <td>\$X</td> <td>\$X</td> </tr> </tbody> </table>							Direct Costs			Common Costs			EGD Total Allocation	EI Cost	EGD Allocation %	EGD Total Cost	All Affiliates	Allocator Type	EGD Allocation%	EGD Total Cost	A	B	C=AxB	D		E	F=DxE	G=C+F	\$X	X%	\$X	\$X	XXX	X%	\$X	\$X							
Direct Costs			Common Costs			EGD Total Allocation																																						
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A	B	C=AxB	D		E	F=DxE	G=C+F																																					
\$X	X%	\$X	\$X	XXX	X%	\$X	\$X																																					
Cost by Department	<table border="1"> <thead> <tr> <th>EI Department</th> <th>Charges</th> </tr> </thead> <tbody> <tr> <td>Example Department 1</td> <td>\$X</td> </tr> <tr> <td>Example Department 2</td> <td>\$X</td> </tr> <tr> <td>Example Department 3</td> <td>\$X</td> </tr> <tr> <td>Total</td> <td>\$X</td> </tr> </tbody> </table>							EI Department	Charges	Example Department 1	\$X	Example Department 2	\$X	Example Department 3	\$X	Total	\$X																											
EI Department	Charges																																											
Example Department 1	\$X																																											
Example Department 2	\$X																																											
Example Department 3	\$X																																											
Total	\$X																																											
Prong 1 Test Determine if EI's charges to EGD are prudently incurred. Grade (Pass or Fail)	Cost Incurrence Review MNP opinion and explanation.																																											
Prong 2 Test Determine if EI's charges to EGD are appropriately allocated. Grade	Cost Allocation Review <i>Direct Cost</i> - MNP opinion of direct cost allocator <i>Common Costs</i> - MNP opinion of activity driver and allocator for the service																																											
Prong 3 Test Do the benefits to ratepayers exceed the costs? Grade	Cost/Benefit Analysis <u>EGD Internal Provision of Service</u> MNP low and high estimates of the staffing complement and other costs required for EGD to fulfill this service function and level internally. <table border="1"> <thead> <tr> <th rowspan="2">Position</th> <th colspan="2">MNP Low Range Estimate</th> <th colspan="2">MNP High Range Estimate</th> </tr> <tr> <th># of FTE</th> <th>Total Cost</th> <th># of FTE</th> <th>Total Cost</th> </tr> </thead> <tbody> <tr> <td>Example Position 1</td> <td>X</td> <td>\$ X</td> <td>X</td> <td>\$ X</td> </tr> <tr> <td>Example Position 2</td> <td>X</td> <td>\$ X</td> <td>X</td> <td>\$ X</td> </tr> <tr> <td>Example Position 3</td> <td>X</td> <td>\$ X</td> <td>X</td> <td>\$ X</td> </tr> <tr> <td>Total</td> <td>X</td> <td>\$ X</td> <td>X</td> <td>\$ X</td> </tr> </tbody> </table> MNP estimate of the range of internal costs based on the staffing complement noted above; and where EI's 2012 allocation falls within that range. <table border="1"> <thead> <tr> <th>EI 2012 Allocation</th> <th>MNP Low Range</th> <th>MNP High Range</th> <th>Allocation Assessment</th> </tr> </thead> <tbody> <tr> <td>\$ X</td> <td>\$ X</td> <td>\$ X</td> <td>Below, Within or Above Range</td> </tr> </tbody> </table>							Position	MNP Low Range Estimate		MNP High Range Estimate		# of FTE	Total Cost	# of FTE	Total Cost	Example Position 1	X	\$ X	X	\$ X	Example Position 2	X	\$ X	X	\$ X	Example Position 3	X	\$ X	X	\$ X	Total	X	\$ X	X	\$ X	EI 2012 Allocation	MNP Low Range	MNP High Range	Allocation Assessment	\$ X	\$ X	\$ X	Below, Within or Above Range
Position	MNP Low Range Estimate		MNP High Range Estimate																																									
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\$ X	\$ X	\$ X	Below, Within or Above Range																																									

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Service Name – 2012 RCAM Analysis

External Provision

Description of EGD's estimates for effort and cost to incur the provision of service externally.

MNP opinion of the reasonableness of EGD external provision estimates and any subjective benefits or detriments to external sourcing. Where an estimate was not created by EGD, MNP provide its own estimate for external provision.

Position	2012 Market Rate	Individuals Required	Hours per Individual	Estimated Cost
Example Position 1	\$ X / hour	X	XXX	\$ X
Example Position 2	\$ X / hour	X	XXX	\$ X
Example Position 2	\$ X / hour	X	XXX	\$ X
Total		X	4,400	\$ X
Low Range (80% of Total)				\$ X
High Range (120% of Total)				\$ X

OEB Benefits

MNP opinion of the benefits of EI provision of services by 'benefit type' as defined by the four categories of the Prong Three Test.

Benefit Type	Reasoning
Replacement	The services provided replace an equivalent service at equal or lower cost.
Synergistic	The services allow the Companies to reduce costs by means of being part of the larger ... group and operating in concert for the procurement of products and services.
Revenue Enhancement	The Companies' activities and capabilities provide value to other affiliates for which payment in cash or kind is received.
Stand-alone	Strategic actions and activities instituted by the Corporate Centre that produce direct value to the Companies.

MNP Conclusion

MNP opinion as to whether or not the provision of service by EI benefits ratepayers.

MNP Conclusion

- Status of MNP prong test results.
- MNP proposed adjustment to the 2012 EGD allocation (if required).

Given the repetitive nature of the individual service assessments and categorization of results, MNP will comment on common factors considered for each prong test across services and identify anomalies as appropriate.

10.4 METHOD TWO – VARIANCE AND COMPARATOR REVIEW

The Individual Service Review (Method 1) focuses exclusively on analysis of the 2012 RCAM results in light of service requirements as agreed between EGD and EI. Acknowledging stakeholder interest in the variance of RCAM results over time and the appropriateness of the magnitude of shared service allocations, MNP undertook three additional types of analysis:

1. **Variance Review** – MNP identified and reviewed cost escalations from prior years, focusing specifically on larger increases from 2007 to 2012. Based on these variances and Intervenor comment, in order to facilitate a more comprehensive review MNP undertook assess Human Resources (HR) and Information Technology (IT) costs. With HR and IT RCAM allocations evaluated individually for 2012 based on levels of activity under Method 1, MNP focused on annual variances for EGD entity-level Operating, Maintenance and Administration ("OM&A") costs within the same categories of HR and IT and compared annual variances in these entity level costs against other rate regulated transmission/ distribution entities in Ontario and other jurisdictions.
2. **Comparator Review** – For HR and IT, MNP compared entity level OM&A costs to other large rate regulated distribution entities in Ontario and other jurisdictions by assessing several comparative metrics indicative of cost-effectiveness for service management.

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3. **Departmental Cost Review** – While RCAM costs are primarily reported at the Primary Service level, allocations to individual Primary Services are built up using time estimates and allocators at the departmental level within EI. MNP reviewed EI budget and RCAM allocations consolidated by department, and noted changes in the ratio of costs being allocated to EGD from 2007 to 2012.

MNP was unable to draw direct comparisons between EGD and other utilities specifically for shared services allocated from an affiliate due to the inability to determine comparative information at the same level of granularity for other entities. Categories of costs are grouped differently, and there is no way to establish specific services and service levels based on reported data.

The value in conducting the variance and comparator review at the entity level for O&M costs (HR and IT) is to show how EGD compares to other similar organizations for measures of cost effectiveness. These comparisons may logically extend to the subset of costs in each area allocated from EI through the RCAM.

11 COST ALLOCATION REVIEW – 2012 – ANALYSIS & FINDINGS

The cost allocation analysis and findings section is organized to detail the analytical approach that led to our findings and present our conclusions.

11.1 INDIVIDUAL SERVICE REVIEWS

11.1.1 Prong One – Incurrence Review

MNP's analysis of the first prong test was based on a definition of need in the context of a standalone public entity of roughly the same size and complexity as EGD. To conduct its review of cost incurrence for each service, MNP reviewed the EGD service schedules and business cases, interviewed Service Recipients and EI RCAM coordinators, reviewed regulatory filings and evidence from previous rate cases, and considered the logic built into the 2007 MNP Report.

In addition, MNP paid particular attention to the exclusion criteria noted in the definition of Prong One, including the exclusions that formed the basis for adjustments in the 2007 MNP Report; namely those in the service areas of 'Government Relations', 'Industry Relations and Corporate Social Responsibility', and 'Internal Employee Communications'. Each of these Service Recipients made note of these 2007 adjusted exclusions in their business cases.

Based on the menu of EI service offerings, EGD identifies exclusions for consideration in development of the allocations. EI then distributes an EI developed RCAM Time Study description and instructions document to EI Service Providers that explains the exclusion criteria and notes which service elements should not be allocated to EGD. The instructions are reviewed by departmental Service Providers and form part of the time entry process. Allocations are then cross checked by the RCAM coordinator to ensure compliance to the exclusion criteria.

For 2012, EGD has noted exclusions in 17 of 30 Primary Services reviewed by MNP. MNP reviewed all departmental exclusions and corresponding logic and found them to be reasonable.

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MNP supported its analysis and findings by specifically inquiring about exclusions with Service Recipients in the interviews.

MNP Incurrence Finding:

MNP finds that the proposed charges are prudently incurred by EGD for the provision of service required by Ontario ratepayers.

11.1.2 Prong Two – Cost Allocation Review

The process for allocator selection and the results of our analysis are documented in the RCAM Process Review section of this report. As discussed, EGD maintains strong standards in their selection of cost drivers for direct and common costs and continues to review allocators to ensure that each is most reflective of the principles of cost causality.

For direct costs, EI loaded Primary Services costs were allocated directly to specific affiliates, and where activities benefit all affiliates, costs were allocated to the 'all affiliates' bucket. MNP found that the use of salary-weighted time to allocate direct costs to EGD is consistent with the OEB's directive (regarding salary-weighting) and the principle of causality (time measures effort). For common costs, MNP focused on the rationale for the selection of allocators, and similarly to the 2007 MNP Report⁷ found that all allocators used were appropriate.

MNP concludes that all costs for Primary Services were allocated appropriately based on cost causality.

MNP Allocation Conclusion:

MNP concludes that all costs for Primary Services were allocated appropriately based on cost causality.

11.1.3 Prong Three – Cost Benefit Review

In undertaking the cost benefit review for each service, MNP completed 3 steps:

1. **Internal Provision Estimates** – MNP estimated the costs of EGD internal provision of service, with lower and upper ranges.
2. **Reasonableness of External Provision** – MNP assessed the reasonableness of EGD's external provision estimates, also including lower and upper ranges.
3. **Benefits Assessment** - In the context of comparison against internal and external provisions, MNP evaluated RCAM allocated costs against benefits as defined by the OEB.

Upon completion of Steps 1 and 2, 2012 RCAM allocations that fell under the upper range estimates for internal and external provisioning options were deemed to pass the Prong Three Test. MNP then determined a potential adjustment to 2012 RCAM service cost based on any

⁷ Independent Evaluation of Enbridge Gas Distribution Inc.'s Regulatory Corporate Cost Allocation Methodology – Final Report, Meyers Norris Penny LLP, February 28, 2007, page 37.

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amounts that exceeded the upper range estimates for internal or external provisioning options. Step 3 was undertaken in all cases to qualify the types of benefits attributed to each service that may offset, where appropriate, any potential adjustments.

11.1.3.1 Internal Provision Estimates

For each service and service level, MNP performed the following steps in determining internal provision estimates:

1. **Estimate Staff Requirements** – Based on service schedules, business cases, primary and secondary research and MNP experience and opinion, MNP estimated an internal staff complement internal to EGD (as a standalone utility) that would be required to perform the services currently being provided by EI (finite number of FTEs or a range).
2. **Assign Fully Loaded Costs** – Assign a range of fully loaded costs to each FTE based on their role and level, including salary, bonus, long-term incentive, benefits, and office/facilities costs.
3. **Add Third Party Costs** – As required, add any additional third party costs necessary to provide the same level of service.
4. **Compare Results** – Compare 2012 RCAM allocation to the range of MNP's internal service provision estimates, identifying the RCAM allocation as 'Below Range', 'Within Range' or 'Above Range'.

MNP did not quantify the costs of planning, establishing, transitioning and implementing an internal service model however EGD estimates one-time recruiting costs alone to represent 1.5 times the recruited staff's annual salary, or 15% of the salary on an annualized basis. Other costs might include travel and training & development. Acknowledging these costs as provisional, MNP did not incorporate transition costs into its findings.

MNP Internal Provision Finding:

Of the 30 primary services reviewed by MNP, 3 services yielded RCAM allocations above the MNP range, 11 fell within the range and 16 fell below the range. As a whole, the total proposed 2012 RCAM primary service allocations fell below the midpoint of the MNP range (33rd percentile).

The 3 services that yielded above-range results were a combined \$154,923 over the range.

11.1.3.2 Reasonableness of External Provision

For each of its service business cases EGD performed an estimate of the effort and costs that an external party would require in providing the same level of support being provided by EI through the RCAM. External parties are broadly defined as professional services firms, including legal firms, accounting and advisory firms or specialist firms (e.g. pension, investment banking). These EGD estimates were developed or approved by the Service Recipients, generally at the Director or VP level within EGD, with the benefit of many years of management experience.

EGD estimates incorporated a team of external staff full time equivalents (FTEs) at various levels of seniority, utilization rates or effort required for each staff member, and average fee rates to arrive at an annual cost for the team. In some cases other disbursements necessary to

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fulfill the service requirement were identified and added to the total external cost. This finite cost was established as a mean, and low and high ranges were developed by selecting 80% and 120% of the mean, respectively.

MNP Approach to External Provisioning

MNP assessed the reasonableness of the Fair Market Value range of costs identified by EGD, and noted how the costs compared to the RCAM allocation and the internal provision estimates. MNP relied on this method for several reasons:

1. **MNP Experience** - As a professional services firm, MNP has significant experience providing consulting and out-sourced services and collaborating with or employing a wide cross-section of external consultants. There are several subsets of external parties, including Consulting (e.g. Management, IT, Finance, HR, Compensation, Regulatory), Specialist Services (e.g. Actuarial, Public Relations) and Legal Services. MNP has direct relevant experience with these categories, and hourly rates attributed to external consultants by EGD generally align with our experience.
2. **The Purpose for External Provisioning** - Standard industry practice is to acquire the services of external consultants in order to fulfill needs for:
 - a. Specialty skills not housed internally.
 - b. Urgency requiring focus that only dedicated external resources can bring.
 - c. Short term capacity to meet temporary or project-based resource requirements.
 - d. Objectivity that may only be provided by those external to the organization.

These external resources command a premium hourly rate compared to calculated total hourly compensation for internal staff based on specialty skills, focus and availability. For external parties to provide a service otherwise available from internal staff (or related party staff) is intuitive only in cases where the external party can be dramatically more efficient. For shared services, any efficiency gains in these cases are normally offset by premium rates, thereby making external sourcing imprudent. This is particularly the case for EGD's numerous small departmental requirements where there are minimal opportunities for external providers to enjoy economies of scale (large teams for extended durations). Without this opportunity, external providers are not in a position to offer the volume discounts that would yield stronger competition to EGD's current arrangement with EI or the option to source the services internally. This fact resulted in the majority of external estimates being much higher than the EI allocations, even with broad-based conservative or aggressive assumptions.

3. **EGD Estimate of External Provisioning Time Requirements** – MNP found that EGD estimates for utilization of external staff was either reasonable or conservative, whereby actual time to fulfill the required services would in many cases consume more hours than estimated.

Results of Analysis

For 8 services categories where EGD was allocated more than zero for 2012, EGD did not attempt an external estimate. Although the exemption criteria to decline making an estimate of external cost is stated in the business cases as the lack of a reasonably competitive market for the services in question, in MNP's opinion external estimates in 6 cases were not attempted due generally to one or more of three factors:

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- The perceived lack of a reasonably competitive market from which to procure the services.
- Perceived high cost to secure an external party.
- Lack of the external party's familiarity or alignment with EGD strategy, operations and history, rendering the provision of service ineffective or inappropriate.

For those services not estimated, MNP was of the opinion that a reasonably competitive market did exist and that an external estimate may have been appropriate. In each case, MNP developed its own estimate of Fair Market Value for the services as described in the business cases and discussed with Service Recipients.

Of the 22 services for which external estimates were created, 14 of the external estimate's low ranges were higher than the 2012 RCAM allocation, and no RCAM allocations exceeded the upper ranges. As noted, MNP found that each estimate was either reasonable or conservative. In addition, each of the MNP estimates of Fair Market Value exceeded the RCAM allocations. Given these results, MNP recommends no proposed adjustments to 2012 RCAM allocations due to lower alternative costs of provisioning externally.

MNP External Provision Finding:

EGD estimates of external service provision were reasonable or conservative and none warranted serious consideration for outsourcing from a cost perspective.

MNP External Provision Recommendation:

MNP recommends that EGD develop more defined criteria for Service Recipients to facilitate the development of external service estimates.

11.1.3.3 Cost Benefits Assessment

Conservatism, Assumptions and Limitations

There are a number of factors that are relevant for consideration of MNP analysis and findings, particularly relating to the assessment of benefits against any potential cost savings driven by alternative service delivery.

MNP has chosen to take a conservative approach in its assessment of internal and external service costs. This approach results in conservative estimates, and is warranted given the inherent subjective nature of service schedules, service levels and cost estimates for shared services as defined by EGD and the RCAM. The following are examples of MNP's assumptions in its calculations:

- The source for MNP salary data to estimate internal provision of service, Salary.com, generates salary data that is a blend of sectors and industries in Ontario. Average cross-industry salaries are slightly lower than those in the energy & utilities sector.⁸ This finding has been adjusted for by MNP incorporating 50th percentile of job wages as the low end of the range and 75th percentile for the high end of the range.

⁸ Watson Wyatt "Annual Canadian Salary Survey - 2008/2009 Executive Compensation Report", October 15, 2008.

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- Salary.com data was acquired for 2011 based on availability and escalated by MNP for the purposes of its 2012 evaluation. Salary data was escalated using Statistics Canada data to calculate average wage growth in Ontario between 2007 and 2011 (2.75%).
- The bonus element of fully loaded costs is represented by a tighter range of 10% to 25% and is on average is lower than bonus attributions of EGD at 7% to 35% for non-union staff.
- The burden element of fully loaded costs is similar to EGD attributions at 30% to 32%.
- MNP has attributed a lower portion of wages to long term incentive plan (e.g. stock based compensation), from 10% to 20% compared to 15% to 70% at EGD.

The following assumptions and limitations should also be noted in conjunction with the data presented in the Cost Benefit Quantum Results table:

- Market value, as defined in the ARC for Gas Utilities, “means the price reached in an open and unrestricted market between informed and prudent parties, acting at arm’s length and under no compulsion to act.”⁹ Given the relative difficulty and high cost of conducting benchmarking for shared services as defined by EGD, MNP did not carry out a benchmark analysis. Instead, MNP applied comparative market cost data to the most common market element of a service (salaries and hourly rates) to determine a reasonable range of comparative costs that can be used to measure Fair Market Value. There is no single market price in the range that is more or less appropriate.
- MNP relied on the EGD business cases to ascertain third party costs incremental to staff costs for internal and external provision of service (e.g. license fees, registration costs, production costs, external consulting fees). This allows comparisons of 2012 RCAM costs to external and internal provision costs based on equivalent services and service levels.
- Cost alone is not an appropriate measure for the benefits of alternative service provision. Factors such as economies of scale, strategic benefits, availability, service quality continuity and on-demand availability need to be considered. This is particularly relevant where 2012 RCAM allocations fell within the lower and upper ranges for internal and external provision costs.
- The costs of switching providers or in-sourcing a service are real in may in some cases be substantial from an effort and cost perspective. These costs and the resource requirements to plan, implement and sustain alternate provisioning are not included in the internal and external cost estimates.

11.1.3.3.1 Prong Three Benefit Category Assessment

Further to the internal and external provision estimate findings, of the 30 primary services reviewed MNP found the following results:

- Three RCAM service allocations fell above the MNP range for internal provision (RCAM Status noted in red below).
- Eleven services fell above the midpoint of the range.
- Nineteen services fell below the midpoint of the range.
- The total 2012 RCAM allocations registered at the 33rd percentile of the range.

⁹ Affiliate Relationships Code for Gas Utilities, OEB, last Revised November 25, 2010.

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The object of the Prong Three Test is to determine if the benefits of services exceed the costs. Each MNP service review template in Appendix D contains MNP's assessment of each prong three benefit for all services, regardless of the status of the RCAM allocations in relation to the internal or external provision ranges.

Replacement Benefit

The Replacement category of benefits stipulates that the service cannot be replaced at equal or lower cost. MNP has applied the Prong Three Test for each primary service such that the replacement test is met under two conditions:

1. The RCAM allocation falls below or within the MNP range of internal provision estimates.
2. The RCAM allocation for each service falls below or within the range of external cost estimates MNP has assessed as reasonable.

Should the replacement test not be met, meaning that the 2012 RCAM allocation exceeds the internal or external range; MNP deems the service in question to have failed Prong Three based on the OEB stipulation.

Analysis of the results for the 3 services above the MNP range demonstrates that even a small cost attributed to switching to external providers or in-sourcing the service may escalate the MNP high range estimate beyond the 2012 RCAM allocations. However, MNP recognizes that these costs are considered to be one-time and can be highly variable depending on the nature of the transition to the preferred alternative provisioning arrangement.

Synergistic Benefit

This benefit is defined by a reduction in the cost for a service because it is spread over two or more affiliates, or economy of scale. Synergistic benefits are achieved through the buying power of a larger entity or the sharing of costs among affiliates that might otherwise be borne entirely by a standalone entity.

The concept of scale economies is important in assessing the third prong test. Economies of scale are most effectively derived through collective and standardized decision-making, where all interested parties have influence to determine the most effective method of delivering services. This influence contributes to the implementation of corporate standard and business unit specific requirements, provided at a reasonable cost compared to market alternatives. It is the understanding of and comparison to alternatives that drive the choice and method of service, as demonstrated by EGD Service Recipients in their business cases.

Economies of scale are most obvious either through lower negotiated charges for products or services required by the affiliate, or when the cost for a service element (program, asset, or resource) is shared among affiliates; effectively reducing or eliminating multiple instances of that element. Examples of these service elements are common in IT departments, examples being IT applications (implementation, upgrade and support), network infrastructure, hardware, data and knowledge management, and help desk support.

HR departments also typically enjoy synergistic benefits of employee surveys and employee training programs. HR policy and processes are typically common across many business units or departments. Recruiting, compensation, pension, labour relations, employee development and succession programs may be standardized according to leading practices and managed by a core service provider, internally or externally, all to the benefit of ratepayers who experience

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higher quality service through better operations management by employees of the utility. As noted in the Appendix D templates, MNP found that the majority of RCAM allocations yielded a synergistic benefit for EGD.

Revenue Enhancement / Cost Recovery Benefits

This benefit category stipulates that costs incurred provide value to other affiliates for which payment is received. This category is not relevant for MNP analysis given that EGD does not incur costs that meet this criterion.

Stand-alone Benefits

Stand-alone benefits arise from strategic actions and activities instituted by the EI that produce direct value to its affiliates. These benefits are typical for functions that require an intimate knowledge of the affiliate's operations or history that may only be acquired by those internal to the company.

Examples of services for which stand-alone benefits prevail are Board of Directors Support, Corporate Compliance, Capital Market Financing and Labour Relations, where the service provider employs a broad and deep understanding of the affiliate's objectives, capabilities and multitude of stakeholder expectations in order to bring broader insight and credibility to bear with affiliate shared services. These benefits in many cases may not be achieved by sourcing services from an external party or an internal party that is not privy to or experienced with broader issues of the Service Provider.

MNP Cost Benefit Findings:

1. All but 3 RCAM primary service costs met the replacement test and are deemed to pass the Prong Three Test.
2. The 3 RCAM primary service allocations that did not meet the replacement test are deemed to have failed Prong Three given that 2012 RCAM allocations fell above the MNP fair market value range of internal service provision costs.
3. For the 3 primary service allocations that fell above the MNP range (Capital Market Financing and Access, Employee Development and HRIS Program Management and Development), MNP recommends a combined downward adjustment to the 2012 RCAM allocations of \$154,923.

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11.1.4 Consolidated Three Prong Test Results – Primary Services
Three Prong Test Results for Primary Services

2012 RCAM - Services Review - (\$)		RCAM Allocation	2012 MNP Range for Internal Provision			2012 RCAM MNP Range Status		MNP Three Prong Test Results - 2012		
Service Function		2012 Agreed under ISA	Low	High	Midpoint	Status	Amount Above Range	Prong 1 Incurrence	Prong 2 Allocation	Prong 3 Cost Benefit
1	Audit & Accounting Advice	91,270	119,694	155,653	137,674	Below	-	Pass	Pass	Pass
2	Board of Directors Support	769,368	615,496	849,000	732,248	Within	-	Pass	Pass	Pass
3	Business Development	736,918	446,785	829,088	637,937	Within	-	Pass	Pass	Pass
4	Capital Market Financing & Access	1,020,173	621,880	991,870	806,875	Above	28,303	Pass	Pass	Fail
5	Cash Management & Banking	481,073	413,971	537,442	475,706	Within	-	Pass	Pass	Pass
6	Consolidation and Planning System Technical Support	245,089	328,197	542,554	435,375	Below	-	Pass	Pass	Pass
7	Corporate Compliance	197,202	277,083	406,726	341,904	Below	-	Pass	Pass	Pass
8	Employee and Labour Relations	478,201	450,312	558,181	504,246	Within	-	Pass	Pass	Pass
9	Employee Development	1,260,568	904,406	1,245,623	1,075,014	Above	14,945	Pass	Pass	Fail
10	Enterprise IT Program Management	868,494	927,584	1,725,687	1,326,636	Below	-	Pass	Pass	Pass
11	Enterprise IT Strategy Planning & Management	624,115	414,244	791,610	602,927	Within	-	Pass	Pass	Pass
12	Expense System Management & Technical Support	95,490	153,098	193,210	173,154	Below	-	Pass	Pass	Pass
13	External Audit Coordination	103,399	119,694	155,653	137,674	Below	-	Pass	Pass	Pass
14	Financial and Project Accounting System Technical Support	352,161	362,776	595,786	479,281	Below	-	Pass	Pass	Pass
15	Government Relations	44,917	80,390	106,472	93,431	Below	-	Pass	Pass	Pass
16	HRIS Program Management and Development	3,009,273	2,472,121	2,897,598	2,684,860	Above	111,675	Pass	Pass	Fail
17	Human Resource Advice	201,779	247,330	333,171	290,250	Below	-	Pass	Pass	Pass
18	Industry Relations & Corporate Social Responsibility	384,365	402,816	530,244	466,530	Below	-	Pass	Pass	Pass
19	Insurance Strategy and Management	108,240	222,266	363,932	293,099	Below	-	Pass	Pass	Pass
20	Investor Services	883,837	720,333	931,769	826,051	Within	-	Pass	Pass	Pass
21	Legal Advice	514,396	430,606	549,488	490,047	Within	-	Pass	Pass	Pass
22	Planning, Management, & Execution of Internal Audits	191,528	422,307	590,362	506,335	Below	-	Pass	Pass	Pass
23	Portal Suite Operations and Technical Support	330,881	322,748	403,707	363,228	Within	-	Pass	Pass	Pass
24	Rate Regulated Entity Support	253,904	266,894	345,206	306,050	Below	-	Pass	Pass	Pass
25	Records & Information Management	538,352	524,070	725,934	625,002	Within	-	Pass	Pass	Pass
26	Risk Assessment & Management	878,461	657,012	908,804	782,908	Within	-	Pass	Pass	Pass
27	Strategic Planning	327,890	403,192	509,795	456,494	Below	-	Pass	Pass	Pass
28	Supply Chain Management	39,706	68,069	91,218	79,644	Below	-	Pass	Pass	Pass
29	Tax Reporting & Planning	55,308	82,109	104,242	93,175	Below	-	Pass	Pass	Pass
30	Total Compensation & Benefits	1,781,809	1,435,149	1,805,350	1,620,250	Within	-	Pass	Pass	Pass
Primary Service Totals		16,868,167	14,912,632	20,775,374	17,844,003	Within	-			
							154,923	Total Amount Above Range		

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11.1.5 Direct Charge and General Expense Analysis

Detailed analysis of each General Expense and Direct Charge is included in Appendix D, with a summary table of our prong results below.

Three Prong Test Results for Direct Charges and General Expenses

2012 RCAM - Services Review - (\$)		RCAM Allocation	MNP Three Prong Test Results - 2012		
Service Function		2012 Agreed under ISA	Prong 1 Incurrence	Prong 2 Allocation	Prong 3 Cost Benefit
31	Depreciation - Risk Management System	64,951	Pass	Pass	Pass
32	Direct EFS Charge	(2,314,784)	Pass	Pass	Pass
33	Directors Fees & Charges	744,819	Pass	Pass	Pass
34	Audit Fees	N/A	N/A	N/A	N/A
35	EGD Stock Based Compensation	7,549,229	Pass	Pass	Pass
36	Insurance Premiums	8,483,868	Pass	Pass	Pass
Direct Charges and General Expenses Total		14,528,083			

Items of Note:

Audit Fees

Audit Fees were a direct charge, and are now accounted for outside the RCAM (as of 2012) to better reflect the nature of the billing, whereby EGD pays PwC audit fee invoices directly. Prong tests are therefore not applicable.

EGD Stock Based Compensation (SBC)

For 2007, significant adjustments were proposed by MNP to reflect what was deemed to be an inappropriate valuation method for SBC. While the majority of publicly traded companies on the TSX used the CICA Handbook approved Black-Scholes method for valuation, EGD SBC was valued using the intrinsic method. Allocations for SBC thereafter have been based on the Black-Scholes valuation method.

Insurance Premiums - 2011

Insurance premiums are considered to be largely outside the control of EGD and EI. While each company can mitigate losses and/or premium increases through proactive risk management, the premiums amounts are quantified using risk factors and losses external to EGD and EI.

Early in 2011, EGD accepted an RCAM allocation of \$4.3 million based on the EI budget approved in December 2010. In the second quarter of 2011, actual insurance premium allocation costs of \$7.2 million became known, resulting in an effective \$2.9 million shortfall for EGD compared to budget. MNP's recommendation is that EI and EGD develop and/or employ an equitable mechanism to ensure ratepayers are kept whole with material unforeseen events that result in large variances against budget pursuant to the RCAM process. This mechanism should account for actual variances both over and under budget.

MNP's understanding is that there is a general mechanism that may be used to accommodate amendments to the ISA (Sections 5 and 7); however, this mechanism has not been triggered for these types of large variances of budget to actual.

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MNP Direct Charge and General Expense Findings:
MNP passed each relevant charge on all prong tests

MNP Recommendation:
EGD and EI should implement a process to account for material unforeseen expenses that result in actual variances over or under budget allocations.

11.2 VARIANCE AND COMPARATOR REVIEW – 2007 TO 2012

The table below shows the compound annual growth rate (CAGR) in expenses by Primary Service between 2007 and 2012, excluding the 3 service areas allocating zero dollars for 2012.

2012 RCAM - Services Review - (\$)		RCAM Allocation			
Service Function	MNP Categorization	2007 OEB Approved	2012 Agreed under ISA	Increase (Decrease) from 2007 to 2012	CAGR from 2007 to 2012
1 Audit & Accounting Advice	Finance & Accounting	86,095	91,270	5,175	1.2%
2 Board of Directors Support	Corporate Management	511,270	769,368	258,098	8.5%
3 Business Development	Corporate Management	652,513	736,918	84,405	2.5%
4 Capital Market Financing & Access	Finance & Accounting	681,246	1,020,173	338,927	8.4%
5 Cash Management & Banking	Finance & Accounting	222,036	481,073	259,037	16.7%
6 Consolidation and Planning System Technical Support	Information Technology	375,868	245,089	(130,779)	-8.2%
7 Corporate Compliance	Regulatory & Government Affairs	99,725	197,202	97,477	14.6%
8 Employee and Labour Relations	Human Resources	253,529	478,201	224,672	13.5%
9 Employee Development	Human Resources	255,425	1,260,568	1,005,143	37.6%
10 Enterprise IT Program Management	Information Technology	149,002	868,494	719,492	42.3%
11 Enterprise IT Strategy Planning & Management	Information Technology	550,749	624,115	73,366	2.5%
12 Expense System Management & Technical Support	Information Technology	119,526	95,490	(24,036)	-4.4%
13 External Audit Coordination	Finance & Accounting	43,174	103,399	60,225	19.1%
14 Financial and Project Accounting System Technical Support	Information Technology	320,766	352,161	31,395	1.9%
15 Government Relations	Regulatory & Government Affairs	119,234	44,917	(74,317)	-17.7%
16 HRIS Program Management and Development	Information Technology	689,995	3,009,273	2,319,278	34.3%
17 Human Resource Advice	Human Resources	101,190	201,779	100,589	14.8%
18 Industry Relations & Corporate Social Responsibility	Corporate Communication & Services	245,307	384,365	139,058	9.4%
19 Insurance Claims Support, Strategy and Management	Corporate Management	84,730	108,240	23,510	5.0%
20 Investor Services	Corporate Communication & Services	994,024	883,837	(110,187)	-2.3%
21 Legal Advice	Legal	303,414	514,396	210,982	11.1%
22 Planning, Management, & Execution of Internal Audits	Finance & Accounting	82,338	191,528	109,190	18.4%
23 Portal Suite Operations and Technical Support	Information Technology	259,283	330,881	71,598	5.0%
24 Rate Regulated Entity Support	Regulatory & Government Affairs	328,451	253,904	(74,547)	-5.0%
25 Records & Information Management	Information Technology	456,875	538,352	81,477	3.3%
26 Risk Assessment & Management	Corporate Management	541,913	878,461	336,548	10.1%
27 Strategic Planning	Corporate Management	167,834	327,890	160,056	14.3%
28 Supply Chain Management	Corporate Management	19,504	39,706	20,202	15.3%
29 Tax Reporting & Planning	Finance & Accounting	10,196	55,308	45,112	40.2%
30 Total Compensation & Benefits	Human Resources	865,843	1,781,809	915,966	15.5%
Primary Service Totals		9,591,055	16,868,167	7,277,112	12.0%

As evidenced with Individual Service Reviews (Method 1) and Appendix D templates for each RCAM service, MNP examined the prudence and appropriateness of allocations for the 2012 RCAM based on service descriptions and service levels required. The purpose of the variance and comparator review is to examine the increases and decreases in RCAM allocations from 2007 to 2012.

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Of the \$7.3 million increase in Primary Services from 2007 to 2012 (as noted in the table above), \$5.4 million or 74% is attributed to services that MNP has categorized as IT and HR functions. MNP also understands that year over year variance explanations have been provided to the Intervenor group through consultative sessions since 2007 and that the Intervenor group has expressed interest in RCAM allocation increases in these same service categories.

Given that costs related to IT and HR are built up based on specific information management requirements and labour force conditions, respectively, it is difficult to draw direct cost comparisons from company to company without a benchmarking exercise or very detailed examination of technology/software or HR program implementation lifecycles specific to each company. This challenge is further complicated by three factors:

1. EGD's categorization of broader shared services 'departmental' costs into 36 unique individual shared services for the purposes of RCAM allocation.
2. RCAM allocations are only a subset of general and administrative costs incurred by EGD.
3. Service levels related to service provision are difficult to quantify, as evidenced by the complex RCAM principles and model used to undertake the allocation effort between EI and EGD.

In an effort to further assess the appropriateness of the RCAM allocations, MNP undertook to elevate its examination of EGD HR and IT costs by reviewing entity level Operating, Maintenance and Administration ("OM&A"), and Capital costs for EGD in these areas. This incremental analysis provides insight into the efficiency or effectiveness of OM&A cost management of EGD during similar periods and in similar operating environments compared to other rate regulated transmission/distribution entities in several Canadian jurisdictions.

Limitations

Due to varying company approaches to financial and regulatory reporting, MNP found it difficult to obtain relevant publicly available data for preferred comparable entities over similar periods of time at the department level for HR and IT. MNP's assessment is based on the meaningful and comparable data it was able to source.

In addition, MNP has evaluated year over year variances using the Compound Annual Growth Rate (CAGR) calculation. This method calculates average annual growth from one year to another, and is useful to capture trends over time. The limitation of using the CAGR calculation is that it does not reflect high or low values (outliers) or reflect total spending during the time span contemplated.

11.2.1 Information Technology

Modern utility companies of the size and complexity of EGD typically incur substantial IT costs on an annual basis and hold large IT asset values on their balance sheets. To effectively maintain infrastructure and systems, deliver utility services and provide billing and customer services, companies like EGD invest in and maintain sophisticated IT hardware and software.

It is reasonable to expect that annual IT expenditures will be highly variable during periods when new programs and large-scale development projects are implemented. In years when new project systems are implemented or upgraded, costs are comparatively high. In years when

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systems are stable and in sustainment mode, costs are comparatively low. These peaks and valleys are typically smoothed by periods of overlapping systems projects.

From 2007 to 2012, like its industry peers, EGD has undertaken numerous IT projects to evolve and modernize its information management capabilities to improve operations and customer service. Increases in IT RCAM allocations during this period are reflective of increased support requirements of EI, where many of EGD's systems are housed. Generally EI will implement or upgrade central systems while EGD and its other affiliates benefit from their use.

Increases in RCAM IT allocations in recent years have been due to support requirements for a number of system implementations and enhancements, including (but not limited to):

- Multi-year Financial Renewal project.
- Financial reporting requirements (i.e. U.S. GAAP).
- Khalix upgrades.
- Expense report system enhancements.
- HRCore Project (May 2010 launch to July 2012 go-live)
- Enterprise content management enhancements.
- SharePoint upgrade.
- Microsoft upgrades (e.g. email).
- Program and project management for upgrades.

2012 RCAM - Services Review - (\$)		RCAM Allocation			
Service Function		MNP Categorization	2007 OEB Approved	2012 Agreed under ISA	Increase (Decrease) from 2007 to 2012 CAGR from 2007 to 2012
6	Consolidation and Planning System Technical Support	Information Technology	375,868	245,089	(130,779) -8.2%
10	Enterprise IT Program Management	Information Technology	149,002	868,494	719,492 42.3%
11	Enterprise IT Strategy Planning & Management	Information Technology	550,749	624,115	73,366 2.5%
12	Expense System Management & Technical Support	Information Technology	119,526	95,490	(24,036) -4.4%
14	Financial and Project Accounting System Technical Support	Information Technology	320,766	352,161	31,395 1.9%
16	HRIS Program Management and Development	Information Technology	689,995	3,009,273	2,319,278 34.3%
23	Portal Suite Operations and Technical Support	Information Technology	259,283	330,881	71,598 5.0%
25	Records & Information Management	Information Technology	456,875	538,352	81,477 3.3%
	Information Technology Total		2,922,064	6,063,855	3,141,791 15.7%

Comparator Analysis

The analysis below demonstrates that EGD's total annual information technology (IT) expenditures are reasonably aligned with other utility industry firms when measured as a percentage of total operating expenses. MNP drew on a study completed by KPMG for Union Gas Ltd. (Union) and its current rate filed case and rebasing application¹⁰. Using 2010 industry data developed by Gartner in the KPMG report, MNP compared EGD to Union and a set of over 90 other utilities from North America and international markets. In relation to Gartner's utilities average metric, Figure 1 below shows that EGD's total IT spend¹¹ (including all IT related O&M expenses and IT capital investments budgeted) as a percentage of its total 2012 budgeted operations expenses is 2.8%, which is in line with the industry average of 2.6%.

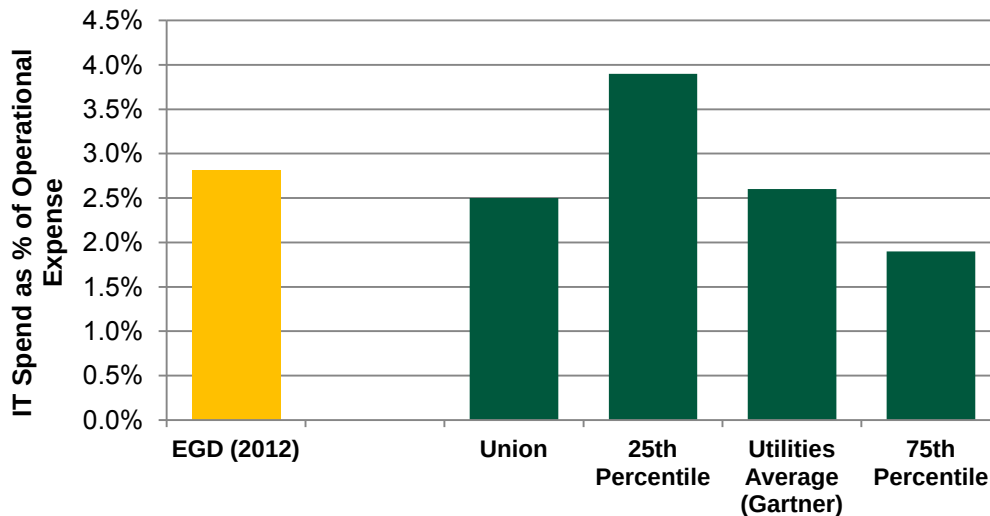
¹⁰ Union Gas Ltd. 2013 Rebasing Application. EB-2011-0210, Exhibit D1 Tab 7 Appendix A.

¹¹ Enbridge Gas Distribution Inc. 2013 Rates Application. EB-2011-0354, Exhibit D1 Tab 1 Schedule 1 and Exhibits B1 Tab 4 and D1 Tab 16, Schedule 1.

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Figure 1: IT Spend as a % of Operational Expense



Variance Analysis

MNP analysis of the growth in EGD IT-related spending also demonstrates reasonableness when compared to utility industry peers. The table below shows that EGD's average annual growth in IT expenditures falls near the bottom of the range of companies for which MNP found relevant data.

Average Annual IT Expense Growth¹²

Company	IT CAGR	Timeline
FortisBC	17.8%	2006 to 2012
Hydro One Networks Distribution	12.5%	2007 to 2011
Hydro One Total	10.9%	2007 to 2011
Toronto Hydro	9.8%	2008 to 2012
EGD	6.4%	2007 to 2012
Union Gas	4.4%	2010 to 2013

11.2.2 Human Resources

EGD is facing challenging conditions in terms of employee development and succession in light of its aging workforce and a strong commitment to employee and customer safety. According to EGD, 18% of its workforce (including 26% of its business leaders) is eligible to retire today, and 30% can retire within the next 5 years. This presents challenges to plan for and implement succession plans for continuity of leadership, ensure institutional knowledge is maintained as senior staff retire, enhance staff and management skills development, and attract and retain high performing staff while maintaining 50th percentile total compensation targets in the Toronto market.

¹² **Enbridge Gas Distribution Inc.** 2013 Rates Application. EB-2011-0354, Exhibit D1 Tab 1 Schedule 1 and Exhibits B1 Tab 4 and D1 Tab 16, Schedule 1.

Toronto Hydro 2012-2014 Electricity Distribution Rates Application. EB-2011-0144, Exhibits F2 Tab 1 Schedule 9 and D1 Tab 8 Schedule 1.

Hydro One Networks 2010 and 2011 Rate Application Update. EB-2009-0096, Exhibit C, Tab 2 Schedule 9.

Union Gas Ltd. 2013 Rebasing Application EB-2011-0210 Exhibit D3 Tab 3 and B1 Tab 7.

FortisBC Energy Utilities 2012 & 2013 Revenue Requirements & Natural Gas Rates Application. Appendix D-3, D-6.

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EGD is undertaking a program to address these issues and position itself to continue to meet operational and customer service obligations in the future. As noted in the table below, the bulk of the increase from 2007 to 2012 lies with the Employee Development and Total Compensation & Benefits services. RCAM allocations to each HR service have increased due to support requirements in the following areas:

- Enhanced leadership development program, including:
 - Succession planning.
 - Knightsbridge Executive Development Program.
 - Mentoring Program.
 - New Union performance management process.
- Enbridge Learning Management System online training program.
- HRIS and PeopleSoft optimization.
- Total Compensation system design.

2012 RCAM - Services Review - (\$)		RCAM Allocation			
Service Function	MNP Categorization	2007 OEB Approved	2012 Agreed under ISA	Increase (Decrease) from 2007 to 2012	CAGR from 2007 to 2012
8 Employee and Labour Relations	Human Resources	253,529	478,201	224,672	13.5%
9 Employee Development	Human Resources	255,425	1,260,568	1,005,143	37.6%
17 Human Resource Advice	Human Resources	101,190	201,779	100,589	14.8%
30 Total Compensation & Benefits	Human Resources	865,843	1,781,809	915,966	15.5%
	Human Resources Total	1,475,987	3,722,357	2,246,370	20.3%

Comparator Analysis

Relative to other Ontario utility firms, EGD's entity level HR expenditures appear reasonable and within the range of comparable organizations when evaluating their cost effectiveness by the following metrics:

- Dollars of Revenue per dollar of HR expense.
- Dollars of Total Assets Managed per dollar of HR expense.
- FTE per million dollars of HR expense^{13,14}.

Figure 2 below summarizes HR expenses per FTE. The presumption within this analysis is that the lower the expense per FTE, the more cost-effectively HR services are delivered.

Using the most recent widely available data from 2011, Figure 3 summarizes revenue and assets per dollar of HR expense. Greater efficiency is directionally indicated by a higher result. EGD falls in line with its utility industry peers, particularly with the similar sized organizations of Union Gas and Toronto Hydro.

¹³ Revenue and Assets – Company Annual Reports 2008 – 2011 (Toronto Hydro, Hydro One, Union Gas, EGD, Fortis BC, Manitoba Hydro, ENMAX).

¹⁴ FTE - Board Filings: *Enbridge* EB-2011-0354, *Union* EB-2011-2010, *Hydro One* EB-2009-0096, *Toronto Hydro* EB-2011-0144 Appendix A.

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Figure 2: HR Cost-Effectiveness Metrics – Resources per FTE (2011)

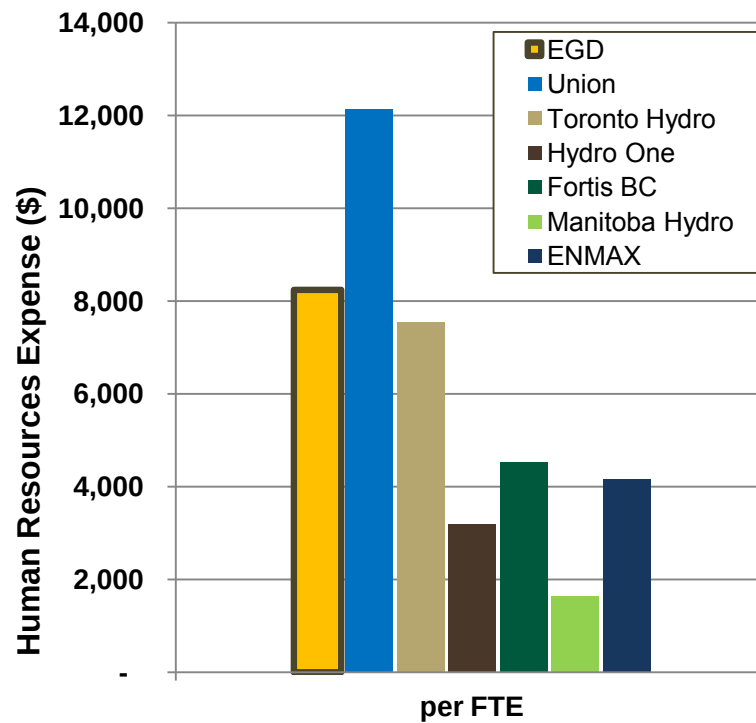
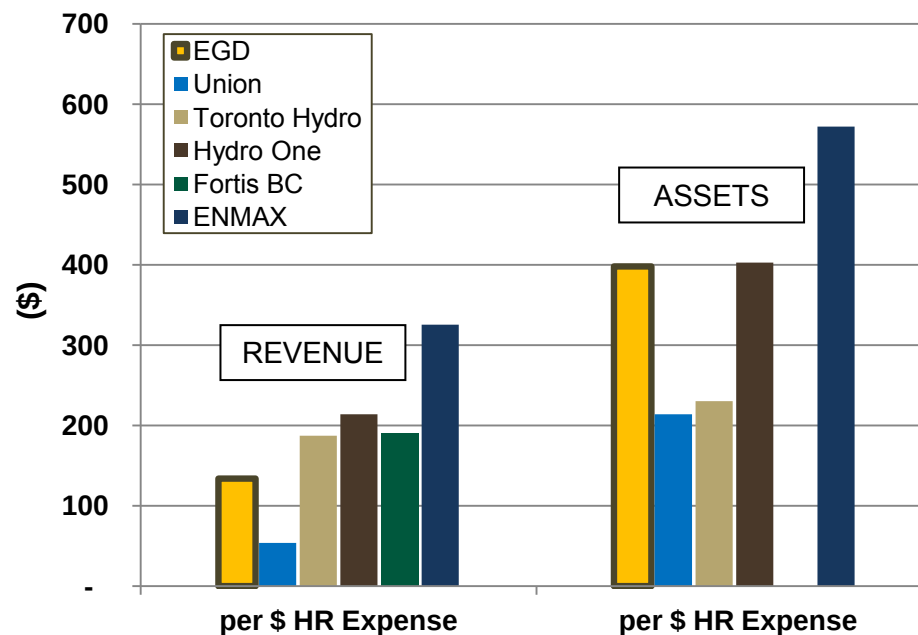


Figure 3: HR Cost-Effectiveness Metrics – Revenue & Assets (2011)



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Variance Analysis

The growth of EGD human resources expenses also appears reasonable and on average, compounded annual growth is lower than other comparable utility firms where data was available. The table below demonstrates a 0.7% increase in EGD's average annualized growth rate, which is at the lower end of the range of annual growth estimates for other Ontario utilities. MNP found only recent and highly variable data for HR expenses for Union Gas, and could not therefore attribute relevant trend data.

Average Annual HR Expense Growth¹⁵

Company	HR CAGR	Timeline
Toronto Hydro	16.2%	2008 to 2011
Hydro One Total	11.3%	2007 to 2011
Hydro One Distribution	11.1%	2007 to 2011
FortisBC	8.7%	2007 to 2012
ENMAX Power	3.1%	2007 to 2010
EGD	0.7%	2007 to 2012
Manitoba Hydro	0.6%	2007 to 2012

Variance and Comparator Review Findings:

For IT and HR entity level expenditures, EGD demonstrates reasonable and competitive operational cost-effectiveness compared to other rate regulated utilities.

11.2.3 Departmental Cost Review

For each Primary Service, direct and common costs are allocated by EI at the departmental level to individual Primary Services through the use of time estimates and various cost drivers and associated allocators. Intervenors have expressed an interest in examination of the proportion of EI costs allocated to EGD by department (as opposed to Primary Service) over time, noting that EI departmental budgets have increased substantially since 2007.

MNP collected RCAM allocation data for 2007 and 2012, consolidated by department, and calculated the % of total EI departmental budgets allocated to EGD through the RCAM. MNP then calculated the increase or decrease in the % of departmental costs allocated to EGD from 2007 to 2012.

Excluding costs of new departments, MNP noted that EGD RCAM allocation ratios of the total EI department budget cost went from 13.2% in 2007 to 7.9% in 2012, a reduction of 5.2%.

¹⁵ **Hydro One** Application, EB-2009-0096 Exhibit C1 Tab 2 Schedule 7, Schedule 8.
ENMAX Power Corp. AUC Rule 5: Annual Operations Financial and Operating Reporting. Years Ending 2009, 2010. Schedule 3.
FortisBC Energy Utilities 2012 & 2013 Revenue Requirements & Natural Gas Rates Application. Appendix D-1, D-3.
Toronto Hydro 2012-2014 Electricity Distribution Rates Application. EB-2011-0144, Exhibit F2, Tab 1 Schedule 10.
Manitoba Hydro 2010/11 & 2011/12 General Rate Application. Tab 6 & 11 and Appendix 4.4 & 11.
Enbridge Gas Distribution Inc. 2013 Rates Application. EB-2011-0354, Exhibit A1 Tab 2 Schedule 1.

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Including the support services budget (incorporating primarily administration, accounting and IT), EGD's RCAM ratio went from 12.3% to 7.9%. While EI total budget costs for departments and support services increased by 255% from \$84.1 million to \$214.4 million from 2007 to 2012, EGD's RCAM allocation for Primary Services increased by 164% from \$10.3 million to \$16.9 million over the same period.

Unless EGD's demand for shared services has kept pace with the growth of EI departmental budgets, MNP would expect to see EGD take on a smaller portion of EI's department costs through the RCAM. Although EGD demand for services has increased, particularly for HR and IT support, as evidenced below the ratio of EI's department costs has decreased over time.

2012 RCAM - Services Review - (\$)	EI Department Budget		RCAM Allocation		EGD RCAM % of EI Dept Budget		
EI Department	2007	2012 ISA Agreed	2007 OEB Approved	2012 ISA Agreed	2007	2012 ISA Agreed	Variance from 2007 to 2012
Alternative & Emerging Technology (10106)	2,110,298	5,332,830	132,892	-	6.3%	0.0%	-6.3%
Audit Services (Calgary) (10050)	1,013,972	2,598,546	56,281	137,506	5.6%	5.3%	-0.3%
CEO (10000)	5,602,432	12,954,780	843,476	1,918,027	15.1%	14.8%	-0.2%
CFO (10045)	1,530,913	3,719,515	220,142	330,663	14.4%	8.9%	-5.5%
CIO (10001)	2,697,401	4,030,466	1,180,225	1,254,040	43.8%	31.1%	-12.6%
Corp Climate Change	61,320	-	15,238	-	24.9%	0.0%	-24.9%
Corporate Admin. (10071)	641,502	1,544,417	59,057	28,055	9.2%	1.8%	-7.4%
Development and Planning (10107)	3,078,670	10,826,264	790	-	0.0%	0.0%	0.0%
Corporate Controller (10047)	5,302,675	15,939,163	208,518	268,893	3.9%	1.7%	-2.2%
Corporate HR (10092)	1,453,644	3,946,946	328,785	457,808	22.6%	11.6%	-11.0%
Corporate IT Operations (10009) livelink licence only	-	702,993	-	36,743	0.0%	5.2%	5.2%
Corporate IT Operations (10009) no livelink licence	1,674,358	1,479,996	151,216	105,770	9.0%	7.1%	-1.9%
Corporate Law (10077)	1,459,539	5,979,072	208,594	326,004	14.3%	5.5%	-8.8%
Corporate Law Legal Fees (10020)	306,600	600,000	44,226	36,612	14.4%	6.1%	-8.3%
Corporate Secretarial (10070)	2,314,249	4,423,865	310,424	138,077	13.4%	3.1%	-10.3%
Corporate Secretarial Legal Fees (10024)	1,175,300	1,220,000	179,319	87,253	15.3%	7.2%	-8.1%
BD East	1,075,543	-	107,554	-	10.0%	0.0%	-10.0%
EFS Strategy & Services (10040)	1,048,304	701,602	350,486	145,374	33.4%	20.7%	-12.7%
EGD Charge	334,194	1,716,941	16,265	2,113	4.9%	0.1%	-4.7%
Enterprise Content Management (10075)	523,784	5,821,798	221,714	304,287	42.3%	5.2%	-37.1%
Enterprise Risk (10046)	-	10,938,498	-	673,278	0.0%	6.2%	6.2%
EPI Charge	4,015,713	14,905,724	54,825	48,135	1.4%	0.3%	-1.0%
Executive VP Corporate Law	-	3,765,602	-	112,968	0.0%	3.0%	3.0%
Group VP Gas Strategy	3,371,759	-	570,125	-	16.9%	0.0%	-16.9%
People & Partners (10094)	1,703,382	3,898,081	394,860	763,916	23.2%	19.6%	-3.6%
HR Enterprise Business Solutions (10089)	-	2,001,904	-	599,029	0.0%	29.9%	29.9%
HRIS Services (10095)	994,368	4,698,241	371,208	1,460,590	37.3%	31.1%	-6.2%
Industry Associations (10023)	475,211	15,914	44,321	856	9.3%	5.4%	-3.9%
Investor Relations (10043)	1,993,628	2,423,890	314,820	65,225	15.8%	2.7%	-13.1%
IT Planning and Governance (10012)	-	4,772,072	-	751,601	0.0%	15.8%	15.8%
Labour Relations (10093)	437,232	1,014,064	177,611	453,245	40.6%	44.7%	4.1%
Risk Insurance (10051)	555,782	1,108,561	67,219	33,257	12.1%	3.0%	-9.1%
Pension & Benefits (10096)	572,092	-	237,893	-	41.6%	0.0%	-41.6%
Investment Review (10109)	1,991,541	2,423,985	35,413	-	1.8%	0.0%	-1.8%
Public & Government Affairs (10072)	3,311,502	16,935,260	319,489	444,382	9.6%	2.6%	-7.0%
Records Management (10079)	-	1,151,750	-	60,198	0.0%	5.2%	5.2%
Organizational Effectiveness(10090)	468,447	3,004,859	52,235	530,855	11.2%	17.7%	6.5%
Tax Services (Calgary) (10049)	1,940,759	3,162,738	6,899	40,013	0.4%	1.3%	0.9%
Total Compensation (10091)	849,259	3,829,233	274,700	989,517	32.3%	25.8%	-6.5%
Treasury (10044)	6,529,362	7,222,792	1,004,875	917,929	15.4%	12.7%	-2.7%
Gas P/L Development (East) (10110)	1,355,126	-	40,507	-	3.0%	0.0%	-3.0%
Gas P/L Development (West) (10111)	1,727,342	-	38,213	-	2.2%	0.0%	-2.2%
Total Departmental Costs	65,697,198	170,812,364	8,640,415	13,522,222	13.2%	7.9%	-5.2%
Support Services Budget	18,395,199	43,594,682	1,671,762	3,345,945	9.1%	7.7%	-1.4%
Total Primary Services	84,092,397	214,407,046	10,312,177	16,868,167	12.3%	7.9%	-4.4%

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11.3 RETURN ON INVESTMENT REVIEW

The ARC allows for a return on invested capital as indicated below.

2.3.10 Where it can be established that a reasonably competitive market does not exist for a service, product, resource or use of asset that a utility acquires from an affiliate, the utility shall pay no more than the affiliate's fully-allocated cost to provide that service, product, resource or use of asset. The fully-allocated cost may include a return on the affiliate's invested capital. The return on invested capital shall be no higher than the utility's approved weighted average cost of capital.¹⁶

A return on invested capital has not been incorporated as a part of each Primary Services' fully allocated cost, but is included as a separate charge in RCAM. The invested capital has been defined as the NBV (net book value) of PPE (property, plant and equipment) assets of EI required to provide the services.

The table below summarizes the Return on Investment calculations for 2012 and 2013. The 2013 return is consistent with EGD's 2013 rate case filing for the 2013 cost of service year.

Rate of Return Calculations

2012						2013	
Net Book Value of EI Assets	Allocation Mechanism to EGD	Allocation Percentage	EGD Portion of EI Assets	Allowable Rate of Return	EGD 2012 Rate of Return	Allowable Rate of Return	EGD 2013 Rate of Return
35,087,973	FCER	14%	4,866,702	7.58%	368,896	7.35%	357,703

¹⁶ Affiliate Relationships Code for Gas Utilities, OEB, last Revised November 25, 2010.

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12 COST ALLOCATION REVIEW – 2013 – ANALYSIS & FINDINGS

For purposes of evaluating the RCAM process and results, MNP conducted its research and analysis based on 2012 data. The completed 2012 RCAM build up process between EI and EGD has allowed MNP to conduct its assessment with a full suite of RCAM documentation.

Given that the suite of RCAM documents has not been prepared for 2013, the only analytical requirement in scope for MNP relating to 2013 is an assessment of the escalation factor and methodology used to inflate 2012 RCAM allocations. EGD has opted to use 2012 RCAM data to provide the basis for its 2013 RCAM budget. The 2013 budget for primary services has been escalated by a factor approved by EI, in this case 2.2%¹⁷. Directors Fees and Charges and EGD Stock Based Compensation are both escalated in the same manner for 2013, while other Direct Charges and General Expenses have been estimated by EI as constants from 2012.

12.1 ESCALATOR REVIEW

EGD has selected an escalator based on the average of Alberta consensus CPI forecasts from TD, RBC, BMO and CIBC, which indicates 2.2% growth for 2013, which MNP finds reasonable based on the logical escalating index of CPI, credible sources for the estimate, and independent corroboration.

The table presented below shows the calculated escalation factor by service, and in a number of instances the calculated escalation factor varies slightly from the stated factor of 2.2%, resulting in a consolidated escalation of 2.17% for primary services.

12.2 PRONG THREE PROPOSED MNP ADJUSTMENTS FOR 2013

For the 3 primary service allocations that fell above the MNP internal service provision range for 2012 (Capital Market Financing and Access, Employee Development and HRIS Program Management and Development), MNP has recommended a combined downward adjustment to the 2012 RCAM allocations of \$154,923. Based on this 2012 RCAM adjustment and escalation factors used by EGD to develop 2013 RCAM estimates for each service, MNP recommends a corresponding combined downward adjustment to the 2013 RCAM allocations of \$158,329.

Prong Three Adjustments for 2012 and 2013

2013 RCAM - Services Review - (\$)		2012 RCAM Allocation			2013 RCAM Allocation	
Service Function		2012 Agreed under ISA	2012 Prong 3 MNP Proposed Adjustment	2012 MNP Proposed	2013 EGD Proposed	2013 Prong 3 MNP Proposed Adjustment (escalated 2012 Adjustment)
4	Capital Market Financing & Access	1,020,173	(28,303)	991,870	1,042,564	(28,924)
9	Employee Development	1,260,568	(14,945)	1,245,623	1,288,299	(15,274)
16	HRIS Program Management and Development	3,009,273	(111,675)	2,897,598	3,075,443	(114,131)
Primary Service Totals		16,868,167	(154,923)	16,713,244	17,234,234	(158,329)

¹⁷ Average of Alberta consensus CPI forecast from four banks - TD, RBC, BMO and CIBC.

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Calculated Escalators for 2013

2013 RCAM - Services Review - (\$)		RCAM Allocations		
Service Function		2012 Agreed under ISA	2013 EGD Proposed	% Change
1	Audit & Accounting Advice	91,270	93,278	2.20%
2	Board of Directors Support	769,368	785,892	2.15%
3	Business Development	736,918	753,039	2.19%
4	Capital Market Financing & Access	1,020,173	1,042,564	2.19%
5	Cash Management & Banking	481,073	491,656	2.20%
6	Consolidation and Planning System Technical Support	245,089	249,486	1.79%
7	Corporate Compliance	197,202	201,540	2.20%
8	Employee and Labour Relations	478,201	488,722	2.20%
9	Employee Development	1,260,568	1,288,299	2.20%
10	Enterprise IT Program Management	868,494	887,579	2.20%
11	Enterprise IT Strategy Planning & Management	624,115	637,845	2.20%
12	Expense System Management & Technical Support	95,490	97,384	1.98%
13	External Audit Coordination	103,399	105,673	2.20%
14	Financial and Project Accounting System Technical Support	352,161	358,097	1.69%
15	Government Relations	44,917	45,895	2.18%
16	HRIS Program Management and Development	3,009,273	3,075,443	2.20%
17	Human Resource Advice	201,779	206,184	2.18%
18	Industry Relations & Corporate Social Responsibility	384,365	392,741	2.18%
19	Insurance Claims Support, Strategy and Management	108,240	109,912	1.54%
20	Investor Services	883,837	903,044	2.17%
21	Legal Advice	514,396	525,600	2.18%
22	Planning, Management, & Execution of Internal Audits	191,528	195,741	2.20%
23	Portal Suite Operations and Technical Support	330,881	338,160	2.20%
24	Rate Regulated Entity Support	253,904	259,490	2.20%
25	Records & Information Management	538,352	550,195	2.20%
26	Risk Assessment & Management	878,461	897,681	2.19%
27	Strategic Planning	327,890	335,020	2.17%
28	Supply Chain Management	39,706	40,580	2.20%
29	Tax Reporting & Planning	55,308	56,525	2.20%
30	Total Compensation & Benefits	1,781,809	1,820,969	2.20%
Primary Service Totals		16,868,167	17,234,234	2.17%
31	Depreciation - Risk Management System	64,951	64,951	0.00%
32	Direct EFS Charge	(2,314,784)	(2,314,784)	0.00%
33	Directors Fees & Charges	744,819	761,205	2.20%
34	Audit Fees	N/A	N/A	N/A
35	EGD Stock Based Compensation	7,549,229	7,715,312	2.20%
36	Insurance Premiums	8,483,868	8,483,868	0.00%
Direct Charges and General Expenses Total		14,528,083	14,710,552	1.26%
Return on Investment		368,896	357,703	-3.03%
Total RCAM Allocation		31,765,146	32,302,489	1.69%

13 CONCLUSION

13.1 MNP FINDINGS

Based on analysis of information gathered, interviews conducted, research undertaken, and comparisons to industry standards and leading practices, MNP made the following key findings:

RCAM Methodology Review

- The ISA is compliant with the ARC.
- The RCAM Methodology remains appropriate for EGD and is adhered to in the development of allocations for 2012 (and 2013 through the escalator).
- Further to MNP's integrity testing on a sample basis, MNP found no calculation errors with the RCAM financial model. The RCAM financial model appears to operate as expected.

Cost Allocation Review

- With consideration for exclusions and service levels required for EGD 2012 business activity, all services passed the Incurrence component of the Three Prong Test.
- All services passed the Allocation component of the Three Prong Test for 2012.
- All but three Primary services passed the Cost Benefit component of the Three Prong Test. The three failed Primary services are Capital Market Financing and Access, Employee Development and HRIS Program Management and Development. These test failures result in a combined MNP recommended downward adjustment to 2013 RCAM EGD proposed allocations by \$158,329.
- Variance and comparator analysis shows that EGD's operational performance relating to entity level HR and IT expenditures is reasonable and competitive with other rate regulated utilities in Ontario and other jurisdictions.
- The Return on Invested Capital calculation for 2013 is appropriate and compliant with the ARC.
- The escalation factor selected by EGD to estimate 2013 RCAM allocation is reasonable.

In MNP's opinion, incorporating MNP proposed adjustments based on the failed Prong Three Tests, the 2012 and 2013 RCAM corporate services allocations are being incurred prudently and allocated appropriately with benefits that exceed costs for ratepayers.

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2012 and 2013 RCAM Proposed Allocations

2013 RCAM - Services Review - (\$)		2012 RCAM Allocation			2013 RCAM Allocation		
Service Function		2012 Agreed under ISA	2012 Prong 3 MNP Proposed Adjustment	2012 MNP Proposed	2013 EGD Proposed	2013 Prong 3 MNP Proposed Adjustment (escalated 2012 Adjustment)	2013 MNP Proposed
1	Audit & Accounting Advice	91,270	-	91,270	93,278	-	93,278
2	Board of Directors Support	769,368	-	769,368	785,892	-	785,892
3	Business Development	736,918	-	736,918	753,039	-	753,039
4	Capital Market Financing & Access	1,020,173	(28,303)	991,870	1,042,564	(28,924)	1,013,640
5	Cash Management & Banking	481,073	-	481,073	491,656	-	491,656
6	Consolidation and Planning System Technical Support	245,089	-	245,089	249,486	-	249,486
7	Corporate Compliance	197,202	-	197,202	201,540	-	201,540
8	Employee and Labour Relations	478,201	-	478,201	488,722	-	488,722
9	Employee Development	1,260,568	(14,945)	1,245,623	1,288,299	(15,274)	1,273,025
10	Enterprise IT Program Management	868,494	-	868,494	887,579	-	887,579
11	Enterprise IT Strategy Planning & Management	624,115	-	624,115	637,845	-	637,845
12	Expense System Management & Technical Support	95,490	-	95,490	97,384	-	97,384
13	External Audit Coordination	103,399	-	103,399	105,673	-	105,673
14	Financial and Project Accounting System Technical Support	352,161	-	352,161	358,097	-	358,097
15	Government Relations	44,917	-	44,917	45,895	-	45,895
16	HRIS Program Management and Development	3,009,273	(111,675)	2,897,598	3,075,443	(114,131)	2,961,312
17	Human Resource Advice	201,779	-	201,779	206,184	-	206,184
18	Industry Relations & Corporate Social Responsibility	384,365	-	384,365	392,741	-	392,741
19	Insurance Claims Support, Strategy and Management	108,240	-	108,240	109,912	-	109,912
20	Investor Services	883,837	-	883,837	903,044	-	903,044
21	Legal Advice	514,396	-	514,396	525,600	-	525,600
22	Planning, Management, & Execution of Internal Audits	191,528	-	191,528	195,741	-	195,741
23	Portal Suite Operations and Technical Support	330,881	-	330,881	338,160	-	338,160
24	Rate Regulated Entity Support	253,904	-	253,904	259,490	-	259,490
25	Records & Information Management	538,352	-	538,352	550,195	-	550,195
26	Risk Assessment & Management	878,461	-	878,461	897,681	-	897,681
27	Strategic Planning	327,890	-	327,890	335,020	-	335,020
28	Supply Chain Management	39,706	-	39,706	40,580	-	40,580
29	Tax Reporting & Planning	55,308	-	55,308	56,525	-	56,525
30	Total Compensation & Benefits	1,781,809	-	1,781,809	1,820,969	-	1,820,969
Primary Service Totals		16,868,167	(154,923)	16,713,244	17,234,234	(158,329)	17,075,905
31	Depreciation - Risk Management System	64,951	-	64,951	64,951	-	64,951
32	Direct EFS Charge	(2,314,784)	-	(2,314,784)	(2,314,784)	-	(2,314,784)
33	Directors Fees & Charges	744,819	-	744,819	761,205	-	761,205
34	Audit Fees	N/A	N/A	N/A	N/A	N/A	N/A
35	EGD Stock Based Compensation	7,549,229	-	7,549,229	7,715,312	-	7,715,312
36	Insurance Premiums	8,483,868	-	8,483,868	8,483,868	-	8,483,868
Direct Charges and General Expenses Total		14,528,083	-	14,528,083	14,710,552	-	14,710,552
Return on Investment		368,896	-	368,896	357,703	-	357,703
Total RCAM Allocation		31,765,146	(154,923)	31,610,223	32,302,489	(158,329)	32,144,160

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13.2 MNP RECOMMENDATIONS

ADJUSTMENTS

With the three failed Prong Three Tests, MNP proposes a consolidated downward adjustment to 2012 and 2013 RCAM allocations of \$154,923 and \$158,329, respectively.

IMPROVEMENT OPPORTUNITIES

Based upon observation and investigation, MNP has identified a number of opportunities to improve the RCAM process.

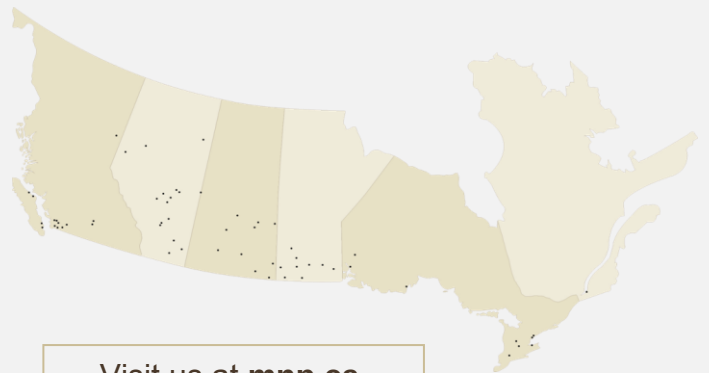
1. **Categorize and Roll up Services for Comparison Purposes** – Despite EGD's alignment with RCAM methodology, with 36 different services it still reports RCAM allocation information at a comparatively granular level with industry comparators. This makes it difficult to compare individual service allocation costs with others to evaluate cost/benefit, and in some cases inhibits the cost-effective opportunity to go to the competitive market to investigate alternative costing. MNP recommends that EGD categorize and roll up services to levels more consistent with reporting of other utilities for comparison purposes, and subsequently undertake a more structured benchmarking study to evaluate costs.
2. **Business Case Upgrades** – MNP recommends that EGD develop two specific upgrades to business cases:
 - a. **Criteria for External Estimates of Cost** – Part III of the business cases requires Service Recipients to estimate costs for external provision of services. Part III also provides an exemption to this requirement if the Recipient deems that there is not a competitive market for equivalent services. In a number of cases, Recipients did not attempt estimates due to factors other than the “the lack of a reasonably competitive market”, although an external estimate may have been of some value in assessing the provision of service. MNP recommends that EGD develop and implement more defined exemption criteria for Service Recipients external estimates.
 - b. **Variance Analysis** – MNP feels it would be prudent to add a section to each business case to track year over year variances in allocation cost. The business cases do not attempt to justify how and why costs are increasing or decreasing over time. Capturing this information may result in new criteria for sourcing the services and allow the Recipient and other stakeholders to compare cost trends to competitors or the market.
3. **Service Level Evaluation** – Although it was apparent that Service Recipients and Service Providers are generally in regular if not frequent communication, MNP was not made aware of any formal retrospective evaluation of service levels or performance at year end or through the budgeting process for the upcoming year. Leading practices in the area of procurement and vendor management suggest that the service recipient hold the service provider to agreed upon performance metrics using a service level agreement or other evaluation mechanism. Similarly, if EGD were to source the services internally, employees would take part in EGD's performance management

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process. This type of process benefits both parties by confirming expectations and providing opportunities to confirm the quality of provision and improve levels of service.

4. **Recovery Mechanism** – Through the course of its investigation, MNP discovered that for 2011, EGD incurred a large shortfall (approximately \$2.9 million) in the allocation of insurance premiums due to a large unanticipated discrepancy between the budgeted allocation and the actual charge shortly thereafter. In cases like these where there is a windfall or shortfall, MNP feels it would be prudent on behalf of ratepayers to consider employing existing or new mechanisms to recover or otherwise true-up any material discrepancies based on unanticipated differences between budgeted and actual allocations for the budget year.



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SEC INTERROGATORY #75

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[D1/4/1, p. 6] Please explain the rationale for requiring the information provided to the RCAM Consultative to be confidential and without prejudice.

RESPONSE

The Company is proposing the continuation of the RCAM consultative which was established pursuant to a complete settlement agreement in the EB-2006-0034 proceeding.

In this settlement agreement, the Company agreed that it would entertain and respond to reasonable questions received from the consultative in respect of matters such as the drivers of material increases in RCAM costs, the discontinuance of any service and the introduction or incurrence of a new service or direct charge. It was anticipated that the information that would be provided to the RCAM Consultative would generally be at a more detailed level than would normally be disclosed in a public proceeding and could include confidential and sensitive information like detailed EI budget information and granular compensation information of EI employees. Enbridge believes that the parties to the settlement agreement understood that it might not be appropriate to disclose such information in a public forum.

Parties agree that all responses and all information provided to the consultative which it may then share with other intervenors will be on a without prejudice basis and will be treated as if such responses and information had been provided by the Company during a Settlement Conference (EB-2006-0034, Exhibit N1, Tab 4, Schedule 1, p. 4).

Witnesses: S. Chhelavda
L. Liauw
B. Yuzwa

Accordingly, the Company is asking only for the continuation of the same treatment of information disclosed to the consultative as has been the case since 2007.

Witnesses: S. Chhelavda
L. Liauw
B. Yuzwa

SEC INTERROGATORY #76

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[D1/4/1, Attach 2, p. 2] Please confirm that this process does not include any provision for the service recipients to challenge the EI pricing, or to negotiate reductions. Please provide a list of all cases in which service recipients challenged EI pricing, and the pricing was reduced, in the RCAM process for 2013.

RESPONSE

EGD does not confirm that the RCAM process does not allow EGD to challenge pricing. EGD does challenge the pricing to achieve reductions.

During the review of EI's costs and cost drivers, cost adjustments may be requested by EGD. In the 2013 RCAM process, EGD challenged the pricing of the Planning, Management & Execution of Internal Audits service, resulting in a pricing reduction.

In reference to EB-2012-0459, Exhibit D1, Tab 4, Schedule 1, Attachment 2, p. 1, it is stated that in step 3 of the process, the service recipients conduct a final review of the service schedules/business cases, assessing EI's competitiveness in conjunction with the alternative costs determined by the service recipients in step 1.

Witnesses: S. Chhelavda
L. Liauw
B. Yuzwa

SEC INTERROGATORY #77

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[D3/2/1] Please provide a table showing all impacts (including tax impacts) of the reduced depreciation rates on Allowed Revenues for each of 2014 through 2018.

RESPONSE

Please refer to the response to Energy Probe Interrogatory #11 at Exhibit I.A16.EGDI.EP.11

Witnesses: S. Kancharla
R. Lei

SEC INTERROGATORY #78

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[D1/11/1, p. 3] Please provide the most current Long Range Plan.

RESPONSE

As a result of the accounting error recently reported within EGD's Q3 2013 Financial Statements, assumptions within the most recent Long Range Plan are no longer accurate. Therefore, that document is no longer reflective of management's expectations. Additionally, the Long Range Plan contains information about unregulated activities by EGD and other related entities. In light of these items, the Long Range Plan is not relevant to this rate application.

The following is an explanation of the recently discovered accounting error.

Due to an internal accounting error, the earnings of Enbridge Gas Distribution were overstated during the period from 2010 to 2013. The total amount of the overstatement of pre-tax earnings during this period was approximately \$104 million.

The internal accounting error did not in any way affect the rates actually paid by customers and Enbridge's customers have at all times paid the correct rates. The accounting error was an understatement of costs as recorded in Enbridge's financial statements, not an incorrect recovery of costs from ratepayers.

The internal accounting error arose from entries that were made to record actual amounts paid for upstream gas transportation. The accounting entries for the actual costs of upstream transportation did not use the appropriate approved toll. As a result, the gas transportation costs were understated, Enbridge's earnings were overstated and the difference flowed to the PGVA account.

Witnesses: K. Culbert
S. Kancharla
B. Yuzwa

Rates are determined on a forecast cost basis where appropriate tolls are used to budget gas cost, PGVA and the related rate design. The actual amounts recorded in the accounting records differed from the rate design resulting in an incorrect recording of transportation tolls included in gas costs. The upstream toll cost recorded was lower than the rate design amount with the difference being recorded for accounting purposes to the PGVA account. The result of Enbridge's internal accounting entries was that, on Enbridge's income statement, earnings were overstated and, on Enbridge's balance sheet, the PGVA amount contained an amount that was incorrect. However, no application was ever made to the OEB to recover or clear the amounts which were incorrectly recorded in the PGVA.

Because of other debits and credits reflected in the PGVA relating to natural gas price variances, inventory valuation adjustments and other adjustments rolling over from one QRAM to another, Enbridge's monitoring processes at the time did not have sufficient granularity to make the cumulative toll amount variance evident. Thus, the impact on Enbridge's pre-tax earnings accumulated to the amount referred to above, but there was no impact on rates paid by customers as no amount recorded in the PGVA on the basis of an incorrect toll was ever cleared to customers.

Witnesses: K. Culbert
S. Kancharla
B. Yuzwa

SEC INTERROGATORY #79

INTERROGATORY

Issue B17: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including:

- a. Is the depreciation amount appropriate?
- b. Is the operating costs amount appropriate?
- c. Is the allocation of O&M costs between utility and non-utility (unregulated) operations appropriate?
- d. Is the amount for income and municipal taxes appropriate?
- e. Is the cost of capital amount appropriate?
- f. Is the Other Revenues amount appropriate?

[D1/11/1, p. 5] Please provide the most recent "actual to budget variance analysis".

RESPONSE

Please find attached actual to budget analysis conducted on a year to date basis at September 30, 2013. This analysis also analyzes year over year variances. Analysis related to unregulated operations has been redacted. Please note, however, that the numerical presentation includes unregulated operations, since the related numbers are embedded in the overall results. The overall results are provided in an effort to be responsive to the question. The fact that some unregulated results are included within the overall numbers is not a concession that such results are relevant or otherwise producible.

GAS DISTRIBUTION

Adjusted Earnings	Actuals		Variance				
			2013 YTD	Q3 2013	Q3 2013	Sept. YTD	Q3 ACT
			vs.	vs.	vs.	vs.	vs.
	2013 YTD	Q3 2013	2012 YTD	Q3 2012	Q2 2013	Bud.	Q3 Bud.
(\$ millions)							
Enbridge Gas Distribution	97	(11)	18	7	(29)	22	2

Enbridge Gas Distribution

September 2013 YTD over September 2012 YTD Variance

- Margin was up by \$16 million, of which \$8 million is due to new customers and higher number of unlocks (60% from fixed charge and 40% from margin on new customers / higher number of unlocks) and \$8 million due to higher unit margin rates in 2013 vs. 2012 (+\$16)
- Higher O&A from increased employee related costs, higher conservation services costs, higher operational, pipeline integrity and safety-related costs, partially offset by lower customer related, IT, Legal, consulting and insurance costs (-\$9)
- Lower depreciation expense due to lower depreciation rates in 2013 vs. 2012 (+\$9)
- Lower other revenue related to ██████████ Conservation Services, and 2012 Earnings Sharing Mechanism (ESM) settlement (extraction and Late Payment Penalty revenue), partially offset by higher Shared Savings Mechanism (SSM) and contract termination revenue (-\$6)
- Lower earnings sharing expense as there is no earnings sharing in 2013 (+\$6)
- Tax benefit from temporary differences related to fixed assets (+\$2)

Q3 2013 Actual over Q3 2012 Actual Variance

- Lower depreciation expense due to lower depreciation rates in 2013 vs. 2012 (+\$3)
- Lower earnings sharing expense as there is no earnings sharing in 2013 (+3)
- Higher Margin due to an increase in number of customers, resulting in more customers being billed the monthly fixed charge, partially offset by higher transportation and storage charges (+\$1)
- Lower other revenue due to the 2012 ESM settlement, partially offset by higher SSM and storage and inspection revenues (\$-2)
- Lower O&A due to lower IT maintenance, customer related and insurance costs (+\$1)
- Tax benefit from temporary differences related to fixed assets (+\$1)

Q3 2013 Actual over Q2 2013 Actual Variance

- Due to seasonality (significant throughput variation – Q1 = 45%, Q2 = 15%, Q3 = 10% & Q4 = 30%, all approximate) comparison to the prior quarter may not be meaningful
- Margin is lower due to a significant decline in throughput from Q2 to Q3 (68 bcf vs. 38 bcf) (-\$31)
- Higher O&A primarily due to higher conservation services costs, higher operational, pipeline integrity and safety-related costs, partially offset by lower customer related and insurance costs (+\$2)
- Tax impacts due to temporary differences related to fixed assets and pension funding (+\$2)
- Higher interest charges due to higher portfolio balance (-\$1)
- Higher depreciation expense due to higher fixed asset balance in Q3 vs. Q2 (-\$1)

September 2013 YTD Actual over September 2013 YTD Budget Variance

- Margin is up by \$4 million due to a higher number of unlocks vs. budget, **(+\$4)**
- Lower O&A, primarily due to lower customer related costs, lower public affairs related costs (timing), higher A&G capitalization, [REDACTED] lower DSM costs and lower inspection costs partially offset by higher operational compliance work **(+\$7)**
- Tax benefit, primarily due to temporary differences re: fixed assets and timing of pension expense vs. funding **(+\$4)**
- Lower depreciation expense due to lower fixed asset balance (lower rate base vs. budget) **(+\$3)**
- Lower interest expense due to lower interest rate and higher allocation to unregulated storage, partially offset by higher portfolio balance. **(+\$2)**
- Higher other revenue due to due to the 2012 ESM settlement. This reversal of \$5.9M results in a reduction of the ESM payable of \$2.9M, (which also results in a recovery of ESM of \$2m after tax) which is classified in other revenue **(+\$2)**

Q3 2013 Actual over Q3 2013 Budget Variance

- Lower other Revenue as a result of the 2012 ESM settlement (concession on 2012 LPP and Extraction revenue), lower TS Revenue, partially offset by the recording of the 2011 SSM revenue (\$5M - timing, as budgeted in Q4). **(-\$2)**
- Tax benefit, primarily due to temporary differences re: fixed assets and timing of pension expense vs. funding **(+\$1)**
- Lower interest expense is due to lower interest expense on long-term debt, [REDACTED] higher capitalized interest, partially offset by higher interest on short-term debt **(+\$2)**
- Lower depreciation expense due to lower fixed asset balance (lower rate base vs. budget) **(+\$1)**

VECC INTERROGATORY #15

INTERROGATORY

ISSUE B17f: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including: Is the Other Revenues amount appropriate?

Evidence Ref: C1/T4/S1/ page 2, Table 1, "Other Service Revenues, Variance between 2014 and 2013"

- a) Please augment the referenced table with a column that provides the most up-to-date available 2013 actuals and forecasted other service revenues, e.g., if a 10-month actual plus 2-month forecast is available for 2013, please provide it; if not, please provide a 2013 9-month actual plus 3-month forecast.
- b) Please provide actual 2012 other service revenues in the same format as in Table 1.
- c) Please provide a breakdown of the 2012 actual other service revenues that is comparable to the 2013 forecast provided in part a) of this interrogatory. For example, if a 9 (actual) + 3 (forecast) is provided in a), please break down the 2012 other service revenues by line item, showing the first 9 months of actuals and the last 3 months of actuals separately.
- d) Please provide historical values by line item as in Table 1 for all previous years for which actuals are available.

RESPONSE

- a) Please see the following table that includes the Company's 9+3 Estimate amounts for the revenue amounts noted in Exhibit C1, Tab 4, Schedule 1, page 2, Table 1, "Other Service Revenues, Variance between 2014 and 2013"

Witnesses: S. McGill
M. Torriano

Other Service Revenues									
Variance between 2014 and 2013									
Line#		Budget	Board						
No.	Particulars (\$ 000's)	2014	2013	Variance	2011	2012	2013 9+3	2015	2016
		(a)	(b)	(c)					
1.1	New Account Charge	\$5,509	\$5,576	(\$67)	\$5,397	\$5,288	\$5,274	\$5,609	\$5,713
1.2	Statement of Account & Lawyer Letters Charge	16	52	-36	13	6	12	16	17
1.3	Cheques Returned Non-Negotiable Charge	158	159	-1	172	152	139	161	164
1.4	Gas Termination Charge for Collection	2,539	2,638	-99	2,344	2,386	2,407	2,586	2,633
1	Total Credit to Customer Support O&M	\$8,222	\$8,425	(\$203)	\$7,926	\$7,832	\$7,832	\$8,372	\$8,527
2.1	Safety Inspection Revenue	495	489	6	453	550	413	501	507
2.2	Meter Testing Revenue	1,049	813	236	900	1,149	1,036	1,062	1,074
2.3	Street Service Alteration Revenue	722	936	-214	972	699	862	730	739
2		\$2,266	\$2,238	\$28	\$2,325	\$2,398	\$2,311	\$2,293	\$2,320
3	Total	\$10,488	\$10,663	(\$175)	\$10,251	\$10,230	\$10,143	\$10,665	\$10,847
4	DPAC	1,647	2,125	-478	3,014	2,421	1,744	1,512	1,420
5	Total Service Charge & DPAC	\$12,135	\$12,788	(\$653)	\$13,265	\$12,651	\$11,887	\$12,177	\$12,267
	Late Payment Penalty Revenue	\$ 10,100	\$ 12,942	\$ (2,842)	\$ 18,238	\$ 12,075	\$ 10,200	\$ 10,100	\$10,100

b) Please see the Company's response VECC Interrogatory #15 found at I.B17.EGDI.VECC.15 (part a) noted above.

c)

Other Service Revenues				
2012 9 & 3 Estimate and Actuals				
Line#		2012		
No.	Particulars (\$ 000's)	Jan - Sep Actual	Oct - Dec Actual	Total 2012 Actual
1.1	New Account Charge	\$4,025	\$1,263	\$5,288
1.2	Statement of Account & Lawyer Letters Charge	7	(\$1)	\$6
1.3	Cheques Returned Non-Negotiable Charge	114	\$38	\$152
1.4	Gas Termination Charge for Collection	2,179	207	2,386
1	Total Credit to Customer Support O&M	\$6,325	\$1,507	\$7,832
2.1	Safety Inspection Revenue ¹	392	158	550
2.2	Meter Testing Revenue ¹	894	255	1,149
2.3	Street Service Alteration Revenue ¹	519	180	699
2		\$1,806	\$592	\$2,398
3	Total	\$8,131	\$2,099	\$10,230
4	DPAC	1,584	837	2,421
5	Total Service Charge & DPAC	\$9,715	\$2,936	\$12,651
	Note: -1) 9 & 3 data is not available for the identified amounts. 7 & 5 information is presented.			

Witnesses: S. McGill
M. Torriano

d)

		Other Service Revenues				
		<u>2007 through 2011</u>				
Line		Actual	Actual	Actual	Actual	Actual
<u>No.</u>	<u>Particulars (\$ 000's)</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>
1.1	New Account Charge	\$ 5,755	\$ 5,358	\$ 5,809	\$ 5,270	\$ 5,397
1.2	Statement of Account & Lawyer Letters Charge	187	37	36	22	13
1.3	Cheques Returned Non-Negotiable Charge	237	232	191	176	172
1.4	Gas Termination Charge for Collection	2,006	2,130	2,147	2,323	2,344
1.	Total Credit to Customer Support O&M	\$ 8,185	\$ 7,757	\$ 8,183	\$ 7,791	\$ 7,926
2.1	Safety Inspection Revenue	415	642	385	412	453
2.2	Meter Testing Revenue	546	581	560	716	900
2.3	Street Service Alteration Revenue	934	1,177	901	836	972
2.		\$ 1,895	\$ 2,400	\$ 1,846	\$ 1,964	\$ 2,325
3.	Total	\$ 10,080	\$ 10,157	\$ 10,029	\$ 9,755	\$ 10,251
4.	DPAC	2,181	2,214	2,628	3,269	3,014
5.	Total Service Charge & DPAC	\$ 12,261	\$ 12,371	\$ 12,657	\$ 13,024	\$ 13,265

Witnesses: S. McGill
M. Torriano

VECC INTERROGATORY #17

INTERROGATORY

ISSUE 817: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including: b. Is the operating costs amount appropriate?

Evidence Ref: D1/T3/S1/ page 7, Table 2, "Other Operating and Maintenance by Cost Type 2013 Board Approved to 2016 Budget"

- a) Please augment the referenced table by adding one column to provide EGO's current best estimate/forecast of actual 2013 costs, indicating the number of months actual and months forecasted used in the estimates.
- b) Please provide (i) the Board approved number of FTEs by category for 2013, and (ii) the actual number of FTEs by category for 2013

RESPONSE

RESPONSE

- a) The 2013 forecast for Other O&M is \$235.3M. However, it is not available by cost type.
- b)
 - (i) There is no Board approved number of FTEs by category for 2013. There is an estimate for the 2013 FTEs provided in Exhibit D1, Tab 3, Schedule 1, Table 4. Set out on the following page is an update of that table.

Witnesses: S. Kancharla
R. Lei
M. Torriano

Table 4
Enbridge Gas Distribution
Full Time Equivalents (FTE's)
From 2013 Latest Estimate to 2016 Budget

		Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7
Line No.	Salary Bands	9 + 3 Forecast	Budget 2014	Budget 2015	Budget 2016	2016 vs. 2015	2015 vs. 2014	2014 vs. 2013
1.	Management	152	154	153	152	(1)	(1)	2
2.	Supervisory	1,464	1,484	1,472	1,470	(1)	(12)	20
3.	Union	674	739	739	739	-	-	65
4.	Total FTE	2,290	2,377	2,364	2,361	(2)	(13)	87

- (ii) The variance between the latest 2013 estimate and 2014 Budget can be attributed to project delay start-up of some Operations programs (including some aspects of the GTA project) and difficulty in recruiting for specialized skills which has impacted staffing levels. This has resulted in a hiring lag in 2013 and therefore reduced the full year FTE count.

The 2014 FTE budget is consistent with the 2013 forecast given that the current active employees are at 2,295, and in addition there are currently 130 positions at various stages of active recruitment.

Witnesses: S. Kancharla
R. Lei
M. Torriano

VECC INTERROGATORY #18

INTERROGATORY

ISSUE 817: Is the Allowed Revenue amount for each of 2014, 2015 and 2016 appropriate, including: b. Is the operating costs amount appropriate?

Evidence Ref: D1/T3/S2/ page 8, Table 1, "Major Employee Expenses"

- a) Please confirm that the entries in the column titled "2013 Budget" contain Board approved numbers in all cases; if unable to so confirm, please identify any entries which differ from the Board approved numbers and provide the Board approved number.

RESPONSE

For 2013 the Board did not approve detailed budget line items that supported the \$414.9M of approved O&M expenses. However, the numbers presented in Table 1 support the Company's internal objective of managing within the overall Board approved budget.

Witnesses: M. Lee
R. Lei
S. Trozzi

BOARD STAFF INTERROGATORY #52

INTERROGATORY

ISSUE: B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: B1/T1/S2/ Utility Rate Base

Please display the actual utility Rate Base for the years 2002 to 2012 and include forecasts for the years 2013 to 2018.

Please display the above figures restated in 2013 constant dollars.

RESPONSE

See attached tables for results.

UTILITY RATE BASE (INCLUDING CIS & CUSTOMER CARE)
 YEAR TO YEAR SUMMARY

Line No.	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9
	2002 Historical Year	2003 Historical Year	2004 Historical Year	2005 Historical Year	2006 Historical Year	2007 Historical Year	2008 Historical Year	2009 Historical Year	2010 Historical Year
	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)
<u>Property, Plant, and Equipment</u>									
1.	3,720.9	3,902.5	4,095.2	4,382.2	4,660.5	4,993.6	5,225.4	5,500.5	5,807.2
2.	(1,147.1)	(1,233.1)	(1,338.8)	(1,510.0)	(1,655.5)	(1,808.1)	(1,955.8)	(2,089.5)	(2,235.7)
3.	2,573.8	2,669.4	2,756.4	2,872.2	3,005.0	3,185.5	3,269.6	3,411.0	3,571.5
<u>Allowance for Working Capital</u>									
4.	1.9	1.1	0.6	0.3	0.2	0.1	-	-	-
5.	1.4	1.4	4.5	4.3	6.6	1.8	0.2	(0.1)	0.5
6.	23.6	19.8	20.2	29.3	22.5	24.5	28.9	26.5	24.1
7.	1.1	0.9	1.1	1.0	1.0	0.8	0.8	0.7	0.6
8.	(22.3)	(26.6)	(30.8)	(37.6)	(42.3)	(44.8)	(44.8)	(53.3)	(67.1)
9.	1.3	2.2	3.3	2.1	2.4	2.3	1.7	1.5	1.3
10.	382.7	433.2	480.6	683.1	598.3	455.0	518.6	406.5	310.1
11.	13.3	0.8	(6.1)	(26.4)	(3.6)	2.3	4.2	1.6	(3.3)
12.	403.0	432.8	473.4	656.1	585.1	442.0	509.6	383.4	266.2
13.	2,976.8	3,102.2	3,229.8	3,528.3	3,590.1	3,627.5	3,779.2	3,794.4	3,837.7
14.	100.0	102.7	104.6	106.9	108.8	110.8	113.3	113.7	116.5
15.	3,703.1	3,757.7	3,841.2	4,105.9	4,104.9	4,072.8	4,149.4	4,151.5	4,097.9

UTILITY RATE BASE (INCLUDING CIS & CUSTOMER CARE)
YEAR TO YEAR SUMMARY

Line No.	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8
	2011 Historical Year	2012 Historical Year	2013 Board Approved	2014 Fiscal Year	2015 Forecast Year	2016 Forecast Year	2017 Forecast Year	2018 Forecast Year
	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)	(\$Millions)
<u>Property, Plant, and Equipment</u>								
1. Cost or redetermined value	6,064.1	6,389.4	6,749.4	7,104.1	7,568.1	8,449.0	8,813.7	9,169.3
2. Accumulated depreciation	(2,398.4)	(2,573.3)	(2,804.1)	(2,965.0)	(3,082.6)	(3,213.4)	(3,365.8)	(3,551.8)
3.	3,665.7	3,816.1	3,945.3	4,139.1	4,485.5	5,235.6	5,447.9	5,617.5
<u>Allowance for Working Capital</u>								
4. Accounts receivable merchandise finance plan	-	-	-	-	-	-	-	-
5. Accounts receivable rebillable projects	1.6	1.9	1.3	1.3	1.3	1.4	1.4	1.4
6. Materials and supplies	30.1	40.3	31.9	32.8	33.7	34.6	34.6	34.6
7. Mortgages receivable	0.4	0.3	0.2	0.1	0.1	-	-	-
8. Customer security deposits	(75.6)	(67.8)	(68.7)	(65.7)	(65.1)	(64.6)	(64.6)	(64.6)
9. Prepaid expenses	1.5	1.2	1.8	0.9	0.9	1.0	1.0	1.0
10. Gas in storage	337.6	229.5	248.4	279.9	291.2	276.3	276.3	276.3
11. Working cash allowance	(4.3)	(10.9)	1.8	43.2	50.0	40.1	40.0	39.9
12. Total Working Capital	291.3	194.5	216.7	292.5	312.1	288.8	288.7	288.6
13. <u>Utility Rate Base</u>	3,957.0	4,010.6	4,162.0	4,431.6	4,797.6	5,524.4	5,736.6	5,906.1
14. Ontario CPI Index (forecasted for 2013 through 2018)	120.1	121.8	124.4	126.9	129.5	132.1	134.7	137.4
15. Inflation Adjusted Rate Base (2013 Constant Dollars)	4,098.7	4,096.2	4,162.0	4,344.3	4,608.7	5,202.4	5,297.9	5,347.3

BOARD STAFF INTERROGATORY #53

INTERROGATORY

ISSUE: B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: B1/T3/S1/Community Expansion

With respect to the Company's new proposal for Community Expansion, will this be filed as separate application or as part of the current application? What is the expected timing?

RESPONSE

The Company's proposal around Community Expansion will be a separate application. The Company expects to file this application in mid 2014.

Witnesses: D. McIlwraith
N. Ryckman

BOARD STAFF INTERROGATORY #54

INTERROGATORY

ISSUE: B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: B2/T1/S1/Summary of Capital Expenditures

- a) Please describe how capital projects are related to efficiency improvements during the 5 year term of the IR Plan.
- b) Does the company employ a screening process to determine which projects offer the greatest potential for efficiency or productivity improvements?
- c) Please describe the process and explain how the Board will be made aware of capital projects that lead to efficiency or productivity improvements.

RESPONSE

- a) There are at least two relationships between capital projects and efficiency improvements during the IR term. First, as noted in paragraph 97 of Exhibit B2, Tab 1, Schedule 1 and elaborated on throughout Exhibit B2, Tab 1, Schedule 1 Capital Overview evidence, the Company expects to incur capital costs greater than what it is seeking recovery of through the Customized IR Plan. Therefore, to accommodate the spending pressures, Enbridge will need to find efficiency improvements. Second, Enbridge will make efforts through the IR term to find capital spending opportunities that may reduce future capital and operating costs.
- b) The Company prioritizes projects based upon its system integrity and reliability management and growth needs as informed by the Asset Plan. Once capital projects are identified, capital budget owners are directed to find available efficiencies and each project is the subject of an internal peer review by management to confirm the priority and need for the project and its roll out.
- c) The commitment of the Company is to provide performance measurement reporting on an annual basis and specifically report the productivity efforts and the results from these efforts. The details and timing of the reporting is provided in the Performance Measurement evidence of Exhibit A2, Tab 11, Schedule 2.

Witnesses: S. Kancharla
L. Lawler
B. Misra
J. Sanders

BOARD STAFF INTERROGATORY #55

INTERROGATORY

ISSUE: B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: B2/T1/S1/ Table 1 Summary of Capital Expenditures

- a) Please indicate which capital projects are 100% required versus any that are discretionary.
- b) What percentage of the total capital budget amount is discretionary? Can any amounts be deferred 1,2,3 or more years?
- c) If so, please identify these amounts and discuss the implications.

RESPONSE

- a) All projects are required. There are no discretionary projects contained within the Capital Budget. Through the budgeting process, the capital budget reflects changes and prioritizing that results in a final list that is made of only the necessary projects.
- b) The Capital Budget contains projects that represent the activities necessary for the period of 2014 to 2018. By proposing its Capital Budget in the level of detail it has done, the Company has outlined the non-discretionary work plan. The Company is accepting the risk of having to manage to the requested Capital Budget envelope given the likelihood that additional expenditures will be necessary for each of the years 2014 to 2018. As described in Table 8 of the Capital Overview Exhibit B2, Tab 1, Schedule 1, page 33, the Company has not included in its budget any amounts for potential "variable" or uncertain costs that may arise through the 2014 to 2018 period.

The table on the following page shows the details of the "variable" costs in the final budget (Review 5).

Witnesses: S. Kancharla
L. Lawler
B. Misra
J. Sanders

<u>Listing of Variable or Uncertain Projects/programs Excluded from the Final Capital</u>					
((\$Ks))					
EXH REF	EXHIBIT DESCRIPTION	V2014	V2015	V2016	Sum 14-16
B2-3-1	Sombra Redundancy	2,000		17,850	19,850
B2-5-2-1	Plastic Mains (Incl Services) Study	-	11,143	10,925	22,068
B2-5-2-2	COMPR COUPLING PRGM		1,061	1,041	2,102
B2-5-2-3	LOAD SHED PLANNING		1,194	1,170	2,364
B2-5-2-4	MOP VERIFICATION	5,304	4,881	4,786	14,971
B2-5-2-5	ILI AND ASSESSMENT PRGM	6,200	6,450	6,324	18,974
B2-5-2-7	MAINS REPL LT \$2M		467	458	925
B2-5-3-2	AMP FITTING REPL	-	13,814	13,694	27,508
B2-5-3-3	Failure of Bonnet Bolts on Valves Study		212		212
B2-5-3-5	SVC REPL LT \$2M	2,254	5,147	5,254	12,655
B2-5-4-3	COMM IND LOW PRESSURE REG STN	1,530	2,387	2,341	6,258
B2-5-4-5	STN REPL LT \$2M		3,979	3,901	7,880
B2-5-6	Load Research Prgm	548	572	560	1,680
B2-6-1	STORAGE OVERVIEW	275	25	375	675
B2-6-1	MCC#1 Generator and Boiler	500			500
B2-6-1	meter boxes	179	186	182	547
B2-6-1	Misc Structures	50	100	100	250
B2-6-1	Engine Compressor Analyzer Automatic	50	50	50	150
B2-6-1	Misc. Wells	50	125	125	300
B2-6-1	Misc Field Lines	50	50	50	150
B2-6-1	Misc. Meas and Reg	50	200	100	350
B2-6-1	Roads	50	50	50	150
B2-6-1	Crowland Plant Automation	20	20	20	60
B2-6-1	SCADA Upgrade and Automation	20	20	20	60
B2-6-1	Farm Purchase (C of A)		100		100
B2-6-1	DSA Boundary changes (purchase leases)			750	750
B2-6-1	Horizontal Well replacement program		5,000		5,000
B2-6-1	High Deliverability Well Erosion		35		35
B2-6-1	Plant Roadways and Culverts		50		50
B2-6-1	Replacement Lines to Horizontal Wells		500		500
B2-6-1-3	WELL INTEGRITY PRGM			400	400
B2-7-1	BUS DEV & CUST STRATEGY	2,612	2,612	2,612	7,836
B2-8-1-7	IT PROJ LT \$2M	900	100	300	1,300
B2-9-1	FAC/GENL PL OVERVIEW	2,500	2,500	2,500	7,500
Grand Total		25,142	63,030	75,938	164,110

c) There are none.

Witnesses: S. Kancharla
L. Lawler
B. Misra
J. Sanders

BOARD STAFF INTERROGATORY #56

INTERROGATORY

ISSUE: B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: B2/T1/S1/ Table 1 Summary of Capital Expenditures

Please provide a table in the same format as Table 1 that also shows the 5 prior years actual amounts – i.e. 2008 to 2012 actual.

RESPONSE

Please see the following table.

<u>Table 1</u>					
<u>Summary of Capital Expenditures</u>					
	Col 1	Col 2	Col 3	Col 4	Col 5
(\$Millions)	<u>Actual</u> 2008	<u>Actual</u> 2009	<u>Actual</u> 2010	<u>Actual</u> 2011	<u>Actual</u> 2012
Customer Related Distribution Plant	102.7	101.6	103.0	115.5	148.7
NGV Rental Equipment	0.3	0.2	0.2	-	0.2
System Improvements and Upgrades	144.8	136.9	153.3	158.5	180.0
General and Other Plant	37.3	42.3	48.3	56.8	53.6
Underground Storage Plant	5.9	4.6	14.7	30.1	22.4
Sub total "Core" Capital Expenditures	<u>291.0</u>	<u>285.6</u>	<u>319.5</u>	<u>360.9</u>	<u>404.9</u>
Customer Information System (CIS) / Training Operations Centre (TOC)	46.4	48.7	8.3	16.2	13.8
Leave to Construct - Power Generation / Major Reinforcements	28.6	14.8	9.8	22.1	19.1
Total Capital Expenditures	<u>366.0</u>	<u>349.1</u>	<u>337.6</u>	<u>399.2</u>	<u>437.8</u>

Witness: J. Sanders

BOARD STAFF INTERROGATORY #57

INTERROGATORY

ISSUE: B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: B2/T5/S1/ para 18

- a) What is the Company's policy regarding contingency amounts included in capital programs?
- b) Is there a standard contingency factor built into the forecast? Please explain.

RESPONSE

- a) The Company does not have a policy regarding contingency amounts included in capital programs. Instead, different contingency amounts are included within particular programs based upon the type of capital program and perceived risks or uncertainties associated with completing the program.
- b) There is no standard contingency factor built into the forecast. However, contingencies are included within individual project budgets that sum together in the program. An example would be the Relocation Program. The forecast is based on historic spend, however, each relocation project within the overall program has an estimate which includes a contingency that is specific to the level of uncertainty associated with such issues including, but not limited to, availability of materials, field conditions and timing of construction.

Witnesses: L. Lawler
J. Sanders

BOARD STAFF INTERROGATORY #58

INTERROGATORY

ISSUE: B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: A2/T1/S1/P 20 and 21 of 40

On pp. 20-21, Enbridge says that “the primary driver for the WAMS (Work and Asset Management System) project is the coming end of the Accenture Services Agreement which was part of the EnVision project that the Board approved in 2004...the Company has decided that a more cost effective solution to the services approach that currently provides Work and Asset Management services would be to implement an in-house IT system”

- a) Did Enbridge try to re-negotiate and/or update the services agreement with Accenture? If so, please provide all supporting documents that provide evidence of the terms of the updated agreement discussed with Accenture and rejected by Enbridge. If not, please explain why.
- b) Did Enbridge obtain competitive bids from alternate vendors for a services agreement? If so, please provide all documents containing details of the bids provided by alternate providers. If not, please explain why alternate bids were not sought.
- c) Please provide all documents and analyses supporting the Company’s conclusion that implementing an in-house IT system would be more cost effective than an outsourced WAMS approach.
- d) Please provide all documents and analyses which show that customers will benefit from an in-house IT system rather than an updated WAMS approach.
- e) For WAMS, is Enbridge proposing to substitute future capital expenditures for costs that are currently booked to operating expenditures? Please explain in detail.

Witnesses: W. Akkermans
M. Brophy
B. Misra

RESPONSE

For clarity, Enbridge is not intending to internally design nor develop a custom application for WAMS. The Existing Technology has come to end of life and requires replacement as outlined in the WAMS evidence. This forms the driving factor behind the business case for WAMS. The term “in-house IT system” refers to Enbridge directly purchasing the licenses for an off the shelf, industry leading product that is available in the marketplace. This also enables Enbridge to have direct relationship and influence with the product vendor. A System Integrator will then be chosen through a competitive bid process to implement the technology solution. Upon go-live, on-going hosting and support services will be required for sustainment. This approach is the same approach used by Enbridge for recent large technology initiatives such as the Customer Information System (“CIS”) implementation.

- a) No, Enbridge did not attempt to re-negotiate a longer term agreement to deliver WAMS because the decision was made to utilize an “in-house” approach. As outlined in Exhibit B2, Tab 8, Schedule 2, paragraph 38, Enbridge is proposing to use two competitive bid processes to first select the WAMS technology and then the System Integrator. During the interim period, Enbridge has re-negotiated an extension to the existing agreement with Accenture for a period of two years.
- b) As outlined in “a”, Enbridge is proposing to use competitive bid processes for WAMS product selection and implementation services. For the 2 year interim period, an alternative service vendor was not practical due to several factors including, time and effort related to transferring these services and related knowledge to another provider, disruption of system availability during a transition, plus the risks of a major outage due to age and obsolescence of the underlying technology and supportability. Additional costs and resource distractions would also have occurred from both Accenture and an alternative vendor during that transition period.
- c) Please refer to the preamble in this response for a definition of the term “in-house IT system”. The term “outsourced WAMS approach” is not a term that Enbridge has used or defined, but for purposes of this response it is assumed to mean a service similar to what is currently being provided by Accenture. Enbridge made the decision to use an “in-house” approach for several reasons including that it aligns well with current industry practices, has worked effectively for recent major business systems such as CIS, and that it enables Enbridge to have a direct relationship with the product vendor and therefore more influence on sustainability of the product to meet Enbridge’s future needs. These factors, plus the ability to reduce additional vendor related costs, make the proposed approach more cost effective. A review of this approach was conducted by Sync Energy (Exhibit B2, Tab 8, Schedule 2, Attachment 1) and was deemed to be in alignment with current trends for the utility industry.

Witnesses: W. Akkermans
M. Brophy
B. Misra

- d) Please refer to the response for “c” above.
- e) Enbridge is not proposing to substitute future capital expenditures for costs that are currently booked to operating expenditures. Enbridge is proposing to depreciate the capital related to WAMS over a 10 year period and annual system support costs are proposed to be treated as O&M which is similar to current business systems such as CIS.

Witnesses: W. Akkermans
M. Brophy
B. Misra

BOARD STAFF INTERROGATORY #59

INTERROGATORY

ISSUE B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: B2/T1/S1/P 12 of 39

Enbridge writes that another driver of its decision to implement an in-house IT system is “the need for the Company to meet more stringent safety and reliability systems...necessitates more flexible information technology.”

Please explain why the in-house IT system Enbridge proposes to develop is more flexible than the IT options available elsewhere in the marketplace. Was there a business case put forward to justify this project? If so, please file it.

RESPONSE

Please refer to the response to Board Staff Interrogatory #58, found at Exhibit I.B18.EGDI.EGDI.STAFF.58.

Witnesses: W. Akkermans
M. Brophy
B. Misra

BOARD STAFF INTERROGATORY #60

INTERROGATORY

ISSUE: B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: B2/T1/S1/P 20 of 39

In finalizing its 2014-2016 Capital Budget, Enbridge says that a senior management committee, as well as finance and regulatory personnel, "conducted peer reviews and scrutinized the list of expenditures in each cycle of the capital forecast."

- a) Please explain what Enbridge means by "peer reviews". For example, did other gas utilities examine Enbridge's expenditures? If so, please identify the "peers".
- b) Please describe in detail the "peer reviews" that Enbridge conducted as part of its capital budgeting process. What factors did the peers use to assess the proposals?
- c) Did Enbridge look at peer utilities? If so, please provide detailed information that Enbridge examined from each of the "peer" utilities that were reviewed.

RESPONSE

- a) "Peer reviews" as stated in paragraph 62 of Exhibit B2, Tab 1, Schedule 1, page 20 is referring to internal stakeholders. Throughout the process various capital owners advocated the need for capital for their respective project or program. A senior management committee ("Capital Owners Committee") made up of senior representatives of the operating groups within the Company, as well as Finance and Regulatory, conducted peer reviews and scrutinized the list of expenditures in each cycle of capital forecast. The Company used its internal expertise base of employees who have a variety of years of service, engineering and construction experience and represented various levels of management as the "peer review" group. Enbridge did not have other utilities examine the proposed capital expenditures.
- b) The detailed explanation of "peer reviews" is described in Exhibit B2, Tab 1, Schedule 1, paragraphs 62 through to 66. The Capital Overview evidence outlines the formal criteria. In the performance of the "peer reviews" the individuals utilized their

Witnesses: J. Sanders
P. Squires

expertise as a cross-functional “stress test” and evaluation of the reasonability of each proposed project. Each individual brought their extensive years of work experience which included backgrounds in engineering, construction, financial and regulatory. The individuals were given the mandate to determine the necessary capital projects and expenditures. The guidance to these individuals was to ensure a thorough review and extensive scrutiny was performed in the “peer review”. The objective was to define the amount of capital expenditures necessary to meet the growth, safety and operational requirements of the business.

- c) Enbridge did not look at peer utilities or any of their specific programs and capital expenditures as a detailed comparator. This type of review was deemed as not meaningful given each utility would have unique characteristics that would not enable a project by project comparison. To be more specific, utilities have many differences such as customer mix (percentage residential, commercial and industrial), urban versus rural densities, geographical differences (sandy soil versus hard rock), age of utility and therefore types of assets being used (percentages of cast iron versus steel mains versus plastic mains). What Enbridge did have and saw as being meaningful in the “peer reviews” is the general understanding of the types of capital programs being executed by peer utilities. Some of the internal experts that participated in the “peer reviews” are members of associations like the American Gas Association and Canadian Gas Association. Through the peer reviews, Enbridge individuals who were members of these types of associations brought their knowledge on the type of work and focus areas that is prominent with other Natural Gas utilities in North America. For example, a trend amongst North American natural gas utilities is extending the In-Line Inspection programs to evaluated pipelines which operate between 20% and 30% SMYS.

BOARD STAFF INTERROGATORY #61

INTERROGATORY

ISSUE B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: B2/T1/S1/P 21 of 39

For each capital forecast, Enbridge says that Executive Management requested information on “the magnitude of the costs that were certain to be spent and those that were outcome based and therefore difficult to forecast.”

Please define the term “outcome based” in this context and outline the difficulties in forecasting these outcome-based costs.

RESPONSE

Outcome based costs were those that were dependent on the result of studies and the execution of certain System Integrity and Reliability programs. This was the reason for tracking “Firm” costs vs. “Variable” costs in Review 2 and onward. With Variable costs, the estimations were dependent on the nature of each respective project. There may be a need to expand the scope of the project. For example, in some cases pacing and/or the scope/size of remediation work will be dependent on the study outcomes or the outcomes of earlier year’s progress. Pipeline inspection activities could result in mains replacement requirements of anywhere from small sections to many kilometers. Table 7 on page 28 of the Capital Budget Overview evidence illustrates the potential magnitude of the System Integrity and Reliability requirements. The Company has included Firm costs of \$94M (2014 to 2016) and excluded Variable costs of \$116M. Due to the uncertainty of the outcomes as explained above, the Company is accepting the risk for the Variable costs.

Witnesses: J. Sanders
P. Squires

BOARD STAFF INTERROGATORY #62

INTERROGATORY

ISSUE B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: B2/T1/S1/P 22 of 39

When discussing the “probability of spending occurring,” Enbridge says that “items of a Medium Probability may have their spending profile changed.” Please explain the criteria that Enbridge used to:

- a) Determine whether a capital project would have its spending profile changed.
- b) Determine how spending profiles were to be changed for projects designated to be “medium probability.”

RESPONSE

- a) The following table shows the application of the various “review” criteria from an iteration timeline perspective. Probability was one of several factors that impacted the decision to include, exclude or defer a project.

<u>Review Criteria as Applied to Iterations of the Capital Budget Process</u>				
Criteria	Prioritization Tiers	Firm vs. Variable	Probability	Pacing
Characteristics	1. Mandatory due to Legislation or OEB mandated	Known or Fixed Costs	High (80%-100%)	Consider the timing of need
	2. Mandatory due diligence necessary to align business objectives and needs	Variable - Uncertain	Medium (50%-80%)	Slow down or Accelerate as required
	3. General -Capital of less priority than Tier 2		Low (0%-50%)	
Review #1 - Jan 18	No	No	Yes	No
Review #2 - Feb 15	Yes	No	Yes	No
Review #3 - Mar 22	Yes	Yes	Yes	No
Review #4 - Apr 2	Yes	Yes	Yes	No
Review #5 - Apr 18	Yes	Yes	Yes	No
Review #6 - May 21	Yes	Yes	Yes	Yes

Witnesses: J. Sanders
P. Squires

- b) The “probability” criteria was used to identify the likelihood of a project and therefore associated costs being executed and put in service in that calendar year. The Medium Probability criteria indicated that there was a 50% to 80% chance that the project would be performed in that year. Through the Capital Budget reviews projects falling into this criteria were evaluated as to whether they should be included into the budget given that the likelihood of the project occurrence was less than a High Probability project (80% to 100%). These projects also were evaluated to understand what elements of the project were driving the lesser probability weighting. In some cases the characterization as a Medium Probability was closely linked to the Firm vs. Variable criteria. Some projects were considered “medium”, because they were more likely to have variable costs. The following tables show a breakdown of the capital by probabilities (High/Low/Medium) and Firm vs. Variable.

Witnesses: J. Sanders
P. Squires

Table 1 - Capital Expenditures : Firm and Variable by Probability (\$Ks)						
Probability	2014 Firm	2015 Firm	2016 Firm	2014 Variable	2015 Variable	2016 Variable
HIGH	400,639	410,172	414,870	15,731	33,428	33,441
LOW	2,866	5,924	2,982	2,000	-	17,850
MEDIUM	40,320	30,531	24,026	7,411	29,603	24,646
Grand Total	443,825	446,627	441,878	25,142	63,031	75,937

Table 2 - Number of Capital Projects/Programs: Firm vs. Variable by Probability						
Probability	2014 Firm	2015 Firm	2016 Firm	2014 Variable	2015 Variable	2016 Variable
HIGH	201	202	199	10	17	18
LOW	3	3	3	1	1	2
MEDIUM	52	52	52	15	20	17
Grand Total	256	257	254	26	38	37

Table 3 - Variable Project/Programs as a Percentage of Firm Projects/Programs by Probability						
Probability	2014	2015	2016			
HIGH	5%	8%	9%			
LOW	33%	33%	67%			
MEDIUM	29%	38%	33%			

Witnesses: J. Sanders
P. Squires

BOARD STAFF INTERROGATORY #63

INTERROGATORY

ISSUE B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: B2/T1/S1/P 24 of 39

Enbridge says that “more than \$180 million was removed from the originally submitted “Bottom Up” grassroots budgets” as a result of the budgeting process.

Please provide a complete financial accounting of all capital projects that were removed, in whole or in part, from Enbridge’s original grassroots budgets, as well as the qualitative value of the capital spending from each of the removed projects.

RESPONSE

Please see the response to SEC Interrogatory #91, found at Exhibit B18.EGDI.SEC.91.

Witnesses: J. Sanders
P. Squires

BOARD STAFF INTERROGATORY #64

INTERROGATORY

ISSUE B18b: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

b. the forecast level of Capital expenditures;

Evidence Ref: B2/T1/S1/P 25 and 26 of 39

Enbridge says that much of the uncertainty associated with system integrity and reliability spending is due to: 1) the fact that the scope and requirements of these programs will not be known until related studies are completed and there is practical experience with the programs; and 2) the Company anticipates more stringent pipeline integrity management legislation, such as that contemplated in the United States but does not know when this will be implemented.

Please explain why investments designed to comply with speculative, future mandates were included in Enbridge's internal, capital budget review process.

RESPONSE

The paragraphs noted in this question are related to the Company's determination that it could only prepare detailed Capital Budgets for three years, rather than five. It is in that context that Enbridge was considering the risks associated with unknown program outcomes and potential legislative changes. As explained in the updated evidence at Exhibit A2, Tab 1, Schedule 1, and Exhibit B2, Tab 1, Schedule 1, Enbridge has now determined that it will assume the risk of using the 2016 Capital Budget as representing 2017 and 2018 capital spending requirements.

Witnesses: L. Lawler
J. Sanders
P. Squires

CCC INTERROGATORY #25

INTERROGATORY

Issue B18 – Is the rate base for each of 2014, 2015 and 2016 appropriate including:

Forecast level of Capital Expenditures

(Ex/ B2/T1/S1/p. 15) The evidence states that government organizations such as the Pan Am Games, TTC and Metrolinx are requiring pipeline replacements or relocations in the coming years. What is the expected cost of those replacements or relocations in 2014, 2015 and 2016? What is EGD's policy with respect to such relocations or replacements? Are capital contributions required? Please explain.

RESPONSE

Relocations for Metrolinx have been identified in the pre-filed evidence, Exhibit B2, Tab 4, Schedule1 (attachment) which details the York Region Rapid Transit expansion plans to 2016 (and beyond). Based on available information, the expected costs of these relocations are identified in the following table:

Table 1: Capital Requirement Summary (\$000)				
	Budget	Forecast		
DESCRIPTION	2013	2014	2015	2016
York Regional Rapid Transit Corporation	5,441	6,000	4,000	3,000

These forecasted costs represent Enbridge's costs in a 35% (municipality), 65% (Enbridge Gas Distribution Inc.) cost sharing mechanism.

The Company's policy on relocations follows the model franchise agreement with the municipality or the Public Service Works on Highways Act referenced in pre-filed evidence, Exhibit B2, Tab 4, Schedule 1.

No contributions from third parties or municipalities are required where replacements are concerned. This work type is generated through internal means, and not by municipal request.

Witnesses: T. MacLean
J. Sanders
P. Squires

CCC INTERROGATORY #26

INTERROGATORY

Issue B18 – Is the rate base for each of 2014, 2015 and 2016 appropriate including:

Forecast level of Capital Expenditures

(Ex. B2/T1/S1/Table 2)

Please provide forecast and actual Utility Capital Expenditures for each year 2007-2013.

RESPONSE

Please see response to SEC Interrogatory #86, found at Exhibit I.B18.EGDI.SEC.86.

Witnesses: J. Sanders
P. Squires

CCC INTERROGATORY #27

INTERROGATORY

Issue B18 – Is the rate base for each of 2014, 2015 and 2016 appropriate including:

Forecast level of Capital Expenditures

(Ex. B2/T1/S1/p. 24) The evidence indicates that through the Capital Budgeting process \$180 million was removed from the 3-year grass roots budgets. Were these projects eliminated or deferred? Please describe the nature of the projects that were removed from the budget.

RESPONSE

Please see the response to SEC Interrogatory #91 found at Exhibit I.B18.EGDI.SEC.91.

Witnesses: J. Sanders
P. Squires

ENERGY PROBE INTERROGATORY #21

INTERROGATORY

Ref: Exhibit B2, Tab 1, Schedule 1

- a) Please add a column to Table 1 that shows the current estimate for capital expenditures for 2013 based on the most recent year-to-date expenditures available for 2013 along with an estimate for the remainder of the year.
- b) Please add a column to Table 2 that shows the current estimate for capital expenditures for 2013 based on the most recent year-to-date expenditures available for 2013 along with an estimate for the remainder of the year.
- c) Please provide the most recent year-to-date customer additions for 2013. Based on the last month currently available for 2013, please provide the number of customer additions since the corresponding month in 2012 (for example October, 2013 over October, 2012).
- d) Please break out the IDC costs shown in Table 5 for the GTA, Ottawa and WAMS projects, along with a line for the remainder of the capital expenditures that attract IDC.

RESPONSE

- a) Please see Table 1 on the following page:

Witnesses: F. Ahmad
L. Au
J. Sanders

<u>Table 1</u>				
<u>Summary of Capital Expenditures</u>				
		Col 1	Col 2	Col 3
(\$Millions)		<u>YTD Sep</u>	<u>Oct-Dec</u>	<u>Forecast</u>
		2013	2013	2013
Customer Related Distribution Plant		99.1	44.2	143.3
NGV Rental Equipment		0.1	0.1	0.2
System Improvements and Upgrades		156.1	56.9	213.0
General and Other Plant		38.3	20.5	58.8
Underground Storage Plant		20.0	3.9	23.9
Sub total "Core" Capital Expenditures		313.6	125.6	439.2
Customer Information System (CIS) / Training Operations Centre (TOC)				
Leave to Construct - Power Generation / Major Reinforcements		48.6	37.5	86.1
Total Capital Expenditures		362.2	163.1	525.3

b) Please see Table 2 on the following page:

Witnesses: F. Ahmad
L. Au
J. Sanders

<u>Table 2</u>						
<u>2013 Forecasted Capital Expenditures</u>						
				Col. 1	Col. 2	Col. 3
Item				<u>YTD Sep</u>	<u>Oct-Dec</u>	<u>Forecast</u>
<u>No.</u>				2013	2013	2013
A.	<u>Customer Related</u>					
1.1.1	Sales Mains			37.2	24.5	61.7
1.1.2	Services			54.7	15.3	70.0
1.1.3	Meters and Regulation			7.2	4.4	11.6
1.1.4	Customer Related Distribution Plant			99.1	44.2	143.3
1.1.5	NGV Rental Equipment			0.1	0.1	0.2
1.1	TOTAL CUSTOMER RELATED CAPITAL			99.2	44.3	143.5
B.	<u>System Improvements and Upgrades</u>					
1.2.1	Mains	- Relocations		30.8	9.1	39.9
1.2.2		- Replacement		32.7	36.6	69.3
1.2.3		- Reinforcement		88.3	21.2	109.5
1.2.4	Total Improvement Mains			151.8	67.0	218.8
1.2.5	Services - Relays			22.4	6.1	28.5
1.2.6	Regulators - Refits			8.9	10.8	19.7
1.2.7	Measurement and Regulation			8.5	6.6	15.1
1.2.8	Meters			13.1	3.9	17.0
1.2	TOTAL SYSTEM IMPROVEMENTS AND UPGRADES			204.7	94.4	299.1
C.	<u>General and Other Plant</u>					
1.3.1	Land, Structures and Improvements			4.4	3.6	8.0
1.3.2	Office Furniture and Equipment			0.6	0.7	1.3
1.3.3	Transp/Heavy Work/NGV Compressor Equipment			4.7	0.4	5.1
1.3.4	Tools and Work Equipment			0.7	0.7	1.4
1.3.5	Computers and Communication Equipment			27.9	15.1	43.0
1.3	TOTAL GENERAL AND OTHER PLANT			38.3	20.5	58.8
D.	Underground Storage Plant			20.0	3.9	23.9
E.	Customer Information System (CIS)					
F.	TOTAL CAPITAL EXPENDITURES			362.2	163.1	525.3

Witnesses: F. Ahmad
L. Au
J. Sanders

c) Please see table below:

Customer Additions	
YTD September <u>2013</u>	12 Months Actual (<u>Oct 2012- Sept 2013</u>)
22,800	34,996

d) Please see the response to SEC Interrogatory #88 found at Exhibit I.B18.EGDI.SEC.88.

Witnesses: F. Ahmad
L. Au
J. Sanders

ENERGY PROBE INTERROGATORY #22

INTERROGATORY

Ref: Exhibit B3, Tab 1, Schedule 3 & Exhibit B4, Tab 1, Schedule 3 & Exhibit B5, Tab 1, Schedule 3.

- a) Please show the derivation of each of the net lag days shown in the tables for each of 2014 and 2015.
- b) Please show the derivation of each of the net lag days used in the 2013 application in EB-2011-0354.
- c) Please explain the differences between the net lag days noted in parts (a) and (b) above. For example, what has changed that has resulted in the net lag days increasing to 8.8 in 2014 from 3.6 in 2013?
- d) Please show the calculation of the Harmonized Sales Tax amount for each of 2014, 2015 and 2016, along with the similar calculation for the amount in the 2013 rebasing filing.
- e) Has EGDI completed a new lead lag study for the application? If yes, please provide it. If not, when was the last lead lag study completed and reviewed by the Board?

RESPONSE

a) and b)

Gas Cost Lag Day

	<u>2013</u>	<u>2014</u>	<u>2015</u>
Revenue Lag Day	42.2	47.1	47.1
Gas Cost Lag Day	38.2	38.3	38.2
Net Gas Cost Lag Day	4.0*	8.8	8.9

*Note the 3.6 net lag day in 2013 was from the original filing. The Final Rate Order net lag day is 4.0, as per EB-2011-0354, Final Rate Order, Appendix A, page 3, filed on 2013-02-14.

Witnesses: A. Kacicnik
M. Kirk

O&M Lag Day

	2013	2014	2015
Revenue Lag Day	42.2	47.1	47.1
O&M Lag Day	60.9	52.1	52.0
	-		
Net O&M Lag Day	18.7	-5.0	-4.9

Storage Costs

	2013	2014	2015
Revenue Lag Day	42.2	47.1	47.1
	-	-	-
Storage Costs	20.3	24.8	19.5
Net O&M Lag Day	62.5	71.9	66.6

Storage Municipal & Capital Taxes

	2013	2014	2015
Revenue Lag Day	42.2	47.1	47.1
Storage Costs	17.8	17.8	17.8
Net O&M Lag Day	24.4	29.3	29.3

- c) In reviewing the details that make up the Net Gas Cost Lag for this response, the Company has noticed an error in the cash flow reports used to generate the collection lag, a portion of the revenue lag. We are working to fix the error and will update the lag days when the correction is made.

The net lag day is the result of subtracting the gas cost lag day from the revenue lag day. While gas cost lag day has been relatively stable, the revenue lag day, as shown here, increases by approximately 5.0 days between 2013 and 2014. An error in one component of the revenue lag day – the collection lag – is responsible for the large increase. As noted above, the Company will update results once the report error has been corrected.

Witnesses: A. Kacicnik
M. Kirk

- d) The following tables display the calculations of the Harmonized Sales Tax (“HST”) amounts reported in evidence for 2013 to 2016. In each table, Column 1 shows the amount of HST the Company is forecast to collect on Revenue items or spend on expense items. It is important to distinguish between gas purchases made in various jurisdictions, as it impacts what level of tax is paid on those purchases (i.e., – GST is paid on gas purchased in Alberta, while HST is paid on gas purchased in Ontario). Column 2 shows the average lag day for each item, and Column 3 is the product of the previous two columns.

SUMMARY OF GST AMOUNTS
FOR WORKING CASH REQUIREMENT
FOR FISCAL YEAR 2013

		Col. 1	Col. 2	Col. 3
		<u>Rev/Exp</u>	<u>Lag Days</u>	<u>Working Cash Requirement</u>
1.1	Revenue	(320.1)	25.7	(22.50) a/
1.2	Gas Purchases HST	79.4	42.4	9.22 a/
1.3	Gas Purchases GST	20.9	40.3	2.31
1.4	O & M	30.0	41.3	3.40 a/
1.5	Capital	62.9	54.5	9.39 a/
1.	Total			1.82

a/ Col. 1 divided by 365 days times Col. 2

Witnesses: A. Kacicnik
M. Kirk

SUMMARY OF HST AMOUNTS
FOR WORKING CASH REQUIREMENT
FOR FISCAL YEAR 2014

		Col. 1	Col. 2	Col. 3
		<u>Rev/Exp</u>	<u>Lag Days</u>	<u>Working Cash Requirement</u>
1.1	Revenue	(339.3)	22.3	(20.7) a/
1.2	Gas Purchases HST	86.9	43.7	10.4 a/
1.3	Gas Purchases GST	28.9	43.7	3.5
1.4	O & M	30.0	44.0	3.6 a/
1.5	Capital	88.7	57.8	14.1 a/
1.	Total			10.8

a/ Col. 1 divided by 365 days times Col. 2

SUMMARY OF HST AMOUNTS
FOR WORKING CASH REQUIREMENT
FOR FISCAL YEAR 2015

		Col. 1	Col. 2	Col. 3
		<u>Rev/Exp</u>	<u>Lag Days</u>	<u>Working Cash Requirement</u>
1.1	Revenue	(352.1)	22.3	(21.5) a/
1.2	Gas Purchases HST	81.1	44.5	9.9 a/
1.3	Gas Purchases GST	33.1	43.2	3.9
1.4	O & M	30.5	44.0	3.7 a/
1.5	Capital	108.1	58.0	17.2 a/
1.	Total			13.2

a/ Col. 1 divided by 365 days times Col. 2

Witnesses: A. Kacicnik
M. Kirk

SUMMARY OF HST AMOUNTS
FOR WORKING CASH REQUIREMENT
FOR FISCAL YEAR 2016

		Col. 1	Col. 2	Col. 3
		<u>Rev/Exp</u>	<u>Lag Days</u>	<u>Working Cash Requirement</u>
1.1	Revenue	(370.3)	18.9	(19.2) a/
1.2	Gas Purchases HST	72.4	38.7	7.7 a/
1.3	Gas Purchases GST	25.5	38.5	2.7
1.4	O & M	31.5	38.8	3.3 a/
1.5	Capital	58.5	51.5	8.3 a/
1.	Total			2.8

a/ Col. 1 divided by 365 days times Col. 2

- e) The Company has updated lead/lag day information for this application, and does so for each QRAM and annual rate case. However, the Company does not file the study in each case. In EBRO 495, the Board identified the Working Cash Study as a non-essential exhibit not needing to be filed with the Company's Test Year Evidence. The derivation of lead/lag days follows the methodology approved by the Board in RP-1999-0001, at Exhibit B2, Tab 1, Schedule 1.

Witnesses: A. Kacicnik
M. Kirk

ENERGY PROBE INTERROGATORY #23

INTERROGATORY

Ref: Exhibit B3, Tab 2, Schedule 1

Please provide a table that shows the actual year-to-date gross customer additions in 2013 for the most recent month available, in the same level of detail as shown in Table 1. Please also provide the corresponding budget forecast for the same year-to-date period.

RESPONSE

Please see Table 1 below.

Table 1

Item No.	Sector	Col. 1	Col. 2
		YTD Oct Budget 2013	YTD Oct Actual 2013
	<u>Residential</u>		
1.1	New Construction	23,096	18,947
1.2	Replacement	<u>4,916</u>	<u>5,902</u>
1.0	Total Residential	<u>28,012</u>	<u>24,849</u>
	<u>Commercial</u>		
2.1	New Construction	1,352	1,432
2.2	Replacement	<u>597</u>	<u>346</u>
2.0	Total Commercial	<u>1,949</u>	<u>1,778</u>
	<u>Industrial</u>		
3.1	New Construction	6	16
3.2	Replacement	<u>0</u>	<u>0</u>
3.0	Total Industrial	<u>6</u>	<u>16</u>
4.0	Total Gross Customer Additions	<u>29,967</u>	<u>26,643</u>

ENERGY PROBE INTERROGATORY #24

INTERROGATORY

Ref: Exhibit B1, Tab 1, Schedule 2

- a) Please explain the reduction in customer security deposits in 2014 through 2016 relative to the forecast for 2013 despite the growing number of customers in each year.
- b) Please provide the most recent year-to-date level of customer deposits for 2013.
- c) Please provide the level of customer deposits for each of 2010 through 2012.

RESPONSE

- a) The reason why the Company expects that the value of customer security deposits held will be reduced in 2014 through 2016 relative to the forecast for 2013 despite growth in the number of customers in each of these years is that effective as of January 2012 Enbridge revised its Security Deposit Policy for Residential Customers such that security deposits will be returned after a customer achieves a one year good payment history. This change was implemented so that Enbridge's security deposit policy would be consistent with policies applying to other Ontario Energy Board regulated energy distribution utilities. Prior to January 2012, residential security deposits were held by the Company until a customer achieved a two year good payment history. The Company expects that the impact of customer growth on the value of security deposits held will be more than offset by the effect of the implementation of this revised policy over the next three years.
- b) As of September 30, 2013 the value of customer security deposits held by the Company was \$62.129 million.

Witnesses: K. Culbert
K. Lakatos-Hayward
S. McGill

c) Please see the table below.

Value of Customer Security Deposits Held by the Company as of December 31st					
	<u>Line No.</u>	<u>Year</u>		<u>Amount Held (millions)</u>	
	1	2010		\$ 73.324	
	2	2011		\$ 78.742	
	3	2012		\$ 67.314	

Witnesses: K. Culbert
K. Lakatos-Hayward
S. McGill

ENERGY PROBE INTERROGATORY #25

INTERROGATORY

Ref: Exhibit C1, Tab 2, Schedule 1, Appendix B & Exhibit A2, Tab 3, Schedule 1

Paragraph 1 in Exhibit C1, Tab 2, Schedule 1, Appendix B refers to the "preliminary" customer forecast for 2015 and 2016. Paragraph 18 in Exhibit A2, Tab 3, Schedule 1 discusses the streamlining of the volumetric forecast by approving the customer additions within this proceeding for 2014 through 2016.

Is EGD proposing the Board approve customer additions for 2015 and 2016 in this proceeding, or that the customer additions for 2015 and 2016 would be approved on a preliminary basis and replaced with more current forecasts as part of the annual filing process for 2015 and 2016 rates?

RESPONSE

Enbridge is seeking approval for customer additions for 2015 to 2018 in this proceeding as explained within updated evidence. The approved customer additions for 2015 through 2018, will be used as inputs to update the 2015 through 2018 customer forecasts. The Company will provide updated forecast volumes based on the updated forecasts of customer unlocks budget and latest economic assumptions as part the annual Rate Adjustment process to derive the final rates for 2015 through 2018.

Witnesses: R. Cheung
K. Culbert
R. Fischer
A. Kacicnik
M. Lister
S. Qian

SEC INTERROGATORY #80

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[A2/1/1, p. 1] Please provide a vintage table, by asset class, showing the numbers of each asset class at each vintage, and the dollars currently included in rate base for each asset class at each vintage. Please provide, for each asset class, evidence comparing the vintages of the Applicant's assets in that class with other gas utilities of comparable size in North America. If there is a substantial age difference between the assets of a class for Enbridge and for its peers, please provide an analysis of the impact on that difference on capital planning, including in particular the issue of "aging infrastructure".

RESPONSE

Please refer to the table below which identifies the asset class by vintage. The rate base dollars are shown by asset class only at an aggregate level, and are not available associated with the asset vintage.

The Company does not have information about the vintage of asset classes of other Utilities.

Witnesses: L. Lawler
J. Sanders

Distribution Asset Classes		Quantity	Rate Base \$M	Decade of YEAR OF INSTALL DATE								
Pipe				Unknown	Prior to 1950	1950 to 1959	1960 to 1969	1970 to 1979	1980 to 1989	1990 to 1999	2000 to 2009	2010 to Present
Mains (km)		36,665	2,638									
	Cast Iron	-		-	-	0	-	-	-	0	-	-
	Bare Steel	3		-	0	1	-	1	0	0	1	0
	Coated Steel	13,128		18	10	2,357	4,551	2,471	1,114	1,528	949	131
	Plastic - Vintage	3,760		-	-	1	53	1,989	1,718	-	0	0
	Plastic - Other	19,774		154	-	-	-	-	4,073	7,043	7,108	1,395
	Unclassified	-										
Services (#)		1,998,682	2,256									
	Copper	7,063		1		2	3,687	3,292	35	30	16	
	Bare Steel	29,317		3	74	9,046	1,146	820	105	5,307	11,182	1,634
	Coated Steel	154,797		24	12	14,565	64,542	35,495	11,127	15,673	11,045	2,314
	Steel Tubing	283					279	4				
	Plastic - Vintage	283,523		3	74	92	916	174,060	108,378			
	Plastic - Other	1,523,680		53					282,522	513,695	594,663	132,747
	Unclassified	19				7	5	1		4	2	
Measurement & Regulation			748									
Gate Stations (#)		44										
Feeder Stations (#)		19										
District Stations (#)		2,118										
Header Stations (#)		2,418										
Sales Stations (#)		9,991										
Customer Meter Sets		2,098,342										
Main & Station Valves												
Main Line Valves (#)		20,527		7	1	3,795	6,509	4,368	1,502	2,694	964	687
Station Valves (#)		11,200		1,383		27	121	659	1,650	5,398	1,739	223
Unclassified		8						4			4	
			5,642									

Witnesses: L. Lawler
J. Sanders

SEC INTERROGATORY #81

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[A2/1/1, p. 17] Please explain the “uncertainty of capital spending requirements beyond 2016” faced by the Applicant that are in any way fundamentally different from the uncertainties faced by an electricity distributor preparing a five year Custom IR application.

RESPONSE

Enbridge has explained within its evidence the reasons why it cannot make a detailed forecast of capital spending requirements beyond 2016. Enbridge is not aware of whether electricity distributors are in a position to make a detailed forecast of capital spending for five year periods, Enbridge is not sufficiently aware of the asset and operational details of electricity distributors to make a meaningful comparison between the uncertainties facing electricity distributors as compared to Enbridge.

That said, some things that may make it more difficult for Enbridge (as compared to electricity distributors) to provide detailed forecasts of capital spending requirements beyond 2016 include:

- o Different evolving safety requirements/regulations
- o Different impact from third party projects (relocations) because of the fact that most of Enbridge’s system is below ground
- o Different reinforcement requirements related to Enbridge’s growing system

Witnesses: L. Lawler
J. Sanders

SEC INTERROGATORY #82

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[A2/1/1, p. 19] Please provide whatever evidence the Applicant has supporting the claim of an “acceleration of changes and additions to codes and regulations”.

RESPONSE

Major pipeline incidents in recent years have led to heightened awareness and concern regarding the integrity and reliability of natural gas transmission and distribution systems across North America. Enbridge and the industry have increased focus on system integrity and reliability. This increased focus coupled with the legislative changes associated with the newly adopted Oil and Gas Pipeline Systems Code (Z662-11) by the TSSA, have caused an acceleration of change associated with managing system integrity and reliability.

Please refer to the pre-filed evidence Exhibit B2, Tab 5, Schedule 1, pages 3 and 4 and the attached document entitled “TSSA Oil and Gas Pipeline Systems Code Adoption Document Amendment” which stipulates the requirements associated with Integrity Management Programs for pipeline systems operating above 30% SMYS, as well as all distribution operating assets.

The Company’s interpretation of this requirement is that EGD need’s to analyze the entire storage, transmission and distribution system and its components, determine their suitability for continued service and remediate assets determined by the Company to have risk of failure. This is the approach taken within the Asset Plan.

Witnesses: L. Lawler
J. Sanders



Fuels Safety Program	Ref. No.: FS-196-12	Rev. No.:
OIL AND GAS PIPELINE SYSTEMS CODE ADOPTION DOCUMENT AMENDMENT	Date: November 1, 2012	Date:

IN THE MATTER OF AN AMENDMENT TO THE

Oil and Gas Pipeline Systems Code Adoption Document

adopted as part of Ontario Regulation 210/01 (Oil and Gas Pipeline Systems)
by section 8(1) of Ontario Regulation 223/01 (Codes and Standards Adopted by Reference)
made under the *Technical Standards and Safety Act, 2000*, S.O. 2000, c. 16

The Director for the purposes of O. Reg. 210/01 (Oil and Gas Pipeline Systems), under authority of section 36(3)(a) of the *Technical Standards and Safety Act, 2000*, S.O. 2000, c. 16 (the “Act”), hereby amends the Oil and Gas Pipeline Systems Code Adoption Document published by the Technical Standards and Safety Authority and dated June 1, 2001, as amended, as follows:

- 1. All sections of the Oil and Gas Pipeline Systems Code Adoption Document (Sections 1 to 5) are revoked and replaced with Sections 1 to 5 of this document.**

Section 1

CODES ADOPTED BY REFERENCE

1. The Director hereby adopts and requires all persons to whom O. Reg. 210/01 (Oil and Gas Pipeline Systems) applies to comply with the standards, procedures and other requirements of the following codes and regulations:
 - (a) **CSA Z662-11 (Oil and Gas Pipeline Systems)**, published by the Canadian Standards Association, as amended by Section 2 of this document;
 - (b) **CSA Z246.1-09 (Security Management for Petroleum and Natural Gas Industry Systems)**, published by the Canadian Standards Association; and
 - (c) **CSA Z276-11 (Liquefied Natural Gas (LNG) - Production, Storage and Handling)**, published by the Canadian Standards Association.

Section 2

AMENDMENTS TO CSA Z662-11 (OIL AND GAS PIPELINE SYSTEMS)

2. For the purposes of compliance with this Code Adoption Document, CSA-Z662-11 (Oil and Gas Pipeline Systems) shall be deemed to be amended as follows:

- (1) Clause **1.2** is amended by adding the following item:

- (h) pipelines that carry gas to and from a well head assembly of a designated storage reservoir.

- (2) Clause **1.3** is amended by adding the following items:

- (p) digester gas or gas from landfill sites
- (q) multiphase fluids
- (r) gathering lines
- (s) offshore pipeline systems
- (t) oil field steam distribution pipeline systems oil field water services
- (u) carbon dioxide pipeline systems.

- (3) Clause **3.2** is amended by renumbering the existing clause as 3.2.1 and adding the following clause:

3.2.2

Natural gas distributors shall incorporate into the procedures for managing the integrity of pipeline systems required in clause 3.2.1 an action plan that includes:

- (a) a description of the steps taken or that will be taken to mitigate the potential of penetration of sewer lines by a natural gas pipeline during trenchless installation;
- (b) a program that raises stakeholder awareness of the potential safety issues that could arise when attempting to clear a blocked sewer service line beyond the outside walls of a building; and
- (c) an assessment of potential risks and a plan to mitigate these risks.

- (4) Clause **4.1.8** is deleted and substituted with the following:

4.1.8

Steel oil and gas pipelines may be designed in accordance with the requirements of Annex C, provided that such designs are suitable for the conditions to which such pipelines are to be subjected, and provided that the design has been reviewed and approved by the Director prior to installation or use.

- (5) Clause 4.3.4 is amended by adding the following clauses:

4.3.4.9 High consequence areas

4.3.4.9.1 Definitions

The following definitions apply to the remainder of clause 4.3.4:

Assessment means the use of testing techniques set out in this section to ascertain the condition of a covered pipeline segment.

Covered segment or **Covered pipeline segment** means a segment of oil or gas transmission pipeline located in a high consequence area. The terms “oil”, “gas” and “transmission” are defined in O. Reg. 210/01. For the purpose of this document, transmission lines include only lines with an MOP of 30% or more of the SMYS.

High consequence area means

- (a) for a gas transmission pipeline, an area defined as:
 - (i) a Class 3 location under CSA Z662-11, Clause 4.3.3;
 - (ii) a Class 4 location under Clause 4.3.3;
 - (iii) any area in a Class 1 or Class 2 location where the potential impact radius is greater than 200 metres and the area within the potential impact circle contains 20 or more buildings intended for human occupancy; or
 - (iv) any area in a Class 1 or Class 2 location where the potential impact circle contains an *identified site*; and
- (b) for an oil pipeline, an area containing:
 - (i) a *commercially navigable waterway*, which means a waterway where a substantial likelihood of commercial navigation exists;
 - (ii) a *high population area*, which means an urbanized area, as defined and delineated by the latest Statistics Canada Census, that contains 50,000 or more people or has a population density of at least 385 people per square km;
 - (iii) an *other populated area*, which means a place, as defined and delineated by the latest Statistics Canada Census, that contains a concentrated population, such as an incorporated or unincorporated city, town, village, or other designated residential or commercial area; or

- (iv) an *unusually sensitive area*, as defined in company's pipeline integrity management program.

Identified site means, for Class 1 and Class 2 locations, any of the following areas:

- (a) an outside area or open structure that is occupied by 20 or more persons on at least 50 (not necessarily consecutive) days in any 12 month period. Examples include but are not limited to, beaches, playgrounds, recreational facilities, camping grounds, outdoor theaters, stadiums, recreational areas near a body of water, and areas outside a rural building such as a religious facility;
- (b) a building that is occupied by 20 or more persons at least five (not necessarily consecutive) days a week for at least 10 (not necessarily consecutive) weeks in any 12 month period. Examples include, but are not limited to, religious facilities, office buildings, community centers, general stores, 4-H facilities, sporting and entertainment facilities; or
- (c) a facility occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate. Examples include but are not limited to hospitals, prisons, schools, day-care facilities, retirement facilities and assisted-living facilities.

Potential impact circle, for natural gas or HVP pipelines systems, is a circle of radius equal to the potential impact radius (PIR).

Potential impact radius (PIR) means the radius of a circle within which the potential failure of a pipeline could have significant impact on people or property, determined by the following formula:

$$r = 0.00313 \text{ times square root of } (pd^2)$$

where:

r is the radius of the circular area surrounding the point of failure in metres (m)

p is the MOP of the pipeline in kPa

d is the nominal diameter of the pipeline in mm

NOTE: 0.00313 is the factor for natural gas based on conversion from a formula used in GRI-00/0189. This number will vary for other gases depending upon their heat of combustion. An operator transporting gas other than natural gas shall refer to ASME/ANSI B31.8 S for the formula to calculate the potential impact radius.

4.3.9.2 Identification of high consequence areas

- (a) *General*. Operating companies shall identify which segments of its oil and gas transmission pipeline system are in high consequence areas. The operator must

describe in its integrity management program the method used to establish high consequence areas, including the determination of the potential impact radius.

- (b) *Identified sites.* The operator shall identify identified sites by
 - (i) using information the operator has obtained from routine operation and maintenance activities; and
 - (ii) obtaining information about locations that are likely to meet the criteria for identified sites from public officials with safety or emergency response or planning responsibilities (such as officials from local emergency planning response agencies or from municipal planning departments).
- (c) *Identified sites – where public officials cannot assist.* If the public officials mentioned above indicate that they do not have the necessary information or are otherwise unable to identify potential identified sites, the operator shall use the following methods, as appropriate, to identify potential identified sites:
 - (i) the presence of signs, public notices, flags or other markings that suggest that the area may become an identified site in the future; and
 - (ii) the existence of publicly available information, including online and at local land registry offices, that suggests the area may become an identified site in the future.
- (d) *Newly identified high consequence areas.* When an operator obtains information suggesting that the area around a pipeline segment not previously identified as a high consequence area could constitute a high consequence area, the operator shall evaluate whether the area indeed constitutes a high consequence area. If the segment is determined to constitute a high consequence area, it must be incorporated into the operator's baseline assessment plan as a high consequence area within one year from the date the area is identified.

4.3.4.10 Operator's responsibility to implement this clause

4.3.4.10.1

An operator of a covered pipeline segment shall develop and follow a written program (part of the pipeline system integrity management program (IMP)) that contains all the elements described in the IMP and that addresses the risks on each covered transmission pipeline segment.

4.3.4.10.2 Implementation standards

An operator may use an equivalent standard or practice to a standard or practice required by clause 4.3.4 only when the operator demonstrates in its Integrity Management Program that the alternative standard or practice provides an equivalent level of safety to the public and property.

4.3.4.11 Risk assessment

The operator shall conduct a risk assessment that follows Annex B Guidelines for risk assessment of pipelines falling within the scope of CSA Z662-11 for each covered

segment. The risk assessment shall include the high consequence areas and determine if additional preventive or mitigation measures are needed.

The operator shall prioritize the covered pipeline segments according to the risk.

4.3.4.12 Remediation

For each covered segment, the operator shall develop and establish measures to prevent or reduce the probability of an incident and to limit the potential consequences thereof.

These measures shall include conducting a risk analysis of the pipeline segment to identify additional measures to enhance public safety or environmental protection. Such measures may include, but are not limited to:

- (a) establishing shorter inspection intervals;
- (b) installing emergency flow restricting devices (remote operated valves, check valves and automatic shut off valves, as applicable);
- (c) modifying the systems that monitor pressure or detect leaks, as applicable;
- (d) providing additional training to personnel on response procedures;
- (e) conducting drills with local emergency responders; and
- (f) adopting other management controls.

Evacuation procedures shall take into consideration the PIR.

For oil pipeline segments located in high consequence areas, the operating company shall provide the Ontario Ministry of Natural Resources (MNR) and the Ontario Ministry of Environment (MOE) an opportunity to comment on the company's contingency plan for leaks or spills and shall address any comments provided by MOE or MNR.

- (6) Clause **7.10.3.2** is deleted and substituted with the following:

7.10.3.2

For HVP and for sour service pipeline systems, all butt welds shall be inspected by radiographic or ultrasonic methods, or a combination of such methods, for 100% of their circumferences, in accordance with the requirements of clause 7.10.4.

- (7) Clause **10.3.7.1** is deleted and substituted with the following:

10.3.7.1

Prior to a change in service fluid, including from non-sour service to sour service, the operating company shall conduct an engineering assessment to determine whether the pipeline systems would be suitable for the new service fluid. The assessment shall include consideration of the design, material, construction, operating, and maintenance history of the pipeline system and shall be submitted to the Director for approval.

- (8) Clause **10.3** is amended by adding the following clause:

10.3.10

For the protection of the pipeline, the public and the environment, the operating company shall develop a pipeline integrity management program for steel pipelines with an MOP of 30% or more of the SMYS that complies with the applicable requirements of clause 3.2 of CSA Z662-11. The integrity management program shall include the following items:

- (a) a management system;
- (b) a working records management system;
- (c) a condition monitoring program, and
- (d) a mitigation program.

- (9) Clause **10.5.2** is amended by adding the following clauses:

10.5.2.6 Emergency communication meetings

The operator of a transmission pipeline shall conduct meetings with local authorities, inviting police, firefighting authorities, Ontario Ministry of Transportation (MTO), Ministry of Natural Resources (MNR), Ministry of the Environment (MOE), local conservation authorities and TSSA, to explain to the authorities the characteristics of the pipeline system the operator operates, the type of fuels being transported and the typical behaviour of these fuels in case of uncontrolled escapes or spills and the capabilities and the coordination required to respond to pipeline emergencies.

These meetings shall be conducted at intervals not exceeding five years at locations that ensure the key stakeholders can attend. The meetings shall be prioritized so as to correspond to the operating company's prioritization of the covered pipeline segments according to the risk.

10.5.2.7

Operating companies shall prepare an emergency response plan and make it available on request to the authorities referred to in clause 10.5.2.6.

- (10) Clause **10.6** is amended by adding the following clause:

10.6.5 Right-of-way encroachment

10.6.5.1

No person shall install patios or concrete slabs on the pipeline right-of-way or fences across the pipeline right-of-way unless written permission is first obtained from the operating company.

10.6.5.2

No person shall erect any building (including garden sheds) or install swimming pools on the pipeline right-of-way, and no person shall deposit or store any flammable material, solid or liquid spoil, refuse, waste or effluent on the pipeline right-of-way.

10.6.5.3

Notwithstanding the above, operating companies may erect structures required for purpose of pipeline system operation on the pipeline right-of-way.

10.6.5.4

No person shall operate a vehicle or mobile equipment except for farm machinery or personal recreation vehicles across or along a pipeline right-of-way unless written permission is first obtained from the operating company or the vehicle or mobile equipment is operated within the travelled portion of a highway or public road in the pipeline right-of-way.

10.6.5.5

Operating companies shall develop written procedures for periodically determining the depth of cover for pipelines operated over 30% of SMYS. Such written procedures shall include a rationale for the frequency selected for such depth determinations. Where the depth of cover is found to be less than 60 cm in lands being used for agriculture, an engineering assessment shall be done in accordance with clause 3.3 and a suitable mitigation plan shall be developed and implemented to ensure the pipeline is adequately protected from hazards.

(11) Clause **10.15.1.2** is amended by adding the following items:

- (e) maintain warning signs and markers along the pipeline right-of-way;
- (f) maintain existing fences around above ground pipeline facilities; and
- (g) empty tanks and purge them of hazardous vapours within 60 days of deactivation.

(12) Clause **12.4.11.1** is renumbered as clause **12.4.11.1.1**. Clause **12.4.11** is amended by adding the following clauses:

12.4.11.1.2

All new and replacement natural gas service regulators shall comply with the requirements of CSA 6.18-02 (R2008) (Service Regulators for Natural Gas), published by the Canadian Standards Association, including the Drip and Splash Test contained in Appendix A of the said standard. Where a regulator-meter set installation or supplemental protective devices provides equivalent protection against regulator vent freeze up passes a successful test in accordance with Appendix C of the said standard, the requirements of Appendix A (Drip and Splash Test) and those contained in clause

14.15 (Freezing Rain Test) of the standard are waived. Evidence of tests completed in accordance with Appendix C of the standard shall be retained by the operating company as permanent records.

12.4.11.1.3

Regulator-meter set configurations shall be included in the operating company's operating and maintenance procedures.

- (13) Clause **12.4.15.6** is revoked and substituted with the following:

12.4.15.6

Where regulator failure would result in the release of gas, open ends of the vents shall be located where the gas can escape freely into the atmosphere and away from any openings in the buildings. Clearances from building openings shall be commensurate with local conditions and the volume of gas that might be released, but shall not be less than those set out in the following table:

Clearance from service regulator vents discharge (m)

<i>Column:</i>	I	II	III	IV
Building opening	0.3	1	3	1
Appliance vent outlet	0.3	1	1	1
Moisture exhaust duct (dryers)	1	1	1	1
Mechanical air intake	1	3	3	3
Appliance air intake	0.3	1	3	3
Source of ignition	0.3	1	1	3

Column I applies to natural gas regulators certified under CSA 6.18 standard, incorporating an OPCO system and with a limited relief of 1.5 m³/h.

Column II applies to natural gas regulators certified under CSA 6.18 standard (if within the scope of the standard) with a relief capacity up to 55 m³/h.

Column III applies to natural gas regulators with a relief capacity over 55 m³/h.

Column IV applies to propane regulators.

Where regulators might be submerged during floods, either a special anti-flood-type breather vent fitting shall be installed or the vent line shall be extended above the height of the expected flood waters.

- (14) Clause **12.10.11** is amended by adding the following items:

- (e) For polyethylene piping installed in Class 1 and Class 2 locations, the upgraded maximum operating pressure shall not exceed the design pressure calculated in accordance with the requirements of Clause 12.4.2; and
- (f) For polyethylene piping installed in Class 3 and Class 4 locations, the upgraded maximum operating pressure shall not exceed the design pressure calculated in accordance with the requirements of clause 12.4.2 with a combined design factor and temperature derating factor ($F \times T$) of 0.32, unless the operating company conducts an engineering assessment to determine whether it would be suitable for the existing polyethylene piping to be operated at the new pressure. The assessment shall include consideration of the design, material, construction, operating, and maintenance history of the pipeline system and be submitted to the Director for approval.

(15) Clause **12.10** is amended by adding the following clause:

12.10.16

Operating companies shall establish effective procedures for managing the integrity of pipeline systems with an MOP less than 30% of SMYS (Distribution Systems) so that they are suitable for continued service, in accordance with the applicable requirements of clause 3.2 of CSA Z662-11.

Section 3

POLYETHYLENE PIPE CERTIFICATION

3. Polyethylene piping and fittings that are used in a polyethylene gas pipeline shall be certified by a designated testing organization accredited by the Standards Council of Canada as conforming to CAN/CSA-B137.4-09 (Polyethylene Piping Systems for Gas Services).

Section 4

WELDER QUALIFICATION

4. Welds shall not be made in any steel pipe that forms or is intended to form a part of a steel oil or gas pipeline or a component of a steel pipeline unless the welding procedures have been approved and the welder is qualified to make the weld in accordance with the requirements of CSA-Z662-11 (Oil and Gas Pipeline Systems) and is the holder of the appropriate authorization issued under O. Reg. 220/01 (Boilers and Pressure Vessels) made under the Act.

Section 5

MISCELLANEOUS

5.

- (1) Where there is a conflict between a standard, specification, code or publication adopted in sections 1, 2, 3 or 4 of this document, this document prevails.
- (2) Any reference to “Director” in a code amended by this document means the Director for O. Reg. 210/01 (Oil and Gas Pipeline Systems).
- (3) Any person involved in an activity, process or procedure to which this document applies shall comply with this document.
- (4) Except as provided below, this Code Adoption Document amendment is effective **November 1, 2012**.
- (5) Notwithstanding Section 5(4), the following parts of the Code Adoption Document are effective **March 1, 2013**:
 - (a) Section 1(b), which adopts CSA Z246.1-09 (Security Management for Petroleum and Natural Gas Industry Systems); and
 - (b) Section 2(5), which adds clause 4.3.4.9 (re high consequence areas) to clause 4.3.4. of CSA Z662-11 (Oil and Gas Pipeline Systems).

SIGNED this 31st day of August, 2012



John Marshall

Director for O. Reg. 210/01, appointed under authority of section 4(1) of the Act

Technical Standards and Safety Authority

14th Floor - Centre Tower
3300 Bloor St. West
Toronto, Ontario M8X 2X4

*This document was developed in consultation with the
Gaseous Fuels Advisory Council and the Pipeline Risk Reduction Group*

SEC INTERROGATORY #83

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[A2/1/3, p. 2] Please provide the data behind the chart "EGD Capital Expenditure".

RESPONSE

Please see the table on the following page. See also the response to SEC Interrogatory #8 found at Exhibit I.A1.EGDI.SEC.8.

Witnesses: L. Lawler
J. Sanders

Capital Expenditure Profile 2000-2018																			
(\$Millions)																			
	Col1	Col2	Col3	Col4	Col5	Col6	Col7	Col8	Col9	Col10	Col11	Col12	Col13	Col14	Col15	Col16	Col17	Col18	Col19
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013B	2014F	2015F	2016F	2017F	2018F
Customer Related System integrity Others GTA & Ottawa	117	123	116	115	120	137	135	136	120	109	108	136	152	123	122	130	141	146	148
	62	97	106	74	96	125	177	152	157	145	159	161	187	193	153	248	242	277	304
	36	30	31	36	63	54	53	67	90	96	71	103	90	71	205	94	67	62	57
Total Capital Expenditure	-	-	-	-	-	-	-	-	-	-	-	-	9	63	202	360	-	-	-
	215	250	253	225	278	316	365	355	366	349	338	399	438	450	682	832	450	485	509

Witnesses: L. Lawler
J. Sanders

SEC INTERROGATORY #84

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B1/3/1, p. 1] Please explain how, in the absence of the Community Expansion Proposal, the Applicant determined the amounts, if any, it should include in its capital budget for community expansion. If no amounts were included in the budget, how does the Applicant propose to integrate consideration of the Community Expansion proposal with consideration of this Application?

RESPONSE

The Company's Community Expansion proposal is still under development and therefore no amounts were included in the capital budget. The Company will bring forward a separate application in mid-2014 for consideration by the Board. This Application may include a request for appropriate rate treatment of additional costs.

Witnesses: D. McIlwraith
N. Ryckman

SEC INTERROGATORY #85

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/1/1, p. 1] *"The budgeting process has ensured the Enbridge's 2014 to 2016 Capital Budget reflects the level of spending necessary to meet the growth, safety and operational requirements of the business."* Please advise what evidence the Applicant has to support this connection between the budgeting process and the Capital Budget.

RESPONSE

The manner in which the budgeting process assessed Enbridge's growth, safety and operational requirements, and led to a budget to accommodate those requirements, is described within Exhibit B2, Tab 1, Schedule 1 (see for example, paragraphs 51 to 97). See also Interrogatory responses I.B18.EGDI.SEC.91, I.B18.EGDI.STAFF.55, and I.A1.EGDI.SEC.11.

Witnesses: S. Kancharla
J. Sanders
P. Squires

SEC INTERROGATORY #86

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/1/1, p. 4] Please expand Table 2 to add columns for 2007 through 2012 actual, and 2013 forecast (9+3 or 10+2).

RESPONSE

Please see the table on the following page which includes a 9+3 forecast for 2013.

COMPARISON OF CAPITAL EXPENDITURES 2007 THROUGH 2012 ACTUAL AND 2016 FORECAST (\$M)											
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col.10	Col. 11
Item No.	Actual 2007	Actual 2008	Actual 2009	Actual 2010	Actual 2011	Actual 2012	Forecast 2013	Budget 2013	Forecast 2014	Forecast 2015	Forecast 2016
A. <u>Customer Related</u>											
1.1.1 Sales Mains **	83.9	60.6	48.2	46.7	72.1	65.3	61.7	44.6	39.6	42.1	49.1
1.1.2 Services	40.9	49.3	48.7	52.6	55.9	71.8	70.0	68.1	69.0	73.7	76.3
1.1.3 Meters and Regulation	11.4	9.7	11.9	8.3	7.6	14.7	11.6	10.3	10.4	11.0	11.7
1.1.4 Customer Related Distribution Plant	136.2	119.6	108.8	107.6	135.6	151.8	143.3	123.0	119.0	126.8	137.1
1.1.5 NGV Rental Equipment	0.1	0.3	0.2	0.2	-	0.2	0.2	0.3	3.4	3.6	3.7
1.1 TOTAL CUSTOMER RELATED CAPITAL	136.3	119.9	109.0	107.8	135.6	152.0	143.5	123.3	122.4	130.4	140.8
B. <u>System Improvements and Upgrades</u>											
1.2.1 Mains - Relocations	11.2	14.8	8.0	13.2	15.5	13.0	39.9	27.5	28.6	24.9	26.0
1.2.2 - Replacement	49.7	58.8	49.9	55.7	54.6	49.1	69.3	71.0	105.6	94.2	82.5
1.2.3 - Reinforcement	17.1	16.7	16.8	14.0	9.8	37.5	23.4	27.0	21.3	31.6	18.1
1.2.4 Total Improvement Mains	78.0	90.3	74.7	82.9	79.8	99.6	132.7	125.5	155.5	150.7	126.6
1.2.5 Services - Relays	35.8	30.4	37.0	45.8	45.9	48.1	28.5	17.3	29.8	34.5	52.1
1.2.6 Regulators - Refits	3.1	3.5	7.7	6.4	5.6	11.3	19.7	9.7	9.8	10.0	10.1
1.2.7 Measurement and Regulation	15.6	13.4	9.2	10.3	11.4	17.1	15.1	24.3	31.5	34.1	32.6
1.2.8 Meters	19.3	18.9	15.9	13.1	17.8	20.0	17.0	16.0	16.6	18.5	20.8
1.2 TOTAL SYSTEM IMPROVEMENTS AND UPGRADES	151.8	156.5	144.5	158.5	160.5	196.1	213.0	192.8	243.2	247.8	242.2
C. <u>General and Other Plant</u>											
1.3.1 Land, Structures and Improvements	2.7	3.4	2.9	14.0	20.9	18.0	8.0	7.8	12.9	11.2	6.8
1.3.2 Office Furniture and Equipment	0.9	1.0	0.9	1.9	5.1	1.4	1.3	1.6	4.6	4.7	4.4
1.3.3 Transp/Heavy Work/NGV Compressor Equipment	7.4	11.0	11.4	6.5	7.4	3.1	5.1	4.8	4.6	4.7	4.7
1.3.4 Tools and Work Equipment	1.4	3.6	2.3	2.5	1.9	2.0	1.4	1.4	1.5	1.5	1.5
1.3.5 Computers and Communication Equipment	17.5	18.3	24.8	32.0	37.7	42.9	42.4	32.0	32.7	30.6	31.0
1.3 TOTAL GENERAL AND OTHER PLANT	29.9	37.3	42.3	56.9	73.0	67.4	58.2	47.6	56.3	52.7	48.4
D. Underground Storage Plant	4.5	5.9	4.6	14.7	30.1	22.4	23.9	22.4	21.9	15.7	10.5
E. Sub total "CORE" CAPITAL EXPENDITURES	322.5	319.6	300.4	337.9	399.2	437.9	438.6	386.1	443.8	446.6	441.9
F. Customer Information System (CIS) /WAMS		46.4	48.7	(0.3)			0.6	0.5	36.3	25.7	8.1
G. <u>Leave to Construct</u>											
1.7.1 Ottawa Reinforcement							62.4	44.0	5.1		
1.7.2 GTA Reinforcement							23.7	19.3	197.1	359.7	-
1.7 TOTAL LEAVE TO CONSTRUCT	-	-	-	-	-	-	86.1	63.3	202.2	359.7	-
H. TOTAL CAPITAL EXPENDITURES	322.5	366.0	349.1	337.6	399.2	437.9	525.3	449.9	682.3	832.0	450.0
** Power Generation Projects Included in Sales Mains	21.1	13.0	5.7	4.6	19.8	0.3	0.4				

Witnesses: J. Sanders
P. Squires

SEC INTERROGATORY #87

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/1/1, p. 9] Please advise whether Table 3 is labour costs, or only capitalized labour costs

RESPONSE

Table 3 reflects capitalized salaries and employee expenses for departments within Engineering and Operations.

Witnesses: J. Sanders
P. Squires

SEC INTERROGATORY #88

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/1/1, p. 10] Please provide the calculation of the IDC in Table 5 for each year. Please disaggregate the IDC for the GTA and Ottawa reinforcements. Please extend Table 5 backwards to cover 2007 through 2012 as well.

RESPONSE

Please refer to Table 1 on the following page for the Interest During Construction calculation. Interest During Construction is a function of Construction Work in Progress ("CWIP") balances. The calculation assumes a CWIP base amount of \$60M (Item 2). Line items 3 and 5 reflect the estimated amount of "direct" expenditures that would attract interest during construction. The high level estimation assumes that the expenditure amounts are half year effective. The sum of the CWIP base and the direct capital spend (half effective) is multiplied by the prescribed interest rate (weighted average cost of debt). The result (item 7) is the estimated interest during construction for the fiscal period. Table 2 provides the 2007 through 2012 historical information.

Witnesses: J. Sanders
P. Squires

Table 1 - Interest During Construction Calculation						
(\$Thousands)						
Item number			Forecast 2014	Forecast 2015	Forecast 2016	Factor
1	Prescribed Interest Rate (Weighted Average Cost of Debt)					5.75%
2	Assumed Work in Progress Base					60,000
3	Estimated Core Direct Distribution/Storage WIP Capital Expenditures		133,725	115,893	119,928	
4	Estimated Interest During Construction - Distribution and Storage Plant		7,295	6,782	6,898	
5	Estimated Core Direct Information Technology-Software WIP Capital Expenditures		17,580	16,320	16,500	
6	Estimated Interest During Construction - Information Technology Software		505	469	474	
7	Estimated Interest During Construction Core Capital (4 plus 6)		7,800	7,251	7,372	

Table 2 - Interest During Construction 2007-2012 Actual, 2013 Budget and 2014 - 2016 Forecast											
(\$Millions)											
Line No.		Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10
		Actual 2007	Actual 2008	Actual 2009	Actual 2010	Actual 2011	Actual 2012	Budget 2013	Forecast 2014	Forecast 2015	Forecast 2016
1	Core Capital - Interest During Construction	3.3	2.4	2.0	2.8	5.2	5.8	5.4	7.8	7.3	7.4
2	WAMS - Interest During Construction								0.6	2.0	
3	Interest During Construction per B2-1-1 Table 5	3.3	2.4	2.0	2.8	5.2	5.8	5.4	8.4	9.3	7.4
4	GTA Reinforcement - Interest During Construction (embedded in GTA costs)								3.7	15.1	
5	Summary Total: Interest During Construction	3.3	2.4	2.0	2.8	5.2	5.8	5.4	12.1	24.4	7.4

Witnesses: J. Sanders
P. Squires

SEC INTERROGATORY #89

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/1/1, p. 12] "The Company has decided that a more cost-effective solution to the services approach that currently provides Work and Asset Management Services would be to implement an in-house IT system." Please provide the cost-benefit analysis, business case or similar existing document on which this decision was based

RESPONSE

Please refer to Board Staff Interrogatory #58 found at Exhibit I.B18.EGDI.SEC.58.

Witnesses: W. Akkermans
M. Brophy

SEC INTERROGATORY #90

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/1/1, p. 12] Please confirm that the Company does not currently “schedule an AMP Fitting replacement to coincide with a leak survey or service relay”. If confirmed, please explain why.

RESPONSE

The Company does not schedule an AMP Fitting replacement to coincide with a leak survey as a different skill set is required to perform the AMP Fitting repair work, than that required to perform the leak survey. A Leak Surveyor is a highly mobile, minimally equipped foot patrolperson. The surveyor is only equipped to perform leakage surveys and investigations. They are not equipped for construction activity or other maintenance activities.

If the copper downstream of the fitting is found to be leaking through the Leak Survey program, or if the service is being relayed for other reasons, the AMP Fitting is also replaced with the service. The Company manages this work to ensure it is performed efficiently keeping in mind the safety of the public as well as the impact to the ratepayer.

The AMP Fitting program proposed in evidence at Exhibit B2, Tab 5, Schedule 3, Attachment 2, targets the AMP Fittings at higher probability to leak as part of the proactive replacement program. By targeting AMP Fitting replacement in this way, the number of occurrences of AMP Fitting failures identified through Leak Survey will be reduced.

Witness: L. Lawler

SEC INTERROGATORY #91

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/1/1, pp. 17-20] Please provide the “Bottom-Up list of business needs” referred to, for all years from 2014 to 2018. Please identify all material changes to the capital budget from this initial list (i.e. immediately prior to January 18, 2013), to the final Capital Budget. Please specify which of those changes were made by the Capital Owners Committee, and which were made by Executive Management.

RESPONSE

The January 18th, Review 1 is considered the baseline iteration containing the “Bottom Up” list of business needs.

Please see the response SEC Interrogatory #95, found at Exhibit B18.EGDI.SEC.95 which shows the calculation of the \$185.9M decrease in Review 6 (the final budget) compared to Review 1 and also shows the iterative budget totals at each respective Review Cycle. In the initial baseline scenario, 2014 through 2018 capital was considered. After Review Cycle 3 the capital budget process did not evaluate 2017 and 2018 projects and amounts. The budget process applied a number of criteria to prioritize the proposed spending as described in paragraph 66 of Exhibit B2, Tab 1, Schedule 1. The timing of the need, alternative actions, probability and other financial analysis were all considerations in delaying, eliminating projects altogether or accepting the risk of uncertainty. The AMP fitting project is an example where pacing the project was deemed an acceptable risk. All changes were reviewed and approved by both the Capital Operating Committee and the Executive Management Team.

Witnesses: J. Sanders
P. Squires

Table 1 provides the capital reductions summarized by the business area detail between Review 1 and Review 6. Table 2 provides the same information at the program level.

Table 1															
SUMMARY COMPARISON OF CHANGES FINAL REVIEW 6 VS. BASELINE REVIEW 1															
(\$K)															
Review 1- Jan 18th								Review 6 - Final Capital				Changes Review 6 vs. Review 1			
CAPITAL BUSINESS AREA	F2014	F2015	F2016	Sum 14-16	F2017	F2018	Sum 17-18	F2014	F2015	F2016	Sum 14-16	F2014	F2015	F2016	Sum 14-16
1. CUST GROWTH	105,098	113,073	121,050	339,222	123,789	126,280	250,069	91,156	97,495	102,340	290,991	(13,943)	(15,579)	(18,710)	(48,231)
2. REINFORCEMENT	8,925	16,583	3,343	28,851	29,550	53,217	82,767	10,894	16,958	8,744	36,595	1,969	375	5,401	7,745
3. RELOCATIONS	15,336	15,786	16,203	47,325	16,527	16,858	33,385	15,236	13,386	12,603	41,225	(100)	(2,400)	(3,600)	(6,100)
4. SYSTEM INTEGRITY RELIABILITY	139,670	173,113	169,554	482,336	167,374	170,840	338,214	104,020	110,201	123,655	337,876	(35,650)	(62,911)	(45,899)	(144,460)
5. STORAGE	22,231	14,816	14,785	51,832	16,025	16,466	32,491	19,168	13,808	8,910	41,886	(3,063)	(1,008)	(5,875)	(9,946)
6. GENERAL PLANT	28,052	29,601	27,483	85,136	23,915	29,043	52,958	27,095	25,614	20,986	73,695	(957)	(3,987)	(6,497)	(11,441)
7. IT	24,300	26,200	27,200	77,700	31,150	29,450	60,600	29,300	27,200	27,500	84,000	5,000	1,000	300	6,300
8. DLC	88,691	88,343	91,313	268,347	93,389	95,515	188,904	103,656	98,274	93,001	294,930	14,965	9,931	1,688	26,583
9. AG	36,523	37,072	37,664	111,259	38,000	38,000	76,000	35,500	36,440	37,140	109,080	(1,023)	(632)	(524)	(2,179)
9. IDC	7,435	8,981	9,825	26,241	8,000	8,000	16,000	7,800	7,251	6,999	22,050	365	(1,730)	(2,826)	(4,191)
Summary Total	476,262	523,568	518,419	1,518,249	547,719	583,669	1,131,388	443,825	446,627	441,877	1,332,329	(32,437)	(76,941)	(76,542)	(185,920)

Witnesses: J. Sanders
P. Squires

Table 2																						
PROGRAM DETAIL- COMPARISON OF CHANGES FINAL REVIEW 6 VS. BASELINE REVIEW 1																						
(\$K)																						
Review 1- Jan 18th															Review 6 - Final Capital				Changes Review 6 vs. Review 1			
PLANT DETAIL	PROGRAM DETAIL	F2014	F2015	F2016	Sum 14-16	F2017	F2018	Sum 17-18			F2014	F2015	F2016	Sum 14-16			F2014	F2015	F2016	Sum 14-16		
1. CUST GROWTH	Customer Growth	105,098	113,073	121,050	339,222	123,789	126,280	250,069			91,156	97,495	102,340	290,991			(13,943)	(15,579)	(18,710)	(48,231)		
2. REINFORCEMENT	Alliston Reinforcement	1,020	2,069	-	3,089						-	1,040	2,111	3,151			(1,020)	(1,029)	2,111	62		
2. REINFORCEMENT	Bathurst Reinforcement						9,937	9,937														
2. REINFORCEMENT	Central West Reinforcement					541		541														
2. REINFORCEMENT	Chippawa Reinforcement	408	-		408						408	-	-	408			-	-	-	-		
2. REINFORCEMENT	Green Bank Reinforcement	51	-	-	51						51	-	-	51			-	-	-	-		
2. REINFORCEMENT	Greenbank Reinforcement						17,776	17,776														
2. REINFORCEMENT	Huronario Reinforcement	765	-	-	765	1,082		1,082			-	780	-	780			(765)	780	-	15		
2. REINFORCEMENT	Hwy 35/7 Reinforcement										-	1,665	-	1,665			-	1,665	-	1,665		
2. REINFORCEMENT	Kinston Road Reinforcement	918	-	-	918						918	-	-	918			-	-	-	-		
2. REINFORCEMENT	Landsdowne Park Reinforcement										1,224	-	-	1,224			1,224	-	-	1,224		
2. REINFORCEMENT	Markham Reinforcement	-	-	424	424		1,767	1,767			-	-	-	-			-	-	(424)	(424)		
2. REINFORCEMENT	New Bayview Station Reinforcement					21,649		21,649			-	-	-	-			-	-	-	-		
2. REINFORCEMENT	Oriole Reinforcement						6,624	6,624			-	-	-	-			-	-	-	-		
2. REINFORCEMENT	Oshawa Reinforcement										-	-	3,714	3,714			-	-	3,714	3,714		
2. REINFORCEMENT	Peterborough Reinforcement	1,530	-	-	1,530	1,299		1,299			1,530	-	-	1,530			-	-	-	-		
2. REINFORCEMENT	Pickering Reinforcement	-	208	-	208	2,706		2,706			-	-	-	-			-	(208)	-	(208)		
2. REINFORCEMENT	Richmond Hill Reinforcement	-	1,040	-	1,040	649	833	1,482			1,020	-	-	1,020			1,020	(1,040)	-	(20)		
2. REINFORCEMENT	Spadina Reinforcement						662	662			-	-	-	-			-	-	-	-		
2. REINFORCEMENT	Steeles/Rouge Reinforcement	918	-	-	918						1,530	-	-	1,530			612	-	-	612		
2. REINFORCEMENT	Thorton Gate Pressure Elevation										765	-	-	765			765	-	-	765		
2. REINFORCEMENT	Vanjamur Pressure Elevation										133	-	-	133			133	-	-	133		
2. REINFORCEMENT	Various other Reinforcement	2,805	2,861	2,918	8,584	1,624	1,707	3,331			2,805	2,861	2,918	8,584			-	-	-	-		
2. REINFORCEMENT	Whites Rd Reinforcement										-	-	-	208			-	208	-	208		
2. REINFORCEMENT	York Region Reinforcement	510	10,404	-	10,914	13,911	13,911	13,911			510	10,404	-	10,914			-	-	-	-		
3. RELOCATIONS	Regional relocations	15,336	15,786	16,203	47,325	16,527	16,858	33,385			15,236	13,386	12,603	41,225			(100)	(2,400)	(3,600)	(6,100)		
4. SYSTEM INTEGRITY RELIABILITY	20-Inch Lakeshore Line Replacement	5,610	-	-	-	5,610					-	-	-	-			(5,610)	-	-	(5,610)		
4. SYSTEM INTEGRITY RELIABILITY	AC Corrosion (Remediation work)										102	52	27	181			102	52	27	181		
4. SYSTEM INTEGRITY RELIABILITY	AMP Fitting Replacement	10,200	31,212	31,836	73,248	32,473	33,122	65,595			8,543	13,100	30,046	51,689			(1,657)	(18,112)	(1,790)	(21,559)		
4. SYSTEM INTEGRITY RELIABILITY	Anodeless Riser Replacement	275	281	669	1,225	682	696	1,378			-	-	-	-			(275)	(281)	(669)	(1,225)		
4. SYSTEM INTEGRITY RELIABILITY	Bare Steel Drips (study & removal program)										255	-	-	255			255	-	-	255		
4. SYSTEM INTEGRITY RELIABILITY	Bare Steel Services Replace										-	0	0	1			-	0	1	1		
4. SYSTEM INTEGRITY RELIABILITY	Bare Steel Services Study	-	208	-	208						-	-	-	-			-	(208)	-	(208)		
4. SYSTEM INTEGRITY RELIABILITY	Cambrian Road Phase 2	408	-	-	408						408	-	-	408			-	-	-	-		
4. SYSTEM INTEGRITY RELIABILITY	Casing Study & Program	510	520	531	1,561	541	552	1,093			510	-	-	510			-	(520)	(531)	(1,051)		
4. SYSTEM INTEGRITY RELIABILITY	Chicago Fitting Study	204	-	-	204						204	-	-	204			-	-	-	-		
4. SYSTEM INTEGRITY RELIABILITY	Coated Steel Program (Mains & Services)	367	375	-	742						362	-	-	362				(5)	(375)	-	(380)	
4. SYSTEM INTEGRITY RELIABILITY	Compliance of Integrity Programs	1,224	1,248	-	1,273	3,746	1,299	1,546	2,845		-	-	-	-			(1,224)	(1,248)	(1,273)	(3,746)		
4. SYSTEM INTEGRITY RELIABILITY	Compression Outlet Service Tee Study										2,866	2,924	2,982	8,771			2,866	2,924	2,982	8,771		
4. SYSTEM INTEGRITY RELIABILITY	Distribution Integrity Technology										1,597	1,934	2,063	5,594			1,597	1,934	2,063	5,594		
4. SYSTEM INTEGRITY RELIABILITY	Distribution Records Management Program	8,160	7,283	6,367	21,810	6,495	6,624	13,119			9,639	8,740	7,695	26,074			1,479	1,457	1,328	4,264		
4. SYSTEM INTEGRITY RELIABILITY	District Station Equipment Replacement	2,550	2,601	2,653	7,804	2,706	2,760	5,466			-	-	-	-			(2,550)	(2,601)	(2,653)	(7,804)		
4. SYSTEM INTEGRITY RELIABILITY	District/Header Station Equipment Replacement										6,477	9,728	10,984	27,189			6,477	9,728	10,984	27,189		
4. SYSTEM INTEGRITY RELIABILITY	Don River Bridge Crossing Replacement	9,700	(0)	0	9,700						-	(0)	0	0			(9,700)	-	0	(9,700)		
4. SYSTEM INTEGRITY RELIABILITY	EFV Program	1,530	-	-	1,530						500	604	733	1,837			(1,030)	604	733	307		
4. SYSTEM INTEGRITY RELIABILITY	Encased Bridge Crossings Study	-	208	-	208						-	208	0	208			-	(0)	0	208		
4. SYSTEM INTEGRITY RELIABILITY	Failure of Bonnet Bolts on Valves Study	-	-	212	212						-	-	-	-			-	-	(212)	(212)		
4. SYSTEM INTEGRITY RELIABILITY	Farm Tap Study	-	208	-	208						-	208	265	473			-	-	265	265		
4. SYSTEM INTEGRITY RELIABILITY	Fixed Oh to EA contractors	5,628	5,740	5,855	17,224	5,972	6,092	12,064			-	-	-	-			(5,628)	(5,740)	(5,855)	(17,224)		
4. SYSTEM INTEGRITY RELIABILITY	Gate Station Equipment Replacement	5,100	5,202	5,306	15,608	5,412	5,520	10,932			12,160	10,440	7,060	29,660			7,060	5,238	1,754	14,052		
4. SYSTEM INTEGRITY RELIABILITY	Header Stations	1,000	1,020	1,040	3,060	1,061	1,082	2,143			1,500	1,537	1,576	4,613			500	517	536	1,553		
4. SYSTEM INTEGRITY RELIABILITY	ILI for pipelines	10,200	10,404	10,612	31,216	10,824	11,041	21,865			11,000	8,900	8,502	28,402			800	(1,504)	(2,110)	(2,814)		
4. SYSTEM INTEGRITY RELIABILITY	Innes and Orleans Station	92	-	-	92						92	-	-	92			-	-	-	-		
4. SYSTEM INTEGRITY RELIABILITY	Inside Regulator Replacement										36	5	5	46			36	5	5	46		
4. SYSTEM INTEGRITY RELIABILITY	Isolated Steel Mains CP Program										-	-	-	-			-	-	-	-		
4. SYSTEM INTEGRITY RELIABILITY	Isolated Steel Remediation Program										1,326	1,353	-	2,679			1,326	1,353	-	2,679		
4. SYSTEM INTEGRITY RELIABILITY	Isolated Steel Study	1,326	1,353	-	2,679						-	-	-	-			(1,326)	(1,353)	-	(2,679)		
4. SYSTEM INTEGRITY RELIABILITY	Isolation Valve Study & Installation (RCV / AC)	3,060	3,121	3,184	9,365	3,247	3,312	6,559			-	-	-	-			(3,060)	(3,121)	(3,184)	(9,365)		
4. SYSTEM INTEGRITY RELIABILITY	Jumpser and Service Extension Study	102	104	106	312						408	208	212	828			306	104	106	516		
4. SYSTEM INTEGRITY RELIABILITY	Load Reservoir Program	548	560	572	1,681	585	598	1,183			-	0	0	1			(548)	(560)	(572)	(1,680)		
4. SYSTEM INTEGRITY RELIABILITY	Load Shed Zone										1,145	1,171	1,194	3,510			1,145	1,171	1,194	3,510		
4. SYSTEM INTEGRITY RELIABILITY	Low Pressure Delivery Meter Set Program	3,060	5,202	5,306	13,568	5,412	5,520	10,932			1,530	2,341	2,388	6,259			(1,530)	(2,861)	(2,918)	(7,309)		
4. SYSTEM INTEGRITY RELIABILITY	Meter Barrier Study & Program	-	-	-	-	-	-	-			-	-	-	-			-	-	-	-		
4. SYSTEM INTEGRITY RELIABILITY	Meter boxes										-	-	-	-			-	-	-	-		
4. SYSTEM INTEGRITY RELIABILITY	Meters (MGI)	18,452	19,906	21,645	60,003	21,013	21,601	42,614			14,355	15,926	17,944	48,225			(4,097)	(3,980)	(3,701)	(11,778)		
4. SYSTEM INTEGRITY RELIABILITY	Miscellaneous Replacement Mains	4,080	4,162	4,245	12,486	4,330	4,416	8,746			5,388	5,866	5,058	16,311			1,308	1,704	813	3,825		
4. SYSTEM INTEGRITY RELIABILITY	N-1 reliability of supply for Single source networks										-	520	0	521			-	520	0	521		
4. SYSTEM INTEGRITY RELIABILITY	Network OPS/ORM M&R LEAK	1,758	1,794	1,830	5,382	1,866	1,903	3,769			1,758	1,794	1,830	5,382			-	-	-	-		
4. SYSTEM INTEGRITY RELIABILITY	Operate Gas Network - SMART System	3,570	6,763	6,898	17,230	7,036	7,177	14,213			-	-	-	-			(3,570)	(6,763)	(6,898)	(17,230)		
4. SYSTEM INTEGRITY RELIABILITY	Pipeline Markers	-	-	-	-	-	-	-			10	10	11	31			-	-	11	31		
4. SYSTEM INTEGRITY RELIABILITY	Plastic Mains (Ind Services) Study	-	12,485	21,224	33,709	21,649	22,082	43,731			-	-	-	-			-	(12,485)	(21,224)	(33,709)		
4. SYSTEM INTEGRITY RELIABILITY	Reg Refits	8,914	9,285	9,671	27,869	9,742	9,937	19,679			9,814	9,985	10,171	29,966			900	700	750	2,150		
4. SYSTEM INTEGRITY RELIABILITY	Relays	9,473	10,097	10,763	30,339	10,868	10,975	21,843			4,737	5,049	5,381	15,167			(4,737)	(5,049)	(5,381)	(15,167)		
4. SYSTEM INTEGRITY RELIABILITY	Remote Control Valve Study & Installation										565	602	680	1,847			-	602	680	1,847		
4. SYSTEM INTEGRITY RELIABILITY	Replace 1.8 km of NPS 12 XHP main with 1.8k	-	-	3,714	3,714						-	-	-	-			-	-	(3,714)	(3,714)		
4. SYSTEM INTEGRITY RELIABILITY	Residential Meter Sets Study (ind. SMART sy	204	-	-	204						-	-	-	-			(204)	-	-	(204)		
4. SYSTEM INTEGRITY RELIABILITY	Sewer Safety Program	706	720	734	2,160	749	764	1,513			1,530	1,561	1,592	4,682			824	841	857	2,522		
4. SYSTEM INTEGRITY RELIABILITY	Sombra Tecumseh Redundancy	2,000	17,850	-	19,850						-	-	-	-			(2,000)	(17,850)	-	(19,850)		
4. SYSTEM INTEGRITY RELIABILITY	Targeted Compression Couplings Pressure C	2,040	2,081	2,122	6,243	2,165	2,208	4,373			1,622	2,040	2,061	5,723			(418)	(41)	(61)	(520)		
4. SYSTEM INTEGRITY RELIABILITY	Vanjamur Pressure Elevation	133	-	-	133						-	-	-	-			(133)	-	-	(133)		
4. SYSTEM INTEGRITY RELIABILITY	Verification of MAOP	14,426	8,000	8,000	30,426	8,000	8,000	16,000			3,296	3,397	3,195	9,888								

Witnesses: J. Sanders
P. Squires

		Review 1- Jan 18th							Review 6 - Final Capital				Changes Review 6 vs. Review 1			
PLANT DETAIL	PROGRAM DETAIL	F2014	F2015	F2016	Sum 14-16	F2017	F2018	Sum 17-18	F2014	F2015	F2016	Sum 14-16	F2014	F2015	F2016	Sum 14-16
5. STORAGE	Acid Program	300		325	625			-				-	(300)	-	(325)	(625)
5. STORAGE	Base Gas	18	18		36			-				-	(18)	(18)	-	(36)
5. STORAGE	C of A (Stack Height, Turbo and Noise Attenuation)	250			250			-				-	(250)	-	-	(250)
5. STORAGE	Compressor Engine Overhaul				-			-	250	250	500	1,000	-	250	500	1,000
5. STORAGE	Compressor Overhaul (valve replacement)	100	100	100	300			-	100	225	100	425	-	125	-	125
5. STORAGE	Corunna Compressor Plant				-			-	9,680	4,620	-	14,300	9,680	4,620	-	14,300
5. STORAGE	Crowland Plant Automation	50	50	50	150			-	-	-	-	-	(50)	(50)	(50)	(150)
5. STORAGE	Crowland Plant Upgrades	200	200		400			-	200	200	-	400	-	-	-	-
5. STORAGE	Drawing Upgrades	100	100	100	300			-	100	100	100	300	-	-	-	-
5. STORAGE	DSA Boundary changes (purchase leases)	1,000	1,000		2,000			-	-	-	-	-	(1,000)	(1,000)	-	(2,000)
5. STORAGE	Engine Compressor Analyzer Automation (In Progress)	100	100	100	300			-	-	-	-	-	(100)	(100)	(100)	(300)
5. STORAGE	Engine Overhaul	250	250	500	1,000			-	-	-	-	-	(250)	(250)	(500)	(1,000)
5. STORAGE	Farm Purchase (C of A)			1,000	1,000			-	-	-	-	-	-	-	(1,000)	(1,000)
5. STORAGE	Gas Chromatograph at Chatham D				-			-		400		400	-	400	-	400
5. STORAGE	High Deliverability Well Erosion	60	60	70	190			-	-	-	-	-	(60)	(60)	(70)	(190)
5. STORAGE	Horizontal Well replacement program		2,500	7,500	10,000	10,000	10,000	20,000	-	-	-	-	-	(2,500)	(7,500)	(10,000)
5. STORAGE	Integrity of Pools (abandoned wells)		1,000		1,000			-	-	-	-	-	-	(1,000)	-	(1,000)
5. STORAGE	Integrity Records	150			150			-	-	-	-	-	(150)	-	-	(150)
5. STORAGE	MCC#1 Generator and Boiler	2,500			2,500			-	-	-	-	-	(2,500)	-	-	(2,500)
5. STORAGE	Misc Structures	100	100	100	300	150	100	250	-	-	-	-	(100)	(100)	(100)	(300)
5. STORAGE	Misc Field Lines	100	100	100	300	300	400	700	-	-	-	-	(100)	(100)	(100)	(300)
5. STORAGE	Misc Compressor	100	100	100	300	1,050	800	1,850	433	388	425	1,246	333	288	325	946
5. STORAGE	Misc Meas and Reg	250	250	500	1,000	500	500	1,000	-	-	-	-	(250)	(250)	(500)	(1,000)
5. STORAGE	Misc Wells	100	250	250	600	775	1,166	1,941	-	-	-	-	(100)	(250)	(250)	(600)
5. STORAGE	MOC C of A				-			-	3,000	-	-	3,000	3,000	-	-	3,000
5. STORAGE	Observation Wells				-			-	1,850	2,450	1,600	5,900	1,850	2,450	1,600	5,900
5. STORAGE	OEB Hearing and Observation Wells	3,500	3,500		7,000			-	-	-	-	-	(3,500)	(3,500)	-	(7,000)
5. STORAGE	Pipe Spec Standard (Engineering standards in place)	100	100	100	300			-	100	100	100	300	-	-	-	-
5. STORAGE	Pipeline Integrity Records				-			-	150	-	-	150	150	-	-	150
5. STORAGE	Plant Roadways and Culverts		50	50	100			-	-	-	-	-	-	(50)	(50)	(100)
5. STORAGE	Press Test/log/wellhead & fence replace	1,825	1,150	1,300	4,275			-	-	-	-	-	(1,825)	(1,150)	(1,300)	(4,275)
5. STORAGE	Remote Operations Control	600			600			-	350	-	-	350	(250)	-	-	(250)
5. STORAGE	Replacement Lines to Horizontal Wells			1,000	1,000	2,000	3,000	5,000	-	-	-	-	-	-	(1,000)	(1,000)
5. STORAGE	Road Purchase (Tecumseh Road)				-	1,250	500	1,750	-	-	-	-	-	-	-	-
5. STORAGE	Roads	70	75	80	225			-	-	-	-	-	(70)	(75)	(80)	(225)
5. STORAGE	SCADA Upgrade and Automation	50	50	50	150			-	-	-	-	-	(50)	(50)	(50)	(150)
5. STORAGE	Tecumseh New Building ORM	9,000	2,000		11,000			-	-	-	-	-	(9,000)	(2,000)	-	(11,000)
5. STORAGE	Warehouse / Layout Change				-			-	-	150	-	150	-	150	-	150
5. STORAGE	Warehouse retrofit/Johnson barn abandonment		500		500			-	-	-	-	-	-	(500)	-	(500)
5. STORAGE	Well Acid Program				-			-	300	-	325	625	300	-	325	625
5. STORAGE	Well Casing Replacement	678	698	720	2,096			-	2,530	4,800	5,760	13,090	(678)	(698)	(720)	(2,096)
5. STORAGE	Well Integrity				-			-	-	-	-	-	2,530	4,800	5,760	13,090
5. STORAGE	Well Loops	555	390	690	1,635			-	-	-	-	-	(555)	(390)	(690)	(1,635)
5. STORAGE	Wellhead Emergency Shutdown				-			-	125	125	-	250	125	125	-	250
5. STORAGE	Wellhead ESD	125	125		250			-	-	-	-	-	(125)	(125)	-	(250)
6. GENERAL PLANT	Building Improvements	3,475	1,550	1,600	6,625	1,725	1,725	3,450	5,090	2,600	2,910	10,600	1,615	1,050	1,310	3,975
6. GENERAL PLANT	Community events requirements - vehicles, vehicle wrapping, BBQ's, tents,				-			-	25	25	25	75	25	25	25	75
6. GENERAL PLANT	Convert Vacated Meter Shop space at VPC into 200 offices				-			-	-	2,100	-	2,100	-	2,100	-	2,100
6. GENERAL PLANT	Fleet	7,800	7,800	7,800	23,400	7,800	7,800	15,600	5,300	5,300	5,300	15,900	(2,500)	(2,500)	(2,500)	(7,500)
6. GENERAL PLANT	Fleet Garage Relocation to a New Leased Property				-			-	-	3,000	-	3,000	-	3,000	-	3,000
6. GENERAL PLANT	Meter Shop Relocation to Markland Leased Property				-			-	3,000	-	-	3,000	3,000	-	-	3,000
6. GENERAL PLANT	Natural Gas Transportation - Customer Compressor	7,612	7,712	7,814	23,137	5,306	5,412	10,718	2,000	2,100	2,202	6,301	(5,612)	(5,612)	(5,612)	(16,836)
6. GENERAL PLANT	Natural Gas Transportation - Rental Cylinder	69	71	73	213	75	77	152	69	71	73	213	-	-	-	-
6. GENERAL PLANT	Natural Gas Transportation - Rental VRA's	1,412	1,415	1,418	4,245	1,421	1,426	2,847	1,412	1,415	1,418	4,245	-	-	-	-
6. GENERAL PLANT	Natural Gas Transportation - Utility Compressor	105	107	110	322	112	114	226	105	107	110	322	-	-	-	-
6. GENERAL PLANT	Natural Gas Transportation - Utility Fleet Cylinders	51	103	105	259	107	109	216	51	103	105	259	-	-	-	-
6. GENERAL PLANT	Natural Gas Transportation - Utility Fleet Vehicles	458	468	479	1,405	489	500	989	458	468	479	1,405	-	-	-	-
6. GENERAL PLANT	New Office / Conference / Space Alterations	3,315	3,870	2,830	10,015	2,850	2,850	5,700	4,830	3,520	3,860	12,210	1,515	(350)	1,030	2,195
6. GENERAL PLANT	Office Furniture and Equipment	3,630	6,380	5,130	15,140	3,905	8,905	12,810	4,630	4,680	4,380	13,690	1,000	(1,700)	(750)	(1,450)
6. GENERAL PLANT	Tools and Work Equipment	125	125	125	375	125	125	250	125	125	125	375	-	-	-	-

Witnesses: J. Sanders
P. Squires

		Review 1- Jan 18th							Review 6 - Final Capital				Changes Review 6 vs. Review 1			
PLANT DETAIL	PROGRAM DETAIL	F2014	F2015	F2016	Sum 14-16	F2017	F2018	Sum 17-18	F2014	F2015	F2016	Sum 14-16	F2014	F2015	F2016	Sum 14-16
7. IT	Altra GMS / SCADA / GOMS	300	300	300	900	300		300	300	300	300	900	-	-	-	-
7. IT	Capital & OM Analytics Upgr				-			-	200	400	400	1,000	200	400	400	1,000
7. IT	CIS	4,800	4,800	6,800	16,400	4,800	4,800	9,600	6,800	4,800	6,800	18,400	2,000	-	-	2,000
7. IT	Clarity	-	-	-	-	300		300				-	-	-	-	-
7. IT	COMMS	500	1,000	1,000	2,500	500	200	700	300	600	600	1,500	(200)	(400)	(400)	(1,000)
7. IT	Customer Care Improvement Initiative							-	6,500	4,000	1,000	11,500	6,500	4,000	1,000	11,500
7. IT	Data Centre Operations	2,900	3,000	1,400	7,300			-	2,100	2,100	2,600	6,800	(800)	(900)	1,200	(500)
7. IT	Datapak / Viewer	200	-	-	200			-	200	-	-	200	-	-	-	-
7. IT	DSM DARTs	-	-	-	-	500	1,500	2,000				-	-	-	-	-
7. IT	EDMS	200	-	-	200			-	200	-	-	200	-	-	-	-
7. IT	EHS	100	-	100	200		100	100	100	-	100	200	-	-	-	-
7. IT	eInvoice	100	100	100	300	100	100	200	100	100	100	300	-	-	-	-
7. IT	eLMS	200	-	-	200			-	200	-	-	200	-	-	-	-
7. IT	EnMAR	100	100	100	300	2,000		2,000	100	100	100	300	-	-	-	-
7. IT	Enterprise GIS	500	500	500	1,500	200	200	400	500	500	500	1,500	-	-	-	-
7. IT	EnTRAC	-	2,000	2,000	4,000	2,000	200	2,200	-	2,000	2,000	4,000	-	-	-	-
7. IT	ESM / SRM	400	400	1,000	1,800	600	400	1,000	400	400	1,000	1,800	-	-	-	-
7. IT	Extranet	1,000	1,500	1,000	3,500	1,000	1,000	2,000				-	(1,000)	(1,500)	(1,000)	(3,500)
7. IT	Gas Molecule	1,000	300	200	1,500			-	1,000	300	200	1,500	-	-	-	-
7. IT	Gas Storage	800	300	300	1,400			-				-	(800)	(300)	(300)	(1,400)
7. IT	Gas Storage - GIS	1,000	200	200	1,400			-	1,000	200	200	1,400	-	-	-	-
7. IT	Information & Productivity Services	3,000	6,000	3,800	12,800	5,500	4,000	9,500	3,000	6,000	3,800	12,800	-	-	-	-
7. IT	Integrated Training Environment	200	-	-	200			-	200	-	-	200	-	-	-	-
7. IT	IT Risk Management	400	700	900	2,000			-	400	400	900	1,700	-	(300)	-	(300)
7. IT	IT Service Management/ Desktop Replaceme	2,100	2,300	4,300	8,700	6,450	12,350	18,800	2,100	2,600	4,300	9,000	-	300	-	300
7. IT	Lakeside Services GPS				-			-	150	100	150	400	150	100	150	400
7. IT	MVRS	900	300	-	1,200	300		300	900	300		1,200	-	-	-	-
7. IT	Network Services	400	900	900	2,200			-	400	900	400	1,700	-	-	(500)	(500)
7. IT	Orm Facilities Integrity SW				-			-	200	100		300	200	100	-	300
7. IT	Orm IDP IVE Continuation Project				-			-	200	200	50	450	200	200	50	450
7. IT	Orm Knowledge Management				-			-	1,100	500	200	1,800	1,100	500	200	1,800
7. IT	Orm Leak Survey Mgt Sys Repl				-			-	350	100	100	550	350	100	100	550
7. IT	ORMs Projects	2,000	1,000	500	3,500			-				-	(2,000)	(1,000)	(500)	(3,500)
7. IT	RAVE	300	200	200	700	100	100	200	300	200	200	700	-	-	-	-
7. IT	Risk Management	900	300	100	1,300			-	-	-	-	-	(900)	(300)	(100)	(1,300)
7. IT	Sustainment	-	-	1,500	1,500	1,500	1,500	3,000	-	-	1,500	1,500	-	-	-	-
7. IT	WAMS (Post Implementation Enhancements	-	-	-	-	5,000	3,000	8,000				-	-	-	-	-
8. DLC	Allocations	88,691	88,343	91,313	268,347	93,389	95,515	188,904	103,656	98,274	93,001	294,930	14,965	9,931	1,688	26,583
9. AG	Allocations	36,523	37,072	37,664	111,259	38,000	38,000	76,000	35,500	36,440	37,140	109,080	(1,023)	(632)	(524)	(2,179)
9. IDC	Allocations	7,435	8,981	9,825	26,241	8,000	8,000	16,000	7,800	7,251	6,999	22,050	365	(1,730)	(2,826)	(4,191)
Summary Total		476,262	523,568	518,419	1,518,249	547,719	583,669	1,131,388	443,825	446,627	441,877	1,332,329	(32,437)	(76,941)	(76,542)	(185,920)

Witnesses: J. Sanders
P. Squires

SEC INTERROGATORY #92

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/1/1, p. 23] Please provide all financial analyses that showed capital and O&M cost interaction, and describe what actions were taken to modify the budget as a result of each of these analyses.

RESPONSE

The financial analysis performed as part of the capital budget process included several types of financial review. Capital and O&M cost interaction was one type, where applicable. Other forms of financial analysis performed were:

- Historical Trends: Historical trends were performed for those programs which had a few years of prior service operations such as non-project specific Relocations, non-project specific Reinforcements, Customer Growth, Department Labour Costs, and overall Information Technology and Facilities and General Plant spending amounts. The review process benchmarked prior year spending with proposed future year spending.
- Unit Rates: Unit rates where applicable were analyzed and the buildup of the rates was examined. For example, the capital costs to add new customers were reviewed and the overall cost per customer unit costs were held at 2013 levels with a marginal increase for inflation.

On O&M and Capital cost interaction, the AMP replacements (capital) and related leak survey (O&M) are an example where the cost interaction was considered. The O&M

Witnesses: S. Kancharla
J. Sanders
P. Squires

costs associated with repairing leaking AMP fittings are expected to decline in the long term as the asset is removed and replaced.

Another example of how O&M and Capital cost interaction was considered was in EGD's plans to conduct a study on its vintage steel mains ("Coated Steel Study and Remediation Program," outlined in the EGD Asset Plan, Exhibit B2, Tab 10, Schedule 1, p. 75), to determine where to proactively replace segments of these mains prior to failure. The capital investment in the study and replacement of priority steel mains will offset eventual O&M costs related to emergency response after a leak or failure, in addition to reducing risk.

The capital and O&M cost interaction analyses did not always result in explicit reductions to the 2014 to 2018 budgets, as many of the anticipated reductions in O&M are expected to occur over the longer term. The prospect of O&M budget reductions was weighed and considered as only one criterion among the many considered as part of the overall capital budget review process outlined at Exhibit B2, Tab 1, Schedule 1, pages 21 to 24.

Witnesses: S. Kancharla
J. Sanders
P. Squires

SEC INTERROGATORY #93

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/1/1, pp. 24, 27, 28] "Through the rigour of the Capital Budget Process, more than \$180 million was removed from the originally submitted "Bottom Up" grassroots budgets." With respect to this claim:

- a. Please provide a list of all the amounts removed making up this \$180 million.
- b. Please identify which of the amounts related to each year of the capital budget.
- c. For each year from 2007 through 2012, please provide the percentage difference between the initial capital budget requests of all departments, and the final capital budget approved by the Company.
- d. Please confirm that \$116 million of the \$180 million is the variable spend on system integrity, referred to on page 27. Please confirm that, if the Company determines to spend all or part of that \$116 million during the IRM period, it will seek to include that additional amount in rate base on rebasing, or at some earlier time.
- e. Please confirm that some or all of the \$180 million is made up of the \$160 million of variable spend other than system integrity, referred to on page 28. interaction, and describe what actions were taken to modify the budget as a result of each of these analyses.

Witnesses: J. Sanders
P. Squires

RESPONSE

- a) Please see the response to SEC Interrogatory #91 at Exhibit I.B18.EGDI.SEC.91
- b) Please see the response to SEC Interrogatory #91 at Exhibit I.B18.EGDI.SEC.91
- c) The Company does not retain or keep the preliminary versions of historical capital budgets. The final budgets for 2007 through 2012 are shown in Table 1 below.

Table 1 : 2007-2012 Capital Budget Expenditures					
(\$M)					
Budget 2007	Budget 2008	Budget 2009	Budget 2010	Budget 2011	Budget 2012
318.0	401.3	325.5	327.0	403.3	404.5

- d) The \$116M relates to variable or uncertain spend which was not included in the final budget (Review 5). The Company would seek rate base recovery of any variable (unbudgeted) spend at re-basing in 2019.
- e) The listing of reductions from the initial budget that total \$185M (Table 2 in I.B18.EGDI.SEC.91) is not the same listing as the variable amounts \$164M as shown below. A reduction from Review 1 (\$185M) does not translate directly to a variable cost item in the final capital review. Table 2 on the next page shows the details of the variable items which have been excluded from the final capital budgets for 2014 to 2016.

Table 2					
<u>Listing of Variable or Uncertain Projects/programs Excluded from the Final Capital</u>					
((\$Ks))					
EXH REF	EXHIBIT DESCRIPTION	V2014	V2015	V2016	Sum 14-1
B2-3-1	Sombra Redundancy	2,000		17,850	19,850
B2-5-2-1	Plastic Mains (Incl Services) Study	-	11,143	10,925	22,068
B2-5-2-2	COMPR COUPLING PRGM		1,061	1,041	2,102
B2-5-2-3	LOAD SHED PLANNING		1,194	1,170	2,364
B2-5-2-4	MOP VERIFICATION	5,304	4,881	4,786	14,971
B2-5-2-5	ILI AND ASSESSMENT PRGM	6,200	6,450	6,324	18,974
B2-5-2-7	MAINS REPL LT \$2M		467	458	925
B2-5-3-2	AMP FITTING REPL	-	13,814	13,694	27,508
B2-5-3-3	Failure of Bonnet Bolts on Valves Study		212		212
B2-5-3-5	SVC REPL LT \$2M	2,254	5,147	5,254	12,655
B2-5-4-3	COMM IND LOW PRESSURE REG STN	1,530	2,387	2,341	6,258
B2-5-4-5	STN REPL LT \$2M		3,979	3,901	7,880
B2-5-6	Load Research Prgm	548	572	560	1,680
B2-6-1	STORAGE OVERVIEW	275	25	375	675
B2-6-1	MCC#1 Generator and Boiler	500			500
B2-6-1	meter boxes	179	186	182	547
B2-6-1	Misc Structures	50	100	100	250
B2-6-1	Engine Compressor Analyzer Automatic	50	50	50	150
B2-6-1	Misc. Wells	50	125	125	300
B2-6-1	Misc Field Lines	50	50	50	150
B2-6-1	Misc. Meas and Reg	50	200	100	350
B2-6-1	Roads	50	50	50	150
B2-6-1	Crowland Plant Automation	20	20	20	60
B2-6-1	SCADA Upgrade and Automation	20	20	20	60
B2-6-1	Farm Purchase (C of A)		100		100
B2-6-1	DSA Boundary changes (purchase leases)			750	750
B2-6-1	Horizontal Well replacement program		5,000		5,000
B2-6-1	High Deliverability Well Erosion		35		35
B2-6-1	Plant Roadways and Culverts		50		50
B2-6-1	Replacement Lines to Horizontal Wells		500		500
B2-6-1-3	WELL INTEGRITY PRGM			400	400
B2-7-1	BUS DEV & CUST STRATEGY	2,612	2,612	2,612	7,836
B2-8-1-7	IT PROJ LT \$2M	900	100	300	1,300
B2-9-1	FAC/GENL PL OVERVIEW	2,500	2,500	2,500	7,500
Grand Total		25,142	63,030	75,938	164,110

Witnesses: J. Sanders
P. Squires

SEC INTERROGATORY #94

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/1/1, p. 30] Please advise what steps the Applicant took to reduce capital spending in “business as usual” areas in order to accommodate higher capital spending requirements in other areas, such as reinforcements

RESPONSE

The Company went through a detailed process of prioritizing capital spending including “business as usual” and is accepting increased risk to accommodate capital requirements in a number of areas including reinforcements. As described on pages 30 to 32 of the Capital Budget Overview evidence at, Exhibit B2, Tab 1, Schedule 1, the process involved the categorization of “firm” vs. “variable” costs. Variable costs contained elements of uncertainty or were dependent on study outcomes or outcomes of prior year’s progress. As shown on Table 8 of Exhibit B2, Tab 1, Schedule 1, the variable costs total \$164 Million which was not included in the final budget. The Company expects that it will have to accommodate some of the variable costs and accepts the risk that it will not be able manage these within the requested Capital Budget envelope.

Witnesses: P. Squires
S. Kancharla

SEC INTERROGATORY #95

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/1/1, p. 30] Please provide the calculations of the percentages in para. 88.

RESPONSE

Please see Table 1 below which illustrates the decreased capital compared to Review 1 and the respective percentages.

Table 1 - Calculation of Decreased Capital versus Review 1						
(\$Thousands)						
			Col 1	Col 2	Col 3	Col 4
Line Number	Review Iteration	Review Date	Forecast 2014	Forecast 2015	Forecast 2016	Total
1	Review 1 Total	18-Jan	476,262	523,568	518,419	1,518,249
2	Review 2 Total	15-Feb	485,010	570,313	553,820	1,609,143
3	Review 3 Total	22-Mar	435,739	420,039	411,591	1,267,369
4	Review 4 Total	2-Apr	445,509	459,964	452,251	1,357,724
5	Review 5 Total	18-Apr	468,627	461,631	458,054	1,388,312
6	Review 6 Total	21-May	443,825	446,627	441,877	1,332,329
	Calculations:					
7	Total Decrease from Review 1 (line 6 less line 1)		(32,437)	(76,941)	(76,542)	(185,920)
8	Percentage Decrease (line 7 divided by line 1)		-6.8%	-14.7%	-14.8%	-12.2%

Witness: J. Sanders

SEC INTERROGATORY #96

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/1/1, p. 33] Please advise, with respect to the “existing FTE numbers” claim:

- a. This claim excludes the GTA and Ottawa reinforcements, and WAMS.
- b. For each case in which a department sought an FTE increase for the purpose of meeting the capital plan, and that increase was denied, what solution was found to allow the work to proceed (e.g. outsourcing, RCAM, increased overtime, etc.).

RESPONSE

- a. Table 4 at Exhibit D1, Tab 3, Schedule 1, page 14 represents the Company's FTE levels. This would include FTE requirements for GTA Reinforcement and WAMS. Ottawa Reinforcement is expected to be completed in 2014 and therefore no increased FTE is required.
- b. As described in paragraphs 21 and 93 of the Capital Overview at Exhibit B2, Tab1, Schedule 1, the Company has resolved to maintain its overall FTE level flat through the 2014 to 2016 period. The capitalized departmental labour costs relate to back office type functions such as planning, drafting, pipeline inspection, field operations and records management within the Operations and Engineering departments. The Company expects to deliver its Core Capital spending without adding additional

Witnesses: J. Sanders
P. Squires

departmental labour costs by finding additional operational efficiencies. As indicated in Paragraph 95 of Exhibit B2, Tab 1, Schedule 1, where additional FTEs are needed to accomplish work the costs will be accommodated in other parts of the Capital Budget. While specific examples of how the Company will manage FTEs to meet the capital plan are not yet available, the Company is committed to accomplishing this through additional efficiencies and redeployment of resources.

Witnesses: J. Sanders
P. Squires

SEC INTERROGATORY #97

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/8/1, p. 3] Please identify the costs included in Allowed Revenues for each of 2014 through 2018 relating to a) Envision, and b) WAMS (including related O&M). For each year in which revenue requirement is proposed to include the old and the new system, please explain why this is appropriate.

RESPONSE

The amounts contained within the Allowed Revenue for 2014 to 2018 for WAMS and Envision are shown within the attached Appendices A and B. The Company's evidence at Exhibit B2, Tab 8, Schedule 2, explains the necessity of WAMS in relation to the services previously provided by Accenture Business Services from April 2003 to April 2014 and to be further provided until the implementation of WAMs in December 2015.

Accenture provided work and asset management services within the Envision asset management program, which supported and contributed to EGD's construction, maintenance and service activities. As supported and approved by the Board within previous rate proceedings the result was that some of those costs were capitalized within mains asset categories along with the derived benefits from Envision all of which are included and being recovered within EGD's 2013 Board Approved revenue at existing rates as shown within Line 21 in Appendix B.

Within previously approved rates and within currently requested Allowed Revenue amounts, all available tax deductions in relation to the Envision program have been

Witnesses: T. Adespido
B. Misra

passed through rates to ratepayers in advance of the longer period of recovery of the costs capitalized which underpin those tax deductions. It follows that EGD should recover Allowed Revenues associated with capitalized amounts which permitted advanced tax deductions and benefits already received by ratepayers as previously anticipated by parties and approved by the Board.

As the necessity of the WAMS system is explained within the evidence noted previously, it is evident and reasonable that the associated costs of the new system are also properly recoverable.

Witnesses: T. Adespido
B. Misra

ALLOWED REVENUE
WAMS (2014 - 2018 Cap. Structure)

(\$000's)						
Line No.		2014	2015	2016	2017	2018
Cost of capital						
1.	Rate base	0.0	2,439.6	61,052.5	60,736.1	53,672.9
2.	Required rate of return	<u>6.76%</u>	<u>6.90%</u>	<u>7.02%</u>	<u>7.04%</u>	<u>7.10%</u>
3.	Cost of capital	0.0	168.3	4,285.9	4,275.8	3,810.8
Cost of service						
4.	Gas costs	-	-	-	-	-
5.	Operation and Maintenance	-	-	4,100.0	4,227.9	4,359.8
6.	Depreciation and amortization	-	-	6,358.3	7,063.2	7,063.2
7.	Municipal and other taxes	-	-	-	-	-
8.	Cost of service	-	-	10,458.3	11,291.1	11,423.0
Misc. & Non-Op. Rev						
9.	Other operating revenue	-	-	-	-	-
10.	Other income	-	-	-	-	-
11.	Misc. & Non-operating Rev.	-	-	-	-	-
Income taxes on earnings						
12.	Excluding tax shield	-	(6,459.1)	(9,581.0)	(3,377.2)	(1,476.4)
13.	Tax shield provided by interest expense	-	<u>(21.5)</u>	<u>(533.9)</u>	<u>(531.1)</u>	<u>(472.2)</u>
14.	Income taxes on earnings	-	(6,480.6)	(10,114.9)	(3,908.3)	(1,948.6)
Taxes on (def) / suff.						
15.	Gross (def.) / suff.	0.0	8,588.0	(6,296.3)	(15,865.7)	(18,073.5)
16.	Net (def.) / suff.	<u>0.0</u>	<u>6,312.2</u>	<u>(4,627.8)</u>	<u>(11,661.3)</u>	<u>(13,284.0)</u>
17.	Taxes on (def.) / suff.	0.0	(2,275.8)	1,668.5	4,204.4	4,789.5
18.	Allowed Revenue	0.0	(8,588.1)	6,297.8	15,863.0	18,074.7
Revenue at existing Rates						
19.	Gas sales	0.0	0.0	0.0	0.0	0.0
20.	Transportation service	0.0	0.0	0.0	0.0	0.0
21.	Transmission, compression and storage	0.0	0.0	0.0	0.0	0.0
22.	Rounding adjustment	<u>0.0</u>	<u>(0.1)</u>	<u>1.5</u>	<u>(2.7)</u>	<u>1.2</u>
23.	Revenue at existing rates	0.0	(0.1)	1.5	(2.7)	1.2
24.	Gross revenue (def.) / suff.	<u>0.0</u>	<u>8,588.0</u>	<u>(6,296.3)</u>	<u>(15,865.7)</u>	<u>(18,073.5)</u>

ALLOWED REVENUE
Envision (2014 - 2018 Cap. Structure)

(\$000's)						
Line No.		2014	2015	2016	2017	2018
Cost of capital						
1.	Rate base	112,807.0	114,708.0	112,334.0	105,899.6	99,465.2
2.	Required rate of return	<u>6.76%</u>	<u>6.90%</u>	<u>7.02%</u>	<u>7.04%</u>	<u>7.10%</u>
3.	Cost of capital	7,625.8	7,914.9	7,885.8	7,455.3	7,062.0
Cost of service						
4.	Gas costs	-	-	-	-	-
5.	Operation and Maintenance	888.9	888.9	-	-	-
6.	Depreciation and amortization	5,937.8	6,260.2	6,434.4	6,434.4	6,434.4
7.	Municipal and other taxes	-	-	-	-	-
8.	Cost of service	<u>6,826.7</u>	<u>7,149.1</u>	<u>6,434.4</u>	<u>6,434.4</u>	<u>6,434.4</u>
Misc. & Non-Op. Rev						
9.	Other operating revenue	-	-	-	-	-
10.	Other income	-	-	-	-	-
11.	Misc. & Non-operating Rev.	-	-	-	-	-
Income taxes on earnings						
12.	Excluding tax shield	2,026.2	1,867.2	3,162.8	4,222.8	4,222.8
13.	Tax shield provided by interest expense	<u>(1,001.4)</u>	<u>(1,009.2)</u>	<u>(982.4)</u>	<u>(926.1)</u>	<u>(875.1)</u>
14.	Income taxes on earnings	1,024.8	858.0	2,180.4	3,296.7	3,347.7
Taxes on (def) / suff.						
15.	Gross (def.) / suff.	629.3	15.6	(764.2)	(1,700.1)	(1,231.4)
16.	Net (def.) / suff.	<u>462.5</u>	<u>11.5</u>	<u>(561.7)</u>	<u>(1,249.6)</u>	<u>(905.1)</u>
17.	Taxes on (def.) / suff.	(166.8)	(4.1)	202.5	450.5	326.3
18.	Allowed Revenue	15,310.5	15,917.9	16,703.1	17,636.9	17,170.4
Revenue at existing Rates						
19.	Revenue at existing rates	15,935.2	15,935.2	15,935.2	15,935.2	15,935.2
20.	Rounding adjustment	<u>4.6</u>	<u>(1.7)</u>	<u>3.7</u>	<u>1.6</u>	<u>3.8</u>
21.	Revenue at existing rates	15,939.8	15,933.5	15,938.9	15,936.8	15,939.0
22.	Gross revenue (def.) / suff.	<u>629.3</u>	<u>15.6</u>	<u>(764.2)</u>	<u>(1,700.1)</u>	<u>(1,231.4)</u>

SEC INTERROGATORY #98

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/8/1, Attach 1, p. 1, 3] Please provide details of any annual maintenance fees paid to SAP or any other service provider with respect to the CIS system. Please explain how the “regular system upgrades” and “enhancement packs and repairs” referred to differ from the software modifications included in the annual maintenance fees.

RESPONSE

1. The details of the annual maintenance fees are as follows:

<u>Maintenance 2013</u>	<u>(Estimated) Maintenance 2014</u>
\$2,643,846.05	\$2,696,722.97

The annual maintenance fees are part of O&M cost budget and were settled as part of the September 2, 2011 Customer Care/CIS Settlement Agreement (EB-2011-0226). Annual maintenance refers to changes that arise from the software vendor, SAP, based on industry best practices. SAP supplies regular updates to maintenance paying customers such as Enbridge Gas Distribution.

The updates described above have to then be implemented into the CIS production system. This implementation is referred to as an “Upgrade”. Due to the scale of changes brought about by an Upgrade and the complex nature of the SAP solution, the Upgrade implementation involves extensive testing, business impact analysis,

Witnesses: T. Adesipo
B. Misra

re-training, custom code reviews and a tightly managed three-day production shutdown/startup.

Regular system Upgrades help to keep the CIS SAP software compatible with current versions, enhance productivity via performance improvements, maintain systems integrity, and also help to reduce the customizations through the use of new functionality provided by the core SAP software.

Enhancements and repairs are specific to the customer. These address Enbridge's specific business needs and support objectives to improve productivity, safety and reliability (e.g. meter replacements) and meet regulatory requirements (e.g. QRAM).

Witnesses: T. Adesipo
B. Misra

SEC INTERROGATORY #99

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/8/1, Attach 1, p. 2] Please confirm that the Applicant did not spend money on CIS upgrades during IRM, but proposes to start upgrades once back on cost of service.

RESPONSE

The Company can confirm that it did not spend money on CIS upgrades during the 2008 through 2012 IRM period. Enbridge's CIS was put in Service in Q3 of 2009 and during the remainder of the first Incentive Regulation period Enbridge was involved in the stabilization of the CIS technology and related business processes. The Stabilization period prevented Enbridge from performing upgrades during the first 3 years. While the SAP software itself has not yet been upgraded Enbridge has implemented over 3,000 changes to its CIS at a total cost of \$13.4 Million since it was implemented in 2009. These changes have increased the usability of the system and addressed new requirements such as the Board's Customer Service Rules.

The Company completed the first phase of the CIS upgrade project in 2013 which entailed the replacement of the CIS hardware platform at a cost of \$3.5 Million. Further, as noted in the September 2, 2011 Customer Care/CIS Settlement Agreement (EB-2011-0226); there was a clear expectation that CIS upgrades would be required over the term of the Company's next IR period. The parties to the Settlement Agreement acknowledged that as the system aged enhancements to it would be required. Therefore the Settlement Agreement specified that a \$50 Million threshold

Witnesses: T. Adesipo
S. McGill
B. Misra

with respect to such costs would need to be exceeded before the Company would be required to seek further approvals for spending with respect to its CIS over the course of the period ending in 2018.

To maintain the CIS system at a current SAP version, Enbridge will be moving to a two year upgrade cycle as was contemplated during the software implementation during this next IR term. In preparation for this ongoing upgrade cycle, work commenced in 2013 to build an extensive set of testing scripts to cover all areas of the CIS system which will be available for future upgrades. In conjunction with this the SAP software has already been upgraded in the first of EGD's test environments to enable training and impact analysis work related to the software upgrade to be completed in 2013. This initial work was foundational for the complete CIS Software upgrade project to be executed in 2014.

Witnesses: T. Adesipo
S. McGill
B. Misra

SEC INTERROGATORY #100

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/8/1. Attach 2, p. 1] Please provide details of all failures of EnTRAC within the last three years.

RESPONSE

The details of all the EnTRAC failures for the years 2010, 2011, 2012 and YTD Oct 2013 are attached. Below is the summary of the EnTRAC failures for this time period.

Failures by Year Production Batch Job				
2010	2011	2012	YTD Oct 2013	Total of failures
89	67	59	40	255
Batch Job = 71 Other = 18	Batch Job 51 Other = 16	Batch Job = 43 Other = 16	Batch Job = 32 Other = 8	

Batch Job Failure - EnTRAC has an automated nightly job stream that consists of about 75 batch jobs. Each batch job processes data and when one of these jobs fails it is called a batch job failure. This batch job failure needs to be resolved by EnTRAC Support and then rerun to a successful conclusion. Below are 3 examples of batch jobs and their business impacts:

- Batch Job - Contract updates to the billing system (CIS) – The EnTRAC application provides critical information to the downstream billing system named

Witnesses: T. Adesipo
B. Misra

CIS. The contract information sent by EnTRAC determines what price individual customers of Enbridge Gas Distribution are billed for their gas supply commodity charges on their monthly bills. If the contract updates are not sent to the billing system, then the Mass Market Customers or Large Volume Customers may not be billed correctly.

- Batch Job – Deliveries – Each Gas Vendor must arrange for daily Delivery of gas for each of their pools of customers. The customers then consume the gas that is delivered on a daily basis. If the Gas Deliveries file is not loaded (or a Vendor does not deliver gas), but the customers consumes gas, then the EnTRAC system will automatically generate non-compliance charges/penalties for the overrun of gas and apply them to the Vendor.
- Consumer Notification Letters – When a customer has a request to change their gas supplier, a letter is generated and mailed out to inform the customer of their new gas supplier (Vendor) and also the date on which the change of gas supplier will take effect. This applies if EGD (System Gas) is their current gas supplier and they want their gas supply provided by a gas Vendor. This is still the case if their current gas Supplier is a Vendor and they want to revert back to having EGD (System Gas) be the gas supplier. If the Xerox Printer system is offline then Consumer Notification Letters will not be printed and mailed out to the customer.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
1/3/2010	Engine	Delivery Manager	RETURN_MESSAGE=ORA-01403: no data found RETURN CODE=100 100 ORA-01403: no data found ent_delivery_mgr_pkg.run_delivery_manager_prc 100 ORA-01403: no data found ent_delivery_mgr_pkg.allocate_delivery_prc 100 ORA-01403: no data found Exception occurred while calculating MDV at delivery area ent_comp_mgr_pkg.get_mdv_delivery_area_prc	The job failed because a pool have been terminated, however it still has a future expiry date of Dec 31, 2011. A data patch was applied to set pool term expiry date to end date of one day less than commencement date. To troubleshoot the bad data a data patch was first applied to turn on DB login and then a rerun of the job (and expected subsequent failure) showed the first bad pool.
1/4/2010	Interface	P2P to ENTRAC	Summary: PENTRAC-840703-ALL (GIMLI @PROD-ENTRAC) failed with status code 1 Description: PENTRAC-840703-ALL (GIMLI @PROD-ENTRAC) failed with status code 1 SYSDOUT: + cd /prod/apps/EntRAC/jobs/scripts/ + ent_P2PtoENTRAC.drv 04012010 PL/SQL procedure successfully completed. RETURN_MESSAGE=Some of the files for the Day which were recieved before SPM are still not de-crypted RETURN CODE=-20043	Ran the query and found there are 666 files that need to be decrypted around 8:30PM. Asked Production Services to order up a new job PENTRAC-840703-ALL for run date Jan 3, 2010. Once this job has finished, then force PENTRAC-840703-ALL for run date Jan 4, 2010 OK.
1/7/2010	Engine	Charge Uploader	PENTRAC-520604-ALL on GIMLI failed with status code 1. + cd /prod/apps/EntRAC/jobs/scripts/ + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_chargeuploaderengine.drv 07012010 Exception in thread "main" EXCEPTION: com.entbridge.entrac.framework.exceptions.\ SystemException, MESSAGE: MethodName: run ; CAUSE: (java.lang.NullPointerException) at com.entbridge.entrac.business.shared.adjustment.chargeuploader.ChargeUploader.\ rEngine.run(ChargeUploaderEngine.java:634) at com.entbridge.entrac.business.shared.adjustment.chargeuploader.ChargeUploader.\ rEngine.main(ChargeUploaderEngine.java:692) System shutting down. Destroying all components. System shut down complete.	Adrian uploaded 6 files today and chargeuploader engine failed on processing two of them (Req_106369_2010_1_7_2_0_40_256.xml and Req_106369_2010_1_7_2_0_811.xml) since 3 of the adjustments in these two files are applied to three terminated pool. Removed these 2 adjustments from that file Req_106369_2010_1_7_2_0_811.xml and change pool 601658 to HunterPd in file Req_106369_2010_1_7_2_0_40_256.xml. Asked production services to order up a new job and rerun it for run date Jan 7, 2010. Rerun job ended OK. The XMLs exist on Gimli in the directory /prod/apps/EntRAC/tmp/.
1/8/2010	Engine	IRS	PENTRAC-970625-BCD210R8-Y Summary: PENTRAC-970625-BCD210R8-Y (GIMLI @PROD-ENTRAC) Description: PENTRAC-970625-BCD210R8-Y (GIMLI @PROD-ENTRAC) ODATE 10/01/08 The job is missing an in condition: PENTRAC-970625-OK ODATE 10/01/08.	remove in condition PENTRAC-970625-OK ODATE 10/01/08. From Neluri figured what was preventing the job to run. In fact the job has the IN condition it's previous ran OK. The job runs only once a month and this happened to be December 08 last year. It looks like Control-M does not look that far or it is a settings issue. Any way I have added the missing condition and the job ended OK.
1/9/2010	Interface	P2P to ENTRAC	Summary: PENTRAC-840703-ALL (GIMLI @PROD-ENTRAC) failed with status code 1 Description: PENTRAC-840703-ALL (GIMLI @PROD-ENTRAC) failed with status code 1 SYSDOUT: + cd /prod/apps/EntRAC/jobs/scripts/ + ent_P2PtoENTRAC.drv 09012010 PL/SQL procedure successfully completed. RETURN_MESSAGE=Some of the files for the Day which were recieved before SPM are still not de-crypted RETURN CODE=-20043	Ran the query and found there are no unencrypted files. Asked Production Services to rerun the job and it ended OK around 8:40PM

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
1/11/2010	Interface	SAP To ENTRAC Monthly Cnsmptn Trailer	PENTRAC-340861-8CD-Y(APOLLO@PROD-ENTRAC) failed at 23:17 status code - 129 sysout + cd /prod/appl/entrac/scripts/ + ent_SAPToENTRACMonthlyCnsmptnTrailer.drv 20100111120000 prod Trailer Record Mismatch Found - 20100111120000 Mismatch Found	The sap_entrac_monthly_cons_20100112012536.dat is corrupt. The Trailer record indicates that there are 123917 records but there are in fact only 123207 records. Additionally the record at row 89392 is corrupt. Sent high priority ticket HD138900 to SAP team. They regenerated and sent a corrected file. The subsequent run failed (although the Datastage job finished ok) because a duplicate record existed in the ent_if_cnsmptn_log table for the earlier trailer that was received (which was correct) therefore this trailer job was forced ok in Control M. The next job 860 SAP To ENTRAC Monthly Cnsmptn failed because the remaining data file was not named sap_entrac_monthly_cons_detail.dat. The file was renamed and the next run failed because Prod Services started running the job before the I/F was actually reset. The job was simply rerun as the reset had completed and it was successful. (Lesson Learned: Prod Services should wait at least one minute after resetting the failed Datastage job to return the interface. Also we have to rename the Details file as sap_entrac_monthly_cons_detail.dat manually if datastage job fails and we need to force SAP To ENTRAC Monthly Consumption Trailer Job OK)
1/15/2010	Interface	P2P to ENTRAC	RETURN_MESSAGE=Some of the files for the Day which were received before SPM are still not de-crypted RETURN CODE=-20043	Ran the query and found there are 165 files that need to be decrypted around 8:30PM. Asked Production Services to order a new job PENTRAC-840703-ALL for run date Jan 14, 2010. Once this job has finished, then force PENTRAC-840703-ALL for run date Jan 15, 2010 OK.
1/16/2010	Engine	MDV	SYSOUT: + cd /prod/appl/entrac/scripts/ + entrac_mdvenge.drv 16012010 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-12842: Cursor invalidated during parallel execution RETURN CODE=-12842 Application Log: -12842 ORA-12842: Cursor invalidated during parallel execution Input parameters--> calc_date_1 16-JAN-10 v_user_id 66 -12842 ORA-12842: Cursor invalidated during parallel execution Error occurred while processing pool --> pool_id 101189 pool_tm_cnsmcnt_date 01-MAY-10 -12842 ORA-12842: Cursor invalidated during parallel execution Error occurred while processing pool --> pool_id 101189 pool_tm_cnsmcnt_date 01-MAY-10	Told Production services to rerun the job and it finished successfully.
1/19/2010	Engine	STR Validation	cd /prod/appl/entrac/scripts/entrac_strvaldateengine.drv 19012010 1 row updated. Commit complete. BEGIN ent_ebt_validation_pkg.ebt_validation_main_prc(TO_DATE(20100119,'YYYYMMDD'),:ret_code,:ret_message); END; ERROR at line 1: ORA-03113: end-of-file on communication channel select 'RETURN_MESSAGE=' :ret_message from dual ERROR at line 1: ORA-03114: not connected to ORACLE	Rerun the job 2 more times and it finished successfully on 3rd attempt. Talked to Maria and she says that the only fix is to upgrade the DB as there are no 9i patches to resolve.
1/21/2010	Engine	Consumption Exception Processor	PENTRAC-1000627-ALL(GIMU@PROD-ENTRAC) The job failed with code 1. sysout: + cd /prod/appl/entrac/scripts/entrac_ConsumptionExceptionProcessor.drv 21012010 Caused by: Caused by: An irrecoverable stack overflow has occurred. Unexpected Signal : 10 occurred at PC=0x3080 Function name=(N/A) Library=(N/A)	Reran the job. Completed successfully.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
1/27/2010	Engine	Compliance Manager Daily Charges	Start time: 05:48 End time: 06:14 + cd /prod/apps/EnTRAC/jobs/scripts/entrac_complimgdailychgengine.drv 27012010 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01653: unable to extend table ENT_ADMIN.ENT_PL_AGNT_ASCNT_STG by 1024 in tablespace ENT_DATA RETURN CODE=-1653	Creted incident ticket(HD141266) to the DBA's to add more tablespace which was done and the rerun of the job was successful.
2/1/2010	Engine	Charge Uploader	+ cd /prod/apps/EnTRAC/jobs/scripts/entrac_chargesuploaderengine.drv 01022010 Exception in thread "main" EXCEPTION: com.enbridge.entrac.framework.exceptions.\SystemException. MESSAGE: MethodName: run ; CAUSE: (java.lang.NumberFormatException: null) at com.enbridge.entrac.business.shared.adjustment.chargeuploader.ChargeUploade\Engine.run(ChargeUploadeEngine.java:634) at com.enbridge.entrac.business.shared.adjustment.chargeuploader.ChargeUploade\Engine.main(ChargeUploadeEngine.java:692) System shutting down. Destroying all components. System shut down complete. RETURN_MESSAGE=Some of the files for the Day which were recieved before SPM are still not de-crypted RETURN CODE=-20043	Asked Production Services to force it OK to allow the downsteam jobs to run since run date is not the 7th or 8th of the month and I will work on it in the morning. There are 6 adjustments in that file with adjustment type UOG_SUPPLY_CDA_LDVC. Looks like ChargeUploader engine could not handle this kind of adjustment. Asked Adrian to have Susan apply them manually via screens one by one. Applied a data patch to remove an entry in ent_chrg_upld_info and file on Unix. Will ask Nick to create a Remedy to fix the root cause of the problem in ChargeUploader Engine.
2/2/2010	Interface	P2P to ENTRAC	Job PENTRAC-410505-ALL (APOLLO@PROD-ENTRAC) failed with a status code 111.	Ran the query and found there are 447 files that need to be decrypted around 8:28PM. Asked Production Services to order a new job PENTRAC-840703-ALL for run date Feb 1, 2010. Once this job has finished, then force PENTRAC-840703-ALL for run date Feb 2, 2010 OK.
2/3/2010	Interface	AltraToEnTRAC Delivery	Job PENTRAC-410505-ALL (APOLLO@PROD-ENTRAC) failed with a status code 111.	Copied the inbound file AltraToEnTRACDaily20100201.txt to the folder /dev/app/entrac2wrtv/indata on lynx. Ran the job called AltraToEnTRACDeliveryCheckAllRejects on entdev project on lynx using the entstst database. Discovered that 8 rejected txn was created by this job.(invalid supplier mnemonic) Sent email note to Kent Wirth and Edmonion SMS staff requesting update the mnemonic in ENTRAC. SMS staff updated mnemonic and asked production services to rerun the job.
2/4/2010	Interface	P2P to ENTRAC	RETURN_MESSAGE=Some of the files for the Day which were recieved before SPM are still not de-crypted RETURN CODE=-20043	Ran the query and found there are over 130 files that need to be decrypted around 8:30PM. Asked Production Services to order a new job PENTRAC-840703-ALL for run date Feb 1, 2010. Once this job has finished, then force PENTRAC-840703-ALL for run date Feb 3, 2010 OK.
2/25/2010	Engine	I/A Processor	cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_IVAProcessor.drv 25022010 USERID Caused by: Caused by: An irrecoverable stack overflow has occurred. Unexpected Signal : 10 occurred at PC=0x3d80 Function name=(N/A) Library=(N/A) NOTE: We are unable to locate the function name symbol for the error just occurred. Please refer to release documentation for possible reason and solutions. Current Java thread: "main", prio=4 tid=0x00035218 nid=1 lwp_id=3458304 runnable [0x00000000.0x680f1\ ec0] Dynamic libraries: /opt/java1.3/bin/./bin/PA_RISC2.0/native_threads/java text:0x00001000-0x00007384 data:0x00008000-0x000086b8 /opt/java1.3/bin/./jre/lib/PA_RISC2.0/server/libjvm.s text:0x00000000-0x00000000 data:0x00001000-0x00001000 /usr/lib/libpthread.1 text:0x00000000-0x00000000 data:0x00000000-0x00000000 /usr/lib/libm.2 text:0x00000000-0x00000000 data:0x00000000-0x00000000 /usr/lib/librt.2 text:0x00000000-0x00000000 data:0x00000000-0x00000000 /usr/lib/libc1.2 text:0x00000000-0x00000000 data:0x00000000-0x00000000 /usr/lib/libc1.2 text:0x00000000-0x00000000 data:0x00000000-0x00000000 /usr/lib/libCsup.2 text:0x00000000-0x00000000 data:0x00000000-0x00000000 /usr/lib/libc.2 text:0x00000000-0x00000000 data:0x00000000-0x00000000	rerun the job

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
2/26/2010	Engine	Charge Uploader	+ cd /prod/apps/EntRAC/jobs/scripts/entrac_chargesuploaderengine.drv 26022010 Exception in thread "main" EXCEPTION: com.enbridge.entrac.framework.exceptions.\nSystemException, MESSAGE: MethodName: run ; CAUSE: (java.lang.NumberFormatException: null) at com.enbridge.entrac.business.shared.adjustment.chargeuploader.ChargeUploader.\nrEngine.run(ChargeUploaderEngine.java:634) at com.enbridge.entrac.business.shared.adjustment.chargeuploader.ChargeUploader.\nrEngine.main(ChargeUploaderEngine.java:692) System shutting down. Destroying all components. System shut down complete.	Charge Uploader Engine blew up when processing the last file with adjustment type UOG_SUPPLY_CDA_LVDC. Asked Production Services to force it OK to allow the downstream jobs to run and I will prepare a data patch to remove an entry in ent_chrg_upld_info and file on Unix in the morning. Asked Adrian to have Susan apply them manually via screens one by one and not to upload the XML file with adjustment type UOG_SUPPLY_CDA_LVDC until further notice. Applied a data patch and removed the file from Unix on Feb 27
3/1/2010	Engine	Consumption Exception Processor	cd /prod/apps/EntRAC/jobs/scripts/ entrac_ConsumptionExceptionProcessor.drv 01032010 USERID An irrecoverable stack overflow has occurred. Unexpected Signal : 10 occurred at PC=0x3480 Function name=(N/A) Library=(N/A) NOTE: We are unable to locate the function name symbol for the error just occurred. Please refer to release documentation for possible reason and solutions. Job PENTRAC-410505-ALL (APOLLO@PROD-ENTRAC) failed with a status code 111.	Reran the job and it completed successfully.
3/3/2010	Interface	AltraToEntRAC Delivery		Copied the inbound file AltraToEntRACDaily20100301.txt to the folder /dev/app/entrac2dev/indata on lynx. Ran the job called AltraToEntRACDeliveryCheckAllRejects on ent2dev project on lynx using the entstst database. Discovered that 1 rejected txn was created by this job.(invalid supplier mnemonic) Sent email note to Kent Wirth and Edmonton SMS staff requesting update the mnemonic in ENTRAC. SMS staff updated mnemonic and asked production services to rerun the job.
3/3/2010	Interface	P2P To ENTRAC	RETURN_MESSAGE=Some of the files for the Day which were recieved before 5PM are still not de-crypted RETURN CODE=-20043	Ran the query and found there are over 600 files that need to be decrypted around 8:30PM. Asked Production Services to order a new job PENTRAC-840703-ALL for run date Mar 2, 2010. Once this job has finished, then force PENTRAC-840703-ALL for run date Mar 3, 2010 OK.
3/4/2010	Interface	P2P To ENTRAC	RETURN_MESSAGE=Some of the files for the Day which were recieved before 5PM are still not de-crypted RETURN CODE=-20043	Ran the query and found there are over 311 files that need to be decrypted around 8:30PM. Asked Production Services to order a new job PENTRAC-840703-ALL for run date Mar 3, 2010. The job failed as well with the same messages. Ran the query and found there are 204 files that need to be decrypted with run date Mar 2, 2010. Asked Production Services to order a new job PENTRAC-840703-ALL for run date Mar 2, 2010. The job completed successfully. Asked Production Services rerun the job PENTRAC-840703-ALL with run date Mar 3, 2010. The job failed as well with the same messages. There is not much I can do, just asked Production Services to force PENTRAC-840703-ALL for run date Mar 4, 2010 OK.
3/5/2010	Interface	P2P To ENTRAC	RETURN_MESSAGE=Some of the files for the Day which were recieved before 5PM are still not de-crypted RETURN CODE=-20043	Asked Production Services to order a new job PENTRAC-840703-ALL for run date Mar 4, 2010. Once this job has finished, then force PENTRAC-840703-ALL for run date Mar 5, 2010 OK.
3/9/2010	Interface	P2P To ENTRAC	RETURN_MESSAGE=Some of the files for the Day which were recieved before 5PM are still not de-crypted RETURN CODE=-20043	Asked Production Services to order a new job PENTRAC-840703-ALL for run date Mar 8, 2010. Once this job has finished, then force PENTRAC-840703-ALL for run date Mar 9, 2010 OK.
3/10/2010	Interface	P2P To ENTRAC	RETURN_MESSAGE=Some of the files for the Day which were recieved before 5PM are still not de-crypted RETURN CODE=-20043	Asked Production Services to order a new job PENTRAC-840703-ALL for run date Mar 9, 2010. Once this job has finished, then force PENTRAC-840703-ALL for run date Mar 10, 2010 OK.
3/11/2010	Interface	P2P To ENTRAC	RETURN_MESSAGE=Some of the files for the Day which were recieved before 5PM are still not de-crypted RETURN CODE=-20043	Asked Production Services to order a new job PENTRAC-840703-ALL for run date Mar 10, 2010. Once this job has finished, then force PENTRAC-840703-ALL for run date Mar 11, 2010 OK.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
3/12/2010	Interface	P2P To ENTRAC	RETURN_MESSAGE=Some of the files for the Day which were recieved before SPM are still not de-crypted RETURN CODE=-20043	Asked Production Services to order a new job PENTRAC-840703-ALL for run date Mar 10, 2010. Once this job has finished, then force PENTRAC-840703-ALL for run date Mar 11, 2010 OK.
3/13/2010	Interface	P2P To ENTRAC	RETURN_MESSAGE=Some of the files for the Day which were recieved before SPM are still not de-crypted RETURN CODE=-20043	Asked Production Services to order a new job PENTRAC-840703-ALL for run date Mar 12, 2010. Once this job has finished, then force PENTRAC-840703-ALL for run date Mar 13, 2010 OK.
3/14/2010	Interface	P2P To ENTRAC	RETURN_MESSAGE=Some of the files for the Day which were recieved before SPM are still not de-crypted RETURN CODE=-20043	Asked Production Services to order a new job PENTRAC-840703-ALL for run date Mar 13, 2010. Once this job has finished, then force PENTRAC-840703-ALL for run date Mar 14, 2010 OK.
3/15/2010	Interface	SAP To ENTRAC Work Order	cd /prod/app/entrac/Scripts/ ent_SAPToENTRACWorkOrder.drv 20100315120000 prod Output of /prod/app/entrac/Log/SAPToENTRACWorkOrder-20100315120000.log File picked up for processing: sap_entrac_workorder_20100315170026.dat Rejected file prepended: /prod/app/entrac/Rejects/SAPToENTRACWorkOrder_20100315170026.dat 4120000.rejects Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Mon Mar 15 19:00:05 2010- Job ended: -Mon Mar 15 19:01:56 2010- ERROR: Job did not return successfully Rows pushed through reject link (sap_work_orders_rejects_fj: -4619- Rows pushed through reject link (ent_if_error): -4619- (errorID=3329401) ACCOUNT NUMBER NOT FOUND 910000432091 Account does not exist; The account number in the moveout document must exist \n ent_account table. (errorID=3329402) ACCOUNT NUMBER NOT FOUND 910000433351 Account does not exist; The account number in the moveout document must exist \n ent_account table.	DataStage job aborted due to message ORA-01722: invalid number. Bad record number not shown in log file nor Director log. Opened job in DataStage designer, and enabled "Show performance statistics" to show approximate record number causing failure. Designer showed 2548 rows were successfully processed. Discovered record number 2549 contained an extra "<del>" delimiter in txn in the SME2 field. It actually was the 6th chr of a postal code in this free form field. Removed the extra "<del>", and ask Prod Services to copy new fixed file, to back up the reject file, reset Datastage job and rerun the job and it finished successfully.
3/29/2010	Interface	SAP To ENTRAC Monthly Cnsmptn Trailer	PENTRAC-340861-BCD-Y (on APOLLO) (@PROD-ENTRAC) The job failed with status code = 129 on 2010/03/30. See Remedy incident record HD149838. Start time: 00:28 End time: 00:28 + cd /prod/app/entrac/Scripts/ + ent_SAPToENTRACMonthlyCnsmptnTrailer.drv 20100329120000 prod Trailer Record Mismatch Found - 20100329120000 Mismatch Found	sap_entrac_monthly_cons_20100330000408.dat file is corrupt. The Trailer record indicated that there were 118827 records in the file but there were in fact only 116161 records Created a Remedy ticket to request SAPCIS HD149838 to regenerate a new file (HD149840). Asked Production Services to run ENCHG-340861-BCD-Y to change owner from cnprod to entrac. The job failed with return code 111, but it did changed the owner from cnprod to entrac. Ask Production Services to rerun PENTRAC-340861-BCD-Y. The job was simply rerun and it had completed successfully
4/1/2010	Engine	IRR	Summary: PENTRAC-990624-ALL (GIMLI @PROD-ENTRAC) failed with status code 1 Description: PENTRAC-990624-ALL (GIMLI @PROD-ENTRAC) failed with status code 1. SYSOUT: + cd /prod/apps/Entrac/jobs/scripts/ + entrac_invoicereadyengine.drv 01042010 BEGIN ent_irr_gnrtr_pkg.generate_irr_prc(TO_DATE(20100401,'YYYYMMDD')):res_code\ .:res_msg; END; * ERROR at line 1: ORA-01403: no data found ORA-06512: at "ENT_ADMIN.ENT_IRR_GNRTR_PKG", line 219 ORA-06512: at line 1 Exception FATAL ent_irr_gnrtr_pkg.get_stranded_iva_prc 100 ORA-01403: no data found Other Exception FATAL ent_irr_gnrtr_pkg.generate_irr_prc	Turned on DB logging and had Prod Services rerun the job. The logs pointed to an IVA for an account that does not have a PPG with effective date before pool term commencement date for this IVA in ent_acnt_ppg table. account_id 5208407 iva_id 1608176 A data patch LiveRelease_CHG81558 was created to set the status of the IVA to 13(exception) so it can be bypassed. The rerun of the engine was successful. The IRR engine does not handle the scenario described above. Some discussions with the business will have to be done to discuss a possible code change to handle it.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
4/6/2010	Engine	Move Request Contract Setup (CCL-2)	+ cd /prod/apps/EntRAC/jobs/scripts/ + entrac_movestrtctstetupengine.drv 06042010 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-00001: unique constraint (ENT_ADMIN.ENT_ACNT_POOL_TERM_LK1) violated RETURN CODE=-1	Root Cause of the issue was that a account pool term record was created by the timeline engine for an old account in a CCL that was already finalized(Oct31/09). It also had a drop at the same time. First due to a problem is the big query starting near line 7458 in the ent_move_prcsr_pkg.create_cntrct_asctn_prc Big Query produced 3 rows for a new account: ACCOUNT_ID POOL_ID POOL_TERM_CNVMCMINT_DATE EFFECTIVE_DATE EXPIRY_DATE QUASI_ADD_IND MOVE_IN_DATE 5250837 100661 6/1/2009 10/30/2009 5/31/2010 0 10/30/2009 5250837 -1 1/1/1990 11/1/2009 0 10/30/2009 5250837 100661 6/1/2010 6/1/2010 0 10/30/2009 The unique constraint error was produced in the second inserts to ent_acnt_pool_term for the sg accounts. The code was creating the SG record with an Effective Date to "Expiry Date + 1" of the above record in this case 5/31/2010 plus 1 = 6/1/2010. A record already existed in the ent_acnt_pool_term table for the old account with Effective Date of 6/1/2010 select * from ent_acnt_pool_term where account_id = 3179069 and account_pool_term_id = 18789960 ACCOUNT_POOL_TERM_ID ACCOUNT_ID POOL_ID POOL_TERM_CNVMCMINT_DATE EFFECTIVE_DATE EXPIRY_DATE MODIFIED_BY USER_ID MODIFICATION_DATE QUASI_ADD_IND 18789960 3179069 100661 6/1/2010 10/31/2009 64 1/30/2010 7:28:47 PM 0 This record should not have been produced on Jan 30 2010 by the timeline engine because the account was already finalized. The fix was to delete the incorrect record by data patch for the old account in the ent_acnt_pool_term table. The rerun of the CCL2 engine was successful.
4/6/2010	Engine	Charge Uploader	The job failed with status code = 1 on 2010/04/06. See Remedy incident record HD151005. Start time: 23:08 End time: 23:18 + cd /prod/apps/EntRAC/jobs/scripts/entrac_chargesuploaderengine.drv 06042010 Exception in thread "main" EXCEPTION: com.entbridge.entrac.framework.exceptions.SystemException, MESSAGE: MethodName: run; CAUSE: (java.lang.NullPointerException) at com.entbridge.entrac.business.shared.adjustment.chargeuploader.ChargeUploaderEngine.run(ChargeUploaderEngine.java: 634) at com.entbridge.entrac.business.shared.adjustment.chargeuploader.ChargeUploaderEngine.main(ChargeUploaderEngine.java: 692) System shutting down. Destroying all components. System shut down complete.	Charge Uploader Engine blew up. Asked Production Services to force it OK to allow the downstream jobs to run. Spoke to client on April 7 and ask them if they put in any special adjustment because the file is too big to verify. Client told me Terri put in an adjustment with pool_name = 1. I copied the file to my personal directory /home/setoe and removed the record from the file Req_106317_2010_4_6_9_10_238.xml with pool_name = -1 and ask DBA to copy the file to production directory from my personal directory /home/setoe sent the following email to Production Services. 1. Login to Gimli using the "conprd" ID. 2. next to prompt enter cd /prod/apps/EntRAC/tmp and hit enter cp Req_106317_2010_4_6_9_10_238.xml 3. next to prompt, enter Req_106317_2010_4_6_9_10_238_bkup.xml and hit enter 4.cd /home/setoe cp Req_106317_2010_4_6_9_10_238.xml /prod/apps/EntRAC/tmp Step 4 is done by DBA, because Production Services doesn't have the right.
4/10/2010	Other	PBRIO-010001	PBRIO-010001 (APOLLO @ENTRAC-BRIO) failed status code 127 SYSOUT: + cd /prod/app/entrac/Scripts/ + run_DailyReportsTrigger.drv prod + run_DailyReportsTrigger.drv(45); /prod/app/entrac/Scripts/run_DailyReportsTrigger.cmd: not found.	As part of Oracle 10g upgrade project this job now runs from apollo rather than gimli replacement server (mumbai). CMD file was missing. Requested prod services to copy file.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
4/10/2010	Other	Check P2P Errors	PENTRAC-790875-ALL (APOLLO @PROD-ENTRAC) failed with status code 1. SYSDOUT: + cd /prod/app/entrac/scripts/ + ent_CheckP2PErrors.drv 210100410 Errors in ./CheckP2PErrors.sql This Script is used by ent_CheckP2PErrors.drv to check for P2P errors select the_Company, * ERROR at line 10: ORA-06550: line 10, column 1: PL/SQL: ORA-00942: table or view does not exist	db connection string in sql needed to be changed from @entractop2p.cgc-enbridge.com to @entractop2p-egd-enbridge.com Corrected and requested prod services to copy the file called "CheckP2PErrors.sql" from apollo folder /home/tuinmane/oracle to apollo folder /prod/app/entrac/Scripts and then rerun the failed job.
4/11/2010	Engine	Charge Uploader	PENTRAC-520604-ALL (MADRID @MUMBAI-PROD-ENTRAC) failed with status code 1. SYSDOUT: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_chargesuploaderengine.drv 11042010 Exception in thread "main" java.lang.NoClassDefFoundError: com/enbridge/entrac/business/shared/adjustment/ChargeUploader/ChargeUploaderEngine	Maria changed permissions of folder /u01/app/oracle/product/j2ee_prodent50/j2ee/ to 755 on mumbai. Job was rerun and completed successfully.
4/11/2010	Engine	IVA Processor	PENTRAC-2020630-ALL (MADRID @MUMBAI-PROD-ENTRAC) failed with status code 1. SYSDOUT: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_IVAProcessor.drv 11042010 USERID Exception in thread "main" java.lang.NoClassDefFoundError: com/enbridge/entrac/business/cr/iva/IVAProcessor	Maria changed permissions of folder /u01/app/oracle/product/j2ee_prodent50/j2ee/ to 755 on mumbai. Job was rerun and completed successfully.
4/11/2010	Engine	Consumption Exception	PENTRAC-1000627-ALL (MADRID @MUMBAI-PROD-ENTRAC) failed with status code 1. SYSDOUT: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_ConsumptionExceptionProcessor.drv 11042010 USERID Exception in thread "main" java.lang.NoClassDefFoundError: com/enbridge/entrac/business/shared/ce/ConsumptionExceptionEngine	Maria changed permissions of folder /u01/app/oracle/product/j2ee_prodent50/j2ee/ to 755 on mumbai. Job was rerun and completed successfully.
4/21/2010	Engine	IVA Processor	PENTRAC-2020630-ALL (MADRID @MUMBAI-PROD-ENTRAC) failed with status code 1. SYSDOUT: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_IVAProcessor.drv 21042010 USERID Exception in thread "main" java.lang.NoClassDefFoundError: com/enbridge/entrac/business/cr/iva/IVAProcessor	Michael changed permissions of folder /u01/app/oracle/product/j2ee_prodent50/j2ee/ to 755 on mumbai. Job was rerun and completed successfully.
4/21/2010	Engine	Consumption Exception	PENTRAC-1000627-ALL (MADRID @MUMBAI-PROD-ENTRAC) failed with status code 1. SYSDOUT: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_ConsumptionExceptionProcessor.drv 21042010 USERID Exception in thread "main" java.lang.NoClassDefFoundError: com/enbridge/entrac/business/shared/ce/ConsumptionExceptionEngine	Michael changed permissions of folder /u01/app/oracle/product/j2ee_prodent50/j2ee/ to 755 on mumbai. Job was rerun and completed successfully.
4/21/2010	Engine	Consumer Notification	PENTRAC-150125-ALL (MADRID @MUMBAI-PROD-ENTRAC) The job failed with code 1. SYSDOUT: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_ConsumerNotificationengine.drv 21042010 Exception in thread "main" java.lang.NoClassDefFoundError: com/enbridge/entrac/business/cr/iva/IVAProcessor	Michael changed permissions of folder /u01/app/oracle/product/j2ee_prodent50/j2ee/ to 755 on mumbai. Job was rerun and completed successfully.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
4/30/2010	Engine	IWA Processor	PENTRAC-2020630-ALL (MADID @MUMBAI-PROD-ENTRAC) failed with status code - 1 <pre> sysout - + cd /prod/apps/entrac/objs/scripts/ + entrac_IWAProcessor.drv 30042010 USERID Apr 30, 2010 8:00:02 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Apr 30, 2010 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Apr 30, 2010 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Apr 30, 2010 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Apr 30, 2010 8:00:03 PM java.util.jar.Attributes read java.lang.StackOverflowError at java.lang.reflect.Method.equals(Method.java:169) at org.sape.carbon.core.component.proxy.DefaultComponentProxyInvocationHandler.handleInvoke(DefaultComponentProxyInvocationHandler.java:316) at org.sape.carbon.core.util.reflection.GenericProxy.invoke(GenericProxy.java:104) at \$Proxy19.getComponentName(Unknown Source) at org.sape.carbon.core.component.lifecycle.DefaultLifecycleInterceptor.getComponentName(DefaultLifecycleInterceptor.java:848) + cd /prod/app/entrac/Scripts/ + run_MonthlyReportsTrigger1.drv prod Wrong number of parameters. Usage env ENV: Environment to execute the job in. Possible values are [dev], [wrty] or [\ prod]. </pre>	Rerun job
5/1/2010	Other	EnTRAC Monthly Reports	<pre> + cd /prod/app/entrac/Scripts/ + run_MonthlyReportsTrigger1.drv prod Wrong number of parameters. Usage env ENV: Environment to execute the job in. Possible values are [dev], [wrty] or [\ prod]. </pre>	run_MonthlyReportsTrigger1.cmd was wrong. Ask production services to copy run_MonthlyReportsTrigger1.cmd from /home/jiangj which was original from CVS to /prod/app/entrac/Scripts using entrac and rerun the job
5/3/2010	Other	EnTRAC Monthly Billing Cycle Reports	<pre> + cd /prod/app/entrac/Scripts/ + run_BillingCycleReportsTrigger.drv prod run_BillingCycleReportsTrigger.drv[27]: *M*: not found. run_BillingCycleReportsTrigger.drv[29]: Syntax error at line 29 : 'if' is not matched. </pre>	The run_BillingCycleReportsTrigger.drv had bad end of line characters "M" at the end of each line. This was the first run of these monthly reports since 10g migration. The bad end of line characters were manually removed from the .drv file, the new version was copied to Scripts directory and the rerun was successful.
5/15/2010	Interface	FILEWATCH-ALTRA-DAILY	Summary: FILEWATCH-ALTRA-DAILY ODATE 5/16 (APOLLO @PROD-ENTRAC) failed status Description: FILEWATCH-ALTRA-DAILY ODATE 5/16 (APOLLO @PROD-ENTRAC) failed status	sent email to EOS Support to regenerate the file for May 16.
5/15/2010	Other	Consumer Notification Letters Archive and Print	Summary: PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC) failed with status code 1 Description: PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC) failed with status code 1. SYSDOUT: <pre> + cd /prod/app/entrac/Scripts/ + ent.EnTRACToXeroxCN.drv 20100515120000 prod /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/log/FTPCNLETTER-20100515120000.log </pre>	sent ticket to UNIX team to bring up the server. From David Ord: Just checked the IP and it's a printer in the VPC Xerox office so possibly they have not restarted operations as of yet. Forced the job OK, sent file to Xerox for printing on Monday. Monday May 17. Sent this email to P.S.to resend letters to Xerox. Please order a new job PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC), remove all in and out condition and run it with run date May 15 2010. Sent an email to Greg to inform him of the problem on the weekend.
5/16/2010	Interface	ENCHG-410505-ALL	Summary: ENCHG-410505-ALL (APOLLO@PROD-ENTRAC) FAILED WITH STATUS CODE 1 Description: ENCHG-410505-ALL (APOLLO@PROD-ENTRAC) failed with status code 1. SYSDOUT: <pre> + cd /prod/app/entrac/Indata/ + chmod 640 AltraToEnTRACDaily20100514.txt chmod: can't change AltraToEnTRACDaily20100514.txt: Not owner + chown entrac:entrac AltraToEnTRACDaily20100514.txt AltraToEnTRACDaily20100514.txt: Not owner </pre>	Confirmed the ownership of the file is "entrac", and the permissions are 755. Unsure how file obtained this ownership and permissions. The problem could be job has failed once because there is no file, I asked EOS to send me another file. I have to detach the file from my email and saved in my personal directory and copied to production directory by Production Services. This could caused the problem I have now. Asked Prod Services to Force OK failed job.
5/16/2010	Other	Consumer Notification Letters Archive and Print	<pre> + cd /prod/app/entrac/Scripts/ + ent.EnTRACToXeroxCN.drv 20100516120000 prod /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/log/FTPCNLETTER-20100516120000.log </pre>	Forced the job OK, sent file to Xerox for printing on Monday. Sent this email to P.S.to resend letters to Xerox. Monday May 17. Please order a new job PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC), remove all in and out condition and run it with run date May 16 2010. Sent an email to Greg to inform him of the problem on the weekend.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
5/22/2010	Other	Consumer Notification Letters Archive and Print	The job failed with status code 1. End time 21:31 Sysout: + cd /prod/app/entrac/Scripts/ + ent_EnTRACToXeroxCN.drv 20100522120000 prod /usr/local/bin/lpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/lpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20100522120000.log	Xerox print queue seems to be unavailable. Confirmed this by logging into apollo server using my ID and executed the following print command from "/usr/local/bin/" folder: lpr -H 192.168.253.124 -P GDAR_letters -N "C"(media=letter)" /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20100522.pdf This job can easily be rerun on Monday, after we confirm print queue is available. As a result forced OK this job.
5/23/2010	Other	Consumer Notification Letters Archive and Print	The job failed with status code 1; End time 20:55 Sysout: + cd /prod/app/entrac/Scripts/ + ent_EnTRACToXeroxCN.drv 20100523120000 prod /usr/local/bin/lpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/lpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20100523120000.log	same as yesterday
5/24/2010	Other	Consumer Notification Letters Archive and Print	The job failed with status code = 1 on 201005/24. See Remedy incident record HD158461. Start time: 21:14 End time: 21:14 + cd /prod/app/entrac/Scripts/ + ent_EnTRACToXeroxCN.drv 20100524120000 prod /usr/local/bin/lpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/lpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20100524120000.log	same as yesterday
5/31/2010	Interface	PENTRAC-080863-ALL	+ cd /prod/app/entrac/Scripts/ + ent_SAPToEnTRACAccount.drv 20100531120000 prod Output of /prod/app/entrac/Log/SAPToEnTRACAccount-20100531120000.log File picked up for processing: sap_entrac_account_20100531171924.dat Rejected file prepended: /prod/app/entrac/Rejects/SAPToEnTRACAccount_201005301120000.rejects Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Mon May 31 19:06:25 2010- Job ended: -Mon May 31 19:06:28 2010- ERROR: Job did not return successfully Rows pushed through reject link (ent_if_error): -0-	from Eric! goofed modifying the May 30 reject file. Rather than editing the May 30 reject file directly I had to obtain the reject txns from the ent_if_error table. However, I forgot to remove the extra comma delimiter that is inserted into the reject txn in the ent_if_error table. Thus I simply replaced all occurrences of '@' with '@' in the May 30 rejects file. Instruction Eric sent to Production Services: 1) Login to Apollo using "entrac" ID 2) Change directory by typing command: cd /prod/app/entrac/Rejects 3) Delete a file by typing command: rm SAPToEnTRACAccount_20100531120000.rejects 4) copy new file by typing command: cp /home/tuinman/SAPToEnTRACAccount_20100530120000.rejects /prod/app/entrac/Rejects/SAPToEnTRACAccount_20100530120000.rejects 5) Rerun the failed control-m job.
6/3/2010	Interface	AltraToEnTRAC Delivery	Job PENTRAC-410505-ALL (APOLLO@PROD-ENTRAC) failed with a status code 111.	Copied the inbound file AltraToEnTRACDaily20100601.txt to the folder /dev/app/entrac2dev/indata on lynx. Ran the job called AltraToEnTRACDeliveryCheckAllRejects on ent2dev project on lynx using the entcal1 database. Discovered that 1 rejected bn was created by this job (invalid supplier mnemonic) Sent email note to Kent Wirth and Edmonton SMS staff requesting update the mnemonic in EnTRAC. SMS staff updated mnemonic and asked production services to rerun the job.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
6/16/2010	Engine	CCL2	RETURN_MESSAGE=Post move activities failed with error message: ORA-01400: cannot insert NULL into ("ENT_ADMIN"."ENT_DSTRBTN_CONTRACT"."REVENUE_CLASS_ID") OTHER EXCEPTION Ent_Move_Prcsr_Pkg.create_cntrct_ascm_prc	Modified Ent_Move_Prcsr_Pkg and ent_revenue_class_pkg with more debug code. We have found one bad record that needs to be fixed. The ent_revenue_class_pkg.rtrv_rvn_cls_by_date_fn function was returning a Null revenue class which caused a later insert into the ent_dstrbtn_contract table by the CCL2 engine to fail trying to insert the null. Applied an emergency data patch and reran the job successfully. A new account involved in a CCL with an old mass market account, came in from SAP as a LVB account, but it has a Revenue Class(76)-RCID 100031 for a mass market account. The Revenue class was data patched with a LVB appropriate one(70)-RCID: 100029. The logging code added to the RC function is ent_logging_pkg.log_info_prc(v_procedure_name, ent_system_constants_pkg.default_log_info_exit_msg 'account id is ' account_id_i 'curr rev class is ' cur_revenue_class_id_i 'effective date is ' effective_date_j 'returned rev class is ' v_new_revenue_class_id,NULL);
6/26/2010	Other	Consumer Notification Letters Archive and Print	+ cd /prod/app/entrac/Scripts/ + ent_EntRACtoXeroxCN.drv 20100626120000 prod /usr/local/bin/rip: warning: /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20100626.pdf is an empty file /usr/local/bin/rip: error: check_ack: timed out waiting for ACK to our data file contents /usr/local/bin/rip: fatal error: unable to send file '/prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20100626.pdf' to Jpd Output of /prod/app/entrac/Log/FTPONLETTER-20100626120000.log	Forced job OK since the file is empty. Rerun the job on Monday, it still failed. Manisha is looking into the problem to see if Xerox has changed the server configuration.
7/3/2010	Interface	Altra To EnTRAC Delivery	cd /prod/app/entrac/Scripts/ + ent_AltraToEnTRACDelivery.drv 20100703120000 prod Output of /prod/app/entrac/Log/AltraToEnTRACDelivery-20100703120000.log Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Sat Jul 3 09:00:07 2010- Job ended: -Sat Jul 3 09:00:22 2010- ERROR: Job did not return successfully	Copied the inbound file AltraToEnTRACDaily20100701.txt to the folder /dev/app/entrac2dev/indata on lynx. Ran the job called AltraToEnTRACDeliveryCheckAllRejects on ent2dev1 project on lynx using the entcat1 database. Discovered that 3 rejected bn was created by this job (invalid blank supplier mnemonic) Sent email note to Kent Wirth and Edmonton SMS staff requesting update the mnemonic in EnTRAC. SMS staff updated mnemonic and the file was resent and Prod Services successfully reran the job.
7/4/2010	Interface	ENCHG-410505-ALL	PENTRAC-410505-ALL failed on previous day. More than one file sitting in the Indata folder with the same time stamp (because the original file was renamed to backup)	Forced this job OK and sent email to Production Services to remove two file with date stamp 20100701.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
7/13/2010	Engine	Consumption Exception Processor	PENTRAC-1000627-ALL(MADRID@MUMBAI-PROD-ENTRAC) The job failed with code 1. sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_ConsumptionExceptionProcessor.drv 13072010 USERID Jul 13, 2010 8:00:04 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path..... Jul 13, 2010 8:00:04 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Caused by: Caused by: Exception in thread "main" java.lang.StackOverflowError at java.lang.Exception.<init>(Exception.java:43) at org.sape.runtime.exception.<init>(RuntimeException.java:59) at org.sape.runtime.exception.ComponentException.<init>(ComponentException.java:42) at org.apache.log4j.AppenderSkeleton.doAppend(AppenderSkeleton.java:221) at org.apache.log4j.helpers.AppenderAttachableImpl.appendLoopOnAppenders(AppenderAttachableImpl.java:57) at org.apache.log4j.Category.callAppenders(Category.java:187) System shutting down. Destroying all components. System shut down complete. The job failed with code 1. sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_ConsumptionExceptionProcessor.drv 13072010 USERID	Reran the job and it completed successfully.
7/21/2010	Engine	Consumer Notification	Jul 13, 2010 8:00:04 PM java.util.jar.Attributes read Got an exception while generating a PDF. Document processing failure at line 72: "<org.ujac.print.BaseDocumentTag.processEscapeSequences(BaseDocumentTag.java:2039)" at 26: "<^" at org.ujac.print.BaseDocumentTag.processContents(BaseDocumentTag.java:1892)" at org.ujac.print.BaseDocumentTag.addChunk(BaseDocumentTag.java:1816)" at org.ujac.print + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_ConsumerNotificationEngine.drv 21072010 Jul 21, 2010 9:35:39 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Jul 21, 2010 9:35:39 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Jul 21, 2010 9:35:39 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Exception in thread "main" EXCEPTION: com.entrac.entrac.framework.exceptions.1 SystemException. MESSAGE: MethodName: main ; CAUSE: (EXCEPTION: com.entrac.entrac.framework.exceptions.SystemException, MESSAGE: MethodName: readCustomerLetter ; CAUSE: (java.io.IOException: PDF header signature not found.) at com.entrac.entrac.business.cm.consumer.notification.ConsumerNotificationEnl gine.main(ConsumerNotificationEngine.java:848) Caused by: EXCEPTION: com.entrac.entrac.framework.exceptions.SystemException, MESSAGE: MethodName: readCustomerLetter ; CAUSE: (java.io.IOException: PDF header signature not found.) at com.entrac.entrac.business.cm.consumer.notification.ConsumerNotificationEnl gine.readCustomerLetter(ConsumerNotificationEngine.java:450) at com.entrac.entrac.business.cm.consumer.notification.ConsumerNotificationEnl gine.run(ConsumerNotificationEngine.java:163) at com.entrac.entrac.business.cm.consumer.notification.ConsumerNotificationEnl gine.main(ConsumerNotificationEngine.java:839) Caused by: java.io.IOException: PDF header signature not found at com.lowagie.text.pdf.PRTokeniser.checkPDFHeader(Unknown Source)	apply data patch (LiveRelease_HD167632.) to bypass bad letter with backslash in address - update ent_letter from set the empty letter status to 1. rerun job Email from George: The failure message: "MESSAGE: MethodName: readCustomerLetter ; CAUSE: (java.io.IOException: PDF header signature not found.)" There is a proc that returns to the Java code, the letters for the day from the ent_letter table with a letter_status_id of 2- "Not sent". There are 208 letters to be sent tonight. One of them appears to be empty and is probably causing the engine failure. The bad one is: LETTER_ID = 343479 See the screen shot below. I simply clicked on the letter_pdf column in TOAD for all of today's letters and one appears to have zero data length..ie empty which would not have a header as the failure message states. You can data patch the bad one to "Sent" status to bypass and let the engine run and create the rest of the good letters. Update ent_letter Set letter_status_id = 1 where Letter_id = 343479;

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
7/21/2010	Other	Processed STR Materialized View	+ entrac_refresh_ent_processed_str_mv.drv 21072010 BEGIN DBMS_MVIEW_REFRESH(ent_processed_str_mv, atomic_refresh=>false); END; * ERROR at line 1: ORA-01031: insufficient privileges ORA-06512: at "SYS.DBMS_SNAPSHOT", line 2251 ORA-06512: at "SYS.DBMS_SNAPSHOT", line 2457 ORA-06512: at "SYS.DBMS_SNAPSHOT", line 2426 ORA-06512: at line 1	page DBA oncall to set correct privilege. This Mat View is run with ENT_USER id not ENT_ADMIN as other Mat Views use. The following grants were issued in ENTPRODI: GRANT SELECT ON ENT_ADMINENT_PROCESSED_STR_MVW TO ENT_ENGINE_RUN_ROLE; GRANT SELECT ON ENT_ADMINENT_PROCESSED_STR_MVW TO ENT_READONLY_ROLE; GRANT ALTER, DELETE, INSERT, SELECT, UPDATE, ON COMMIT REFRESH, QUERY REWRITE, DEBUG, FLASHBACK ON ENT_ADMINENT_PROCESSED_STR_MVW TO ENT_UPDATE_ROLE;
7/28/2010	Interface	Altra To Entrac Delivery	+ cd /prod/app/entrac/Scripts/ + ent_AltraToEntracDelivery.drv 20100728120000 prod ent_AltraToEntracDelivery.drv[46]: ./environment.drv: not found.	send instruction to Production Services: Please login in apollo with entrac id cd /prod/app/entrac/Scripts run the following command: chmod 777 environment.drv job rerun successfully.
7/28/2010	Engine	STR Validation Implementation	-1422 ORA-01422: exact fetch returns more than requested number of rows Input parameters: ebs_id_1 = 623923821643 account_id_1 = 5325971 effective_date_1 = 01-AUG-10; pool_id_1 = -1 pool_term_start_date_1 = 01-JAN-90 user_id_1 = 513 calc_date_1 = 28-JUL-10 PENTRAC-080863-ALL (APOLLO @PROD-ENTRAC) failed with code 111.	Prepare the data patch to correct the bad data
8/1/2010	Interface	SAP To Entrac Account	SYSDOUT: + cd /prod/app/entrac/Scripts/ + ent_SAPToEntracAccount.drv 20100801120000 prod Output of /prod/app/entrac/Log/SAPToEntracAccount_20100801120000.log File picked up for processing: sap_entrac_account_20100801170928.dat Rejected file prepended: /prod/app/entrac/Rejects/SAPToEntracAccount_2010073111 20000 rejects Job ran: checking for errors Job status: -RUN FAILED (3)- Job started: -Sun Aug 1 19:08:16 2010- Job ended: -Sun Aug 1 19:20:47 2010- ERROR: Job did not return successfully Rows pushed through reject link (ent_if_error): -11594- * There were 11594 errors, but only the first 5 are shown here. See the ent_if_error table for all errors.	Job log file and datastage log do not identify the bad txn or cause of failure. Datastage designer performance stats show that 31907 txns were successfully processed before failure. Txn 31907 was for acct 086561816524. I confirmed that ent_account table was updated for this account on Aug 1. Datastage software seems to have aborted for unknown reason. I did not see any obvious problems with the data beyond txn 31907. Thus, I proceeded to prepare a new input file that excludes all txns up to and including txn 31907. Tested this file in ent2perf test environment using engent1 database. Test Job completed successfully. Requested prod services to copy revised sap_entrac_account_20100801170928.dat file to apollo. Renamed existing files. Job completed successfully.
8/3/2010	Engine	IVA Processor	PENTRAC-2000628-ALL (MADRID@PROD-ENTRAC) + cd /prod/apps/EntTRAC/jobs/scripts/ + entrac_ivaengine.drv 03082010 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-01422: exact fetch returns more than requested number of rows	Turned on DB logging and had Prod Services rerun the job. The logs pointed to an account has incorrect data in ent_acct_pool_term and ent_dsribtn contract which caused this job to fail. account_id 5354283 Three data patch LiveRelease_HD169392 was created to update ent_acct_pool_term and ent_dsribtn_contract
8/3/2010	Engine	IRR	Summary: PENTRAC-990624-ALL (GIMU @PROD-ENTRAC) failed with status code 1 SYSDOUT: + cd /prod/apps/EntTRAC/jobs/scripts/ + entrac_invocaterateradyengine.drv 03082010 BEGIN ent_irr_gnrtr_pkg.generate_irr_prc(to_date('20100803','YYYYMMDD'),res_code,res_msg); END; * ERROR at line 1: ORA-01403: no data found ORA-06512: at "ENT_ADMIN.ENT_IRR_GNRTR_PKG", line 219 ORA-06512: at line 1 Exception FATAL ent_irr_gnrtr_pkg.get_stranded_iva_prc 100 ORA-01403: no data found Other Exception FATAL ent_irr_gnrtr_pkg.generate_irr_prc	Turned on DB logging and had Prod Services rerun the job. The logs pointed to an IVA for an account that does not have a PPG with effective date before pool term commencement date for this IVA in ent_acct_ppg table. account_id 52293565308684,5317223 iva_id 165490,1769044,1770553 Three data patch LiveRelease_HD169566 were created to set the status of the IVA to 13(exception) so it can be bypassed. The rerun of the engine was successful. The IRR engine does not handle the scenario described above. Some discussions with the business will have to be done to discuss a possible code change to handle it.
8/4/2010	Interface	PENTRAC-3050869-ALL (APOLLO @ PROD-ENTRAC)	+ cd /prod/app/entrac/Scripts/ + ent_SAPToEntracIVAPostingHeaderTrailer.drv 20100804120000 prod Output of /prod/app/entrac/Log/SAPToEntracVendorAdjustmentsHdrTr869-20100804120000.log File picked up for processing: sap_entrac_va_post_20100804060258.dat File not processed due to older DateTimestamp	renamed file to a date older than the file processed on Aug. 3, 2010. rerun job.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
8/24/2010	Interface	Altra To ENTRAC Delivery	DataStage Job 171 Phantom 397 Program "JOB.768952934.DT.1404845912.TRANS2": Line 508, COMMON size mismatch in subroutine "DSU.AbortJob". Program "JOB.768952934.DT.1404845912.TRANS2": Line 508, Unable to load file "DSU.AbortJob". Program "JOB.768952934.DT.1404845912.TRANS2": Line 508, Unable to load subroutine. Attempting to Cleanup after ABORT raised in stage AltraToENTRACDelivery...SE DataStage Phantom Aborting with @ABORT.CODE = 3	Copied the inbound file AltraToENTRACDaily20100822.txt to the folder /dev/appl/entracdev/indata on lynx. Ran the job called AltraToENTRACDeliveryCheckAllRejects on ent2dev project on lynx using the entgen1 database. Discovered that 1 rejected txn was created by this job reason: (SUPPLIER_MNEMONIC: NULL) Sent email note to Kent Wirth and Edmonton SMS staff requesting they fix the file and resend. Prod Services reran the CHMOD job and successfully reran the interface job.
9/1/2010	Engine	IRR	PENTRAC-990624-ALL(MADRID@MUMBAI-PROD-ENTRAC) The job failed with status code 1; End time 00:38 Sysout + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_invoicereadyengine.drv 01092010 BEGIN ent_irr_gntr_pkg generate_irr_prc(TO_DATE(20100901,'YYYYMMDD'))::res_code\ ::res_msg); END; * ERROR at line 1: ORA-01422: exact fetch returns more than requested number of rows ORA-06512: at "ENT_ADMIN.ENT_IRR_GNTR_PKG", line 220 ORA-06512: at line 1 RETURN MESSAGE= RETURN CODE=	Confirmed that failure happened in get_stranded_iva_prc. Ran cursor SQL in this proc and obtained 15 accounts. Checked these accounts and confirmed that account 910002668572 has duplicate DC records. Prepared emergency data patch (CHG96345) to assign end date to 1 of the DC records. Job failed again with different reason - no records found. Prepared datapatch to change database logging level from 3 to 1, then requested rerun of job. Two iva txns were causing engine failure. iva_id =1800909, 1818944. Two more data patches applied to update the status of the bns to 13 (exception) since the underlying contract data for these accounts look ok (acnts 910003378926 and 910003338211. Engine rerun completed ok.
9/12/2010	Interface	SAP To ENTRAC Account	PENTRAC-080863-ALL (APOLLO @PROD-ENTRAC) failed with code 111. SYSOUT: + cd /prod/appl/entrac/scripts/ + ent_SAPToENTRACAccount.drv 20100912120000 prod Output of /prod/appl/entrac/Log/SAPToENTRACAccount-20100912120000.log File picked up for processing: sap_entrac_account_20100912170427.dat Rejected file prepended: /prod/appl/entrac/Rejects/SAPToENTRACAccount_2010091111 20000 rejects Job ran: checking for errors Job status: -RUN FAILED (3)- Job started: -Sun Sep 12 19:09:32 2010- Job ended: -Sun Sep 12 19:13:25 2010- ERROR: Job did not return successfully Rows pushed through reject link (ent_if_error): -9098- * There were 9130 errors, but only the first 5 are shown here. See the ent_if_error table for all errors.	Job log file and datstage log do not identify the bad txn or cause of failure. Datstage Director monitor shown 9098 is where the program processing at the time the job failed. I looked at account at row 9098, it doesn't look bad, and I checked a few rows above and below row 9098. James noticed it said Abnormal termination of stage SAPToENTRACAccount.Process, Accountinfo detected. Ask production Services to rerun the job with the original file because do not know which record is bad (should have remove the records rejected already). The job failed again, this time, it shown 9087 records have processed. I looked at 9088, it said row 9088, too many columns in record. This time, I removed 9088 rows from input file and requested prod services to copy revised sap_entrac_account_20100801170928.dat file to apollo. Renamed existing files. Job completed successfully. Requested prod services to copy revised (has to remove the extra rejected records as result of run# 2) SAPToENTRACAccount_20100912180000 rejects file to apollo rejects directory.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
9/20/2010	Interface	SAPToEnTRACMont hlyCnsmptn	Summary: PENTRAC-350860-BCD-Y on APOLLO failed with status code 111. Start time: 23:43 End time: 23:56 + cd /prod/app/entra/Scripts/ + ent_SAPToEnTRACMonthlyCnsmptn.drv 20100920120000 prod Output of /prod/app/entra/Log/SAPToEnTRACMonthlyCnsmptn_SAPMnthlyCnsmptn-2010 0920120000.log Rejected file prepended: /prod/app/entra/Rejects/SAPToEnTRACMonthlyCnsmptn_20 100917120000.rejects Job ran; checking for errors Job status: -RUN FAILED (3)-	Job failed similar to Sept 23, 2009. Modify the environment.drv to set DS_MAX_WARNINGS to 150000 instead of 100000 since there are more than 2000 rejects in the reject file. asked prod services to copy environmentals.drv to scripts directory that sets max warnings to 150000 from the usual 100000. \$ pwd /prod/app/entra/Scripts \$ diff environment.drv ~/environmentals.drv 30c30 < export DS_MAX_WARNINGS=100000 --- > export DS_MAX_WARNINGS=150000 Production Services; Please following the instruction below ASAP 1) Login apollo as entrac 2) Change directory to /prod/app/entra/Scripts by running cd /prod/app/entra/Scripts 3) Backup existing environment.drv file by running mv environment.drv environmentbkup3.drv 4) Copy modified environment.drv file from /home/setoe by running cp /home/jiang/environmentals.drv /prod/app/entra/Scripts/environment.drv 5) Please arrange to reset an EnTRAC DataStage job by following these instructions: Ligon to Apollo Unix server (telnet) using the "conprd" ID Run the job called "DSresetJob" located in the directory /home/conprd/scripts/ When prompted, enter the ProjectName "entracprod"
9/22/2010	Engine	CCL2	PENTRAC-900123-ALL on MUMBAI failed with status code 1. Start time: 01:35 End time: 01:39 + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_movergstntrctsetupengine.drv 22092010 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422	Added more debug statement in CCL2 to identify which account caused the engine failure. Applied the data patch to bypass this account with account id 5404777 by updating the account set up date from 22-Sep-2010 to 21-Sep-2010 on ent_account table and reran this job. It ended OK around 3PM
9/23/2010	Engine	CCL2	Sysout: + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_movergstntrctsetupengine.drv 23092010 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422 Sysout: + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_movergstntrctsetupengine.drv 23092010 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422 Start time: 01:35 End time: 01:39 + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_movergstntrctsetupengine.drv 22092010 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01422: exact fetch returns more than requested number of rows	Added more debug statement in CCL2 to identify which account caused the engine failure. Applied the data patch to bypass this account with account id 5405954 by updating the account set up date from 23-Sep-2010 to 22-Sep-2010 on ent_account table and reran this job. Return ended ok. Root cause was a CCL engine change that was deployed 2 days ago. Change was backed out the next day and Manisha will fix.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
9/27/2010	Other	Consumer Notification Letters Archive and Print	+ ent_EnTRACToXeroxCN.drv 20100927120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20100927.pdf h as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20100927120000.log	Forced the job OK, sent file to Xerox for printing on Tuesday. Sent this email to P.S.to resend letters to Xerox. Tuesday Sept. 28 Please order a new job PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC), remove all in and out condition and run it with run date Sept. 27,2010. Sent an email to Lynne to inform her of the problem on the weekend.
9/28/2010	Other	Consumer Notification Letters Archive and Print	+ ent_EnTRACToXeroxCN.drv 20100928120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20100928.pdf h as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20100928120000.log	Forced the job OK, sent file to Xerox for printing on Wednesday. Sent this email to P.S.to resend letters to Xerox. Wednesday Sept. 29 Please order a new job PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC), remove all in and out condition and run it with run date Sept. 28,2010. Sent an email to Entrac Support to inform her of the problem on the weekend.
9/29/2010	Other	Consumer Notification Letters Archive and Print	+ ent_EnTRACToXeroxCN.drv 20100929120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20100929.pdf h as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20100929120000.log	Forced the job OK, sent file to Xerox for printing on Thursday. Sent this email to P.S.to resend letters to Xerox. Thursday Sept. 30 Please order a new job PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC), remove all in and out condition and run it with run date Sept. 29,2010. Sent an email to Entrac Support to inform them of the problem last night
10/3/2010	Interface	Altra To ENTRAC Delivery	PENTRAC-410505-ALL (APOLLO @PROD-ENTRAC) failed with code 111. SYSOUT: + cd /prod/app/entrac/Scripts/ + ent_AltraToENTRACDelivery.drv 20101003120000 prod Output of /prod/app/entrac/Log/AltraToENTRACDelivery-20101003120000.log	Copied the inbound file AltraToENTRACDaily20101001.txt to the folder /dev/app/entrac2wrt/Indata on lynx Ran the job called AltraToENTRACDeliveryCheckAllRejects on ent2wrt project on lynx using the entward database. Discovered that 1 rejected bn was created by this job (invalid SACI supplier mnemonic) Sent email note to Kent Wirth and Edmonton SMS staff requesting update the mnemonic in ENTRAC. SMS staff resent file and Prod Services successfully reran the job.
10/4/2010	Other	Consumer Notification Letters Archive and Print	+ ent_EnTRACToXeroxCN.drv 20101004120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20101004.pdf h as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20101004120000.log	Forced the job OK, sent file to Xerox for printing on Thursday. Sent this email to P.S.to resend letters to Xerox. Tuesday Oct 5 Please order a new job PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC), remove all in and out condition and run it with run date Oct 4,2010. Sent an email to Entrac Support to inform them of the problem last night
10/7/2010	Interface	SAPToENTRACWork Order	SYSOUT: + cd /prod/app/entrac/Scripts/ + ent_SAPToENTRACWorkOrder.drv 20101007120000 prod Output of /prod/app/entrac/Log/SAPToENTRACWorkOrder-20101007120000_1.log File picked up for processing: ERROR:file not found	Renamed the file with date and time greater than the value in database and reran the failed job. It ended OK around 8:30PM
10/24/2010	Interface	SAPToENTRACWork Order	Sysout: + cd /prod/app/entrac/Scripts/ + ent_SAPToENTRACWorkOrder.drv 20101024120000 prod Output of /prod/app/entrac/Log/SAPToENTRACWorkOrder-20101024120000.log File picked up for processing: sap_entrac_workorder_20101024170037.dat Rejected file prepended: /prod/app/entrac/Rejects/SAPToENTRACWorkOrder_20101024120000-rejects	Datstage Director log shows the following message: Abnormal termination of stage SAPToENTRACWorkOrder.Process_Sap_Work_Orders detected No clear indication of problem. Thus, requested Prod Services to rename Oct 24 rejects file and I renamed the following 2 files: sap_entrac_workorder_20101024170037.dat (to ORIGsap_entrac_workorder_20101024170037.datORIG) sap_entrac_workorder_20101024170037.dat.pre_reject_prepend (to sap_entrac_workorder_20101024170037.dat) Prod services reran job and it completed successfully.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
11/2/2010	Engine	IRR	PENTRAC-990624-ALL (on MUMBAI) (MADRID @MUMBAI-PROD-ENTRAC) The job failed with status code = 1 on 2010/11/03. See Remedy incident record HD184670. Start time: 00:15 End time: 00:16 + cd /prod/apps/ENTRAC/jobs/scripts/ + entrac_invoicereadyengine.drv 02112010 BEGIN ent_irr_gnrtr_pkg.generate_irr_prc(TO_DATE(20101102,'YYYYMMDD'),res_code,res_msg); END; * ERROR at line 1: ORA-01403: no data found ORA-06512: at "ENT_ADMIN.ENT_IRR_GNRTR_PKG", line 220 ORA-06512: at line 1 RETURN MESSAGE=	Turned on DB logging and had Prod Services rerun the job. The logs pointed to an IVA for an account that does not have a PPG with effective date before pool term commencement date for this IVA in ent_acnt_ppg table. account_id 5411717 iva_id 1893274 Data patch LiveRelease_CHG102544 was created to set the status of the IVA to 13(exception) so it can be bypassed. The rerun of the engine was successful. The IRR engine does not handle the scenario described above. Some discussions with the business will have to be done to discuss a possible code change to handle it.
11/3/2010	Interface	Altra To ENTRAC Delivery	ent_AltraToENTRACDelivery.drv PENTRAC-410505-ALL (APOLLO @PROD-ENTRAC) failed status 111 at 9:00 a.m. Description: ent_AltraToENTRACDelivery.drv (APOLLO @PROD-ENTRAC) failed status 111 at 9:00 a.m.	Copied the inbound file AltraToENTRACDaily20101101.txt to the folder /dev/app/entrac2wrt/InData on lynx. Ran the job called AltraToENTRACDeliveryCheckAllRejects on ent2wrt project on lynx using the entward database. Discovered that 2 rejected bn was created by this job.(invalid supplier mnemonics) Sent email note to Kent Wirth and Edmonton SMS staff requesting update the mnemonic in ENTRAC. SMS staff resent file and Prod Services successfully reran the job. It took 2 attempts by SMS to generate a correct file.
11/19/2010	Interface	SAP To ENTRAC Service Provider CHMOD job	ENCHG-1140859-ALL(APOLLO @PROD-ENTRAC) failed + cd /prod/app/entrac/InData/ + chmod 640 sap_entrac_service_provider_*.dat chmod: can't access sap_entrac_service_provider_*.dat + chown entrac-entrac.sap_entrac_service_provider_*.dat sap_entrac_service_provider_*.dat: No such file or directory PENTRAC-070518-ALL(APOLLO @PROD-ENTRAC) failed	SAP had problems tonight with FTP jobs and their FTP job ran without sending the file, which caused our CHMOD job to fail. Sap job was fixed, the file resent and Prod Services reran the job successfully.
11/19/2010	Interface	SAPToENTRACWork Order	The job failed with status code 111.	A modified work order reject file was put into production today, however it had bad data(wrong delimiter). Restored the previous good reject file and copied prepend as the regular data file. The rerun of the job was successful.
11/28/2010	Other	Consumer Notification Letters Archive and Print	The job failed with code 1. sysout: + cd /prod/app/entrac/Scripts/ + ent_ENTRACToXeroxCN.drv 20101128120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20101128.pdf has data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20101128120000.log	Forced the job OK, sent file to Xerox for printing on Monday. Sent this email to P.S.to resend letters to Xerox. Monday Nov 29 Please order a new job PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC), remove all in and out condition and run it with run date Nov 28, 2010.
12/2/2010	Other	Consumer Notification Letters Archive and Print	The job failed with code 1. sysout: + cd /prod/app/entrac/Scripts/ + ent_ENTRACToXeroxCN.drv 20101202120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20101202.pdf has data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20101202120000.log	Forced the job OK, sent file to Xerox for printing on Friday. Sent this email to P.S.to resend letters to Xerox. Friday Dec 3 Please order a new job PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC), remove all in and out condition and run it with run date Dec 2, 2010.
12/2/2010	Engine	CCL2	RETURN_MESSAGE=Post move activities failed with error message: ORA-01400: cannot insert NULL into ("ENT_ADMIN"."ENT_DSTRBTN_CONTRACT": "REVENUE_CLASS_ID")	Engine failed when doing the post move activities for a CCL with new account id 5464756 (account_num 930610031496) and old account id 2758158. This new account is a LVB account from SAP with revenue_class id 100031 (revenue_class_num 76) which is valid only for mass market account. Revenue Class for old account_id 2758158 is 100266 with old_revenue_class_num 14 and revenue_class_num 14 is valid for both mass market account and LVB account. Update the revenue_class_id from 100031 with revenue_class_num 76 to 100004 with revenue_class_num 14 for account_id 5464756 and rerun the engine. CCL2 ended OK around 2:05AM

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
12/3/2010	Interface	Altra To ENTRAC Delivery	ent_AltraToENTRACDelivery.drv PENTRAC-410505-ALL (APOLLO @PROD-ENTRAC) failed status 111 at 9:00 a.m. Description: ent_AltraToENTRACDelivery.drv (APOLLO @PROD-ENTRAC) failed status 111 at 9:00 a.m.	Corrective Action Taken Copied the inbound file AltraToENTRACDaily20101201.txt to the folder /dev/app/entracdev/indata on lynx. Ran the job called AltraToENTRACDeliveryCheckAllRejects on ent2dev project on lynx using the entwar2 database. Discovered that 2 rejected bn was created by this job (invalid supplier mnemonics) Sent email note to Kent Wirth and Edmonton SMS staff requesting update the mnemonic in ENTRAC. SMS staff reset file and Prod Services successfully ran the job. It took 3 attempts by SMS to generate a correct file.
12/5/2010	Other	Consumer Notification Letters Archive and Print	The job failed with code 1. sysout: + cd /prod/app/entrac/Scripts/ + ent_ENTRACToXeroxCN.drv 2010120120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20101202.pdf has data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/log/FTPCNLETTER-2010120120000.log Summary: PENTRAC-350860-BCD-Y on APOLLO job failed with status code 111. Description: PENTRAC-350860-BCD-Y on APOLLO job failed with status code 111.	Forced the job OK, sent file to Xerox for printing on Monday. Sent this email to P.S. to resend letters to Xerox. Monday Dec 6 Please order a new job PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC), remove all in and out condition and run it with run date Dec 5, 2010.
12/13/2010	Interface	SAPToENTRACMonthlyCnsmptn	Summary: PENTRAC-350860-BCD-Y on APOLLO job failed with status code 111. Description: PENTRAC-350860-BCD-Y on APOLLO job failed with status code 111. Start time: 01:34 End time: 01:44 + cd /prod/app/entrac/Scripts/ + ent_SAPToENTRACMonthlyCnsmptn.drv 20101213120000 prod Output of /prod/app/entrac/Log/SAPToENTRACMonthlyCnsmptn_SAPMnthlyCnsmptn-2010\1213120000.log Rejected file prepended: /prod/app/entrac/Rejects/SAPToENTRACMonthlyCnsmptn_20\101210120000.rejects Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: Tue Dec 14 01:34:55 2010- Job ended: Tue Dec 14 01:42:00 2010- ERROR: Job did not return successfully WARNING: Cannot get info on link process_LVB_CIS_Monthly_Consumption.ent_if_err\ or (255) Rows pushed through reject link (ent_if_err): -- (errorID=8286621) SAPToENTRACMonthlyCnsmptn..process_SAP_Monthly_Consumption: The value of the row is: ACCOUNT_NUM = 910003996033 CYCLE BILLING_MONTH = 03 CYC\ LE BILLING_YEAR = 2011 BILLING_CALENDAR_DATE = 20101208 BILLING_CYCLE_DATE = 20\110304 MODIFIED_BY_USER_ID = 195 SAPToENTRACMonthlyCnsmptn..process_SAP_Monthly_Consumption: ORA-01400: cannot insert NULL into ("ENT_ADMIN"."ENT_NO_BILL_CNMSMPTN"."A") CACCOUNT_ID"ISAPToENTRACMonthlyCnsmptn..process_SAP_Monthly_Consumption: DBMS.CODE=ORA-01400 General SQL error: All business validations in the interface were met, but the \ database action failed anyway. Summary: PENTRAC-350860-BCD-Y on APOLLO job failed with status code 111. Description: PENTRAC-350860-BCD-Y on APOLLO job failed with status code 111. Start time: 01:34 End time: 01:44 + cd /prod/app/entrac/Scripts/	Job failed similar to Sept 20, 2010. Got tones of warning. Modify the environment.drv to set DS_MAX_WARNINGS to 300000 instead of 150000. asked prod services to copy environmentals.drv to scripts directory that sets max warnings to 300000 from the usual 150000. \$ pwd /prod/app/entrac/Scripts \$ diff environment.drv ~environmentals.drv 30c30 < export DS_MAX_WARNINGS=150000 --- > export DS_MAX_WARNINGS=300000 sent instruction to Production Services to back up environment.drv file, reject file, reset DataStage etc., The job failed couple times more, then a new message comes up : SAPToENTRACMonthlyCnsmptn..SAP_CONSUMPTION_EXTRACT_F_SAP_Consumpti on_extract_f: read, delimited() - row 525, too many columns in record Found a corrupted record. 0001999999.9100040453784.20110304.20101208.000000000.000000000.BILL.20100700 01999999.910004048870.20110301.20101203.000000000.000000000.BILL.20101019.2 010117.039.001.Y.N. 359, 02.2011.03.2011, 0000000000000.0.600001171932.000000000000.A.20101203, Prepared instructions and sent to Production Services to backup original SAP input file, reject file, reset DataStage file and rerun job. After process 2300 records, the job hung.
				Eric find an error message: ... ds_ipcgetnext() - timeout waiting for mutex Tested the file in LYNX, job completed as expected, asked George Chan for help. George Chan did lots of things in Apollo: re-import DataStage job, clean up, bounced Apollo server.... Rerun job, the job completed successfully.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
1/3/2011	Interface	Altra To ENTRAC Delivery	PENTRAC-410505-ALL (APOLLO @PROD-ENTRAC) failed with code 111. SYSDOUT: + cd /prod/app/entrac/Scripts/ + ent_AltraToENTRACDelivery.drv 20110103120000 prod Output of /prod/app/entrac/Log/AltraToENTRACDelivery-20110103120000.log Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Mon Jan 3 09:00:06 2011- Job ended: -Mon Jan 3 09:00:21 2011- ERROR: Job did not return successfully WARNING: Cannot get info on link Process_Delivery_Data.altra_extract_rejects_f \ (255) Rows pushed through reject link (altra_extract_rejects_f): -- WARNING: Cannot get info on link Process_Delivery_Data.ent_if_error01 (255) Rows pushed through reject link (ent_if_error01): -- Rows pushed through reject link (ent_if_error02): -0-	Copied the inbound file AltraToENTRACDaily20110101.txt to the folder /dev/app/entrac2wrtv/Indata on lynx. Ran the job called AltraToENTRACDeliveryCheckAllRejects on ent2dev project on lynx using the entenv1 database. Discovered that 4 rejected bxn was created by this job. (invalid supplier mnemonics) Sent email note to Kent Wirth and Edmonton SMS staff requesting update the mnemonic in ENTRAC. SMS staff resent file and Prod Services successfully reran the job. The job fail once more. The job failed to to a missing DPA "8997600". Updated the gazefire_dpa.txt with the dpa number, since this is a Gazifire pool. Re-ran the job. Ended OK.
1/7/2011	Other	Consumer Notification Letters Archive and Print	The job failed with code 1. sysout: + cd /prod/app/entrac/Scripts/ + ent_EntRACToXeroxCN.drv 20110107120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20110107.pdf h) as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20110107120000.log	Forced the job OK, sent file to Xerox for printing on Monday. Sent this email to P.S. to resend letters to Xerox. Monday Jan 10 11 Please order a run of the PENTRAC-2120130-ALL job using the order date of Jan 7, 2011. For this run only, delete all conditions for the job as we do not want it to interfere with tonight's regularly scheduled run.
1/10/2011	Other	Consumer Notification Letters Archive and Print	The job failed with code 1. sysout: + cd /prod/app/entrac/Scripts/ + ent_EntRACToXeroxCN.drv 20110110120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20110110.pdf has data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20110110120000.log	Forced the job OK, sent file to Xerox for printing on Tuesday. Sent this email to P.S. to resend letters to Xerox. Please order a run of the PENTRAC-2120130-ALL job using the order date of Jan 10, 2011. For this run only, delete all conditions for the job as we do not want it to interfere with tonight's regularly scheduled run.
1/15/2011	Engine	Move Request Contract Setup (CCL-2)	RETURN MESSAGE=Post move activities failed with error message: ORA-01400: cannot insert NULL into ('ENT_ADMIN','ENT_DISTRBTN_CONTRACT','REVENUE_CLASS_ID')	Engine failed when doing the post move activities for a CCL with new account id 5497217 (account_num 930610027423) and old account id 1940444. This new account is a LVB account from SAP with revenue_class_id 100031 (revenue_class_num 76) which is valid only for mass market account. Revenue Class for old account_id 1940444 is 100266 with old revenue_class_num 14 and revenue_class_num 14 is valid for both mass market account and LVB account. Update the revenue_class_id from 100031 with revenue_class_num 76 to 100004 with revenue_class_num 14 for account_id 5497217 and rerun the engine. IT ended OK around 11:30PM
1/22/2011	Engine	Altra To ENTRAC Delivery	PENTRAC-410505-ALL (APOLLO @PROD-ENTRAC) failed with code 111. SYSDOUT: + cd /prod/app/entrac/Scripts/ + ent_AltraToENTRACDelivery.drv 20110122120000 prod Output of /prod/app/entrac/Log/AltraToENTRACDelivery-20110122120000.log Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Sat Jan 22 09:00:07 2011- Job ended: -Sat Jan 22 09:00:22 2011- ERROR: Job did not return successfully WARNING: Cannot get info on link Process_Delivery_Data.altra_extract_rejects_f \ (255) Rows pushed through reject link (altra_extract_rejects_f): -- WARNING: Cannot get info on link Process_Delivery_Data.ent_if_error01 (255) Rows pushed through reject link (ent_if_error01): -- Rows pushed through reject link (ent_if_error02): -0-	Copied the inbound file AltraToENTRACDaily20110120.txt to the folder /dev/app/entrac2wrtv/Indata on lynx. Ran the job called AltraToENTRACDeliveryCheckAllRejects on ent2dev project on lynx using the entenv1 database. Discovered that 4 rejected bxn was created by this job. (invalid supplier mnemonics) Sent email note to Kent Wirth and Edmonton SMS staff requesting update the mnemonic in ENTRAC. SMS staff resent file and Prod Services successfully reran the job. Ended OK.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken																														
1/23/2011	Interface	SAP To ENTRAC Account	PENTRAC-080863-ALL (APOLLO @PROD-ENTRAC) failed with code 111. SYSDOUT: + cd /prod/appl/entrac/scripts/ + ent_SAPToENTRACAccount.drv 20110123120000 prod Output of /prod/appl/entrac/Log/SAPToENTRACAccount_20110123120000.log File picked up for processing: sap_entrac_account_20110123170703.dat Rejected file prepended: /prod/appl/entrac/Rejects/SAPToENTRACAccount_2011012211 20000.rejects Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Sun Jan 23 19:35:11 2011- Job ended: -Sun Jan 23 19:43:47 2011- ERROR: Job did not return successfully Rows pushed through reject link (ent_if_error): -6207- * There were 6207 errors, but only the first 5 are shown here.	Job log file and database log do not identify the bad txn or cause of failure. Database designer performance stats show that 9519 txns were successfully processed before failure (on the audit link). I don't see any bad records around records 9519. Database software just said Abnormal termination of stage. Thus, I proceeded to export the file out to my C drive and found three records with account number 910004435270 with 2 null columns C and D, and shifted the other columns to the right. I removed these three records and requested prod services to copy/revised sap_entrac_account_20110123170703.dat file to apollo. Renamed existing files. Job rerun completed successfully.																														
1/30/2011	Interface	SAP To ENTRAC Account	PN080863-A@POLLO@PROD-ENTRAC) failed. The job failed with status code 111. End time 19:45 HD199216 SYSDOUT: + cd /prod/appl/entrac/scripts/ + ent_SAPToENTRACAccount.drv 20110130120000 prod Output of /prod/appl/entrac/Log/SAPToENTRACAccount_20110130120000.log File picked up for processing: sap_entrac_account_20110130170702.dat Rejected file prepended: /prod/appl/entrac/Rejects/SAPToENTRACAccount_2011012911 20000.rejects Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Sun Jan 30 19:13:20 2011- Job ended: -Sun Jan 30 19:15:02 2011- ERROR: Job did not return successfully Rows pushed through reject link (ent_if_error): -852-	No apparent reason for job aborting. Last database log message says: Abnormal termination of stage SAPToENTRACAccount.Process_AccountInfo detected Seen this mystery error before. Simple rerun fixed the problem. Renamed the following files, and then request prod services to rerun the job: 1) SAPToENTRACAccount_20110130120000.rejects to SAPToENTRACAccount_20110130120000.rejects.bkup 2) sap_entrac_account_20110130170702.dat to sap_entrac_account_20110130170702.dat.ORG 3) sap_entrac_account_20110130170702.dat.pre_reject_prepend to sap_entrac_account_20110130170702.dat. Rerun completed successfully.																														
2/3/2011	Interface	AltraTo ENTRAC Delivery	+ cd /prod/appl/entrac/scripts/ + ent_AltraToENTRACDelivery.drv 20110203120000 prod Output of /prod/appl/entrac/Log/AltraToENTRACDelivery-20110203120000.log Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Thu Feb 3 09:00:07 2011- Job ended: -Thu Feb 3 09:00:39 2011- ERROR: Job did not return successfully WARNING: Cannot get info on link Process_Delivery_Data.altra_extract_rejects.f \ (255) Rows pushed through reject link (altra_extract_rejects.f): -- WARNING: Cannot get info on link Process_Delivery_Data.ent_if_error01 (255) Rows pushed through reject link (ent_if_error01): -- Rows pushed through reject link (ent_if_error02): -0-	problem records: <table border="1"> <thead> <tr> <th>Pipeline Point</th><th>Supplier</th><th>DPA</th><th>Type</th><th>LVDC</th></tr> </thead> <tbody> <tr> <td>Volume</td><td>Reject Reason</td><td>OTS</td><td>5</td><td>Invalid Supplier</td></tr> <tr> <td>Enbridge EDA</td><td>BLEC</td><td>501086091</td><td>OTS</td><td>5</td></tr> <tr> <td>Enbridge EDA</td><td>SUEN</td><td>8957600</td><td>OTS</td><td>326</td></tr> <tr> <td>Enbridge EDA</td><td>RGPM</td><td>971</td><td>OTSABC</td><td>9</td></tr> <tr> <td></td><td></td><td></td><td>Invalid Supplier</td><td></td></tr> </tbody> </table> The invalid DPA Number record can be ignored because development doesn't have that DPA # in Gazifere_pools file SMS corrected the file and sent us a new file The new file has the incorrect name 'AltraToENTRACDaily20110201.txt' instead of AltraToENTRACDaily20110201.txt caused ENTCHG job failed The new file has been renamed, the ENTCHG job ran successfully and database job has been reset and the job rerun successfully.	Pipeline Point	Supplier	DPA	Type	LVDC	Volume	Reject Reason	OTS	5	Invalid Supplier	Enbridge EDA	BLEC	501086091	OTS	5	Enbridge EDA	SUEN	8957600	OTS	326	Enbridge EDA	RGPM	971	OTSABC	9				Invalid Supplier	
Pipeline Point	Supplier	DPA	Type	LVDC																														
Volume	Reject Reason	OTS	5	Invalid Supplier																														
Enbridge EDA	BLEC	501086091	OTS	5																														
Enbridge EDA	SUEN	8957600	OTS	326																														
Enbridge EDA	RGPM	971	OTSABC	9																														
			Invalid Supplier																															
2/3/2011	Engine	PENTRAC-2000628-ALL(MADRID@MUMBAI-PROD-ENTRAC)	+ cd /prod/apps/EntRAC/jobs/scripts/ + entrac_ivaengine.drv 03022011 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-01403: no data found RETURN CODE=100 Summary: PENTRAC-2000628-ALL(MADRID@MUMBAI-PROD-ENTRAC) failed Description: PENTRAC-2000628-ALL(MADRID@MUMBAI-PROD-ENTRAC) failed The job failed with status code 1. End time 22:36 SYSDOUT: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_ivaengine.drv 03022011 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-01403: no data found RETURN CODE=100	search on the application log for error message: 100 ORA-01403: no data found Actual SLA ID NOT FOUND : source name ent_iva_engine_pkg.iva_validate_prc Turn on debug found iva id 2025243 account id 5446100 belongs to a pool (pool id 103784) is early terminated (1-Jan-2011); can not find an active account sla id. Data patch to set the iva id 2025243's current status id to 13 (exception)																														

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
2/5/2011	Interface	P2P To EnTRAC	RETURN_MESSAGE=Some of the files for the Day which were recieved before 5PM are still not de-crypted RETURN CODE=-20043	Asked Production Services to order a new job PENTRAC-840703-ALL for run date Feb 4, 2011. Once this job has finished, then force PENTRAC-840703-ALL for run date Feb 5, 2011 OK.
2/6/2011	Interface	P2P To EnTRAC	RETURN_MESSAGE=Some of the files for the Day which were recieved before 5PM are still not de-crypted RETURN CODE=-20043	Asked Production Services to order a new job PENTRAC-840703-ALL for run date Feb 5, 2011. This extra run also failed as there were files from the 5th still not de-crypted due to P2P queues being hung. Tried to contact DBA's via Remedy ticket, page and cell phone call but there was no response. Forced Feb 6 OK in control M. The DBA's bounced P2P the morning of Feb 7 and queues are now working. Root cause was omission by DBA's to bounce after server memory upgrade was performed.
2/24/2011	Interface	Altra To EnTRAC Delivery	Summary: ent_AltraToEnTRACDelivery.drv (PENTRAC-410505-ALL) failed status 111 at 9:00 a.m. Description: ent_AltraToEnTRACDelivery.drv (PENTRAC-410505-ALL) failed status 111 at 9:00 a.m. Category: Applications-Business Type: EnTRAC Item: Batch Job Failure Work Log:	run# 1 problem records: Pipeline Point Volume Enbridge CDA Supplier Reject Reason DPA NULL 6135 CDS 619555 null Invalid Supplier run#2 received a new file from SMS Pipeline Point Volume Enbridge CDA Supplier Reject Reason DPA NULL 6135 CDS 619555 null Invalid Contract# The problem is the contract number belongs to a pool which has DPA# 9082 instead of 6135 run#3 received a new file from SMS Pipeline Point Volume Enbridge CDA Supplier Reject Reason DPA NULL 9082 CDS 619555 null Contract number null run#4 received a new file from SMS Pipeline Point Volume Enbridge CDA Supplier Reject Reason DPA NULL 9082 CDS 619555 null This file has all the correct information and datastage job has been reset and the job rerun successfully.
2/25/2011	Engine	STR Validation Implementation	PENTRAC-878127-ALL (MADRID@PROD-ENTRAC) Failed + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_strimplementationengine.drv 25022011 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01403: no data found RETURN CODE=100	The STR Implementation engine failed because it tried to implement a Drop that was in Accepted Pending status with effective date of Mar 1, but the account had been finalized. I created an emergency data patch to set the status of the Drop to Accepted Held so that we could rerun the STR Implementation engine. After the data patch the job was rerun.
2/26/2011	Engine	MDV Engine	PENTRAC-160106-ALL (MADRID@MUMBAI-PROD-ENTRAC) failed The job failed with status code 1; End time 00:11 Sysout + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_mdvenengine.drv 26022011 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422 There were duplicate data - 2 pool termination requests in for pool_id = 104208 in the ENT_PL_TRMNTN_ROST table. Failure in proc: ent_system_util_pkg.is_pl_trmntn_apprvd_fn SELECT pool_id, COUNT(*) FROM ent_pl_trmntn_rgst p where p.trmntn_rgst_status_id = 2 GROUP BY pool_id HAVING COUNT(*) > 1;	Data patch LiveRelease_CHG114080.sql was created to delete one of the pool termination request duplicates. Rerun was successful.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
2/28/2011	Other	Consumer Notification Letters Archive and Print	The job failed with code 1. sysout: + cd /prod/app/entrac/Scripts/ + ent_EnTRACToXeroxCN.drv 20110228120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20110228.pdf h) as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20110228120000.log	Xerox printer offline. Prod Services forced the job OK; will rerun the job next biz day.
3/1/2011	Other	Consumer Notification Letters Archive and Print	The job failed with code 1. sysout: + cd /prod/app/entrac/Scripts/ + ent_EnTRACToXeroxCN.drv 20110228120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20110228.pdf h) as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20110228120000.log	Xerox printer offline. Prod Services forced the job OK; will rerun the job next biz day.
3/1/2011	Engine	ABC Fees Engine	PENTRAC-330610-1ST on MUMBAI failed with status code 1. Start time: 00:41 End time: 00:43 + cd /prod/apps/ENTRAC/jobs/scripts/ + entrac_abchargecalculatorengine.drv 01032011 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-00001: unique constraint (ENT_ADMIN.ENT_ABC_SRVC_CHRG_PK) violated RETURN CODE=-1	Ran the first SQL shown in update_charges_prc to identify pool terms. Examined rows and determined that pool_id=102151 had a row for a future pool term (July 1, 2011) and the count showed 2 rate 1 accounts (910002667503, 910002320411). Examined data further and discovered that these accounts are incorrectly linked to this pool term and they should be linked to pool_id=100189 and pool term commencement date of July 1 2010. Created a data patch to correct the data in ent_acnt_pool_term table for these accounts. The accounts were involved in CCL. Engine rerun successfully after data patch implemented. Implemented a 2nd data patch to revert pool_id to 102151, since both acnts had a pending pool transfer. Inserted the missing records in ent_acnt_pool_term for pool term starting July 1 2011.
3/3/2011	Engine	PENTRAC-2000628-ALL (MADRID - @MUMBAI-PROD-ENTRAC)	PENTRAC-2000628-ALL (MADRID - @MUMBAI-PROD-ENTRAC) failed with code 1. SYSOUT: + cd /prod/apps/ENTRAC/jobs/scripts/ + entrac_ivaengine.drv 03032011 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01403: no data found RETURN CODE=100	Turned on DB logging After turning on debugging for this job, we discovered that one IVA for account 910004447711 was linked to an expired pool term. (iva_id=2057565, ebt_id=623924883749) Data patch set the IVA_STATUS to 13 (exception) in order that the IVA engine will skip this txn. re-ran job; it completed successfully.
3/5/2011	Other	PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC)	+ cd /prod/app/entrac/Scripts/ + ent_EnTRACToXeroxCN.drv 20110305120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20110305.pdf h) as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20110305120000.log	Forced the job OK; sent file to Xerox for printing on Monday. Sent this email to P.S. to resend letters to Xerox. Monday Mar 7 Please order a new job PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC), remove all in and out condition and run it with run date Mar05 Sent an email to Greg to inform him of the problem on the weekend.
3/7/2011	Other	Consumer Notification Letters Archive and Print	The job failed with code 1. sysout: + cd /prod/app/entrac/Scripts/ + ent_EnTRACToXeroxCN.drv 20110307120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20110307.pdf h) as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20110307120000.log	Xerox printer offline. Prod Services forced the job OK; will rerun the job next biz day.
3/8/2011	Other	Consumer Notification Letters Archive and Print	The job failed with status code = 1 on 2011/03/08. As per the documentation the job was forced OK. See Remedy incident record HD205698. Start time: 23:40 End time: 23:41 + cd /prod/app/entrac/Scripts/ + ent_EnTRACToXeroxCN.drv 20110308120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20110308.pdf h) as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20110308120000.log	Sent this email to P.S. to resend letters to Xerox next morning Mar 9.. Wednesday Mar 9 Please order a new job PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC), remove all in and out condition and run it with run date Mar08

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
3/9/2011	Other	Consumer Notification Letters Archive and Print	The job failed with status code = 1 on 2011/03/09. As per the documentation the job was forced OK. See Remedy incident record HD205945. The job failed with code 1. sysout: + cd /prod/app/entrac/scripts/ + ent_ENTRACToXeroxCN.drv 20110309120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20110309.pdf h) as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/log/FTPCNLETTER-20110309120000.log	Sent this email to P.S.to resend letters to Xerox next morning Mar10.. Thursday Mar 10 Please order a new job PENTRAC-2120130-ALL (APOLLO @PROD-ENTRAC), remove all in and out condition and run it with run date Mar09
3/20/2011	Interface	SAP To ENTRAC Account	PENTRAC-080863-ALL(APOLO@PROD-ENTRAC) failed The job failed with status code 111. End time 19:40	No apparent reason for job aborting. Last datstage log message says: Abnormal termination of stage SAPToENTRACAccount.Process_Accountinfo detected Seen this mystery error before. Simple rerun fixed the problem. Renamed the following files, and then request prod services to rerun the job: 1) SAPToENTRACAccount_20110320120000.rejects to SAPToENTRACAccount_20110320120000.rejects.bkup 2) sap_entrac_account_20110320170704.dat to sap_entrac_account_20110320170704.dat.Orig 3) sap_entrac_account_20110320170704.dat.pie reject_prepend to sap_entrac_account_20110320170704.dat. Rerun completed successfully.
3/30/2011	Other	Consumer Notification Letters Archive and Print	The job failed with status code = 1 on 2011/03/30 As per the documentation the job was forced OK. The job failed with code 1. sysout: + cd /prod/app/entrac/scripts/ + ent_ENTRACToXeroxCN.drv 20110330120000 prod PENTRAC-990624-ALL (MADRID @MUMBAI-PROD-ENTRAC) failed with code 1. SYSOUT: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_invoicereadyengine.drv 01042011 BEGIN ent_irr_gnrtr_pkg.generate_irr_prc(TO_DATE(20110401,'YYYYMMDD'),res_code) :res_msg; END; ERROR at line 1: ORA-01403: no data found ORA-06512: at 'ENT_ADMIN.ENT_IRR_GNRTR_PKG', line 220 ORA-06512: at line 1	Sent this email to P.S.to resend letters to Xerox next morning Mar31. Job completed successfully.
4/2/2011	Engine	IRR	PENTRAC-870127-ALL(MADRID@MUMBAI-PROD-ENTRAC) The job failed with code 1. sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_stirmentengine.drv 11042011 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-01403: no data found RETURN CODE=100	Turned on DB logging and had Prod Services rerun the job. The Log indicated Account 5399432 Iva_id 1871641 & Account 5527921 Iva_id 2049254, both with a status of 11 (Posted On Bill) were causing the failure. The status of each account was set to 13 to force the records to be bypassed. The job was re-run, and completed successfully.
4/11/2011	Engine	STR Validation Implementation	PENTRAC-870127-ALL(MADRID@MUMBAI-PROD-ENTRAC) The job failed with code 1. sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_stirmentengine.drv 11042011 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-01403: no data found RETURN CODE=100	The STR Implementation engine failed because it tried to implement a Drop that was in Accepted Pending status with effective date of Mar 1, but the account had been finalized. I created an emergency data patch to set the status of the Drop to Accepted Held so that we could rerun the STR Implementation engine. After the data patch the job was rerun.
6/8/2011	Other	Consumer Notification Letters Archive and Print	The job failed with status code = 1 on 2011/06/08 As per the documentation the job was forced OK. The job failed with code 1.	Sent email to Prod Services the next morning to rerun job to send letters to Xerox. Job completed successfully.
6/28/2011	Engine	STR Validation Implementation	PENTRAC-870127-ALL(MADRID@MUMBAI-PROD-ENTRAC) The job failed with code 1. sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_stirmentengine.drv 27062011 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-01422: exact fetch returns more than requested number of rows App log: -1422 ORA-01422: exact fetch returns more than requested number of rows Input parameters: ebt_id_1 = 62392523 70443;account_id_1 = 5549307;effective_date_1 = 01-JUL-11;	The engine failed because it tried to implement a Drop for an account that had overlapping distribution contract information. A data patch was created to correct the DC information. Rerun of the engine was successful.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
7/1/2011	Engine	ABC Fees Engine	PENTRAC-330610-1ST (MADRID - @MUMBAI-PROD-ENTRAC) failed with code 1. SYSOUT: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_abchargecalculatorengine.drv 01072011 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-00001: unique constraint (ENT_ADMIN.ENT_ABC_SRVC_CHRG_PK) violated RETURN CODE=-1	Ran the first SQL shown in update_charges_prc to identify pool terms. Examined rows and determined that pool_id=101376 had a row for a future pool term (Aug 1, 2011) and the count showed 2 rate 1 accounts (910002760164,910003030421). These two accounts had future pool_term_cmmnt_date of Aug 01 2011 in ent_acnt_pool_term Created a data patch to correct the data in ent_acnt_pool_term table for these accounts. The accounts were involved in CCL. Engine rerun successfully after data patch implemented.
7/3/2011	Interface	Altra To ENTRAC Delivery	cd /prod/app/entrac/scripts/ + ent_AltraToENTRACDelivery.drv 20110703120000 prod Output of /prod/app/entrac/Log/AltraToENTRACDelivery-20110703120000.log Job ran; checking for errors Job status: -RUN FAILED (3) Job started: -Sat Jul 3 09:00:07 2011- Job ended: -Sat Jul 3 09:00:22 2011- ERROR: Job did not return successfully	Copied the inbound file AltraToENTRACDaily20110701.txt to the folder /dev/app/entrac2dev/InData on lynx. Ran the job called AltraToENTRACDeliveryCheckAllRejects on entrac2it project on lynx using the entprod1 database. Discovered that 1 rejected bn was created by this job (invalid "TIDAL MATT" supplier mnemonic) Sent email note to Kent Wirth and Edmonton SMS staff requesting update the mnemonic in ENTRAC. SMS staff informed they have trouble with new version of Excel. Receive information from SMS, deleted the record with invalid mnemonic and the file was corrected and Prod Services successfully reran the job.
7/4/2011	Interface	Altra To ENTRAC Delivery	"* cd /prod/app/entrac/InData/ + chmod 640 AltraToENTRACDaily20110701_ORIG.txt AltraToENTRACDaily20110702.txt chmod: can't change AltraToENTRACDaily20110701_ORIG.txt: Not owner + chown entrac:entrac AltraToENTRACDaily20110701_ORIG.txt AltraToENTRACDaily20110702.txt AltraToENTRACDaily20110701_ORIG.txt: Not owner	sent email to Production Services to force job OK and remove AltraToENTRACDaily20110701_ORIG.txt from /prod/app/entrac/InData/
7/4/2011	Interface	SAP To ENTRAC Daily Consumption	Running more than 4 hours. Job was stopped in order to investigate reason for slow performance. It appears job was hanging in Oracle lookup stage.	Asked DBA to reanalyze the tables used in the query called by DS cleanup the cached info for Oracle Optimizer and Rerun the job
7/6/2011	Engine	CCL2	PENTRAC-900123-ALL (VPC-LX-008@MUMBAI-PROD-ENTRAC) The job failed with code 1. sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_movestgtctstetupengine.drv 06072011 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422	Added more debug statement in CCL2 to identify which account caused the engine failure. Applied the data patch to bypass this account with account id 5629655 by updating the account set up date from 06-Jul-2011 to 05-Jul-2011 on ent_account table and reran this job. The scenario was a CCL. Drop and move whose new account came in with a finalization date which was same as engine run date.
7/10/2011	Engine	CCL2	The job failed with status code 1. End time: 21:32 Sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_movestgtctstetupengine.drv 10072011 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-06502: PL/SQL: numeric or value error RETURN CODE=-6502	the problem was caused by the debug version implement on July 6, retrieve the production code from CVS and deploy to production environment. Apply data patch to change data to original form. The job rerun successfully.
7/17/2011	Other	Consumer Notification Letters Archive and Print	PENTRAC-2120130-ALL (VPC-LX-005@PROD-ENTRAC) failed with code 127. + cd /prod/app/entrac/scripts/ + ent_ENTRACToXeroxCN.drv 20110716120000 prod /prod/app/entrac/OutData/ConsolidatedConsumerNotificationLetter_20110716.pdf h) as data. /ent_ENTRACToXeroxCN.cmd(22): /usr/local/bin/rpr: not found. Output of /prod/app/entrac/Log/FTPCNLETTER-20110716120000.log + cd /prod/app/entrac/scripts/ + ent_AltraToENTRACDelivery.drv 20110719120000 prod Output of /prod/app/entrac/Log/AltraToENTRACDelivery-20110719120000.log Job ran; checking for errors Job status: -RUN FAILED (3) Job started: -Tue Jul 19 09:00:07 2011- Job ended: -Tue Jul 19 09:00:17 2011- ERROR: Job did not return successfully	File missing on Apollo after Datastage 8.5 upgrade. Contacted Julio Gomez for resolution.
7/19/2011	Interface	Altra To ENTRAC Delivery	cd /prod/app/entrac/scripts/ + ent_AltraToENTRACDelivery.drv 20110719120000 prod Output of /prod/app/entrac/Log/AltraToENTRACDelivery-20110719120000.log Job ran; checking for errors Job status: -RUN FAILED (3) Job started: -Tue Jul 19 09:00:07 2011- Job ended: -Tue Jul 19 09:00:17 2011- ERROR: Job did not return successfully	Copied the inbound file AltraToENTRACDaily20110717.txt to the folder /dev/app/entrac2dev/InData on lynx. Ran the job called AltraToENTRACDeliveryCheckAllRejects on entrac2it project on lynx using the entprod1 database. Discovered that 1 rejected bn was created by this job (missing supplier mnemonic) Sent email note to Kent Wirth and Edmonton SMS staff requesting correction of file.Prod Services successfully reran the job.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
7/26/2011	Engine	Consumption Exception Processor	+ cd /prod/apps/EntRAC/jobs/scripts/ + entrac_ConsumptionExceptionProcessor.drv 25072011 USERID Jul 25, 2011 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Jul 25, 2011 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path..... Caused by: Exception in thread "main" java.lang.StackOverflowError at java.lang.Exception.<init>(Exception.java:41) at java.lang.RuntimeException.<init>(RuntimeException.java:43)..... + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_movestrcnsetupengine.drv 03082011 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01403: no data found RETURN CODE=100	Reran the job and it completed successfully.
8/3/2011	Engine	CCL2	+ cd /prod/apps/EntRAC/jobs/scripts/ + entrac_movestrcnsetupengine.drv 03082011 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01403: no data found RETURN CODE=100	Turned on logging level 1 to determine cause of failure. The proc that failed was: ent_move_prcs_pkg.create_cntrd_asch_prc After engine rerun again, the ent_application_log table showed the problem was related to acnt 910005348662 (acnt id 5647617). This acnt had 2 outstanding CCL bns in ent_move_info_sgt table. Applied emergency data patch to change the ent_account.acnt_setup_Date from Aug 3 2011 to Aug 2 2011. The engine was rerun successfully.
8/7/2011	Other	Consumer Notification Letters Archive and Print	+ ent_EntRACtoXeroxCN.drv 20110807120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20110807.pdf h) as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20110807120000.log	Sent email to Prod Services the next morning to rerun job to send letters to Xerox. Job completed successfully.
8/12/2011	Engine	Consumption Exception Processor	PENTRAC-1000627-ALL(VPC-LX-008@MUMBAI-PROD-ENTRAC) failed The job failed with status code 1. End time 20:00 at org.sape.carbon.core.component.ComponentException.<init>(ComponentException.java:42) at org.sape.carbon.core.component.lifecycle.LifecycleException.<init>(LifecycleException.java:39) at org.sape.carbon.core.component.lifecycle.ComponentUnavailableException.<init>(ComponentUnavailableException.java:40) at org.sape.carbon.core.component.lifecycle.DefaultLifecycleInterceptor.invoke(DefaultLifecycleInterceptor.java:95) at org.sape.carbon.core.component.proxy.DefaultComponentProxyInvocationHandler.handleInvoke(DefaultComponentProxyInvocationHandler.java:345) at org.sape.carbon.core.util.reflection.GenericProxy.invoke(GenericProxy.java:3)	Reran the job and it completed successfully.
8/15/2011	Engine	XML Request Processor	BEGIN ent_xml_rqst_prcs_pkg.xml_rqst_prc_main_prc(TO_DATE(20110815,'YYYYMMDD')); };ret_code:=ret_message); END; * ERROR at line 1: ORA-06502: PL/SQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRC", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.enbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.DropRequestDBAdapter :: savePIPTnInfo :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.DropRequestDBAdapter :: savePIPTnInfo :: Error Code = -1830 :: Error Message = ORA-01830: date format picture ends before converting entire input string ORA-06512: at line 1	Engine aborted with ORACLE 1830 (date format picture ends before converting....), but do not know which xml id it failed on. run this SQL: select * FROM ent_ebt_xml WHERE ebt_xml_status_id =1 --cm_constants_pkg.ebt_xml_stts_not_parsed The smallest ebt_xml_id is 863544. Open up this file look for date parameter and found effective date has timestamp after the YYYY-mm-dd. It is from Planet Energy. Open all 45 files from Planet Energy and look for incorrect effective date, found 6 files. Implemented data patch to change the status of these files to 2 (parsed) in order that engine will skip it. Engine rerun after data patch applied. send email to client to ask them to resend these files.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
8/18/2011	Engine	XML Request Processor	<pre> BEGIN ent_xml_rqst_prscr_pkg.xml_rqst_prscr_main_prc(TO_DATE(20110818,'YYYYMMDD')) };ret_code:=ret_message); END; * ERROR at line 1: ORA-06502: PL/SQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCSCR_PKG", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.enbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.DropRequestDBAdapter :: saveIPTxnInfo :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.DropRequestDBAdapter :: saveIPTxnInfo :: Error Code = -1830 :: Error Message = ORA-01830: date format picture ends before converting entire input string ORA-06512: at line 1 </pre>	Prepared a data patch to skip two xml files sent by Planet Energy with bad effective date and reran the job. Job ended successfully around 10:15PM.
8/18/2011	Engine	CCL2	<pre> PENTRAC-900123-ALL(VPC-LX-008@MUMBAI-PROD-ENTRAC) The job failed with code 1. sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_movestrciscsetupengine.drv 18082011 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN_MESSAGE=Post move activities failed with error message: ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422 </pre>	Added more debug statement in CCL2 to identify which account caused the engine failure. Applied the data patch to bypass this account with account id 5665032 by updating the account set up date from 18-Aug-2011 to 17-Aug-2011 on ent_account table and reran this job.
8/19/2011	Engine	XML Request Processor	<pre> cd /prod/apps/EntRAC/jobs/scripts/ + entrac_xmlrequestprocessor.drv 19082011 1 row updated. Commit complete. BEGIN ent_xml_rqst_prscr_pkg.xml_rqst_prscr_main_prc(TO_DATE(20110819,'YYYYMMDD')) };ret_code:=ret_message); END; * ERROR at line 1: ORA-06502: PL/SQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCSCR_PKG", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.enbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.DropRequestDBAdapter :: saveIPTxnInfo :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.DropRequestDBAdapter :: saveIPTxnInfo :: Error Code = -1830 :: Error Message = ORA-01830: date format picture ends before converting entire input string ORA-06512: at line 1 </pre>	Prepared a data patch to skip 4 xml files sent by Planet Energy with bad effective date and reran the job. Job ended successfully.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
8/30/2011	Engine	CCL2	PENTRAC-900123-ALL(VPC-LX-008@MUMBAI-PROD-ENTRAC) The job failed with code 1. <pre> sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_movergstctrtctsetupengine.drv 30082011 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422 PENTRAC-900123-ALL(VPC-LX-008@MUMBAI-PROD-ENTRAC) The job failed with code 1. sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_movergstctrtctsetupengine.drv 30082011 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422 </pre>	Had Prod Services compile the Debug version of CCL2 engine and run it to identify which account caused the engine failure. It failed twice on 2 accounts(S674994, S675075). Applied data patch to bypass both accounts in sequence and the second rerun was successful.
9/13/2011	Engine	XML Request Processor	PENTRAC-120108-ALL(VPC-LX-008@MUMBAI-PROD-ENTRAC) The job failed with code 1. <pre> sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_xmlrequestprocessor.drv 13092011 1 row updated. Commit complete. BEGIN ent_xml_rqst_prcsr_pkg.xml_rqst_prcsr_main_prc(TO_DATE(20110913,'YYYYMMDD')));ret_code:=ret_message); END; * ERROR at line 1: ORA-06502: PL/SQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCR_PKG", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.enbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCIRejectDBAdapter :: savePIPTxnInfo :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCIRejectDBAdapter :: savePIPTxnInfo :: Error Code = -1841 :: Error Message = ORA-01841: (full) year must be between -4713 and +9999, and not be 0 ORA-06512: at line 1 </pre>	Prepared a data patch to skip 1 xml files sent by Direct Energy Marketing Limited with bad effective date and reran the job. Job ended successfully. The effective date contained a year of -2011. This was not picked up by XML spy.
9/21/2011	Engine	XML Request Processor	PENTRAC-120108-ALL(VPC-LX-008@MUMBAI-PROD-ENTRAC) The job failed with code 1. <pre> sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_xmlrequestprocessor.drv 21092011 BEGIN ent_xml_rqst_prcsr_pkg.xml_rqst_prcsr_main_prc(TO_DATE(20110921,'YYYYMMDD')));ret_code:=ret_message); END; ERROR at line 1: ORA-06502: PLUSQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCR_PKG", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.enbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCIRejectDBAdapter :: savePIPTxnInfo :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCIRejectDBAdapter :: savePIPTxnInfo :: Error Code = -1841 :: Error Message = ORA-01841: (full) year must be between -4713 and +9999, and not be 0 </pre>	Used following sql to identify bad xml bxn: <pre>select * FROM ent_ebt_xml WHERE ebt_xml_status_id =1 order by ebt_xml_id</pre> The smallest ebt_xml_id is 876635. Open up this file look for date parameter and found effective date has date with negative year (-2011-08-26). XML is from Direct Energy. 2nd ebt_xml_id 876821 had same problem. Implemented data patch to change the status of these files to 2 (parsed) in order that engine will skip it. Engine rerun successfully after data patches applied.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
9/24/2011	Engine	IVA Engine	2000628-ALL on MUMBAI failed with status code 1 RETURN_MESSAGE=ORA-01654: unable to extend index ENT_ADMIN.TXN_REF_NUM_IDX by 10 24 in tablespace ENT_INDEX RETURN CODE=-1654	
9/27/2011	Engine	MDV Engine	PENTRAC-160106-ALL(MADRID@MUMBAI-PROD-ENTRAC) failed The job failed with status code 1; End time 01:01 Sysout + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_mdvenvengine.drv 27092011 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422 There were duplicate data - 2 pool termination requests in for pool_id = 103752 in the ENT_PL_TRMNTN_RQST table. failure in proc: ent_system_util_pkg.is_pl_trmntn_aprvd_fn SELECT pool_id, COUNT(*) FROM ent_pl_trmntn_rqst p where p.trmntn_rqst STATUS_ID = 2 GROUP BY pool_id HAVING COUNT(*) > 1;	Data patch LiveRelease_CHG137187.sql was created to delete one of the pool termination request duplicates. Rerun was successful.
10/11/2011	Engine	XML Request Processor	PENTRAC-120108-ALL (VPC-LX-008@MUMBAI-PROD-ENTRAC) Job failed with code 1. See sysout for details. + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_xmlrequestprocessor.drv 11102011 1 row updated. Commit complete. BEGIN ent_xml_rqst_prcsr_pkg.xml_rqst_main_prc(to_date(20111011,'YYYYMMDD'),:ret_code,:ret_message); END; ERROR at line 1: ORA-06502: PL/SQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCRS_PKC", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.entbridge.entrac.framework.exceptions.DBSystemException: com.entbridge.entrac.business.cm.requestprocessor.dbadapter.CCRejectDBAdapter :: savePIPTxnInfo :: com.entbridge.entrac.business.cm.requestprocessor.dbadapter.CCRejectDBAdapter :: savePIPTxnInfo :: Error Code = -1861 :: Error Message = ORA-01861: literal does not match format string ORA-06512: at line 1 RETURN_MESSAGE= hash table.	Used following sql to identify bad xml txn: select * FROM ent_ebl_xml WHERE ebl_xml_status_id =1 order by ebl_xml_id The smallest ebl_xml_id is 883467. Opened up this file to look for some invalid data. Could not find any noticeable errors. XML is from Aluminor Limited 2nd bad ebl_xml_id 883470 had same problem. Implemented 2 data patches to change the status of these files to 2 (parsed) in order that engine will skip it. Engine rerun successfully after 2 data patches applied.
10/11/2011	Interface	SAP To ENTRAC Daily Consumption	Job aborted after running for more than 5 hours. It appears job was hanging in Oracle Input Stage that is used to populate a hash table.	Sent Remedy ticket HD240969 to oncall DBA (Maria) to re-analyze the 4 tables used in the SQL: ent_dsirbnt_contract, ent_account, ent_revenue_class, ent_contract_type_cd. She did not have to flush the shared pool this time as oracle reparsed the query due to the new stats (on July 4, oracle still used the same bad execution plan even after she analyzed the 4 tables, that is why she flushed the shared pool back then). Job completed successfully.
10/15/2011	Other	Consumer Notification Letters Archive and Print	/prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20111015.pdf h) as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/log/FTPCNETTER-20111015120000.log	Xerox printer offline. Prod Services forced the job OK; will rerun the job next biz day.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
10/16/2011	Other	Consumer Notification Letters Archive and Print	/prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20111016.pdf h) as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/log/FTPCNLETTER-20111015120000.log	Xerox printer offline. Prod Services forced the job OK; will rerun the job next biz day.
11/8/2011	Engine	XML Response Generation Engine	-22813 ORA-22813: operand value exceeds system limits IRRs could not be generated" This typically occurs when free memory in the database has been exhausted. The engine failure to send out 5,198 IRR's was caused by an IRR for account num: 173515445950. The account has an extremely high number(over 800) of prior period adjustments. The engine did not fail, but the error was discovered from the reject report showing the 5198 IRRs did not get sent out.	A data patch was applied to bypass the bad IRR and let the rest of the IRRs get sent out.
11/15/2011	Engine	CCL2	+ cd /prod/apps/EntRAC/jobs/scripts/ + entrac_moverstcrtcsetupengine.drv 15112011 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01403: no data found RETURN CODE=100	Added more debug statement in CCL2 to identify which account caused the engine failure. Applied the data patch to bypass 2 accounts with account id in (5756926, 5757019) by updating the account set up date from 15-Nov-2011 to 14-Aug-2011 on ent_account table and reran this job.
11/15/2011	Interface	SAPToEntRACMonthlyCrsmpInPost edNotInvoiced.drv	JORA-00257: archiver error: Connect internal only, until freed.	Paged the EnTRAC Oracle Support to resolve the connection issue and reran the job
11/23/2011	Engine	CCL2	+ cd /prod/apps/EntRAC/jobs/scripts/ + entrac_moverstcrtcsetupengine.drv 23112011 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01403: no data found RETURN CODE=100	Added debug statement in CCL2 to identify which account caused the engine failure. Applied the data patch to bypass 1 account with account id in (5765183) by updating the account set up date from 23-Nov-2011 to 22-Nov-2011 on ent_account table and reran this job.
12/2/2011	Engine	CCL2	Sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_moverstcrtcsetupengine.drv 02122011 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01403: no data found RETURN CODE=100	Added debug statement in CCL2 to identify which account caused the engine failure. Applied the data patch to bypass 1 account with account id in (5776363) by updating the account set up date from 02-dec-2011 to 01-dec-2011 on ent_account table and reran this job.
12/2/2011	Interface	PENTRAC-380504-BCD-Y PENTRAC-680864-BCD-Y PENTRAC-3070871-BCD-Y PENTRAC-360876-BCD-Y	JORA-00257: archiver error. Connect internal only, until freed.	Paged the EnTRAC Oracle Support to resolve the connection issue and reran the job
12/4/2011	Interface	PN410505-A/PENTRAC-410505-ALL	+ cd /prod/app/entrac/Scripts/ + ent_AltraToEntRACDelivery.drv 20111204120000 prod Output of /prod/app/entrac/log/AltraToEntRACDelivery-20111204120000.log Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Sun Dec 4 09:00:07 2011- Job ended: -Sun Dec 4 09:00:15 2011- ERROR: Job did not return successfully	Copied the inbound file AltraToEntRACDaily20111202.txt to the folder /dev/app/entrac2perf/InData on lynx. Ran the job called AltraToEntRACDeliveryCheckAllRejects on entven2 project on lynx using the entven2 database. Discovered that 1 rejected bins were created by this job. The rejected bins were due to DPA number is NULL. Sent email note to SMS staff to let them know DPA number is NULL on record number 5 and ask them to resend a new file:
12/4/2011	Interface	CH2130867-A/ENCHG-2130867-ALL	+ cd /prod/app/entrac/InData/ + chmod 640 sap_entrac_va_post_status_*20*.dat sap_entrac_va_post_20*.dat chmod: can't access sap_entrac_va_post_status_*20*.dat chmod: can't access sap_entrac_va_post_20*.dat + chown entrac:entrac sap_entrac_va_post_status_*20*.dat sap_entrac_va_post_20*.dat sap_entrac_va_post_status_*20*.dat: No such file or directory sap_entrac_va_post_20*.dat: No such file or directory	Rerun of interface job using the new interface file and job completed successfully by 6:30 PM. SAP didn't send file over, forced the job OK

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
12/4/2011	Interface	SAPCIS IVA Interface from ENTRAC	Summary: SAPCIS IVA interface from ENTRAC failed as a result of an invalid record in the file. Description: SAPCIS interface failed as a result of an invalid record in the file. Refer to the attached file entrac_sap_va_20111204082042.dat. Record 2148 (the second record below) has no PPG number. 9001 193550288006 +2.25 VendorAdjustment 20111203 102185345 000624910 9001 191000720930 +2.25 VendorAdjustment 20111203 102185351 9001 093560243624 +2.25 VendorAdjustment 20111203 102185352 000624910 Are you able to provide a new file today?	James gave instruction to Earl to removed the bad record and modify the trailer record. Earl reran his job and the downstream jobs have rerun successfully.
12/4/2011	Interface	PN2130867- A/PENTRAC- 2130867-ALL	Sysout; + cd /prod/app/entrac/Scripts/ + ent_SAPtoENTRACIVAPostedStatusHeaderTrailer.drv 20111204120000 prod Output of /prod/app/entrac/Log/SAPtoENTRACIVAPostedStatusTrailer-20111204120000\ O.log File picked up for processing: ERROR:file not found	Did not force the job OK, discussed with James, James helped Earl to removed the bad record and modify the trailer record. Earl reran his job and this job have rerun successfully.
12/5/2011	Interface	Interface	+ chmod 640 AltraToENTRACDaily20111202_orig.txt AltraToENTRACDaily20111203.txt chmod: can't change AltraToENTRACDaily20111202_orig.txt: Not owner + chown entrac:entrac AltraToENTRACDaily20111202_orig.txt AltraToENTRACDaily20111203.txt AltraToENTRACDaily20111202_orig.txt: Not owner	There are multiple file with the same name due to Altra to Entrac job failed on Dec 4. Asked prod services to remove the two files AltraToENTRACDaily20111202_orig.txt AltraToENTRACDaily20111202_bad.txt Asked prod services to Force OK job.
12/10/2011	Other	FILEWATCH-ALTRA-DAILY	Altra daily interface file missing.	Contacted Edmonton HelpDesk. They paged oncall support person for Altra. Yasmin Qadri said their FTP job failed last night, but they were not paged. Requested resending of file for Gas Day Dec 8, 2011. Initial file received was for wrong gas day (Dec 9), thus, requested correct file for gas day Dec 8. Copied to /prod/app/entrac/Indata, and asked Prod Services to Force OK the FILEWATCH-ALTRA-DAILY job, then ENCHG-410505-ALL job. Interface job aborted due to invalid file name. Renamed file name, and requested rerun of job - it completed successfully. On Dec 13 business users discovered that the ent_delivery table recorded these deliveries for gas day Dec 31 2011 rather than Dec 8 2011. Note, the interface job correctly populated the ent_delivery_dtl table with the correct gas day. Upon further investigation I discovered that the datastage job did complete successfully but it contained thousands of warning messages. These warning messages were referring to missing volumes for gas day Dec 31 2011. This caused the param value written to the ent_job_log_param table to contain gas day Dec 31 2011 rather than Dec 8 2011. The archived input file did not contain any evidence of txns for gas day Dec 31; all txns were for gas day Dec 8. It is a mystery as to why Datastage job produced these warning messages. Due to the invalid param value in ent_job_log_param table, the Delivery mgr for Dec 10 populated the ent_delivery table with invalid Delivery_date and subsequent engines in Dec 10 job stream calculated non-compliance events for unauthorized suspension. CHG145287 created to correct the data and delete these non-compliance events.
12/11/2011	Other	Consumer Notification Letters Archive and Print	/prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20111211.pdf \\ as data. /usr/local/bin/rip: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rip: fatal error: client_open(): cannot connect to ipd Output of /prod/app/entrac/Log/FTPCNLETTER-20111211120000.log	Xerox printer offline. Prod Services forced the job OK; will rerun the job next biz day.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
12/13/2011	Interface	ENCHG-070518-ALL(VPC-LX-005/APOLLO@PRO D-ENTRAC)	sysout: + cd /prod/app/entrac/InData/ + chmod 640 sap_entrac_workorder_20111213170051.dat chmod: can't change sap_entrac_workorder_20111213170051.dat: Not owner + chown entrac:entrac sap_entrac_workorder_20111213170051.dat sap_entrac_workorder_20111213170051.dat: Not owner	Ask production services to move two files to Archive folder: Reply from production services: The two files were moved to /prod/app/entrac/InData/Archive/20111213/SAPToEnTRACWorkOrder> And compress total 2242 -rw-r--r-- 1 entrac entrac 409910 Dec 13 19:00 sap_entrac_workorder_20111213170051.dat.pre_reject_prepend.Z -rw-r--r-- 1 entrac entrac 736493 Dec 13 19:00 sap_entrac_workorder_20111213170051.dat.Z ENCHG-070518-ALL and PENTRAC-070518-ALL were forced OK.
1/3/2012	Interface	Altra To ENTRAC Delivery	+ cd /prod/app/entrac/Scripts/ + ent_AltraToEnTRACDelivery.drv 20120103120000 prod Output of /prod/app/entrac/Log/AltraToEnTRACDelivery-20120103120000.log Job ran; checking for errors Job status: -RUN FAILED (3) Job started: -Tue Jan 3 09:00:08 2012- Job ended: -Tue Jan 3 09:00:23 2012- ERROR: Job did not return successfully WARNING: Cannot get info on link Process_Delivery_Data.altra_extract_rejects_f	Copied the inbound file AltraToEnTRACDaily20120101.txt to the folder /dev/app/entrac2dev/InData on lynx. Ran the job called AltraToEnTRACDeliveryCheckAllRejects on ent2dev project on lynx using the entven2 database. Discovered that 5 rejected bns were created by this job. (invalid supplier mnemonics) and 1 rejected due to related to gazifere pool. Sent email note to Kent Wirth and Edmonton SMS staff requesting update the mnemonic in ENTRAC. SMS staff reset file and Prod Services successfully reran the job. Added dpa number 8997610 to gazifere_pools.txt
1/3/2012	Interface	SAPToEnTRACWork Order	sysout: + cd /prod/app/entrac/Scripts/ + ent_SAPToEnTRACWorkOrder.drv 20120103120000 prod Output of /prod/app/entrac/Log/SAPToEnTRACWorkOrder-20120103120000.log File picked up for processing: sap_entrac_workorder_20120103170042.dat Rejected file prepended: /prod/app/entrac/Rejects/SAPToEnTRACWorkOrder_20120103170042.dat 2120000 rejects Job ran; checking for errors Job status: -RUN FAILED (3) Job started: -Tue Jan 3 19:00:08 2012- Job ended: -Tue Jan 3 19:02:11 2012- ERROR: Job did not return successfully	Found the bad record by looking in the Datastage log. The error in the D.S. job is: SAPToEnTRACWorkOrder..SAP_WORK_ORDERS_F.sap_work_orders_f: nl_read_delimited() - row 6510, too many columns in record Looked for extra ^ delimiters in the sap_entrac_workorder_20120103170042.dat file. Found 2 rows 6510 & 6525. Removed these rows from the file. backed up the original file, Had production services copy the new file, and re-run the job.
1/6/2012	Engine	Consumption Exception Processor	sysout: + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_ConsumptionExceptionProcessor.drv 06012012 USERID Jan 6, 2012 8:00:02 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path The job failed with code 1.	Job was rerun, and it completed successfully.
1/14/2012	Engine	CCL2	sysout: + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_movestrtctstetupengine.drv 14012012 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN_MESSAGE=Post move activities failed with error message: ORA-01403: no data found RETURN CODE=100	Had Prod service compile the DEBUG version of ent_move_prcsr_pkg_more_dc.sql. Reran the job. It failed. Patched account 5815269 to bypass. Re-ran the job, and it still failed. As instructed by George, applied the ent_move_prcsr_pkg_body_Old.sql. Re-ran the job, it succeeded. Re-applied the original code, and shut off debug.
1/19/2012	Other	FILEWATCH-ALTRA-DAILY	Altra daily interface file missing.	Contacted Edmonton HelpDesk. They paged oncall support person for Altra, no response. Called the sms oncall phone#, and provided the phone# for Yasmin Qadri. Yasmin returned called and said they will send us the file through the normal channel. The file received and the job rerun successfully.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
2/1/2012	Engine	CCL2	sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_movestrtctrtctsetupengine.drv 01022012 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN_MESSAGE=Post move activities failed with error message: ORA-00001: unique constraint (ENT_ADMIN.ENT_ACNT_POOL_TERM_UK1) violated RETURN CODE=-1	George added debug code to the ENT_MOVE_PRCRSC_PKG. Found that account ID 5827550 was being inserted twice into the ent_acnt_pool_term with the same EFFECTIVE_DATE. Bypassed the account using the code below: update ent_account set acnt_setup_date = to_date('31-JAN-2012', 'DD-MON-YYYY'), modified_by_user_id = v_patch_user_id, modification_date = sysdate where account_id = 5827550;
2/2/2012	Engine	Charge Uploader	+ cd /prod/apps/EntRAC/jobs/scripts/entrac_chargesuploaderengine.drv 02022012 Exception in thread "main" EXCEPTION: com.enbridge.entrac.framework.exceptions.\n SystemException,	Asked Production Services to force it OK to allow the downstream jobs to run since run date is not the 7th or 8th of the month. Sent data patch LiveRelease_CHG151313.sql to delete charge_upload_info_id = 101125 and update upload_date to a future date Feb 2, 2099 to bypass the record with charge_upload_info_id = 101124.
3/7/2012	Engine	Charge Uploader	PENTRAC-520604-ALL (MUMBAI)/VPC-LX-008@PROD-ENTRAC has failed with status code 1. Sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_chargesuploaderengine.drv 07032012 Mar 7, 2012 9:52:47 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path	Because this engine failed on 7th of month, I could not Force OK this job. Based on error in ent_application_log table I discovered that the proc ent_adj_pkg.validate_gl_acc_num_prc gave error msg: ORA-01403: no data found Error occurred while validating the gl account number for Misc Self Service Charges I discovered that the uploaded file called Req_106317_2012_3_7_8_30_9_465.xml on mumbai folder /prod/apps/EntRAC/tmp/ contained a PPA txn for an invalid MSA/Pool Name combination. (msa=100744 and pool name=10532'). The correct pool name is '010532'. I updated the xml file and requested Viad (DBA) to rename the bad xml file and copy my updated file to the folder /prod/apps/EntRAC/tmp/. Job was rerun twice and it failed both times. Next day we discovered that 12 of 13 txns in XML file were successfully loaded three times, and 1 of 13 txns was successfully loaded 2 times. Terri Jackson will input manual txns to reverse the duplicate/triplicate dollars and volumes. Txns exist in ent_pl_chrg_crdt table. Jason confirmed that the new Jenkins deploy that was done this evening did not set the permissions correctly on folder /prod/apps/EntRAC/tmp. it should be 775. James implemented data patch to adjust uploaded_date in ent_chrg_upld_info table so next running of engine will skip this txn. At a future date, we need another data patch to store contents of XML file in job field in ent_chrg_upld_info table, and to remove the XML file from folder /prod/apps/EntRAC/tmp.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
3/21/2012	Engine	Consumption Exception	<pre> at com.enbridge.entrac.framework.logging.EnTRACIDBCAppender.getConnection(EnTRACIDBCAppender.java:335) at com.enbridge.entrac.framework.logging.EnTRACIDBCAppender.flushBuffer(EnTRACIDBCAppender.java:183) at com.enbridge.entrac.framework.logging.EnTRACIDBCAppender.append(EnTRACIDBCAppender.java:155) at org.apache.log4j.AppenderSkeleton.doAppend(AppenderSkeleton.java:221) at org.apache.log4j.helpers.AppenderAttachableImpl.appendLoopOnAppenders(AppenderAttachableImpl.java:57) at org.apache.log4j.Category.callAppenders(Category.java:187) at org.apache.log4j.Category.forcedLog(Category.java:372) at org.apache.log4j.Category.log(Category.java:864) at org.apache.commons.logging.impl.Log4JLogger.error(Log4JLogger.java:184) at org.sape.carbon.core.exception.DefaultExceptionHandler.handleException(DefaultExceptionHandler.java:92) at org.sape.carbon.core.exception.BaseRuntimeException.<init>(BaseRuntimeException.java:63) at org.sape.carbon.core.component.ComponentException.<init>(ComponentException.java:42) at org.sape.carbon.core.component.lifecycle.LifecycleException.<init>(LifecycleException.java:39) at org.sape.carbon.core.component.lifecycle.ComponentUnavailableException.<init>(ComponentUnavailableException.java:40) at org.sape.carbon.core.component.lifecycle.DefaultLifecycleInterceptor.invoke(DefaultLifecycleInterceptor.java:95) at org.sape.carbon.core.component.proxy.DefaultComponentProxyInvocationHandler.<init>(DefaultComponentProxyInvocationHandler.java:95) </pre>	Force it OK due to the deployment problem and rerun it next day once security settings have been fixed
3/21/2012	Engine	IVA Processor	<pre> at com.enbridge.entrac.framework.logging.EnTRACIDBCAppender.getConnection(EnTRACIDBCAppender.java:335) at com.enbridge.entrac.framework.logging.EnTRACIDBCAppender.flushBuffer(EnTRACIDBCAppender.java:183) at com.enbridge.entrac.framework.logging.EnTRACIDBCAppender.append(EnTRACIDBCAppender.java:155) at org.apache.log4j.AppenderSkeleton.doAppend(AppenderSkeleton.java:221) at org.apache.log4j.helpers.AppenderAttachableImpl.appendLoopOnAppenders(AppenderAttachableImpl.java:57) at org.apache.log4j.Category.callAppenders(Category.java:187) at org.apache.log4j.Category.forcedLog(Category.java:372) at org.apache.log4j.Category.log(Category.java:864) at org.sape.carbon.core.exception.DefaultExceptionHandler.handleException(DefaultExceptionHandler.java:92) at org.sape.carbon.core.exception.BaseRuntimeException.<init>(BaseRuntimeException.java:63) at org.sape.carbon.core.component.ComponentException.<init>(ComponentException.java:42) at org.sape.carbon.core.component.lifecycle.LifecycleException.<init>(LifecycleException.java:39) at org.sape.carbon.core.component.lifecycle.ComponentUnavailableException.<init>(ComponentUnavailableException.java:40) at org.sape.carbon.core.component.lifecycle.DefaultLifecycleInterceptor.invoke(DefaultLifecycleInterceptor.java:95) at org.sape.carbon.core.component.proxy.DefaultComponentProxyInvocationHandler.<init>(DefaultComponentProxyInvocationHandler.java:95) </pre>	Force it OK due to the deployment problem and rerun it next day once security settings have been fixed

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
3/21/2012	Engine	Consumer Notification	<pre> at com.enbridge.entrac.framework.logging.EnTRACJDBCAppender.getConnection(EnTRACJDBCAppender.java:335) at com.enbridge.entrac.framework.logging.EnTRACJDBCAppender.flushBuffer(EnTRACJDBCAppender.java:183) at com.enbridge.entrac.framework.logging.EnTRACJDBCAppender.append(EnTRACJDBCAppender.java:155) at org.apache.log4j.AppenderSkeleton.doAppend(AppenderSkeleton.java:221) at org.apache.log4j.helpers.AppenderAttachableImpl.appendLoopOnAppenders(AppenderAttachableImpl.java:57) at org.apache.log4j.Category.callAppenders(Category.java:187) at org.apache.log4j.Category.forcedLog(Category.java:372) at org.apache.log4j.Category.log(Category.java:864) at org.apache.commons.logging.impl.Log4JLogger.error(Log4JLogger.java:184) at org.sape.carbon.core.exception.DefaultExceptionHandler.handleException(DefaultExceptionHandler.java:92) at org.sape.carbon.core.exception.BaseRuntimeException.<init>(BaseRuntimeException.java:63) at org.sape.carbon.core.component.ComponentException.<init>(ComponentException.java:42) at org.sape.carbon.core.component.lifecycle.LifecycleException.<init>(LifecycleException.java:39) at org.sape.carbon.core.component.lifecycle.ComponentUnavailableException.<init>(ComponentUnavailableException.java:40) at org.sape.carbon.core.component.lifecycle.DefaultLifecycleInterceptor.invoke(DefaultLifecycleInterceptor.java:95) at org.sape.carbon.core.component.proxy.DefaultComponentProxyInvocationHandler.handleInvoke(DefaultComponentProxyInvocationHandler.java:345) at org.sape.carbon.core.util.reflection.GenericProxy.invoke(GenericProxy.java:104) at org.sape.carbon.core.component.lifecycle.LifecycleException.<init>(LifecycleException.java:39) at org.sape.carbon.core.component.lifecycle.LifecycleException.<init>(LifecycleException.java:39) at org.sape.carbon.core.component.lifecycle.ComponentUnavailableException.<init>(ComponentUnavailableException.java:40) at org.sape.carbon.core.component.lifecycle.DefaultLifecycleInterceptor.invoke(DefaultLifecycleInterceptor.java:95) at org.sape.carbon.core.component.proxy.DefaultComponentProxyInvocationHandler.handleInvoke(DefaultComponentProxyInvocationHandler.java:345) </pre>	Force it OK due to the deployment problem and rerun it next day once security settings have been fixed
3/21/2012	Engine	Charge Uploader	<pre> at com.enbridge.entrac.framework.logging.EnTRACJDBCAppender.getConnection(EnTRACJDBCAppender.java:335) at com.enbridge.entrac.framework.logging.EnTRACJDBCAppender.flushBuffer(EnTRACJDBCAppender.java:183) at com.enbridge.entrac.framework.logging.EnTRACJDBCAppender.append(EnTRACJDBCAppender.java:155) at org.apache.log4j.AppenderSkeleton.doAppend(AppenderSkeleton.java:221) at org.apache.log4j.helpers.AppenderAttachableImpl.appendLoopOnAppenders(AppenderAttachableImpl.java:57) at org.apache.log4j.Category.callAppenders(Category.java:187) at org.apache.log4j.Category.forcedLog(Category.java:372) at org.apache.log4j.Category.log(Category.java:864) at org.apache.commons.logging.impl.Log4JLogger.error(Log4JLogger.java:184) at org.sape.carbon.core.exception.DefaultExceptionHandler.handleException(DefaultExceptionHandler.java:92) at org.sape.carbon.core.exception.BaseRuntimeException.<init>(BaseRuntimeException.java:63) at org.sape.carbon.core.component.ComponentException.<init>(ComponentException.java:42) at org.sape.carbon.core.component.lifecycle.LifecycleException.<init>(LifecycleException.java:39) at org.sape.carbon.core.component.lifecycle.ComponentUnavailableException.<init>(ComponentUnavailableException.java:40) at org.sape.carbon.core.component.lifecycle.DefaultLifecycleInterceptor.invoke(DefaultLifecycleInterceptor.java:95) at org.sape.carbon.core.component.proxy.DefaultComponentProxyInvocationHandler.handleInvoke(DefaultComponentProxyInvocationHandler.java:345) </pre>	Force it OK due to the deployment problem and rerun it next day once security settings have been fixed

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
3/22/2012	Engine	XML Request Processor	Description: PENTRAC-120108-ALL(VPC-LX-008@PROD-ENTRAC) failed The job failed with status code 1. End time 20:02 SYSDOUT: <pre> + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_xmlrequestprocessor.drv 22032012 1 row updated. Commit complete. BEGIN ent_xml_rqst_prcsr_pkg.xml_rqst_prcsr_main_prc(TO_DATE(20120322,'YYYYMMDD'));ret_code:=ret_message); END; * ERROR at line 1: ORA-06502: PL/SQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCR_PKG", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.enbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCIRejectDBAdapter :: savePIPTxnInfo :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCIRejectDBAdapter :: savePIPTxnInfo :: Error Code = -1861 :: Error Message = ORA-01861: literal does not match format string ORA-06512: at line 1 RETURN MESSAGE= RETURN CODE= </pre>	select * FROM ent_ebt_xml WHERE ebt_xml_status_id=1 order by ebt_xml_id The smallest ebt_xml_id is 938196. Opened up this file and saw that last 2 transactions (CCI Reject) had effective dates with 5 digit years. ex EffectiveDate>12973-07-06</EffectiveDate>. XML is from Direct Energy. Implemented data patch to change the status of this file to 2 (parsed) in order that engine will skip it. Engine reran successfully after data patch applied.
3/29/2012	Engine	Consumption Exception	<pre> at com.enbridge.entrac.framework.logging.ENTRACIDBCA.pender.getConnection(ENTRACIDBCA.pender.java:335) at com.enbridge.entrac.framework.logging.ENTRACIDBCA.pender.flushBuffer(ENTRACIDBCA.pender.java:183) at com.enbridge.entrac.framework.logging.ENTRACIDBCA.pender.append(ENTRACIDBCA.pender.java:155) at org.apache.log4j.AppenderSkeleton.doAppend(AppenderSkeleton.java:221) at org.apache.log4j.helpers.AppenderAttachableImpl.appendLoopOnAppenders(AppenderAttachableImpl.java:57) at org.apache.log4j.Category.callAppenders(Category.java:187) at org.apache.log4j.Category.forcedLog(Category.java:372) at org.apache.log4j.Category.log(Category.java:864) at org.sape.carbon.commons.logging.impl.Log4jLogger.error(Log4jLogger.java:184) at org.sape.carbon.core.exception.DefaultExceptionHandler.handleException(DefaultExceptionHandler.java:92) at org.sape.carbon.core.exception.BaseRuntimeException.<init>(BaseRuntimeException.java:63) at org.sape.carbon.core.component.ComponentException.<init>(ComponentException.java:42) at org.sape.carbon.core.component.lifecycle.LifecycleException.<init>(LifecycleException.java:39) at org.sape.carbon.core.component.lifecycle.ComponentUnavailableException.<init>(ComponentUnavailableException.java:40) at org.sape.carbon.core.component.lifecycle.DefaultLifecycleInterceptor.invoke(DefaultLifecycleInterceptor.java:95) at org.sape.carbon.core.component.proxy.DefaultComponentProxyInvocationHandler.< </pre>	Force it OK due to the deployment problem and rerun it next day once security settings have been fixed

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
3/29/2012	Engine	Consumption Exception Processor	PENTRAC-100627-ALL(WPC-LX-008@PROD-ENTRAC) failed Status code 1. End time 20:00 Sysout: + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_ConsumptionExceptionProcessor.drv 29032012 USERID Mar 29, 2012 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Mar 29, 2012 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Mar 29, 2012 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Mar 29, 2012 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Mar 29, 2012 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Mar 29, 2012 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Mar 29, 2012 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Mar 29, 2012 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Mar 29, 2012 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Mar 29, 2012 8:00:03 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path	Force it OK due to the deployment problem and rerun it next day once security settings have been fixed
3/29/2012	Engine	Consumer Notification	at com.enbridge.entrac.framework.logging.EnTRACJDBCAppender.getConnection(EnTRACJDBCAppender.java:335) at com.enbridge.entrac.framework.logging.EnTRACJDBCAppender.flushBuffer(EnTRACJDBCAppender.java:183) at com.enbridge.entrac.framework.logging.EnTRACJDBCAppender.append(EnTRACJDBCAppender.java:155) at org.apache.log4j.AppenderSkeleton.doAppend(AppenderSkeleton.java:221) at org.apache.log4j.helpers.AppenderAttachableImpl.appendLoopOnAppenders(AppenderAttachableImpl.java:57) at org.apache.log4j.Category.callAppenders(Category.java:187) at org.apache.log4j.Category.forcedLog(Category.java:372) at org.apache.log4j.Category.log(Category.java:864) at org.apache.commons.logging.impl.Log4JLogger.error(Log4JLogger.java:184) at org.sape.carbon.core.exception.DefaultExceptionHandler.handleException(DefaultExceptionHandler.java:92) at org.sape.carbon.core.exception.BaseRuntimeExceptionHandler. <init>(BaseRuntimeExceptionHandler.java:63) at org.sape.carbon.core.component.ComponentException.<init>(ComponentException.java:42) at org.sape.carbon.core.component.lifecycle.LifecycleException.<init>(LifecycleException.java:39) at org.sape.carbon.core.component.lifecycle.ComponentUnavailableException.<init>(ComponentUnavailableException.java:40) at org.sape.carbon.core.component.lifecycle.DefaultLifecycleInterceptor.invoke(DefaultLifecycleInterceptor.java:95) at org.sape.carbon.core.component.proxy.DefaultComponentProxyInvocationHandler.handleInvoke(DefaultComponentProxyInvocationHandler.java:345) at org.sape.carbon.core.util.reflection.GenericProxy.invoke(GenericProxy.java:104)</init>	Force it OK due to the deployment problem and rerun it next day once security settings have been fixed
3/29/2012	Engine	Change Uploader	at com.enbridge.entrac.framework.logging.EnTRACJDBCAppender.getConnection(EnTRACJDBCAppender.java:335) at com.enbridge.entrac.framework.logging.EnTRACJDBCAppender.flushBuffer(EnTRACJDBCAppender.java:183) at ppender.java:155) System shutting down. Destroying all components. System shut down complete.	Force it OK due to the deployment problem and rerun it next day once security settings have been fixed

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
4/3/2012	Engine	Charge Uploader	+ cd /prod/apps/EntRAC/jobs/scripts/ + entrac_chargesuploaderengine.drv 03042012 Apr 3, 2012 11:17:35 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path CAUSE: (java.io.FileNotFoundException: /prod/apps/EntRAC/tmp/Req_106317_2012_4_3_2_46_46_438.xml (Permission denied (errno:13))) PENTRAC-070518-ALL(VPC-LX-005/APOLLO)	Permissions of 2 XML files in /prod/apps/EntRAC/tmp folder on mumbai server are 600. The permissions need to be set to minimum of 640. Since files are owned by oracle ID, DBA changed the permissions to 774. Job was rerun the next morning and it completed successfully.
4/6/2012	Interface	SAPToEntRACWork Order	The job failed with code 111. sysout: + cd /prod/app/entrac/scripts/ + ent_SAPToEntRACWorkOrder.drv 20120406120000 prod Output of /prod/app/entrac/Log/SAPToEntRACWorkOrder-20120406120000.log File picked up for processing: sap_entrac_workorder_20120406170039.dat Rejected file prepended: /prod/app/entrac/Rejects/SAPToEntRACWorkOrder_20120406170039.dat Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Fri Apr 6 19:00:08 2012- Job ended: -Fri Apr 6 19:01:16 2012- ERROR: Job did not return successfully Rows pushed through reject link (sap_work_orders_rejects_f): -2588- Rows pushed through reject link (ent_if_error): -2588- (errorID=15182890) INVALID REASON Invalid reason: The reason code in the work order interface file is invalid. Summary: PENTRAC-520604-ALL(VPC-LX-008/mumbai@PROD-ENTRAC) Description: PENTRAC-520604-ALL(VPC-LX-008/mumbai@PROD-ENTRAC) The job failed with code 1. : CAUSE: (java.io.FileNotFoundException: /prod/apps/EntRAC/tmp/Req_106317_2012_4_6_0_4_47_784.xml (Permission denied (errno:13))) ^ at	Record 2955 had the wrong postal code (L^T1W4). Renamed the file with date and time greater than the value in database and reran the failed job. It ended OK around 9:30PM
4/6/2012	Engine	Charge Uploader	Job running over 12 hours	Forced Job OK. Permissions of /prod/apps/EntRAC/tmp/Req_106317_2012_4_6_0_4_47_784.xml Contacted On-Call DBA and requested the permissions of the file be changed to 774.
4/16/2012	Engine	XML Response Generation Engine	The job failed with status code 1. End time 20:38 The job was forced OK at 20:50 (08:50 PM) as per documentation. sysout: + cd /prod/app/entrac/scripts/ + ent_ENTRACtoXeroxCN.drv 20120416120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20120416.pdf h\ as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to ipd Output of /prod/app/entrac/Log/FTPCNETTER-20120416120000.log	Contacted On-Call DBA. She recommended that the job be killed and the tables Analyzed. Xerox printer offline. Prod Services forced the job OK; will rerun the job next biz day.
4/16/2012	Other	Consumer Notification Letters Archive and Print	+ cd /prod/app/entrac/scripts/ + ent_ENTRACtoXeroxCN.drv 20120416120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20120416.pdf h\ as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to ipd Output of /prod/app/entrac/Log/FTPCNETTER-20120416120000.log	
5/3/2012	Interface	Altra To EntRAC Delivery	+ cd /prod/app/entrac/scripts/ + ent_AltraToEntRACDelivery.drv 20120503120000 prod Output of /prod/app/entrac/Log/AltraToEntRACDelivery-20120503120000.log Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Thu May 3 09:00:08 2012- Job ended: -Thu May 3 09:00:19 2012- ERROR: Job did not return successfully WARNING: Cannot get info on link Process_Delivery_Data.altra_extract_rejects_f \ (255) Rows pushed through reject link (altra_extract_rejects_f): -- WARNING: Cannot get info on link Process_Delivery_Data.ent_if_error01 (255) Rows pushed through reject link (ent_if_error01): -- Rows pushed through reject link (ent_if_error02): -0- Product Name: Batch Job	Copied the inbound file AltraToEntRACDaily20120501.txt to the folder /dev/app/entrac2dev/indata on lynx. Ran the job called AltraToEntRACDeliveryCheckAllRejects on ent2dev project on lynx using the entprod1 database. Discovered that 4 rejected txns were created by this job.(null supplier mnemonics). Sent email note to Kent Wirth and Edmonton SMS staff requesting the file be fixed. They sent a second file which also failed. It had one record with null supplier mnemonic. SMS staff sent a second corrected file and Prod Services successfully reran the job. Before first rerun, added dpa numbers 8997540, 8997560, 964578 to gazifere_pools.txt

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
5/9/2012	Engine	IVA Processor	Summary: PENTRAC-2020630-ALL(VPC-LX-008@PROD-ENTRAC) failed Description: PENTRAC-2020630-ALL(VPC-LX-008@PROD-ENTRAC) failed The job failed with status code 1. End time 20:00 Sysout: <pre>+ cd /prod/apps/ENTRAC/jobs/scripts/ + entrac_IVAProcessor.drv 09052012 USERID May 9, 2012 8:00:04 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path May 9, 2012 8:00:04 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path May 9, 2012 8:00:04 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path May 9, 2012 8:00:04 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path May 9, 2012 8:00:04 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path May 9, 2012 8:00:04 PM java.util.jar.Attributes read</pre>	Re-run the job
5/11/2012	Other	Consumer Notification Letters Archive and Print	The job failed with status code 1. End time 20:37 Sysout: <pre>+ cd /prod/app/entrac/Scripts/ + ent_ENTRACToXeroxCN.drv 20120511120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20120511.pdf h\ as data. /usr/local/bin/rip: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rip: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20120511120000.log</pre>	Xerox room printer offline due to VPC Power Outage. Prod Services forced the job OK. Job was successfully re-run the next biz day.
5/12/2012	Other	Consumer Notification Letters Archive and Print	Sysout: <pre>+ cd /prod/app/entrac/Scripts/ + ent_ENTRACToXeroxCN.drv 20120512120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20120512.pdf h\ as data. /usr/local/bin/rip: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rip: fatal error: client_open(): cannot connect to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20120512120000.log Product Name: Batch Job</pre>	Xerox room printer offline due to VPC Power Outage. Prod Services forced the job OK. Job was successfully re-run the next biz day.
5/13/2012	Other	Consumer Notification Letters Archive and Print	no sysout given	Xerox room printer offline due to VPC Power Outage. Prod Services forced the job OK. Job was successfully re-run the next biz day.
5/20/2012	Engine	STR Validation Implementation	PENTRAC-870127-ALL(MADRID@PROD-ENTRAC) failed <pre>+ cd /prod/apps/ENTRAC/jobs/scripts/ + entrac_strimplementengine.drv 20052012 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01403: no data found RETURN CODE=100</pre>	The STR Implementation engine failed because it tried to implement a Drop that was in Accepted Pending status with effective date of 24-May-2012, but the account had been finalized on 12-May-2012. I created an emergency data patch to set the status of the Drop to Accepted Held so that we could re-run the STR Implementation engine. After the data patch the job was re-run.
5/21/2012	Engine	MDV Engine	PENTRAC-160106-ALL(VPC-LX-008/MUMBAI@PROD-ENTRAC) The job failed with status code 1. Sysout: <pre>+ cd /prod/apps/ENTRAC/jobs/scripts/ + entrac_mdvenengine.drv 21052012 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-00054: resource busy and acquire with NOWAIT specified RETURN CODE=-54 Product Name: Batch Job</pre>	Ran a query to see if there were any locked MDV related tables and there were none. Asked prod services to re-run the job and it was successful.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
6/3/2012	Interface	Altra To EnTRAC Delivery	PENTRAC-410505-ALL on apollo has failed with status code 111. /prod/app/entrac/scripts/ + ent_AltraToEnTRACDelivery.drv 20120603120000 prod Output of /prod/app/entrac/Log/AltraToEnTRACDelivery-20120603120000.log Job ran; checking for errors Job status: -RUN FAILED (3-) Job started: -Sun Jun 3 09:00:08 2012- Job ended: -Sun Jun 3 09:00:37 2012- ERROR: Job did not return successfully	Corrective Action Taken Copied the inbound file AltraToEnTRACDaily20120601.txt to the folder /dev/app/entrac2dev/indata on lynx. Ran the job called AltraToEnTRACDeliveryCheckAllRejects on ent2dev project on lynx using the entprod1 database. Discovered that 1 rejected txn was created by this job. (null supplier mnemonics). Sent email note to Kent Wirth and Edmonton SMS staff requesting the file be fixed. They sent a second file and Prod Services successfully reran the job.
6/3/2012	Engine	MDV Engine	PENTRAC-160106-ALL (on MUMBAI) failed at 22:29 (10:29 PM) with status code 1. The job was submitted at 21:42 (09:42 PM). Sysout: + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_mdvengrine.drv 03062012 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-20002: RETURN CODE=-20002	Problem encountered with pool_id=104931. I discovered that this pool had a pool termination txn input by Julie Alexander today at 10:25, same time as engine failure. Requested prod services to rerun the engine, since this engine is designed to bypass pools with an approved pool termination txn. Rerun completed successfully.
6/7/2012	Engine	BGA report engine 1	+ cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_bgaprgntdataengine.drv 07062012 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422	Problem encountered with pool_id=101830 and pool_trm_cmnctm_date = '1-jul-2011'. This pool started with 2 accounts on previous pool term, rolled over to this pool term. These two accounts early terminated at March 8,9 2012. Two accounts (930610055531 and 930610055805) added to this pool effective December 19, 2011, retroactively (I think is added retroactively because the modification date on the table is March 21, 28, 2012). MDV reestablished engine picked up these two accounts on March 31 and the MDV effective date is May 1, 2012. But these two accounts (account_id 5861277 and 5865046) early terminated on April 4, 11, 2012). BGA report does not know to handle this pool, so it failed. To get BGA report to re-run and doesn't hold up people's access to EnTRAC today. I data patched this pool as though there is no MDV reestablishment. This is an expired pool, so "should not" have adverse effect on this pool. I updated ENT_POOL_TERM, ENT_POOL_TERM_UPDATES to remove the MDV effective date. I removed the estimated consumption header and detail for the new accounts in the following tables. ENT_PL_EST_CONS_DTL ENT_PL_EST_CONS_HDR ENT_PL_EST_CONS_DTL_UPD ENT_PL_EST_CONS_HDR_UPD
6/8/2012	Other	MonthReportTrigger5.drv	status code 11 An error has occurred executing SQLPLUS	This job was unable to connect to Hyeron Server since server is unavailable from 7PM Friday Jun8 to 8PM Saturday Jun 9 due to upgrade. Reran the job after hyperion database was available around 3:30PM Jun9 and it ended OK.
6/20/2012	Engine	STR Validation Implementation	PENTRAC-870127-ALL(VPC-LX-008@MUMBAI-PROD_ENTRAC) The job failed with status code 1. sysout: + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_strimplemengine.drv 20062012 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01403: no data found RETURN CODE=-1400	The STR Implementation engine failed because it tried to implement a Drop that was in Accepted Pending status with effective date of 24-JUN-2012, but the account had been finalized on 19-JUN-2012. I created an emergency data patch to set the status of the Drop to Accepted Held so that we could rerun the STR Implementation engine. After the data patch the job was rerun successfully.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
6/28/2012	Engine	XML Request Processor	Summary: PENTRAC-120108-ALL failed Description: PENTRAC-120108-ALL ERROR at line 1: ORA-06502: PL/SQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCR_PKG", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.enbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCIAcceptDBAdapter :: saveIPTxnInfo :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCIAcceptDBAdapter :: saveIPTxnInfo :: Error Code = -1861 :: Error Message = ORA-01861: literal does not match format string ORA-06512: at line 1 Product Name: Batch Job	select * FROM ent_ebt_xml WHERE ebt_xml_status_id =1 order by ebt_xml_id The smallest ebt_xml_id was 968681. Did not look for the error. XML is from Absolute Energy Inc. and was uploaded via screen. Implemented data patch to change the status of this file to 2 (parsed) in order that engine will skip it. Engine failed a second time. Now the smallest ebt_xml_id was 968635 (Direct Energy Marketing Limited - came thru P2P). Made 2nd datapatch. Engine reran successfully after 2nd data patch applied.
7/21/2012	Other	Check P2P Errors	Summary: PENTRAC-790875-ALL failed status code 1 Description: Failed with ODATE 120721 Product Name: Batch Job	ENTRAC and P2P database was unavailable due to upgrade. Reran this job after database had been upgraded to 11g from 10g and it ended OK around 2PM on Jul 22, 2012
7/28/2012	Other	Consumer Notification Letters Archive and Print	Summary: PENTRAC-2120130-ALL on apollo has failed with status code 1. Description: PENTRAC-2120130-ALL on apollo has failed with status code 1. Job Forced OK as per documentation. Sysout: + ent_ENTRACToXeroxCN drv 20120728120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20120728.pdf h as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to ipd Output of /prod/app/entrac/Log/FTPCNLETTER-20120728120000.log Product Name: Batch Job	Xerox printer offline. Prod Services forced the job OK. Job was successfully rerun the next biz day.
7/29/2012	Other	Consumer Notification Letters Archive and Print	Summary: PENTRAC-2120130-ALL on apollo has failed with status code 1. Description: PENTRAC-2120130-ALL on apollo has failed with status code 1. Job Forced OK as per documentation. Sysout: + ent_ENTRACToXeroxCN drv 20120729120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20120729.pdf h as data. /usr/local/bin/rpr: error: connect to 192.168.253.124:515: Connection timed out /usr/local/bin/rpr: fatal error: client_open(): cannot connect to ipd Output of /prod/app/entrac/Log/FTPCNLETTER-20120729120000.log Product Name: Batch Job	Xerox printer offline. Prod Services forced the job OK. Job was successfully rerun the next biz day.
7/31/2012	Engine	XML Request Processor	PENTRAC-120108-ALL (VPC-LX-008@PROD-ENTRAC) failed Status code 1. End time 20:05 Sysout: + cd /prod/apps/ENTRAC/jobs/scripts/ + entrac_xmlrequestprocessor.drv 31072012 1 row updated. Commit completed. BEGIN ent_xml_rqst_prcsr_pkg.xml_rqst_prcsr_main_prc(TO_DATE(20120731,'YYYYMMDD\'),'').:ret_code,:ret_message); END; * ERROR at line 1: ORA-03113: end-of-file on communication channel ERROR: ORA-03114: not connected to ORACLE ERROR: ORA-03114: not connected to ORACLE	Had production services rerun the job and it failed again. Turned on DB logging and after rerun saw that the engine was failing on the first file being processed. Data patched the first data file and reran but engine failed again. The engine was suddenly aborting while in java code as per the logging info. Jason examined the java code but nothing unusual was found. Asked DBA to bounce the DB and the subsequent rerun was successful.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
8/8/2012	Engine	BCA Report Generator (1)	cd /prod/apps/EntRAC/jobs/scripts/ entrac_bgaprtgntdataengine.drv 07082012 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422	Re-ran the engine with debug on so that it would tell us which pool had the bad data. Logging indicated that the job failed on pool 104127. This is a Nov 11 pool that is early expired and the MDV was Reestablished for Apr 1 and Jul 1. Created data patch to reverse the Jul 1 MDV Reestablishment in the following tables ENT_POOL_TERM, ENT_POOL_TERM_UPDATES, ENT_PL_EST_CONS_DTL, ENT_PL_EST_CONS_HDR, ENT_PL_EST_CONS_DTL_UPD, ENT_PL_EST_CONS_HDR_UPD. Upon rerun the engine finished successfully but ran slowly for approx 8 hours.
8/10/2012	Other	Actual Consumption Materialized view refresh	cd /prod/app1/entrac/scripts/ ent_refresh_cons_mat_view.drv 20120810120000 prod Output of /prod/app1/entrac/Log/ent_refresh_cons_mat_view-20120810120000.log Executing DBMS_MVIEW.REFRESH ERROR: error in materialized view refresh path not a valid month at "SYS.DBMS_SNAPSHOT", line 2563 at "SYS.DBMS_SNAPSHOT", line 2776 at "SYS.DBMS_SNAPSHOT", line 2745 at line 1: BEGIN DBMS_MVIEW.REFRESH('ent_admin.ent_actl_cnsmpth_mv', atomic_re\ fresh=>false); END; * ERROR at line 1: ORA-12008: error in materialized view refresh path ORA-01843: not a valid month ORA-06512: at "SYS.DBMS_SNAPSHOT", line 2563 ORA-06512: at "SYS.DBMS_SNAPSHOT", line 2776 ORA-06512: at "SYS.DBMS_SNAPSHOT", line 2745 ORA-06512: at line 1	The monthly job failed because the to_date function used in the where clause can no longer accept a zero month in the new 11g version of Oracle. Code in the materialized view was changed to decode the zero month to month 1. These are old consumption records that are not currently being selected for the 24 month window used in the Mat View..
8/11/2012	Interface	SAP to EntRAC Work Order	4. change permission jobs failed with file not found error: ENCHG-070518-ALL, ENCHG-080863-ALL, ENCHG-1140859-ALL, ENCHG-2130867-ALL failed	The jobs failed because earlier CIS had forced ok 4 outbound EntRAC jobs. Requested CIS to rerun their jobs via Prod services. After that was done, prod services reran the 4 change permission jobs which finished successfully.
8/23/2012	Engine	CCL2	Post move activities failed with error message: ORA-00001: unique constraint (ENT_ADMIN.ENT_ACNT_PPG_PK) violated RETURN CODE=-1	Look at ent_move_info_sig, found two rows with new_account_id and old_account_id are the same. created a data patch to by pass the bad account(acc id 6000771) in ent_account table (change the acct_setup_date to one day less than engine run date). Please see LiveRelease_INC36528 for detail. from George: The CCL2 engine job failed due to bad work order data that was sent to us. We can't blame SAP for sending it, more so it's human error, as this information is manually input by work management clerks upstairs. For a CCL pair, it is normally 1 Lock WO matched to 1 Unlock WO. Here we were sent 2 separate Lock WO's on different dates referencing the 1 Unlock and 2 CCL's were generated. When the new account came in last night, it tried to create 2 account PPG records due to the 2 CCL's. It has never happened before and most likely won't happen again.
8/28/2012	Engine	CCL2	PENTRAC-900123-ALL (VPC-LX-000@PROD-ENTRAC) failed The job failed with status code1. End time 21:36. Sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_moverqsttrctsetupengine.drv 28082012 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN_MESSAGE=Post move activities failed with error message: ORA-01403: no data found PENTRAC-900123-ALL (VPC-LX-000@PROD-ENTRAC) failed The job failed with status code1. End time 21:36. Sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_moverqsttrctsetupengine.drv 28082012 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN_MESSAGE=Post move activities failed with error message: ORA-01403: no data found	Saket had been working on a fix for this "no data found" error which was to go to production soon. Got the fixed version of the code from him and had prod services compile and rerun. The subsequent rerun was successful.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
9/3/2012	Interface	AltraToEnTRAC Delivery	<pre> + ent_AltraToEnTRACDelivery.drv 20120903120000 prod Output of /prod/app/entrac/log/AltraToEnTRACDelivery-20120903120000.log Job ran; checking for errors Job status: -RUN FAILED (3) - Job started: -Mon Sep 3 09:00:10 2012- Job ended: -Mon Sep 3 09:00:30 2012- ERROR: Job did not return successfully WARNING: Cannot get info on link Process_Delivery_Data.altra_extract_rejects_f \ (255) Rows pushed through reject link (altra_extract_rejects_f): -- WARNING: Cannot get info on link Process_Delivery_Data.ent_if_error01 (255) Rows pushed through reject link (ent_if_error01): -- Rows pushed through reject link (ent_if_error02): -0- Product Name: Batch Job </pre>	Copied the inbound file AltraToEnTRACDaily20120903.txt to the folder /dev/app/entrac2dev/indata on lynx. Ran the job called AltraToEnTRACDeliveryCheckAllIRRejects on entrac2dev project on lynx using the entprod1 database. Discovered that 1 rejected txns were created by this job by checking the rejects file (no data was written to the DB). The rejected txns were due to DPA number 8997700 doesn't exist in table add 8997700 to gazfile_jools.txt ReRun job and job completed successfully by 3 PM.
9/6/2012	Engine	XML Request Processor	<pre> ERROR at line 1: ORA-06502: PL/SQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCR_PKG", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.enbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.XMLDBAdapter :: savePIPTxnInfo :: Error trying to save EBT_XML_ID = 989601 The error occurred in a PIP transaction of type: HistoricalConsumptionRequest. :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.HistoricalConsumption RequestDBAdapter :: savePIPTxnInfo :: For input string: "12" ORA-06512: at line 1 ERROR at line 1: ORA-06502: PL/SQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCR_PKG", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.enbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.XMLDBAdapter :: savePIPTxnInfo :: Error trying to save EBT_XML_ID = 989601 The error occurred in a PIP transaction of type: HistoricalConsumptionRequest. :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.HistoricalConsumption RequestDBAdapter :: savePIPTxnInfo :: For input string: "12" ORA-06512: at line 1 </pre>	(Nice new error message!) I just took an old datapatch and changed it to use the xml_ID listed in the nice new error message (989601). I had to change the userID too of course. The datapatch changes the status of the bad record to 'processed'. Today's datapatch is LiveRelease_INC39019.sql.
9/29/2012	Engine	CCL2	<pre> Sysout: + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_moverqstcrctsetupengine.drv 29092012 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422 Product Name: EnTRAC </pre>	Added more debug statement in CCL2 to identify which account caused the engine failure. Applied the data patch to bypass this account with account_id 6038047 by updating the account set up date from 29-Sep-2012 to 28-Sep-2012 on ent_account table and reran this job. It ended OK.
10/2/2012	Engine	XML Request Processor	PENTRAC-120108-ALL on MUMBAI is executing past its run time average of 2 minutes.	There were a high number of IRR (Application advice accept) transactions causing the engine to run slowly, however it ultimately completed after running for 4.85 hours. No action required.

[illegible]

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
11/1/2012	Other	Consumer Notification Letters Archive and Print	PENTRAC-2120130-ALL @PROD-ENTRAC (apollo) - status code =1 - forced okay per documentation	Xerox printer offline. Prod Services forced the job OK; To check: open command prompt window and type: 'ping 192.168.253.124'. If you get a response, then the printer is online again, and you can have the job re-run with the run date of the day it failed.
11/2/2012	Other	Consumer Notification Letters Archive and Print	Summary: PENTRAC-2120130-ALL @PROD-ENTRAC (VPC-LX-005@apollo); Force job okay per doc.	Xerox printer offline. Prod Services forced the job OK; To check: open command prompt window and type: 'ping 192.168.253.124'. If you get a response, then the printer is online again, and you can have the job re-run with the run date of the day it failed.
11/3/2012	Other	Consumer Notification Letters Archive and Print	Summary: PENTRAC-2120130-ALL (VPC-LX-005 @PROD-ENTRAC) has failed with status code 1 Description: PENTRAC-2120130-ALL (VPC-LX-005 @PROD-ENTRAC) has failed with status code 1 at 20:35. Sysout: + cd /prod/app/entrac/Scripts/ + ent_EntracToXeroxCN.drv 20121103120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20121103.pdf h) as data. /usr/local/bin/rpr: error: check_ack: timed out waiting for ACK to our job req uest /usr/local/bin/rpr: fatal error: unable to send job request to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20121103120000.log	Xerox printer offline. Prod Services forced the job OK; To check: open command prompt window and type: 'ping 192.168.253.124'. If you get a response, then the printer is online again, and you can have the job re-run with the run date of the day it failed.
11/4/2012	Other	Consumer Notification Letters Archive and Print	Summary: PENTRAC-2120130-ALL @PROD-ENTRAC (VPC-LX-005@apollo); Force job okay per doc.	Xerox printer offline. Prod Services forced the job OK; To check: open command prompt window and type: 'ping 192.168.253.124'. If you get a response, then the printer is online again, and you can have the job re-run with the run date of the day it failed.
11/5/2012	Other	Consumer Notification Letters Archive and Print		Xerox printer offline. Prod Services forced the job OK; To check: open command prompt window and type: 'ping 192.168.253.124'. If you get a response, then the printer is online again, and you can have the job re-run with the run date of the day it failed.
11/6/2012	Other	Consumer Notification Letters Archive and Print	Summary: PENTRAC-2120130-ALL on Apollo failed status code 1. Description: PENTRAC-2120130-ALL on Apollo failed status code 1. Job started and failed at 20:34. Sysout: + cd /prod/app/entrac/Scripts/ + ent_EntracToXeroxCN.drv 20121106120000 prod /prod/app/entrac/Outdata/ConsolidatedConsumerNotificationLetter_20121106.pdf h) as data. /usr/local/bin/rpr: error: check_ack: timed out waiting for ACK to our job req uest /usr/local/bin/rpr: fatal error: unable to send job request to lpd Output of /prod/app/entrac/Log/FTPCNLETTER-20121106120000.log Product Name: ENTRAC	Xerox printer offline. Prod Services forced the job OK; To check: open command prompt window and type: 'ping 192.168.253.124'. If you get a response, then the printer is online again, and you can have the job re-run with the run date of the day it failed.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
12/7/2012	Engine	XML Response Generation Engine	The engine did not fail, however EnTRAC support sent a Change/TAR ticket stating that no IRR's had been sent out starting Dec 3/12. There was an IRR for an account that had 600 adjustments. This IRR was causing the IRR_rspns_prc proc in the XML Response engine to abort(not fail) and no further IRR's could be processed since Dec 3. They were all lying in Ready for XML response state.	Ran the query to see fatal error(which does not cause the engine to fail): select log_id, usr.LOGIN_USER, NAME from ENT_APPLICATION_LOG log, ent_user usr where log_id >= 137379281 -10000. and log.MODIFIED_BY_USER_ID = usr.user_id and source_name in ('ent_gnt_xml_rspns_pkg.generate_pip_rspns_prc', 'ent_gnt_xml_rspns_pkg.rr_req_prc') order by log_log_id desc; Ran the following query to find the account with the high number of adjustments: select EACA.ACCOUNT_NUM, ERR.EBT_IRR_ID, count(*) from ent_actl_cnsmptn_adj eaca, ent_ebt_irr err where err.ebt_status_id = 3 and EACA.ACCOUNT_NUM = ERR.DISTRIBUTOR_ACNT_NUM and EACA.IRR_SENT_STTS is NULL and EACA.BILLING_CYCLE_YEAR > 2012 group by EACA.ACCOUNT_NUM, ERR.EBT_IRR_ID order by count(*) desc; Created Data patch LiveRelease_CRO37872.sql to bypass the IRR with too many adjustments. The XML Response engine was then run and the rest of the IRR's since Dec 3 were generated in outbound files. The EnTRAC to P2P IF was then run to send the files out. Alternate Query select ESP.EBT_IRR_VRSN_ID, ERR.EBT_IRR_ID, count(*) from ent_ebt_irr_svc_prd esp, ent_ebt_irr err, ent_ebt_irr_vrsn esiv where --err.ebt_status_id = 3 Esp.EBT_IRR_VRSN_ID = EEIV.EBT_IRR_VRSN_ID and EEIV.EBT_IRR_ID = ERR.EBT_IRR_ID and err.ebt_type_id = 34 and EEIV.BILLING_YEAR >= 2012 group by ESP.EBT_IRR_VRSN_ID, ERR.EBT_IRR_ID order by count(*) desc; The date format is incorrect in ent_EnTRACTop2P cmd. The date format should be YYYYMMDD rather than DDMMYYYY. The defect exist in EnTRAC since EnTRAC implementation. The problem didn't show up before because the last two digits of the year is 12 or less which is a valid month. Made a change to this cmd file, the job rerun successfully.
1/1/2013	Interface	EnTRAC to P2P	<pre>+ cd /prod/apps/EnTRAC/jobs/scripts/ + ent_EnTRACTop2P.drv 01012013 BEGIN p2p_if_pip_doc_pkg.pull_pipe_doc_prc(TO_DATE(20130101,'DDMMYYYY'),ret_code,ret_message); END; *</pre> ERROR at line 1: ORA-01843: not a valid month ORA-06512: at "SYS.STANDARD", line 167 ORA-06512: at line 1	I took an old datapatch and changed it to use the xml_id listed in the error message (1038836). I had to change the userID too of course. The datapatch changes the status of the bad record to 'processed'. Today's datapatch is LiveRelease_INC61920.sql.
1/5/2013	Engine	XML Request Processor	Summary: PENTRAC-120108-ALL (on MUMBAI) failed Description: PENTRAC-120108-ALL (on MUMBAI) failed with status code 1. Start Time: 20:03 End Time: 20:03 There is no documentation available for this job. Sysout: <pre>+ cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_xmlrequestprocessor.drv 05012013 1 row updated. Commit complete. BEGIN ent_xml_rqst_prcsr_pkg.xml_rqst_prcsr_main_prc(TO_DATE(20130105,'YYYYMMDD\ '),ret_code,ret_message); END; *</pre> ERROR at line 1: ORA-06502: PL/SQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCSCR_PKG", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.enbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.XMLDBAdapter :: savePIPTxnInfo :: Error trying to save EBT_XML_ID = 1038836 The error occurred In a PIP transaction of type: ChangeConsumerInfoReject. :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCRejectDBAdapter	

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
1/8/2013	Engine	BGA Report Engine 2	"Summary: PENTRAC-500001-BCD21OR8-Y(VPC-LX-008@PROD-ENTRAC) failed Description: PENTRAC-500001-BCD21OR8-Y(VPC-LX-008@PROD-ENTRAC) failed The job failed with status code 1. End time 20:03 Sysout: + cd /prod/apps/EntTRAC/jobs/scripts/ + entrac_bgaprtgntengine.drv 08012013 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-01422: exact fetch returns more than requested number of rows RETURN CODE=-1422"	Corrective Action Taken Turned on debugging and rean engine. It promptly failed on no data found error. Ran query A below and found one potential pool that would cause too many rows error. Ran Qry B from the failed engine proc and it showed 2 (too many rows). This was an April 1,12 pool that was early terminated on Dec. 1,12 but the MDV had also been Reestablished for it for Dec. 1,12. Created data patch LiveRelease_CRO40746.sql to reverse the MDV Reestablishment of the pool. Another script was created to clean up tables of partial engine run. The engine then completed successfully. Later during the day of Jan 9, Direct Purchase reported that BGA volumes had doubled for many pools. This issue is currently being worked. Query A select * from ent_pool_term_updates epu , ent_pool_term epd where epu.mdv_effective_date = '1-DEC-2012' and epu.pool_id = epd.pool_id and EPTU_POOL_TERM_CNMCNMT_DATE=EPT_POOL_TERM_CNMCNMT_DATE and EPTU_TERM_EXPIRY_DATE < EPTU.MDV_EFFECTIVE_DATE Query B - from BGA PPT2 write_report_proc SELECT pterm.mdv_effective_date pterm_expiry_date pterm.mdv_effective_date pterm.mdv_expiry_date -INTO v.mdv_effective_date v.term_expiry_date FROM ENT_POOL_TERM pterm, ENT_POOL_TERM_UPDATES ptermu WHERE pterm.pool_id = 105129-pool_id,1 AND pterm.pool_term_cnmcnmt_date = '01-APR-2012'-pool_term_cnmcnmt_date,1 AND ptermu.pool_term_cnmcnmt_date = pterm.pool_term_cnmcnmt_date AND ptermu.pool_id = pterm.pool_id AND ('01-DEC-2012' > term_expiry_date OR ('01-DEC-2012' BETWEEN ptermu.mdv_effective_date AND ptermu.mdv_expiry_date AND pterm.term_expiry_date BETWEEN ptermu.mdv_effective_date AND ptermu.mdv_expiry_date)); Going forward, the correct way to rerun this engine is to first have the following SQL run before the rerun: DELETE FROM ent_pl_bga_rptl_sq pbs WHERE EXISTS (SELECT 1 FROM ent_pool_bga_rpt pbrp WHERE pbrp.report_date = LAST_DAY(ADD_MONTHS(Engine Run date, -2)) + 1 AND pbrs.pool_id = pbrp.pool_id AND pbrs.pool_term_cnmcnmt_date = pbrp.pool_term_cnmcnmt_date) The record with the missing PPG id was removed from the file, the trailer record altered with respect to the number of records and the negative total column to account for the missing record. Asked Prod Services to run the FTP job ENPUT-2080866-ALL and the file was sent to CIS. Earl reran his job and the downstream jobs have rerun successfully.
1/22/2013	Interface	SAPCIS IVA interface from ENTRAC	Summary: SAPCIS IVA interface from ENTRAC failed as a result of an invalid record in the file. Description: SAPCIS interface failed as a result of an invalid record in the file(entrac_sap_va_20130121.dat). One of the records was missing the PPG id and caused the CIS job to fail. 9002185320678716 -1.97 VendorAdjustmentGas 20130121 102379341 500975399 90021910008213495 -2.55 VendorAdjustmentGas 20130121 102379342 missing PPG" 90021084521314004 -2.48 VendorAdjustmentGas 20130121 102379344 000619824	The record with the missing PPG id was removed from the file, the trailer record altered with respect to the number of records and the negative total column to account for the missing record. Asked Prod Services to run the FTP job ENPUT-2080866-ALL and the file was sent to CIS. Earl reran his job and the downstream jobs have rerun successfully.
1/22/2013	Interface	ENCHG-2130867-ALL	Summary: ENCHG-2130867-ALL on apollo has failed with status code 1. Sysout: + cd /prod/app/entrac/Indata/ + chimod 640 sap_entrac_va_post_status_*20*.dat + sap_entrac_va_post_20*.dat chimod: can't access sap_entrac_va_post_status_*20*.dat chimod: can't access sap_entrac_va_post_20*.dat + chown entrac:entrac sap_entrac_va_post_status_*20*.dat + sap_entrac_va_post_20*\n.dat sap_entrac_va_post_status_*20*.dat: No such file or directory sap_entrac_va_post_20*.dat: No such file or directory Product Name: ENTRAC	CIS forced one of their jobs OK and this sent a IN condition for the ENTRAC job to run and it failed because CIS did not send a file. Told Prod Services to set the job back to Wait State.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
1/29/2013	Engine	XML Request Processor	Summary: Job PENTRAC-120108-ALL failed on Mumbai Description: Job PENTRAC-120108-ALL failed on Mumbai with a status code 1. See Sysout details below. Please let Production Services know of any further instructions. Thanks. <pre>+ cd /prod/apps/EntRAC/jobs/scripts/ + entrac_xmlrequestprocessor.drv 29012013 1 row updated. Commit complete. BEGIN ent_xml_rqst_prcsr_pkg.xml_rqst_prcsr_main_prc(TO_DATE(20130129,'YYYYMMDDI'),ret_code,ret_message); END; *</pre> ERROR at line 1: ORA-06502: PLUSQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCR_PKG", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.entbridge.entrac.framework.exceptions.DBSystemException: com.entbridge.entrac.business.cm.requestprocessor.dbadapter.XMLDBAdapter :: savePIPTxnInfo :: Error trying to save EBT_XML_ID = 1046518 The error occurred in a PIP transaction of type: ChangeConsumerInfoAccept. :: com.entbridge.entrac.business.cm.requestprocessor.dbadapter.CCIAcceptDBAdapter :: savePIPTxnInfo :: com.entbridge.entrac.business.cm.requestprocessor.dbadapter.CCIAcceptDBAdapter :: savePIPTxnInfo :: Error Code = -1841 :: Error Message = ORA-01841. (full) Year must be between -4713 and +9999, and not be 0 ORA-06512: at line 1 RETURN MESSAGE=	I took an old datapatch and changed it to use the xml_ID listed in the error message (1046518). I had to change the userid too, of course. The datapatch changes the status of the bad record to 'processed'. Today's datapatch is LiveRelease_INC66752.sql.
1/29/2013	other	Consumer Notification Letters Archive and Print	Summary: Job PENTRAC-2120130-ALL failed on Apollo Description: Job PENTRAC-2120130-ALL failed on Apollo with a status code 1. See Sysout details below. Please let Production Services know of any further instructions. Thanks. NOTE: The job has been 'forced OK' as per Documentation. The Doc also indicates 'Low Priority'. <pre>+ cd /prod/app/entrac/Scripts/ + ent_EntRACtoXerox.drv 20130129120000 prod /prod/app/entrac/Outdata/Queue/20130128/FTPCLNLETTER/ConsolidatedConsumerNotifi\ cationLetter_20130128.pdf has data. /prod/app/entrac/Outdata/Queue/20130129/FTPCLNLETTER/ConsolidatedConsumerNotifi\ cationLetter_20130129.pdf has data. /usr/local/bin/rfpr: error: check_ack: timed out waiting for ACK to our job req. uest /usr/local/bin/rfpr: fatal error: unable to send job request to lpd Output of /prod/app/entrac/Log/FTPCLNLETTER 20130129120000.log ConsolidatedConsumerNotificationLetter_20130129 queued as /prod/app/entrac/Out\ data/Queue/20130129/FTPCLNLETTER/ConsolidatedConsumerNotificationLetter_20130129\ .pdf /usr/local/bin/rfpr: info: 1 file spooled to GDAR_letters@192.168.253.124 (prox) y (none) Number of Letters sent to Xerox for Print on - 20130128 ConsolidatedConsumerNotificationLetter_20130128 archived as /prod/app/entrac/O\ utdata/Archive/20130128/FTPCLNLETTER/ConsolidatedConsumerNotificationLetter_2013\ 0128.pdf Z 20130128 removed successfully from Queue folder Product Name: Batch Job</pre>	Low priority, so I worked on this the next business day. So far, asked Marcin at Xerox if there have been any changes. Sent details to Rob Manocchio to see if he can find the cause. Later, somebody from Xerox said that the power went out and something had to be reset. Everything got sent out successfully.
3/3/2013	Interface	AltraToEntRAC Delivery	<pre>+ cd /prod/app/entrac/Scripts/ + ent_AltraToEntRACDelivery.drv 20130303120000 prod Output of /prod/app/entrac/Log/AltraToEntRACDelivery-20130303120000.log Job ran; checking for errors Job status: --RUN FAILED (3) -- Job started: -Sun Mar 3 09:00:12 2013- Job ended: -Sun Mar 3 09:00:24 2013- ERROR: Job did not return successfully WARNING: Cannot get info on link Process_Delivery_Data.altra_extract_rejects_f \ (255) Rows pushed through reject link (altra_extract_rejects_f): -- WARNING: Cannot get info on link Process_Delivery_Data.ent_if_error01 (255) Rows pushed through reject link (ent_if_error01): -- Rows pushed through reject link (ent_if_error02): -0-</pre>	Copied the inbound file AltraToEntRACDaily20130303.txt to the folder /dev/app/entrac2dev/indata on lynx. Ran the job called AltraToEntRACDeliveryCheckAllRejects on entrac2dev project on lynx using the entprod1 database. Discovered that 1 rejected txns were created by this job by checking the rejects file (no data was written to the DB). The rejected txns were due to missing pool name for one of the record. 2013.3: "Empress"; MEMML MTT"; 971132"; ABCFUEL"; 5..... The job was then rerun but it failed again because the ent_admin password was locked. A DBA reactivated the account and then the job was rerun successfully rerun job.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
3/15/2013	Interface	AltraToEnTRAC Delivery	<pre> + cd /prod/app/entrac/scripts/ + ent_AltraToEnTRACDelivery.drv 20130315120000 prod Output of /prod/app/entrac/Log/AltraToEnTRACDelivery-20130315120000.log Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Fri Mar 15 09:00:08 2013- Job ended: -Fri Mar 15 09:00:22 2013- ERROR: Job did not return successfully WARNING: Cannot get info on link Process_Delivery_Data.altra_extract_rejects_f \ (255) Rows pushed through reject link (altra_extract_rejects_f): -- WARNING: Cannot get info on link Process_Delivery_Data.ent_if_error01 (255) Rows pushed through reject link (ent_if_error01): -- Rows pushed through reject link (ent_if_error02): -0- + ent_AltraToEnTRACDelivery.drv 20130303120000 prod Output of /prod/app/entrac/Log/AltraToEnTRACDelivery-20130303120000.log Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Sun Mar 3 09:00:12 2013- Job ended: -Sun Mar 3 09:00:24 2013- ERROR: Job did not return successfully WARNING: Cannot get info on link Process_Delivery_Data.altra_extract_rejects_f \ (255) Rows pushed through reject link (altra_extract_rejects_f): -- WARNING: Cannot get info on link Process_Delivery_Data.ent_if_error01 (255) Rows pushed through reject link (ent_if_error01): -- Rows pushed through reject link (ent_if_error02): -0- </pre>	The Datastage log indicated a pipeline point name 'CONSCDA' causing a problem ask SMS to send us a new file. The new file owner is entfp 1. Ask P.S. to run Please run this ENCHG-410505-ALL to change owner 2. ask P.S. to rename the original to ...xtBAD 3. the new file has wrong date 20120316, ask P.S. to change file name to 20120313. 4. ask P.S. to reset datastage job and rerun Rerun job and job completed successfully by 5 PM.
3/24/2013	Engine	PCR Generation	<pre> + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_pcrengine.drv 24032013 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-08103: object no longer exists RETURN_CODE=-8103 Product Name: Batch Job </pre>	rerun engine with debug on, completed successfully
3/29/2013	Engine	PCR Generation	<pre> Summary: VPC-LX-008(VPC-LX-008@PROD-ENTRAC) failed Description: VPC-LX-008(VPC-LX-008@PROD-ENTRAC) failed The job failed with status code 1. Sysout: + cd /prod/apps/EnTRAC/jobs/scripts/ + entrac_pcrengine.drv 29032013 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-08103: object no longer exists RETURN_CODE=-8103 </pre>	a re-run completed successfully.
3/30/2013	Engine	PCR Generation	<pre> cd /prod/apps/EnTRAC/jobs/scripts/ entrac_pcrengine.drv 30032013 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-08005: specified row does not exist RETURN_CODE=-8005 </pre>	a re-run completed successfully. (I'm surprised)
4/3/2013	Interface	ENCHG-070518-ALL	This was not a job failure, but a Control M "Shout" was generated to notify Prod Services that the work order file icaa_pendlock.dat (usually in by 7pm) had not been received by 8:45pm.	CIS processing was late and the file subsequently arrived by 9:30pm and this job to change the file permissions ran successfully and so did the subsequent Work Order Interface job.
4/3/2013	Engine	PCR Generation	<pre> cd /prod/apps/EnTRAC/jobs/scripts/ entrac_pcrengine.drv 03042013 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-08103: object no longer exists RETURN_CODE=-8103 </pre>	Prod Services reran the job as they have been instructed and the job completed successfully.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
4/5/2013	Engine	xml request processor	ERROR at line 1: ORA-06502: PL/SQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCR_PKG", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.enbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.XMLDBAdapter :: savePIPTxnInfo :: Error trying to save EBT_XML_ID = 1070461 The error occurred In a PIP transaction of type: ChangeConsumerInfoReject. :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCIRejectDBAdapter :: savePIPTxnInfo :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCIRejectDBAdapter :: savePIPTxnInfo :: Error Code = -1861 :: Error Message = ORA-01861: literal does not match format string ORA-06512: at line 1	I took an old datapatch and changed it to use the xml_ID listed in the error message (1070461) . I changed the userID to -1195. The datapatch changes the status of the bad record to 'processed' (2). Today's datapatch is LiveRelease_INC78797.sql. This xml only has 4 PIPS in it. 1 is CCI accept. 3 are CCI Reject. All 4 have a 5 digit year. It's direct Energy. DRN = PML200402412013040506100000712
4/6/2013	Engine	PCR Generation	+ cd /prod/apps/EntRAC/jobs/scripts/ + entrac_pcrengine.drv 06042013 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01502: index 'ENT_ADMIN.ENT_PROCESSED_STR_MVW_IDX1' or partition of such index is in unusable state RETURN_CODE=-1502 Product Name: Batch Job + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_pcrengine.drv 06042013 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01502: index 'ENT_ADMIN.ENT_PROCESSED_STR_MVW_IDX1' or partition of such index is in unusable state RETURN_CODE=-1502 Product Name: Batch Job	Prod Services reran the job as they have been instructed and the job completed successfully.
4/7/2013	Engine	PCR Generation	PENTRAC-170111-ALL (on MUMBAI) failed with status code 1. Start Time: 21:14 End Time: 21:19 + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_pcrengine.drv 07042013 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-08103: object no longer exists RETURN_CODE=-8103 PENTRAC-170111-ALL on mumbai has failed with status code 1. Sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_pcrengine.drv 13042013 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01502: index 'ENT_ADMIN.ENT_PROCESSED_STR_MVW_IDX1' or partition of such index is in unusable state RETURN_CODE=-1502 Summary: PENTRAC-170111-ALL on mumbai has failed with status code 1. Description: PENTRAC-170111-ALL on mumbai has failed with status code 1. Sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_pcrengine.drv 13042013 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01502: index 'ENT_ADMIN.ENT_PROCESSED_STR_MVW_IDX1' or partition of such index is in unusable state RETURN_CODE=-1502 Summary: PENTRAC-170111-ALL on mumbai has failed with status code 1. Description: PENTRAC-170111-ALL on mumbai has failed with status code 1. Sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_pcrengine.drv 13042013 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01502: index 'ENT_ADMIN.ENT_PROCESSED_STR_MVW_IDX1' or partition of such index is in unusable state RETURN_CODE=-1502 Summary: PENTRAC-170111-ALL on mumbai has failed with status code 1.	Prod Services reran the job as they have been instructed and the job completed successfully.
4/13/2013	Engine	PCR Generation	+ cd /prod/apps/EntRAC/jobs/scripts/ + entrac_pcrengine.drv 13042013 PL/SQL procedure successfully completed. RETURN_MESSAGE=ORA-01502: index 'ENT_ADMIN.ENT_PROCESSED_STR_MVW_IDX1' or partition of such index is in unusable state RETURN_CODE=-1502 Summary: PENTRAC-170111-ALL on mumbai has failed with status code 1.	Prod Services reran the job and the job completed successfully.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
5/17/2013	Interface	OpenLink To Entrac Delivery	FILEWATCH-ALTRA-DAILY(VPC-LX-005@PROD-ENTRAC) failed The job failed with status code 7. Sysout: <pre>+ ctmfw /prod/app/entrac/Indata/AltraToEntracDaily20130515.txt CREATE 0 60 15 \ 5 90 0517 08:31:03 : File '/prod/app/entrac/Indata/AltraToEntracDaily20130515.txt' \ was not CREATED within the time limit. id=1.</pre>	This incident happened in the morning of a business day. I contacted the support person for Openlink (Yousef Shorman) by email. He arranged to have Openlink send us the file. I had to check that it was the right file by going on Apollo. The first couple of tries he made gave us a file with the wrong name. After the properly named file showed up, I had the job re-run and everything went OK.
5/23/2013	Engine	XML Response Generation Engine	The engine did not fail, however ENTRAC support sent a incident ticket stating that no IRR's had been sent out starting Tues May 21/13. There was an IRR for an account that had 727 adjustments. This IRR was causing the IRR_rspns_prc proc in the XML Response engine to abort (but not fail) and no further IRR's could be processed since May 21/13. They were all lying in Ready for XML response state. error: -22813 ORA-22813: operand value exceeds system limits IRRs could not be generated -22813 ORA-22813: operand value exceeds system limits IRR XML Response Processor failed	Ran the query to see fatal error(which does not cause the engine to fail): <pre>select log_id, usr.LOGIN_USER_NAME from ENT_APPLICATION_LOG log, ent_user usr where log_id >= 147945408 -10000. and log.MODIFIED_BY USER_ID = usr.user_id and source_name in ('ent_gmt_xml_rspns_pkg.generate_pip_rspns_prc', 'ent_gmt_xml_rspns_pkg.rrr_red_prc') order by log_id desc;</pre> Ran the following query to find the account with the high number of adjustments: <pre>select EACA.ACCOUNT_NUM, ERR.EBT_IRR_ID, count(*) from ent_actl_cnsmptn_adj_eaca, ent_ebt_irr_err where err_ebt_status_id = 3 and EACA.ACCOUNT_NUM = ERR.DISTRIBUTOR_ACNT_NUM and EACA.IRR_SENT_STTIS is NULL and EACA.BILLING_CYCLE_YEAR > 2012 group by EACA.ACCOUNT_NUM, ERR.EBT_IRR_ID order by count(*) desc;</pre> Created Emergency Data patch LiveRelease_CRQ60353.sql to bypass the IRR with too many adjustments. The XML Response engine was then run and the rest of the IRR's since May 21/13 were generated in outbound files. The ENTRAC to P2P IF was then run to send the files out. Alternate Query <pre>select ESP.EBT_IRR_VRSN_ID, ERR.EBT_IRR_ID, count(*) from ent_ebt_irr_swc_prd esp, ent_ebt_irr_err, ent_ebt_irr_vrsn espv where --err_ebt_status_id = 3 ESP.EBT_IRR_VRSN_ID = EEIV.EBT_IRR_VRSN_ID and EEIV.EBT_IRR_ID = ERR.EBT_IRR_ID and err_ebt_type_id = 34 and EEIV.BILLING_YEAR >= 2012 group by ESP.EBT_IRR_VRSN_ID, ERR.EBT_IRR_ID order by count(*) desc;</pre> The failure was caused due to incorrect Delivery Data loaded this morning (Jun 2). The May 31 file that Openlink sent actually contained May 1 data. Resolution was 2 part. 1 Delete the bad data loaded to the ent_delivery_dtl table 2 Gt the correct data from Openlink. A data patch was created/implemented to cleanup the bad May 1 Delivery data and Openlink resent the corrected file with May 31 data and it was loaded. The failed job was then rerun successfully.
6/2/2013	Engine	Delivery Manager	Summary: PENTRAC-430104-ALL (PN430104-A)@PROD-ENTRAC - failed on code=1. <pre>+ cd /prod/apps/Entrac/jobs/scripts/ + entrac_dlvymngengine.drv 02062013 PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-20177: RETURN CODE=-20177 ORA-20177: Delivery manager has already been run for this date Product Name: Batch Job</pre>	The failure was caused due to incorrect Delivery Data loaded this morning (Jun 2). The May 31 file that Openlink sent actually contained May 1 data. Resolution was 2 part. 1 Delete the bad data loaded to the ent_delivery_dtl table 2 Gt the correct data from Openlink. A data patch was created/implemented to cleanup the bad May 1 Delivery data and Openlink resent the corrected file with May 31 data and it was loaded. The failed job was then rerun successfully.
6/3/2013	Other	ENCHG-410505-ALL	ENCHG-410505-ALL (on APOLLO) failed with status code 1. Start Time: 07:02 End Time: 07:02 Sysout: <pre>+ cd /prod/app/entrac/Indata/ + chmod 640 AltraToEntracDaily20130601.txt chmod: can't change AltraToEntracDaily20130601.txt: Not owner + chown entrac:entrac AltraToEntracDaily20130601.txt AltraToEntracDaily20130601.txt: Not owner Product Name: Batch Job</pre>	The job failed due to the previous night issue with the Delivery Manager. When Yousef sent the corrected May 31 file, some other files were inadvertently sent which wiped out the file containing Jun 1 data. I had saved this file and had it copied back to Indata using the "entrac" id. Since this job runs with user "entftp" and changes ownership of the file from "entftp" to "entrac", it failed because it could not execute the command. Since the file already had the correct ownership in the first place, Prod Services was asked to simply force the failed job ok.
6/6/2013	Interface	P2P To Entrac	PENTRAC-840703-ALL@PROD-ENTRAC job failed on code=1. No documentation. In entrac log, there was: <pre>-1400 ORA-01400: cannot insert NULL into ("ENT_ADMIN"."ENT_EBT_XML"."RECIPIENT_SLA_ID") OTHER EXCEPTION</pre>	the record in the P2P database had 'enbridgegd' instead of 'ENBRIDGEGD' in the p2p_xml.doc.recptnmp_unique_id column. Made a datapatch to change it. Re-ran the job and it ran successfully.
6/7/2013	Interface	P2P To Entrac	PENTRAC-840703-ALL@PROD-ENTRAC job failed on code=1. No documentation. In entrac log, there was: <pre>-1400 ORA-01400: cannot insert NULL into ("ENT_ADMIN"."ENT_EBT_XML"."RECIPIENT_SLA_ID") OTHER EXCEPTION</pre>	the record in the P2P database had 'enbridgegd' instead of 'ENBRIDGEGD' in the p2p_xml.doc.recptnmp_unique_id column. Made a datapatch to change it. Re-ran the job and it ran successfully.

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
6/14/2013	Other	ENCHG-410505-ALL	ENCHG-410505-ALL on APOLLO failed with status code 1. Start time: 07:02 End time: 07:02 + cd /prod/app/entrac/indata/ + chmod 640 AltraToEnTRACDaily20130601.txt + AltraToEnTRACDaily20130612.txt chmod: can't change AltraToEnTRACDaily20130601.txt: Not owner + chown entrac:entrac AltraToEnTRACDaily20130601.txt + AltraToEnTRACDaily20130612.txt AltraToEnTRACDaily20130601.txt: Not owner Product Name: EnTRAC	It seems from time to time Openlink has sent "extra" garbage files that they should not send. The job failed because 2 days ago they had sent a (unneeded) 2 week old Jun 1 file, which yesterday had the permissions correctly changed (to entrac:owner) but today failed because the ownership was changed yesterday on the file. This is a file that we would never use and would sit in indata forever. In any case the job did already change the current day file (Jun 12), so the job was forced ok and then I asked Prod services to rename the needed file(s).
6/30/2013	Engine	CCL2	Sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_movestrtscitsetupengine.drv 30062013 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-06502: PL/SQL: numeric or value error	this seems to be a new problem, George confirmed there is no CCL and no ROS for account set up dat June 30. Rerun the job with the debug version George provided. The job was rerun successfully.
7/12/2013	Other	FILEWATCH-ALTRA-DAILY	The delivery file was not received last night @ 7:30 therefore this file watcher job running @ 8:30am failed.	Asked Openlink MRM support to send the file which they FTP'd. Prod Services then forced the failed job ok and then the CHMOD job ran and the ALTRA Delivery Interface successfully loaded the file.
7/14/2013	Engine	CCL2	PENTRAC-900123-ALL (on MUMBAI) failed with status code 1. Start Time: 20:48 End Time: 20:48 Sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_movestrtscitsetupengine.drv 14072013 1 row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-06502: PL/SQL: numeric or value error RETURN CODE=6502 Product Name: Batch Job	There is a bug in the current production version of the CCL2 engine causing the failure. Had Prod Services compile and rerun the older debug version of the code and the rerun completed successfully. Like the Jul 30/13 failure, there were no new accounts that came in for CCL or ROS tonight.
7/29/2013	Engine	Consumer Notification	Got an exception while generating a PDF. Document processing failure at line 72: org.apache.pdfbox.pdmodel.pdfstream.PDFStreamException: Syntax expression: unknown escape sequence '\0' at chunk 'C:\O DEL PROPERTY MANAGEMENT INC.'^ at org.ujac.print.BaseDocumentTag.processEscapes(BaseDocumentTag.java:2039)^ at org.ujac.print.BaseDocumentTag.addChunk(BaseDocumentTag.java:1816)^ at org.ujac.print.BaseDocumentTag.addChunk(BaseDocumentTag.java:1751)^ at org.ujac.print.BaseDocumentTag.flushContent(BaseDocumentTag.java:810)^ at org.ujac.print.DocumentHandler.endElement(DocumentHandler.java:2136)^ at org.apache.crimson.parser.Parser2.maybeElement(Parser2.java:1712)^ at org.apache.crimson.parser.Parser2.content(Parser2.java:1963)^ at org.apache.crimson.parser.Parser2.maybeElement(Parser2.java:1691)^ at org.apache.crimson.parser.Parser2.content(Parser2.java:1963)^ at org.apache.crimson.parser.Parser2.maybeElement(Parser2.java:1691)^ at org.apache.crimson.parser.Parser2.content(Parser2.java:1963)^ at org.apache.crimson.parser.Parser2.maybeElement(Parser2.java:1691)^ at org.apache.crimson.parser.Parser2.parse(Parser2.java:337)^ at org.apache.crimson.parser.XMLReaderImpl.parse(XMLReaderImpl.java:448)^ at org.ujac.print.DocumentPrinter.print(DocumentPrinter.java:802)^ at org.ujac.print.DocumentPrinter.print(DocumentPrinter.java:658)^ at org.ujac.print.DocumentPrinter.print(DocumentPrinter.java:638)^ at com.enbridge.entrac.framework.pdfgenerator.PDFGenerator.generatePDF(PDFGenerator.java:117)^ at com.enbridge.entrac.business.shared.STRConsumerNotificationGenerator.STRConsumerNotificationGenerator.java:375)^ at com.enbridge.entrac.business.cm.consumernotification.ConsumerNotificationEngine.main(ConsumerNotificationEngine.java:837)^	There were 2 failures and 2 data patches. On the first failure of the engine, the application log provided the name 'C:\O Del Property Management Inc.' and the problem was a unknown escape sequence...ie the backslash is an illegal character. To identify the bad letter, the following was done: A query was run on the ent_premise table to find the premise using the billing name. select premise_num from ent_premise where BILLING_NAME AND_ADDR_LINE_1 like '%C/O DEL PROPERTY MANAGEMENT INC.%'; The result provided 8 premises. Another query was run on ent_account to find the 8 possible accounts that for these premises: select account_num from ent_account where premise_num in (94159,978789,1099032,1104053,1663598,2165881,1136903,318600); Since the letter_name field in the ent_letter table is a concatenation of various data, we scan the letters for any of the account numbers: select * from ent_letter where (letter_name like '%701136209996%' or letter_name like '%701772559995%' or letter_name like '%801296509994%' or letter_name like '%801595609990%' or letter_name like '%735656509993%' or letter_name like '%735417009995%' or letter_name like '%721941529992%' or letter_name like '%701657329991%') and letter_status_id =2; --2 = unsent Letter_name 'Acct701657329991_TxtCORALENERG2013072915443266389' came up and

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
8/4/2013	Other	FILEWATCH-ALTRA-DAILY	The delivery file was not received last night @ 7:30 therefore this file watcher job running @ 8:30am failed.	sent an email to SMS got reply email: I re-ran the report this morning and I can see it on the server. I don't know why the file was not produced last evening, it is a scheduled job. I will get our IT folks to follow up when they are back in the office on Tuesday.
8/21/2013	Engine	XML Request Processor Engine	PENTRAC-120108-ALL(VPC-LX-008@PROD-ENTRAC) failed The job failed with status code 1. End time 20:03 Sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_xmlrequestprocessor.drv 21082013 1. row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=ORA-29532: Java call terminated by uncaught Java exception: com.e nbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.bu ss.cm.requestprocessor.XMLRequestProcessor :: parseXML :: Start of root element expected. Summary: ENCHG-420506-3RD (VPC-LX-005 @ENTRAC) failed status 1 at 20:01 p.m. Description: ENCHG-420506-3RD (VPC-LX-005 @ENTRAC) failed status 1 at 20:01 p.m. Product Name: ENTRAC	Use following sql to identify bad xml bn: select * FROM ent_ebt_xml WHERE ebt_xml_status_id =1 order by ebt_xml_id The smallest ebt_xml_id is 1125856. Opened up this file from "Energy Source Natural Gas Inc" to look for some invalid data. This file only has one bn (a transfer) and the first line has some funny character(3 upside down question marks), the rest of the file looks OK. Implemented a data patch to change the status of this record to 2 (parsed) in order that engine will skip it. Engine rerun successfully after data patch applied.
9/3/2013	Other	ENCHG-420506-3RD	Summary: ENCHG-420506-3RD (VPC-LX-005 @ENTRAC) failed status 1 at 20:01 p.m. Description: ENCHG-420506-3RD (VPC-LX-005 @ENTRAC) failed status 1 at 20:01 p.m. Product Name: ENTRAC	check the file AltraToEnTRACMonthly201308.txt, the file is there, The non zero return code is the result of more than one monthly consumption adjustment files sitting in the Indata folder. Forced the job OK, the next job completed successfully.
9/9/2013	Engine	CCL2	+ cd /prod/apps/EntRAC/jobs/scripts/ + entrac_movestntcsetupengine.drv 09092013 1. row updated. Commit complete. PL/SQL procedure successfully completed. RETURN MESSAGE=Post move activities failed with error message: ORA-01422: exact f fetch returns more than requested number of rows ORA-01403: no data found RETURN CODE=-1422	The job failed when the create contract association called the ent_system_util_pkg.get_acnt_mv_in proc to get the account mov, Logging was turned on and on rerun, the bad DC was identified. The DC was then matched to an old account in a CCL in the ent_move_info_stg table. The corresponding new account was then matched and then a data patch was created to bypass the new account by changing the acnt_setup_date in the ent_account table to yesterday(Sep 8/13). The subsequent rerun was successful. The failure occurred in a procedure outside of the CCL2 engine whose purpose is to retrieve the MDV of an old account in a CCL and apply it to the new account. The account 910007557525, had multiple account pool term records within the same pool term. ie it was on pool starting Feb 1/13, then it dropped off after two months, then two months later it was re-enrolled to the same pool, therefore it had many account pool term records created within a relatively short time. SQL in the procedure, retrieving the date in which the account joined the pool, returned 2 dates causing the oracle error.
9/12/2013	Engine	xml request processor	ORA-06502: PL/SQL: numeric or value error: character string buffer too small ORA-06512: at "ENT_ADMIN.ENT_XML_RQST_PRCR_PKG", line 352 ORA-29532: Java call terminated by uncaught Java exception: com.enbridge.entrac.framework.exceptions.DBSystemException: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.XMLDBAdapter :: savePIPTxnInfo :: Error trying to save EBT_XML_ID = 1133298 The error occurred in a PIP transaction of type: ChangeConsumerInfoAccept. :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCIAcceptDBAdapter :: savePIPTxnInfo :: com.enbridge.entrac.business.cm.requestprocessor.dbadapter.CCIAcceptDBAdapter :: savePIPTxnInfo :: Error Code = -1841 :: Error Message = ORA-01841: (full) Year must be between -4713 and +9999, and not be 0 ORA-06512: at line 1	I took an old datapatch and changed it to use the xml_id listed in the error message (1133298) . I changed the userID to -1228. The datapatch changes the status of the bad record to 'processed' (2). Today's datapatch is LiveRelease_INC107336.sql. <PIPTxnaction This xml only has a bad date (typen before the year) <PIPTxnaction TransactionReferenceNumber="TML200402412013091120123222431"> <ChangeConsumerInfoAccept <OriginalTransactionReferenceNumber="TENBRIDGEGD2013091104125822850"> <ChangeReason>ConsumerInitiated</ChangeReason> <EffectiveDate> 2013-09-10</EffectiveDate>

Run Date	Type	Job Name	Reason for Failure	Corrective Action Taken
9/28/2013	Engine	IVA Engine	Sysout: + cd /prod/apps/EntRAC/jobs/scripts/ + entrac_ivaengine.drv 28092013 PLUSQL procedure successfully completed. RETURN_MESSAGE=ORA-01403: no data found RETURN CODE=100 Product Name: Batch Job	search on the application log for error message. 100 ORA-01403: no data found Actual SLA ID NOT FOUND : source name ent_iva_engine_pkg.iva_validate_prc Turn on debug last log before failure was for EBT_ID 6239273392785, which corresponds to iva_id 2572908. Data patch to set the iva_id 2025243's current status id to 13 (exception)
10/3/2013	Engine	xml request processor	ORA-06502: PLUSQL: numeric or value error: character string buffer too small ORA-06512: at 'ENT_ADMIN.ENT_XML_RQST_PRC', line 352 ORA-29532: Java call terminated by uncaught Java exception: com.entbridge.entrac.framework.exceptions.DBSystemException: com.entbridge.entrac.business.cm.requestprocessor.dbadapter.XMLDBAdapter :: savePIPTxnInfo :: Error trying to save EBT_XML_ID = 1140754 The error occurred in a PIP transaction of type: ChangeConsumerInfoAccept :: com.entbridge.entrac.business.cm.requestprocessor.dbadapter.CCIAcceptDBAdapter :: savePIPTxnInfo :: com.entbridge.entrac.business.cm.requestprocessor.dbadapter.CCIAcceptDBAdapter :: savePIPTxnInfo :: Error Code = -1841 :: Error Message = ORA-01841: (full) year must be between -4713 and +9999, and not be 0 ORA-06512: at line 1	I took an old datapatch and changed it to use the xml_ID listed in the error message (1140754) : I changed the userID to -1234. The datapatch changes the status of the had record to 'processed' (2). Today's datapatch is LiveRelease_INC1111100.sql.
10/17/2013	Engine	Consumption Exception Processor	+ cd /prod/apps/EntRAC/jobs/scripts/ + entrac_ConsumptionExceptionProcessor.drv 17102013 USERID Oct 17, 2013 8:00:05 PM java.util.jar.Attributes read WARNING: Duplicate name in Manifest: Class-Path Caused by: Exception in thread "main" java.lang.StackOverflowError at java.lang.reflect.Method.copy(Method.java:90) at java.lang.reflect.ReflectAccess.copyMethod(ReflectAccess.java:88) at sun.reflect.ReflectionFactory.copyMethod(ReflectionFactory.java:270) at java.lang.Class.getMethod(Class.java:1910) at java.lang.Class.getMethod(Class.java:1924) at java.lang.Class.getMethod(Class.java:984) at org.apache.commons.logging.LogFactory.getContextClassLoader(LogFactory.java):482	Reran the job and it completed successfully.
11/3/2013	Interface	OpenLink To EntRAC Delivery	+ cd /prod/app/entrac/scripts/ + ent_AltraToEntRACDelivery.drv 20131103120000 prod Output of /prod/app/entrac/Log/AltraToEntRACDelivery-20131101.log Job ran; checking for errors Job status: -RUN FAILED (3)- Job started: -Sun Nov 3 09:00:08 2013- Job ended: -Sun Nov 3 09:00:29 2013- ERROR: Job did not return successfully WARNING: Cannot get info on link Process_Delivery_Data.altra_extract_rejects_1 (255) Rows pushed through reject link (altra_extract_rejects_f): -- WARNING: Cannot get info on link Process_Delivery_Data.ent_if_error01 (255) Rows pushed through reject link (ent_if_error01): -- Rows pushed through reject link (ent_if_error02): -0- Product Name: Batch Job	George ran the input file in Lynx (Copied the inbound file AltraToEntRACDaily20131103.txt to the folder /dev/app/entrac2dev/indata on lynx. Ran the job called AltraToEntRACDeliveryCheckAIRRejects on entrac2dev project on lynx using the entprod1 database) and found out that Altra sent us an update for a pool that doesn't exist in EntRAC. Asked Altra to fix. Altra told us that that pool is a Gazliere pool. So we needed to add it to the list of Gazliere pools. That list is at Apollo: /prod/app/entrac/indata/gazliere_pools.txt. I added the pool name to the list, had prod services copy the updated file to apollo. then had prod services reset the database job and re-run the failed job.
11/4/2013	Other	FILEWATCH-ALTRA-DAILY	The delivery file was not received last night @ 7:30 therefore this file watcher job running @ 8:30am failed. + ctmfw /prod/app/entrac/indata/AltraToEntRACDaily20131109.txt CREATE 0 + 6015 \5 90 1111 08:31:11 : File '/prod/app/entrac/indata/AltraToEntRACDaily20131109.txt' was not CREATED within the time limit. id=1.	Sent an email to SMS. They reran the adhoc job to create and FTP the file and it was successfully received. We then asked Prod Services to force OK the file watch job and this allowed the subsequent change permissions job (ENCHG-410505-ALL) and Altra Interface job(PENTRAC-410505-ALL) to successfully run.
11/4/2013	Other	FILEWATCH-ALTRA-DAILY	The delivery file was not received last night @ 7:30 therefore this file watcher job running @ 8:30am failed. + ctmfw /prod/app/entrac/indata/AltraToEntRACDaily20131109.txt CREATE 0 + 6015 \5 90 1111 08:31:11 : File '/prod/app/entrac/indata/AltraToEntRACDaily20131109.txt' was not CREATED within the time limit. id=1.	Sent an email to SMS. They reran the adhoc job to create and FTP the file and it was successfully received. We then asked Prod Services to force OK the file watch job and this allowed the subsequent change permissions job (ENCHG-410505-ALL) and Altra Interface job(PENTRAC-410505-ALL) to successfully run.

SEC INTERROGATORY #101

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/8/1, Attach 2, p. 2] Please provide the full comparison the Applicant did of the replacement option with the life extension option. What are the relative life expectancies of the system under the replacement and extension options?.

RESPONSE

Life Extension Option

The life extension option would include the system upgrades identified below:

- Enhancements to support evolving customer & market requirements
- Hardware upgrades and the associated Operating System upgrades
- Upgrades/Patches to the foundational technology
- Changes to the customizations as a result of core software upgrades.
- Enhancements to the existing functionality (reports, optimization of screens, etc).
- Validation of upstream and downstream system interfaces (other Enbridge systems that feed to, or receive from EnTRAC such as CIS – SAP).

The capital cost requirement of this option is shown in Table 1 on the following page:

Witnesses: T. Adesipo
K. Fazal
B. Misra

Table 1: Capital Cost Total (\$000)

	<u>Budget</u>		<u>Forecast</u>	
	2013	2014	2015	2016
Total Costs	100	0	2,000	2,000

This life extension option would have a life expectancy of 5 years, thereby, extending the application life to year 2020.

Replacement Option

Enbridge has obtained a high level vendor estimate for the EnTRAC system replacement for \$9 million. This estimate does not include the internal costs of implementing the solution, system integration and training. This replacement option would have a life expectancy of 10 years, similar to our experience with the current EnTRAC system which was implemented in 2003.

Based on the above information the most cost effective approach is seen to be the life extension option. The life extension option is a known option that the company has experienced in the last 10 years. This option also reduces the associated risk of moving to a new system. Additionally, this option provides the rate payers a lower cost impact during the IR period.

Witnesses: T. Adesipo
K. Fazal
B. Misra

SEC INTERROGATORY #102

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/8/1, Attach 3] Please explain in detail how this initiative differs from, and integrates with, the initiative described in Attachment 1.

RESPONSE

Please see the response to SEC Interrogatory #98 found at Exhibit I.B18.EGDI.SEC.98.

Exhibit B2, Tab 8, Schedule 1, Attachment 1 (Business Application Upgrade – Customer Information System) involves initiatives to maintain the integrity of the CIS system, to exploit new functionality available from SAP and to implement regular system upgrades. These software upgrades help to keep the CIS SAP software compatible with current versions, enhance productivity via performance improvements, maintain systems integrity, and also help to reduce the customizations to the core SAP software. Also included are annual modification and enhancement activities to improve customer service representative and back office billing functionality and efficiency to maintain the integrity of the CIS system.

Exhibit B2, Tab 8, Schedule 1, Attachment 3 (Customer Care Improvement Initiatives) on the other hand, involves initiatives that are directed towards Enbridge's goal to be responsive to its customers. These initiatives are not included within the enhancement packs described in Attachment 1. Specific initiatives such as rebuilding the customer website and CIS billing enhancements have been identified in this attachment. This initiative will take place after the CIS SAP upgrade beginning in 2014 and continuing into 2015. This work involves adding additional new functionality in respect of the rebilling and budget billing activities of the Company in order to meet the changing

Witnesses: T. Adesipo
B. Misra

needs of its customers and improve its customer's experience and convenience by providing customers with more options in how and when they interact with Enbridge.

Witnesses: T. Adesipo
B. Misra

SEC INTERROGATORY #103

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/8/1, Attach 6] Please expand Table 1 to include 2007 through 2012, and forecast actuals (9+3 or 10+2) for 2013

RESPONSE

Please find expanded Table 1 below:

Table 1: Capital Cost Summary (\$000)										
Description	Actual						Forecast			
IT Desktop & Device Replacement	2007	2008	2009	2010	2011	2012	2013 (9+3)	2014	2015	2016
TOTAL	1,068	2,305	2,007	1,250	1,198	1,949	1,925	2,100	2,600	4,300

Witnesses: T. Adesipo
B. Misra

SEC INTERROGATORY #104

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/8/2, p. 8] Please provide details of the “significant technology risks” that will be mitigated by implementing the WAMS Program.

RESPONSE

As noted in evidence at Exhibit B2, Tab 8, Schedule 2, the agreement with Accenture expires as of April 1, 2014. In anticipation of this, the Company evaluated the several options against the major criteria outlined at Exhibit B2, Tab 8, Schedule 2, page 9, paragraph 21. A comparison summary of the extent to which each of the options considered mitigate against any significant technological risks that exist is presented at Figure 2 on page 16 of the same evidence. The WAMS Program is the only option that effectively mitigates those significant technology risks.

Business applications are primarily made up of hardware, software and operating systems that enable them to deliver key functionalities. All of the components need to work together for a system to function and be considered secure, available, reliable, maintainable and supportable. This also requires that all the components are compatible with each other and that the software vendors support them. The technology risks identified could destabilize the system and the key criteria would be negatively impacted as a result. Additional details related to these criteria and the technology risks which the Company would face absent the WAMS Program are included below.

Security: is defined as underlying controls/checks in an Application and operating system that protects against vulnerabilities through flaws in the design, development,

Witnesses: W. Akkermans
M. Brophy
B. Misra

deployment, upgrade, or maintenance and external attack. As outlined in Exhibit B2, Tab 8, Schedule 2, page 5, Paragraph 11, Enbridge indicates that "Utilizing systems that are not Windows supported provides an unacceptable security risk to online attacks and other threats to the Company network. Enbridge currently receives on average 1 million external attacks per month. The Existing Technology (defined in Exhibit B2, Tab 8, Schedule 2, p. 2, par 3) is interfaced to many other key systems (e.g., CIS, Oracle), providing additional risk since having one system compromised, also compromises the other systems that interface. If a vulnerable component is attacked and the damage spread to other system components, resulting failures could force movement to manual processes and in many cases could prevent critical Company functions (e.g., customer billing). Current staffing levels and protocols at Enbridge are not aligned to operate on this type of manual basis for more than a very short period of time. This scenario could result in focusing on emergency only functions and delaying other non-emergency related work. In short, Enbridge cannot risk operating an unprotected system within its enterprise network". WAMS will provide a supported system that provides an adequate level of protection against this Security risk.

Availability: is defined as the probability that an Application will work as required and when required. If a system is not available for an extended period of time, then users will have to move to temporary manual processes. The availability of a system can also be impacted by online attacks, events that may occur unrelated to the core system, and/or the age of the different components (Hardware, Software, and Operating System) of the system. When events unrelated to the core system occur, ability and time to recover will be impacted by the age of the core system components (e.g., hardware, software and operating system). This issue can be compounded where multiple interfaces are involved, like with the Existing Technology. A recent unplanned outage to the Existing Technology indicated that the recovery time of the current system has been longer than expected. This is primarily driven by the factors outlined above. WAMS will provide new hardware and software infrastructure that will assist in mitigating this risk.

Reliability: is defined as the ability of an Application to perform the required functions over a period of time without failure. In order to perform utility functions outlined in Exhibit B2, Tab 8, Schedule 2, page 6, paragraph 14, a business system must be reliable. Reliability is impacted by the age of hardware, software and the underlying operating system, the significant number of systems changes that have occurred over the past decade and by factors outlined in the other criteria listed in this response.

Maintainability: is defined as the ease with which an Application can be maintained in order to isolate and correct defects, prevent unexpected breakdowns, maximize the Application's useful life, meet new business requirements, and make future maintenance easier. As systems age, the time it takes to find the defects and fix them continues to increase and the time it takes to make changes to meet new business requirements also increases. All these

Witnesses: W. Akkermans
M. Brophy
B. Misra

elements combined also increase the overall cost of maintaining the system. The leading indicators ("Response to urgent and high incidents") related to resolution time with the current system show that the defect isolation and fix time is increasing which poses an operational risk. An increase in defects and resolution time means that the system could be shut down for a longer period of time as teams identify and fix an issue. Business impacts related to this risk and the others outlined in this response are included below in the Business Impacts section.

Supportability: is defined as the ability of Application Support, Service and Vendor to install, configure, and monitor the Application, identify exceptions and faults, isolate defects and issues that would prevent the application from functioning as expected, and provide maintenance services. The technology underlying the Existing Technology is old and will become unsupported as outlined in evidence at Exhibit B2, Tab 8, Schedule 2, pages 6 and 7. Additionally, it should be recognized that the individual components that make up the Existing Technology are also only supported on a best efforts basis.

Business Impacts High Level Summary

It is commonly understood that large complicated businesses require technology that meets the criteria outlined above. However, to provide some additional context, the following provides a high level summary of business risks that WAMS will help avoid and mitigate. In the event that there is an unplanned outage to the Existing Technology, the Company would follow manual processes in the short-term, less than 72 hours, and limit the work to only emergency work and existing work already issued to field technicians. If the outage is estimated to be a long-term outage, 72 hours or longer, there would be significant impacts to the Company's ability to provide core utility services. The Company would initiate and/or develop interim business processes that would be manual in nature. This would adversely impact the Company's business operations. Business impacts include, but are not limited to the following:

- a negative impact to the level of service that the Company would be able to provide to its customers for work such as constructing new natural gas mains and services, unlocking new gas meters, and completing the required safety inspections for new customers;
- a reduction in the number of available appointments offered to customers due to manual processes that would impact the efficiency of getting customer service requests out to the field technicians for completion;
- a reduction in the Company's ability to achieve the Service Quality Requirements ("SQR's") targets and the ability to monitor and report on the SQR's, such as Appointments Met Within the Designated Time Period, Time to Reschedule Appointments, and the Number of Days to Reconnect a Customer;

Witnesses: W. Akkermans
M. Brophy
B. Misra

- an unfavourable impact to the safety of the Company's operations as the Company would lose the ability to update its work and asset records through an enterprise system, which could negatively impact the confidentiality, integrity, accessibility and availability of the Company's records;
- a reduction in the Company's ability to perform required preventive maintenance inspections due to the inability to automatically generate these types of inspections, which could put the Company in non-compliance with its regulatory obligations;
- a reduction in the Company's ability to manage the administration of the warning tags process, which would pose a potential public safety issue and would put the Company in non-compliance with its legislative obligations. The warning tag process is managed by an automated workflow that administers the communication and follow-up to customers when a third party certified gas technician encounters a hazardous situation concerning gas equipment that is either a safety issue or a direct infraction of the Natural Gas and Propane Installation Code; and the business impacts outlined above would result in increased costs resulting from the Company's efforts to implement interim business processes, which would include costs for items such as, hiring additional resources, acquiring new or additional tools, potential legal claims, and developing manual processes, etc.

In summary, the significant technology risks which the company would face include not only those outlines above from the Existing Technology given its age and limited supportability, it also includes the business risks that could result if WAMS did not proceed.

Witnesses: W. Akkermans
M. Brophy
B. Misra

SEC INTERROGATORY #105

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/8/2, p. 11] Please provide an estimate of the cost of each element on Figure 1.

RESPONSE

Figure 1 of the WAMS evidence referred to above is a contextual diagram meant to provide context to some existing systems and proposed initiatives included in the Company's evidence. Those systems are not specifically within the scope of WAMS, but it was thought that the contextual diagram would help show how these are linked.

For information related to those initiatives, please refer to the following sections of the Company's evidence:

WAMS – Exhibit B2, Tab 8, Schedule 2

MOP – Exhibit B2, Tab 5, Schedule 2, Attachment 4

DRM – Exhibit B2, Tab 5, Schedule 5, Attachment 2

Asset Plan – Exhibit B2, Tab 10, Schedule 1

Witnesses: W. Akkermans
M. Brophy
B. Misra

SEC INTERROGATORY #106

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/8/2, p. 12] Please explain why the option of continuing with Accenture or another outsourcing company, but with new technology owned by them, was not considered.

RESPONSE

Please refer to the response to Board Staff Interrogatory #58, found at Exhibit I.B18.EGDI.SEC.58.

Witnesses: W. Akkermans
M. Brophy
B. Misra

SEC INTERROGATORY #107

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/8/2, p. 19] Please provide a detailed calculation of the total revenue requirement impact of the WAMS Program, including tax impacts, for each of 2014 through 2018.

RESPONSE

See the response to SEC Interrogatory #97, found at Exhibit I.B18.EGDI.SEC.97.

Witnesses: W. Akkermans
M. Brophy
B. Misra

SEC INTERROGATORY #108

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/9/1, p. 5] Please provide the business case or other planning document or documents supporting the budget for Office Furniture and Equipment.

RESPONSE

The budget for Office Furniture and Equipment is required to both replace existing furniture and equipment that is over 25 years old and at the end of its life cycle or furnish all new planned building space. Detailed justification supporting the budget for office furniture and equipment was provided in pre-filed evidence at Exhibit B2, Tab 9, Schedule 1, pages 5 and 6. There is no associated business case document.

Additional details of the office furniture and equipment budgets for 2014 to 2016 are shown in the following table.

Witnesses: P. Rapini
R. Riccio

Item No.	(\$000)	Col. 1 <u>Budget 2014</u>	Col. 2 <u>Budget 2015</u>	Col. 3 <u>Budget 2016</u>
<u>Replace Existing Furniture & Equipment</u>				
1.1	Cafeteria Tables and Chairs	50	0	0
1.2	Scarborough Kennedy Road Operations Depot Renovation	400	0	0
1.3	Brampton Colony Court Operations Depot Renovation	400	0	0
1.4	Thorold Administrative Office Renovation	400	0	0
1.5	Ottawa Coventry Road Administrative Office Renovation	300	600	0
1.6	Victoria Park Complex Furniture Replacement	2,000	1,900	3,000
1.7	Chairs and Other Equipment	<u>280</u>	<u>180</u>	<u>230</u>
1.	Total Replacement	<u>3,830</u>	<u>2,680</u>	<u>3,230</u>
<u>Furnish New Planned Building Space</u>				
2.1	New Operations Facility in Casselman	125	0	0
2.2	Meter Shop Relocation to a Leased Property	400	0	0
2.3	New Thorold Mezzanine Conference Center	225	0	0
2.4	Fleet Garage Relocation to a Leased Property	0	250	0
2.5	Conversion of Vacated Space at VPC into Office Space	0	1,000	1,000
2.6	Gas Storage Operations New Building	0	600	0
2.7	Chairs	<u>50</u>	<u>150</u>	<u>150</u>
2.	Total New	<u>800</u>	<u>2,000</u>	<u>1,150</u>
3.	Total Office Furniture and Equipment	<u>4,630</u>	<u>4,680</u>	<u>4,380</u>

Witnesses: P. Rapini
R. Riccio

SEC INTERROGATORY #109

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/9/1, p. 15] Please provide the business case, cost benefit analysis, or other such document showing that “the plan to create additional office and parking space at VPC will be cost-effective”.

RESPONSE

The VPC Functional Alignment Project (the “Project”) planned over the 2014 to 2016 period will create additional office and parking space at VPC cost-effectively and will also achieve significant improvements to employee safety, result in all head office administrative staff housed in one building and improve employee engagement. The justification and cost benefit analysis for this project was provided in pre-filed evidence at Exhibit B2, Tab 9, Schedule 1, Attachment 1.

Witnesses: P. Rapini
R. Riccio

SEC INTERROGATORY #110

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/9/1, Attach 1, p. 9] Please explain why the alternatives considered did not including replacing the existing 45 year old buildings with one or more new office buildings, either on the same land or in a new location. Please provide any internal planning or other documents that consider in whole or in part the timing or cost of replacing the VPC complex. Please advise the Applicant's current best estimate as to when VPC will have to be replaced.

RESPONSE

Replacing the existing 45 year old buildings with one or more new office buildings was considered as an alternative option. However, redevelopment of the Victoria Park Complex ("VPC") site or relocation to a new site is a significant undertaking that is not being planned for in the 5-year IR period. Enbridge determined that it was not a realistic alternative at this time. Regardless of the timing of plans to replace the office complex at VPC, the existing industrial uses on site (the meter shop and the fleet garage) would have to be relocated as they would not be part of any new office complex either on the existing site at Victoria Park Avenue and Consumers Road or in a new location. The mixed uses at VPC were appropriate at the time the building was opened in 1968, but that is no longer the case - the industrial uses do not need to be part of the office complex.

The Facilities Services department is continually assessing its real estate portfolio of both owned and leased properties to ensure that the current and future building space needs of EGD are met. The department monitors real estate market conditions,

Witnesses: P. Rapini
R. Riccio

developments in the areas surrounding our properties, and explores all real estate options available, not just for the VPC property, but for all of the Company's owned and leased properties. Enbridge's long-term real estate strategy for the VPC site is reviewed in detail from time to time and the most recent review completed by The Facilities Management Group in November 2012 is attached.

The City of Toronto has recognized that redevelopment in the north section of the Consumers Road Business Park will be a mix of residential, commercial and offices uses. The Light Rail transit along Sheppard Avenue and the Arterial use designation has encouraged the intensification of land use in the area. The City of Toronto has reviewed the employment uses as part of the Official Plan review and has determined that a number of properties along Sheppard and Victoria Park Avenues are designated for mixed use. As the easterly 4.5 acres of the VPC site is included in the re-designation, there is an increased potential for redevelopment of the site for a higher value. EGD will continue to adjust to the long term management and optimization of its property assets while maintaining effective facilities to meet the needs of its workforce and efficient operating costs.

Regarding the question as to the best estimate of when the VPC office complex will have to be replaced, as evident by the IR filing for the 2014 to 2018 period, there are no plans to replace the VPC office complex before the end of 2018. The budget requirements (currently estimated in the \$150 to \$175 million range to construct a building of approximately 400,000 square feet) would have to be incorporated into a future rates case filing to seek approval from the OEB before proceeding with a project of this magnitude.

Timing has not been established as to when the VPC office complex will have to be replaced. The existing office building at VPC is in adequate structural condition for its age and most life cycle replacements have been completed; however, there are a number of indicators of functional obsolescence both from internal issues (primarily that the building is at maximum capacity, lack of natural light) and external factors (underutilization of site). The evolution of the vacated meter shop and fleet garage space will provide much needed office space and parking. This is described in detail at Exhibit B2, Tab 9, Schedule 1, Attachment 1.

Witnesses: P. Rapini
R. Riccio



ENBRIDGE GAS DISTRIBUTION INC.
CORPORATE REAL ESTATE OPTIONS ANALYSIS
NOVEMBER, 2012



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SECTION 1

CONFIDENTIALITY & LIMITING CONDITIONS

1.1 REPORT CONTENTS

Enbridge Gas Distribution ("EGD") and has retained Facility Management Group ("FMG" or "We"), to assist in updating EGD's overall real estate strategy related to its Victoria Park Campus ("VPC") located at 500 Consumers Road, Toronto, ON.

This confidential report ("Report") has been prepared by FMG and is based on information obtained from EGD and other third party sources considered reliable. FMG makes no representations, declarations or warranties, express or implied, as to the accuracy or completeness of such information.

This report contains various financial estimates, projections and assumptions based on market information obtained at the time this report which may or may not prove to be correct. FMG makes no representations, declarations or warranties, express or implied, as to the accuracy or completeness of such information or, that any of the financial estimates, projections or assumptions will be realized.

FMG expressly disclaims any and all liability for any errors or omissions in this Report or any other written or oral communication. This report has been prepared to assist EGD in analyzing various options related to its real estate strategy and does not purport to be all-inclusive or to contain all the information that may be required in determining such strategy. This Report does not contain information or analysis with respect to taxation, regulatory and accounting issues related to EGD. This Report is presented for information and discussion purposes only.

If this Report or, any information contained herein is provided to any third party at any time, orally or otherwise, such information shall be provided as a convenience only, without representation or warranty as to its accuracy or completeness and should not be relied upon without independent investigation and verification.

1.2 CONFIDENTIALITY

EGD will not permit this Report to be used, in any manner detrimental to the interests of the FMG or its affiliates, or for any other purpose than to assist EGD in updating its overall real estate strategy related to its Victoria Park Campus. The terms and conditions in this Section with respect to confidentiality and the disclaimer contained in the heading "Report Contents" will relate to all sections of the report as if stated independently therein.

For questions or comments, please contact:

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SECTION 2

EXECUTIVE SUMMARY

VPC is EGD's corporate headquarters and is situated in north Toronto's Consumers Road Business Park. VPC is comprised of 3-buildings totaling approximately 346,000 sf on 15 acres. The Consumers Road Business Park is one of Toronto's older employment areas and generally, vacancy rates are higher than other comparable areas. While market conditions have not attracted significant office development, the Consumers Road Business Park is located strategically at the intersection of Highways 401 and 404 and along two major Avenues, Sheppard and Victoria Park. A proposed extension to the Sheppard Subway Line, in some form, has renewed interest in the area. Dated office, industrial and retail properties are being demolished to make way for high-density residential development.

EGD has been occupying VPC since 1968 and given the current interest in the area, EGD is taking the opportunity to consider its long-term real estate strategy. FMG has been retained to provide a current opinion of value for VPC and to review the options available regarding EGD's long-term occupancy. FMG has analyzed all available options from a cash flow perspective over the next 40-years considering, occupancy costs, capital requirements, sale proceeds and the value of retained assets.

The analysis makes the following key assumptions:

- The Status Quo is no longer suitable for EGD operations. EGD currently leases space in addition to VPC at a neighbouring building and employees often travel between them. Furthermore, much of the office space within VPC has been reclaimed from former industrial areas and is separated from the main part of the building by a link; and
- Any potential alternative location should be within a reasonable proximity of VPC. This report therefore focuses primarily on the northernmost parts of the city and its surrounding suburbs.

In estimating the current market value of VPC, FMG has assumed that EGD will proceed with planning recommendations made by Bousfields Inc. detailed in Section 5 but summarized as follows:

- VPC is severed into two parcels divided by an extension of Hallcrown Place;
- The west portion of the VPC site, approximately 10 acres, remains under the current zoning; and
- An application is made to the municipality to re-designate the east portion of the VPC site, approximately 4.5 acres, to allow for a "mixed-use" including multi-unit residential.

Based on the recommendations above, FMG estimates the current market value of VPC at **\$30.2 million**.

Having established the current market value of VPC, FMG analyzed the Status Quo and the following scenarios, in order of least overall cost to EGD:

- Purchase a suitable office building/campus within proximity to VPC (referred to herein as Scenario 1A);



- Construct a new office tower for EGD's occupancy on the west portion of the VPC land and retain ownership. Once occupied, EGD would then sell the east portion of the VPC land (referred to herein as Scenario 2A);
- Lease a suitable office building/campus within proximity to VPC (referred to herein as Scenario 1B); and
- Sell the entire VPC site to a developer who would then construct a new office tower on the west portion of the VPC land and lease to EGD.

The following table highlights the results of the scenario analysis. All figures represent a cost and have therefore been displayed as negative numbers:

	O&M (NPV)	Capital Outlay (NPV)	Property Acquisitions (NPV)	Property Sale Proceeds (NPV)	Terminal Value (NPV)	Total (NPV)
Status Quo						
SQA - Purchase new facility at year 21	(146,706,905)	(40,801,359)	(34,982,616)	15,111,490	16,405,648	(190,973,742)
SQB - Lease new facility at year 21	(188,757,714)	(36,382,861)	-	15,111,490	-	(210,029,085)
SQC - Continue to lease overflow at Atria	(152,663,439)	(30,735,970)	-	-	6,960,445	(176,438,965)
Scenario						
1A - Purchase Alternative Building	(155,870,157)	(38,823,332)	(83,879,719)	27,578,887	16,405,648	(234,588,673)
1B - Lease Alternative Building	(262,409,936)	(30,096,486)	-	27,578,887	-	(264,927,535)
2A - Retain Ownership	(153,428,884)	(126,298,980)	-	14,570,697	15,411,366	(249,745,800)
2B - Lease Back	(284,882,702)	(14,691,026)	-	28,584,705	-	(270,989,023)

- The purchase of an existing building at an alternative location, if available (Scenario 1A), represents the least overall cost to EGD primarily because office buildings in most parts of the GTA can be purchased below replacement cost.
- Constructing a new tower on VPC West Lands and retaining ownership (Scenario 2A) represents the second least overall cost as EGD would continue to occupy space in which it only incurs taxes and operating costs. However, this scenario represents the greatest capital requirement.
- Leasing an existing building at an alternative location, if available (Scenario 1B), represents the third least overall cost as it would allow EGD to potentially relocate to a jurisdiction with lower taxes and operating costs, nor would it incur the capital cost associated with constructing a new tower.
- Selling VPC to a developer to construct a new tower on the west portion of the VPC land and leasing to EGD upon completion (Scenario 2B), is the least attractive scenario primarily because the economic rent required by a such a developer/investor to rationalize the development, far exceeds the current market rent.

Notwithstanding that Scenario 1A represents an overall cost that is potentially \$15 million less than Scenario 2A, the intangible costs associated with employee retention and EGD having control of its own asset has not been factored into this analysis. Furthermore, Scenario 1A assumes that a suitable asset is



available for acquisition at the time of execution. We therefore recommend that EGD pursue both Scenarios 1A & 2A concurrently. The following outlines the proposed next steps:

1. Commence process to attain approval for direction and funding;
2. Proceed with the re-designation of the east portion of the VPC land as outlined in Section 5;
3. Commence with relocation of meter shop and fleet building (required in all scenarios);
4. Begin internal planning for construction of a new tower on VPC west land; and
5. Engage a Real Estate Advisor for a period of 6-months to canvas the market for opportunities at alternative locations;
6. Re-analyze/validate scenarios upon completion of market canvassing;
7. If a suitable alternative site cannot be attained within the parameters set out in this analysis, commence external planning for construction of a new tower on the west portion of VPC with the intent to retain ownership.

The recommendations above will:

- Secure the market value of VPC;
- Ensure EGD has an opportunity to validate the assumptions for all scenarios with real-time market feedback through an open and organized process;
- Ensure that EGD does not miss a potentially beneficial opportunity that may lie within the overlapping ranges in the scenario analysis;
- Not commit EGD to any particular scenario without complete due diligence; and
- Still allow reasonable time to construct a new tower on the west portion of the VPC lands.



SECTION 3

VICTORIA PARK CAMPUS (“VPC”) OVERVIEW

Municipal Address: 500 Consumers Road, Toronto, ON

Improvements: VPC is a mixed-use campus comprised of a 5-storey, office tower (“VPC Tower” with an adjoining single storey industrial building utilized partially as office space and partially as a meter shop (“Annex/Link”). An additional free-standing industrial building is located on the western portion of the site (“Fleet Building”).

Vintage: The original VPC was constructed in 1968 with 3 additional floors added to the VPC Tower in 1978.

Area Measures:	VPC Tower	225,000 sf
	Annex/Link	86,000 sf (office – 51,600 sf, meter shop–34,400 sf)
	Fleet Building	<u>35,000 sf</u>
	Total VPC Area	346,000 sf

Site Area: Approximately 15 Acres

Frontage: Victoria Park Avenue – 489’
Consumers Road – 1,308’

Zoning: Current zoning is MO – Industrial Office Business Park. Permitted uses include a range commercial and industrial and all existing uses fall within the current by-law. Allowable gross floor area is 150% of the site area (approximately 980,100 sf). No height restrictions are specified.

Official Plan: The entire site is currently designated as “Employment Area”. Employment areas generally permit offices, industrial and small retail uses. The current designation does not permit residential use. A more thorough discussion of planning concerns is addressed in Section 5.

Market Conditions: VPC is located in one of Toronto’s more established office/industrial parks. Historically, the area has experienced higher office vacancy rates than other areas of the city and continues to do so. As such, the area has witnessed limited development until recently. Discussions of an extension to the TTC’s Sheppard Subway line combined with VPC proximity to major highways have renewed interest in the area and several sites within proximity of VPC have been sold for condominium and retail redevelopment.



SECTION 4

CONSUMERS ROAD MARKET CONTEXT

VPC is situated in the Toronto East office market but more specifically, the Consumers Road submarket as defined by Colliers International. Its boundaries extend from Victoria Park Avenue & Warden Avenue on the east to Finch Avenue on the north, Bayview Avenue to the west and Highway 401 to the south (Map1). The market has a total office inventory of approximately 3.8 million square feet of which 1.3 million square feet is Class “A/AAA” space, 2.0 million square feet is Class “B” space and 500k is Class “C” space.

Map 1 - Consumers Road Submarket
Source: Colliers International



Within the Central East market there are 5 distinct submarkets and the Consumers Road submarket ranks third in total inventory but has historically witnessed a higher than average vacancy rate when compared to the other submarkets (Chart 1). As of Q2 2012 the overall vacancy rate in the Consumers Road area is approximately 11.3% with Class “B” vacancy at 13.8%.

Chart 1 - Toronto East Historical Vacancy
Source: Colliers International



Q2 2012 weighted average Class “B” and “C” asking net rents were reported to be \$11.00/sf and \$10.00/sf respectively. Table 1 on the following page summarizes current availability and shows a range for Class “B/C” asking rates between \$8.00/sf and \$12.50/sf. It should be noted however that larger blocks of space are generally at the lower end of the range. There has not been significant absorption of vacant space in recent months but information that is available supports this range (Table 2 on following page). Of particular interest however, is that Class “B” Net Effective Rents (NERs) which represent the actual rent received by the landlord after deducting tenant allowances and commissions average approximately \$5.00/sf. In fact, even though the available data is a small sampling, it suggests that even Class “A” NERs are well below \$10.00/sf.



"The Market Commentary" a report prepared by Lennard Commercial Realty for Q3 2012 considers an interesting statistic. The report ranks all submarkets in the Greater Toronto Area based on the number of office buildings defined as "Problem Buildings" or, buildings with 15% or greater direct vacancy, divided by the total number of office buildings within the submarket. Consumers Road Class "B" and Class "A" rank first and third respectively with both classes above 33%.

Table 1 – Consumers Road Availability. Source: Colliers International

Address/Building	Available (SF)	Asking Rate	Additional		Gross Rent	Class
			Rent			
2225/2235 Sheppard Ave. E - Atria	61,000	\$ 15.00	\$ 18.05	\$	33.05	A
2001/2005 Sheppard Ave. E - Heron's Hill	30,000	\$ 14.00	\$ 16.70	\$	30.70	A
2550 Victoria Park - Lansing Square	16,000	\$ 12.00	\$ 15.65	\$	27.65	A
200 Yorkland - Gallery	30,000	\$ 11.50	\$ 17.73	\$	29.23	A
251/255 Consumers Rd. - Parkway Place	70,000	\$ 12.50	\$ 16.23	\$	28.73	B
2/4/6 Lansing Square	19,000	\$ 9.00	\$ 15.65	\$	24.65	B
505/515 Consumers Road	68,000	\$ 8.00	\$ 12.90	\$	20.90	B
2450 Victoria Park - Universal (Sublet)	7,300	\$ 8.50	\$ 15.87	\$	24.37	C

Notwithstanding the statistics, there are some suggestions by industry professionals that a lack of contiguous space and increasing rents in other submarkets may direct tenants to what is a relative "buyers market" in the Consumers Road area. Furthermore, there are other factors, particularly redevelopment to mixed-use that will lead to a decrease in the overall inventory of office space.

Table 2 – Lease Transactions. Source: Colliers International

Address/Building	Area (SF)	Face Rate	T.I.	Commission	NER	Additional		Gross Rent	Class
						Rent			
200 Yorkland - Gallery	9,800	\$ 12.10	\$ 31.00	\$ 5.00	\$ 3.40	\$ 17.73	\$	29.83	A
2225 Sheppard - Atria	16,500	\$ 14.50	\$ 25.00	\$ 5.00	\$ 7.27	\$ 18.00	\$	32.50	A
505 Consumers Road	2,017	\$ 8.50	\$ 7.00	\$ 5.00	\$ 5.53	\$ 12.90	\$	21.40	B
251 Consumers Road - Parkway Place	1,210	\$ 10.33			\$ 4.95	\$ 16.50	\$	26.83	B

The Consumers Road submarket benefits from its proximity to major highways, shopping and the TTC. The areas to the north of VPC are primarily low-density residential and several former office/retail properties have been purchased for the purposes of mixed-use, retail or, high-density residential redevelopment. There has been much discussion regarding some form of extension to the Sheppard Subway Line and although it is undetermined at this point when, this combined with a review of the Official Plan has renewed interest in the Consumers Road area. Map 2 on the following page summarizes recent transaction activity and current condominium developments.



Map No.	Date	Type	Address	Area	Units	Purchase Price (\$)	Purchase Price (\$/Unit)	Zoning	Proposed Density (x Lot Area)	Comments Development Status
1	Mar-12	Office Building	265 Yorkland Blvd.	44,000	SF	5,475,000	124	MO		User buyer
2	Mar-12	Office Building	2450 Victoria Park Ave.	92,790	SF	13,000,000	140	MO		User/Investor
3	Jun-11	Office Building	259 Yorkland Blvd.	27,065	SF	6,453,750	238	MO		User buyer
4	Aug-07	Office Building	243-255 Consumers Rd.	765,293	SF	125,300,000	164	MO		Investor
5	Nov-12	Office/Retail Land	243-255 Consumers Rd.	2.50	Acres	5,000,000	2,000,000	MO		Unconfirmed
6	Feb-12	Residential Land	271 Yorkland Blvd.	2.21	SF	4,450,000	2,011,754	MO		No Application
7	Jan-12	Residential Land	2075 Sheppard Ave. E.	1.46	Acres	8,770,000	6,006,849	MO(14)		No Application
8	Nov-11	Residential Land	2135 Sheppard Ave. E.	5.17	Acres	20,000,000	3,868,472	MO	4.7	Application Submitted
9	Oct-11	Residential Land	2992 Sheppard Ave. E.	0.44	Acres	3,000,000	6,756,757	N/A	6	Approved
10	Dec-10	Residential Land	2993 Sheppard Ave. E.	0.94	Acres	3000000	3,191,489	N/A	1.8	Application Submitted
11	Jan-10	Retail Land	2901 Sheppard Ave. E.	1.50	Acres	5,000,000	3,328,895	Mixed-Use		
12		Residential Land	2205 Sheppard Ave. E.	6.12		N/A	N/A	MO	3.7	Application Approved
13		Residential Land	2-6 Lansing Sq.	15.32	Acres	N/A	N/A	MO	4.7	Listed/Offering Pulled



SECTION 5

PLANNING CONSIDERATIONS

Given the economics for office development within proximity of VPC, it's not surprising that there have been no new office buildings constructed and as the existing inventory of office space continues to age, the focus will naturally shift to a higher and better use. There have been several transactions in the recent past for the purposes of redevelopment in and around VPC and so long as the Toronto condominium market continues to thrive, so should this trend. Based on this trend, EGD has engaged Bousfields Inc. ("Bousfields"), a well-known and reputable planning consultant, to investigate the alternative land use options and planning considerations related to VPC. What follows is an excerpt from a proposal to EGD from Bousfields dated May, 2012:

"The entire property is currently designated as Employment Areas in the City of Toronto Official Plan, which permits uses such as offices, manufacturing, warehousing, distribution, research and development facilities, utilities, media facilities, parks, hotels, ancillary retail outlets, restaurants and small scale stores and services. However, residential uses are not permitted.

The frontage of the property along Victoria Park Avenue is identified as an Avenue on the Urban Structure plan (Map 2) of the Official Plan. Avenues are important corridors along major streets where reurbanization is anticipated and encouraged to create new housing and job opportunities. The Avenues are intended for mixed-use development, with an emphasis on residential growth. The interior (west) portion of the property is identified as part of an Employment District. Employment Districts are intended to be preserved solely for employment uses over the long-term and are to focus on job intensification.

The site is zoned MO (Industrial-Office Business Park Zone) by North York Zoning By-law 7625, as amended, which permits a wide range of industrial, commercial and institutional uses; however, residential uses are not permitted. The maximum gross floor area permitted is 150% of the area of the lot. There is no maximum building height specified in the MO zone. Based on our review of the City of Toronto Official Plan and Zoning By-law 7625, amendments to both the Official Plan and the Zoning By-law would be required in order to permit the redevelopment of the Victoria Park Avenue frontage of the property for residential/mixed-use purposes.

As well, Policy 2.2.6.5 of the Province's Growth Plan for the Greater Golden Horseshoe speaks to "employment land conversions" and states that:

"Municipalities may permit conversion of lands within employment areas, to non-employment uses, only through a municipal comprehensive review . . ."

A "municipal comprehensive review" is defined as "an official plan review, or an official plan amendment, initiated by a municipality". The City of Toronto is currently undertaking a municipal comprehensive review/official plan review, which is tentatively scheduled for completion in late 2012 (although this is likely to go over into 2013). The municipal comprehensive review/official plan review (MCR/OPR) process was initiated in May 2011, and preliminary recommendations could come forward as early as September 2012."

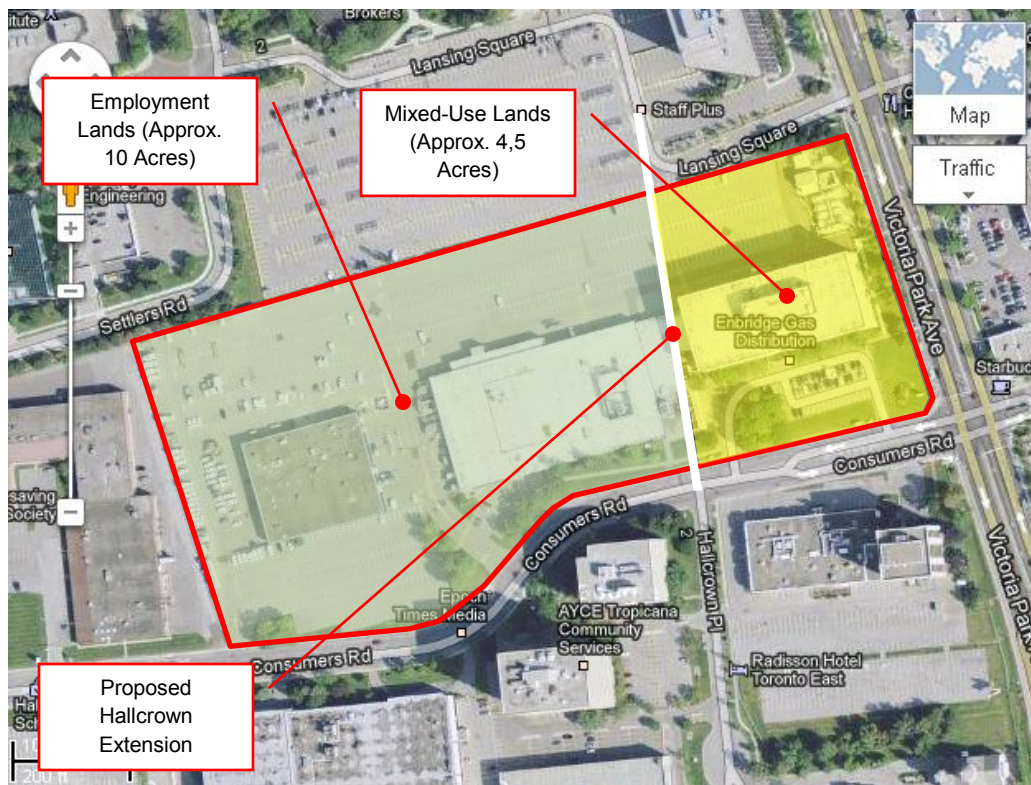


Bousfields recommended that EGD submit a letter to the City of Toronto requesting re-designation of the east portion of the VPC lands to “mixed-use” as input to the Official Plan Review/Municipal Comprehensive Review as soon as possible. The Bousfields proposal continued to outline what it considered to be an “appropriate and supportable” submission:

“In the case of the subject property, it is our opinion that an extension of Hallcrown Place would form a logical boundary between the proposed *Mixed Use Areas* designation to the east and the *Employment Areas* designation to the west. In fact, the Avenue Segment Studies done in support of the Atria IV and Tribute applications show an extension of Hallcrown Place northerly to Sheppard Avenue and beyond as part of a finer-grain road network that could support redevelopment of the broader area. As a condition of development approval, we expect that the City would likely request the dedication of lands for the Hallcrown Place extension, to form the boundary between the residential/mixed-use redevelopment and the remaining employment lands.

We have estimated the area of the easterly portion of the property fronting Victoria Park Avenue, east of the Hallcrown Place extension, to be approximately 1.8 hectares (4.5 acres). At a density of 3.0-3.5 FSI, the floor area of a residential/mixed-use development would be 54,000-63,000 square metres (580,000-680,000 square feet).”

The aerial photograph below, provided for illustration only, outlines the VPC site, the potential extension of Hallcrown Place referred to above and the delineation between the lands recommended by Bousfields as the proposed mixed-use area and what is proposed to remain as Employment Lands.





As discussed in Section 6, the proposed “re-designation” of the easterly portion of the VPC lands helps to preserve the property value range established in both the 2010 and 2011 Reports and potentially mitigates the negative impact of the current market dynamics. EGD has a window of opportunity given the ongoing Official Plan Review and should take steps towards the highest and best use. Regardless of EGD’s long-term real estate strategy, by proceeding with the Bousfields recommendations, EGD will secure the future value of the VPC site.



SECTION 6

VALUATION SUMMARY

VPC was appraised by Wagner, Andrews & Kovacs as at May 14, 2010 (the "Appraisal"). A further review of the Appraisal and opinion of fair market value was provided by Ernst & Young Real Estate Services Inc. as at March, 2011 ("2011 Report"). The Appraisal and 2011 Report established a fair market value of VPC between \$28.9 million and \$30.8 million, a variance of \$1.9 million or, approximately 6.6%.

6.1 APPRAISAL SUMMARY

The Appraisal determined that estimating the value of VPC using the Income Approach would be difficult due to the uncertainty of future tenancy. There were no large lease transactions to establish a benchmark at the time. The Appraisal used both the Income Approach to establish an "as-is" value and a Direct Comparison Approach to establish a value for "Highest and Best Use".

Income Approach ("as-is"):

Based on market information available at the time, the "as-is" value, assuming VPC was leased to a single-tenant¹ was estimated as follows:

	VPC
Area (SF)	346,000
Current Market Net Rent PSF	7.50
Potential Net Income (NOI = Net Rent x Area)	2,595,000
Vacancy Allowance (5% of NOI)	129,750
	2,465,250
Non Recoverable Operating Expenses (3% NOI)	73,958
Adjusted NOI	2,391,293
Cap Rate	8.25%
Capitalized Value	28,985,364
Capitalized Value \$PSF	83.77

Direct Comparison Approach ("Highest and Best Use"):

The appraisal surmised that the VPC lands, particularly the lands underlying the Annex/Link and Fleet buildings are underutilized. The current improvements combine a total 121,000 sf or, approximately 40% of the estimated land area² while the allowable gross building area is 150% of the land area ("Density"). As such, it was assumed that the VPC Tower (210,000 sf – net leasable area) would remain in its current state as an office building situated on 7.5 acres, while the west portion of the VPC lands (also 7.5 acres) would be valued as developable land under the current zoning (hereinafter referred to as the "Employment Land". Based on the Direct Comparison Approach³, the values on the following page were determined.

¹ Due to design elements & limited vertical transportation, VPC does not lend itself to multi-tenant occupancy.

² Current Zoning under "Employment Lands" permits gross building area to a maximum of 1.5x the land area.

³ A wide range of comparable office building sales were cited prior to adjustments (\$79 psf - \$242 psf).



- a. VPC Tower – 210,000 sf x \$95 psf = \$19,950,000
- b. Employment Land – 7.5 acres x \$1,200,000/acre = \$9,000,000
- c. Total VPC Value = \$28,950,000

Appraised Value:

In consideration of all factors, the Appraisal determined the overall value of VPC to be **\$29,000,000** or, **\$83 psf** based on the existing improvements.

6.2 2011 REPORT SUMMARY

The 2011 Report concurred with the Appraisal with respect to the underutilization of the Employment Land lands and considered VPC in two separate components:

1. The VPC Tower, valued on an “as is” basis using the Income Approach; and
2. The value of the Employment Lands as per the Appraisal.

Income Approach:

The following outlines the key assumptions and resulting value for VPC Tower utilizing the Income Approach assuming as per the 2011 Report:

1. Key Assumptions:
 - a. A capitalized market Net Effective Rent of \$9.90 psf⁴;
 - b. A rentable area of 225,000 sf versus 210,000 sf;
 - c. An overall cap rate of 8.75%⁵;
 - d. A input Vacancy Allowance of 7.5% of NOI; and
 - e. Non-recoverable expense reduction of 6% of NOI

2. Valuation:

	VPC Tower
Area (SF)	225,000
Office Rent (NER)/Sq. Ft.	9.90
Potential Net Operating Income	2,227,500
Vacancy Allowance (7.5% NOI)	167,063
	2,060,438
Non Recoverable Operating Expenses (6.0% NOI)	123,626
Adjusted NOI	1,936,811
Cap Rate	8.75%
Capitalized Value	22,134,986
Less NPV of Capital Items	288,225
Adjusted Capitalized Value (VPC Tower)	21,846,761
Capitalized Value \$PSF	97.10

⁴ NER of \$9.90 psf based on face rate of asking net rent of \$11.00 psf and a 10% deduction for leasing costs.

⁵ Range of Class “B” Cap Rates at time of report was 7.5% - 8.5%. A 25 bps premium attributed to VPC as a Class “C” building.



Opinion of Value:

Using the same methodology, assumptions and value derived in the 2010 Appraisal, the 2011 Report added the value of the Employment Land to the value above and concluded the value below.

- a. VPC Tower – \$21,846,761, \$97.10 psf
- b. VPC West Lands – 7.5 acres x \$1,200,000/acre = 9,000,000

In consideration of all factors, an overall value for VPC of **\$30,847,000** or, **\$89 psf** of existing improvements at the time of the Report.

6.3 CURRENT OPINION OF VALUE

FMG has analyzed the current market value of VPC using both the Income Approach, to test any variance to the previous “as-is” values, and the Direct Comparison Approach based on the recommendations provided by Bousfields Proposal⁶ as a highest and best use analysis.

Income Approach (“as-is”):

The following estimates the current market value of each individual component of VPC on an “as-is” basis (“Component Value”) using the Direct Capitalization method. Below are the key assumptions and resulting value:

1. Key Assumptions:

- a. The area measures for the purposes of this analysis are as per the 2011 Report;
- b. All VPC components are leased by a single-tenant for a 10-year term;
- c. There have been limited lease transactions comparable to VPC. However, based on the transactions available, posted asking rates and the attributes of VPC, we estimate the range of acceptable net rents to be between \$8.50 psf \$9.50 psf⁷. We have applied the mid-range rate of \$9.00 psf to the VPC Tower and Annex office area only;
- d. A potential tenant will attribute an industrial market rent to the Fleet building and Meter Shop. Based on our review of industrial lease rates, we have applied a net rate of \$5.50 psf.
- e. VPC will be leased on an “as-is” basis but a tenant inducement of \$15 psf will be required for office areas to cover the cost of remediation of designated substances⁸;
- f. Leasing fees will apply to a potential transaction;
- g. Due to single-tenant occupancy, a vacancy allowance of 5% is sufficient even in contrast to the current market vacancy rate;
- h. Non-recoverable Operating Expenses as per 2010 Appraisal; and
- i. A reasonable range of Cap Rates based on comparable sales are between 6.6% and 8%. We have selected a mid-point in this range or, 7.25% for the purposes of this model.

⁶ See “Planning Considerations”

⁷ See Section 4, Tables 1&2. Source: Colliers International

⁸ Cost estimated for remediation are estimated based on discussions with EGD. These costs could be reduced significantly when completed in unoccupied space.



2. Valuation:

	VPC Tower	Annex Office	Annex Industrial	Fleet Building	VPC Total
Area (SF)	225,000	51,600	34,400	35,000	346,000
Current Market Net Rent PSF	9.00	9.00	5.50	5.50	8.30
Potential Net Income (NOI = Net Rent x Area)	2,025,000	464,400	189,200	192,500	2,871,100
Operating Expenses PSF (OPEX)	12.57	12.57	5.59	5.59	11.17
Additional Rent (Additional Rent = OPEX x Area)	2,827,988	648,552	192,191	195,543	3,864,274
Total Potential Gross Rent	4,852,988	1,112,952	381,391	388,043	6,735,374
Vacancy Allowance (5% of Gross Rent)	242,649	55,648	19,070	19,402	336,769
Non Recoverable Operating Expenses (3% NOI)	60,750	13,932	5,676	5,775	86,133
Adjusted NOI	1,721,601	394,820	164,454	167,323	2,448,198
Cap Rate	7.25%	7.25%	7.25%	7.25%	7.25%
Component Value - Before Leasing Costs	23,746,215	5,445,799	2,268,337	2,307,901	33,768,252
Component Value \$PSF	105.54	105.54	65.94	65.94	97.60
Tenant Allowance/Remediation Costs	15.00	15.00	1.25	1.25	12.24
Broker Fees	5.00	5.00	1.00	1.00	4.20
Total Leasing Costs	4,500,000	1,032,000	77,400	78,750	5,688,150
Net Effective Rent (NER)	6.12	6.12	5.18	5.18	5.93
Component Value - Final	19,246,215	4,413,799	2,190,937	2,229,151	28,080,102
Adjusted Final Value PSF	85.54	85.54	63.69	63.69	81.16

The Income Approach above, using current market metrics, arrives at a value of \$28,080,102 or, \$81.16 psf, nearly \$1,000,000 below the range of value as per the 2010 Appraisal and the 2011 Report for the following reasons:

1. The 2010 Appraisal assumed a potential single-tenant leasing VPC on an "as-is" basis and applied no tenant allowances or leasing fees. The appraisal noted that no investigation had been done with respect to potential environmental concerns. Based on the known presence of settled dust contaminants, the cost of such remediation would be deducted directly from the overall capitalized value. The valuation above assumes largely the same as the 2010 Appraisal, in that a potential single-tenant leases VPC "as-is" but an allowance for tenant work, including remediation of settled contaminants, has been accounted for. A small allowance for leasing fees has been accounted for above.
2. The 2011 Report utilized an Income Approach as the primary approach to valuation of VPC. However, in contrast to the 2010 Appraisal, the 2011 Report capitalized a Net Effective Rent ("NER"). Since a NER accounts for tenant allowances and commissions, the valuation effectively accounts for what was not accounted for in the 2010 Appraisal. However, the applied NER of \$9.90 is significantly higher than the current market NER range between \$5.00 to \$6.00 psf. The valuation model above uses a market net rent, less deduction for vacancy and non recoverable



costs to determine a Net Operating Income for capitalization. Deductions for Tenant Allowance and Leasing Costs are then made directly from the capitalized value.

To validate the results of the value derived by way of the Income Approach, we have reviewed recent office building sales within a reasonable proximity of VPC and established a range of value for Class “B” and “C” office buildings between \$103 psf to \$170 psf⁹. Given the size of VPC and large industrial component, we have estimated the VPC value slightly below the low end of this range.

Property	Date of Sale	Price	Building Size	Price PSF	Cap Rate	Land Area (Acres)	Building Class
Consilium Place	7/23/2012	\$ 198,620,758	1,036,716	\$ 191.00	7.40%	20.93	A
1 Concorde Gate	12/1/2010	\$ 87,000,000	548,742	\$ 159.00	8.30%	7.60	A
111 Gordon Baker	12/1/2010	\$ 16,150,000	165,000	\$ 98.00	14.50%	1.67	A
115 Gordon Baker	9/14/2010	\$ 21,200,000	147,358	\$ 144.00	7.80%	1.77	A
2075 Kennedy Road	8/12/2010	\$ 30,850,000	240,527	\$ 151.00	9.30%	6.46	A
1131 Leslie Street	5/3/2012	\$ 8,250,000	48,500	\$ 170.00	6.70%	1.52	B
265 Yorkland Blvd.	3/2/2012	\$ 5,475,000	43,985	\$ 124.00	N/A	0.65	B
885 Don Mills Road	8/15/2011	\$ 7,080,000	59,449	\$ 119.00	N/A	2.22	B
259 Yorkland Blvd.	6/21/2011	\$ 6,453,750	27,065	\$ 238.00	N/A	0.63	B
155 Gordon Baker	4/4/2011	\$ 25,250,000	244,925	\$ 103.00	7.50%	8.40	B
2450 Victoria Park	3/6/2012	\$ 13,000,000	92,790	\$ 140.00	6.60%	4.79	C

Based on the resulting value determined by the Income Approach and other factors discussed herein, we suggest that VPC, in its current state, no longer represents the highest and best use for the property.

Direct Comparison Approach (“Land Value”):

As discussed in Sections 4 and 5 herein, the Consumers Road submarket has undergone substantial change. The office market conditions continue to lag the rest of the GTA but recent redevelopment activity has sparked a renewed interest in the area. Below highlights an analysis of the Bousfields recommendations¹⁰ using comparable lands sales based on the following assumptions:

1. **Employment Land** - The west portion of the VPC site (10 Acres) will continue under its current designation under the Official Plan and Zoning By-law as Employment Lands and Industrial Office Business Park. An overall developable area will remain at 1.5 x the site area and all that would be required for redevelopment would be a site plan application.
2. **Mixed Use Land** - The east portion of the VPC site (4.5 acres), separated by the west portion of the site by a 0.5 acre road allowance (estimated), will be re-designated for mixed-use (residential with ground floor retail) with an estimated developable area of up to 3.5 x the site area.

Comparable Employment Land Sales:

The 2010 Appraisal used the same approach to estimate the value of the west VPC lands or, the employment lands, then 7.5 acres. The Appraisal analyzed 6 comparable land sales from Mississauga to Toronto but referenced 3 in particular that best compared to the VPC lands ranging in value between \$1,000,000/acre and \$1,300,000/acre. Since the time of the 2010 Appraisal, there have been no transactions within proximity of VPC that have been sold for use as Employment Lands of a size that

⁹ We note that although 259 Yorkland was traded at \$238 psf, the building is 27,000 sf and not indicative of value for a building the size of VPC.

¹⁰ See: Section 5 – Planning Considerations



compares to the proposed VPC West Lands. The following summarizes the relevant details of transactions similar in use but significantly smaller:

1. 271 Yorkland Boulevard – At the time of the sale (February, 2012), the site was improved with a 51,000 sf industrial building. The site area totals 2.21 acres and was purchased by VHL Developments for \$4,450,000 or, \$2,011,754/acre. The zoning in place at the time of sale was the same as the current for zoning for VPC allowing for a gross building area up to 150% of the lot size and the overall purchase price represents a price per buildable sf of approximately \$30. It has been suggested by those familiar with the transaction that the purchaser has a long-term residential redevelopment plan. Given the size of the property relative to VPC, we suggest that the values reflect a substantial premium to the VPC surplus lands.
2. 243-244 Consumers Road – A small portion of the westerly lands on at Parkway Place (estimated at 2.5 acres) have been sold to Audi Canada for the construction of a 6-storey car dealership and office building. The transaction details are not available at this point in time but those who are familiar with the transaction report a purchase price of approximately \$2,000,000/acre and a price/buildable foot of approximately \$25. An application has been submitted to amend the current zoning by-law based on use but and it is likely to be granted. The site is visible from the 401 and 404 and considered a premium site for the proposed use.
3. Passmore Avenue, Scarborough – A 2.265 acre vacant and unimproved site located south of Steeles on Markham road, sold in June 2012. Current zoning allows for a maximum buildable gross floor area of 70% of the lot area. The purchase price of \$1,349,000 represents a price/buildable sf of approximately \$19.55 psf. Although the property is not situated in the immediate vicinity of VPC and it is a much smaller site, it does reflect a pure Employment Land value.

Comparable Residential Land Sales:

As discussed above, it has been assumed based on recommendations provided by Bousfield that EGD proceed with a process of re-designation to mixed-use for the east portion of the VPC land (4.5 acres). We have drawn upon the following recent transactions to estimate a value for these lands:

1. 2075 Sheppard Avenue East – Situated on the south side of Sheppard, just east of the 404, this 1.46 acre site is situated in a prime redevelopment location. At the time of the sale (January, 2012), the site was improved with 3 single tenant retail buildings totaling approximately 15,000 sf. The purchase price represents of \$8,770,000 represents a price/acre of approximately \$6,000,000. The purchaser intends redevelop the site to condominium later in 2013. The site was Zoned MO at the time of sale. Given the location of the property relative to VPC, we suggest that the values reflect a substantial premium to the VPC East Lands.
2. 2135 Sheppard Avenue East (Don Howsen Site) – A larger parcel, 5.19 acres was sold to Tribute Communities in November, 2011 for a total consideration of \$20,000,000. The site was zoned MO at the time of sale but the purchaser has submitted an Official Plan and Rezoning application proposing 3, 30-47 storey residential towers with ground floor retail. Based on the proposed development, the purchase price represents a price/buildable foot of approximately \$17 and a price/acre of \$3,853,565. Those familiar with the project have indicated that the public meetings regarding the development plan have been met with resistance from neighbouring low-density residential residents.



3. 2002 Pharmacy Avenue & 2992 Sheppard Avenue East – Currently being marketed as the “Maestro”, this .444 acre parcel was purchased in October, 2011 for a total consideration of \$3,000,000 or, \$6,756,757/acre and approximately \$25/buildable foot. The current project was based on a successful rezoning application to permit a 14-storey residential tower representing a gross building area 6x the land parcel.
4. 2933 Sheppard Avenue East – Sold to in December 2010 for \$3,000,000. An application is currently in circulation that proposes a total gross building area of 1.8 x the site area of 0.94 acres or, approximately 77,000 sf. The total consideration represents a price/buildable foot of approximately \$39.

Based on the comparable sales noted above, the following table exhibits the values attributed to both the west or, Employment Lands and the east or Mixed-Use Lands:

Land Valuation Matrix

	Site Area (Acres)	Site Area (SF)	Density (xSite Area)	Buidlable Area (SF)	\$/SF Buildable	Land Value	Land Value/Acre
VPC West Lands - 2010/2011 Report	7.50	326,700	1.50	490,050	18.37	9,000,000	1,200,000
VPC West Lands - Current	7.50	326,700	1.50	490,050	20.00	9,801,000	1,306,800
VPC West Lands - Bousfield	10.00	435,600	1.50	653,400	20.00	13,068,000	1,306,800
VPC East Lands - Bousfield	4.50	196,020	3.50	686,070	25.00	17,151,750	3,811,500
Road Allowance - Bousfield	0.50	21,780	-	-	-	-	-
Land Value - Highest & Best Use	15.00	653,400	2.05	1,339,470	22.56	30,219,750	2,014,650

In summary, we suggest that the highest and best use is currently land for the purposes of redevelopment as shown above and the corresponding value of to be approximately **\$30,000,000**. We note however, that the preservation of this value requires that EGD proceed with the recommendations by Bousfield.



SECTION 7

ANALYSIS OF THE STATUS QUO

The following summarizes the analysis of EGD's occupancy from both a physical and financial perspective over the period of the next forty years on a net present value, cash flow basis. We have selected a 40-year time frame for the purposes of this analysis as any projections beyond that exceed what can be reasonably predicted. Because VPC will extend beyond its useful life during the analysis period, we have considered the Status Quo under three scenarios:

1. VPC remains in its current state until the 21st year of the analysis at which point EGD purchases a new facility at an alternate location (referred to herein as "SQA");
2. VPC remains in its current state until the 21st year of the analysis at which point EGD leases a new facility at an alternate location (referred to herein as "SQB"); and
3. VPC remains in its current state and EGD continues to lease overflow space as needed at Atria over the entire analysis period (referred to herein as "SQC");

For the purposed of comparison, all scenarios have been separated into 3 major categories:

1. **Occupancy Costs** - The total of all rents, operating expenses and facilities related extraordinary expenses associated with EGD occupied properties, whether owned or leased (shown as a negative amount);
2. **Capital Items** – The total of all capital costs for ongoing maintenance and/or construction costs related to EGD occupied facilities (shown as a negative amount); and
3. **Acquisition Costs, Sale Proceeds & Terminal Value** - The present value of costs associated with purchasing or selling property and the end of analysis property value or, "Terminal Value" if ownership is retained (Acquisition Costs shown as a negative number and Sale Proceeds and Terminal Value shown as a positive number).

In preparing this analysis the following major assumptions have been made¹¹:

1. VPC alone does not, and will not accommodate EGD's current space requirements or future growth. EGD is currently leasing approximately 86,000 sf at a neighboring building (Atria) in addition to the 276,600 sf of office space occupied at VPC. Growth forecasts provided by EGD indicate that an additional 18,000 sf will be required at Atria by 2015. EGD has projected total occupancy by 2015 at 380,600 sf
2. As referred to in Section 2.3 of the 2011 Report, qualitative issues such as access to natural light, small workstation footprints relative to industry standards, health and safety concerns regarding settled dust contaminants and a large building floor plate may impede employee productivity.
3. As identified in Section 2.3 of the 2011 Report, based on a common benchmarking technique, the Facilities Condition Index, VPC ranked "average" to "poor" potentially leading to maintenance being conducted post failure at an increased cost.

¹¹ All other assumptions are detailed in Appendix 3.



The results of the Status Quo Cash Flow model are as follows:

1. **Occupancy Costs (O&M)** – based on the assumptions noted above and as provided in “Appendix 3 - Status Quo A, B & C – Detailed Cash Flow”, the sum of the total 40-year Occupancy Costs ranges between **\$147 million (SQC) and \$189 million (SQB)** on an NPV basis.

Key Sensitivities: The Status Quo Occupancy Costs are not highly sensitive in Scenarios SQA and SQC. The rents associated with Atria are based on the actual leases and Taxes and Operating Costs have been provided by EGD but are forecast based on actual amounts. Amounts shown for Designated Substance Remediation are based on reasonable estimates provided by EGD Facilities and it is assumed in Scenario SQA that EGD can potentially acquire an alternate facility in a jurisdiction with a lower O&M base. However, Scenario SQB assumes a lease at an alternate facility commencing in year 21 of the analysis. The O&M base for this scenario includes a base rent not considered in Scenarios SQA and SQC. The O&M in this scenario is therefore considerably higher.

2. **Capital Items** – based on the assumptions noted above and as provided in “Appendix 3 - Status Quo A, B & C – Detailed Cash Flow”, the sum of the total 40-year Capital Items ranges between **\$31 million (SQC) and \$41 million (SQA)** on an NPV basis:

Key Sensitivities: The Status Quo Capital Items range between scenarios due to the requirements for retrofitting at alternative locations in year 21 of the analysis. It is assumed in both Scenarios SQA and SQB that an alternative facility meeting EGD’s need exactly will be difficult to acquire. In Scenario SQA, an allowance of \$50 psf (2012 dollars) is input for retrofitting and in Scenario SQB, it is assumed that \$25 psf (2012 dollars) will be required above and beyond an tenant inducements provided by a landlord. The amounts input for Scenario SQC are based on unfinished items identified in the Building Condition Assessment prepared by Carson Dunlop and the EGD 10-Year Capital Plan. All items have been provided by EGD and are assumed reasonable and correct.

3. **Acquisition Costs, Sale Proceeds & Terminal Value** – based on the Terminal Value assumptions as noted in Appendix 2, Section A1 & A2:

- a. A Terminal Value of VPC is applied at year 41 in Scenario SQA, where EGD acquires an alternative facility in year 21 of the analysis, and in Scenario SQC, where EGD remains in VPC in its current state for the duration of the analysis. The input values applied are as follows:

- i. SQA – Terminal Value = **+\$16.4 million (NPV)**
- ii. SQB – Terminal Value = **+\$0 (VPC sold at year 21 of analysis)**
- iii. SQC – Terminal Value = **+\$6.9 million (NPV)**

- b. The Terminal Values above are offset in the total NPV calculation by Property Acquisitions (represented as a negative or, cash outflow) and Sale Proceeds (represented as a positive or, cash inflow) as follows:

- i. SQA – Disposition of VPC at year 21 = **+\$15.1 million (NPV)**
- ii. SQA – Acquisition of alternative facility at year 21 = **-\$34.9 million (NPV)**
- iii. SQB – Disposition of VPC at year 21 = **+\$15.1 million (NPV)**
- iv. SCQ – No Property Acquisitions/Sale Proceeds applied



Key Sensitivities: The Status Quo Terminal Values are sensitive on their own. The Terminal Value is calculated by capitalizing the market rent in the last year of the analysis assuming that the properties remains in their current use. The market rent is assumed to increase annually by the market growth rate and given the current uncertainty in leasing markets, particularly over a period of 40-years it is difficult to forecast with accuracy. Both the market rental rate and the Terminal Cap Rate can have a significant impact on the Terminal Value. However, in present value terms, the Terminal Value, Acquisitions and Dispositions combined have a relatively low net impact to the overall status quo. The net impact to overall NPV costs range between approximately +\$3.5 million in SQA, up to +\$15.1 million in SQB. In consideration of all factors above, the overall Cash Flow Costs of the Status Quo scenarios on an NPV basis are provided below:

	O&M (NPV)	Capital Outlay (NPV)	Property Acquisitions (NPV)	Property Sale Proceeds (NPV)	Terminal Value (NPV)	Total (NPV)
Status Quo						
SQA - Purchase new facility at year 21	(146,706,905)	(40,801,359)	(34,982,616)	15,111,490	16,405,648	(190,973,742)
SQB - Lease new facility at year 21	(188,757,714)	(36,382,861)	-	15,111,490	-	(210,029,085)
SQC - Continue to lease overflow at Atria	(152,663,439)	(30,735,970)	-	-	6,960,445	(176,438,965)



SECTION 8

SCENARIO 1

Sell VPC and move to alternative site (Purchase vs. Lease)

The following summarizes the analysis of EGD's occupancy from both a physical and financial perspective over the period of the next forty years on a cash flow basis. We have selected a 40-year time frame for the purposes of this analysis as any projections beyond 40-years exceed what can be reasonably predicted and would extend beyond the estimated useful life of the building.

For the purposed of comparison, scenarios 1A and 1B have been separated into 3 major categories:

1. **Occupancy Costs (O&M)** - The total of all rents, operating expenses and facilities related extraordinary expenses associated with EGD occupied properties, whether owned or leased (shown as a negative amount);
2. **Capital Items** – The total of all capital costs for ongoing maintenance and/or construction costs related to EGD occupied facilities (shown as a negative amount); and
3. **Acquisition Costs, Sale Proceeds & Terminal Value** - The present value of costs associated with purchasing or selling property and the end of analysis property value or, "Terminal Value" if ownership is retained (Acquisition Costs shown as a negative number and Sale Proceeds and Terminal Value shown as a positive number).

In preparing this analysis the following major assumptions have been made¹²:

1. EGD takes a period of approximately 1-year to either purchase (Scenario 1A) or lease (Scenario 1B) a suitable 375,000 sf existing property on an alternative site within proximity of VPC and an additional year to retrofit for its own use¹³;
2. EGD sells entire VPC site at the value determined in Section 6.3 (allows 2-years to re-designate east portion of VPC land as per Bousfields recommendations);
3. EGD will not undertake to remediate known Designated Substances and will incur maintenance costs only; and
4. EGD is committed to all leased areas in Atria until the end of 2016.

¹² All other assumptions are detailed in Appendix 4.

¹³ Further investigation will be required as to the timing required to move the EGD data centre



Summarized below are the results of the Cash Flow model relating to a potential purchase of an alternative facility to VPC (Scenario 1A):

1. **Occupancy Costs (O&M)** – based on the assumptions noted above and as provided in the Scenario 1A – Detailed Cash Flow - Appendix 4:

- a. The sum of the total 40-year Occupancy Costs on an NPV basis is approximately **-\$156 million**
- b. The NPV of above represents an increase in O&M cost over the lowest range of the Status Quo of approximately \$3 million. Notwithstanding the fact that EGD would not incur the cost of base rent in an owned facility, regardless of location, EGD's entire occupied area would be subject to the O&M costs generally attributable to Class "A" office space. The lowest range of the Status Quo (SQ) assumes that EGD continues to occupy areas with a lower occupancy cost such as the Link/Annex office areas. Furthermore, EGD would continue to occupy leased space in Atria until the natural lease expiry.

Key Sensitivities: Scenario 1A Occupancy Costs are sensitive primarily to Taxes & Operating Costs associated with a new building. All Taxes & Operating Costs for Atria are based on existing leases and posted rates and for the purposes of this analysis, it has been assumed that Taxes & Operating Costs in a new facility could be up as high as Atria. We note however, that suburban Tax and Operating Costs are typically lower and if EGD were to purchase a property within proximity to VPC but outside of the Toronto boundaries, the overall results would improve from what is shown in this report. Amounts shown for Designated Substance Maintenance are based on reasonable estimates provided by EGD Facilities.

2. **Capital Items** – based on the assumptions noted above and as provided in the Scenario 1A – Detailed Cash Flow - Appendix 4:

- a. The sum of the total 40-year Capital Costs on an NPV basis = **-\$38.82 million**
- b. The NPV of above represents a cost increase to the lowest range of the Status Quo NPV of approximately \$5.6 million. Scenario 1A assumes that any potential alternative location, if available at the time of execution, would require significant retrofitting to meet EGD specifics. An allowance of \$50 psf or, \$19.5 million (2012 dollars) has been input for this purpose.

Key Sensitivities: Scenario 1A Capital Items are sensitive to the costs associated with retrofitting an existing building for EGD use. All other capital items are believed to be accurate. In addition to retrofitting costs, Capital Costs associated with moving the current data centre and allowances for move general costs and FF&E have been assumed. All other capital items identified in the Status Quo relating to ongoing maintenance at VPC have been removed based on the assumption that VPC will be demolished.

3. **Acquisition/Sale Proceeds/Terminal Value** – based on the assumptions noted above and as provided in the Scenario 1A – Detailed Cash Flow - Appendix 4:

- a. Scenario 1A has an input Acquisition Cost for a new facility of \$250 psf (2012 dollars) or, **-\$93.75 million (-\$83.88 million NPV).**



- b. VPC sale proceeds have been input at **\$30.22 million (NPV = \$27.58 million)** based on the value established in Section 6.3.
- c. The NPV of the Terminal Value of the new facility applied at year 41 = **\$16.4 million**.

Key Sensitivities: The Acquisition Costs are the key variable in the Scenario 1A Cash Flow modeling. It is difficult to predict the potential availability of suitable facilities and equally as difficult to estimate a potential purchase price. The Cash Flow model referenced above utilizes a mid point in a range of purchase prices between \$225 psf and \$275 psf. This range was determined based on recent suburban Class “A” office transactions as shown in the table below.¹⁴ It has been assumed that EGD’s preference would be to acquire a property within a reasonable proximity of VPC and for all intents and purposes, a “suburban” location.

Date	Property	Municipality	Price	Area (SF)	\$psf	Cap Rate
1-Aug-12	90 Sheppard Avenue East	North York	76,500,000	269,081	284	6.10%
23-Jul-12	100, 200 & 300 Consilium Place	Scarborough	182,620,758	1,036,716	172	7.40%
8-Mar-12	Mississauga Executive Centre	Mississauga	57,500,000	1,075,741	214	
19-Jan-12	Airway Centre II, III & IV	Mississauga	109,868,566	492,743	209	7.50%
19-Jan-12	5001 Yonge Street	North York	107,775,000	311,787	346	6.70%
12-Dec-11	York Mills Centre	North York	161,000,000	549,000	293	6.10%
1-Dec-11	3000-3100 Steeles Avenue E. & 7065 Woodbine Ave.	Markham	48,000,000	235,271	204	6.90%
11-Oct-11	5035 & 5045 South Service Road	Burlington	35,550,000	159,237	223	6.80%
27-Jul-11	College Square	Mississauga	60,286,000	242,339	249	6.20%
21-Jul-11	Sussex Centre	Mississauga	157,000,000	657,503	239	7.30%
14-Feb-11	302 Town Centre Boulevard	Markham	32,500,000	180,000	174	6.40%
1-Dec-10	Concorde Corporate Centre	North York	87,000,000	548,742	159	8.30%
15-Oct-10	6750 Century Avenue	Mississauga	29,150,000	99,869	292	6.90%

The table above illustrates a range of prices on a psf basis between approximately \$160 psf to \$350 psf and averaging \$235 psf. However, when the range is normalized by eliminating the 5001 Yonge Street trade (premium location with direct subway access), the average sale price decreases to \$226. We have assumed a premium to the average for use in this analysis to account for a potential lack of supply and EGD specific requirements such as space required for a data centre.

Overall Cash Flow NPV: -\$234.59 million

¹⁴ Source: Colliers International



Summarized below are the results of the Cash Flow model relating to a potential lease of an alternative facility to VPC (Scenario 1B):

1. **Occupancy Costs (O&M)** – based on the assumptions noted above and as provided in the Scenario 1B – Detailed Cash Flow - Appendix 4:

- d. The sum of the total 40-year Occupancy Costs on an NPV basis is approximately **-\$262 million**.
- e. The NPV of above represents, an increase in cost of \$109 million over the Status Quo due to the fact that EGD would pay rent in addition to Taxes & Operating Costs on all occupied space.

Key Sensitivities: Scenario 1B Occupancy Costs are the primary sensitivity to the overall NPV of this Scenario. The analysis attempts to capture lease values that allow for fair comparison to Scenario 1A. In doing so, we have assumed that EGD leases alternative suitable space in a location with Taxes, Operating Costs similar to that of Class “A” space within proximity to VPC (Atria). Net Rents have been input at Weighted Average Asking Rents for Class “A” suburban GTA office space¹⁵. This is not intended to suggest that these figures represent an absolute range and it is possible that a lease could be negotiated higher or lower. It is intended merely to establish a reasonable range for the purposes of comparison.

2. **Capital Items** – based on the assumptions noted above and as provided in the Scenario 1B – Detailed Cash Flow - Appendix 4:

- a. The sum of the total 40-year Capital Costs on an NPV basis = **-\$30 million**
- a. The NPV of above represents a marginal decrease to the lowest range of the Status Quo NPV. Scenario 1B assumes an allowance of \$25 psf (2012 dollars) for EGD specific improvements above and beyond any potential tenant inducements offered by a landlord.

Key Sensitivities: Scenario 1B Capital Items do not contribute to a significant portion of the overall costs. In fact, Capital Items represent approximately 11% of total costs in this scenario. Included in Capital Costs is a general allowance for EGD specific tenant fit-out that may not be covered under by a tenant inducement and allowances for moving the data centre, FF&E etc.

4. **Acquisition/Sale Proceeds/Terminal Value** – based on the assumptions noted above and as provided in the Scenario 1B – Detailed Cash Flow - Appendix 4:

- a. Because Scenario 1B assumes that VPC is sold to offset the costs associated with an alternative facility. That and the fact that EGD will lease the alternative facility means that there is no applicable Acquisition Cost or Terminal Value in this scenario.
- b. VPC sale proceeds are held constant with Scenario 1A at **\$30.22 million (NPV = \$27.58 million)** based on the value established in Section 6.3.

Key Sensitivities: The VPC sale proceeds are sensitive to a purchaser’s perceived value. However, based on Section 6, there has generally been a consensus amongst appraisers and consultants with respect to the reasonable range of value over the past several years. Although

¹⁵ Source: Colliers International 2012 Q2 Market Statistics



there is an urgency to secure the value of VPC based on the current planning considerations, sensitivity to the VPC value does not have a material impact on this scenario relative to others.

Overall Cash Flow NPV: -\$264.93 million



SECTION 9

SCENARIO 2

Sell VPC East Lands and construct new VPC Tower on West Land (Retain Ownership vs. Lease)

The following summarizes the analysis of EGD's occupancy from both a physical and financial perspective over the period of the next forty years on a cash flow basis. We have selected a 40-year time frame for the purposes of this analysis as any projections beyond 40-years exceed what can be reasonably predicted and would extend beyond the estimated useful life of the building.

For the purposed of comparison, all scenarios have been separated into 3 major categories:

1. **Occupancy Costs (O&M)** - The total of all rents, operating expenses and facilities related extraordinary expenses associated with EGD occupied properties, whether owned or leased (shown as a negative amount);
2. **Capital Items** – The total of all capital costs for ongoing maintenance and/or construction costs related to EGD occupied facilities (shown as a negative amount); and
3. **Acquisition Costs, Sale Proceeds & Terminal Value** - The present value of costs associated with purchasing or selling property and the end of analysis property value or, "Terminal Value" if ownership is retained (Acquisition Costs shown as a negative number and Sale Proceeds and Terminal Value shown as a positive number).

In preparing this analysis the following major assumptions have been made¹⁶:

1. EGD proceeds with the recommendations made by Bousfields to re-designated the east portion of the VPC lands to a mixed-use, referred to in Section 5;
2. A new office tower is constructed on approximately 10 acres of land on the west portion of the VPC lands over a period of 36 months;
3. EGD retains ownership of the new tower, sells the east portion of the VPC lands once it has moved into the new tower (Scenario 2A) or, sells the entire VPC property to a developer who will construct the new office tower and lease to EGD (Scenario 2B); and
4. EGD is committed to all leased areas in Atria until the end of 2016.

¹⁶ All other assumptions are detailed in Appendix 5.



Summarized below are the results of the Cash Flow model relating to the construction of a new office tower on the west portion of the VPC property with retained ownership, Scenario 2A:

1. **Occupancy Costs (O&M)** – based on the assumptions noted above and as provided in the Scenario 2A – Detailed Cash Flow - Appendix 5:

- a. The sum of the total 40-year Occupancy Costs on an NPV basis is approximately **-\$153 million**.
- b. The NPV of above represents an overall O&M costs less that \$1 million above the lowest range of the status quo and \$35 million less than the highest range. Similar to SQC and 1A, EGD would not incur the base rental costs associated with the leasing of its facility in any scenario in which it retains ownership.

Key Sensitivities: Scenario 2A Occupancy Costs are sensitive primarily to Taxes & Operating Costs associated with a new building. All Taxes & Operating Costs for Atria are based on existing leases and posted rates and for the purposes of this analysis, it has been assumed that Taxes & Operating Costs in the new tower would be equal to that of Atria. Based on the re-designation of the east portion of the VPC lands, it has been further been assumed that after EGD vacates the building it is ultimately demolished. Amounts are only shown for Designated Substance Maintenance and not remediation. These amounts are based on reasonable estimates provided by EGD Facilities.

2. **Capital Items** – based on the assumptions noted above and as provided in the Scenario 2A – Detailed Cash Flow - Appendix 5:

- a. The sum of the total 40-year Capital Costs on an NPV basis = **-\$126 million**
- b. The NPV above ranges between **\$85 million** and **\$95 million** greater than all other scenarios due to the fact that the entire cost of construction is incurred by EGD.

Key Sensitivities: Scenario 2A Capital Items are primarily sensitive to hard construction costs. As illustrated in Appendix 6 and 7, hard construction costs have been assumed at \$210 psf. Including soft costs, construction of parking, tenant fit-out, moving of the data centre and all other additional costs, the total project costs are estimated between \$354 psf and \$389 psf. Note that there is no land cost attributed to the project in Scenario the former and a land cost of \$1.3 million/acre attributable to the latter.

3. **Acquisition/Sale Proceeds/Terminal Value** – based on the assumptions noted above and as provided in the Scenario 2A – Detailed Cash Flow - Appendix 5:

- a. No acquisition costs apply to this scenario
- b. The sale proceeds of **\$14.57 million (NPV)** for the east portion of the VPC lands are based on the value established in Section 6.3.
- c. Because EGD retains ownership of the new tower post construction, a Terminal Value has been applied at the end of the analysis period. The Terminal Value of the new facility applied at year 41 = **\$15.4 million (NPV)**

Key Sensitivities: The only sensitivity in this category, and only because it is difficult to forecast, lies with the Terminal Value. The Terminal Value contributes a positive NPV and offsets the construction costs from a Cash Flow perspective. Although given the long discounting period, its



impact is not material. It should be noted that the Terminal Value in this scenario is calculated using market rent base less than that of an owned facility in an alternative location due to the market dynamics within the Consumers Road.

Overall Cash Flow NPV: -\$249.75 million



Summarized below are the results of the Cash Flow model relating to the construction of a new office tower on the west portion of the VPC property with EGD “leasing-back” on completion, Scenario 2B:

1. **Occupancy Costs (O&M)** – based on the assumptions noted above and as provided in the Scenario 2B – Detailed Cash Flow - Appendix 5:

- a. The sum of the total 40-year Occupancy Costs on an NPV basis is approximately **-\$284 million**.
- b. The NPV of above represents the greatest overall O&M costs, approximately \$22 million greater than Scenario 1B and close to \$100 million greater than the highest range of the Status Quo.

Key Sensitivities: Scenario 2B Occupancy Costs represent the largest occupancy cost amongst all scenarios, by a significant amount, for the following reasons. Firstly, the Taxes and Operating Costs have been benchmarked based on actual rates at Atria.

Secondly, a developer’s Initial Yield and IRR from which the economic rent is derived, is largely based on a potential tenant’s strength. EGD would be considered a first class tenant and in all likelihood, there would be many developers willing to consider this type of scenario. As such, it is possible that the Initial Yield and IRR assumed could be pushed lower and reduce the overall Occupancy Cost but, for the purposes of this analysis we have extrapolated the investment criteria from current Class “A” office sales. Note all Yields and IRRs used in this analysis are unleveraged for the purposes of comparing scenarios. The cost of a developer’s debt will increase the economic rents.

Lastly, the initial economic rent resulting from the assumptions ranges between \$22 psf and \$24 psf with escalations to \$28 psf and \$30 psf based on the projected construction costs. These rents approach downtown Class “A” rents and EGD would effectively be paying a gross rent of \$40+ psf on all of its occupied area.

2. **Capital Items** – based on the assumptions noted above and as provided in the Scenario 2B – Detailed Cash Flow - Appendix 5:

- a. The sum of the total 40-year Capital Costs on an NPV basis = **-\$15 million**
- b. The NPV above represents the least overall Capital Cost compared to all other scenarios due to the fact that the entire cost of construction is incurred by a developer

Key Sensitivities: Scenario 2B assumes that the only capital requirements are allowances for FF&E and move related costs. The data centre costs have been included in the overall construction costs.

3. **Acquisition/Sale Proceeds/Terminal Value** – based on the assumptions noted above and as provided in the Scenario 2B – Detailed Cash Flow - Appendix 5

- a. No acquisition costs apply to this scenario
- b. The VPC sale proceeds have been input at **\$30.22 million (NPV = \$27.58 million)** based on the value established in Section 6.3.
- c. Because EGD does not retain ownership of the new tower no Terminal Value is required.



Key Sensitivities: There is not significant sensitivity to these variables other than purchase price paid by the developer for VPC. Although it would have little impact on an NPV basis, it would alter the occupancy costs as the land component of the sale will be added to calculation for economic rent. If EGD were to pursue this scenario, a further analysis should be conducted to determine the effect of contributing the land to the developer at little or no cost.

Overall Cash Flow NPV: -\$270.99 million



SECTION 10

KEY FINDINGS

The table below prioritizes the results of the various scenario Cash Flow projects from least to greatest overall cost on a NPV basis with the key sensitivities highlighted in grey:

OPTIONS SUMMARY

All Figures in (\$CDN) unless otherwise specified.

	O&M (NPV)	Capital Outlay (NPV)	Property Acquisitions (NPV)	Property Sale Proceeds (NPV)	Terminal Value (NPV)	Total (NPV)
Status Quo						
SQA - Purchase new facility at year 21	(146,706,905)	(40,801,359)	(34,982,616)	15,111,490	16,405,648	(190,973,742)
SQB - Lease new facility at year 21	(188,757,714)	(36,382,861)	-	15,111,490	-	(210,029,085)
SQC - Continue to lease overflow at Atria	(152,663,439)	(30,735,970)	-	-	6,960,445	(176,438,965)
						-
Scenario						
1A - Purchase Alternative Building	(155,870,157)	(38,823,332)	(83,879,719)	27,578,887	16,405,648	(234,588,673)
1B - Lease Alternative Building	(262,409,936)	(30,096,486)	-	27,578,887	-	(264,927,535)
						-
2A - Retain Ownership	(153,428,884)	(126,298,980)	-	14,570,697	15,411,366	(249,745,800)
2B - Lease Back	(284,882,702)	(14,691,026)	-	28,584,705	-	(270,989,023)

1. **Scenario 1A** - the purchase of an existing building at an alternative location represents the least overall cost to EGD relative to the Status Quo for the following reasons:
 - a. Office buildings in most parts of the GTA can be purchased below replacement cost;
 - i. The total project costs for new construction for EGD, whether on the VPC site or an alternative, are forecast to range between \$340 psf to \$400 psf.
 - ii. An existing suburban Class "A" office building should be able to be purchased between \$225 psf to \$275 psf (2012 dollars).
 - b. If EGD owns its facility, regardless of location, it will not incur the cost of a net rent; and
 - c. If EGD owns its facility, a Terminal Value is applied to the Cash Flow.

Scenario 1A Pros:

- a. Overall Occupancy Costs at low range of Status Quo and less than high range of Status Quo;
- b. Potentially a shorter time frame to end-state – estimated at 2 years vs. 3 years for new construction; and
- c. Overall ease of transition. EGD does not have to lease additional swing space or, occupy areas under construction.

Scenario 1A Cons:

- a. Overall capital requirement versus Status Quo (\$39 million vs. \$31 million at low range);
- b. Limited availability of suitable buildings for sale;
- c. EGD will have to relocate employees;



2. **Scenario 1B** - Leasing an existing building at an alternative location represents the lesser overall cost to EGD between lease scenarios (1B & 2B) for the following reasons:

- a. Compared to the lease of a new tower on VPC lands, EGD could relocate to a lower cost municipality; and
 - i. The assumptions in the Cash Flow analysis assume a gross rent of approximately \$35 psf versus over \$40 psf gross in the case of leasing a new tower at VPC.

Scenario 1B Pros:

- a. Lower Occupancy Cost compared to leasing new tower at VPC;
- b. Capital requirement offset by sale of VPC and potential Tenant Inducements;
- c. Potentially a shorter time frame to end-state – estimated at 2 years vs. 3 years for new construction; and
- d. Overall ease of transition. EGD does not have to lease additional swing space or, occupy areas under construction.

Scenario 1B Cons:

- a. Greater overall Occupancy Cost versus Status Quo and Scenario 1A;
- b. Limited availability of suitable large contiguous space within proximity of VPC;
- c. EGD will have to relocate employees; and
- d. If suitable space can't be found at estimated lease rates, overall costs begin to overlap costs associated with construction of new tower at VPC. Key sensitivity in lease rates.

3. **Scenario 2A** – Constructing a new tower on VPC West Lands and retaining ownership represents the second least overall cost to range to EGD, and potentially competes with Scenario 1A for the following reasons:

- a. Overall Occupancy Cost equal to or less than Status Quo due to the fact that EGD would not incur the cost of rent at Atria after 2016;
- b. EGD would retain ownership and a Terminal Value has been applied; and
- c. VPC sale proceeds offset a portion of capital costs.

Scenario 2A Pros:

- a. Lower Occupancy Cost compared to leasing. No net rent applied;
- b. EGD would not have to relocate employees;
- c. EGD would have building suited specifically to its needs; and
- d. EGD would maintain control of its own asset.

Scenario 2A Cons:

- a. EGD would incur the total project cost in the short-term (\$126 million);
- b. EGD would require additional swing space at Atria;
- c. EGD employees would have to endure the inconveniences of construction; and
- d. The time to end-state is longer than scenarios in which EGD relocates to an alternative site (estimated at 3-years versus 2-years).



4. **Scenario 2B** – Selling VPC to a developer to construct a new tower on VPC West Lands and lease to VPC on completion represents the greatest overall cost to range to EGD for the following reasons:

- a. Overall Occupancy Cost significantly greater than all other scenarios; and
 - i. The new tower would be located in an area with higher Tax & Operating Costs than suburban locations
 - ii. The economic rent required to justify the developer's cost of the project far exceeds the current market rent
 - iii. Gross rent estimated in excess of \$40 psf which approaches achievable rents in far superior locations.
- b. Because EGD would not retain ownership, no Terminal Value is applied.

Scenario 2B Pros:

- a. Sale of VPC completely offsets capital requirement;
- b. EGD would not have to relocate employees; and
- c. EGD would have building suited specifically to its needs.

Scenario 2B Cons:

- a. Significantly increased Occupancy Cost;
- b. EGD would require additional swing space at Atria;
- c. EGD employees would have to endure the inconveniences of construction; and
- d. The time to end-state is longer than scenarios in which EGD relocates to an alternative site (estimated at 3-years versus 2-years).



SECTION 11

RECOMMENDATIONS & NEXT STEPS

1. The scenarios vary substantially between Operating and Capital Costs. In order to move forward, EGD must consider what its key priorities are and how the various scenarios affect regulatory and accounting issues.
2. Given the time horizon, EGD should proceed with a funding proposal based on the likely scenarios, 1A & 2A.
3. Notwithstanding the outcome of point 1, EGD should engage Bousfields to proceed with a submission to the City of Toronto with regard to a re-designation of the VPC East Lands to Mixed-Use as soon as possible. By doing so, EGD is not precluded from executing on any of the scenarios contained herein and potentially increases the value of VPC. A key assumption in the scenario analysis. We recommend that the submission does not reference EGD's long-term occupancy on the site.
4. All scenarios will require the relocation of the Fleet Building and in Scenarios 2A and 2B, the demolition of the Annex/Link Building prior to construction. We recommend that EGD proceed with the process of relocating the Fleet building so as to not delay the direction at the time of execution.
5. Based on physical and functional limitations pointed out in the 2011 Report, the Status Quo is not a viable option. The results of the scenario analysis enable us to prioritize the scenarios based on a range of overall costs closest to the Status Quo, but until the scenarios are tested in the market, they will remain theoretical.

We propose the following process that will allow EGD to investigate the real world reality of the scenario analysis without commitment:

- a. Engage a Realty Advisor, broker or consultant, by way of Request for Qualification ("RFQ") or, in this case a project specific Request for Proposal ("RFP") for a "Market Test". In other words, to canvas the market for:
 - i. Purchase opportunities;
 - ii. Suitable lease opportunities; and
 - iii. Potential purchasers/developers for VPC.

There are many transaction structures that may be available to EGD. For example, in discussions with Colliers International, we were advised of a potential opportunity to acquire, swap, or lease Class "A" office space within proximity to VPC, suitable for EGD's needs that would fall within the assumptions herein. The opportunity discussed was not "listed".

The risk that EGD faces is that the scenarios analyzed herein may overlap given the sensitivity to the market assumptions, particularly Scenarios 1A and 2A. There may be several opportunities such as the one referred to above and by committing to any particular scenario without a "Market Test" EGD may preclude itself from capitalizing on a beneficial opportunity in a scenario not selected.



Furthermore, given that EGD would be seen as an “AAA” covenant, there would be an overwhelming and aggressive response to any indication or rumor, that VPC and EGD tenancy was “in the market”. Without an organized approach EGD will be inundated with input from the brokerage and development community with no ability to analyze or vet the information. By officially engaging a real estate advisor, EGD will legitimize the “Market Test”.

6. If the “Market Test” did not yield a satisfactory result, as a fall-back position, EGD’s next best scenario would be to construct a new tower on the VPC West Lands and retain ownership. Based on the current Official Plan and Zoning in-place, all that is required of EGD to construct a new tower on the west portion of VPC lands is to submit, and have approved, a Site Plan Application. The 6-month “Market Test” would not jeopardize the estimated 3-year time horizon and if it was forecast, at some point during the 6-month period, that the “Market Test” was unlikely to yield the desired result, EGD could engage an architectural/design firm to begin preparation of the Site Plan Application.

APPENDIX 1

OPERATING EXPENSE BASE CALCULATION

All Figures in (\$CDN) unless otherwise specified.

All expenses information provided by EGD.

Note

1	Annual Expenses Growth Rate	2.00%
2	Area Measures	SF
	VPC Tower	225,000
	VPC Annex/Link - Office	51,600
	VPC Annex/Link - Industrial	34,400
	VPC - Fleet Building	35,000
	Total	346,000

	2010		Base Year 2011		2012		Analysis Start 2013	
	Actual (\$)	\$/SF	Actual (\$)	\$/SF	Estimate (\$)	\$/SF	Estimate (\$)	\$/SF
Operating Costs (OPEX)	3,858,520	11.15	4,156,075	12.01	4,239,197	12.25	4,323,980	12.50
3 EGD Deductions	(692,574)	(2.00)	(1,157,399)	(3.35)	(1,180,547)	(3.41)	(1,204,158)	(3.48)
4 Property Management	400,000	1.16	410,000	1.18	418,200	1.21	426,564	1.23
5 Hydro	(685,540)	(1.98)	(680,744)	(1.97)	(694,359)	(2.01)	(708,246)	(2.05)
5/6 Natural Gas	-	-	-	-	-	-	-	-
5 Water	(63,363)	(0.18)	(60,798)	(0.18)	(62,014)	(0.18)	(63,254)	(0.18)
Adjusted Operating Costs (OPEX)	2,817,043	8.14	2,667,134	7.71	2,720,477	7.86	2,774,886	8.02
Fixed Costs								
7 Realty Taxes	1,065,830	3.08	1,025,500	2.96	1,046,010	3.02	1,066,930	3.08
7 Insurance	21,586	0.06	21,586	0.06	22,018	0.06	22,458	0.06
Total Fixed Costs (FC)	1,087,416	3.14	1,047,086	3.03	1,068,028	3.09	1,089,388	3.15
Total OPEX & FC (Net of Utilities)	3,904,459	11.28	3,714,220	10.73	3,788,504	10.95	3,864,274	11.17
8 Allocation of OPEX & FC								
VPC Tower	2,857,681	12.70	2,718,174	12.08	2,772,538	12.32	2,827,988	12.57
VPC Annex/Link - Office	655,362	12.70	623,368	12.08	635,835	12.32	648,552	12.57
VPC Annex/Link - Industrial	194,016	5.64	184,728	5.37	188,423	5.48	192,191	5.59
VPC - Meter Shop	197,400	5.64	187,950	5.37	191,709	5.48	195,543	5.59
Total	3,904,459	11.28	3,714,220	10.73	3,788,504	10.95	3,864,274	11.17
9 Utilities								
Hydro	685,540	1.98	680,744	1.97	694,359	2.01	708,246	2.05
Credit - Fuel Cell Savings	-	-	(300,000)	(0.87)	(306,000)	(0.88)	(312,120)	(0.90)
Natural Gas	-	-	-	-	-	-	-	-
Water	63,363	0.18	60,798	0.18	62,014	0.18	63,254	0.18
Total Utilities	748,903	2.16	441,542	1.28	450,373	1.30	459,380	1.33

Notes

- Based on average CPI growth - All Items(1992-2011) Source: Statistics Canada.
- Area measures as per 2011 Report.
- Deductions for non-facilities items.
- Facilities related administrative salaries.
- Analysis compares EGD Operating Expenses to Operating Expenses of other buildings that do not include tenant specific utilities. All utilities have been extracted from EGD Operating Costs
- EGD does not incur charges for NG. Included for illustration purposes only.
- All fixed costs provided by EGD.
- This analysis uses assumptions regarding individual components of VPC. This allocation is based on market data provided by Colliers International.
- Utilities extracted from EGD Operating Costs

APPENDIX 2

TERMINAL VALUE CALCULATIONS

All Figures in (\$CDN) unless otherwise specified.

Terminal Value is used to attribute value to an asset with continuing income at the end of an investment period.

Note

1 Market Rent - Annual Growth Rate 2.00%

SECTION A1 - VPC

VPC Terminal Value - For Use in Status Quo A&B (Year 21)

	Area (SF)	Analysis Begin	2013 Market Rent (PSF)	2013 Market Cap Rate	Analysis End	2053 Market Rent	2053 Terminal Cap Rate	Terminal Value
		2013			2053			
3 Component								
VPC Tower	225,000	8.50	7.25%		12.63	8.25%		34,446,962
VPC Annex/Link - Office	51,600	8.50	7.25%		12.63	8.25%		7,899,837
VPC Annex/Link - Industrial	34,400	5.00	7.25%		7.43	8.25%		3,097,975
VPC - Meter Shop	35,000	5.00	7.25%		7.43	8.25%		3,152,010
Total Terminal Value - Status Quo	346,000							48,596,784
<i>Total Terminal Value - Status Quo (PSF)</i>								<i>140.45</i>

SECTION A2 - VPC

VPC Terminal Value - For Use in Status Quo C (Year 41)

	Area (SF)	Analysis Begin	2013 Market Rent (PSF)	2013 Market Cap Rate	Analysis End	2053 Market Rent	2053 Terminal Cap Rate	Terminal Value
		2013			2053			
3 Component								
VPC Tower	225,000	8.50	7.25%		18.77	9.25%		45,652,712
VPC Annex/Link - Office	51,600	8.50	7.25%		18.77	9.25%		10,469,689
VPC Annex/Link - Industrial	34,400	5.00	7.25%		11.04	9.25%		4,105,760
VPC - Fleet Building	35,000	5.00	7.25%		11.04	9.25%		4,177,372
Total Terminal Value - Status Quo	346,000							64,405,533
<i>Total Terminal Value - Status Quo (PSF)</i>								<i>186.14</i>

SECTION B - EXISTING TOWER - ALTERNATIVE LOCATION

Terminal Value - For Use in Status Quo/Scenario A (Year 41)

	Area (SF)	Analysis Begin	2013 Market Rent (PSF) ^c	2013 Market Cap Rate ^c	Analysis End	2053 Market Rent ^d	2053 Terminal Cap Rate ^e	Terminal Value ^a
		2013			2053			
5	375,000	16.50	7.00%		36.43	9.00%		151,802,727
<i>Total Terminal Value - Existing Tower, Alternate Location (PSF)</i>								<i>404.81</i>

SECTION C - NEW TOWER ON VPC SITE

VPC Terminal Value - For Use in Scenario 2A (Year 40)

	Area (SF)	Analysis Begin	2013 Market Rent (PSF) ^u	2013 Market Cap Rate ^v	Analysis End	2053 Market Rent ^u	2053 Terminal Cap Rate ^v	Terminal Value ^w
		2013			2053			
New Tower	375,000	15.50	7.00%		34.22	9.00%		142,602,562
Total Terminal Value - New Tower								380.27
<i>Total Terminal Value - New Tower (PSF)</i>								

Notes

- Based on average CPI growth - All Items(1992-2011) Source: Statistics Canada.
- Assumes no appreciation in value
- All market information provided by Colliers International
- Assumes no appreciation in value. Equal to acquisition Cost.
- Cap Rate used to calculate Economic Rent. See"?"
- Cap Rate used to calculate Economic Rent. See"?"
- 100 bps increase to initial Cap Rate based on ongoing Enbridge covenant.

APPENDIX 3

STATUS QUO A - CASH FLOW (Purchase At Year 21)

All Figures in \$(CDN) unless otherwise specified.

1	Expense Growth Rate:		2.00%								
2	Occupied Office Area (SF):	363,943	358,223	376,223	376,223	376,223	376,223	376,223	376,223	376,223	376,223
	Area (SF)	1	2	3	4	5	6	7	8	9	10
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
SECTION A											
Note											
	Base Rent										
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	-	-	-	-	-	-	-	-	-
3	VPC Fleet Building	35,000	-	-	-	-	-	-	-	-	-
	Atria - Suite 801 \$/SF	11.88	12.00	12.00	12.00	12.00	12.75	13.00	13.00	13.00	13.00
4	Atria - Suite 801	19,900	(236,412)	(238,800)	(238,800)	(238,800)	(253,725)	(258,700)	(258,700)	(258,700)	(258,700)
	Atria - Suite 401 \$/SF	12.00	12.00	12.00	12.00	12.00	12.00	12.67	13.00	13.00	13.00
4	Atria - Suite 401	48,226	(578,712)	(578,712)	(578,712)	(578,712)	(578,712)	(611,023)	(626,938)	(626,938)	(626,938)
	Atria - Suite 132 \$/SF	5.00	-	-	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	(28,600)	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	12.00	13.33	14.00	14.00	14.00	14.00	14.67	15.00	15.00	15.00
4	Atria - Suite 1700	13,497	(161,964)	(179,915)	(188,958)	(188,958)	(188,958)	(198,001)	(202,455)	(202,455)	(202,455)
	Atria - New Suite SSF	-	-	14.00	14.00	14.00	14.00	14.00	15.00	15.00	15.00
4/6	Atria - New Suite	18,000	-	(252,000)	(252,000)	(252,000)	(252,000)	(252,000)	(270,000)	(270,000)	(270,000)
	New Tower SSF	-	-	-	-	-	-	-	-	-	-
7	New Tower	375,000	-	-	-	-	-	-	-	-	-
	Total Base Rent		(1,005,688)	(997,427)	(1,258,470)	(1,258,470)	(1,273,395)	(1,319,724)	(1,358,093)	(1,358,093)	(1,358,093)
SECTION B											
	Operating Expenses										
	VPC Tower \$/SF	12.57	12.82	13.08	13.34	13.60	13.88	14.15	14.44	14.73	15.02
8	VPC Tower - OPEX & FC	225,000	(2,827,988)	(2,884,548)	(2,942,239)	(3,001,084)	(3,061,105)	(3,122,328)	(3,184,774)	(3,248,470)	(3,313,439)
	VPC Annex Office \$/SF	12.57	12.82	13.08	13.34	13.60	13.88	14.15	14.44	14.73	15.02
8	VPC Annex Office - OPEX & FC	51,600	(648,552)	(661,523)	(674,753)	(688,249)	(702,014)	(716,054)	(730,375)	(744,982)	(759,882)
	VPC Annex Industrial \$/SF	5.59	5.70	5.81	5.93	6.05	6.17	6.29	6.42	6.55	6.68
8	VPC Annex Industrial - OPEX & FC	34,400	(192,191)	(196,035)	(199,956)	(203,955)	(208,034)	(212,194)	(216,438)	(220,767)	(225,182)
	VPC Fleet Building \$/SF	5.59	5.70	5.81	5.93	6.05	6.17	6.29	6.42	6.55	6.68
8	VPC Fleet Building - OPEX & FC	35,000	(195,543)	(199,454)	(203,443)	(207,512)	(211,662)	(215,895)	(220,213)	(224,618)	(229,110)
	Atria - Suite 801 \$/SF	18.41	18.78	19.15	19.54	19.93	20.33	20.73	21.15	21.57	22.00
9	Atria - Suite 801 - T&O	19,900	(366,359)	(373,686)	(381,160)	(388,783)	(396,559)	(404,490)	(412,580)	(420,831)	(429,248)
	Atria - Suite 401 \$/SF	18.41	18.78	19.15	19.54	19.93	20.33	20.73	21.15	21.57	22.00
9	Atria - Suite 401 - T&O	48,226	(887,841)	(905,597)	(923,709)	(942,184)	(961,027)	(980,248)	(999,853)	(1,019,850)	(1,040,247)
	Atria - Suite 132 \$/SF	7.67	-	-	-	-	-	-	-	-	-
9	Atria - Suite 132 - T&O	5,720	(43,872)	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	18.41	18.78	19.15	19.54	19.93	20.33	20.73	21.15	21.57	22.00
9	Atria - Suite 1700 - T&O	13,497	(248,480)	(253,449)	(258,518)	(263,689)	(268,962)	(274,342)	(279,829)	(285,425)	(291,134)
	Atria - New Suite SSF	-	-	19.15	19.54	19.93	20.33	20.73	21.15	21.57	22.00
9	Atria - New Suite - T&O	18,000	-	-	(344,768)	(351,663)	(358,696)	(365,870)	(373,188)	(380,651)	(388,264)
	New Tower SSF	-	-	-	-	-	-	-	-	-	-
10	New Tower - T&O	375,000	-	-	-	-	-	-	-	-	-
	Atria - # of parking Stalls	286.00	270.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00
11	Atria Parking	-	(257,400)	(247,860)	(301,508)	(307,538)	(313,689)	(319,963)	(326,362)	(332,889)	(339,547)
	Total Taxes & Operating Costs		(5,668,226)	(5,722,153)	(6,230,055)	(6,354,656)	(6,481,749)	(6,611,384)	(6,743,611)	(6,878,484)	(7,016,053)
	Gross Rental Expense		(6,673,914)	(6,719,580)	(7,488,525)	(7,613,126)	(7,740,219)	(7,884,779)	(8,063,336)	(8,236,577)	(8,374,146)
	Other Expenses Items										
12	Designated Substance Remediation	(1,500,000)	(1,500,000)	(2,000,000)	-	-	-	-	-	-	-
12	Remediation Move Costs	(250,000)	(250,000)	(250,000)	-	-	-	-	-	-	-
12	Designated Substance Maintenance	-	(100,000)	(150,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
	Total Other Expense Items		(1,750,000)	(1,850,000)	(2,400,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
	Total Expense		(8,423,914)	(8,569,580)	(9,888,525)	(7,863,126)	(7,990,219)	(8,134,779)	(8,313,336)	(8,486,577)	(8,624,146)
SECTION C											
	Capital Items										
13	General Capital Allowance	(1,000,000)	(1,020,000)	(1,040,400)	(1,061,208)	(1,082,432)	(1,104,081)	(1,126,162)	(1,148,686)	(1,171,659)	(1,195,093)
14	Furniture Replacement Program	(1,500,000)	(1,500,000)	(1,500,000)	(1,500,000)	-	-	-	-	-	-
14	Carpet Replacement	(350,000)	(500,000)	-	-	-	-	-	-	-	-
14	Elevator Upgrades	(200,000)	-	-	-	-	-	-	-	-	-
14	Parking Lot Repairs	-	-	-	(500,000)	-	-	-	-	-	-
14	Washroom Upgrades	-	-	-	-	(300,000)	(200,000)	(300,000)	(200,000)	-	-
15	General Tenant Improvements	-	-	-	-	-	-	-	-	-	-
16	Construction Costs	-	-	-	-	-	-	-	-	-	-
17	FF&E, Move Allowance, IT	-	-	-	-	-	-	-	-	-	-
	Total Capital Items		(3,050,000)	(3,020,000)	(2,540,400)	(3,061,208)	(1,382,432)	(1,304,081)	(1,426,162)	(1,348,686)	(1,171,659)
SECTION D											
18	Acquisitions	-	-	-	-	-	-	-	-	-	-
19	Dispositions	-	-	-	-	-	-	-	-	-	-
20	Terminal Value	-	-	-	-	-	-	-	-	-	-
	CASH FLOW (CF)		(11,473,914)	(11,589,580)	(12,428,925)	(10,924,334)	(9,372,651)	(9,438,860)	(9,739,498)	(9,835,262)	(9,959,560)
	PV of CF		(190,973,742)								
21	Discount Rate		5.72%								

APPENDIX 3

STATUS QUO A - CASH FLOW (Purchase At Year 21)

All Figures in \$(CDN) unless otherwise specified.

1	Expense Growth Rate:									
2	Occupied Office Area (SF):	376,223	376,223	376,223	376,223	376,223	376,223	376,223	376,223	376,223
	Area (SF)	11	12	13	14	15	16	17	18	19
		2023	2024	2025	2026	2027	2028	2029	2030	2031

SECTION A

Note

	Base Rent									
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Fleet Building	35,000	-	-	-	-	-	-	-	-
	Atria - Suite 801 \$/SF	13.75	14.00	14.00	14.00	14.00	14.75	15.00	15.00	15.00
4	Atria - Suite 801	19,900	(273,625)	(278,600)	(278,600)	(278,600)	(293,525)	(298,500)	(298,500)	(298,500)
	Atria - Suite 401 \$/SF	13.00	13.67	14.00	14.00	14.00	14.00	14.67	15.00	15.00
4	Atria - Suite 401	48,226	(626,938)	(659,249)	(675,164)	(675,164)	(675,164)	(707,475)	(723,390)	(723,390)
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	15.00	15.67	16.00	16.00	16.00	16.00	16.67	17.00	17.00
4	Atria - Suite 1700	13,497	(202,455)	(211,498)	(215,952)	(215,952)	(215,952)	(224,995)	(229,449)	(229,449)
	Atria - New Suite \$/SF	15.00	15.00	16.00	16.00	16.00	16.00	16.00	17.00	17.00
4/6	Atria - New Suite	18,000	(270,000)	(270,000)	(288,000)	(288,000)	(288,000)	(288,000)	(306,000)	(306,000)
	New Tower \$/SF	-	-	-	-	-	-	-	-	-
7	New Tower	375,000	-	-	-	-	-	-	-	-
	Total Base Rent		(1,373,018)	(1,419,347)	(1,457,716)	(1,457,716)	(1,472,641)	(1,518,970)	(1,557,339)	(1,557,339)

SECTION B

	Operating Expenses									
	VPC Tower \$/SF	15.32	15.63	15.94	16.26	16.58	16.92	17.25	17.60	17.95
8	VPC Tower - OPEX & FC	225,000	(3,447,302)	(3,516,248)	(3,586,573)	(3,658,304)	(3,731,471)	(3,806,100)	(3,882,222)	(4,039,064)
	VPC Annex Office \$/SF	15.32	15.63	15.94	16.26	16.58	16.92	17.25	17.60	17.95
8	VPC Annex Office - OPEX & FC	51,600	(790,581)	(806,393)	(822,521)	(838,971)	(855,751)	(872,866)	(890,323)	(926,292)
	VPC Annex Industrial \$/SF	6.81	6.95	7.09	7.23	7.37	7.52	7.67	7.82	7.98
8	VPC Annex Industrial - OPEX & FC	34,400	(234,280)	(238,965)	(243,745)	(248,620)	(253,592)	(258,664)	(263,837)	(274,496)
	VPC Fleet Building \$/SF	6.81	6.95	7.09	7.23	7.37	7.52	7.67	7.82	7.98
8	VPC Fleet Building - OPEX & FC	35,000	(238,366)	(243,133)	(247,996)	(252,956)	(258,015)	(263,175)	(268,439)	(279,284)
	Atria - Suite 801 \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
9	Atria - Suite 801 - T&O	19,900	(446,590)	(455,521)	(464,632)	(473,924)	(483,403)	(493,071)	(502,932)	(512,991)
	Atria - Suite 401 \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
9	Atria - Suite 401 - T&O	48,226	(1,082,273)	(1,103,918)	(1,125,997)	(1,148,517)	(1,171,487)	(1,194,917)	(1,218,815)	(1,243,191)
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
9	Atria - Suite 1700 - T&O	13,497	(302,895)	(308,953)	(315,132)	(321,435)	(327,864)	(334,421)	(341,109)	(347,932)
	Atria - New Suite \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
9	Atria - New Suite - T&O	18,000	(403,950)	(412,029)	(420,270)	(428,675)	(437,249)	(445,994)	(454,914)	(464,012)
	New Tower \$/SF	-	-	-	-	-	-	-	-	-
10	New Tower - T&O	375,000	-	-	-	-	-	-	-	-
	Atria - # of parking Stalls	322.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00
11	Atria Parking	-	(353,265)	(360,330)	(367,536)	(374,887)	(382,385)	(390,033)	(397,833)	(405,790)
	Total Taxes & Operating Costs		(7,299,502)	(7,445,492)	(7,594,402)	(7,746,290)	(7,901,216)	(8,059,240)	(8,220,425)	(8,384,833)
	Gross Rental Expense		(8,672,520)	(8,864,839)	(9,052,118)	(9,204,006)	(9,358,932)	(9,531,881)	(9,739,395)	(10,109,869)
	Other Expense Items									
12	Designated Substance Remediation	-	-	-	-	-	-	-	-	-
12	Remediation Move Costs	-	-	-	-	-	-	-	-	-
12	Designated Substance Maintenance	-	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
	Total Other Expense Items		(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
	Total Expense		(8,922,520)	(9,114,839)	(9,302,118)	(9,454,006)	(9,608,932)	(9,781,881)	(9,989,395)	(10,192,172)

SECTION C

	Capital Items									
13	General Capital Allowance	(1,218,994)	(1,243,374)	(1,268,242)	(1,293,607)	(1,319,479)	(1,345,868)	(1,372,786)	(1,400,241)	(1,428,246)
14	Furniture Replacement Program	-	-	-	-	-	-	-	-	-
14	Carpet Replacement	-	-	-	-	-	-	-	-	-
14	Elevator Upgrades	-	-	-	-	-	-	-	-	-
14	Parking Lot Repairs	-	-	-	-	-	-	-	-	-
14	Washroom Upgrades	-	-	-	-	-	-	-	-	-
15	General Tenant Improvements	(2,812,500)	(2,812,500)	-	-	-	-	-	-	-
16	Construction Costs	-	-	-	-	-	-	-	-	-
17	FF&E, Move Allowance, IT	-	-	-	-	-	-	-	-	-
	Total Capital Items	(4,031,494)	(4,055,874)	(1,268,242)	(1,293,607)	(1,319,479)	(1,345,868)	(1,372,786)	(1,400,241)	(1,428,246)

SECTION D

18	Acquisitions	-	-	-	-	-	-	-	-	-
19	Dispositions	-	-	-	-	-	-	-	-	-
20	Terminal Value	-	-	-	-	-	-	-	-	-
	CASH FLOW (CF)	(12,954,014)	(13,170,714)	(10,570,360)	(10,747,612)	(10,928,410)	(11,127,749)	(11,362,181)	(11,592,414)	(11,788,115)

PV of CF

21 Discount Rate

APPENDIX 3

STATUS QUO A - CASH FLOW (Purchase At Year 21)

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:								
2	Occupied Office Area (SF):	376,223	375,000	375,000	375,000	375,000	375,000	375,000	375,000

	Area (SF)	20 2032	21 2033	22 2034	23 2035	24 2036	25 2037	26 2038	27 2039	28 2040

SECTION A

Note

Base Rent										
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	8.01	8.17	8.34	8.50	8.67	8.85	9.02	9.20
3	VPC Fleet Building	35,000	(400,623)	(408,636)	(416,808)	(425,144)	(433,647)	(442,320)	(451,167)	(460,190)
	Atria - Suite 801 \$/SF	-	15.00	-	-	-	-	-	-	-
4	Atria - Suite 801	19,900	(298,500)	-	-	-	-	-	-	-
	Atria - Suite 401 \$/SF	-	15.00	-	-	-	-	-	-	-
4	Atria - Suite 401	48,226	(723,390)	-	-	-	-	-	-	-
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	-	17.00	-	-	-	-	-	-	-
4	Atria - Suite 1700	13,497	(229,449)	-	-	-	-	-	-	-
	Atria - New Suite SSF	-	17.00	-	-	-	-	-	-	-
4/6	Atria - New Suite	18,000	(306,000)	-	-	-	-	-	-	-
	New Tower SSF	-	-	-	-	-	-	-	-	-
7	New Tower	375,000	-	-	-	-	-	-	-	-
	Total Base Rent		(1,557,339)	(400,623)	(408,636)	(416,808)	(425,144)	(433,647)	(442,320)	(451,167)

SECTION B

Operating Expenses										
	VPC Tower \$/SF	-	18.31	-	-	-	-	-	-	-
8	VPC Tower - OPEX & FC	225,000	(4,119,845)	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	18.31	-	-	-	-	-	-	-
8	VPC Annex Office - OPEX & FC	51,600	(944,818)	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	8.14	-	-	-	-	-	-	-
8	VPC Annex Industrial - OPEX & FC	34,400	(279,986)	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	8.14	8.30	8.47	8.64	8.81	8.99	9.17	9.34
8	VPC Fleet Building - OPEX & FC	35,000	(284,869)	(415,096)	(423,397)	(431,865)	(440,503)	(449,313)	(458,299)	(467,465)
	Atria - Suite 801 \$/SF	-	26.82	-	-	-	-	-	-	-
9	Atria - Suite 801 - T&O	19,900	(533,716)	-	-	-	-	-	-	-
	Atria - Suite 401 \$/SF	-	26.82	-	-	-	-	-	-	-
9	Atria - Suite 401 - T&O	48,226	(1,293,416)	-	-	-	-	-	-	-
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	-	26.82	-	-	-	-	-	-	-
9	Atria - Suite 1700 - T&O	13,497	(361,988)	-	-	-	-	-	-	-
	Atria - New Suite SSF	-	26.82	-	-	-	-	-	-	-
9	Atria - New Suite - T&O	18,000	(482,758)	-	-	-	-	-	-	-
	New Tower SSF	-	22.58	23.03	23.49	23.96	24.44	24.93	25.43	25.94
10	New Tower - T&O	375,000	(8,467,715)	(8,637,069)	(8,809,811)	(8,986,007)	(9,165,727)	(9,349,042)	(9,536,022)	(9,726,743)
	Atria - # of parking Stalls	-	322.00	-	-	-	-	-	-	-
11	Atria Parking	-	(422,184)	-	-	-	-	-	-	-
	Total Taxes & Operating Costs		(8,723,580)	(8,882,810)	(9,060,467)	(9,241,676)	(9,426,510)	(9,615,040)	(9,807,341)	(10,003,487)
	Gross Rental Expense		(10,280,919)	(9,283,434)	(9,469,102)	(9,658,484)	(9,851,654)	(10,048,687)	(10,249,661)	(10,454,654)
Other Expenses Items										
12	Designated Substance Remediation	-	-	-	-	-	-	-	-	-
12	Remediation Move Costs	-	-	-	-	-	-	-	-	-
12	Designated Substance Maintenance	-	(250,000)	-	-	-	-	-	-	-
	Total Other Expense Items		(250,000)	-	-	-	-	-	-	-
	Total Expense		(10,530,919)	(9,283,434)	(9,469,102)	(9,658,484)	(9,851,654)	(10,048,687)	(10,249,661)	(10,454,654)

SECTION C

Capital Items										
13	General Capital Allowance	(1,456,811)	(500,000)	(510,000)	(520,200)	(530,604)	(541,216)	(552,040)	(563,081)	(574,343)
14	Furniture Replacement Program	-	-	-	-	-	-	-	-	-
14	Carpet Replacement	-	-	-	-	-	-	-	-	-
14	Elevator Upgrades	-	-	-	-	-	-	-	-	-
14	Parking Lot Repairs	-	-	-	-	-	-	-	-	-
14	Washroom Upgrades	-	-	-	-	-	-	-	-	-
15	General Tenant Improvements	-	(28,418,744)	-	-	-	-	-	-	-
16	Construction Costs	-	(10,609,664)	-	-	-	-	-	-	-
17	FF&E, Move Allowance, IT	-	(7,673,061)	-	-	-	-	-	-	-
	Total Capital Items		(1,456,811)	(47,201,469)	(510,000)	(520,200)	(530,604)	(541,216)	(552,040)	(563,081)

SECTION D

18	Acquisitions	-	(112,500,000)	-	-	-	-	-	-	-
19	Dispositions	-	48,596,784	-	-	-	-	-	-	-
20	Terminal Value	-	-	-	-	-	-	-	-	-
	CASH FLOW (CF)		(11,987,731)	(120,388,119)	(9,979,102)	(10,178,684)	(10,382,258)	(10,589,903)	(10,801,701)	(11,017,735)

PV of CF

21 Discount Rate

APPENDIX 3

STATUS QUO A - CASH FLOW (Purchase At Year 21)

All Figures in \$(CDN) unless otherwise specified.

1	Expense Growth Rate:								
2	Occupied Office Area (SF):	375,000	375,000	375,000	375,000	375,000	375,000	375,000	375,000

	Area (SF)	29 2041	30 2042	31 2043	32 2044	33 2045	34 2046	35 2047	36 2048	37 2049

SECTION A

Note

Base Rent										
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	9.39	9.58	9.77	9.96	10.16	10.36	10.57	11.00
3	VPC Fleet Building	35,000	(469,394)	(478,782)	(488,357)	(498,124)	(508,087)	(518,249)	(528,614)	(539,186)
	Atria - Suite 801 \$/SF	-	-	-	-	-	-	-	-	-
4	Atria - Suite 801	19,900	-	-	-	-	-	-	-	-
	Atria - Suite 401 \$/SF	-	-	-	-	-	-	-	-	-
4	Atria - Suite 401	48,226	-	-	-	-	-	-	-	-
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	-	-	-	-	-	-	-	-	-
4	Atria - Suite 1700	13,497	-	-	-	-	-	-	-	-
	Atria - New Suite \$/SF	-	-	-	-	-	-	-	-	-
4/6	Atria - New Suite	18,000	-	-	-	-	-	-	-	-
	New Tower \$/SF	-	-	-	-	-	-	-	-	-
7	New Tower	375,000	-	-	-	-	-	-	-	-
	Total Base Rent		(469,394)	(478,782)	(488,357)	(498,124)	(508,087)	(518,249)	(528,614)	(539,186)

SECTION B

Operating Expenses										
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
8	VPC Tower - OPEX & FC	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
8	VPC Annex Office - OPEX & FC	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
8	VPC Annex Industrial - OPEX & FC	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	9.73	9.92	10.12	10.32	10.53	10.74	10.95	11.40
8	VPC Fleet Building - OPEX & FC	35,000	(486,351)	(496,078)	(505,999)	(516,119)	(526,442)	(536,970)	(547,710)	(558,664)
	Atria - Suite 801 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 801 - T&O	19,900	-	-	-	-	-	-	-	-
	Atria - Suite 401 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 401 - T&O	48,226	-	-	-	-	-	-	-	-
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 1700 - T&O	13,497	-	-	-	-	-	-	-	-
	Atria - New Suite \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - New Suite - T&O	18,000	-	-	-	-	-	-	-	-
	New Tower \$/SF	-	26.46	26.99	27.53	28.08	28.64	29.21	29.79	30.39
10	New Tower - T&O	375,000	(9,921,278)	(10,119,703)	(10,322,097)	(10,528,539)	(10,739,110)	(10,953,892)	(11,172,970)	(11,396,429)
	Atria - # of parking Stalls	-	-	-	-	-	-	-	-	-
11	Atria Parking	-	-	-	-	-	-	-	-	-
	Total Taxes & Operating Costs		(10,407,628)	(10,615,781)	(10,828,096)	(11,044,658)	(11,265,552)	(11,490,863)	(11,720,680)	(11,955,093)
	Gross Rental Expense		(10,877,022)	(11,094,562)	(11,316,454)	(11,542,783)	(11,773,638)	(12,009,111)	(12,249,293)	(12,494,279)
Other Expenses Items										
12	Designated Substance Remediation	-	-	-	-	-	-	-	-	-
12	Remediation Move Costs	-	-	-	-	-	-	-	-	-
12	Designated Substance Maintenance	-	-	-	-	-	-	-	-	-
	Total Other Expense Items		-	-	-	-	-	-	-	-
	Total Expense		(10,877,022)	(11,094,562)	(11,316,454)	(11,542,783)	(11,773,638)	(12,009,111)	(12,249,293)	(12,494,279)

SECTION C

Capital Items										
13	General Capital Allowance	(585,830)	(597,546)	(609,497)	(621,687)	(634,121)	(646,803)	(659,739)	(672,934)	(686,393)
14	Furniture Replacement Program	-	-	-	-	-	-	-	-	-
14	Carpet Replacement	-	-	-	-	-	-	-	-	-
14	Elevator Upgrades	-	-	-	-	-	-	-	-	-
14	Parking Lot Repairs	-	-	-	-	-	-	-	-	-
14	Washroom Upgrades	-	-	-	-	-	-	-	-	-
15	General Tenant Improvements	-	-	-	-	-	-	-	-	-
16	Construction Costs	-	-	-	-	-	-	-	-	-
17	FF&E, Move Allowance, IT	-	-	-	-	-	-	-	-	-
	Total Capital Items	(585,830)	(597,546)	(609,497)	(621,687)	(634,121)	(646,803)	(659,739)	(672,934)	(686,393)

SECTION D

18	Acquisitions	-	-	-	-	-	-	-	-	-
19	Dispositions	-	-	-	-	-	-	-	-	-
20	Terminal Value	-	-	-	-	-	-	-	-	-
	CASH FLOW (CF)	(11,462,852)	(11,692,109)	(11,925,951)	(12,164,470)	(12,407,759)	(12,655,915)	(12,909,033)	(13,167,213)	(13,430,558)

PV of CF

21 Discount Rate

APPENDIX 3

STATUS QUO A - CASH FLOW (Purchase At Year 21)

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:			
2	Occupied Office Area (SF):	375,000	375,000	375,000

	Area (SF)	38 2050	39 2051	40 2052
SECTION A				
Note				
Base Rent				
	VPC Tower \$/SF	-	-	-
3	VPC Tower	225,000	-	-
	VPC Annex Office \$/SF	-	-	-
3	VPC Annex Office	51,600	-	-
	VPC Annex Industrial \$/SF	-	-	-
3	VPC Annex Industrial	34,400	-	-
	VPC Fleet Building \$/SF	11.22	11.44	11.67
3	VPC Fleet Building	35,000	(560,969)	(572,188)
	Atria - Suite 801 \$/SF	-	-	-
4	Atria - Suite 801	19,900	-	-
	Atria - Suite 401 \$/SF	-	-	-
4	Atria - Suite 401	48,226	-	-
	Atria - Suite 132 \$/SF	-	-	-
4/5	Atria - Suite 132	5,720	-	-
	Atria - Suite 1700 \$/SF	-	-	-
4	Atria - Suite 1700	13,497	-	-
	Atria - New Suite \$/SF	-	-	-
4/6	Atria - New Suite	18,000	-	-
	New Tower \$/SF	-	-	-
7	New Tower	375,000	-	-
	Total Base Rent	(560,969)	(572,188)	(583,632)

SECTION B

Operating Expenses				
	VPC Tower \$/SF	-	-	-
8	VPC Tower - OPEX & FC	225,000	-	-
	VPC Annex Office \$/SF	-	-	-
8	VPC Annex Office - OPEX & FC	51,600	-	-
	VPC Annex Industrial \$/SF	-	-	-
8	VPC Annex Industrial - OPEX & FC	34,400	-	-
	VPC Fleet Building \$/SF	11.62	11.86	12.09
8	VPC Fleet Building - OPEX & FC	35,000	(581,234)	(592,859)
	Atria - Suite 801 \$/SF	-	-	-
9	Atria - Suite 801 - T&O	19,900	-	-
	Atria - Suite 401 \$/SF	-	-	-
9	Atria - Suite 401 - T&O	48,226	-	-
	Atria - Suite 132 \$/SF	-	-	-
9	Atria - Suite 132 - T&O	5,720	-	-
	Atria - Suite 1700 \$/SF	-	-	-
9	Atria - Suite 1700 - T&O	13,497	-	-
	Atria - New Suite \$/SF	-	-	-
9	Atria - New Suite - T&O	18,000	-	-
	New Tower \$/SF	31.62	32.25	32.90
10	New Tower - T&O	375,000	(11,856,845)	(12,093,982)
	Atria - # of parking Stalls	-	-	-
11	Atria Parking	-	-	-
	Total Taxes & Operating Costs	(12,438,079)	(12,686,841)	(12,940,578)
	Gross Rental Expense	(12,999,048)	(13,259,029)	(13,524,210)
Other Expenses Items				
12	Designated Substance Remediation	-	-	-
12	Remediation Move Costs	-	-	-
12	Designated Substance Maintenance	-	-	-
	Total Other Expense Items	-	-	-
	Total Expense	(12,999,048)	(13,259,029)	(13,524,210)

SECTION C

Capital Items				
13	General Capital Allowance	(700,121)	(714,123)	(728,406)
14	Furniture Replacement Program	-	-	-
14	Carpet Replacement	-	-	-
14	Elevator Upgrades	-	-	-
14	Parking Lot Repairs	-	-	-
14	Washroom Upgrades	-	-	-
15	General Tenant Improvements	-	-	-
16	Construction Costs	-	-	-
17	FF&E, Move Allowance, IT	-	-	-
	Total Capital Items	(700,121)	(714,123)	(728,406)

SECTION D

18	Acquisitions	-	-	-
19	Dispositions	-	-	-
20	Terminal Value	-	-	151,802,727
	CASH FLOW (CF)	(13,699,169)	(13,973,152)	137,550,112

PV of CF

21	Discount Rate			

SQA - Notes

- 1 Based on average CPI growth - All Items (1992-2011). Source: Statistics Canada.
- 2 Occupied area varies up to 2015 based on expansion and expires within Atria.
- 3 No internal base rent assumed for VPC.
- 4 All Atria lease information based on leases in place or currently under negotiation as provided by EGD.
- 5 Atria Suite 132 expires 05/2013. EGD does not intend to renew this suite.
- 6 As advised by EGD, additional space at Atria will be required by 2015; rental rates have been estimated based on current lease transactions.
- 7 Assumes that EGD purchases new building at year 21 - no rent applied.
- 8 All VPC Operating Expenses provided by EGD - Appendix 1.
- 9 Based on Atria posted Tax & Operating Costs.
- 10 Based on 2012 posted Atria rate inflated by 2% annually.
- 11 EGD currently rents approximately 286 parking spaces at Atria. As EGD leases additional space, additional parking is assumed at a rate of \$75/month/stall inflated annually at Expense Growth Rate based on 1 stall/500 sf of leased space.
- 12 All information regarding Designated Substance Remediation is based on estimates provided by EGD management.
- 13 Based on estimates by EGD management regarding general non-scheduled annual capital spend. Increased annually by Expense Growth Rate.
- 14 All information with respect to Capital Items provided by EGD as identified on 2011 Report - Appendix N.
- 15 Assumes that tenant improvements or renovations will be required for VPC Tower at \$25 psf over 2 years starting in year 11 of analysis. Assumes that EGD specific renovations will be required at \$50 psf. for new building in year 21.
- 16 Costs associated with relocation of data centre. As per 2011 Report and provided by EGD. Inflated at 2% annually.
- 17 Allowance for furniture, fixtures & equipment, move and IT costs
- 18 Purchase of new facility at year 21 - \$300 psf.
- 19 Assumes that EGD sells VPC in year 21. Based on capitalized market rent (see Appendix 2).
- 20 See Appendix 2, Section A - VPC Terminal Value.
- 21 EGD Weighted Average Cost of Capital (WACC) as identified in 2011 Report.

APPENDIX 3

STATUS QUO B - CASH FLOW (Lease At Year 21)

All Figures in \$(CDN) unless otherwise specified.

1	Expense Growth Rate:		2.00%								
2	Occupied Office Area (SF):	363,943	358,223	376,223	376,223	376,223	376,223	376,223	376,223	376,223	376,223
	Area (SF)	1	2	3	4	5	6	7	8	9	10
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
SECTION A											
Note											
	Base Rent										
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	-	-	-	-	-	-	-	-	-
3	VPC Fleet Building	35,000	-	-	-	-	-	-	-	-	-
	Atria - Suite 801 \$/SF	11.88	12.00	12.00	12.00	12.00	12.75	13.00	13.00	13.00	13.00
4	Atria - Suite 801	19,900	(236,412)	(238,800)	(238,800)	(238,800)	(253,725)	(258,700)	(258,700)	(258,700)	(258,700)
	Atria - Suite 401 \$/SF	12.00	12.00	12.00	12.00	12.00	12.00	12.67	13.00	13.00	13.00
4	Atria - Suite 401	48,226	(578,712)	(578,712)	(578,712)	(578,712)	(578,712)	(611,023)	(626,938)	(626,938)	(626,938)
	Atria - Suite 132 \$/SF	5.00	-	-	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	(28,600)	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	12.00	13.33	14.00	14.00	14.00	14.00	14.67	15.00	15.00	15.00
4	Atria - Suite 1700	13,497	(161,964)	(179,915)	(188,958)	(188,958)	(188,958)	(198,001)	(202,455)	(202,455)	(202,455)
	Atria - New Suite SSF	-	-	14.00	14.00	14.00	14.00	14.00	15.00	15.00	15.00
4/6	Atria - New Suite	18,000	-	-	(252,000)	(252,000)	(252,000)	(252,000)	(270,000)	(270,000)	(270,000)
	New Tower SSF	-	-	-	-	-	-	-	-	-	-
7	New Tower	375,000	-	-	-	-	-	-	-	-	-
	Total Base Rent		(1,005,688)	(997,427)	(1,258,470)	(1,258,470)	(1,273,395)	(1,319,724)	(1,358,093)	(1,358,093)	(1,358,093)
SECTION B											
	Operating Expenses										
	VPC Tower \$/SF	12.57	12.82	13.08	13.34	13.60	13.88	14.15	14.44	14.73	15.02
8	VPC Tower - OPEX & FC	225,000	(2,827,988)	(2,884,548)	(2,942,239)	(3,001,084)	(3,061,105)	(3,122,328)	(3,184,774)	(3,248,470)	(3,313,439)
	VPC Annex Office \$/SF	12.57	12.82	13.08	13.34	13.60	13.88	14.15	14.44	14.73	15.02
8	VPC Annex Office - OPEX & FC	51,600	(648,552)	(661,523)	(674,753)	(688,249)	(702,014)	(716,054)	(730,375)	(744,982)	(759,882)
	VPC Annex Industrial \$/SF	5.59	5.70	5.81	5.93	6.05	6.17	6.29	6.42	6.55	6.68
8	VPC Annex Industrial - OPEX & FC	34,400	(192,191)	(196,035)	(199,956)	(203,955)	(208,034)	(212,194)	(216,438)	(220,767)	(225,182)
	VPC Fleet Building \$/SF	5.59	5.70	5.81	5.93	6.05	6.17	6.29	6.42	6.55	6.68
8	VPC Fleet Building - OPEX & FC	35,000	(195,543)	(199,454)	(203,443)	(207,512)	(211,662)	(215,895)	(220,213)	(224,618)	(229,110)
	Atria - Suite 801 \$/SF	18.41	18.78	19.15	19.54	19.93	20.33	20.73	21.15	21.57	22.00
9	Atria - Suite 801 - T&O	19,900	(366,359)	(373,686)	(381,160)	(388,783)	(396,559)	(404,490)	(412,580)	(420,831)	(429,248)
	Atria - Suite 401 \$/SF	18.41	18.78	19.15	19.54	19.93	20.33	20.73	21.15	21.57	22.00
9	Atria - Suite 401 - T&O	48,226	(887,841)	(905,597)	(923,709)	(942,184)	(961,027)	(980,248)	(999,853)	(1,019,850)	(1,040,247)
	Atria - Suite 132 \$/SF	7.67	-	-	-	-	-	-	-	-	-
9	Atria - Suite 132 - T&O	5,720	(43,872)	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	18.41	18.78	19.15	19.54	19.93	20.33	20.73	21.15	21.57	22.00
9	Atria - Suite 1700 - T&O	13,497	(248,480)	(253,449)	(258,518)	(263,689)	(268,962)	(274,342)	(279,829)	(285,425)	(291,134)
	Atria - New Suite SSF	-	-	19.15	19.54	19.93	20.33	20.73	21.15	21.57	22.00
9	Atria - New Suite - T&O	18,000	-	-	(344,768)	(351,663)	(358,696)	(365,870)	(373,188)	(380,651)	(388,264)
	New Tower SSF	-	-	-	-	-	-	-	-	-	-
10	New Tower - T&O	375,000	-	-	-	-	-	-	-	-	-
	Atria - # of parking Stalls	286.00	270.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00
11	Atria Parking	-	(257,400)	(247,860)	(301,508)	(307,538)	(313,689)	(319,963)	(326,362)	(332,889)	(339,547)
	Total Taxes & Operating Costs		(5,668,226)	(5,722,153)	(6,230,055)	(6,354,656)	(6,481,749)	(6,611,384)	(6,743,611)	(6,878,484)	(7,016,053)
	Gross Rental Expense		(6,673,914)	(6,719,580)	(7,488,525)	(7,613,126)	(7,740,219)	(7,884,779)	(8,063,336)	(8,236,577)	(8,374,146)
	Other Expenses Items										
12	Designated Substance Remediation	(1,500,000)	(1,500,000)	(2,000,000)	-	-	-	-	-	-	-
12	Remediation Move Costs	(250,000)	(250,000)	(250,000)	-	-	-	-	-	-	-
12	Designated Substance Maintenance	-	(100,000)	(150,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
	Total Other Expense Items		(1,750,000)	(1,850,000)	(2,400,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
	Total Expense		(8,423,914)	(8,569,580)	(9,888,525)	(7,863,126)	(7,990,219)	(8,134,779)	(8,313,336)	(8,486,577)	(8,624,146)
SECTION C											
	Capital Items										
13	General Capital Allowance	(1,000,000)	(1,020,000)	(1,040,400)	(1,061,208)	(1,082,432)	(1,104,081)	(1,126,162)	(1,148,686)	(1,171,659)	(1,195,093)
14	Furniture Replacement Program	(1,500,000)	(1,500,000)	(1,500,000)	(1,500,000)	-	-	-	-	-	-
14	Carpet Replacement	(350,000)	(500,000)	-	-	-	-	-	-	-	-
14	Elevator Upgrades	(200,000)	-	-	-	-	-	-	-	-	-
14	Parking Lot Repairs	-	-	-	(500,000)	-	-	-	-	-	-
14	Washroom Upgrades	-	-	-	-	(300,000)	(200,000)	(300,000)	(200,000)	-	-
15	General Tenant Improvements	-	-	-	-	-	-	-	-	-	-
16	Construction Costs	-	-	-	-	-	-	-	-	-	-
17	FF&E, Move Allowance, IT	-	-	-	-	-	-	-	-	-	-
	Total Capital Items		(3,050,000)	(3,020,000)	(2,540,400)	(3,061,208)	(1,382,432)	(1,304,081)	(1,426,162)	(1,348,686)	(1,171,659)
SECTION D											
18	Acquisitions	-	-	-	-	-	-	-	-	-	-
19	Dispositions	-	-	-	-	-	-	-	-	-	-
20	Terminal Value	-	-	-	-	-	-	-	-	-	-
	CASH FLOW (CF)		(11,473,914)	(11,589,580)	(12,428,925)	(10,924,334)	(9,372,651)	(9,438,860)	(9,739,498)	(9,835,262)	(9,959,560)
	PV of CF		(210,029,085)								
21	Discount Rate		5.72%								

APPENDIX 3

STATUS QUO B - CASH FLOW (Lease At Year 21)

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:									
2	Occupied Office Area (SF):	376,223	376,223	376,223	376,223	376,223	376,223	376,223	376,223	376,223
	Area (SF)	11	12	13	14	15	16	17	18	19
		2023	2024	2025	2026	2027	2028	2029	2030	2031

SECTION A

Note

	Base Rent									
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Fleet Building	35,000	-	-	-	-	-	-	-	-
	Atria - Suite 801 \$/SF	13.75	14.00	14.00	14.00	14.00	14.75	15.00	15.00	15.00
4	Atria - Suite 801	19,900	(273,625)	(278,600)	(278,600)	(278,600)	(293,525)	(298,500)	(298,500)	(298,500)
	Atria - Suite 401 \$/SF	13.00	13.67	14.00	14.00	14.00	14.00	14.67	15.00	15.00
4	Atria - Suite 401	48,226	(626,938)	(659,249)	(675,164)	(675,164)	(675,164)	(707,423)	(723,390)	(723,390)
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	15.00	15.67	16.00	16.00	16.00	16.00	16.67	17.00	17.00
4	Atria - Suite 1700	13,497	(202,455)	(211,498)	(215,952)	(215,952)	(215,952)	(224,995)	(229,449)	(229,449)
	Atria - New Suite \$/SF	15.00	15.00	16.00	16.00	16.00	16.00	16.00	17.00	17.00
4/6	Atria - New Suite	18,000	(270,000)	(270,000)	(288,000)	(288,000)	(288,000)	(288,000)	(306,000)	(306,000)
	New Tower \$/SF	-	-	-	-	-	-	-	-	-
7	New Tower	375,000	-	-	-	-	-	-	-	-
	Total Base Rent		(1,373,018)	(1,419,347)	(1,457,716)	(1,457,716)	(1,472,641)	(1,518,970)	(1,557,339)	(1,557,339)

SECTION B

	Operating Expenses									
	VPC Tower \$/SF	15.32	15.63	15.94	16.26	16.58	16.92	17.25	17.60	17.95
8	VPC Tower - OPEX & FC	225,000	(3,447,302)	(3,516,248)	(3,586,573)	(3,658,304)	(3,731,471)	(3,806,100)	(3,882,222)	(4,039,064)
	VPC Annex Office \$/SF	15.32	15.63	15.94	16.26	16.58	16.92	17.25	17.60	17.95
8	VPC Annex Office - OPEX & FC	51,600	(790,581)	(806,393)	(822,521)	(838,971)	(855,751)	(872,866)	(890,323)	(926,292)
	VPC Annex Industrial \$/SF	6.81	6.95	7.09	7.23	7.37	7.52	7.67	7.82	7.98
8	VPC Annex Industrial - OPEX & FC	34,400	(234,280)	(238,965)	(243,745)	(248,620)	(253,592)	(258,664)	(263,837)	(274,496)
	VPC Fleet Building \$/SF	6.81	6.95	7.09	7.23	7.37	7.52	7.67	7.82	7.98
8	VPC Fleet Building - OPEX & FC	35,000	(238,366)	(243,133)	(247,996)	(252,956)	(258,015)	(263,175)	(268,439)	(279,284)
	Atria - Suite 801 \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
9	Atria - Suite 801 - T&O	19,900	(446,590)	(455,521)	(464,632)	(473,924)	(483,403)	(493,071)	(502,932)	(512,991)
	Atria - Suite 401 \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
9	Atria - Suite 401 - T&O	48,226	(1,082,273)	(1,103,918)	(1,125,997)	(1,148,517)	(1,171,487)	(1,194,917)	(1,218,815)	(1,243,191)
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
9	Atria - Suite 1700 - T&O	13,497	(302,895)	(308,953)	(315,132)	(321,435)	(327,864)	(334,421)	(341,109)	(347,932)
	Atria - New Suite \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
9	Atria - New Suite - T&O	18,000	(403,950)	(412,029)	(420,270)	(428,675)	(437,249)	(445,994)	(454,914)	(464,012)
	New Tower \$/SF	-	-	-	-	-	-	-	-	-
10	New Tower - T&O	375,000	-	-	-	-	-	-	-	-
	Atria - # of parking Stalls	322.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00
11	Atria Parking	-	(353,265)	(360,330)	(367,536)	(374,887)	(382,385)	(390,033)	(397,833)	(405,790)
	Total Taxes & Operating Costs		(7,299,502)	(7,445,492)	(7,594,402)	(7,746,290)	(7,901,216)	(8,059,240)	(8,220,425)	(8,384,833)
	Gross Rental Expense		(8,672,520)	(8,864,839)	(9,052,118)	(9,204,006)	(9,358,932)	(9,531,881)	(9,739,395)	(10,109,869)
	Other Expense Items									
12	Designated Substance Remediation	-	-	-	-	-	-	-	-	-
12	Remediation Move Costs	-	-	-	-	-	-	-	-	-
12	Designated Substance Maintenance	-	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
	Total Other Expense Items		(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
	Total Expense		(8,922,520)	(9,114,839)	(9,302,118)	(9,454,006)	(9,608,932)	(9,781,881)	(9,989,395)	(10,192,172)

SECTION C

	Capital Items									
13	General Capital Allowance	(1,218,994)	(1,243,374)	(1,268,242)	(1,293,607)	(1,319,479)	(1,345,868)	(1,372,786)	(1,400,241)	(1,428,246)
14	Furniture Replacement Program	-	-	-	-	-	-	-	-	-
14	Carpet Replacement	-	-	-	-	-	-	-	-	-
14	Elevator Upgrades	-	-	-	-	-	-	-	-	-
14	Parking Lot Repairs	-	-	-	-	-	-	-	-	-
14	Washroom Upgrades	-	-	-	-	-	-	-	-	-
15	General Tenant Improvements	(2,812,500)	(2,812,500)	-	-	-	-	-	-	-
16	Construction Costs	-	-	-	-	-	-	-	-	-
17	FF&E, Move Allowance, IT	-	-	-	-	-	-	-	-	-
	Total Capital Items		(4,031,494)	(4,055,874)	(1,268,242)	(1,293,607)	(1,319,479)	(1,345,868)	(1,372,786)	(1,428,246)

SECTION D

18	Acquisitions	-	-	-	-	-	-	-	-	-
19	Dispositions	-	-	-	-	-	-	-	-	-
20	Terminal Value	-	-	-	-	-	-	-	-	-
	CASH FLOW (CF)		(12,954,014)	(13,170,714)	(10,570,360)	(10,747,612)	(10,928,410)	(11,127,749)	(11,362,181)	(11,592,414)

PV of CF

21 Discount Rate

APPENDIX 3

STATUS QUO B - CASH FLOW (Lease At Year 21)

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:									
2	Occupied Office Area (SF):	376,223	375,000	375,000	375,000	375,000	375,000	375,000	375,000	375,000

	Area (SF)	20 2032	21 2033	22 2034	23 2035	24 2036	25 2037	26 2038	27 2039	28 2040

SECTION A

Note

Base Rent										
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	8.01	8.17	8.34	8.50	8.67	8.85	9.02	9.20
3	VPC Fleet Building	35,000	(400,623)	(408,636)	(416,808)	(425,144)	(433,647)	(442,320)	(451,167)	(460,190)
	Atria - Suite 801 \$/SF	-	15.00	-	-	-	-	-	-	-
4	Atria - Suite 801	19,900	(298,500)	-	-	-	-	-	-	-
	Atria - Suite 401 \$/SF	-	15.00	-	-	-	-	-	-	-
4	Atria - Suite 401	48,226	(723,390)	-	-	-	-	-	-	-
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	-	17.00	-	-	-	-	-	-	-
4	Atria - Suite 1700	13,497	(229,449)	-	-	-	-	-	-	-
	Atria - New Suite SSF	-	17.00	-	-	-	-	-	-	-
4/6	Atria - New Suite	18,000	(306,000)	-	-	-	-	-	-	-
	New Tower SSF	-	26.75	26.75	26.75	26.75	26.75	28.75	28.75	28.75
7	New Tower	375,000	(10,030,145)	(10,030,145)	(10,030,145)	(10,030,145)	(10,030,145)	(10,780,145)	(10,780,145)	(10,780,145)
	Total Base Rent		(1,557,339)	(10,438,780)	(10,446,953)	(10,455,289)	(10,463,792)	(11,222,465)	(11,231,312)	(11,240,335)

SECTION B

Operating Expenses										
	VPC Tower \$/SF	-	18.31	-	-	-	-	-	-	-
8	VPC Tower - OPEX & FC	225,000	(4,119,845)	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	18.31	-	-	-	-	-	-	-
8	VPC Annex Office - OPEX & FC	51,600	(944,818)	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	8.14	-	-	-	-	-	-	-
8	VPC Annex Industrial - OPEX & FC	34,400	(279,986)	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	8.14	8.30	8.47	8.64	8.81	8.99	9.17	9.35
8	VPC Fleet Building - OPEX & FC	35,000	(284,869)	(415,096)	(423,397)	(431,865)	(440,503)	(449,313)	(458,299)	(467,465)
	Atria - Suite 801 \$/SF	-	26.82	-	-	-	-	-	-	-
9	Atria - Suite 801 - T&O	19,900	(533,716)	-	-	-	-	-	-	-
	Atria - Suite 401 \$/SF	-	26.82	-	-	-	-	-	-	-
9	Atria - Suite 401 - T&O	48,226	(1,293,416)	-	-	-	-	-	-	-
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	-	26.82	-	-	-	-	-	-	-
9	Atria - Suite 1700 - T&O	13,497	(361,988)	-	-	-	-	-	-	-
	Atria - New Suite SSF	-	26.82	-	-	-	-	-	-	-
9	Atria - New Suite - T&O	18,000	(482,758)	-	-	-	-	-	-	-
	New Tower SSF	-	22.58	23.03	23.49	23.96	24.44	24.93	25.43	25.94
10	New Tower - T&O	375,000	(8,467,715)	(8,637,069)	(8,809,811)	(8,986,007)	(9,165,727)	(9,349,042)	(9,536,022)	(9,726,743)
	Atria - # of parking Stalls	-	322.00	-	-	-	-	-	-	-
11	Atria Parking	-	(422,184)	-	-	-	-	-	-	-
	Total Taxes & Operating Costs		(8,723,580)	(8,882,810)	(9,060,467)	(9,241,676)	(9,426,510)	(9,615,040)	(9,807,341)	(10,003,487)
	Gross Rental Expense		(10,280,919)	(19,313,578)	(19,499,247)	(19,688,629)	(19,881,799)	(20,078,832)	(21,029,806)	(21,443,892)
Other Expenses Items										
12	Designated Substance Remediation	-	-	-	-	-	-	-	-	-
12	Remediation Move Costs	-	-	-	-	-	-	-	-	-
12	Designated Substance Maintenance	-	(250,000)	-	-	-	-	-	-	-
	Total Other Expense Items		(250,000)	-	-	-	-	-	-	-
	Total Expense		(10,530,919)	(19,313,578)	(19,499,247)	(19,688,629)	(19,881,799)	(20,078,832)	(21,029,806)	(21,443,892)

SECTION C

Capital Items										
13	General Capital Allowance	(1,456,811)	(500,000)	(510,000)	(520,200)	(530,604)	(541,216)	(552,040)	(563,081)	(574,343)
14	Furniture Replacement Program	-	-	-	-	-	-	-	-	-
14	Carpet Replacement	-	-	-	-	-	-	-	-	-
14	Elevator Upgrades	-	-	-	-	-	-	-	-	-
14	Parking Lot Repairs	-	-	-	-	-	-	-	-	-
14	Washroom Upgrades	-	-	-	-	-	-	-	-	-
15	General Tenant Improvements	-	(14,209,372)	-	-	-	-	-	-	-
16	Construction Costs	-	(10,609,664)	-	-	-	-	-	-	-
17	FF&E, Move Allowance, IT	-	(7,673,061)	-	-	-	-	-	-	-
	Total Capital Items		(1,456,811)	(32,992,097)	(510,000)	(520,200)	(530,604)	(541,216)	(552,040)	(563,081)

SECTION D

18	Acquisitions	-	-	-	-	-	-	-	-	-
19	Dispositions	-	48,596,784	-	-	-	-	-	-	-
20	Terminal Value	-	-	-	-	-	-	-	-	-
	CASH FLOW (CF)		(11,987,731)	(3,708,892)	(20,009,247)	(20,208,829)	(20,412,403)	(20,620,048)	(21,581,846)	(22,018,235)

PV of CF

21 Discount Rate

APPENDIX 3

STATUS QUO B - CASH FLOW (Lease At Year 21)

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:								
2	Occupied Office Area (SF):	375,000	375,000	375,000	375,000	375,000	375,000	375,000	375,000

	Area (SF)	29 2041	30 2042	31 2043	32 2044	33 2045	34 2046	35 2047	36 2048	37 2049

SECTION A

Note

Base Rent										
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	9.39	9.58	9.77	9.96	10.16	10.36	10.57	11.00
3	VPC Fleet Building	35,000	(469,394)	(478,782)	(488,357)	(498,124)	(508,087)	(518,249)	(528,614)	(539,970)
	Atria - Suite 801 \$/SF	-	-	-	-	-	-	-	-	-
4	Atria - Suite 801	19,900	-	-	-	-	-	-	-	-
	Atria - Suite 401 \$/SF	-	-	-	-	-	-	-	-	-
4	Atria - Suite 401	48,226	-	-	-	-	-	-	-	-
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	-	-	-	-	-	-	-	-	-
4	Atria - Suite 1700	13,497	-	-	-	-	-	-	-	-
	Atria - New Suite \$/SF	-	-	-	-	-	-	-	-	-
4/6	Atria - New Suite	18,000	-	-	-	-	-	-	-	-
	New Tower \$/SF	-	28.75	28.75	30.75	30.75	30.75	30.75	32.75	32.75
7	New Tower	375,000	(10,780,145)	(10,780,145)	(11,530,145)	(11,530,145)	(11,530,145)	(11,530,145)	(12,280,145)	(12,280,145)
	Total Base Rent		(11,249,539)	(11,258,927)	(12,018,502)	(12,028,269)	(12,038,232)	(12,048,394)	(12,058,759)	(12,830,115)

SECTION B

Operating Expenses

	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
8	VPC Tower - OPEX & FC	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
8	VPC Annex Office - OPEX & FC	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
8	VPC Annex Industrial - OPEX & FC	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	9.73	9.92	10.12	10.32	10.53	10.74	10.95	11.40
8	VPC Fleet Building - OPEX & FC	35,000	(486,351)	(496,078)	(505,999)	(516,119)	(526,442)	(536,970)	(547,710)	(558,664)
	Atria - Suite 801 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 801 - T&O	19,900	-	-	-	-	-	-	-	-
	Atria - Suite 401 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 401 - T&O	48,226	-	-	-	-	-	-	-	-
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 1700 - T&O	13,497	-	-	-	-	-	-	-	-
	Atria - New Suite \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - New Suite - T&O	18,000	-	-	-	-	-	-	-	-
	New Tower \$/SF	-	26.46	26.99	27.53	28.08	28.64	29.21	29.79	30.39
10	New Tower - T&O	375,000	(9,921,278)	(10,119,703)	(10,322,097)	(10,528,539)	(10,739,110)	(10,953,892)	(11,172,970)	(11,396,429)
	Atria - # of parking Stalls	-	-	-	-	-	-	-	-	-
11	Atria Parking	-	-	-	-	-	-	-	-	-
	Total Taxes & Operating Costs		(10,407,628)	(10,615,781)	(10,828,096)	(11,044,658)	(11,265,552)	(11,490,863)	(11,720,680)	(12,194,195)
	Gross Rental Expense		(21,657,167)	(21,874,707)	(22,846,599)	(23,072,928)	(23,303,783)	(23,539,256)	(23,779,438)	(25,024,310)
Other Expenses Items										
12	Designated Substance Remediation	-	-	-	-	-	-	-	-	-
12	Remediation Move Costs	-	-	-	-	-	-	-	-	-
12	Designated Substance Maintenance	-	-	-	-	-	-	-	-	-
	Total Other Expense Items		-	-	-	-	-	-	-	-
	Total Expense		(21,657,167)	(21,874,707)	(22,846,599)	(23,072,928)	(23,303,783)	(23,539,256)	(23,779,438)	(25,024,310)

SECTION C

Capital Items

13	General Capital Allowance	(585,830)	(597,546)	(609,497)	(621,687)	(634,121)	(646,803)	(659,739)	(672,934)	(686,393)
14	Furniture Replacement Program	-	-	-	-	-	-	-	-	-
14	Carpet Replacement	-	-	-	-	-	-	-	-	-
14	Elevator Upgrades	-	-	-	-	-	-	-	-	-
14	Parking Lot Repairs	-	-	-	-	-	-	-	-	-
14	Washroom Upgrades	-	-	-	-	-	-	-	-	-
15	General Tenant Improvements	-	-	-	-	-	-	-	-	-
16	Construction Costs	-	-	-	-	-	-	-	-	-
17	FF&E, Move Allowance, IT	-	-	-	-	-	-	-	-	-
	Total Capital Items	(585,830)	(597,546)	(609,497)	(621,687)	(634,121)	(646,803)	(659,739)	(672,934)	(686,393)

SECTION D

18	Acquisitions	-	-	-	-	-	-	-	-	-
19	Dispositions	-	-	-	-	-	-	-	-	-
20	Terminal Value	-	-	-	-	-	-	-	-	-
	CASH FLOW (CF)	(22,242,997)	(22,472,254)	(23,456,096)	(23,694,615)	(23,937,904)	(24,186,059)	(24,439,178)	(25,447,358)	(25,710,703)

PV of CF

21 Discount Rate

APPENDIX 3

STATUS QUO B - CASH FLOW (Lease At Year 21)

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:			
2	Occupied Office Area (SF):	375,000	375,000	375,000

	Area (SF)	38 2050	39 2051	40 2052
SECTION A				
Note				
Base Rent				
	VPC Tower \$/SF	-	-	-
3	VPC Tower	225,000	-	-
	VPC Annex Office \$/SF	-	-	-
3	VPC Annex Office	51,600	-	-
	VPC Annex Industrial \$/SF	-	-	-
3	VPC Annex Industrial	34,400	-	-
	VPC Fleet Building \$/SF	11.22	11.44	11.67
3	VPC Fleet Building	35,000	(560,969)	(572,188)
	Atria - Suite 801 \$/SF	-	-	-
4	Atria - Suite 801	19,900	-	-
	Atria - Suite 401 \$/SF	-	-	-
4	Atria - Suite 401	48,226	-	-
	Atria - Suite 132 \$/SF	-	-	-
4/5	Atria - Suite 132	5,720	-	-
	Atria - Suite 1700 \$/SF	-	-	-
4	Atria - Suite 1700	13,497	-	-
	Atria - New Suite \$/SF	-	-	-
4/6	Atria - New Suite	18,000	-	-
	New Tower \$/SF	32.75	32.75	32.75
7	New Tower	375,000	(12,280,145)	(12,280,145)
	Total Base Rent		(12,841,114)	(12,863,777)

SECTION B

Operating Expenses				
	VPC Tower \$/SF	-	-	-
8	VPC Tower - OPEX & FC	225,000	-	-
	VPC Annex Office \$/SF	-	-	-
8	VPC Annex Office - OPEX & FC	51,600	-	-
	VPC Annex Industrial \$/SF	-	-	-
8	VPC Annex Industrial - OPEX & FC	34,400	-	-
	VPC Fleet Building \$/SF	11.62	11.86	12.09
8	VPC Fleet Building - OPEX & FC	35,000	(581,234)	(592,859)
	Atria - Suite 801 \$/SF	-	-	-
9	Atria - Suite 801 - T&O	19,900	-	-
	Atria - Suite 401 \$/SF	-	-	-
9	Atria - Suite 401 - T&O	48,226	-	-
	Atria - Suite 132 \$/SF	-	-	-
9	Atria - Suite 132 - T&O	5,720	-	-
	Atria - Suite 1700 \$/SF	-	-	-
9	Atria - Suite 1700 - T&O	13,497	-	-
	Atria - New Suite \$/SF	-	-	-
9	Atria - New Suite - T&O	18,000	-	-
	New Tower \$/SF	31.62	32.25	32.90
10	New Tower - T&O	375,000	(11,856,845)	(12,093,982)
	Atria - # of parking Stalls	-	-	-
11	Atria Parking	-	-	-
	Total Taxes & Operating Costs		(12,438,079)	(12,940,578)
	Gross Rental Expense		(25,279,193)	(25,539,174)
	Other Expenses Items			
12	Designated Substance Remediation	-	-	-
12	Remediation Move Costs	-	-	-
12	Designated Substance Maintenance	-	-	-
	Total Other Expense Items		-	-
	Total Expense		(25,279,193)	(25,539,174)

SECTION C

Capital Items				
13	General Capital Allowance	(700,121)	(714,123)	(728,406)
14	Furniture Replacement Program	-	-	-
14	Carpet Replacement	-	-	-
14	Elevator Upgrades	-	-	-
14	Parking Lot Repairs	-	-	-
14	Washroom Upgrades	-	-	-
15	General Tenant Improvements	-	-	-
16	Construction Costs	-	-	-
17	FF&E, Move Allowance, IT	-	-	-
	Total Capital Items	(700,121)	(714,123)	(728,406)

SECTION D

18	Acquisitions	-	-	-
19	Dispositions	-	-	-
20	Terminal Value	-	-	-
	CASH FLOW (CF)	(25,979,314)	(26,253,297)	(26,532,760)

PV of CF

21 Discount Rate

SQB- Notes

- 1 Based on average CPI growth - All Items (1992-2011) Source: Statistics Canada.
- 2 Occupied area varies up to 2015 based on expansion and expires within Atria.
- 3 No internal base rent assumed for VPC.
- 4 All Atria lease information based on leases in place or currently under negotiation as provided by EGD.
- 5 Atria Suite 132 expires 05/2013. EGD does not intend to renew this suite.
- 6 As advised by EGD, additional space at Atria will be required by 2015, rental rates have been estimated based on current lease transactions.
- 7 Assumes that EGD Leases new site at market rent. Based on 2013 market rent (\$16.50 psf) inflated by 2% annually to year 21, rental steps of \$2.00 psf every 5-years thereafter.
- 8 All VPC Operating Expenses provided by EGD - Appendix 1.
- 9 Based on Atria posted Tax & Operating Costs.
- 10 Based on 2012 posted Atria rate inflated by 2% annually.
- 11 EGD currently rents approximately 286 parking spaces at Atria. As EGD leases additional space, additional parking is assumed at a rate of \$75/month/stall inflated annually at Expense Growth Rate based on 1 stall/500 sf of leased space.
- 12 All information regarding Designated Substance Remediation is based on estimates provided by EGD management.
- 13 Based on estimates by EGD management regarding general non-scheduled annual capital spend. Increased annually by Expense Growth Rate.
- 14 All information with respect to Capital Items provided by EGD as identified on 2011 Report - Appendix N.
- 15 Assumes that tenant improvements or renovations will be required for VPC Tower at \$25 psf over 2 years starting in year 11 of analysis. Assumes that EGD specific improvements or renovations above and beyond landlord tenant inducements will be required at \$25 psf for new lease in year 21.
- 16 Costs associated with relocation of data centre. As per 2011 Report and provided by EGD. Inflated at 2% annually.
- 17 Allowance for furniture, fixtures & equipment, move and IT costs
- 18 Not applicable in this scenario.
- 19 Assumes that EGD sells VPC in year 21. Based on capitalized market rent (see Appendix 2).
- 20 Not applicable in this scenario.
- 21 EGD Weighted Average Cost of Capital (WACC) as identified in 2011 Report.

APPENDIX 3

STATUS QUO C - CASH FLOW (Purchase At Year 21)

All Figures in \$(CDN) unless otherwise specified.

1	Expense Growth Rate:	2.00%									
2	Occupied Office Area (SF):	363,943	358,223	376,223	376,223	376,223	376,223	376,223	376,223	376,223	376,223

	Area (SF)	1 2013	2 2014	3 2015	4 2016	5 2017	6 2018	7 2019	8 2020	9 2021	10 2022

SECTION A

Note

Base Rent											
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	-	-	-	-	-	-	-	-	-
3	VPC Fleet Building	35,000	-	-	-	-	-	-	-	-	-
	Atria - Suite 801 \$/SF	11.88	12.00	12.00	12.00	12.00	12.75	13.00	13.00	13.00	13.00
4	Atria - Suite 801	19,900	(236,412)	(238,800)	(238,800)	(238,800)	(253,725)	(258,700)	(258,700)	(258,700)	(258,700)
	Atria - Suite 401 \$/SF	12.00	12.00	12.00	12.00	12.00	12.00	12.67	13.00	13.00	13.00
4	Atria - Suite 401	48,226	(578,712)	(578,712)	(578,712)	(578,712)	(578,712)	(611,023)	(626,938)	(626,938)	(626,938)
	Atria - Suite 132 \$/SF	5.00	-	-	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	(28,600)	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	12.00	13.33	14.00	14.00	14.00	14.00	14.67	15.00	15.00	15.00
4	Atria - Suite 1700	13,497	(161,964)	(179,915)	(188,958)	(188,958)	(188,958)	(198,001)	(202,455)	(202,455)	(202,455)
	Atria - New Suite SSF	-	-	14.00	14.00	14.00	14.00	14.00	15.00	15.00	15.00
4/6	Atria - New Suite	18,000	-	(252,000)	(252,000)	(252,000)	(252,000)	(252,000)	(270,000)	(270,000)	(270,000)
	New Tower SSF	-	-	-	-	-	-	-	-	-	-
7	New Tower	375,000	-	-	-	-	-	-	-	-	-
Total Base Rent			(1,005,688)	(997,427)	(1,258,470)	(1,258,470)	(1,273,395)	(1,319,724)	(1,358,093)	(1,358,093)	(1,358,093)

SECTION B

Operating Expenses											
	VPC Tower \$/SF	12.57	12.82	13.08	13.34	13.60	13.88	14.15	14.44	14.73	15.02
8	VPC Tower - OPEX & FC	225,000	(2,827,988)	(2,884,548)	(2,942,239)	(3,001,084)	(3,061,105)	(3,122,328)	(3,184,774)	(3,248,470)	(3,313,439)
	VPC Annex Office \$/SF	12.57	12.82	13.08	13.34	13.60	13.88	14.15	14.44	14.73	15.02
8	VPC Annex Office - OPEX & FC	51,600	(648,552)	(661,523)	(674,753)	(688,249)	(702,014)	(716,054)	(730,375)	(744,982)	(759,882)
	VPC Annex Industrial \$/SF	5.59	5.70	5.81	5.93	6.05	6.17	6.29	6.42	6.55	6.68
8	VPC Annex Industrial - OPEX & FC	34,400	(192,191)	(196,035)	(199,956)	(203,955)	(208,034)	(212,194)	(216,438)	(220,767)	(225,182)
	VPC Fleet Building \$/SF	5.59	5.70	5.81	5.93	6.05	6.17	6.29	6.42	6.55	6.68
8	VPC Fleet Building - OPEX & FC	35,000	(195,543)	(199,454)	(203,443)	(207,512)	(211,662)	(215,895)	(220,213)	(224,618)	(229,110)
	Atria - Suite 801 \$/SF	18.41	18.78	19.15	19.54	19.93	20.33	20.73	21.15	21.57	22.00
9	Atria - Suite 801 - T&O	19,900	(366,359)	(373,686)	(381,160)	(388,783)	(396,559)	(404,490)	(412,580)	(420,831)	(429,248)
	Atria - Suite 401 \$/SF	18.41	18.78	19.15	19.54	19.93	20.33	20.73	21.15	21.57	22.00
9	Atria - Suite 401 - T&O	48,226	(887,841)	(905,597)	(923,709)	(942,184)	(961,027)	(980,248)	(999,853)	(1,019,850)	(1,040,247)
	Atria - Suite 132 \$/SF	7.67	-	-	-	-	-	-	-	-	-
9	Atria - Suite 132 - T&O	5,720	(43,872)	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	18.41	18.78	19.15	19.54	19.93	20.33	20.73	21.15	21.57	22.00
9	Atria - Suite 1700 - T&O	13,497	(248,480)	(253,449)	(258,518)	(263,689)	(268,962)	(274,342)	(279,829)	(285,425)	(291,134)
	Atria - New Suite SSF	-	-	19.15	19.54	19.93	20.33	20.73	21.15	21.57	22.00
9	Atria - New Suite - T&O	18,000	-	-	(344,768)	(351,663)	(358,696)	(365,870)	(373,188)	(380,651)	(388,264)
	New Tower SSF	-	-	-	-	-	-	-	-	-	-
10	New Tower - T&O	375,000	-	-	-	-	-	-	-	-	-
	Atria - # of parking Stalls	286.00	270.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00
11	Atria Parking	-	(257,400)	(247,860)	(301,508)	(307,538)	(313,689)	(319,963)	(326,362)	(332,889)	(339,547)
Total Taxes & Operating Costs			(5,668,226)	(5,722,153)	(6,230,055)	(6,354,656)	(6,481,749)	(6,611,384)	(6,743,611)	(6,878,484)	(7,016,053)
Gross Rental Expense			(6,673,914)	(6,719,580)	(7,488,525)	(7,613,126)	(7,740,219)	(7,884,779)	(8,063,336)	(8,236,577)	(8,374,146)
Other Expenses Items											
12	Designated Substance Remediation		(1,500,000)	(1,500,000)	(2,000,000)	-	-	-	-	-	-
12	Remediation Move Costs		(250,000)	(250,000)	(250,000)	-	-	-	-	-	-
12	Designated Substance Maintenance		-	(100,000)	(150,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
Total Other Expense Items			(1,750,000)	(1,850,000)	(2,400,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
Total Expense			(8,423,914)	(8,569,580)	(9,888,525)	(7,863,126)	(7,990,219)	(8,134,779)	(8,313,336)	(8,486,577)	(8,624,146)

SECTION C

Capital Items											
13	General Capital Allowance		(1,000,000)	(1,020,000)	(1,040,400)	(1,061,208)	(1,082,432)	(1,104,081)	(1,126,162)	(1,148,686)	(1,171,659)
14	Furniture Replacement Program		(1,500,000)	(1,500,000)	(1,500,000)	(1,500,000)	-	-	-	-	-
14	Carpet Replacement		(350,000)	(500,000)	-	-	-	-	-	-	-
14	Elevator Upgrades		(200,000)	-	-	-	-	-	-	-	-
14	Parking Lot Repairs		-	-	(500,000)	-	-	-	-	-	-
14	Washroom Upgrades		-	-	-	(300,000)	(200,000)	(300,000)	(200,000)	-	-
15	General Tenant Improvements		-	-	-	-	-	-	-	-	-
16	Construction Costs		-	-	-	-	-	-	-	-	-
17	FF&E, Move Allowance, IT		-	-	-	-	-	-	-	-	-
Total Capital Items			(3,050,000)	(3,020,000)	(2,540,400)	(3,061,208)	(1,382,432)	(1,304,081)	(1,426,162)	(1,348,686)	(1,171,659)

SECTION D

18	Acquisitions	-	-	-	-	-	-	-	-	-	-
19	Dispositions	-	-	-	-	-	-	-	-	-	-
20	Terminal Value	-	-	-	-	-	-	-	-	-	-

CASH FLOW (CF)

		(11,473,914)	(11,589,580)	(12,428,925)	(10,924,334)	(9,372,651)	(9,438,860)	(9,739,498)	(9,835,262)	(9,795,806)	(9,959,560)

PV of CF

(176,438,965)

21 Discount Rate

5.72%

APPENDIX 3

STATUS QUO C - CASH FLOW (Purchase At Year 21)

All Figures in \$(CDN) unless otherwise specified.

1	Expense Growth Rate:									
2	Occupied Office Area (SF):	376,223	376,223	376,223	376,223	376,223	376,223	376,223	376,223	376,223
	Area (SF)	11	12	13	14	15	16	17	18	19
		2023	2024	2025	2026	2027	2028	2029	2030	2031

SECTION A

Note

	Base Rent									
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Fleet Building	35,000	-	-	-	-	-	-	-	-
	Atria - Suite 801 \$/SF	13.75	14.00	14.00	14.00	14.00	14.75	15.00	15.00	15.00
4	Atria - Suite 801	19,900	(273,625)	(278,600)	(278,600)	(278,600)	(293,525)	(298,500)	(298,500)	(298,500)
	Atria - Suite 401 \$/SF	13.00	13.67	14.00	14.00	14.00	14.00	14.67	15.00	15.00
4	Atria - Suite 401	48,226	(626,938)	(659,249)	(675,164)	(675,164)	(675,164)	(707,475)	(723,390)	(723,390)
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	15.00	15.67	16.00	16.00	16.00	16.00	16.67	17.00	17.00
4	Atria - Suite 1700	13,497	(202,455)	(211,498)	(215,952)	(215,952)	(215,952)	(224,995)	(229,449)	(229,449)
	Atria - New Suite \$/SF	15.00	15.00	16.00	16.00	16.00	16.00	16.00	17.00	17.00
4/6	Atria - New Suite	18,000	(270,000)	(270,000)	(288,000)	(288,000)	(288,000)	(288,000)	(306,000)	(306,000)
	New Tower \$/SF	-	-	-	-	-	-	-	-	-
7	New Tower	375,000	-	-	-	-	-	-	-	-
	Total Base Rent		(1,373,018)	(1,419,347)	(1,457,716)	(1,457,716)	(1,472,641)	(1,518,970)	(1,557,339)	(1,557,339)

SECTION B

	Operating Expenses									
	VPC Tower \$/SF	15.32	15.63	15.94	16.26	16.58	16.92	17.25	17.60	17.95
8	VPC Tower - OPEX & FC	225,000	(3,447,302)	(3,516,248)	(3,586,573)	(3,658,304)	(3,731,471)	(3,806,100)	(3,882,222)	(4,039,064)
	VPC Annex Office \$/SF	15.32	15.63	15.94	16.26	16.58	16.92	17.25	17.60	17.95
8	VPC Annex Office - OPEX & FC	51,600	(790,581)	(806,393)	(822,521)	(838,971)	(855,751)	(872,866)	(890,323)	(926,292)
	VPC Annex Industrial \$/SF	6.81	6.95	7.09	7.23	7.37	7.52	7.67	7.82	7.98
8	VPC Annex Industrial - OPEX & FC	34,400	(234,280)	(238,965)	(243,745)	(248,620)	(253,592)	(258,664)	(263,837)	(274,496)
	VPC Fleet Building \$/SF	6.81	6.95	7.09	7.23	7.37	7.52	7.67	7.82	7.98
8	VPC Fleet Building - OPEX & FC	35,000	(238,366)	(243,133)	(247,996)	(252,956)	(258,015)	(263,175)	(268,439)	(279,284)
	Atria - Suite 801 \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
9	Atria - Suite 801 - T&O	19,900	(446,590)	(455,521)	(464,632)	(473,924)	(483,403)	(493,071)	(502,932)	(512,991)
	Atria - Suite 401 \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
9	Atria - Suite 401 - T&O	48,226	(1,082,273)	(1,103,918)	(1,125,997)	(1,148,517)	(1,171,487)	(1,194,917)	(1,218,815)	(1,243,191)
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
9	Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
9	Atria - Suite 1700 - T&O	13,497	(302,895)	(308,953)	(315,132)	(321,435)	(327,864)	(334,421)	(341,109)	(347,932)
	Atria - New Suite \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
9	Atria - New Suite - T&O	18,000	(403,950)	(412,029)	(420,270)	(428,675)	(437,249)	(445,994)	(454,914)	(464,012)
	New Tower \$/SF	-	-	-	-	-	-	-	-	-
10	New Tower - T&O	375,000	-	-	-	-	-	-	-	-
	Atria - # of parking Stalls	322.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00
11	Atria Parking	-	(353,265)	(360,330)	(367,536)	(374,887)	(382,385)	(390,033)	(397,833)	(405,790)
	Total Taxes & Operating Costs		(7,299,502)	(7,445,492)	(7,594,402)	(7,746,290)	(7,901,216)	(8,059,240)	(8,220,425)	(8,384,833)
	Gross Rental Expense		(8,672,520)	(8,864,839)	(9,052,118)	(9,204,006)	(9,358,932)	(9,531,881)	(9,739,395)	(10,109,869)
	Other Expense Items									
12	Designated Substance Remediation	-	-	-	-	-	-	-	-	-
12	Remediation Move Costs	-	-	-	-	-	-	-	-	-
12	Designated Substance Maintenance	-	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
	Total Other Expense Items		(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
	Total Expense		(8,922,520)	(9,114,839)	(9,302,118)	(9,454,006)	(9,608,932)	(9,781,881)	(9,989,395)	(10,192,172)

SECTION C

	Capital Items									
13	General Capital Allowance	(1,218,994)	(1,243,374)	(1,268,242)	(1,293,607)	(1,319,479)	(1,345,868)	(1,372,786)	(1,400,241)	(1,428,246)
14	Furniture Replacement Program	-	-	-	-	-	-	-	-	-
14	Carpet Replacement	-	-	-	-	-	-	-	-	-
14	Elevator Upgrades	-	-	-	-	-	-	-	-	-
14	Parking Lot Repairs	-	-	-	-	-	-	-	-	-
14	Washroom Upgrades	-	-	-	-	-	-	-	-	-
15	General Tenant Improvements	(2,812,500)	(2,812,500)	-	-	-	-	-	-	-
16	Construction Costs	-	-	-	-	-	-	-	-	-
17	FF&E, Move Allowance, IT	-	-	-	-	-	-	-	-	-
	Total Capital Items	(4,031,494)	(4,055,874)	(1,268,242)	(1,293,607)	(1,319,479)	(1,345,868)	(1,372,786)	(1,400,241)	(1,428,246)

SECTION D

18	Acquisitions	-	-	-	-	-	-	-	-	-
19	Dispositions	-	-	-	-	-	-	-	-	-
20	Terminal Value	-	-	-	-	-	-	-	-	-
	CASH FLOW (CF)	(12,954,014)	(13,170,714)	(10,570,360)	(10,747,612)	(10,928,410)	(11,127,749)	(11,362,181)	(11,592,414)	(11,788,115)

PV of CF

21 Discount Rate

APPENDIX 3

STATUS QUO C - CASH FLOW (Purchase At Year 21)

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:								
2	Occupied Office Area (SF):	376,223	375,000	375,000	375,000	375,000	375,000	375,000	375,000

	Area (SF)	20 2032	21 2033	22 2034	23 2035	24 2036	25 2037	26 2038	27 2039	28 2040
SECTION A										
Note										
Base Rent										
VPC Tower \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Tower	225,000	-	-	-	-	-	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Annex Office	51,600	-	-	-	-	-	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-	-
VPC Fleet Building \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Fleet Building	35,000	-	-	-	-	-	-	-	-	-
Atria - Suite 801 \$/SF		15.00	15.75	16.00	16.00	16.00	16.00	16.75	17.00	17.00
4 Atria - Suite 801	19,900	(298,500)	(313,425)	(318,400)	(318,400)	(318,400)	(318,400)	(333,325)	(338,300)	(338,300)
Atria - Suite 401 \$/SF		15.00	15.00	15.67	16.00	16.00	16.00	16.00	16.67	17.00
4 Atria - Suite 401	48,226	(723,390)	(723,390)	(755,701)	(771,616)	(771,616)	(771,616)	(771,616)	(803,927)	(819,842)
Atria - Suite 132 \$/SF		-	-	-	-	-	-	-	-	-
4/5 Atria - Suite 132	5,720	-	-	-	-	-	-	-	-	-
Atria - Suite 1700 \$/SF		17.00	17.00	17.67	18.00	18.00	18.00	18.00	18.67	19.00
4 Atria - Suite 1700	13,497	(229,449)	(229,449)	(238,492)	(242,946)	(242,946)	(242,946)	(242,946)	(251,989)	(256,443)
Atria - New Suite SSF		17.00	17.00	17.00	18.00	18.00	18.00	18.00	18.00	19.00
4/6 Atria - New Suite	18,000	(306,000)	(306,000)	(306,000)	(324,000)	(324,000)	(324,000)	(324,000)	(324,000)	(342,000)
New Tower SSF		-	-	-	-	-	-	-	-	-
7 New Tower	375,000	-	-	-	-	-	-	-	-	-
Total Base Rent		(1,557,339)	(1,572,264)	(1,618,593)	(1,656,962)	(1,656,962)	(1,656,962)	(1,671,887)	(1,718,216)	(1,756,585)

SECTION B

Operating Expenses

VPC Tower \$/SF		18.31	18.68	19.05	19.43	19.82	20.22	20.62	21.03	21.45
8 VPC Tower - OPEX & FC	225,000	(4,119,845)	(4,202,242)	(4,286,287)	(4,372,012)	(4,459,453)	(4,548,642)	(4,639,615)	(4,732,407)	(4,827,055)
VPC Annex Office \$/SF		18.31	18.68	19.05	19.43	19.82	20.22	20.62	21.03	21.45
8 VPC Annex Office - OPEX & FC	51,600	(944,818)	(963,714)	(982,988)	(1,002,648)	(1,022,701)	(1,043,155)	(1,064,018)	(1,085,299)	(1,107,005)
VPC Annex Industrial \$/SF		8.14	8.30	8.47	8.64	8.81	8.99	9.17	9.35	9.54
8 VPC Annex Industrial - OPEX & FC	34,400	(279,986)	(285,586)	(291,297)	(297,123)	(303,066)	(309,127)	(315,310)	(321,616)	(328,048)
VPC Fleet Building \$/SF		8.14	8.30	8.47	8.64	8.81	8.99	9.17	9.35	9.54
8 VPC Fleet Building - OPEX & FC	35,000	(284,869)	(290,567)	(296,378)	(302,306)	(308,352)	(314,519)	(320,809)	(327,225)	(333,770)
Atria - Suite 801 \$/SF		26.82	27.36	27.90	28.46	29.03	29.61	30.20	30.81	31.42
9 Atria - Suite 801 - T&O	19,900	(533,716)	(544,390)	(555,278)	(566,384)	(577,711)	(589,265)	(601,051)	(613,072)	(625,333)
Atria - Suite 401 \$/SF		26.82	27.36	27.90	28.46	29.03	29.61	30.20	30.81	31.42
9 Atria - Suite 401 - T&O	48,226	(1,293,416)	(1,319,285)	(1,345,670)	(1,372,584)	(1,400,035)	(1,428,036)	(1,456,597)	(1,485,729)	(1,515,443)
Atria - Suite 132 \$/SF		-	-	-	-	-	-	-	-	-
9 Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-	-
Atria - Suite 1700 \$/SF		26.82	27.36	27.90	28.46	29.03	29.61	30.20	30.81	31.42
9 Atria - Suite 1700 - T&O	13,497	(361,988)	(369,228)	(376,612)	(384,145)	(391,828)	(399,664)	(407,657)	(415,811)	(424,127)
Atria - New Suite SSF		26.82	27.36	27.90	28.46	29.03	29.61	30.20	30.81	31.42
9 Atria - New Suite - T&O	18,000	(482,758)	(492,413)	(502,262)	(512,307)	(522,553)	(533,004)	(543,664)	(554,537)	(565,628)
New Tower SSF		-	-	-	-	-	-	-	-	-
10 New Tower - T&O	375,000	-	-	-	-	-	-	-	-	-
Atria - # of parking Stalls		322.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00	322.00
11 Atria Parking	-	(422,184)	(430,628)	(439,240)	(448,025)	(456,985)	(466,125)	(475,448)	(484,957)	(494,656)
Total Taxes & Operating Costs		(8,723,580)	(8,898,052)	(9,076,013)	(9,257,533)	(9,442,684)	(9,631,538)	(9,824,168)	(10,020,652)	(10,221,065)
Gross Rental Expense		(10,280,919)	(10,470,316)	(10,694,606)	(10,914,495)	(11,099,646)	(11,288,500)	(11,496,055)	(11,738,868)	(11,977,650)
Other Expenses Items										
12 Designated Substance Remediation		-	-	-	-	-	-	-	-	-
12 Remediation Move Costs		-	-	-	-	-	-	-	-	-
12 Designated Substance Maintenance		(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
Total Other Expense Items		(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)
Total Expense		(10,530,919)	(10,720,316)	(10,944,606)	(11,164,495)	(11,349,646)	(11,538,500)	(11,746,055)	(11,988,868)	(12,227,650)

SECTION C

Capital Items

13 General Capital Allowance		(1,456,811)	(1,485,947)	(1,515,666)	(1,545,980)	(1,576,899)	(1,608,437)	(1,640,606)	(1,673,418)	(1,706,886)
14 Furniture Replacement Program		-	-	-	-	-	-	-	-	-
14 Carpet Replacement		-	-	-	-	-	-	-	-	-
14 Elevator Upgrades		-	-	-	-	-	-	-	-	-
14 Parking Lot Repairs		-	-	-	-	-	-	-	-	-
14 Washroom Upgrades		-	-	-	-	-	-	-	-	-
15 General Tenant Improvements		-	-	-	-	-	-	-	-	-
16 Construction Costs		-	-	-	-	-	-	-	-	-
17 FF&E, Move Allowance, IT		-	-	-	-	-	-	-	-	-
Total Capital Items		(1,456,811)	(1,485,947)	(1,515,666)	(1,545,980)	(1,576,899)	(1,608,437)	(1,640,606)	(1,673,418)	(1,706,886)

SECTION D

18 Acquisitions		-	-	-	-	-	-	-	-	-
19 Dispositions		-	-	-	-	-	-	-	-	-
20 Terminal Value		-	-	-	-	-	-	-	-	-
CASH FLOW (CF)		(11,987,731)	(12,206,263)	(12,460,273)	(12,710,475)	(12,926,545)	(13,146,937)	(13,386,661)	(13,662,286)	(13,934,536)

PV of CF

21 Discount Rate

APPENDIX 3

STATUS QUO C - CASH FLOW (Purchase At Year 21)

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:			
2	Occupied Office Area (SF):	375,000	375,000	375,000

	Area (SF)	38 2050	39 2051	40 2052
SECTION A				
Note				
Base Rent				
		-	-	-
3	VPC Tower \$/SF	225,000	-	-
	VPC Annex Office \$/SF	-	-	-
3	VPC Annex Office	51,600	-	-
	VPC Annex Industrial \$/SF	-	-	-
3	VPC Annex Industrial	34,400	-	-
	VPC Fleet Building \$/SF	-	-	-
3	VPC Fleet Building	35,000	-	-
	Atria - Suite 801 \$/SF	19.00	19.00	19.00
4	Atria - Suite 801	19,900	(378,100)	(378,100)
	Atria - Suite 401 \$/SF	19.00	19.00	19.00
4	Atria - Suite 401	48,226	(916,294)	(916,294)
	Atria - Suite 132 \$/SF	-	-	-
4/5	Atria - Suite 132	5,720	-	-
	Atria - Suite 1700 \$/SF	21.00	21.00	21.00
4	Atria - Suite 1700	13,497	(283,437)	(283,437)
	Atria - New Suite \$/SF	21.00	21.00	21.00
4/6	Atria - New Suite	18,000	(378,000)	(378,000)
	New Tower \$/SF	-	-	-
7	New Tower	375,000	-	-
	Total Base Rent	(1,955,831)	(1,955,831)	(1,955,831)

SECTION B

Operating Expenses				
		26.15	26.67	27.21
8	VPC Tower - OPEX & FC	225,000	(5,884,153)	(6,121,873)
	VPC Annex Office \$/SF	26.15	26.67	27.21
8	VPC Annex Office - OPEX & FC	51,600	(1,349,432)	(1,403,950)
	VPC Annex Industrial \$/SF	11.62	11.86	12.09
8	VPC Annex Industrial - OPEX & FC	34,400	(399,889)	(416,044)
	VPC Fleet Building \$/SF	11.62	11.86	12.09
8	VPC Fleet Building - OPEX & FC	35,000	(406,864)	(423,301)
	Atria - Suite 801 \$/SF	38.31	39.07	39.85
9	Atria - Suite 801 - T&O	19,900	(762,278)	(793,074)
	Atria - Suite 401 \$/SF	38.31	39.07	39.85
9	Atria - Suite 401 - T&O	48,226	(1,847,317)	(1,921,948)
	Atria - Suite 132 \$/SF	-	-	-
9	Atria - Suite 132 - T&O	5,720	-	-
	Atria - Suite 1700 \$/SF	38.31	39.07	39.85
9	Atria - Suite 1700 - T&O	13,497	(517,008)	(537,895)
	Atria - New Suite \$/SF	38.31	39.07	39.85
9	Atria - New Suite - T&O	18,000	(689,497)	(717,353)
	New Tower \$/SF	-	-	-
10	New Tower - T&O	375,000	-	-
	Atria - # of parking Stalls	322.00	322.00	322.00
11	Atria Parking	-	(602,983)	(627,343)
	Total Taxes & Operating Costs	(12,459,421)	(12,708,609)	(12,962,782)
	Gross Rental Expense	(14,415,252)	(14,664,440)	(14,918,613)
Other Expenses Items				
12	Designated Substance Remediation	-	-	-
12	Remediation Move Costs	-	-	-
12	Designated Substance Maintenance	(250,000)	(250,000)	(250,000)
	Total Other Expense Items	(250,000)	(250,000)	(250,000)
	Total Expense	(14,665,252)	(14,914,440)	(15,168,613)

SECTION C

Capital Items				
13	General Capital Allowance	(2,080,685)	(2,122,299)	(2,164,745)
14	Furniture Replacement Program	-	-	-
14	Carpet Replacement	-	-	-
14	Elevator Upgrades	-	-	-
14	Parking Lot Repairs	-	-	-
14	Washroom Upgrades	-	-	-
15	General Tenant Improvements	-	-	-
16	Construction Costs	-	-	-
17	FF&E, Move Allowance, IT	-	-	-
	Total Capital Items	(2,080,685)	(2,122,299)	(2,164,745)

SECTION D

18	Acquisitions	-	-	-
19	Dispositions	-	-	-
20	Terminal Value	-	-	64,405,533
	CASH FLOW (CF)	(16,745,937)	(17,036,739)	47,072,176

PV of CF

21 Discount Rate

SQC - Notes

- 1 Based on average CPI growth - All Items (1992-2011). Source: Statistics Canada.
- 2 Occupied area varies up to 2015 based on expansion and expires within Atria.
- 3 No internal base rent assumed for VPC.
- 4 All Atria lease information based on leases in place or currently under negotiation as provided by EGD.
- 5 Atria Suite 132 expires 05/2013. EGD does not intend to renew this suite.
- 6 As advised by EGD, additional space at Atria will be required by 2015, rental rates have been estimated based on current lease transactions.
- 7 Assumes that EGD purchases new building at year 21 - no rent applied.
- 8 All VPC Operating Expenses provided by EGD - Appendix 1.
- 9 Based on Atria posted Tax & Operating Costs.
- 10 Based on 2012 posted Atria rate inflated by 2% annually.
- 11 EGD currently rents approximately 286 parking spaces at Atria. As EGD leases additional space, additional parking is assumed at a rate of \$75/month/stall inflated annually at Expense Growth Rate based on 1 stall/500 sf of leased space.
- 12 All information regarding Designated Substance Remediation is based on estimates provided by EGD management.
- 13 Based on estimates by EGD management regarding general non-scheduled annual capital spend. Increased annually by Expense Growth Rate.
- 14 All information with respect to Capital Items provided by EGD as identified on 2011 Report - Appendix N.
- 15 Assumes that tenant improvements or renovations will be required for VPC Tower at \$25 psf over 2 years starting in year 11 of analysis. Assumes that EGD specific renovations will be required at \$50 psf. for new building in year 21.
- 16 Costs associated with relocation of data centre. As per 2011 Report and provided by EGD. Inflated at 2% annually.
- 17 Allowance for furniture, fixtures & equipment, move and IT costs
- 18 Purchase of new facility at year 21 - \$300 psf.
- 19 Assumes that EGD sells VPC in year 21. Based on capitalized market rent (see Appendix 2).
- 20 See Appendix 2, Section A - VPC Terminal Value.
- 21 EGD Weighted Average Cost of Capital (WACC) as identified in 2011 Report.

APPENDIX 4

SCENARIO 1A - SELL ENTIRE VPC SITE AND PURCHA

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:								
2	Occupied Office Area (SF):	375,000	375,000	375,000	375,000	375,000	375,000	375,000	375,000

	Area (SF)	11 2023	12 2024	13 2025	14 2026	15 2027	16 2028	17 2029	18 2030	19 2031

SECTION A

Note

Base Rent										
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	6.57	6.70	6.84	6.98	7.11	7.26	7.40	7.55	7.70
3/9	VPC Fleet Building	35,000	(328,650)	(335,223)	(341,928)	(348,766)	(355,742)	(362,857)	(370,114)	(377,516)
	Atria - Suite 801 \$/SF	-	-	-	-	-	-	-	-	-
4	Atria - Suite 801	19,900	-	-	-	-	-	-	-	-
	Atria - Suite 401 \$/SF	-	-	-	-	-	-	-	-	-
4	Atria - Suite 401	48,226	-	-	-	-	-	-	-	-
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	-	-	-	-	-	-	-	-	-
4	Atria - Suite 1700	13,497	-	-	-	-	-	-	-	-
	Atria - New Suite \$/SF	-	-	-	-	-	-	-	-	-
6	Atria - New Suite	18,000	-	-	-	-	-	-	-	-
	New Tower \$/SF	-	-	-	-	-	-	-	-	-
7	New Tower	375,000	-	-	-	-	-	-	-	-
	Total Base Rent		(328,650)	(335,223)	(341,928)	(348,766)	(355,742)	(362,857)	(370,114)	(377,516)

SECTION B

Operating Expenses

	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
8	VPC Tower - OPEX & FC	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
8	VPC Annex Office - OPEX & FC	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
8	VPC Annex Industrial - OPEX & FC	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	6.81	6.95	7.09	7.23	7.37	7.52	7.67	7.82	7.98
9	VPC Fleet Building - OPEX & FC	35,000	(340,523)	(347,333)	(354,280)	(361,366)	(368,593)	(375,965)	(383,484)	(391,154)
	Atria - Suite 801 \$/SF	-	-	-	-	-	-	-	-	-
10	Atria - Suite 801 - T&O	19,900	-	-	-	-	-	-	-	-
	Atria - Suite 401 \$/SF	-	-	-	-	-	-	-	-	-
10	Atria - Suite 401 - T&O	48,226	-	-	-	-	-	-	-	-
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
10	Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	-	-	-	-	-	-	-	-	-
10	Atria - Suite 1700 - T&O	13,497	-	-	-	-	-	-	-	-
	Atria - New Suite \$/SF	-	-	-	-	-	-	-	-	-
10	Atria - New Suite - T&O	18,000	-	-	-	-	-	-	-	-
	New Tower \$/SF	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78	26.29
11	New Tower - T&O	375,000	(8,415,633)	(8,583,945)	(8,755,624)	(8,930,737)	(9,109,352)	(9,291,539)	(9,477,369)	(9,666,917)
	Atria - # of parking Stalls	-	-	-	-	-	-	-	-	-
12	Atria Parking	-	-	-	-	-	-	-	-	-
	Total Taxes & Operating Costs		(8,756,156)	(8,931,279)	(9,109,904)	(9,292,102)	(9,477,944)	(9,667,503)	(9,860,853)	(10,058,070)
	Gross Rental Expense		(9,084,806)	(9,266,502)	(9,451,832)	(9,640,869)	(9,833,686)	(10,030,360)	(10,230,967)	(10,435,587)
	Other Expenses Items									
13	Designated Substance Remediation	-	-	-	-	-	-	-	-	-
13	Remediation Move Costs	-	-	-	-	-	-	-	-	-
13	Designated Substance Maintenance	-	-	-	-	-	-	-	-	-
	Total Other Expense Items		-	-	-	-	-	-	-	-
	Total Expense		(9,084,806)	(9,266,502)	(9,451,832)	(9,640,869)	(9,833,686)	(10,030,360)	(10,230,967)	(10,435,587)

SECTION C

Capital Items

14	General Capital Allowance	(609,497)	(621,687)	(634,121)	(646,803)	(659,739)	(672,934)	(686,393)	(700,121)	(714,123)
15	Furniture Replacement Program	-	-	-	-	-	-	-	-	-
15	Carpet Replacement	-	-	-	-	-	-	-	-	-
15	Elevator Upgrades	-	-	-	-	-	-	-	-	-
15	Parking Lot Repairs	-	-	-	-	-	-	-	-	-
15	Washroom Upgrades	-	-	-	-	-	-	-	-	-
16	General Tenant Improvements	-	-	-	-	-	-	-	-	-
17	Construction Costs	-	-	-	-	-	-	-	-	-
18	FF&E, Move Allowance, IT	-	-	-	-	-	-	-	-	-
	Total Capital Items	(609,497)	(621,687)	(634,121)	(646,803)	(659,739)	(672,934)	(686,393)	(700,121)	(714,123)

SECTION D

19	Acquisitions	-	-	-	-	-	-	-	-	-
20	Dispositions	-	-	-	-	-	-	-	-	-
21	Terminal Value	-	-	-	-	-	-	-	-	-
	CASH FLOW (CF)	(9,694,303)	(9,888,189)	(10,085,953)	(10,287,672)	(10,493,426)	(10,703,294)	(10,917,360)	(11,135,707)	(11,358,421)

PV of CF

22 Discount Rate

APPENDIX 4

SCENARIO 1A - SELL ENTIRE VPC SITE AND PURCHA

All Figures in (\$CDN) unless otherwise specified.

1 Expense Growth Rate:
2 Occupied Office Area (SF): 375,000

	Area (SF)	20 2032	21 2033	22 2034	23 2035	24 2036	25 2037	26 2038	27 2039	28 2040
SECTION A										
Note										
Base Rent										
VPC Tower \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Tower	225,000	-	-	-	-	-	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Annex Office	51,600	-	-	-	-	-	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-	-
VPC Fleet Building \$/SF		7.86	8.01	8.17	8.34	8.50	8.67	8.85	9.02	9.20
3/9 VPC Fleet Building	35,000	(392,768)	(400,623)	(408,636)	(416,808)	(425,144)	(433,647)	(442,320)	(451,167)	(460,190)
Atria - Suite 801 \$/SF		-	-	-	-	-	-	-	-	-
4 Atria - Suite 801	19,900	-	-	-	-	-	-	-	-	-
Atria - Suite 401 \$/SF		-	-	-	-	-	-	-	-	-
4 Atria - Suite 401	48,226	-	-	-	-	-	-	-	-	-
Atria - Suite 132 \$/SF		-	-	-	-	-	-	-	-	-
4/5 Atria - Suite 132	5,720	-	-	-	-	-	-	-	-	-
Atria - Suite 1700 \$/SF		-	-	-	-	-	-	-	-	-
4 Atria - Suite 1700	13,497	-	-	-	-	-	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-	-	-	-	-	-
6 Atria - New Suite	18,000	-	-	-	-	-	-	-	-	-
New Tower \$/SF		-	-	-	-	-	-	-	-	-
7 New Tower	375,000	-	-	-	-	-	-	-	-	-
Total Base Rent		(392,768)	(400,623)	(408,636)	(416,808)	(425,144)	(433,647)	(442,320)	(451,167)	(460,190)

SECTION B

Operating Expenses

VPC Tower \$/SF		-	-	-	-	-	-	-	-	-
8 VPC Tower - OPEX & FC	225,000	-	-	-	-	-	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-	-	-	-	-	-
8 VPC Annex Office - OPEX & FC	51,600	-	-	-	-	-	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-	-	-	-	-	-
8 VPC Annex Industrial - OPEX & FC	34,400	-	-	-	-	-	-	-	-	-
VPC Fleet Building \$/SF		8.14	8.30	8.47	8.64	8.81	8.99	9.17	9.35	9.54
9 VPC Fleet Building - OPEX & FC	35,000	(406,956)	(415,096)	(423,397)	(431,865)	(440,503)	(449,313)	(458,299)	(467,465)	(476,814)
Atria - Suite 801 \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - Suite 801 - T&O	19,900	-	-	-	-	-	-	-	-	-
Atria - Suite 401 \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - Suite 401 - T&O	48,226	-	-	-	-	-	-	-	-	-
Atria - Suite 132 \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-	-
Atria - Suite 1700 \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - Suite 1700 - T&O	13,497	-	-	-	-	-	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - New Suite - T&O	18,000	-	-	-	-	-	-	-	-	-
New Tower \$/SF		26.82	27.36	27.90	28.46	29.03	29.61	30.20	30.81	31.42
11 New Tower - T&O	375,000	(10,057,460)	(10,258,609)	(10,463,782)	(10,673,057)	(10,886,518)	(11,104,249)	(11,326,334)	(11,552,860)	(11,783,918)
Atria - # of parking Stalls		-	-	-	-	-	-	-	-	-
12 Atria Parking		-	-	-	-	-	-	-	-	-
Total Taxes & Operating Costs		(10,464,417)	(10,673,705)	(10,887,179)	(11,104,923)	(11,327,021)	(11,553,561)	(11,784,633)	(12,020,325)	(12,260,732)
Gross Rental Expense		(10,857,184)	(11,074,328)	(11,295,815)	(11,521,731)	(11,752,165)	(11,987,209)	(12,226,953)	(12,471,492)	(12,720,922)
Other Expenses Items										
13 Designated Substance Remediation		-	-	-	-	-	-	-	-	-
13 Remediation Move Costs		-	-	-	-	-	-	-	-	-
13 Designated Substance Maintenance		-	-	-	-	-	-	-	-	-
Total Other Expense Items		-	-	-	-	-	-	-	-	-
Total Expense		(10,857,184)	(11,074,328)	(11,295,815)	(11,521,731)	(11,752,165)	(11,987,209)	(12,226,953)	(12,471,492)	(12,720,922)

SECTION C

Capital Items

14 General Capital Allowance		(728,406)	(742,974)	(757,833)	(772,990)	(788,450)	(804,219)	(820,303)	(836,709)	(853,443)
15 Furniture Replacement Program		-	-	-	-	-	-	-	-	-
15 Carpet Replacement		-	-	-	-	-	-	-	-	-
15 Elevator Upgrades		-	-	-	-	-	-	-	-	-
15 Parking Lot Repairs		-	-	-	-	-	-	-	-	-
15 Washroom Upgrades		-	-	-	-	-	-	-	-	-
16 General Tenant Improvements		-	-	-	-	-	-	-	-	-
17 Construction Costs		-	-	-	-	-	-	-	-	-
18 FF&E, Move Allowance, IT		-	-	-	-	-	-	-	-	-
Total Capital Items		(728,406)	(742,974)	(757,833)	(772,990)	(788,450)	(804,219)	(820,303)	(836,709)	(853,443)

SECTION D

19 Acquisitions		-	-	-	-	-	-	-	-	-
20 Dispositions		-	-	-	-	-	-	-	-	-
21 Terminal Value		-	-	-	-	-	-	-	-	-
CASH FLOW (CF)		(11,585,590)	(11,817,302)	(12,053,648)	(12,294,721)	(12,540,615)	(12,791,427)	(13,047,256)	(13,308,201)	(13,574,365)

PV of CF

22 Discount Rate

APPENDIX 4

SCENARIO 1A - SELL ENTIRE VPC SITE AND PURCHA

All Figures in (\$CDN) unless otherwise specified.

- 1 Expense Growth Rate:
- 2 Occupied Office Area (SF):

	Area (SF)	38 2050	39 2051	40 2052
SECTION A				
Note				
Base Rent				
VPC Tower \$/SF		-	-	-
3 VPC Tower	225,000	-	-	-
VPC Annex Office \$/SF		-	-	-
3 VPC Annex Office	51,600	-	-	-
VPC Annex Industrial \$/SF		-	-	-
3 VPC Annex Industrial	34,400	-	-	-
VPC Fleet Building \$/SF		11.22	11.44	11.67
3/9 VPC Fleet Building	35,000	(560,969)	(572,188)	(583,632)
Atria - Suite 801 \$/SF		-	-	-
4 Atria - Suite 801	19,900	-	-	-
Atria - Suite 401 \$/SF		-	-	-
4 Atria - Suite 401	48,226	-	-	-
Atria - Suite 132 \$/SF		-	-	-
4/5 Atria - Suite 132	5,720	-	-	-
Atria - Suite 1700 \$/SF		-	-	-
4 Atria - Suite 1700	13,497	-	-	-
Atria - New Suite \$/SF		-	-	-
6 Atria - New Suite	18,000	-	-	-
New Tower \$/SF		-	-	-
7 New Tower	375,000	-	-	-
Total Base Rent		(560,969)	(572,188)	(583,632)
SECTION B				
Operating Expenses				
VPC Tower \$/SF		-	-	-
8 VPC Tower - OPEX & FC	225,000	-	-	-
VPC Annex Office \$/SF		-	-	-
8 VPC Annex Office - OPEX & FC	51,600	-	-	-
VPC Annex Industrial \$/SF		-	-	-
8 VPC Annex Industrial - OPEX & FC	34,400	-	-	-
VPC Fleet Building \$/SF		11.62	11.86	12.09
9 VPC Fleet Building - OPEX & FC	35,000	(581,234)	(592,859)	(604,716)
Atria - Suite 801 \$/SF		-	-	-
10 Atria - Suite 801 - T&O	19,900	-	-	-
Atria - Suite 401 \$/SF		-	-	-
10 Atria - Suite 401 - T&O	48,226	-	-	-
Atria - Suite 132 \$/SF		-	-	-
10 Atria - Suite 132 - T&O	5,720	-	-	-
Atria - Suite 1700 \$/SF		-	-	-
10 Atria - Suite 1700 - T&O	13,497	-	-	-
Atria - New Suite \$/SF		-	-	-
10 Atria - New Suite - T&O	18,000	-	-	-
New Tower \$/SF		38.31	39.07	39.85
11 New Tower - T&O	375,000	(14,364,530)	(14,651,820)	(14,944,857)
Atria - # of parking Stalls		-	-	-
12 Atria Parking		-	-	-
Total Taxes & Operating Costs		(14,945,764)	(15,244,679)	(15,549,573)
Gross Rental Expense		(15,506,733)	(15,816,867)	(16,133,205)
Other Expenses Items				
13 Designated Substance Remediation		-	-	-
13 Remediation Move Costs		-	-	-
13 Designated Substance Maintenance		-	-	-
Total Other Expense Items		-	-	-
Total Expense		(15,506,733)	(15,816,867)	(16,133,205)
SECTION C				
Capital Items				
14 General Capital Allowance		(1,040,343)	(1,061,149)	(1,082,372)
15 Furniture Replacement Program		-	-	-
15 Carpet Replacement		-	-	-
15 Elevator Upgrades		-	-	-
15 Parking Lot Repairs		-	-	-
15 Washroom Upgrades		-	-	-
16 General Tenant Improvements		-	-	-
17 Construction Costs		-	-	-
18 FF&E, Move Allowance, IT		-	-	-
Total Capital Items		(1,040,343)	(1,061,149)	(1,082,372)
SECTION D				
19 Acquisitions		-	-	-
20 Dispositions		-	-	-
21 Terminal Value		-	-	151,802,727
CASH FLOW (CF)		(16,547,075)	(16,878,017)	134,587,150
PV of CF				
22 Discount Rate				

1A - Notes

- 1 Based on average CPI growth - All Items(1992-2011). Source: Statistics Canada.
- 2 Occupied area varies up to 2015 based on expansions and expires within Atria & alternaive property.
- 3 No internal base rent assumed for VPC components.
- 4 All Atria lease information provided by EGD. Assumed that Atria space is committed until end of 2016.
- 5 Atria Suite 132 expires 05/2013. EGD does not intend to renew this suite.
- 6 Not applicable in this scenario
- 7 No rent applicable for new tower in this scenario
- 8 All VPC Operating Expenses provided by EGD. See "Operating Expense Base Calculation" contained herein. Assumes that Annex and Fleet buildings are demolished in 2013.
- 9 Assumes that as VPC is sold, a new Fleet facility will be leased with Taxes & Operating costs occupancy equal to current facility.
- 10 Based on Atria posted estimated Tax & Operating costs provided by EGD & Colliers International
- 11 Assumes Class "A" Taxes & Operating Costs similar to Atria. Suburban rates will be less.
- 12 EGD currently rents approximately 286 parking spaces at Atria. As EGD leases additional space, additional parking is assumed at a rate of \$75/month/stall inflated annually at Expense Growth Rate based on 1 stall/500 sf of leased space.
- 13 All information regarding the designated substance remediation are based on estimates provided by EGD management. No investment would be made based on scheduled demolition in 2015. Assumes maintenance costs only.
- 14 Based on estimates by EGD management regarding general non-scheduled annual capital spend. Increased annually by Expense Growth Rate.
- 15 All information with respect to Capital Items provided by EGD as identified on 2011 Report - Appendix N. - Not applicable to this scenario.
- 16 Assumes that tenant improvements or renovations will be required at \$50 psf for new acquisition.
- 17 Costs associated with relocation of data centre. As per 2011 Report and provided by EGD. Inflated by 2% annually.
- 18 Allowance for furniture, fixtures & equipment, move costs and IT costs associated with all scenarios in which EGD does not occupy VPC in its current state.
- 19 Assumes acquisition of alternative existing facility at \$250/sf.
- 20 Proceeds from sale of VPC based on high value see Section 6.3
- 21 See Appendix 2, Section B - Alternative Location Terminal Value
- 22 EGD Weighted Average Cost of Capital (WACC) as identified in 2011 Report.

APPENDIX 4

SCENARIO 1B - SELL ENTIRE VPC SITE AND LEASE EXISTING TOWER ON ALTERNATIVE SITE

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:	2.00%							
2	Occupied Office Area (SF):	363,943	376,223	376,223	375,000	375,000	375,000	375,000	375,000

	Area (SF)	1 2013	2 2014	3 2015	4 2016	5 2017	6 2018	7 2019	8 2020	9 2021
SECTION A										
Note										
Base Rent										
VPC Tower \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Tower	225,000	-	-	-	-	-	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Annex Office	51,600	-	-	-	-	-	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-	-
VPC Fleet Building \$/SF		-	-	5.61	5.72	5.84	5.95	6.07	6.19	6.32
3/9 VPC Fleet Building	35,000	-	-	(280,500)	(286,110)	(291,832)	(297,669)	(303,622)	(309,695)	(315,889)
Atria - Suite 801 \$/SF		11.88	12.00	12.00	12.00	-	-	-	-	-
4 Atria - Suite 801	19,900	(236,412)	(238,800)	(238,800)	(238,800)	-	-	-	-	-
Atria - Suite 401 \$/SF		12.00	12.00	12.00	12.00	-	-	-	-	-
4 Atria - Suite 401	48,226	(578,712)	(578,712)	(578,712)	(578,712)	-	-	-	-	-
Atria - Suite 132 \$/SF		5.00	-	-	-	-	-	-	-	-
4/5 Atria - Suite 132	5,720	(28,600)	-	-	-	-	-	-	-	-
Atria - Suite 1700 \$/SF		12.00	13.33	14.00	14.00	-	-	-	-	-
4 Atria - Suite 1700	13,497	(161,964)	(179,915)	(188,958)	(188,958)	-	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-	-	-	-	-	-
6 Atria - New Suite	18,000	-	-	-	-	-	-	-	-	-
New Tower \$/SF		-	-	16.50	16.50	16.50	16.50	16.50	18.50	18.50
7 New Tower	375,000	-	-	(6,187,500)	(6,187,500)	(6,187,500)	(6,187,500)	(6,187,500)	(6,937,500)	(6,937,500)
Total Base Rent		(1,005,688)	(997,427)	(7,474,470)	(7,480,080)	(6,479,332)	(6,485,169)	(6,491,122)	(7,247,195)	(7,253,389)

SECTION B

Operating Expenses										
VPC Tower \$/SF		12.57	12.82	-	-	-	-	-	-	-
8 VPC Tower - OPEX & FC	225,000	(2,827,988)	(2,884,548)	-	-	-	-	-	-	-
VPC Annex Office \$/SF		12.57	12.82	-	-	-	-	-	-	-
8 VPC Annex Office - OPEX & FC	51,600	(648,552)	(661,523)	-	-	-	-	-	-	-
VPC Annex Industrial \$/SF		5.59	5.70	-	-	-	-	-	-	-
8 VPC Annex Industrial - OPEX & FC	34,400	(192,191)	(196,035)	-	-	-	-	-	-	-
VPC Fleet Building \$/SF		5.59	5.70	5.81	5.93	6.05	6.17	6.29	6.42	6.55
9 VPC Fleet Building - OPEX & FC	35,000	(195,543)	(199,454)	(290,633)	(296,446)	(302,375)	(308,422)	(314,591)	(320,882)	(327,300)
Atria - Suite 801 \$/SF		18.41	18.78	19.15	19.54	-	-	-	-	-
10 Atria - Suite 801 - T&O	19,900	(366,359)	(373,686)	(381,160)	(388,783)	-	-	-	-	-
Atria - Suite 401 \$/SF		18.41	18.78	19.15	19.54	-	-	-	-	-
10 Atria - Suite 401 - T&O	48,226	(887,841)	(905,597)	(923,709)	(942,184)	-	-	-	-	-
Atria - Suite 132 \$/SF		7.67	-	-	-	-	-	-	-	-
10 Atria - Suite 132 - T&O	5,720	(43,872)	-	-	-	-	-	-	-	-
Atria - Suite 1700 \$/SF		18.41	18.78	19.15	19.54	-	-	-	-	-
10 Atria - Suite 1700 - T&O	13,497	(248,480)	(253,449)	(258,518)	(263,689)	-	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - New Suite - T&O	18,000	-	-	-	-	-	-	-	-	-
New Tower \$/SF		-	-	19.15	19.54	19.93	20.33	20.73	21.15	21.57
11 New Tower - T&O	375,000	-	-	(7,182,662)	(7,326,315)	(7,472,841)	(7,622,298)	(7,774,744)	(7,930,239)	(8,088,843)
Atria - # of parking Stalls		286.00	270.00	270.00	270.00	-	-	-	-	-
12 Atria Parking		(257,400)	(247,860)	(252,817)	(257,874)	-	-	-	-	-
Total Taxes & Operating Costs		(5,668,226)	(5,722,153)	(9,289,499)	(9,475,289)	(7,775,216)	(7,930,720)	(8,089,334)	(8,251,121)	(8,416,143)
Gross Rental Expense		(6,673,914)	(6,719,580)	(16,763,969)	(16,955,369)	(14,254,548)	(14,415,889)	(14,580,457)	(15,498,316)	(15,669,532)
Other Expenses Items										
13 Designated Substance Remediation		-	-	-	-	-	-	-	-	-
13 Remediation Move Costs		-	-	-	-	-	-	-	-	-
13 Designated Substance Maintenance		(100,000)	(100,000)	-	-	-	-	-	-	-
Total Other Expense Items		(100,000)	(100,000)	-	-	-	-	-	-	-
Total Expense		(6,773,914)	(6,819,580)	(16,763,969)	(16,955,369)	(14,254,548)	(14,415,889)	(14,580,457)	(15,498,316)	(15,669,532)

SECTION C

Capital Items										
14 General Capital Allowance		(500,000)	(510,000)	(520,200)	(530,604)	(541,216)	(552,040)	(563,081)	(574,343)	(585,830)
15 Furniture Replacement Program		-	-	-	-	-	-	-	-	-
15 Carpet Replacement		-	-	-	-	-	-	-	-	-
15 Elevator Upgrades		-	-	-	-	-	-	-	-	-
15 Parking Lot Repairs		-	-	-	-	-	-	-	-	-
15 Washroom Upgrades		-	-	-	-	-	-	-	-	-
16 General Tenant Improvements		-	(9,753,750)	-	-	-	-	-	-	-
17 Construction Costs		-	(7,282,800)	-	-	-	-	-	-	-
18 FF&E, Move Allowance, IT		-	(5,163,750)	-	-	-	-	-	-	-
Total Capital Items		(500,000)	(22,710,300)	(520,200)	(530,604)	(541,216)	(552,040)	(563,081)	(574,343)	(585,830)

SECTION D

19 Acquisitions		-	-	-	-	-	-	-	-	-
20 Dispositions		-	30,824,145	-	-	-	-	-	-	-
21 Terminal Value		-	-	-	-	-	-	-	-	-
CASH FLOW (CF)		(7,273,914)	1,294,265	(17,284,169)	(17,485,973)	(14,795,764)	(14,967,929)	(15,143,538)	(16,072,659)	(16,255,362)
PV of CF		(264,927,535)								
22 Discount Rate		5.72%								

APPENDIX 4

SCENARIO 1B - SELL ENTIRE VPC SITE AND LEASE E

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:									
2	Occupied Office Area (SF):	375,000	375,000	375,000	375,000	375,000	375,000	375,000	375,000	375,000

	Area (SF)	10 2022	11 2023	12 2024	13 2025	14 2026	15 2027	16 2028	17 2029	18 2030
SECTION A										
Note										
Base Rent										
VPC Tower \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Tower	225,000	-	-	-	-	-	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Annex Office	51,600	-	-	-	-	-	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-	-
VPC Fleet Building \$/SF		6.44	6.57	6.70	6.84	6.98	7.11	7.26	7.40	7.55
3/9 VPC Fleet Building	35,000	(322,206)	(328,650)	(335,223)	(341,928)	(348,766)	(355,742)	(362,857)	(370,114)	(377,516)
Atria - Suite 801 \$/SF		-	-	-	-	-	-	-	-	-
4 Atria - Suite 801	19,900	-	-	-	-	-	-	-	-	-
Atria - Suite 401 \$/SF		-	-	-	-	-	-	-	-	-
4 Atria - Suite 401	48,226	-	-	-	-	-	-	-	-	-
Atria - Suite 132 \$/SF		-	-	-	-	-	-	-	-	-
4/5 Atria - Suite 132	5,720	-	-	-	-	-	-	-	-	-
Atria - Suite 1700 \$/SF		-	-	-	-	-	-	-	-	-
4 Atria - Suite 1700	13,497	-	-	-	-	-	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-	-	-	-	-	-
6 Atria - New Suite	18,000	-	-	-	-	-	-	-	-	-
New Tower \$/SF		18.50	18.50	18.50	20.50	20.50	20.50	20.50	20.50	22.50
7 New Tower	375,000	(6,937,500)	(6,937,500)	(6,937,500)	(7,687,500)	(7,687,500)	(7,687,500)	(7,687,500)	(7,687,500)	(8,437,500)
Total Base Rent		(7,259,706)	(7,266,150)	(7,272,723)	(8,029,428)	(8,036,266)	(8,043,242)	(8,050,357)	(8,057,614)	(8,815,016)

SECTION B										
Operating Expenses										
VPC Tower \$/SF		-	-	-	-	-	-	-	-	-
8 VPC Tower - OPEX & FC	225,000	-	-	-	-	-	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-	-	-	-	-	-
8 VPC Annex Office - OPEX & FC	51,600	-	-	-	-	-	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-	-	-	-	-	-
8 VPC Annex Industrial - OPEX & FC	34,400	-	-	-	-	-	-	-	-	-
VPC Fleet Building \$/SF		6.68	6.81	6.95	7.09	7.23	7.37	7.52	7.67	7.82
9 VPC Fleet Building - OPEX & FC	35,000	(333,846)	(340,523)	(347,333)	(354,280)	(361,366)	(368,593)	(375,965)	(383,484)	(391,154)
Atria - Suite 801 \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - Suite 801 - T&O	19,900	-	-	-	-	-	-	-	-	-
Atria - Suite 401 \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - Suite 401 - T&O	48,226	-	-	-	-	-	-	-	-	-
Atria - Suite 132 \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-	-
Atria - Suite 1700 \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - Suite 1700 - T&O	13,497	-	-	-	-	-	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - New Suite - T&O	18,000	-	-	-	-	-	-	-	-	-
New Tower \$/SF		22.00	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78
11 New Tower - T&O	375,000	(8,250,620)	(8,415,633)	(8,583,945)	(8,755,624)	(8,930,737)	(9,109,352)	(9,291,539)	(9,477,369)	(9,666,917)
Atria - # of parking Stalls		-	-	-	-	-	-	-	-	-
12 Atria Parking		-	-	-	-	-	-	-	-	-
Total Taxes & Operating Costs		(8,584,466)	(8,756,156)	(8,931,279)	(9,109,904)	(9,292,102)	(9,477,944)	(9,667,503)	(9,860,853)	(10,058,070)
Gross Rental Expense		(15,844,173)	(16,022,306)	(16,204,002)	(17,139,332)	(17,328,369)	(17,521,186)	(17,717,860)	(17,918,467)	(18,873,087)
Other Expenses Items										
13 Designated Substance Remediation		-	-	-	-	-	-	-	-	-
13 Remediation Move Costs		-	-	-	-	-	-	-	-	-
13 Designated Substance Maintenance		-	-	-	-	-	-	-	-	-
Total Other Expense Items		-	-	-	-	-	-	-	-	-
Total Expense		(15,844,173)	(16,022,306)	(16,204,002)	(17,139,332)	(17,328,369)	(17,521,186)	(17,717,860)	(17,918,467)	(18,873,087)

SECTION C										
Capital Items										
14 General Capital Allowance		(597,546)	(609,497)	(621,687)	(634,121)	(646,803)	(659,739)	(672,934)	(686,393)	(700,121)
15 Furniture Replacement Program		-	-	-	-	-	-	-	-	-
15 Carpet Replacement		-	-	-	-	-	-	-	-	-
15 Elevator Upgrades		-	-	-	-	-	-	-	-	-
15 Parking Lot Repairs		-	-	-	-	-	-	-	-	-
15 Washroom Upgrades		-	-	-	-	-	-	-	-	-
16 General Tenant Improvements		-	-	-	-	-	-	-	-	-
17 Construction Costs		-	-	-	-	-	-	-	-	-
18 FF&E, Move Allowance, IT		-	-	-	-	-	-	-	-	-
Total Capital Items		(597,546)	(609,497)	(621,687)	(634,121)	(646,803)	(659,739)	(672,934)	(686,393)	(700,121)

SECTION D										
19 Acquisitions		-	-	-	-	-	-	-	-	-
20 Dispositions		-	-	-	-	-	-	-	-	-
21 Terminal Value		-	-	-	-	-	-	-	-	-
CASH FLOW (CF)		(16,441,719)	(16,631,803)	(16,825,689)	(17,773,453)	(17,975,172)	(18,180,926)	(18,390,794)	(18,604,860)	(19,573,207)

PV of CF
Discount Rate

APPENDIX 4

SCENARIO 1B - SELL ENTIRE VPC SITE AND LEASE E

All Figures in (\$CDN) unless otherwise specified.

- 1 Expense Growth Rate:
- 2 Occupied Office Area (SF):

	Area (SF)	37 2049	38 2050	39 2051	40 2052
SECTION A					
Note					
Base Rent					
VPC Tower \$/SF		-	-	-	-
3 VPC Tower	225,000	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-
3 VPC Annex Office	51,600	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-
3 VPC Annex Industrial	34,400	-	-	-	-
VPC Fleet Building \$/SF		11.00	11.22	11.44	11.67
3/9 VPC Fleet Building	35,000	(549,970)	(560,969)	(572,188)	(583,632)
Atria - Suite 801 \$/SF		-	-	-	-
4 Atria - Suite 801	19,900	-	-	-	-
Atria - Suite 401 \$/SF		-	-	-	-
4 Atria - Suite 401	48,226	-	-	-	-
Atria - Suite 132 \$/SF		-	-	-	-
4/5 Atria - Suite 132	5,720	-	-	-	-
Atria - Suite 1700 \$/SF		-	-	-	-
4 Atria - Suite 1700	13,497	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-
6 Atria - New Suite	18,000	-	-	-	-
New Tower \$/SF		28.50	30.50	30.50	30.50
7 New Tower	375,000	(10,687,500)	(11,437,500)	(11,437,500)	(11,437,500)
Total Base Rent		(11,237,470)	(11,998,469)	(12,009,688)	(12,021,132)

SECTION B

Operating Expenses					
VPC Tower \$/SF		-	-	-	-
8 VPC Tower - OPEX & FC	225,000	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-
8 VPC Annex Office - OPEX & FC	51,600	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-
8 VPC Annex Industrial - OPEX & FC	34,400	-	-	-	-
VPC Fleet Building \$/SF		11.40	11.62	11.86	12.09
9 VPC Fleet Building - OPEX & FC	35,000	(569,837)	(581,234)	(592,859)	(604,716)
Atria - Suite 801 \$/SF		-	-	-	-
10 Atria - Suite 801 - T&O	19,900	-	-	-	-
Atria - Suite 401 \$/SF		-	-	-	-
10 Atria - Suite 401 - T&O	48,226	-	-	-	-
Atria - Suite 132 \$/SF		-	-	-	-
10 Atria - Suite 132 - T&O	5,720	-	-	-	-
Atria - Suite 1700 \$/SF		-	-	-	-
10 Atria - Suite 1700 - T&O	13,497	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-
10 Atria - New Suite - T&O	18,000	-	-	-	-
New Tower \$/SF		37.55	38.31	39.07	39.85
11 New Tower - T&O	375,000	(14,082,872)	(14,364,530)	(14,651,820)	(14,944,857)
Atria - # of parking Stalls		-	-	-	-
12 Atria Parking		-	-	-	-
Total Taxes & Operating Costs		(14,652,709)	(14,945,764)	(15,244,679)	(15,549,573)
Gross Rental Expense		(25,890,179)	(26,944,233)	(27,254,367)	(27,570,705)
Other Expenses Items					
13 Designated Substance Remediation		-	-	-	-
13 Remediation Move Costs		-	-	-	-
13 Designated Substance Maintenance		-	-	-	-
Total Other Expense Items		-	-	-	-
Total Expense		(25,890,179)	(26,944,233)	(27,254,367)	(27,570,705)

SECTION C

Capital Items					
14 General Capital Allowance		(1,019,944)	(1,040,343)	(1,061,149)	(1,082,372)
15 Furniture Replacement Program		-	-	-	-
15 Carpet Replacement		-	-	-	-
15 Elevator Upgrades		-	-	-	-
15 Parking Lot Repairs		-	-	-	-
15 Washroom Upgrades		-	-	-	-
16 General Tenant Improvements		-	-	-	-
17 Construction Costs		-	-	-	-
18 FF&E, Move Allowance, IT		-	-	-	-
Total Capital Items		(1,019,944)	(1,040,343)	(1,061,149)	(1,082,372)

SECTION D

19 Acquisitions		-	-	-	-
20 Dispositions		-	-	-	-
21 Terminal Value		-	-	-	-
CASH FLOW (CF)		(26,910,123)	(27,984,575)	(28,315,517)	(28,653,077)

PV of CF

- 22 Discount Rate

1B - Notes

- 1 Based on average CPI growth - All Items(1992-2011). Source: Statistics Canada.
- 2 Occupied area varies up to 2015 based on expansions and expires within Atria & alternaive property.
- 3 No internal base rent assumed for VPC components.
- 4 All Atria lease information provided by EGD. Assumed that Atria space is committed until end of 2016.
- 5 Atria Suite 132 expires 05/2013. EGD does not intend to renew this suite.
- 6 Not applicable in this scenario
- 7 Assumes initial base rent of \$16.50 psf with rental escalations of \$2.00 psf every 5 years thereafter
- 8 All VPC Operating Expenses provided by EGD. See "Operating Expense Base Calculation" contained herein. Assumes that Annex and Fleet buildings are demolished in 2013.
- 9 Assumes that as VPC is sold, a new Fleet facility will be leased with Taxes & Operating costs occupancy equal to current facility.
- 10 Based on Atria posted estimated Tax & Operating costs provided by EGD & Colliers International
- 11 Assumes Class "A" Taxes & Operating Costs similar to Atria. Suburban rates will be less.
- 12 EGD currently rents approximately 286 parking spaces at Atria. As EGD leases additional space, additional parking is assumed at a rate of \$75/month/stall inflated annually at Expense Growth Rate based on 1 stall/500 sf of leased space.
- 13 All information regarding the designated substance remediation are based on estimates provided by EGD management. No investment would be made based on scheduled demolition in 2015. Assumes maintenance costs only.
- 14 Based on estimates by EGD management regarding general non-scheduled annual capital spend. Increased annually by Expense Growth Rate.
- 15 All information with respect to Capital Items provided by EGD as identified on 2011 Report - Appendix N. - Not applicable to this scenario.
- 16 Assumes that EGD specific improvements or renovations above and beyond landlord tenant inducements will be required at \$25 psf.
- 17 Costs associated with relocation of data centre. As per 2011 Report and provided by EGD. Inflated by 2% annually.
- 18 Allowance for furniture, fixtures & equipment, move costs and IT costs associated with all scenarios in which EGD does not occupy VPC in its current state.
- 19 Not applicable in this scenario
- 20 Proceeds from sale of VPC based on high value see Section 6.3
- 21 Not applicable in this scenario
- 22 EGD Weighted Average Cost of Capital (WACC) as identified in 2011 Report.

APPENDIX 5

SCENARIO 2A - CONSTRUCT NEW OFFICE BUILDING ON VPC WEST (RETAINED OWNERSHIP), SELL VPC EAST - CASH FLOW

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:		2.00%							
2	Occupied Office Area (SF):		363,943	376,223	376,223	375,000	375,000	375,000	375,000	375,000
		Area (SF)	1	2	3	4	5	6	7	8
			2013	2014	2015	2016	2017	2018	2019	2020
			2021							
SECTION A										
Note										
	Base Rent									
	VPC Tower \$/SF		-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF		-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF		-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF		-	5.50	5.61	5.72	5.84	5.95	6.07	6.19
3/9	VPC Fleet Building	35,000	-	(275,000)	(280,500)	(286,110)	(291,832)	(297,669)	(303,622)	(309,695)
	Atria - Suite 801 \$/SF		11.88	12.00	12.00	12.00	-	-	-	-
4	Atria - Suite 801	19,900	(236,412)	(238,800)	(238,800)	(238,800)	-	-	-	-
	Atria - Suite 401 \$/SF		12.00	12.00	12.00	12.00	-	-	-	-
4	Atria - Suite 401	48,226	(578,712)	(578,712)	(578,712)	(578,712)	-	-	-	-
	Atria - Suite 132 \$/SF		5.00	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	(28,600)	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF		12.00	13.33	14.00	14.00	-	-	-	-
4	Atria - Suite 1700	13,497	(161,964)	(179,915)	(188,958)	(188,958)	-	-	-	-
	Atria - New Suite \$/SF		-	-	-	-	-	-	-	-
6	Atria - New Suite	18,000	-	-	-	-	-	-	-	-
	New Tower \$/SF		-	-	-	-	-	-	-	-
7	New Tower	375,000	-	-	-	-	-	-	-	-
	Total Base Rent		(1,005,688)	(1,272,427)	(1,286,970)	(1,292,580)	(291,832)	(297,669)	(303,622)	(309,695)
										(315,889)
SECTION B										
	Operating Expenses									
	VPC Tower \$/SF		12.57	12.82	13.08	-	-	-	-	-
8	VPC Tower - OPEX & FC	225,000	(2,827,988)	(2,884,548)	(2,942,239)	-	-	-	-	-
	VPC Annex Office \$/SF		12.57	12.82	13.08	-	-	-	-	-
8	VPC Annex Office - OPEX & FC	51,600	(648,552)	(661,523)	(674,753)	-	-	-	-	-
	VPC Annex Industrial \$/SF		5.59	5.70	5.81	-	-	-	-	-
8	VPC Annex Industrial - OPEX & FC	34,400	(192,191)	(196,035)	(199,956)	-	-	-	-	-
	VPC Fleet Building \$/SF		5.59	5.70	5.81	5.93	6.05	6.17	6.29	6.42
9	VPC Fleet Building - OPEX & FC	35,000	(195,543)	(284,934)	(290,633)	(296,446)	(302,375)	(308,422)	(314,591)	(320,882)
	Atria - Suite 801 \$/SF		18.41	18.78	19.15	19.54	-	-	-	-
10	Atria - Suite 801 - T&O	19,900	(366,359)	(373,686)	(381,160)	(388,783)	-	-	-	-
	Atria - Suite 401 \$/SF		18.41	18.78	19.15	19.54	-	-	-	-
10	Atria - Suite 401 - T&O	48,226	(887,841)	(905,597)	(923,709)	(942,184)	-	-	-	-
	Atria - Suite 132 \$/SF		7.67	-	-	-	-	-	-	-
10	Atria - Suite 132 - T&O	5,720	(43,872)	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF		18.41	18.78	19.15	19.54	-	-	-	-
10	Atria - Suite 1700 - T&O	13,497	(248,480)	(253,449)	(258,518)	(263,689)	-	-	-	-
	Atria - New Suite \$/SF		-	-	-	-	-	-	-	-
10	Atria - New Suite - T&O	18,000	-	-	-	-	-	-	-	-
	New Tower \$/SF		-	-	-	19.54	19.93	20.33	20.73	21.15
11	New Tower - T&O	375,000	-	-	-	(7,326,315)	(7,472,841)	(7,622,298)	(7,774,744)	(7,930,239)
	Atria - # of parking Stalls		286.00	270.00	270.00	270.00	-	-	-	-
12	Atria Parking		(257,400)	(247,860)	(252,817)	(257,874)	-	-	-	-
	Total Taxes & Operating Costs		(5,668,226)	(5,807,633)	(5,923,786)	(9,475,289)	(7,775,216)	(7,930,720)	(8,089,334)	(8,251,121)
										(8,416,143)
	Gross Rental Expense		(6,673,914)	(7,080,060)	(7,210,756)	(10,767,869)	(8,067,048)	(8,228,389)	(8,392,957)	(8,560,816)
										(8,732,032)
	Other Expenses Items									
13	Designated Substance Remediation		-	-	-	-	-	-	-	-
13	Remediation Move Costs		-	-	-	-	-	-	-	-
13	Designated Substance Maintenance		(100,000)	(100,000)	(100,000)	-	-	-	-	-
	Total Other Expense Items		(100,000)	(100,000)	(100,000)	-	-	-	-	-
	Total Expense		(6,773,914)	(7,180,060)	(7,310,756)	(10,767,869)	(8,067,048)	(8,228,389)	(8,392,957)	(8,560,816)
										(8,732,032)
SECTION C										
	Capital Items									
14	General Capital Allowance		(500,000)	(510,000)	(520,200)	(530,604)	(541,216)	(552,040)	(563,081)	(574,343)
15	Furniture Replacement Program		-	-	-	-	-	-	-	-
15	Carpet Replacement		-	-	-	-	-	-	-	-
15	Elevator Upgrades		-	-	-	-	-	-	-	-
15	Parking Lot Repairs		-	-	-	-	-	-	-	-
15	Washroom Upgrades		-	-	-	-	-	-	-	-
	General Tenant Improvements		-	-	-	-	-	-	-	-
17	Construction Costs		(6,542,959)	(61,734,822)	(59,297,322)	-	-	-	-	-
18	FF&E, Move Allowance, IT		-	-	(5,267,025)	-	-	-	-	-
	Total Capital Items		(7,042,959)	(62,244,822)	(65,084,547)	(530,604)	(541,216)	(552,040)	(563,081)	(574,343)
										(585,830)
SECTION D										
19	Acquisitions		-	-	-	-	-	-	-	-
20	Dispositions		-	-	-	18,201,574	-	-	-	-
21	Terminal Value		-	-	-	-	-	-	-	-
	CASH FLOW (CF)		(13,816,873)	(69,424,882)	(72,395,303)	6,903,101	(8,608,264)	(8,780,429)	(8,956,038)	(9,135,159)
										(9,317,862)
	PV of CF		(249,745,800)							
22	Discount Rate		5.72%							

APPENDIX 5

SCENARIO 2A - CONSTRUCT NEW OFFICE BUILDING

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:									
2	Occupied Office Area (SF):	375,000	375,000	375,000	375,000	375,000	375,000	375,000	375,000	375,000

	Area (SF)	10 2022	11 2023	12 2024	13 2025	14 2026	15 2027	16 2028	17 2029	18 2030
SECTION A										
Note										
Base Rent										
VPC Tower \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Tower	225,000	-	-	-	-	-	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Annex Office	51,600	-	-	-	-	-	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-	-	-	-	-	-
3 VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-	-
VPC Fleet Building \$/SF		6.44	6.57	6.70	6.84	6.98	7.11	7.26	7.40	7.55
3/9 VPC Fleet Building	35,000	(322,206)	(328,650)	(335,223)	(341,928)	(348,766)	(355,742)	(362,857)	(370,114)	(377,516)
Atria - Suite 801 \$/SF		-	-	-	-	-	-	-	-	-
4 Atria - Suite 801	19,900	-	-	-	-	-	-	-	-	-
Atria - Suite 401 \$/SF		-	-	-	-	-	-	-	-	-
4 Atria - Suite 401	48,226	-	-	-	-	-	-	-	-	-
Atria - Suite 132 \$/SF		-	-	-	-	-	-	-	-	-
4/5 Atria - Suite 132	5,720	-	-	-	-	-	-	-	-	-
Atria - Suite 1700 \$/SF		-	-	-	-	-	-	-	-	-
4 Atria - Suite 1700	13,497	-	-	-	-	-	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-	-	-	-	-	-
6 Atria - New Suite	18,000	-	-	-	-	-	-	-	-	-
New Tower \$/SF		-	-	-	-	-	-	-	-	-
7 New Tower	375,000	-	-	-	-	-	-	-	-	-
Total Base Rent		(322,206)	(328,650)	(335,223)	(341,928)	(348,766)	(355,742)	(362,857)	(370,114)	(377,516)

SECTION B										
Operating Expenses										
VPC Tower \$/SF		-	-	-	-	-	-	-	-	-
8 VPC Tower - OPEX & FC	225,000	-	-	-	-	-	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-	-	-	-	-	-
8 VPC Annex Office - OPEX & FC	51,600	-	-	-	-	-	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-	-	-	-	-	-
8 VPC Annex Industrial - OPEX & FC	34,400	-	-	-	-	-	-	-	-	-
VPC Fleet Building \$/SF		6.68	6.81	6.95	7.09	7.23	7.37	7.52	7.67	7.82
9 VPC Fleet Building - OPEX & FC	35,000	(333,846)	(340,523)	(347,333)	(354,280)	(361,366)	(368,593)	(375,965)	(383,484)	(391,154)
Atria - Suite 801 \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - Suite 801 - T&O	19,900	-	-	-	-	-	-	-	-	-
Atria - Suite 401 \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - Suite 401 - T&O	48,226	-	-	-	-	-	-	-	-	-
Atria - Suite 132 \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-	-
Atria - Suite 1700 \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - Suite 1700 - T&O	13,497	-	-	-	-	-	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-	-	-	-	-	-
10 Atria - New Suite - T&O	18,000	-	-	-	-	-	-	-	-	-
New Tower \$/SF		22.00	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78
11 New Tower - T&O	375,000	(8,250,620)	(8,415,633)	(8,583,945)	(8,755,624)	(8,930,737)	(9,109,352)	(9,291,539)	(9,477,369)	(9,666,917)
Atria - # of parking Stalls		-	-	-	-	-	-	-	-	-
12 Atria Parking		-	-	-	-	-	-	-	-	-
Total Taxes & Operating Costs		(8,584,466)	(8,756,156)	(8,931,279)	(9,109,904)	(9,292,102)	(9,477,944)	(9,667,503)	(9,860,853)	(10,058,070)
Gross Rental Expense		(8,906,673)	(9,084,806)	(9,266,502)	(9,451,832)	(9,640,869)	(9,833,686)	(10,030,360)	(10,230,967)	(10,435,587)
Other Expenses Items										
13 Designated Substance Remediation		-	-	-	-	-	-	-	-	-
13 Remediation Move Costs		-	-	-	-	-	-	-	-	-
13 Designated Substance Maintenance		-	-	-	-	-	-	-	-	-
Total Other Expense Items		-	-	-	-	-	-	-	-	-
Total Expense		(8,906,673)	(9,084,806)	(9,266,502)	(9,451,832)	(9,640,869)	(9,833,686)	(10,030,360)	(10,230,967)	(10,435,587)

SECTION C										
Capital Items										
14 General Capital Allowance		(597,546)	(609,497)	(621,687)	(634,121)	(646,803)	(659,739)	(672,934)	(686,393)	(700,121)
15 Furniture Replacement Program		-	-	-	-	-	-	-	-	-
15 Carpet Replacement		-	-	-	-	-	-	-	-	-
15 Elevator Upgrades		-	-	-	-	-	-	-	-	-
15 Parking Lot Repairs		-	-	-	-	-	-	-	-	-
15 Washroom Upgrades		-	-	-	-	-	-	-	-	-
16 General Tenant Improvements		-	-	-	-	-	-	-	-	-
17 Construction Costs		-	-	-	-	-	-	-	-	-
18 FF&E, Move Allowance, IT		-	-	-	-	-	-	-	-	-
Total Capital Items		(597,546)	(609,497)	(621,687)	(634,121)	(646,803)	(659,739)	(672,934)	(686,393)	(700,121)

SECTION D										
19 Acquisitions		-	-	-	-	-	-	-	-	-
20 Dispositions		-	-	-	-	-	-	-	-	-
21 Terminal Value		-	-	-	-	-	-	-	-	-
CASH FLOW (CF)		(9,504,219)	(9,694,303)	(9,888,189)	(10,085,953)	(10,287,672)	(10,493,426)	(10,703,294)	(10,917,360)	(11,135,707)

PV of CF
22 Discount Rate

APPENDIX 5

SCNENARIO 2A - CONSTRUCT NEW OFFICE BUILDING

All Figures in (\$CDN) unless otherwise specified.

- 1 Expense Growth Rate:
- 2 Occupied Office Area (SF):

	Area (SF)	37 2049	38 2050	39 2051	40 2052
SECTION A					
Note					
Base Rent					
VPC Tower \$/SF		-	-	-	-
3 VPC Tower	225,000	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-
3 VPC Annex Office	51,600	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-
3 VPC Annex Industrial	34,400	-	-	-	-
VPC Fleet Building \$/SF		11.00	11.22	11.44	11.67
3/9 VPC Fleet Building	35,000	(549,970)	(560,969)	(572,188)	(583,632)
Atria - Suite 801 \$/SF		-	-	-	-
4 Atria - Suite 801	19,900	-	-	-	-
Atria - Suite 401 \$/SF		-	-	-	-
4 Atria - Suite 401	48,226	-	-	-	-
Atria - Suite 132 \$/SF		-	-	-	-
4/5 Atria - Suite 132	5,720	-	-	-	-
Atria - Suite 1700 \$/SF		-	-	-	-
4 Atria - Suite 1700	13,497	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-
6 Atria - New Suite	18,000	-	-	-	-
New Tower \$/SF		-	-	-	-
7 New Tower	375,000	-	-	-	-
Total Base Rent		(549,970)	(560,969)	(572,188)	(583,632)
SECTION B					
Operating Expenses					
VPC Tower \$/SF		-	-	-	-
8 VPC Tower - OPEX & FC	225,000	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-
8 VPC Annex Office - OPEX & FC	51,600	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-
8 VPC Annex Industrial - OPEX & FC	34,400	-	-	-	-
VPC Fleet Building \$/SF		11.40	11.62	11.86	12.09
9 VPC Fleet Building - OPEX & FC	35,000	(569,837)	(581,234)	(592,859)	(604,716)
Atria - Suite 801 \$/SF		-	-	-	-
10 Atria - Suite 801 - T&O	19,900	-	-	-	-
Atria - Suite 401 \$/SF		-	-	-	-
10 Atria - Suite 401 - T&O	48,226	-	-	-	-
Atria - Suite 132 \$/SF		-	-	-	-
10 Atria - Suite 132 - T&O	5,720	-	-	-	-
Atria - Suite 1700 \$/SF		-	-	-	-
10 Atria - Suite 1700 - T&O	13,497	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-
10 Atria - New Suite - T&O	18,000	-	-	-	-
New Tower \$/SF		37.55	38.31	39.07	39.85
11 New Tower - T&O	375,000	(14,082,872)	(14,364,530)	(14,651,820)	(14,944,857)
Atria - # of parking Stalls		-	-	-	-
12 Atria Parking		-	-	-	-
Total Taxes & Operating Costs		(14,652,709)	(14,945,764)	(15,244,679)	(15,549,573)
Gross Rental Expense		(15,202,679)	(15,506,733)	(15,816,867)	(16,133,205)
Other Expenses Items					
13 Designated Substance Remediation		-	-	-	-
13 Remediation Move Costs		-	-	-	-
13 Designated Substance Maintenance		-	-	-	-
Total Other Expense Items		-	-	-	-
Total Expense		(15,202,679)	(15,506,733)	(15,816,867)	(16,133,205)
SECTION C					
Capital Items					
14 General Capital Allowance		(1,019,944)	(1,040,343)	(1,061,149)	(1,082,372)
15 Furniture Replacement Program		-	-	-	-
15 Carpet Replacement		-	-	-	-
15 Elevator Upgrades		-	-	-	-
15 Parking Lot Repairs		-	-	-	-
15 Washroom Upgrades		-	-	-	-
16 General Tenant Improvements		-	-	-	-
17 Construction Costs		-	-	-	-
18 FF&E, Move Allowance, IT		-	-	-	-
Total Capital Items		(1,019,944)	(1,040,343)	(1,061,149)	(1,082,372)
SECTION D					
19 Acquisitions		-	-	-	-
20 Dispositions		-	-	-	-
21 Terminal Value		-	-	-	142,602,562
CASH FLOW (CF)		(16,222,623)	(16,547,075)	(16,878,017)	125,386,985
PV of CF					
22 Discount Rate					

2A - Notes

- 1 Based on average CPI growth - All Items(1992-2011) Source: Statistics Canada.
- 2 Occupied area varies up to 2015 based on expansions and expiries within Atria & alternaive property.
- 3 No internal base rent assumed for VPC components.
- 4 All Atria lease information provided by EGD. Assumed that Atria space is committed until end of 2016.
- 5 Atria Suite 132 expires 05/2013. EGD does not intend to renew this suite.
- 6 Not applicable in this scenario
- 7 Not applicable in this scenario
- 8 All VPC Operating Expenses provided by EGD. See "Operating Expense Base Calculation" contained herein. Assumes that Annex and Fleet buildings are demolished in 2013.
- 9 Assumes that as VPC is sold, a new Fleet facility will be leased with Taxes & Operating costs occupancy equal to current facility.
- 10 Based on Atria posted estimated Tax & Operating costs provided by EGD & Colliers International
- 11 Assumes Class "A" Taxes & Operating Costs similar to Atria. Suburban rates will be less.
- 12 EGD currently rents approximately 286 parking spaces at Atria. As EGD leases additional space, additional parking is assumed at a rate of \$75/month/stall inflated annually at Expense Growth Rate based on 1 stall/500 sf of leased space.
- 13 All information regarding the designated substance remediation are based on estimates provided by EGD management. No investment would be made based on scheduled demolition in 2016. Assumes maintenance costs only.
- 14 Based on estimates by EGD management regarding general non-scheduled annual capital spend. Increased annually by Expense Growth Rate.
- 15 All information with respect to Capital Items provided by EGD as identified on 2011 Report - Appendix N. - Not applicable to this scenario.
- 16 Assumes that EGD specific improvements or renovations above and beyond landlord tenant inducements will be required at \$25 psf.
- 17 Costs associated with construction of new tower
- 18 Allowance for furniture, fixtures & equipment, move costs and IT costs associated with all scenarios in which EGD does not occupy VPC in its current state.
- 19 Not applicable in this scenario
- 20 Proceeds from sale of VPC based on high value see Section 6.3
- 21 Not applicable in this scenario
- 22 EGD Weighted Average Cost of Capital (WACC) as identified in 2011 Report.

APPENDIX 5

SCENARIO 2B - CONSTRUCT NEW OFFICE BUILDING ON VPC WEST (LEASE BACK), SELL VPC EAST - CASH FLOW

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:		2.00%							
2	Occupied Office Area (SF):		363,943	376,223	376,223	375,000	375,000	375,000	375,000	375,000
		Area (SF)	1	2	3	4	5	6	7	8
			2013	2014	2015	2016	2017	2018	2019	2020
			2021							
SECTION A										
Note										
	Base Rent									
	VPC Tower \$/SF		-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF		-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF		-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF		-	5.50	5.61	5.72	5.84	5.95	6.07	6.19
3/9	VPC Fleet Building	35,000	-	(275,000)	(280,500)	(286,110)	(291,832)	(297,669)	(303,622)	(309,695)
	Atria - Suite 801 \$/SF		11.88	12.00	12.00	12.00	-	-	-	-
4	Atria - Suite 801	19,900	(236,412)	(238,800)	(238,800)	(238,800)	-	-	-	-
	Atria - Suite 401 \$/SF		12.00	12.00	12.00	12.00	-	-	-	-
4	Atria - Suite 401	48,226	(578,712)	(578,712)	(578,712)	(578,712)	-	-	-	-
	Atria - Suite 132 \$/SF		5.00	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	(28,600)	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF		12.00	13.33	14.00	14.00	-	-	-	-
4	Atria - Suite 1700	13,497	(161,964)	(179,915)	(188,958)	(188,958)	-	-	-	-
	Atria - New Suite \$/SF		-	-	-	-	-	-	-	-
6	Atria - New Suite	18,000	-	-	-	-	-	-	-	-
	New Tower \$/SF		-	-	-	24.38	24.38	24.38	24.38	24.38
7	New Tower	375,000	-	-	-	(9,141,802)	(9,141,802)	(9,141,802)	(9,141,802)	(9,141,802)
	Total Base Rent		(1,005,688)	(1,272,427)	(1,286,970)	(10,434,382)	(9,433,634)	(9,439,471)	(9,445,424)	(9,451,497)
										(10,207,690)
SECTION B										
	Operating Expenses									
	VPC Tower \$/SF		12.57	12.82	13.08	-	-	-	-	-
8	VPC Tower - OPEX & FC	225,000	(2,827,988)	(2,884,548)	(2,942,239)	-	-	-	-	-
	VPC Annex Office \$/SF		12.57	12.82	13.08	-	-	-	-	-
8	VPC Annex Office - OPEX & FC	51,600	(648,552)	(661,523)	(674,753)	-	-	-	-	-
	VPC Annex Industrial \$/SF		5.59	5.70	5.81	-	-	-	-	-
8	VPC Annex Industrial - OPEX & FC	34,400	(192,191)	(196,035)	(199,956)	-	-	-	-	-
	VPC Fleet Building \$/SF		5.59	5.70	5.81	5.93	6.05	6.17	6.29	6.42
9	VPC Fleet Building - OPEX & FC	35,000	(195,543)	(284,934)	(290,633)	(296,446)	(302,375)	(308,422)	(314,591)	(320,882)
	Atria - Suite 801 \$/SF		18.41	18.78	19.15	19.54	-	-	-	-
10	Atria - Suite 801 - T&O	19,900	(366,359)	(373,686)	(381,160)	(388,783)	-	-	-	-
	Atria - Suite 401 \$/SF		18.41	18.78	19.15	19.54	-	-	-	-
10	Atria - Suite 401 - T&O	48,226	(887,841)	(905,597)	(923,709)	(942,184)	-	-	-	-
	Atria - Suite 132 \$/SF		7.67	-	-	-	-	-	-	-
10	Atria - Suite 132 - T&O	5,720	(43,872)	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF		18.41	18.78	19.15	19.54	-	-	-	-
10	Atria - Suite 1700 - T&O	13,497	(248,480)	(253,449)	(258,518)	(263,689)	-	-	-	-
	Atria - New Suite \$/SF		-	-	-	-	-	-	-	-
10	Atria - New Suite - T&O	18,000	-	-	-	-	-	-	-	-
	New Tower \$/SF		-	-	-	19.54	19.93	20.33	20.73	21.15
11	New Tower - T&O	375,000	-	-	-	(7,326,315)	(7,472,841)	(7,622,298)	(7,774,744)	(7,930,239)
	Atria - # of parking Stalls		286.00	270.00	270.00	270.00	-	-	-	-
12	Atria Parking		(257,400)	(247,860)	(252,817)	(257,874)	-	-	-	-
	Total Taxes & Operating Costs		(5,668,226)	(5,807,633)	(5,923,786)	(9,475,289)	(7,775,216)	(7,930,720)	(8,089,334)	(8,251,121)
										(8,416,143)
	Gross Rental Expense		(6,673,914)	(7,080,060)	(7,210,756)	(19,909,671)	(17,208,850)	(17,370,191)	(17,534,758)	(17,702,618)
										(18,623,834)
	Other Expense Items									
13	Designated Substance Remediation		-	-	-	-	-	-	-	-
13	Remediation Move Costs		-	-	-	-	-	-	-	-
13	Designated Substance Maintenance		(100,000)	(100,000)	(100,000)	-	-	-	-	-
	Total Other Expense Items		(100,000)	(100,000)	(100,000)	-	-	-	-	-
	Total Expense		(6,773,914)	(7,180,060)	(7,310,756)	(19,909,671)	(17,208,850)	(17,370,191)	(17,534,758)	(17,702,618)
										(18,623,834)
SECTION C										
	Capital Items									
14	General Capital Allowance		(500,000)	(510,000)	(520,200)	(530,604)	(541,216)	(552,040)	(563,081)	(574,343)
15	Furniture Replacement Program		-	-	-	-	-	-	-	-
15	Carpet Replacement		-	-	-	-	-	-	-	-
15	Elevator Upgrades		-	-	-	-	-	-	-	-
15	Parking Lot Repairs		-	-	-	-	-	-	-	-
15	Washroom Upgrades		-	-	-	-	-	-	-	-
16	General Tenant Improvements		-	-	-	-	-	-	-	-
17	Construction Costs		-	-	-	-	-	-	-	-
18	FF&E, Move Allowance, IT		-	-	(5,267,025)	-	-	-	-	-
	Total Capital Items		(500,000)	(510,000)	(5,787,225)	(530,604)	(541,216)	(552,040)	(563,081)	(574,343)
										(585,830)
SECTION D										
19	Acquisitions		-	-	-	-	-	-	-	-
20	Dispositions	30,219,750	-	-	-	-	-	-	-	-
21	Terminal Value		-	-	-	-	-	-	-	-
	CASH FLOW (CF)		22,945,836	(7,690,060)	(13,097,981)	(20,440,275)	(17,750,066)	(17,922,231)	(18,097,840)	(18,276,960)
										(19,209,664)
	PV of CF		(270,989,023)							
22	Discount Rate		5.72%							

APPENDIX 5

SCENARIO 2B - CONSTRUCT NEW OFFICE BUILDING

All Figures in (\$CDN) unless otherwise specified.

1	Expense Growth Rate:									
2	Occupied Office Area (SF):	375,000	375,000	375,000	375,000	375,000	375,000	375,000	375,000	375,000

	Area (SF)	10 2022	11 2023	12 2024	13 2025	14 2026	15 2027	16 2028	17 2029	18 2030

SECTION A

Note

Base Rent										
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Tower	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Office	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
3	VPC Annex Industrial	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	6.44	6.57	6.70	6.84	6.98	7.11	7.26	7.40	7.55
3/9	VPC Fleet Building	35,000	(322,206)	(328,650)	(335,223)	(341,928)	(348,766)	(355,742)	(362,857)	(370,114)
	Atria - Suite 801 \$/SF	-	-	-	-	-	-	-	-	-
4	Atria - Suite 801	19,900	-	-	-	-	-	-	-	-
	Atria - Suite 401 \$/SF	-	-	-	-	-	-	-	-	-
4	Atria - Suite 401	48,226	-	-	-	-	-	-	-	-
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
4/5	Atria - Suite 132	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	-	-	-	-	-	-	-	-	-
4	Atria - Suite 1700	13,497	-	-	-	-	-	-	-	-
	Atria - New Suite \$/SF	-	-	-	-	-	-	-	-	-
6	Atria - New Suite	18,000	-	-	-	-	-	-	-	-
	New Tower \$/SF	26.38	26.38	26.38	26.38	26.38	26.38	26.38	26.38	26.38
7	New Tower	375,000	(9,891,802)	(9,891,802)	(9,891,802)	(9,891,802)	(10,641,802)	(10,641,802)	(10,641,802)	(10,641,802)
	Total Base Rent		(10,214,008)	(10,220,452)	(10,227,025)	(10,233,730)	(10,990,568)	(10,997,544)	(11,004,659)	(11,011,916)

SECTION B

Operating Expenses										
	VPC Tower \$/SF	-	-	-	-	-	-	-	-	-
8	VPC Tower - OPEX & FC	225,000	-	-	-	-	-	-	-	-
	VPC Annex Office \$/SF	-	-	-	-	-	-	-	-	-
8	VPC Annex Office - OPEX & FC	51,600	-	-	-	-	-	-	-	-
	VPC Annex Industrial \$/SF	-	-	-	-	-	-	-	-	-
8	VPC Annex Industrial - OPEX & FC	34,400	-	-	-	-	-	-	-	-
	VPC Fleet Building \$/SF	6.68	6.81	6.95	7.09	7.23	7.37	7.52	7.67	7.82
9	VPC Fleet Building - OPEX & FC	35,000	(333,846)	(340,523)	(347,333)	(354,280)	(361,366)	(368,593)	(375,965)	(383,484)
	Atria - Suite 801 \$/SF	-	-	-	-	-	-	-	-	-
10	Atria - Suite 801 - T&O	19,900	-	-	-	-	-	-	-	-
	Atria - Suite 401 \$/SF	-	-	-	-	-	-	-	-	-
10	Atria - Suite 401 - T&O	48,226	-	-	-	-	-	-	-	-
	Atria - Suite 132 \$/SF	-	-	-	-	-	-	-	-	-
10	Atria - Suite 132 - T&O	5,720	-	-	-	-	-	-	-	-
	Atria - Suite 1700 \$/SF	-	-	-	-	-	-	-	-	-
10	Atria - Suite 1700 - T&O	13,497	-	-	-	-	-	-	-	-
	Atria - New Suite \$/SF	-	-	-	-	-	-	-	-	-
10	Atria - New Suite - T&O	18,000	-	-	-	-	-	-	-	-
	New Tower \$/SF	22.00	22.44	22.89	23.35	23.82	24.29	24.78	25.27	25.78
11	New Tower - T&O	375,000	(8,250,620)	(8,415,633)	(8,583,945)	(8,755,624)	(8,930,737)	(9,109,352)	(9,291,539)	(9,477,369)
	Atria - # of parking Stalls	-	-	-	-	-	-	-	-	-
12	Atria Parking	-	-	-	-	-	-	-	-	-
	Total Taxes & Operating Costs		(8,584,466)	(8,756,156)	(8,931,279)	(9,109,904)	(9,292,102)	(9,477,944)	(9,667,503)	(9,860,853)
	Gross Rental Expense		(18,798,475)	(18,976,608)	(19,158,304)	(19,343,634)	(20,282,671)	(20,475,488)	(20,672,162)	(20,872,769)
	Other Expenses Items									
13	Designated Substance Remediation	-	-	-	-	-	-	-	-	-
13	Remediation Move Costs	-	-	-	-	-	-	-	-	-
13	Designated Substance Maintenance	-	-	-	-	-	-	-	-	-
	Total Other Expense Items		-	-	-	-	-	-	-	-
	Total Expense		(18,798,475)	(18,976,608)	(19,158,304)	(19,343,634)	(20,282,671)	(20,475,488)	(20,672,162)	(20,872,769)

SECTION C

Capital Items										
14	General Capital Allowance	(597,546)	(609,497)	(621,687)	(634,121)	(646,803)	(659,739)	(672,934)	(686,393)	(700,121)
15	Furniture Replacement Program	-	-	-	-	-	-	-	-	-
15	Carpet Replacement	-	-	-	-	-	-	-	-	-
15	Elevator Upgrades	-	-	-	-	-	-	-	-	-
15	Parking Lot Repairs	-	-	-	-	-	-	-	-	-
15	Washroom Upgrades	-	-	-	-	-	-	-	-	-
16	General Tenant Improvements	-	-	-	-	-	-	-	-	-
17	Construction Costs	-	-	-	-	-	-	-	-	-
18	FF&E, Move Allowance, IT	-	-	-	-	-	-	-	-	-
	Total Capital Items		(597,546)	(609,497)	(621,687)	(634,121)	(646,803)	(659,739)	(672,934)	(686,393)

SECTION D

19	Acquisitions	-	-	-	-	-	-	-	-	-
20	Dispositions	-	-	-	-	-	-	-	-	-
21	Terminal Value	-	-	-	-	-	-	-	-	-
	CASH FLOW (CF)		(19,396,021)	(19,586,105)	(19,779,991)	(19,977,755)	(20,929,474)	(21,135,228)	(21,345,096)	(21,559,162)

PV of CF

22 Discount Rate

22 *Discount Rate*

APPENDIX 5

SCNENARIO 2B - CONSTRUCT NEW OFFICE BUILDING

All Figures in (\$CDN) unless otherwise specified.

- 1 Expense Growth Rate:
- 2 Occupied Office Area (SF):

	Area (SF)	37 2049	38 2050	39 2051	40 2052
SECTION A					
Note					
Base Rent					
VPC Tower \$/SF		-	-	-	-
3 VPC Tower	225,000	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-
3 VPC Annex Office	51,600	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-
3 VPC Annex Industrial	34,400	-	-	-	-
VPC Fleet Building \$/SF		11.00	11.22	11.44	11.67
3/9 VPC Fleet Building	35,000	(549,970)	(560,969)	(572,188)	(583,632)
Atria - Suite 801 \$/SF		-	-	-	-
4 Atria - Suite 801	19,900	-	-	-	-
Atria - Suite 401 \$/SF		-	-	-	-
4 Atria - Suite 401	48,226	-	-	-	-
Atria - Suite 132 \$/SF		-	-	-	-
4/5 Atria - Suite 132	5,720	-	-	-	-
Atria - Suite 1700 \$/SF		-	-	-	-
4 Atria - Suite 1700	13,497	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-
6 Atria - New Suite	18,000	-	-	-	-
New Tower \$/SF		30.75	30.75	32.75	32.75
7 New Tower	375,000	(11,530,145)	(11,530,145)	(12,280,145)	(12,280,145)
Total Base Rent		(12,080,115)	(12,091,114)	(12,852,333)	(12,863,777)
SECTION B					
Operating Expenses					
VPC Tower \$/SF		-	-	-	-
8 VPC Tower - OPEX & FC	225,000	-	-	-	-
VPC Annex Office \$/SF		-	-	-	-
8 VPC Annex Office - OPEX & FC	51,600	-	-	-	-
VPC Annex Industrial \$/SF		-	-	-	-
8 VPC Annex Industrial - OPEX & FC	34,400	-	-	-	-
VPC Fleet Building \$/SF		11.40	11.62	11.86	12.09
9 VPC Fleet Building - OPEX & FC	35,000	(569,837)	(581,234)	(592,859)	(604,716)
Atria - Suite 801 \$/SF		-	-	-	-
10 Atria - Suite 801 - T&O	19,900	-	-	-	-
Atria - Suite 401 \$/SF		-	-	-	-
10 Atria - Suite 401 - T&O	48,226	-	-	-	-
Atria - Suite 132 \$/SF		-	-	-	-
10 Atria - Suite 132 - T&O	5,720	-	-	-	-
Atria - Suite 1700 \$/SF		-	-	-	-
10 Atria - Suite 1700 - T&O	13,497	-	-	-	-
Atria - New Suite \$/SF		-	-	-	-
10 Atria - New Suite - T&O	18,000	-	-	-	-
New Tower \$/SF		37.55	38.31	39.07	39.85
11 New Tower - T&O	375,000	(14,082,872)	(14,364,530)	(14,651,820)	(14,944,857)
Atria - # of parking Stalls		-	-	-	-
12 Atria Parking		-	-	-	-
Total Taxes & Operating Costs		(14,652,709)	(14,945,764)	(15,244,679)	(15,549,573)
Gross Rental Expense		(26,732,824)	(27,036,878)	(28,097,012)	(28,413,350)
Other Expenses Items					
13 Designated Substance Remediation		-	-	-	-
13 Remediation Move Costs		-	-	-	-
13 Designated Substance Maintenance		-	-	-	-
Total Other Expense Items		-	-	-	-
Total Expense		(26,732,824)	(27,036,878)	(28,097,012)	(28,413,350)
SECTION C					
Capital Items					
14 General Capital Allowance		(1,019,944)	(1,040,343)	(1,061,149)	(1,082,372)
15 Furniture Replacement Program		-	-	-	-
15 Carpet Replacement		-	-	-	-
15 Elevator Upgrades		-	-	-	-
15 Parking Lot Repairs		-	-	-	-
15 Washroom Upgrades		-	-	-	-
16 General Tenant Improvements		-	-	-	-
17 Construction Costs		-	-	-	-
18 FF&E, Move Allowance, IT		-	-	-	-
Total Capital Items		(1,019,944)	(1,040,343)	(1,061,149)	(1,082,372)
SECTION D					
19 Acquisitions		-	-	-	-
20 Dispositions		-	-	-	-
21 Terminal Value		-	-	-	-
CASH FLOW (CF)		(27,752,768)	(28,077,220)	(29,158,162)	(29,495,722)
PV of CF					
22 Discount Rate					

2B - Notes

- 1 Based on average CPI growth - All Items(1992-2011) Source: Statistics Canada.
- 2 Occupied area varies up to 2015 based on expansions and expiries within Atria & alternaive property.
- 3 No internal base rent assumed for VPC components.
- 4 All Atria lease information provided by EGD. Assumed that Atria space is committed until end of 2016.
- 5 Atria Suite 132 expires 05/2013. EGD does not intend to renew this suite.
- 6 Not applicable in this scenario
- 7 Not applicable in this scenario
- 8 All VPC Operating Expenses provided by EGD. See "Operating Expense Base Calculation" contained herein. Assumes that Annex and Fleet buildings are demolished in 2013.
- 9 Assumes that as VPC is sold, a new Fleet facility will be leased with Taxes & Operating costs occupancy equal to current facility.
- 10 Based on Atria posted estimated Tax & Operating costs provided by EGD & Colliers International
- 11 Assumes Class "A" Taxes & Operating Costs similar to Atria. Suburban rates will be less.
- 12 EGD currently rents approximately 286 parking spaces at Atria. As EGD leases additional space, additional parking is assumed at a rate of \$75/month/stall inflated annually at Expense Growth Rate based on 1 stall/500 sf of leased space.
- 13 All information regarding the designated substance remediation are based on estimates provided by EGD management. No investment would be made based on scheduled demolition in 2016. Assumes maintenance costs only.
- 14 Based on estimates by EGD management regarding general non-scheduled annual capital spend. Increased annually by Expense Growth Rate.
- 15 All information with respect to Capital Items provided by EGD as identified on 2011 Report - Appendix N. - Not applicable to this scenario.
- 16 Assumes that EGD specific improvements or renovations above and beyond landlord tenant inducements will be required at \$25 psf.
- 17 Costs associated with relocation of data centre. As per 2011 Report and provided by EGD. Inflated by 2% annually.
- 18 Allowance for furniture, fixtures & equipment, move costs and IT costs associated with all scenarios in which EGD does not occupy VPC in its current state.
- 19 Not applicable in this scenario
- 20 Proceeds from sale of VPC based on high value see Section 6.3
- 21 Not applicable in this scenario
- 22 EGD Weighted Average Cost of Capital (WACC) as identified in 2011 Report.

APPENDIX 6

CONSTRUCTION COSTS ESTIMATE - NEW BUILDING - Land Included

All Figures in (\$CDN) unless otherwise specified.

SECTION A

Note

	Area Statistics:	Area (SF)
1	Above-Grade Area (GLA)	375,000
2	Average Floor Plate Area (GFA)	21,000
	Number of Floors - Above Grade	18

SECTION B

	Construction Cost Summary	#Units	Unit	2013	2014	2015	Total	\$/Unit
3	Demolition Costs	346,000	SF	605,000	-	1,125,000.00	1,730,000	5.00
4	Hard Costs	375,000	GLA	-	47,250,000	31,500,000	78,750,000	210.00
5	Architectural (5% of Hard Costs)	375,000	GLA	1,575,000	1,378,125	984,375	3,937,500	10.50
5	Engineering/Consultants (5% of Hard Costs)	375,000	GLA	1,575,000	1,378,125	984,375	3,937,500	10.50
6	Development Charges	375,000	GLA	245,626	-	-	245,626	0.66
7	Site Plan Control	375,000	GLA	89,733	-	-	89,733	0.25
8	Education Development	375,000	GLA	217,500	-	-	217,500	0.58
9	Building Permit	375,000	GLA	706,528	-	-	706,528	1.88
	Legal	375,000	GLA	33,333	33,333	33,333	100,000	0.27
	Sub Total	375,000	GLA	5,047,720	50,039,583	34,627,083	89,714,387	234.64
5	Contingency (5%)	375,000	GLA	1,495,238	1,495,238	1,495,238	4,485,719	11.96
10	Construction Management/Developer Fees (2.5%)	-		747,620	747,620	747,620	2,242,860	5.98
	Total Hard & Soft Costs	375,000	GLA	6,542,959	51,534,822	36,122,322	94,200,106	251.20
11	Deck Parking	1,000	Stalls	-	9,000,000	6,000,000	15,000,000	15,000
12	Surface Parking	500	Stalls	-	1,200,000	800,000	2,000,000	4,000
	Total Parking Cost	1,500	Stalls	-	10,200,000	6,800,000	17,000,000	11,333
13	Data Centre	5,000	SF	-	-	7,000,000	7,000,000	1,400.00
14	Tenant Fit-Out	375,000	GLA	-	-	9,375,000	9,375,000	25.00
	Total Additional Construction Costs	375,000	GLA	-	-	16,375,000	16,375,000	43.67
	Total Construction Costs	375,000	GBA - SF	6,542,959	61,734,822	59,297,322	127,575,106	340.20
15	Land Cost	10	Acres	13,068,000	-	-	13,068,000	1,306,800
	Total Construction Cost - Including Land	375,000	GBA - SF	19,610,959	61,734,822	59,297,322	140,643,106	375.05
16	Furniture, Fixtures & Equipment	375,000	GBA - SF	-	-	3,901,500	3,901,500	10.00
16	IS/Telephony	375,000	GBA - SF	-	-	780,300	780,300	2.00
16	Move Costs	375,000	GBA - SF	-	-	585,225	585,225	1.50
	Total Additional EGD Costs	375,000	GBA - SF	-	-	5,267,025	5,267,025	14.05
	Total Project Cost	375,000	GBA - SF	19,610,959	61,734,822	64,564,347	145,910,131	389.09

SECTION C

	Economic Rent (Unleveraged)	
	Area Measure	375,000 GLA SF
	Project Cost - Developer (Including Land)	140,643,106
	Project Cost - Developer (Excluding Land)	127,575,106
17	Going In Yield - Developer	6.50%
	Lease Term	20 Years
18	Unleveraged IRR - Developer	7.62%

SECTION D

Economic Rent (Unleveraged)

	Including Land		Excluding Land	
Rent Schedule	Annual	\$/SF	Annual	\$/SF
Net Rent - Years 1-5	9,141,802	24.38	8,292,382	22.11
Net Rent - Years 6-10	9,891,802	26.38	8,667,382	23.11
Net Rent - Years 11-15	10,641,802	28.38	9,042,382	24.11
Net Rent - Years 16-20	11,391,802	30.38	9,417,382	25.11

Notes

- EGD stabilized occupancy in Status Quo is approx. 376k gross sf. It is assumed that a new building with greater efficiency will accommodate EGDs long-term occupancy requirements.
- Based on 2011 Report
- Cost of demolition for Fleet & Annex buildings in 2013 and VPC Tower in 2015
- Estimated based on Altus Helyar Cost Guide 2012 range of \$185-\$260 psf exluding soft costs, tenant-fit out etc.
- Industry standard allowance. Confirmed by Facility Management Group.
- Based on 2012 City of Toronto development charges. No assumptions made regarding future increases.
- As per 2011 report - \$2,513 + \$2.54 PSM over 500 SM. As per City of Toronto
- As per City of Toronto 2012 Education Development Charges. No assumptions made regarding furture increases.
- As per City of Toronto 2012 Building Permit Fees. No assumptions made regarding furture increases.
- Estimated cost for construction management, developer fees.
- As per requirements identified in 2011 Report. Cost estimated provided by Facility Management Group.
- As per requirements identified in 2011 Report. Cost estimated provided by Facility Management Group.
- As per 2011 Report. Cost estimated provided by EGD.
- Construction costs above do not include allowance for tenant fit-out or, finishing of space.
- See "Section B - Land Valuation Matrix" contained herein
- Cost estimate validated by Facility Management Group
- Assumed minimum initial yield required to rationalize development based on EGD tenancy.
- Unleveraged Internal Rate of Return to developer based on estimated rental increases.

APPENDIX 7

CONSTRUCTION COSTS ESTIMATE - NEW BUILDING - Land Excluded

All Figures in (\$CDN) unless otherwise specified.

SECTION A

Note

	Area Statistics:	Area (SF)
1	Above-Grade Area (GLA)	375,000
2	Average Floor Plate Area (GFA)	21,000
	Number of Floors - Above Grade	18

SECTION B

	Construction Cost Summary	#Units	Unit	2013	2014	2015	Total	\$/Unit
3	Demolition Costs	346,000	SF	605,000	-	1,125,000.00	1,730,000	5.00
4	Hard Costs	375,000	GLA	-	47,250,000	31,500,000	78,750,000	210.00
5	Architectural (5% of Hard Costs)	375,000	GLA	1,575,000	1,378,125	984,375	3,937,500	10.50
5	Engineering/Consultants (5% of Hard Costs)	375,000	GLA	1,575,000	1,378,125	984,375	3,937,500	10.50
6	Development Charges	375,000	GLA	245,626	-	-	245,626	0.66
7	Site Plan Control	375,000	GLA	89,733	-	-	89,733	0.25
8	Education Development	375,000	GLA	217,500	-	-	217,500	0.58
9	Building Permit	375,000	GLA	706,528	-	-	706,528	1.88
	Legal	375,000	GLA	33,333	33,333	33,333	100,000	0.27
	Sub Total	375,000	GLA	5,047,720	50,039,583	34,627,083	89,714,387	234.64
5	Contingency (5%)	375,000	GLA	1,495,238	1,495,238	1,495,238	4,485,719	11.96
10	Construction Management/Developer Fees (2.5%)	-		747,620	747,620	747,620	2,242,860	5.98
	Total Hard & Soft Costs	375,000	GLA	6,542,959	51,534,822	36,122,322	94,200,106	251.20
11	Deck Parking	1,000	Stalls	-	9,000,000	6,000,000	15,000,000	15,000
12	Surface Parking	500	Stalls	-	1,200,000	800,000	2,000,000	4,000
	Total Parking Cost	1,500	Stalls	-	10,200,000	6,800,000	17,000,000	11,333
13	Data Centre	5,000	SF	-	-	7,000,000	7,000,000	1,400.00
14	Tenant Fit-Out	375,000	GLA	-	-	9,375,000	9,375,000	25.00
	Total Additional Construction Costs	375,000	GLA	-	-	16,375,000	16,375,000	43.67
	Total Construction Costs	375,000	GBA - SF	6,542,959	61,734,822	59,297,322	127,575,106	340.20
15	Land Cost	10	Acres	-	-	-	-	-
	Total Construction Cost - Including Land	375,000	GBA - SF	6,542,959	61,734,822	59,297,322	127,575,106	340.20
16	Furniture, Fixtures & Equipment	375,000	GBA - SF	-	-	3,901,500	3,901,500	10.00
16	IS/Telephony	375,000	GBA - SF	-	-	780,300	780,300	2.00
16	Move Costs	375,000	GBA - SF	-	-	585,225	585,225	1.50
	Total Additional EGD Costs	375,000	GBA - SF	-	-	5,267,025	5,267,025	14.05
	Total Project Cost	375,000	GBA - SF	6,542,959	61,734,822	64,564,347	132,842,131	354.25

SECTION C

	Economic Rent (Unleveraged)		
	Area Measure	375,000	GLA SF
	Project Cost - Developer (Including Land)	127,575,106	
	Project Cost - Developer (Excluding Land)	127,575,106	
17	Going In Yield - Developer	6.50%	
	Lease Term	20 Years	
18	Unleveraged IRR - Developer	7.73%	

SECTION D

Economic Rent (Unleveraged)

	Including Land		Excluding Land	
Rent Schedule	Annual	\$/SF	Annual	\$/SF
Net Rent - Years 1-5	8,292,382	22.11	8,292,382	22.11
Net Rent - Years 6-10	9,042,382	24.11	8,667,382	23.11
Net Rent - Years 11-15	9,792,382	26.11	9,042,382	24.11
Net Rent - Years 16-20	10,542,382	28.11	9,417,382	25.11

Notes

- EGD stabilized occupancy in Status Quo is approx. 376k gross sf. It is assumed that a new building with greater efficiency will accommodate EGDs long-term occupancy requirements.
- Based on 2011 Report
- Cost of demolition for Fleet & Annex buildings in 2013 and VPC Tower in 2015
- Estimated based on Altus Helyar Cost Guide 2012 range of \$185-\$260 psf excluding soft costs, tenant-fit out etc.
- Industry standard allowance. Confirmed by Facility Management Group.
- Based on 2012 City of Toronto development charges. No assumptions made regarding future increases.
- As per 2011 report - \$2,513 + \$2.54 PSM over 500 SM. As per City of Toronto
- As per City of Toronto 2012 Education Development Charges. No assumptions made regarding future increases.
- As per City of Toronto 2012 Building Permit Fees. No assumptions made regarding future increases.
- Estimated cost for construction management, developer fees.
- As per requirements identified in 2011 Report. Cost estimated provided by Facility Management Group.
- As per requirements identified in 2011 Report. Cost estimated provided by Facility Management Group.
- As per 2011 Report. Cost estimated provided by EGD.
- Construction costs above do not include allowance for tenant fit-out or, finishing of space.
- See "Section B - Land Valuation Matrix" contained herein
- Cost estimate validated by Facility Management Group
- Assumed minimum initial yield required to rationalize development based on EGD tenancy.
- Unleveraged Internal Rate of Return to developer based on estimated rental increases.

SEC INTERROGATORY #111

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/5] Please provide, for each of the tables in Tab 5 of Exhibit B2, an expanded version of the table showing 2007 through 2012 actuals, and 2013 forecast actuals (9+3 or 10+2).

RESPONSE

Historically, pre-2013, the Company did not track capital expenditures using the same categorization as specified in the Exhibit B2, Tab 5, Schedules 1 to 6. In 2013, EGD began categorizing the System Integrity and Reliability in the same manner as filed in the B2 Exhibits. Table 1 below shows the historic profile at a summary level as identified in Table 2 of Exhibit B2, Tab 5, Schedule 1, page 8. Please note that the contractor fixed costs which are a component of line item 5 System Integrity Resource Costs, for 2013 and beyond are embedded in lines 1 and 2 for years 2007 to 2012. Table 2 below provides the 2013 9+3 Forecast of each respective line item from Table 1 in the more granular format as filed in the exhibits at B2, Tab 5, Schedules 1 to 6. As noted above, this categorization of capital expenditures is not available for the years prior to 2013.

Witnesses: L. Lawler
J. Sanders

Table 1													
System Integrity and Reliability - Actuals 2007-2012 and Forecast 2013-2016													
(\$K's)													
Line Number			Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Per B2-5-1 Table 2			
			2007 Actual	2008 Actual	2009 Actual	2010 Actual	2011 Actual	2012 Actual	2013 (9+3) Forecast	2013 Budget	2014 Forecast	2015 Forecast	2016 Forecast
1	Mains Replacement		22,853	25,281	24,660	30,404	30,731	29,764	29,100	18,237	24,604	24,098	22,110
2	Service Replacement		31,750	22,153	28,867	39,579	36,842	38,577	25,300	17,814	21,118	25,011	41,216
3	Station Replacement		10,746	8,019	3,860	7,599	10,246	12,015	13,000	15,767	23,990	26,442	24,517
4	Other System Integrity and Reliability		25,215	22,447	22,362	20,328	25,448	37,476	40,994	32,906	41,808	42,650	35,810
5	System Integrity Direct Resource Costs		2,501	2,727	2,621	2,747	3,359	6,731	12,911	15,330	20,813	16,925	17,449
6	Total System Integrity and Reliability		93,065	80,627	82,370	100,657	106,626	124,563	121,305	100,054	132,333	135,126	141,102

Witnesses: L. Lawler
J. Sanders

Table 2						
System Integrity and Reliability - 9+3 Forecast 2013, 2013 Budget, 2014-2016 Forecast						
(\$K's)						
		Col 1	Col 2	Col 3	Col 4	Col 5
		2013 (9+3)	2013	2014	2015	2016
		Forecast	Budget	Forecast	Forecast	Forecast
1.1	Miscellaneous Replacement Mains	18,593	8,482	6,960	7,655	5,388
1.2	Compression Couplings	795	1,100	1,622	2,040	2,061
1.3	Load Shed Planning Program	-	1,000	1,145	1,171	1,194
1.4	Maximum Operating Pressure Verification Prgm	2,882	794	3,296	3,397	3,195
1.5	In Line Inspection and Assessment Prgm	6,100	6,861	11,000	8,900	8,502
1.6	Right of Way Easement Monitoring Prgm	730	-	581	935	1,770
1	Mains Replacement	29,100	18,237	24,604	24,098	22,110
2.1	Service Replacements (Misc Relays)	20,982	10,975	8,180	7,426	6,596
2.2	AMP Fitting Replacement Prgm	1,500	4,000	8,543	13,100	30,046
2.3	Compression Outlet Service Tee Replacement Prgm	2,318	1,029	2,866	2,924	2,982
2.4	Sewer Safety Prgm	500	1,839	1,530	1,561	1,592
2	Service Replacement	25,300	17,843	21,119	25,011	41,216
3.1	Gate Stations	4,928	6,642	12,160	10,440	7,060
3.2	District Station	4,950	3,201	7,977	11,625	12,560
3.3	Commercial and Industrial Low Pressure Regulator Stations	-	2,000	1,530	2,341	2,388
3.4	Paper Chart Recorders Replacement Prgm	1,673	1,673	1,758	1,794	1,830
3.5	Station Replacements and Upgrade Projects	1,449	2,251	565	602	680
3	Station Replacement	13,000	15,767	23,990	26,802	24,518
4.1	Meters and Regulator Replacement Prgm	32,600	23,520	24,169	25,911	28,115
4.2	Distribution Records Management Prgm	8,394	9,386	9,639	8,740	7,695
4.3	Envision Extension Project	-	-	8,000	8,000	-
4	Other System Integrity and Reliability	40,994	32,906	41,808	42,651	35,810
5.1	Incremental System Integrity and Reliability Resources	7,395	10,687	15,185	11,185	11,594
5.2	Construction and Service Contractor Fixed Costs	5,516	4,643	5,628	5,740	5,855
5	System Integrity Direct Resource Costs	12,911	15,330	20,813	16,925	17,449

Witnesses: L. Lawler
J. Sanders

SEC INTERROGATORY #112

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/5/1, p. 1] Please provide all reports, memoranda, business cases, and other documents in 2011 or 2012 dealing with the acceleration of the AMP Fitting Replacement program.

RESPONSE

See attached documents dealing with the AMP Fitting Replacement Program:

- Attachment 1 - AMP Fittings – DSI Project Charter
- Attachment 2 - AMP Final Report
- Attachment 3 - Jana AMP Final Report
- Attachment 4 - Enbridge Gas Distribution AMP Fitting Sampling Study Report
- Attachment 5 - EGD AMP Fitting Report

Witnesses: L. Lawler
J. Sanders

Project Charter

AMP Fittings, Study and Replacement Program



Distribution System Integrity
Project Manager(s): Oscar Khazam
Tel.: (416)758.4497
Date: 28 May 2012
Version: 1.0
Project Size: Large

Document Information

Version Control Page:

Date	Revision	Name of Person Making Change	Description of Changes
26 Jan 2012	A	Graham Campbell	Initial Draft
09-Feb-2012	B	Graham Campbell	Requirement and deliverables updated
02-April-2012	C	Oscar Khazam	Document updated for project approval
24-April-2012	Final	Oscar Khazam	Stakeholders information added
28-May-2012	D	Oscar Khazam	Second Draft to accommodate scope changes

Document Owner

The primary contact for questions regarding this document is:

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1. Project Definition

This project was created to continue the 2011 AMP Fitting Sampling Study prepared by the Engineering Department by sampling and analyzing a new list of random AMP Fittings in the Enbridge Gas Distribution (EGD) system.

2. Project Objectives

The project has the following objectives:

To enhance, document and refine the population of services with AMP fittings.

To extract a random sample of AMP fittings from the full EGD AMP Fitting population.

To subsequently use this information to further determine the parameters used to establish the best course of corrective action for a continuous replacement program.

To examine leak survey frequencies of services with AMP fittings.

To define a recommendation and plan for the next stage of the replacement program.

3. Project Benefits

Benefits Summary

- Reduction of the immediate risk of having pressure gas leaks very near to customer structures.
- Reduction of emergency response and unscheduled leak repair.
- Improvement of the overall health of the distribution system by eliminating aging AMP fittings.
- Better understanding of the overall condition of the AMP fittings in the system.

4. Scope Statement

The scope

- Determination of the population.
- Extracting sample size of replaced AMP fittings (approximately 700).
- Define analysis parameters.
- Field data collection (data collection form).
- Training on data collection and sample retrieval.
- Evaluation of samples.
- Analysis of data.
- Leak Survey Evaluation.

- A technical report.
- A recommended program plan.

Out of Scope

- Detailed paper records searches to ensure AMP fitting locations.
- The relay of services associated with the sample locations.
- The installation of new EFV's or replacement of Aldyl"A" Punch Tee caps in the associated services.

5. Project Deliverables

The project deliverables for all Phases of the project include the following

Deliverables	Milestones	Target Date (YYYY-MM-DD)
A. To identify the location and age of all assets that currently have a plastic service, with a transitional AMP fitting to a copper service riser.	A.1 Provide a complete list of locations and understand the age by install date.	2012-06-01
	A.2 Calculate sample size for the full population	2012-06-01
	A.3 Create a list of the random samples for analysis	2012-06-01
B. Extract samples representing the entire population (approximately 700)	B.1 Initiate a workload plan (AFE approvals, Project Number creations, etc)	2012-06-15
	B.2 Create Work Orders and dispatch work	2012-06-15
	B.3 Complete Work Orders and record.	2012-10-30
	B.4 Ensure that all samples are submitted.	2012-11-30
C. The Project will deliver a report and a recommendation for an Asset Replacement Program for 2013 and onwards.	C.1 Analyze samples	2012-11-30
	C.2 Prepare final study report	2012-12-30
	C.3 Recommend forward plan to Asset Management for replacement program	2012-12-30
D. Examine leak survey frequencies of services with AMP fittings.	D.1 Evaluate Leak Survey Frequencies	2012-09-30

6. Project Linkages/ Dependencies

Dependencies:

- AMP Fitting Sampling Study Report – Eng. January 2012

7. Roles and Responsibilities

Role	Includes	Responsibilities
Steering Committee/ Executive Sponsor	ORM ASSET PLAN	• Provides project directional guidance • Resolves issues that can't be resolved by the Sponsor or project team • Approves timing and content of major communications for the organization • Represents their various areas within the context of the project • Ensures the appropriate persons are identified and assigned to be Subject Matter Experts or project team members for their various areas • Identifies impacts where necessary • Acts as ambassadors for the project
Project Sponsor	Director Integrity	• Champions the project • Resolves issues that can't be resolved by the Project Team • Ensures project management team has appropriate resources • Approves project deliverables • Approves major scope changes impacting time, budget or resources • Ensures continuity of project team resources
Business Owner(s) /	Manager, DSI Program Manager, DSI	• Identifies appropriate business resources for project activities and facilitates the acquisition of their time • Provides oversight and insight for the business • Ensures requirements/specifications cover business needs and meet all corporate and regulatory policies and standards • Manages escalated business-specific issues and risks

Role	Includes	Responsibilities
		• Provide reports to department Director • Present materials to Executive Management
Business Project Manager	DSI Project Manager	• Facilitates the regular project team meetings • Manages, assigns and escalates business and joint business-IT issues, risks and scope changes • Orchestrates all required project approvals/signoffs • Maintains project documentation (e.g. Project Charter, Communication Plan, Project Plan, Updates to Operations PMO, weekly reports to Distribution System Integrity) • Manages and controls the integrated business and IT project plan • Manages some project communications • Ensures project is resourced, sequenced, and funded appropriately • Facilitates and ensures that all project team members work together effectively to complete all project requirements • Engages corporate support areas (e.g. Audit, Strategic Sourcing, Finance) for project guidance • Responsible for knowing and executing all required governance processes, following all corporate policies, standards, guidelines, and methodologies
IT Project Manager	N/A	• Delivers the technology to support the business requirements set up by the project
Dedicated Project Team Members	Integrity Technologists Integrity Analysts WMC Manager Ops/Field Mgr EMEC Mgr/Technologist	• Carries out day to day project activities as defined in the Project Plan • Identifies and escalates issues to the Project Manager • Develops deliverables on time, on budget, and within scope • Participates in regular project meetings or discussions

Role	Includes	Responsibilities
Non-Dedicated Project Team Members (SME's)	Field Personnel Workload Planners Engineering	- Carries out project activities as defined in the Project Plan - Participates in regular project meetings or discussions, as required - Acts as contact point for communication between the project team and their operations units - Provides subject matter expertise on an as needed basis - Validates project team activities

8. Project Planning Budget

Project Cost Estimate

Please refer to summary table below

Random sampling of AMP fittings in the EGD system	Jana Project Fee	Miscellaneous	Total cost of project
\$1,395,662	\$159,950	\$30,000	\$1,585,612

Project Effort Estimate

Equivalent Actual Time, no contingency made for productivity loss. Not necessarily sequential. I.e. total effort is not contiguous but concurrent with other activities.

DSI

- Program Manager – 6 weeks, 1FTE
- Project Manager – 16 weeks 3 days, 1FTE
- Technologist – 28 Weeks 2 days, 1FTE

Integrity

- Leak Survey Tech – 700 Leak Surveys, 1FTE
- Leak Survey Project Manager
- Integrity Strategy Analyst
- Asset Risk Manager

Operations

- Field Crew, 700 AMP fitting repairs and sample extractions, 2FTE
- WMC Clerk – 700 Work Packets (> 1WR per packet), 1 FTE

Engineering

- *Lab Technologist, 700 Sample studies TBD, 1FTE*

Milestone Plan

As numerous milestones exist for this program, only a selection of key milestone dates is provided for upcoming milestones.

Major Milestones	Target Date (YYYY-MM-DD)	DSI Function	Project Effort DSI Time, FTE	
A.1 Provide a complete list of locations and understand the age by install date.	2012-06-01	Project Manager Technologist	1week 1week	1 1
A.2 Calculate sample size for the full population	2012-06-01	Project Manager Technologist	1 day 1 day	1 1
A.3 Create a list for the random sample for analysis	2012-06-01	Project Manager Technologist	1 day 1 day	1 1
B.1 Initiate a workload plan (AFE approvals, Project Number creations, etc)	2012-06-15	Project Manager Technologist	1week 1week	1 1
B.2 Create Work Orders and dispatch work	2012-06-15	Project Manager Technologist	2 weeks 2 weeks	1 1
B.3 Complete Work Orders and record.	2012-10-30	Project Manager Technologist	2 weeks 11 weeks	1 1
B.4 Ensure that all samples are submitted.	2012-11-30	Project Manager Technologist	1 day 1 week	1 1
C.1 Analyze samples	2012-11-30	Project Manager Technologist	4 weeks 4 weeks	1 1
C.2 Prepare final study report	2012-12-30	Project Manager Technologist	2 weeks 2 weeks	1 1
C.3 Recommend forward plan to Asset Management for replacement program	2012-12-30	Project Manager Technologist	2 weeks 2 weeks	1 1
D.1 Evaluate Leak Survey Frequencies	2012-09-30	Project Manager Technologist	2 weeks 4 weeks	1 1
General	2012-12-31	Program Manager	6 weeks	1

9. Change Management

Stakeholder Analysis

Stakeholders	Impacts
Engineering	Application of codes and standards. EMEC Analysis Work
Field Operations	Evaluating current practices and records management
Distribution Asset Management	Records management
Integrity	Leak Survey
Work Management Centre	Evaluating current practices and records
Finance	Financial evaluation and support
Legal	Legal, confidentiality, approval

Communication Plan

Communication to Executive team through PMO Sharepoint site

10. Additional Considerations

Constraints

Business Constraints

- Resources (FTEs)
- Records Integrity

WMS Constrains

- Prioritization of projects by DSI. As a result of the specified timelines and without the knowledge of project work volumes, work will be completed by the current WMC Maintenance clerks on overtime. Based on current staffing levels, the WMC Maintenance clerks can create work for approximately 200-300 premises (3 work requests per address) in a week.

Schedule Constraints

- Weather dependency, construction windows, EMEC relocation

Assumptions

Field Force Capacity has no limitations.

Outstanding Issues

Previous investigation (2011) is missing samples from some regions. Possible time constrain to complete sampling in those regions.

Critical Success Factors (CSF)

The overall project's success is based on the following critical factors:

- Efficient communication and allocation of resources from field personnel in the different regions
- Continued support at the executive level for the project, with reinforcement from gas association guidelines and regulatory directives.

Measurement & Analysis

The project manager will monitor the following measurement efficiency indicators throughout the life cycle of this project and to ensure at the end of the project the measurements are collected and analyzed:

Currently the following efficiency indicator measurements are collected and analyzed:

- Number of AMP Fittings sampled
- Number of samples processed and analyzed

11. Appendix

Not applicable

12. Project Approvals

Note for the original project charter, all approvals were received; for subsequent version upgrades, only the executive sponsors approval is obtained.

Business Unit / Department	Name & Title	Signature or Email Approval	Date of Approval
Integrity	Lisa Lawler, Director		
Operations	Jim Alton, GM		
WMC	Mike Scarland, Group Mgr		
Distribution Asset Management	Lloyd Chiotti, Director Dist. Asset. Mgmt		
Engineering	Nick Thalassinis, Chief Eng		



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AMP Fitting Asset Management Plan: Optimizing the Repair, Replace, Inspect decision

Submitted by

BANAK Inc.

May 15, 2013



Executive Summary

We have produced a wide variety of asset management policies for the general problem of replacing the AMP fitting asset base. Each policy has O&M and Capital costs, and a measurable risk of incidents. The results are summarized in the accompanying file “Summary.xlsx”.

Background

Enbridge Gas Distribution (EGD) is Canada’s largest gas distribution utility serving about 2 million customers in central and eastern Ontario, southwestern Quebec and parts of northern New York State. EGD is required to justify its expenditures in and rates charged to customers in Ontario before the Ontario Energy Board (OEB) from time to time.

One aspect of EGD’s planned upcoming submission to the OEB will be concerned with the manner in which AMP fittings will be managed. AMP fittings connect a plastic service line and a copper riser that connects to a customer’s home. These copper risers are known to be in some degraded state and there is the potential for loss of performance due to this degradation. In upcoming years these connections to residential customers will need to be subjected to an asset management plan that includes the possibility of (i) unplanned repair based on customer report, (ii) unplanned repair based on an inspection policy, (iii) preventive replacement up to the AMP fitting, and/or (iii) preventive replacement up to the gas main (“service re-lay”).

EGD eventually wishes to develop an optimal strategy that will balance these four maintenance options, subject to maintenance resource requirements. EGD has already taken a sample of copper risers and subjected the sample to laboratory testing for the purpose of developing estimates of the population distribution of degradation. EGD has also provided other operational and financial data as required to produce an optimal asset management decision.

Methodology, Assumptions, and Data

A “policy” will consist of a mix of asset strategies as follows:

1. The number of AMP fittings that will be subject to preventive replacement.
2. The expected number of AMP fittings repairs that will be unplanned, based on customer report, leak survey, or an unforeseen incident based on the projected probabilities of each of these events in a given year.

All AMP fittings still installed are subject to an annual leak survey.



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We assume that all preventive work is done on the oldest AMP fittings first, and that leak surveys target the oldest AMP fittings.

For any policy we compute a net present value based on discounted annual costs after taxes, and we compute an equivalent annual cost, since not all scenarios are of the same length. In addition we compute the expected number of incidents each year.

The future probabilities of leaks and their detection were obtained from the January 31, 2013 report by Jana Laboratories entitled “AMP Fitting/Copper Riser Reliability Study” (the Jana Report).

The Jana Report proposes several methods to project future leak probabilities. The method we believe is the most applicable to 20 year forecasts uses the Weibull distribution that best fits to the observed failure data from the 2007 to 2011 time period, which is the Weibull distribution with $\beta = 7.0$ and $\eta = 65.1$. Projections very far into the future using this model should be reevaluated regularly.

There are two possible sources of uncertainty in these parameter estimates. The first is that it does not account from the number of AMP fittings that failed before 2007. Excluding these “left truncated” failure times can have the effect of over-estimating β and under-estimating η . We will consider this possibility and have selected $\beta = 6.5$ and $\eta = 70$ as alternative values. In addition, it was found in about 10% of surveyed cases that there is not an AMP fitting in place. We will also consider this possibility.

In general, maintenance resources are constrained. The leak survey will cover 50% in 2014, 80% in 2015, and 100% thereafter. It is considered that 1000 unplanned repairs can be managed per year without incurring increased costs or risk. It is generally planned to have the capacity to perform 4000 preventive actions in 2014, 6000 in 2015, and we will consider the possibility to perform up to 20,000 planned repairs if necessary.

We require an estimate of a probability of an incident per number of leaks, and an average cost consequence of an incident. EGD has tentatively provided a probability of 1 incident per 100,000 discovered leaks, with a cost of \$14,600,000 per incident. The probability of an incident is 1 in 50,000 for undiscovered leaks (undiscovered due to lack of leak survey coverage in 2014 and 2015 and not relevant after 2015) and 1 in 50,000 for leaks that exceed the resources required to perform 1000 reactive maintenance actions per year.

The average cost to perform a reactive repair is \$1,525. This is a weighted average of \$1,400 for the repair and a 13% chance of incurring an extra \$740 cost should the repair be prompted by a customer report (due to an \$80 emergency call cost and a 50% increase in the cost of the emergency repair itself in these cases.)



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The average cost to perform a preventive repair is \$1,400.

The average cost to perform a service re-lay is \$3,500. This is subject to a 30% premium if the re-lay is unplanned, performed in response to a leak survey or customer report. Each re-lay must be leak surveyed in the following year.

The average cost of a single leak survey is \$4, which is considered to be a maintenance cost and not a capital expenditure. Note that the cost of a leak survey is strictly speaking a capital cost when it leads to a repair/re-lay, but the dollar amount is so low that we will not consider this.

All costs above are given in 2013 dollars. These costs are to be subject to 2% annual inflation. The discount rate to be used is 5.878%. It is assumed that repairs have no salvage value at the end of any scenario. The capital cost allowance is 6% and the Ontario corporate tax rate used is 26.5%.

Capital and O&M expenditures are assumed to take place at the beginning of the year for cash flow purposes. EGD will adjust these results to follow their actual accounting practices.



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Results

We have provided several Excel spreadsheets with replacement policies and their financial implications.

Here is a description of table headers:

Total	Number of AMP fittings at beginning of year
Leaks	Number of actual leaks
D.Leaks	Number of detected leaks
Replace	Number of AMP fittings replaced
Relay	Number of planned service re-lays
Leaktest	AMP fittings to be leak surveyed
Expected.Incidents	Expected number of incidents that year
O.M	Pre-tax O&M with inflation
Capital	Pre-tax capital expenditures with inflation
Discounted.Capital	After-tax discounted capital expenditures
Discounted.O.M	After-tax discounted O&M

The grand total of the Discounted.Capital and Discounted.O.M is the net present value, or “NPV”. This number is multiplied by the capital recovery factor to obtain the equivalent annual cost, or “EAC”, which can be used to compare policies with different time horizons.

Note that the Relay column lists the number of planned re-lays. All unplanned work is under the one heading D.leaks, which could be a combination of local repairs and re-lays.

The policies are variations on four scenarios. The planning horizon is long enough for all AMP fittings to be removed.



The five scenarios are as follows:

1. The Weibull(7,65.1) distribution is used as per the Jana report (“Jana Weibull Model.xlsx”).
2. The Weibull(7,65.1) distribution is used as per the Jana report, but 70% of all work (both planned and unplanned) is taken to be service re-lay and costed as such. (“Jana 70relay Model.xlsx”).
3. The Weibull(6.5,70) distribution is used, as it is possible that the data used in the Jana Report might cause over- and under- estimation of the two parameters. (“Jana Weibull Modified.xlsx”).
4. The Weibull(7,65.1) distribution is used, but we assume only 90% of the population actually has AMP fittings in place, at random. (“Jana Weibull 90percentAMP.xlsx”).
5. The Weibull(7,65.1) distribution is used, and the amount of planned work is fixed at 4000 in 2014, 6000 in 2015, and 15,000 thereafter, no matter how much unplanned work is expected to occur. (“Jana 15000 Planned Limit.xlsx”).

For each scenario from 1 to 4 above we generate a policy that targets a range in the expected amount of unplanned work, and the amount of required planned work is allowed to ramp up to as much as 20,000 per year and then ramp down to no less than 8,000 per year.

Finally also provide the results for one special case of no planned work at all, with planning horizon of 60 years, in the file “No Planned.xlsx”.

The main results are summarized in the file “Summary.xlsx”.

The O&M costs are computed as the number of Leak Surveys (including any for the previous years’ service re-lays, if applicable) multiplied by the cost, plus the expected number of incidents multiplied by the cost, times one minus the tax rate, and then discounted.

The present value of the capital expenditure in that year is calculated as follows:

PV: Present Value

i : interest rate for discounting

A: Acquisition cost

U_n : the undepreciated capital cost

CT: corporate tax rate

n : number of years remaining in this policy



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$$PV = A \left[1 - \left(\frac{CT \times CCA}{i + CCA} \right) \left(\frac{1 + i/2}{1 + i} \right) \right] - \frac{i \times CT \times U_n}{(i + CCA)(1 + i)^n}$$

This value is then discounted to today's dollars.

The capital recovery factor, used to convert net present value to equivalent annual cost, is:

$$\frac{i}{1 - r^N},$$

where N is the total number of years in the policy.

A summary of all results is contained in the spreadsheet "Summary.xlsx".



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PROJECT 12-1392

FINAL REPORT

AMP Fitting / Copper Riser Reliability Study



July 30, 2013



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Executive Summary

Enbridge has been observing increasing leak rates in their AMP fitting-copper riser (AMP-CR) asset base. Given that there are roughly 319,000 AMP-CR systems installed in Enbridge's system, Enbridge is proactively developing an asset management strategy to address this issue.

As part of the strategy development, the purpose of this project was to characterize the underlying mechanism, quantify the issue, develop a model for forecasting future leakage rates, forecast future leakage rates for the installed asset base and provide a risk ranking of the installed AMP-CR asset base.

In order to characterize the underlying mechanism and develop the forecast models, field specimens of AMP-CR systems were selected for exhumation and analysis. Complete analysis was conducted on a total of 518 specimens.

Based on the samples provided and the analysis conducted, the following conclusions are drawn:

Characterization of Mechanism:

- The AMP-CR systems appear to be failing as a result of time-dependent localized internal sulphidation corrosion of the copper tubing associated with flow turbulence.
- The minimum wall resulting from the corrosion is observed primarily at the AMP fitting outlet roughly three quarters of the time and at defects (indentations in the tubing wall apparently due to installation) downstream of the fitting outlet the remaining quarter of the time.
- The localized corrosion at the AMP Fitting outlet can potentially lead to a circumferential crack in the copper riser and hence full rupture of the riser, leading to significantly higher gas release rates than the pinhole failure mechanism.
- For those systems with the minimum wall at a downstream defect, corrosion rates at the defect are generally 10 to 20% higher than at the fitting outlet, with some specimens showing corrosion rates 50 to 100% higher.
- The entire population of exhumed fittings examined is experiencing this corrosion mechanism to some extent.
- The primary variables impacting the minimum remaining wall thickness of the specimens are age (wall loss increases with age) and flow rate (wall loss increases with flow rate).
- Operating pressure, proximity to the gate station (as a possible proxy for mercaptan concentration as dosing occurs at the gate station), operating area, soil type, moisture condition of soil, coating type or length from the AMP fitting to the riser, to the grade or to the foundation wall are not seen to have any statistically significant impact on wall loss rates.



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Model & Forecasting Future Leak Rates:

- A leak rate forecasting model (Wall Loss Model) was developed based on the AMP-CR specimens examined. The model used the measured wall thicknesses of the field specimens to derive wall loss rates and project future wall loss. Based on a minimum wall thickness for pressure containment, projected failure rates were derived based on these wall loss projections.
- The observed field leak rates are projected to increase at an accelerating rate, roughly doubling through the next five year period and increasing by four to six fold through the next ten years.
- The percentage of the population at higher risk (with a wall thickness of less than 0.15 mm, roughly 1/6 of the original wall thickness) is roughly 3.5% currently and is projected based on the Wall Loss model to be 11% in 2017, 19% in 2022 and 29% in 2027. This corresponds to roughly 11,000, 35,000, 60,000 and 92,000 AMP-CR systems in 2012, 2017, 2022 and 2027, respectively.
- Based on the 95% confidence limits for the Wall Loss model, it is projected that there will be roughly 6,700 to 9,300 cumulative leaks through the next five years (2013-2017). This projected increase in failure rates is in line with the tripling in leak rates observed through the five year period between 2007 and 2011 (from 204 to 606 failures per year). It is also consistent with the observation that 3.5% of the AMP-CR population (roughly 11,000 systems) currently has a minimum wall thickness less than 0.15 mm, or 1/6 of the original pipe wall thickness. If this trend continues, it is projected that there will be between 33,000 and 44,000 cumulative failures by 2025.
- There is a high level of confidence in the general trends and magnitude of the leak rate projections as based on the following:
 - Excellent agreement was observed between the model projected distribution of wall losses and the actual measured distribution, indicating that the Wall Loss model captures the observed corrosion mechanism.
 - The Wall Loss model failure projections were verified based on comparison with projections from an independently developed model based on the AMP-CR repair data supplied by Enbridge. The models were in good agreement.
 - Both models were further verified by comparison with past observed leak history. Again excellent agreement was observed.



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Risk Ranking:

- Two risk rank approaches were developed; an age based approach and an age-flow rate based approach.
- Based on a 20-year replacement schedule, an asset replacement program based on risk rank removals offers a significant reduction in experienced in-service failures over the course of the program, with roughly 20% fewer failures projected.
- Flow rate is seen to play a key role in the corrosion mechanism. However, inclusion of flow rate into the risk rank model used to guide a simulated replacement program results in only a small (3%) reduction in failures over the course of the program compared to a risk rank model based on age alone. This is believed to be largely due to the limited historical flow data (seven years or roughly 15 to 25% of the AMP-CR system lifetimes) available for model development coupled with the roughly one quarter of the AMP-CR systems showing higher corrosion rates than the general population (where corrosion is occurring at the defect).
- The flow rate analysis was conducted based on the limited flow history data that could be extracted from the Enbridge database, approximately seven years' worth of data for each exhumed AMP-CR service. As the available flow history represents only 15%-25% of the total history of each installation, the model's ability to specifically risk rank the AMP-CR installations is likely more limited than it would be with a full set of flow histories. There will be a significant benefit to Enbridge if this barrier to generating complete operational histories of services can be overcome as it would enable more accurate performance projections that would allow for effective operational and maintenance planning, not only for AMP-CR replacement but other reliability initiatives. This would facilitate a significant reduction in risk in the system in the most cost effective manner.



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1.0 The Current AMP Fitting-Copper Riser Situation

Enbridge has been observing increasing leak rates in their AMP fitting-copper riser (AMP-CR) asset base. Given that there are roughly 319,000 AMP-CR systems installed in Enbridge's system, Enbridge is proactively developing an asset management strategy to address this issue.

The purpose of this project was to characterize the underlying mechanism, quantify the issue, develop a model for forecasting future leakage rates, forecast future leakage rates for the installed asset base and provide a risk ranking of the installed AMP-CR asset base.

2.0 AMP Fitting-Copper Riser Sampling Program

In order to characterize the current state of the AMP-CR asset base, a sampling program was developed by Enbridge and specimen removal was initiated (the breakdown of specimens sampled is summarized in **Section 4**). Specimens were randomly selected within different areas of the Enbridge system and across the various installation periods. The specimens were exhumed and then shipped to Jana for analysis. The specific details of each installation were recorded in the field and upon inspection at Jana. The specimens were then dissected for analysis to determine the specific mechanism leading to field leaks and to characterize the current state of the AMP-CR specimens. The analysis contained in this report is based on the analysis of 518 specimens.

3.0 Primary Conclusions of the AMP-CR Study

An analysis was conducted on the exhumed sample set and the primary findings are summarized in this section with more detailed data and analysis presented in **Sections 4, 5 and 6**, and the attached spreadsheet file containing measurements taken during this study; these measurements were obtained according to the procedure detailed in **Appendix A**.

From the analysis, the failure mode has been clearly identified as time-dependent localized corrosion. Flow turbulence is seen to play a key role in the observed rate of corrosion. Leak forecasting and corrosion rate models have been developed which show good correlation with the field data. In general, the leak rates are expected to increase with aging of the system due to the time-dependent nature of the corrosion process. Leak rate projections are provided in **Section 5** and risk ranking models are provided in **Section 6**.

3.1 Observed Failure Mechanism

The AMP-CR systems appear to be failing as a result of time-dependent localized internal sulphidation corrosion of the copper tubing associated with flow turbulence at the AMP fitting outlet. This localized corrosion results in wall loss, ductile ballooning and cracking of the pipe or pinhole formation as shown in **Figure 3.1** and **Figure 3.2**, respectively.

Figure 3.1: Localized Corrosion Failure at AMP Fitting Outlet

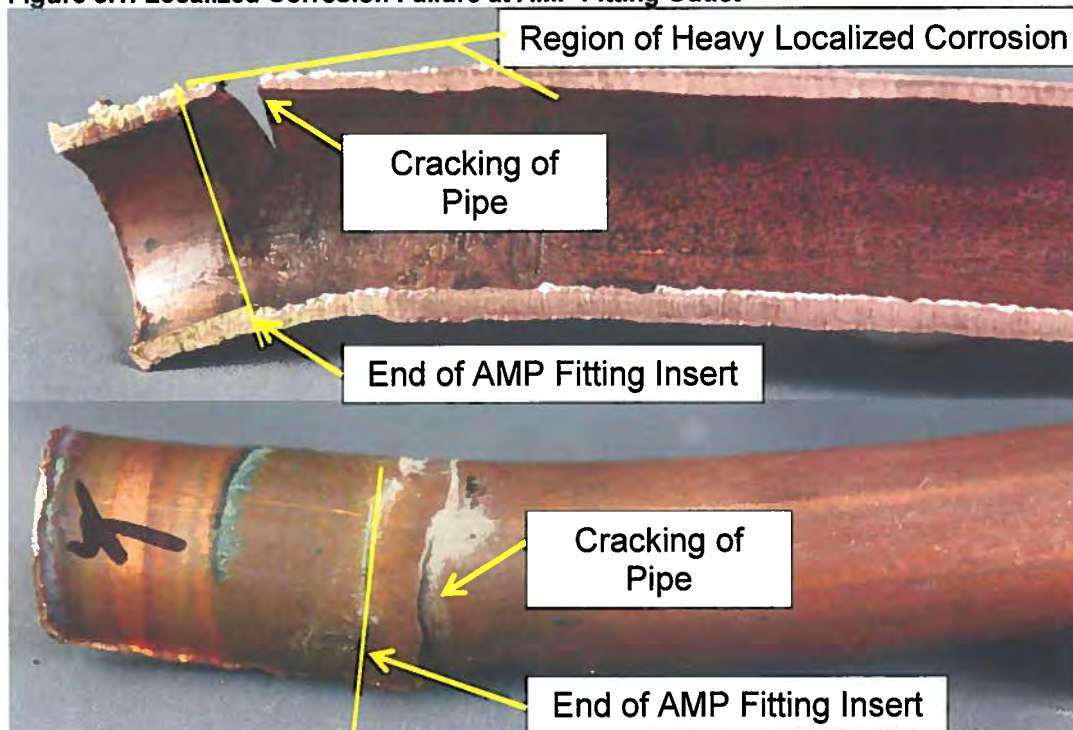
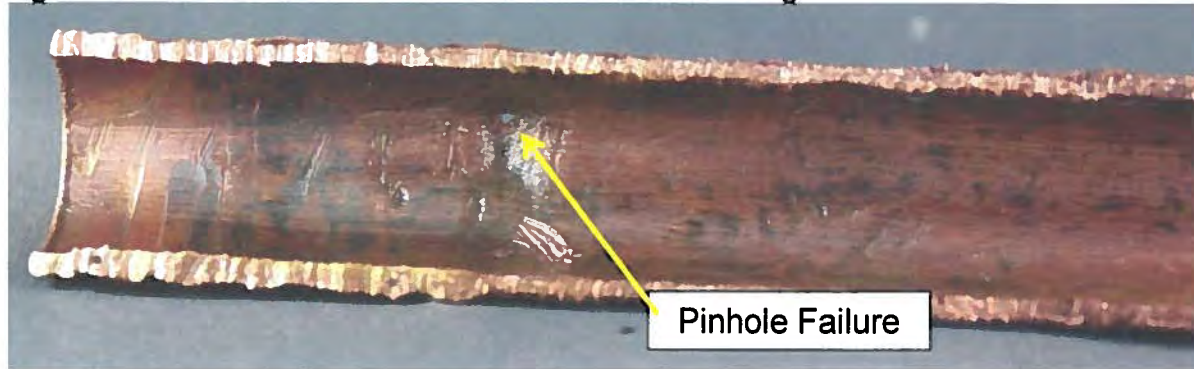
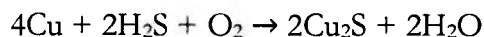


Figure 3.2: Pinhole Corrosion Failure Downstream of AMP Fitting



3.1.1 Sulphidation Corrosion

The copper tubing is corroding due to sulphidation which results in a friable black scale on the inner copper tube surface, as shown in **Figure 3.3**. **Figure 3.4** shows the presence of sulphur and copper in the scale, as determined by SEM-EDX (Scanning Electron Microscopy-Energy Dispersive X-ray) analysis. Sulphidation of copper occurs in gas distribution lines in the presence of hydrogen sulphide (H_2S). The basic reaction is:



This type of corrosion is normally not an issue as the scale forms a passivation layer. In situations where the corrosion rate is gas transport limited, localized attack can occur, however, if the rate of supply of the reactants (H_2S and O_2) is non-uniform as a result of local turbulence and eddies in the gas phase. This localization can be exacerbated if the flow-induced shear at the tubing wall in these locations is sufficient to preferentially remove the Cu_2S scale in these locations, thus removing the passivation layer and allowing on-going corrosion. As discussed in **Section 3.1.3**, this appears to be the mechanism occurring in the AMP-CR systems.

Figure 3.3: Black Friable Copper Sulphate Scale on Inner Pipe Wall

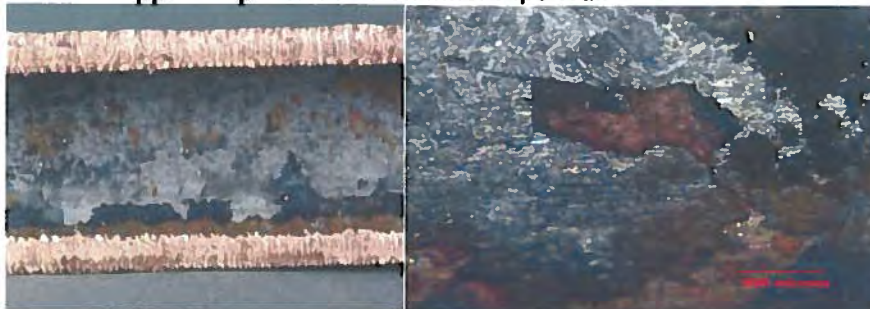
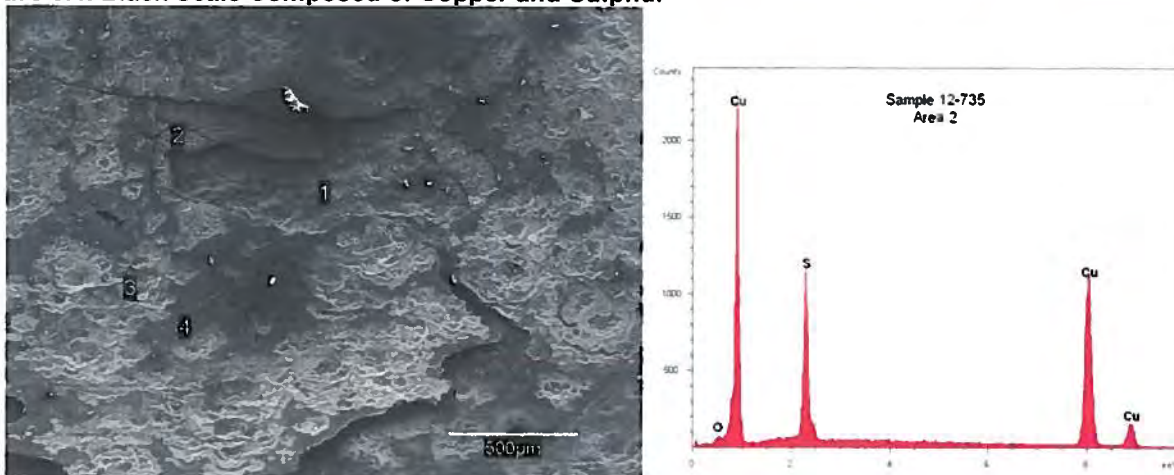


Figure 3.4: Black Scale Composed of Copper and Sulphur



3.1.2 Time-Dependent Localized Corrosion

The observed copper sulphidation is seen to be a time-dependent, localized phenomenon. The minimum wall thickness of the analyzed field specimens is shown in **Figure 3.5**. The maximum corrosion (low minimum wall thickness) is observed predominately in the region of the fitting outlet (76% of specimens – shown in red in **Figure 3.5**) with some specimens showing localized pitting or flow channels beyond the fitting outlet region (24% of specimens – shown in blue in **Figure 3.5**). As shown in **Figure 3.1**, the localized corrosion at the AMP Fitting outlet can potentially lead to a circumferential crack in the copper riser and hence full rupture of the riser, leading to significantly higher gas release rates than the pinhole failure mechanism. Low overall general corrosion rates are observed for the copper tubing as measured 20 cm downstream from the fitting (**Figure 3.6**), with many specimens showing a slightly thicker wall than the unexposed tubing (Roughly 1.0 mm on average - measured under the insert region) due to the presence of the scale layer.



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Figure 3.5: Localized Corrosion at Fitting Outlet and Downstream From Fitting as demonstrated by Minimum Wall Thickness by Installation Year

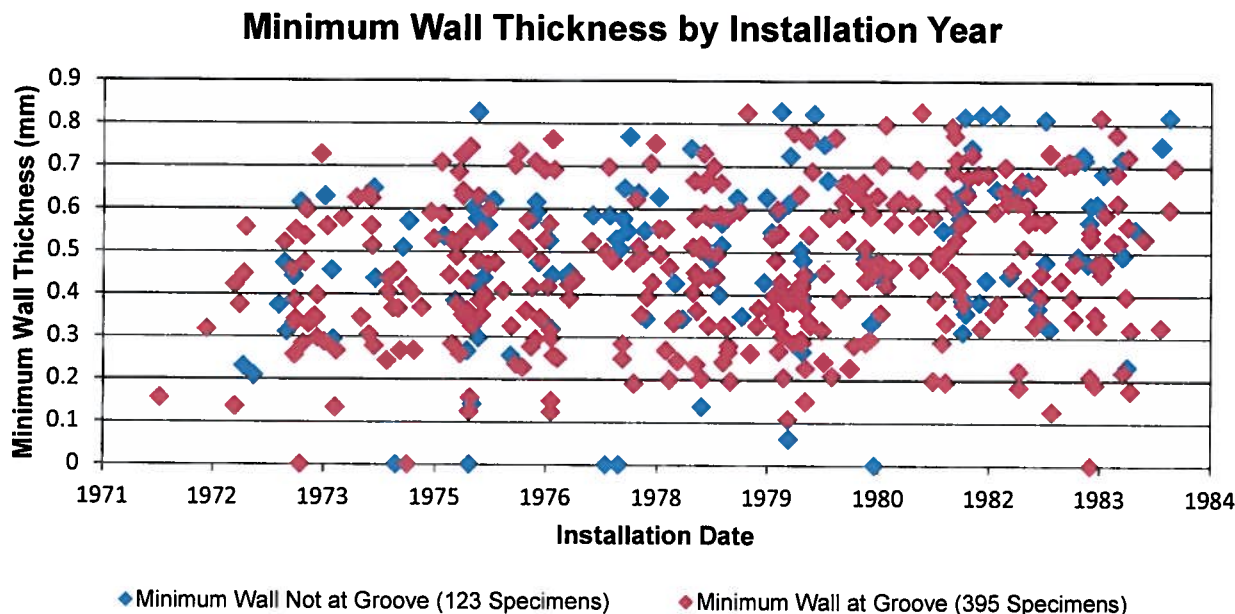
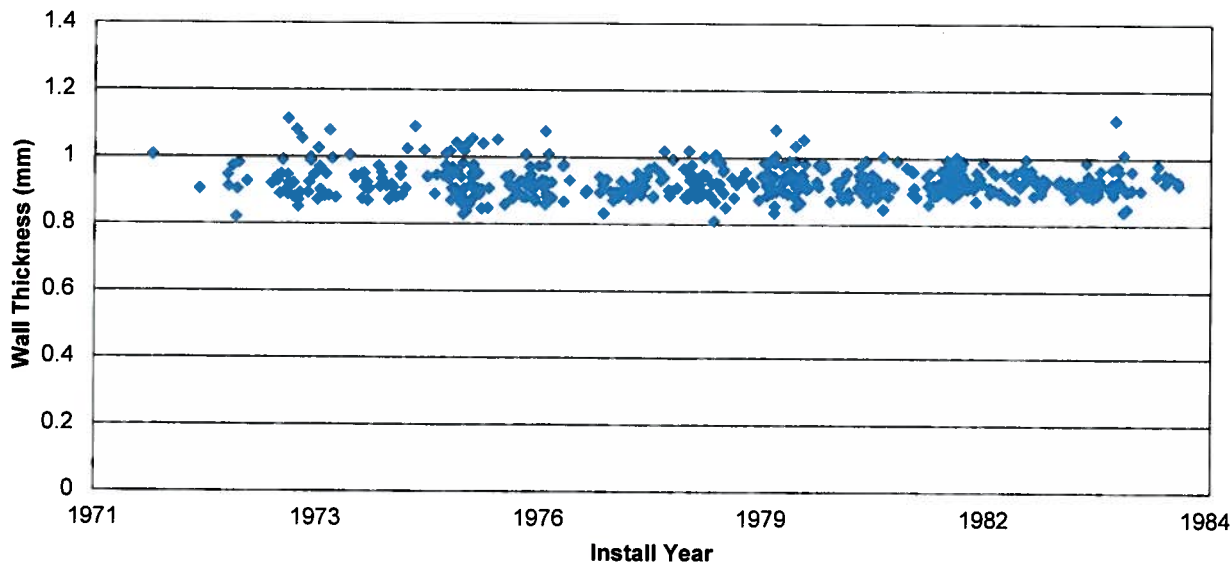


Figure 3.6: Low General Overall Corrosion Rates as demonstrated by Average Wall Thickness at 20 cm Mark by Installation Date





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Figure 3.7 shows the time dependence of the sulphidation process. The average minimum wall thickness decreases with the age of the AMP-CR system. This time dependence appears to be solely a function of the different times available for corrosion, as no statistical difference in the corrosion rate by installation year¹ is observed, nor is there an apparent time trend in the corrosion rate data (Figure 3.8) as shown by the low R^2 value (0.04).

Figure 3.7: Wall Thickness Decreases with Increasing Age of AMP-CR System

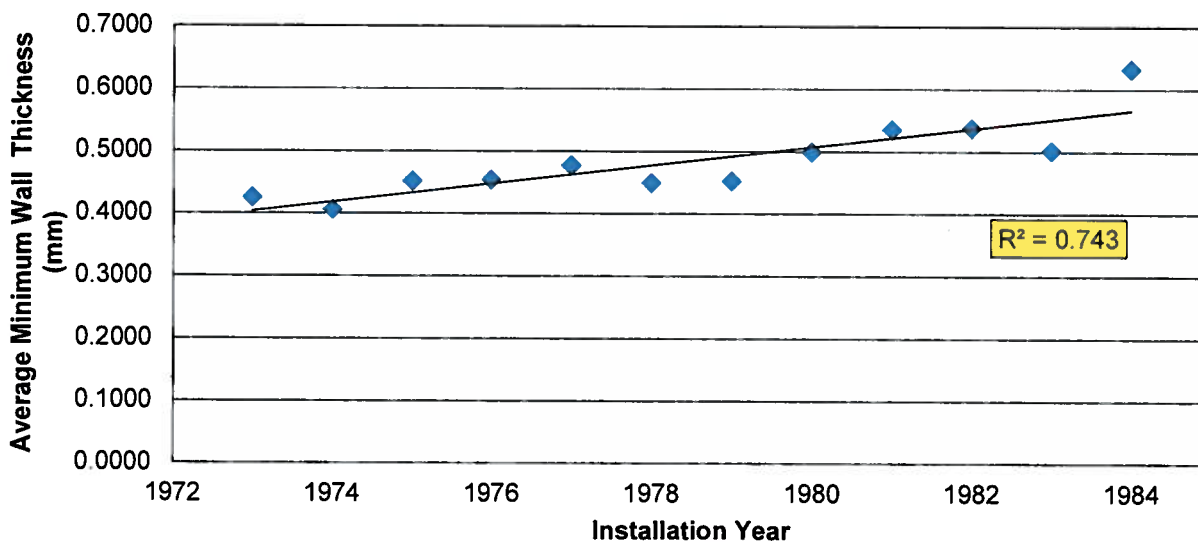
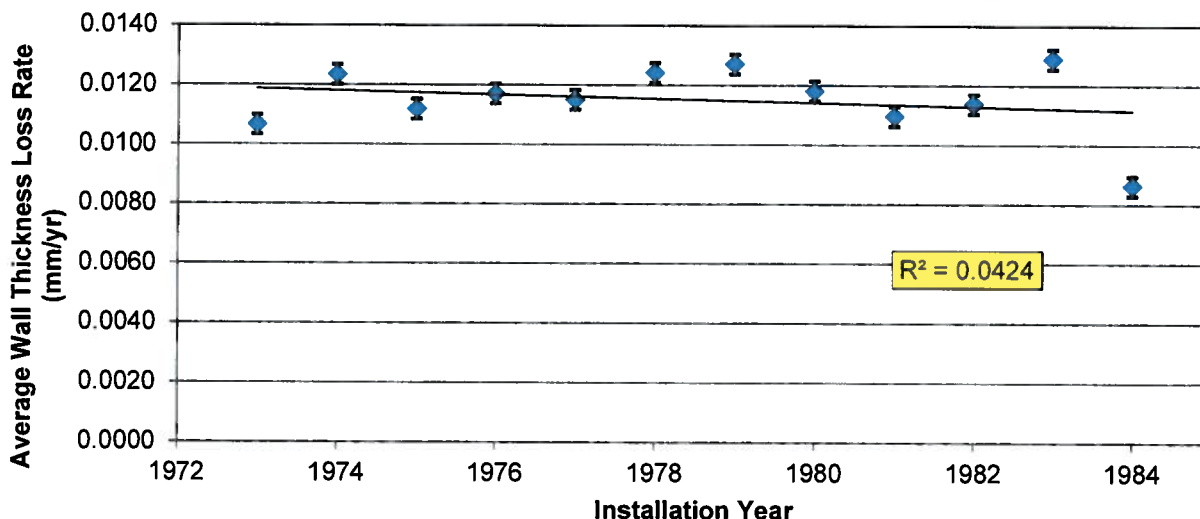


Figure 3.8: Comparison of Average Corrosion and Corrosion Rates by Year of Installation



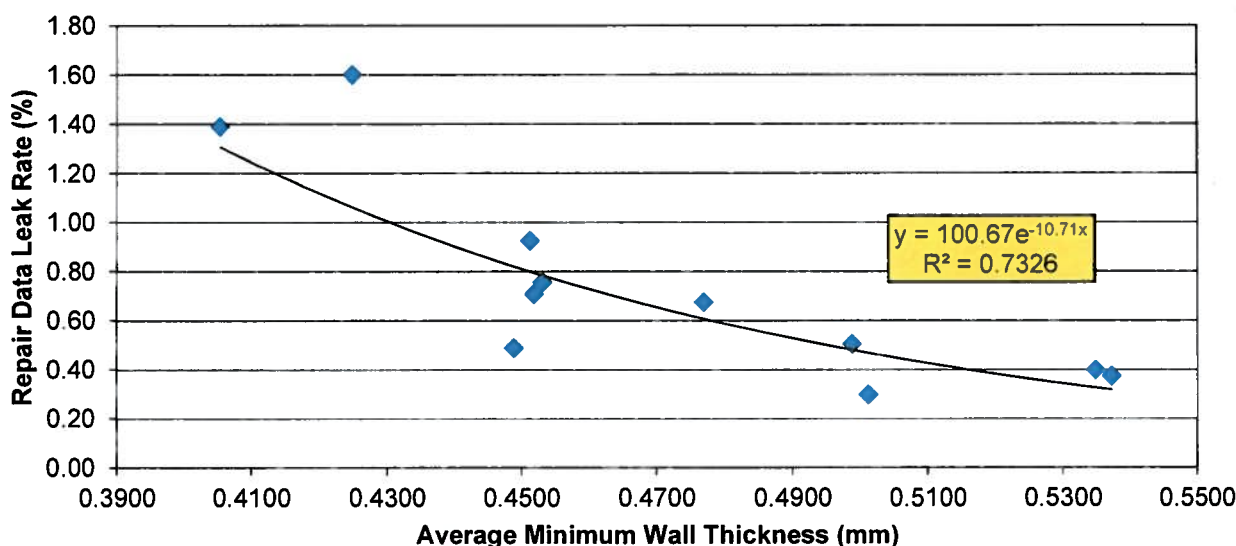
¹ Based on an analysis of variance test (ANOVA) at a 95% confidence level, no statistical difference in the wall loss rates was observed.



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As shown in **Figure 3.9**, there is a general correlation between the average measured minimum wall thickness ($R^2=0.73$ based on exponential fit) and the observed field leak rates based on the repair data provided by Enbridge (data compared for each installation year). This provides an additional point of connection between the observed corrosion and field leaks. The exponential fit also shows that the failure rates appear to increase significantly once a certain minimum wall thickness is reached. This has important consequences for the aging of the overall population as discussed in **Section 5**.

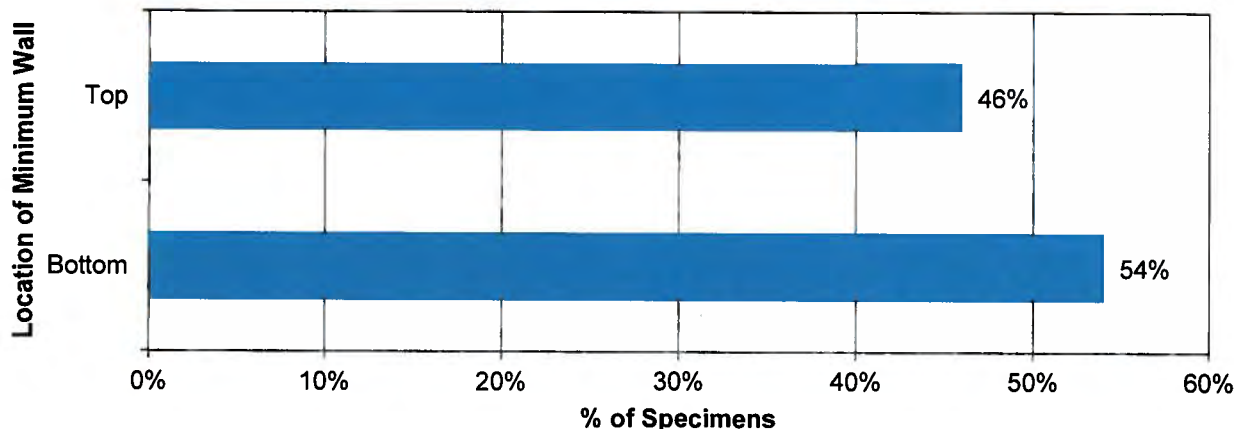
Figure 3.9: Comparison of Average Minimum Wall Thickness versus Repair Data Leak Rate.



Overall, therefore, leaks appear to develop due to localized time-dependent corrosion. The broad scatter in the measured minimum wall thickness of the exhumed specimens suggests that another key factor is, or other key factors are, also involved in the corrosion process.

One potential mechanism of accelerated localized corrosion is the formation of liquid pools in which corrosion rates can be significantly higher than in a pure gas environment. No statistically significant physical evidence of this was observed in the specimen analysis, however. As shown in **Figure 3.10**, the minimum wall is found to be evenly distributed between the top and bottom of the pipe. If liquid pooling was present, the minimum wall would be expected to be predominantly in the bottom of the pipe where the liquid would pool.

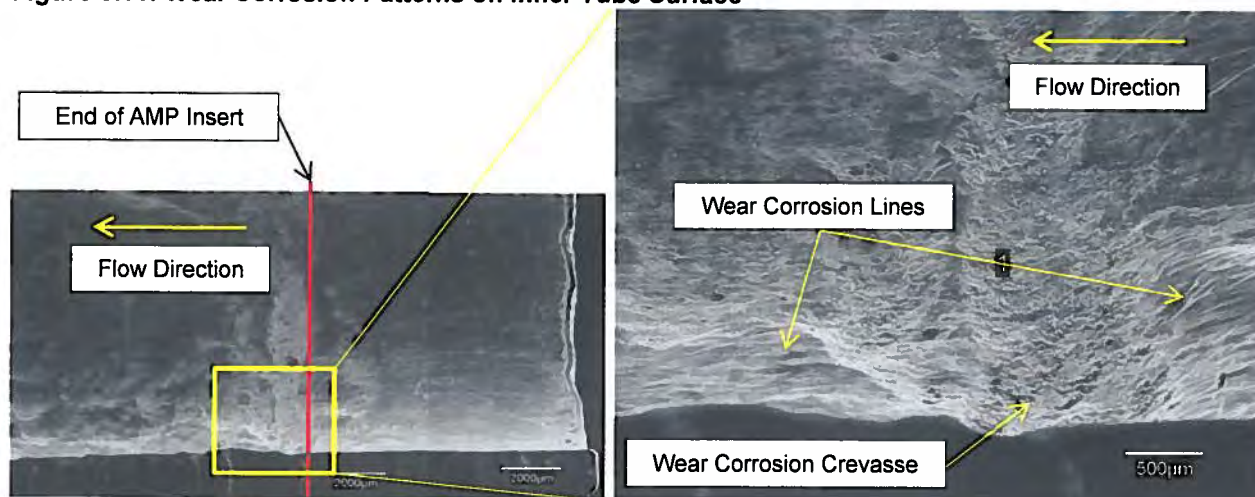
Figure 3.10: Minimum Wall Evenly Distributed Between the Top and Bottom of the Pipe



3.1.3 Flow Turbulence Acceleration of Corrosion

Flow turbulence appears to be playing a significant role in the corrosion process, explaining at least part of the broad scatter in minimum wall thicknesses. As shown previously in **Figure 3.5**, the minimum wall is located in a corrosion groove at the fitting outlet, a high turbulence area, 76% of the time. The remaining 24% of the minimum walls were observed at tubing defect areas that were also regions of high turbulence. Wear corrosion patterns observed with SEM analysis are shown in **Figure 3.11**. It appears that turbulent flow is flaking off the friable copper sulphide (Cu_2S) scale, exposing a fresh copper surface and preventing a stable Cu_2S film from forming a passivation layer.

Figure 3.11: Wear Corrosion Patterns on Inner Tube Surface

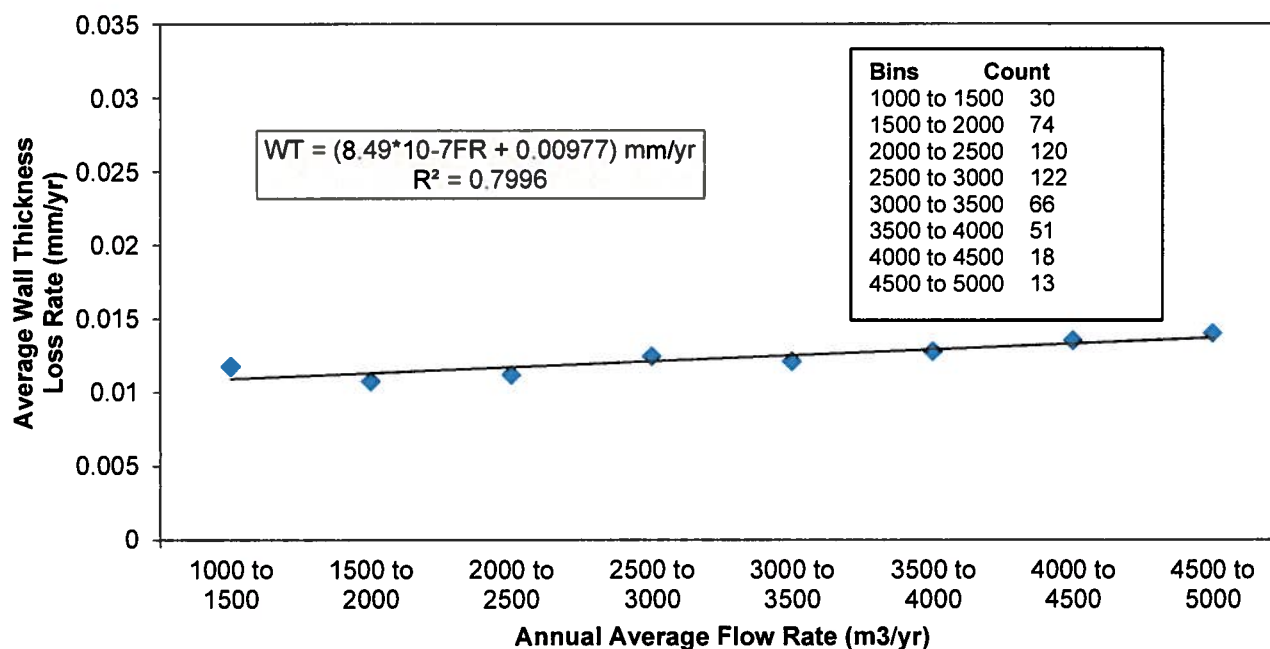




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As gas flow turbulence appears to play a significant role in the dominant failure mode of the AMP-CR system, it was thought that a measure of the turbulence of the flow (i.e. the Reynolds Number) would be a useful predictor of the failure rate of the systems or of the wall loss rate observed on the exhumed specimens. As limited flow history data for services with an AMP-CR system were available for analysis, only a comparison of the flow rate - and by implication the Reynolds Number² - against the wall loss rate was possible. Based on the last seven years of flow history, however, a general correlation ($R^2=0.80$) can be seen between the average annual flow rate and the average wall thickness loss rate (**Figure 3.12**). Combined, the location of the corrosion, the visual evidence of wear corrosion in the flow direction and the correlation between average wall loss rate and average flow rate provide strong evidence that flow rate is a critical variable in the observed corrosion.

Figure 3.12: Analysis of Average Annual Flow Rate versus Average Wall Thickness Loss Rate.



Overall, the data examined provide strong evidence that leaking in the AMP-CR systems is occurring due to time-dependent internal localized sulphidation corrosion of the copper tubing associated with flow turbulence at the AMP fitting outlet.

² Because the gas flow in the meter set is measured as the volumetric flow rate at the standard household service pressure, and the mass flow rate of the gas through the meter must be identical to that through the AMP-CR system, the Reynolds Number in the AMP-CR system is directly proportional to the measured flow rate.



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3.2 Analysis of Field and Exhumed Specimen Data and Model Development

Analysis of the available data and the leak rate projections highlight some key findings: The entire population of the AMP-CR fittings examined is experiencing the above described failure mechanism to some extent. That is, while there are large differences between the rates at which the corrosion mechanism is occurring, some level of localized corrosion is seen in all the specimens examined. The observed issue appears, therefore, to be a systemic one and not isolated to a specific group or subpopulation within the Enbridge system. However, the broad range of observed corrosion rates suggests that there is a broad range in expected residual lifetime (between zero and >50 years) and that it may be possible to isolate the more at risk populations for prioritized removal. This possibility is explored in **Sections 5 and 6**.



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4.0 Analysis of AMP Fitting-Copper Riser Field Data

The repair history data provided by Enbridge and the field exhumed AMP-CR specimens were analyzed to determine the mechanism of failure and characterize the extent of the issue in the field. The overall conclusions have been presented in the previous section. This section and the attached spreadsheet file present additional details of the data and analysis.

4.1 Analysis of Enbridge Repair Data for AMP Fitting-Copper Riser Systems

4.1.1 Summary of Enbridge AMP-CR Repair Data

The field repair data summarized in **Table 4.1** below was provided by Enbridge. The data shows the total installed base for each installation year and the leak repairs by year for the period from 2007 through 2011. Full details of the data are provided in the attached spreadsheet file.

The data show a clear trend of increasing leakage rate with increasing fitting age, consistent with the flow erosion mechanism detailed in **Section 3**. This is seen clearly in **Figure 4.1**. The leak rates range from 0.1% for the 1984 installation year to 1.6% for the 1972 installation year with an overall leakage rate of 0.62%. There is also a general trend of increasing leak rates between the 2007 and 2011 reporting periods with a total of 204 leaks in 2007 rising to 606 leaks in 2011.

The data are used to develop a model of projecting future leak rates as presented in **Section 5**.

Table 4.1: Summary of AMP Fitting-Copper Riser Repair Data

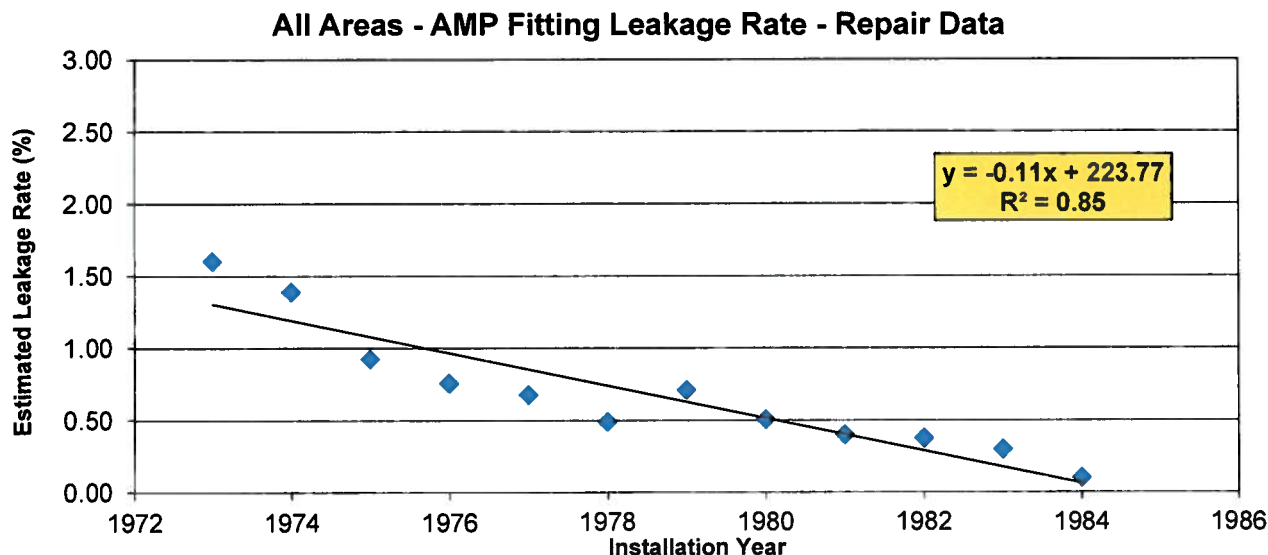
Table 4.1: Summary of AWWA Fitting-Copper Riser Repair Data															
Installation Year	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	Total	
Total Installed	6,420	18,058	18,177	19,366	22,792	23,746	23,580	26,345	34,698	37,836	24,837	29,900	32,721	318,476	
Leak Repairs by Year	2007	12	25	30	23	17	14	15	19	15	11	12	11	0	204
	2008	14	54	45	38	25	23	19	20	20	16	13	7	3	297
	2009	12	50	39	37	36	19	13	58	32	35	17	17	14	379
	2010	21	85	69	30	42	39	22	35	53	37	20	23	9	485
	2011	29	73	66	51	52	65	46	54	54	51	29	30	6	606
Total Leaks	88	287	249	179	172	160	115	186	174	150	91	88	32	1971	
% Leakage Rate ³	1.37	1.60	1.39	0.92	0.76	0.67	0.49	0.71	0.50	0.40	0.37	0.30	0.10	0.62	

³ Based on the 5 year leak survey cycle in which roughly 20% of the population is surveyed each year, the % leakage rate is based on the total leaks found through the 5 year period of 2007 – 2011 (over which the entire population would have been surveyed once). Therefore, this value is an approximation.



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Figure 4.1: Plot of Leakage Rate versus Installation Year



4.2 Analysis of Exhumed AMP Fittings

This section provides a summary of the AMP-CR specimens received and analyzed.

4.2.1 Summary of AMP-CR Specimens Analyzed

A total of 552 specimens were received. Complete data was provided and analysis conducted on 518 specimens as detailed in **Table 4.2**. The detailed specimen data and analysis is provided in the spreadsheet provided with this report.

Table 4.2: Summary of AMP Fitting-Copper Risers Systems Samples

Area	Total AMP-CR Systems	Specimens Provided to Jana	Specimens Fully Analyzed
10	89,910	160	154
20	65,929	128	116
30	43,238	60	54
40	26,212	39	38
50	11,290	5	4
60	50,750	88	82
80	29,514	68	66
90	2,200	4	4
Total	319,043	552	518

The distribution of the specimens that were analyzed and the total installed population by installation year are shown in **Figure 4.2** and detailed in **Table 4.3**. The specimens analyzed are



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generally representative of the installed AMP-CR asset base, with the years 1975, 1976, 1978 and 1979 being somewhat over represented and the year 1984 being significantly under represented. This is taken into consideration in the modeling presented in Section 5.

Figure 4.2: Comparison of Total versus Sampled AMP-CR System Populations

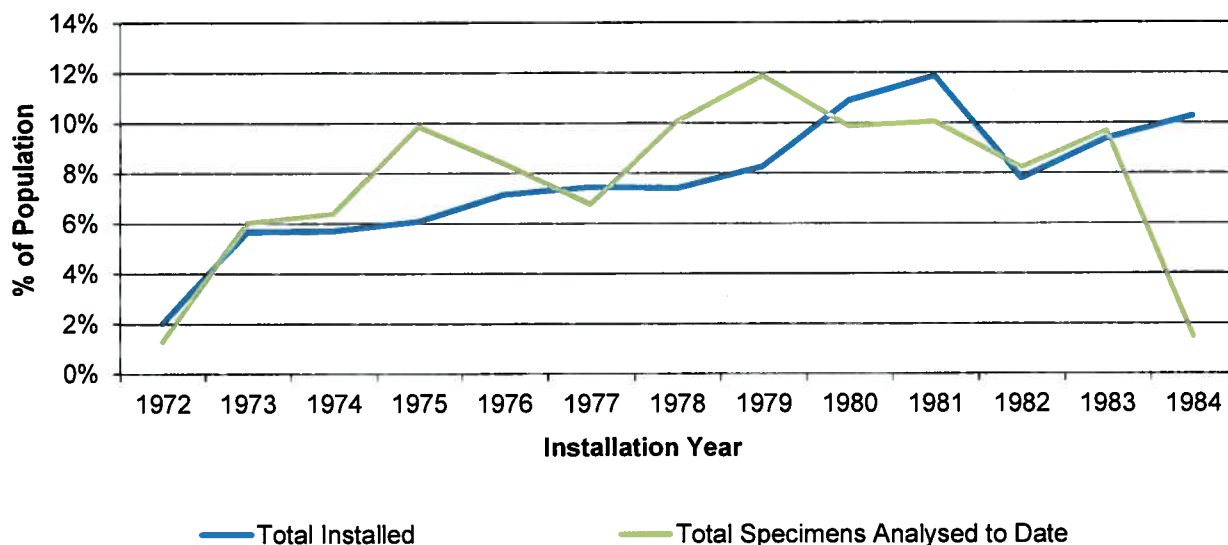


Table 4.3: Comparison of Total versus Sampled AMP-CR Systems (1969-1977)

Install Year	1969	1970	1971	1972	1973	1974	1975	1976	1977
Total Installed	37	170	345	6,420	18,058	18,177	19,366	22,792	23,746
Scheduled Specimens for Removal	0	0	1	12	51	41	67	63	48
Specimens Analyzed	0	0	1	7	30	33	51	44	32

Table 4.3: Continued - Comparison of Total versus Sampled AMP-CR Systems (1978-1984)

Install Year	1978	1979	1980	1981	1982	1983	1984	Total
Total Installed	23,580	26,345	34,698	37,836	24,837	29,900	32,721	319,043
Scheduled Specimens for Removal	68	77	62	68	47	63	62	730
Specimens Analyzed	52	63	52	53	44	48	8	518



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4.2.2 Summary of Analysis Method for AMP-CR Specimens

4.2.2.1 Field Data

Table 4.4 summarizes the data collected from the field. The data has been compiled in an Excel database provided separately from this report.

Table 4.4: Summary of Field Data Collected

Standard Information	Leak Survey	AMP Fitting Soap Test	Soil Observations At AMP Fitting Location
Work request # Address Municipality Province Area PMTS Asset ID DSI ID Date Installed Type of Service	Leak Detected (yes/no) Defect Size (if applicable) Defect Location (if applicable) Leak Classification (if applicable)	Leak Detected (yes/no) Leak Classification (if applicable)	Soil Type (sand/clay/rocks/other) Moisture Condition of Soil(dry/damp/wet/water)

Table 4.4: Continued - Summary of Field Data Collected

Amp Fitting Measurements	Observations	Personnel Information
Total Length (in meters) From the AMP Fitting to the Riser From the AMP Fitting to the Grade From the AMP Fitting to the Foundation Wall	Pictures Comments	Date Work Completed Work Performed by EGD/Contractor PSI or Operations Supervisor name

4.2.2.2 Analysis Procedure for Exhumed Specimens

In addition to the field collected data, the AMP-CR assemblies were visually analyzed upon receipt and any pertinent information was recorded. The specimens were then dissected so that the measurements shown in **Table 4.5** could be taken. The detailed analysis process is provided in **Appendix A**. Specimens noted to have failed – i.e. where the wall was completely perforated at one or more locations – were subjected to additional analysis as detailed and discussed in **Appendix B**.

Table 4.5: Summary of AMP-CR Data Spreadsheet – Dimensioning Data

Location of Pipe	Description of Measurement
Base Wall (wall thickness of unexposed pipe under AMP insert)	One measurement from each pipe half
Wall Thickness at Fitting End	One measurement from each pipe half
Thinnest Wall in Each Pipe Half	Minimum wall and distance from defect from each pipe half
Defect Profile	Height, width, length, position from cut end
Wall Thickness at the 20 cm Mark	Six measurements around the pipe



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4.2.3 Summary of AMP-CR Analysis Results

4.2.3.1 Reported Leakage Rates

Table 4.6 provides a summary of the reported leaks from the exhumed specimens. The number of reported leaks is more than a third higher than the number of actual leaks found (based on observed leak paths in the copper tubing) in the AMP-CR systems. This suggests that some of the reported leaks were detecting leakage from other than the AMP-CR system. Overall, the observed leak rate is in line with what is expected based on past repair data from Enbridge.

Table 4.6: Summary of AMP Fitting-Copper Riser Systems Reported Leaks

Area	Total AMP-CR Systems	Number of Specimens Analyzed	Number of Reported Leaks	Reported Leakage Rate	Number of Observed Leakages	Observed Leakage Rate
10	89,910	154	3	1.95%	4	2.60%
20	65,929	116	5	4.31%	1	0.86%
30	43,238	54	0	-	0	-
40	26,212	38	1	2.63%	1	2.63%
50	11,290	4	0	-	0	-
60	50,750	82	2	2.44%	3	3.66%
80	29,514	66	4	6.06%	2	3.03%
90	2,200	4	0	-	0	-
Total	319,043	518	15	2.90%	11	1.54%

4.2.3.2 Observed Wall Thickness Loss

The key variable of interest in the study was the minimum wall thickness. Based on the original Enbridge study of the AMP-CR systems, it was determined that there was significant scatter observed in the measured minimum wall thickness. One of the key deliverables in this project was to examine and determine the key variables impacting this observed scatter. The general observations are summarized in this section; the data are modeled to project future leak rates in **Section 5** and **Section 6** providing an analysis of the key impacting variables.

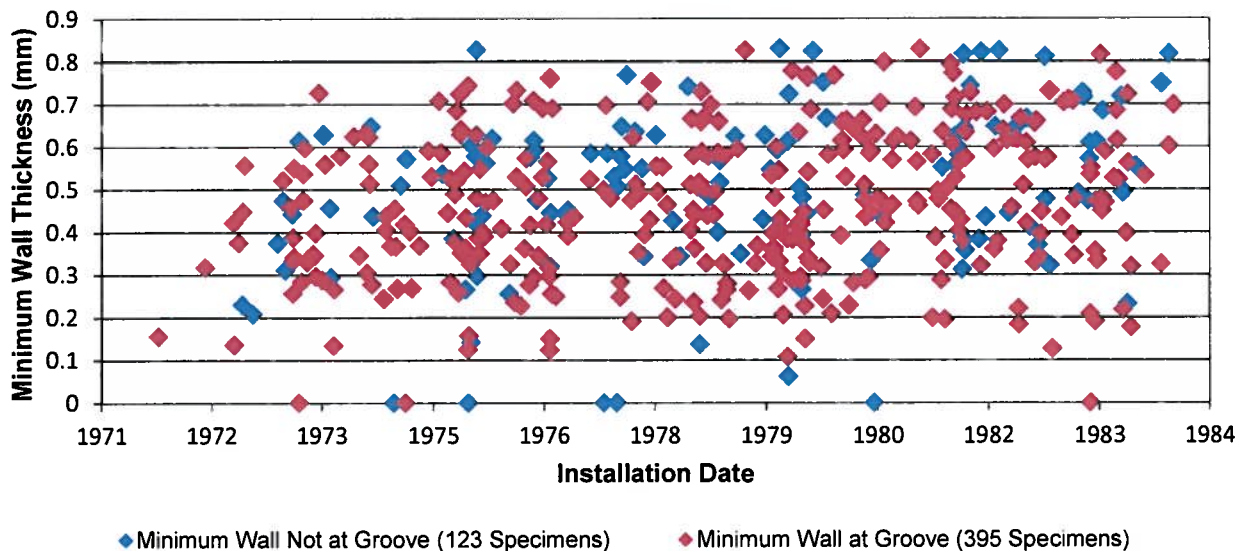
As expected, there is significant scatter in the observed minimum wall thicknesses for the exhumed AMP-CR specimens (**Figure 4.3**), even within a given installation year. As discussed in **Section 3**, part (or all) of this scatter is related to variations in gas flow rates through the fittings.



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Figure 4.3: Localized Corrosion at Fitting Outlet and Downstream From Fitting

Minimum Wall Thickness by Installation Year



4.2.3.3 Analysis of Minimum Wall Thickness

As shown in **Figure 4.4**, the overall minimum wall thicknesses of the AMP-CR specimens examined are roughly normally distributed with an overall mean of 0.48 mm, a median of 0.48 mm and a standard distribution of 0.18 mm. Similar results are obtained when the minimum walls not at the groove and at the groove are examined separately (**Table 4.7** and **Figures 4.5** and **4.6**, respectively).



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Figure 4.4: Histogram of Minimum Wall Thickness for All Specimens Analyzed

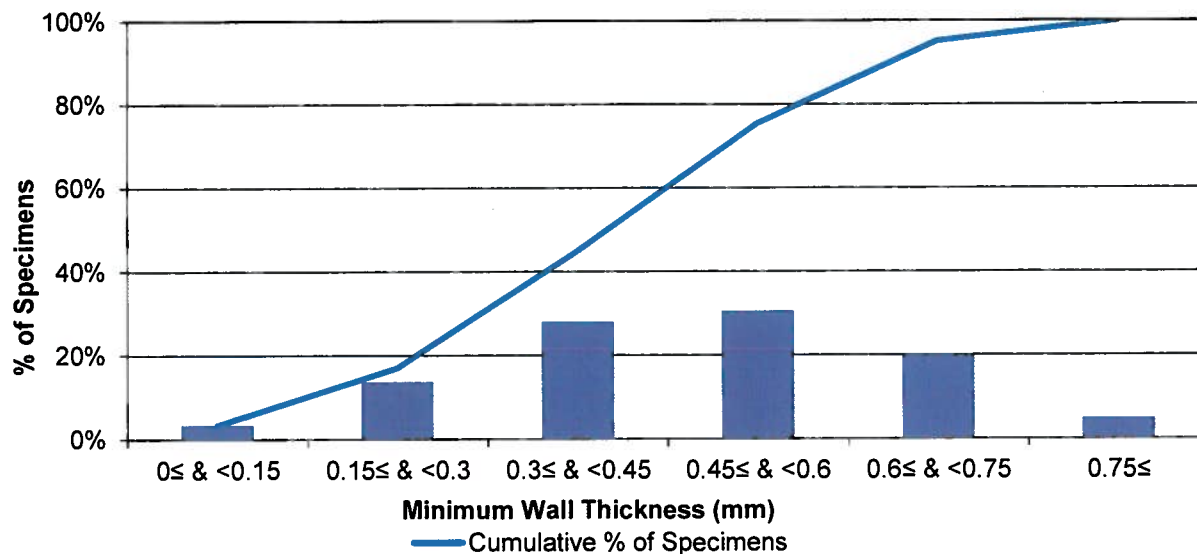
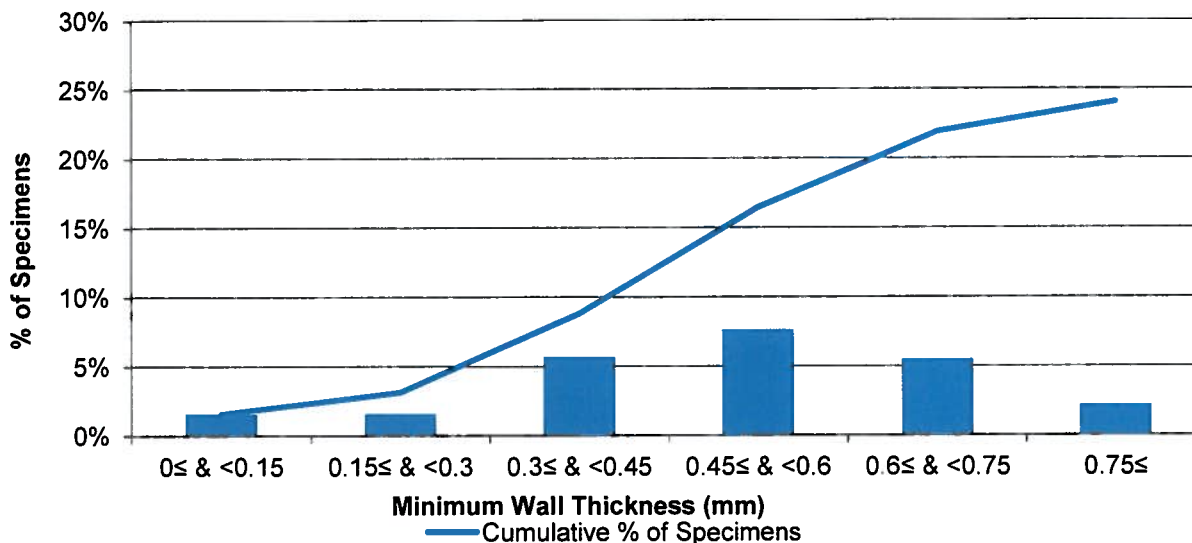


Table 4.7: Comparison of Mean, Median and Standard Deviation of Minimum Wall (in mm)

Minimum Wall	Mean	Median	Standard Deviation
Overall	0.47	0.47	0.18
Not at Groove	0.50	0.52	0.19
At Groove	0.47	0.46	0.17

Figure 4.5: Histogram of Minimum Wall Thickness for Specimens with Minimum Wall Not Located at Groove





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Figure 4.6: Histogram of Minimum Wall Thickness for Specimens with Minimum Wall Located at Groove

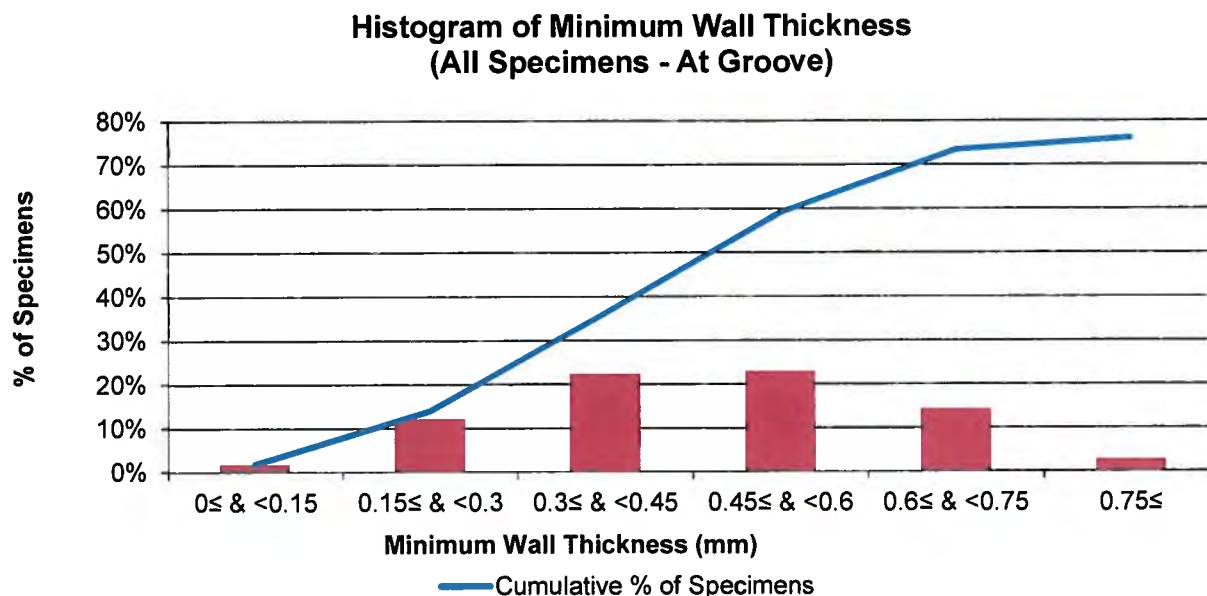


Table 4.8 and Table 4.9 provide a breakdown of the percentage of AMP-CR specimens by minimum wall thickness by area and installation year, respectively. Roughly 45% of the specimens examined have a wall thickness that is less than half of the original wall thickness (roughly 0.9 mm), approximately 14% of the specimens have wall thicknesses that are less than a third of the original wall thickness and roughly 3% have wall thicknesses less than one sixth the original wall thickness.

Table 4.8: Percentage of Specimens in Each Minimum Wall Thickness Bin for Each Area

Area	Minimum Wall Thickness Bins (mm)					
	0<&<0.15	0.15<&<0.3	0.3<&<0.45	0.45<&<0.6	0.6<&<0.75	0.75<
10	4.55%	9.09%	29.22%	29.87%	20.78%	6.49%
20	0.86%	25.86%	30.17%	25.00%	18.10%	-
30	1.89%	15.09%	30.19%	37.74%	7.55%	7.55%
40	2.63%	10.53%	28.95%	36.84%	21.05%	-
60	6.10%	10.98%	24.39%	26.83%	19.51%	12.20%
80	3.08%	6.15%	23.08%	38.46%	27.69%	1.54%
90	-	25.00%	25.00%	-	50.00%	-
All	3.53%	13.33%	27.65%	30.59%	19.61%	5.29%



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Table 4.9: Percentage of Specimens in Each Minimum Wall Thickness Bin for Each Installation Year

Install Year	Minimum Wall Thickness Bins (mm)					
	0<&<0.15	0.15<&<0.3	0.3<&<0.45	0.45<&<0.6	0.6<&<0.75	0.75<&<0.9
1972	14.29%	14.29%	57.14%	14.29%	-	-
1973	3.33%	16.67%	33.33%	33.33%	13.33%	-
1974	9.09%	15.15%	36.36%	24.24%	15.15%	-
1975	5.88%	13.73%	33.33%	29.41%	15.69%	1.96%
1976	2.27%	20.45%	27.27%	29.55%	18.18%	2.27%
1977	6.25%	9.38%	18.75%	43.75%	15.63%	6.25%
1978	1.92%	19.23%	26.92%	36.54%	15.38%	-
1979	3.17%	15.87%	41.27%	17.46%	12.70%	9.52%
1980	1.96%	15.69%	19.61%	33.33%	21.57%	7.84%
1981	-	7.55%	18.87%	35.85%	30.19%	7.55%
1982	2.33%	4.65%	32.56%	20.93%	32.56%	6.98%
1983	2.08%	10.42%	16.67%	39.58%	27.08%	4.17%
1984	-	-	12.50%	25.00%	37.50%	25.00%
All	3.29%	13.57%	27.91%	30.43%	19.96%	4.84%

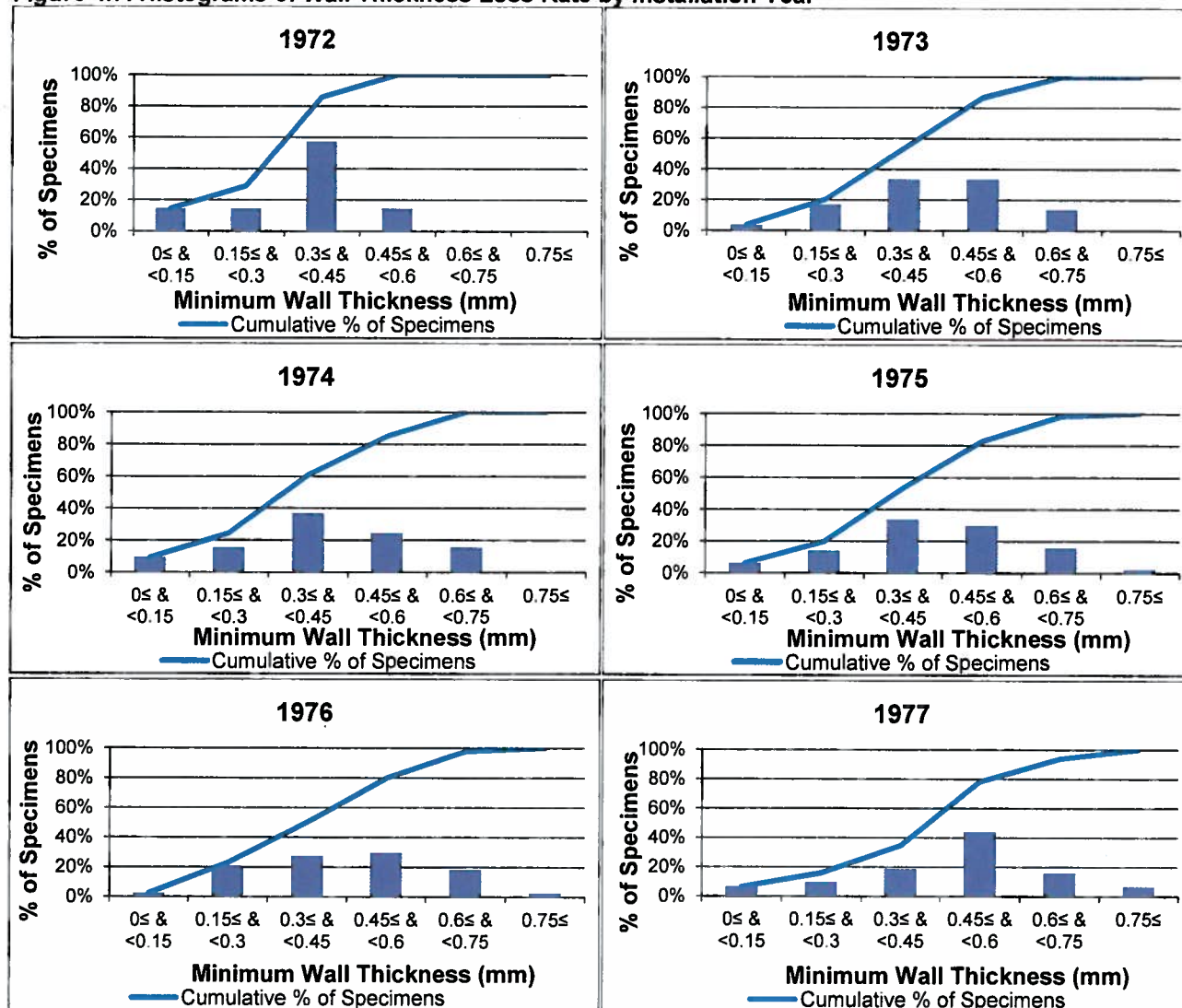
Histograms of the wall thickness loss rates by installation year are provided in **Figure 4.7** and **Figure 4.8**. These histograms provide a visual picture of the observed distribution of wall thicknesses within the population. They also provide a quick visual means of assessing the risk profile within the population. The fraction of specimens on the right hand side of the diagrams (thicker residual minimum wall thickness) are at relatively low risk of leakage due to through wall corrosion in the immediate future, while those on the far left are at a relatively high risk of leakage due to through wall corrosion.

The trend of lower minimum wall thickness for the older installation years is clearly visible. For the 1972 installation year, no specimen with a minimum wall thickness greater than 0.6 mm is observed. This is an important observation as it suggests that the entire population is subject to localized corrosion, just at differing rates. Likewise, for the 1984 installation year, no specimen with a minimum wall below 0.3 mm is observed in the exhumed specimens analyzed. Both these results are consistent with the observed leakage rates (based on the Enbridge repair history) of 1.37% and 0.1%, respectively.



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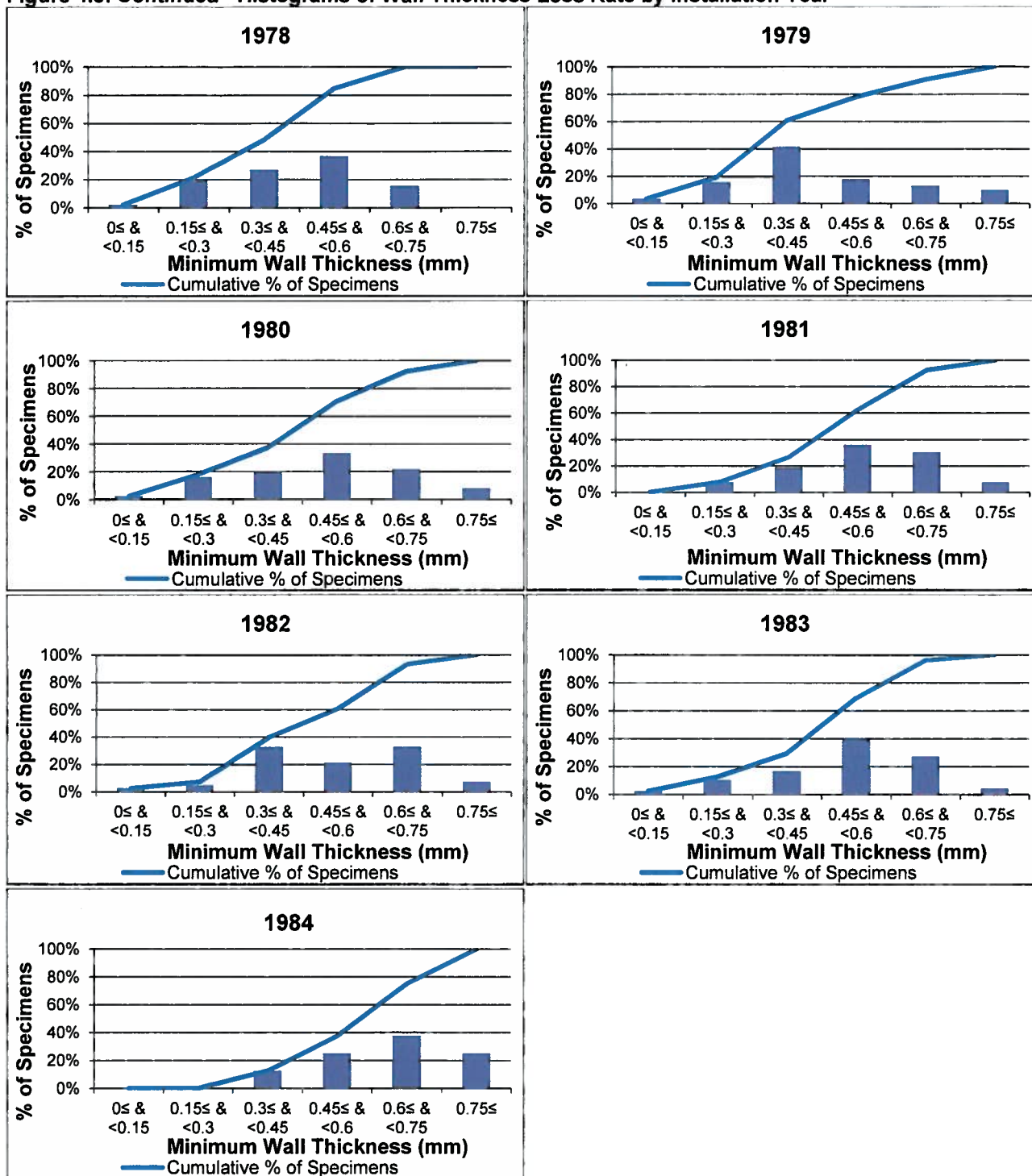
Figure 4.7: Histograms of Wall Thickness Loss Rate by Installation Year





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Figure 4.8: Continued - Histograms of Wall Thickness Loss Rate by Installation Year





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Table 4.10 and **Table 4.11** provide a summary of the average minimum wall thickness and average wall thickness loss rate by area and installation year, respectively. Based on an analysis of variance test (ANOVA), at a 95% confidence level there is a statistically significant difference in the variation of the average minimum wall thickness with installation year. No statistically significant difference was found in the average wall thickness loss rate by installation year, however, suggesting that the observed difference in average wall thickness with installation year is primarily related to age. No statistically significant difference exists in the average minimum wall and average wall thickness loss rates by Area, suggesting that there is not a significant difference in the corrosion mechanism throughout the Enbridge system.

Table 4.10: Averages and Standard Deviations of Minimum Wall Thickness by Area (in mm)

Area	# of Specimens	Average Min. Wall (mm)	Standard Deviation of Min. Wall (mm)	Average Wall Thickness Loss Rate (mm/yr)	Standard Deviation of Wall Thickness Loss Rate (mm/yr)	Repair Data Leak Rate (%)
Overall	518	0.4761	0.1730	0.0118	0.0051	0.62
10	154	0.4834	0.1740	0.0115	0.0053	0.62
20	116	0.4316	0.1560	0.0129	0.0047	0.54
30	54	0.4724	0.1754	0.0122	0.0053	0.87
40	38	0.4687	0.1559	0.0122	0.0044	0.51
50	4	0.5353	0.1631	0.0101	0.0052	0.42
60	82	0.5001	0.1884	0.0115	0.0057	0.57
80	66	0.5116	0.1767	0.0103	0.0046	0.90
90	4	0.4948	0.2328	0.0104	0.0071	n/a

Table 4.11: Averages and Standard Deviations of Minimum Wall Thickness by Installation Year (in mm)

Install Year	# of Specimens	Average Min. Wall (mm)	Standard Deviation of Min. Wall (mm)	Average Wall Thickness Loss Rate (mm/yr)	Standard Deviation of Wall Thickness Loss Rate (mm/yr)	Repair Data Leak Rate (%)
1971	1	0.1560	n/a	0.0170	n/a	n/a
1972	7	0.3549	0.1408	0.0124	0.0043	1.37
1973	30	0.4249	0.1579	0.0107	0.0042	1.60
1974	33	0.4055	0.1582	0.0123	0.0042	1.39
1975	51	0.4514	0.1587	0.0112	0.0044	0.92
1976	44	0.4532	0.1659	0.0117	0.0048	0.76
1977	32	0.4770	0.1803	0.0115	0.0051	0.67
1978	52	0.4489	0.1586	0.0124	0.0047	0.49
1979	63	0.4519	0.1798	0.0127	0.0056	0.71
1980	52	0.4988	0.1805	0.0118	0.0056	0.50
1981	53	0.5347	0.1559	0.0110	0.0051	0.40
1982	44	0.5371	0.1920	0.0114	0.0059	0.37
1983	48	0.5011	0.1645	0.0129	0.0057	0.30
1984	8	0.6323	0.1569	0.0086	0.0060	0.10

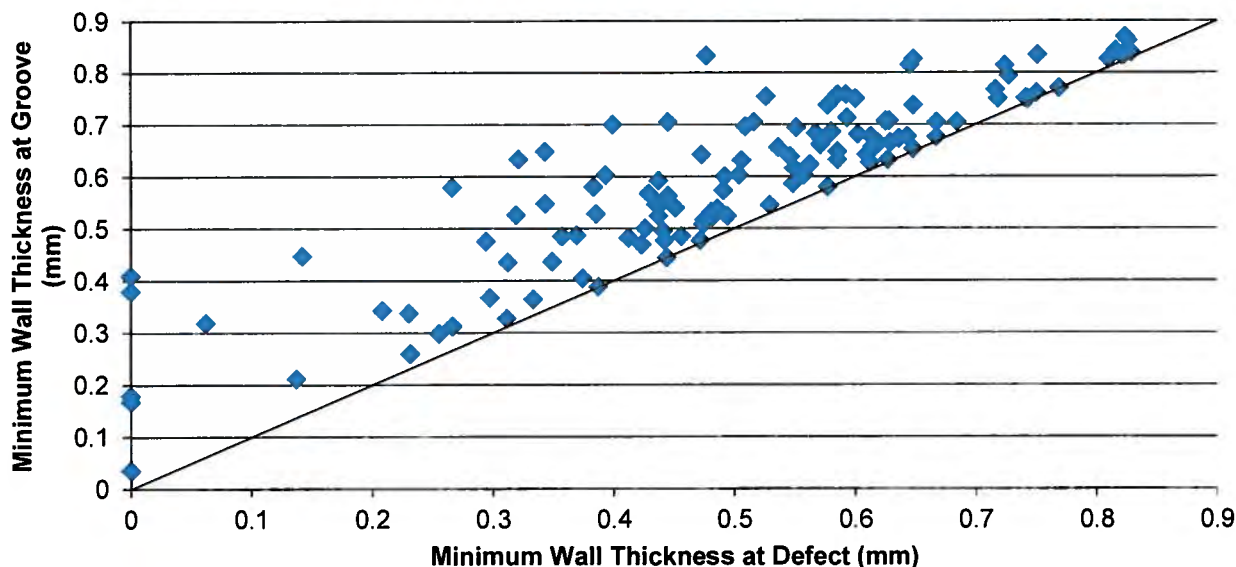


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4.2.3.4 Comparison of Corrosion Rates at Defect and Fitting Outlet

As discussed previously, roughly a quarter of the fittings examined had their minimum wall at a defect downstream from the fitting outlet as opposed to at the fitting outlet. This suggests that for these specimens there were regions of higher turbulence at the defects than at the fitting outlet, leading to higher corrosion rates in the defect area. **Figure 4.9** provides a comparison of the minimum wall thickness at the defect and at the groove (at fitting outlet) and **Figure 4.10** provides a histogram of the ratio of minimum wall at the groove over minimum wall at the defect for those specimens, where the minimum wall was at the defect. Corrosion at the defect is seen to be roughly 10% to 20% higher than that at the groove for most of the specimens examined. For some specimens, however, the corrosion at the defect can be 50 to 100% higher.

Figure 4.9: Minimum Wall Thickness at Groove versus Minimum Wall Thickness at Defect





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Figure 4.10: Histogram of Ratio of Wall Thickness at Groove/Wall Thickness at Defect

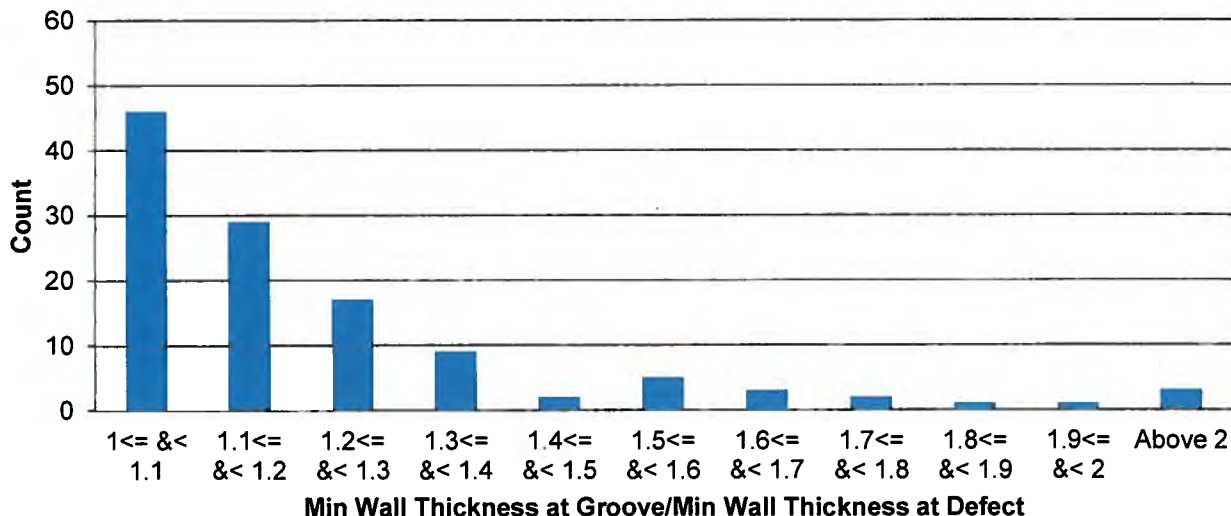


Table 4.12 provides a summary of the number of AMP-CR systems with minimum walls at the defect by area. **Table 4.13** provides the same data by installation year. No statistically significant difference in the percentage of systems with a defect was found by area or by installation year.

Table 4.12: Comparison of Number of AMP-CR Systems with Minimum Wall at Defect by Area

Area	Total Number of Specimens	Count of Specimens with a Defect	% with a defect
10	154	46	29.87%
20	116	30	25.86%
30	54	12	22.22%
40	38	4	10.53%
50	4	0	0.00%
60	82	16	19.51%
80	66	14	21.21%
90	4	1	25.00%
Total	518	123	23.75%



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Table 4.13: Comparison of Number of AMP-CR Systems with Minimum Wall at Defect by Installation Year

Installation Year	Total Number of Specimens	Count of Specimens with a Defect	% with a defect
1971	1	0	0.00%
1972	7	1	14.29%
1973	30	7	23.33%
1974	33	7	21.21%
1975	51	12	23.53%
1976	44	11	25.00%
1977	32	13	40.63%
1978	52	10	19.23%
1979	63	16	25.40%
1980	52	6	11.54%
1981	53	11	20.75%
1982	44	13	29.55%
1983	48	14	29.17%
1984	8	2	25.00%
Total	518	123	23.75%

The key findings from this analysis are:

- Roughly a quarter of the AMP-CR population appears to have a defect that leads to more aggressive corrosion than that in the fitting outlet region.
- These defects appear to be randomly distributed throughout the asset base.
- Corrosion at the defect is seen to be roughly 10% to 20% higher than that at the groove for most of the specimens examined. For some specimens, however, the corrosion at the defect can be 50% to 100% higher.

Combined, these serve to increase the amount of irreducible scatter inherent in the AMP-CR population (that is, the defect population cannot be preferentially selected on any statistical basis)⁴.

⁴ Examining the population for the impact of specific installation crews that may have generated a statistically higher number of defects does not seem warranted based on the random distribution of the defects through the regions and by installation year.



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5.0 Development of Leak Rate Forecasting Models for AMP Fitting-Copper Riser Systems: Exhumed Fitting / Riser Analysis and Repair Data Analysis

A leak rate forecasting model was developed based on the AMP-CR specimens examined. The model used the measured wall thicknesses of the field specimens to derive wall loss rates and project future wall loss. Based on a minimum wall thickness for pressure containment, projected failure rates were derived based on these wall loss projections.

Based on the modeling, it is projected that the observed leakage rates will continue to increase with time at an accelerating rate, roughly doubling through the next five year period and increasing by four- to six-fold through the next ten years. Detailed leak rate and residual lifetime projections are provided in the Sections that follow.

There is a high level of confidence in the general trends and magnitude of the leak rate projections based on the following:

- Excellent agreement was observed between the model projected distribution of wall losses and the actual measured distribution, indicating that the Wall Loss model captures the observed corrosion mechanism.
- The Wall Loss model failure projections were verified based on comparison with projections from an independently⁵ developed model based on the AMP-CR repair data supplied by Enbridge. The models were in good agreement.
- Both models were further verified by comparison with past observed leak history. Again excellent agreement was observed.

The percentage of the population with a wall thickness of less than 0.15 mm (roughly 1/6 of the original wall thickness) is roughly 3.5% currently and is projected based on the Wall Loss model to be 11% in 2017, 19% in 2022 and 29% in 2027. This corresponds to roughly 11,000, 35,000, 60,000 and 92,000 AMP-CR systems in 2012, 2017, 2022 and 2027, respectively⁶.

Based on the 95% confidence limits for the Wall Loss model, it is projected that there will be between roughly 6,700 and 9,300 cumulative leaks through the next five years (2013-2017). This projected increase in failure rates is in line with the tripling in leak rates observed through the five year period between 2007 and 2011 (from 204 to 606 failures per year). It is also consistent with the

⁵ The data for the models was derived from two separate sources: examination of the wall thickness of exhumed specimens and from Enbridge reported leak rates. The Wall Loss model was developed based on a mechanistic understanding of the failure mechanism. The repair data model was developed based on data fitting to historical field data.

⁶ Based on a current installed base of 319,000 AMP-CR systems.



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observation that 3.5% of the AMP-CR population (roughly 11,000 systems) currently has a minimum wall thickness less than 0.15 mm, or 1/6 of the original pipe wall thickness. If this trend continues, there are projected to be between 33,000 and 44,000 cumulative failures by 2025.

The model projections through the next five year period are believed to provide a good estimate of expected performance based on the model validations discussed above and in the sections that follow. The model projections through to 2025 are believed to provide reasonable approximations (order of magnitude). Beyond 2025, model projections were not provided due to potential modeling uncertainties.

Further confirmation of the model projections can be made through comparison with future observed leak rates.



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5.1 Leak Rate Model Based on Analysis of Exhumed Specimens

5.1.1 Modeling Minimum Wall Thickness Loss with Respect to Time

A model was developed to project the wall loss versus time, using the observed wall thickness measurements for the exhumed AMP-CR specimens. The model was then used to forecast projected wall loss for the entire AMP-CR population for 2012, 2017, 2022 and 2027.

The model is based on the assumption of normally distributed initial wall thicknesses and normally distributed wall loss rates. Both of these values may be estimated from measurements taken of the exhumed samples. The model assumes that the minimum wall thickness of an AMP-CR specimen at age t_{age} is its initial wall thickness ($N_{initial\ W.T.}$) minus the age of the specimen in years (t_{age}) times the yearly deterioration (N_{yrdiff}):

$$N_{t_{age}} = N_{initial\ W.T.} - t_{age} * N_{yrdiff}$$

Assuming that both the initial wall thickness and the yearly deterioration are normally distributed, then the distribution of wall thicknesses of specimens at age t_{age} are also normally distributed, with the distribution given as:

$$N_{t_{age}} \sim Normal(t_{age} * \mu_{yrdiff} - \mu_{initial\ W.T.}, t_{age}^2 * \sigma_{yrdiff}^2 + \sigma_{initial\ W.T.}^2)$$

where:

t_{age} = Specimen age in years

$\mu_{initial\ W.T.}$ = Sample average (0.8741 mm)

μ_{yrdiff} = Sample average (0.0119 mm/yr)

$\sigma_{initial\ W.T.}$ = Sample standard deviation (0.0376)

σ_{yrdiff} = Sample standard deviation (0.0052)



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5.1.1.1 Testing Model Assumptions and Model Validity

One of the key model assumptions is that of a normally distributed population. The normal distribution was used based on results from the Kolmogorov-Smirnov (K-S), Chi-Squared and Jarque-Bera tests. Several distributions were fit with the best fit distribution for the initial wall thickness and the yearly deterioration⁷ being the normal distribution (N), using maximum likelihood estimators (Table 5.1). Based on these statistical tests, the model fits the data well, signifying good predictive power.

Table 5.1: Summary of the Validity of the Model

	Initial Wall Thickness	Yearly Deterioration
	By age	By age
K-S Test	5/13 PASS	9/13 PASS
Chi-Squared Test	11/13 PASS	12/13 PASS
Jarque-Bera Test	9/13 PASS	12/13 PASS

Note: Critical value = 0.05

To further test the validity of the model, Wall Loss model projections were compared to the actual wall loss for the sample population with installation years 1972-1984. The model projects a similar distribution of specimens in each minimum wall thickness bin to the actual distribution, as shown in Table 5.2. The data is plotted in Figure 5.1 showing the excellent agreement between the projected and actual minimum wall thickness.

Table 5.2: Percentage of Sample Specimens in Each Minimum Wall Thickness Bin

	<0.15	0.15<=<0.3	0.3<=<0.45	0.45<=<0.6	0.6<=<0.75	0.75<
Loss Model	4.39%	12.91%	26.94%	30.88%	18.39%	6.48%
Actual	3.53%	13.33%	27.65%	30.59%	19.61%	5.29%

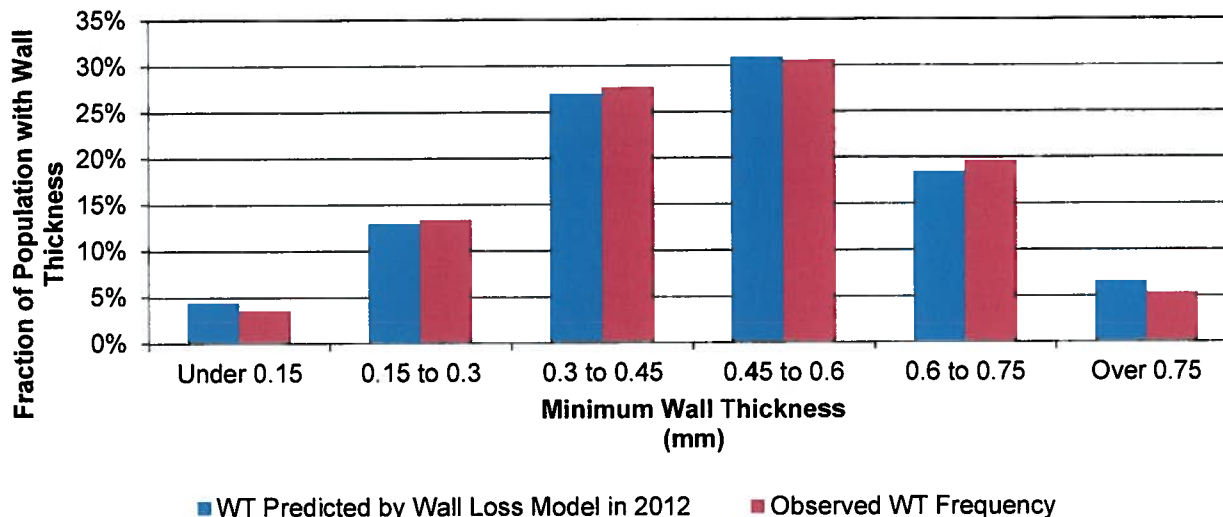
The Wall Loss model, therefore, appears to provide a good tool for projecting future wall loss in the AMP-CR population.

⁷ Yearly Deterioration = (initial wall thickness – minimum wall thickness) / age of specimen (in years)



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Figure 5.1: Comparison of the Projected Minimum Wall Thickness to the Actual Minimum Wall Thickness Loss Distribution



5.1.1.2 Projection of Future Wall Loss in AMP-CR Population

Using the sample population to make inferences about the total population, the Wall Loss model generated by the sample population was applied to the total population⁸. For each specimen in the total population, the minimum loss wall thickness was projected at each year of analysis for December 2012, 2017, 2022 and 2027. Histograms of the resulting projections are provided in **Figures 5.2, 5.3, 5.4 and 5.5** for 2012, 2017, 2022 and 2027, respectively. The histograms show the shift to lower wall thickness as a function of time.

For the current AMP-CR population, just under 20% of the population has a minimum wall thickness less than 0.3 mm, or roughly 1/3 of the original pipe thickness. In 2017 this increases to roughly 30%, 40% in 2022 and 50% in 2027.

For the highest risk population, with a wall thickness of less than 0.15 mm (roughly 1/6 of the original wall thickness), the numbers are roughly 3.5% currently, 11% in 2017, 19% in 2022 and 29% in 2027. This corresponds to roughly 11,000, 35,000, 60,000 and 92,000 in 2012, 2017, 2022 and 2027, respectively.

⁸ Total population with installation years from 1969 to 1984



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Figure 5.2: Histogram of Minimum Wall Thickness Loss for the Population as of December 2012

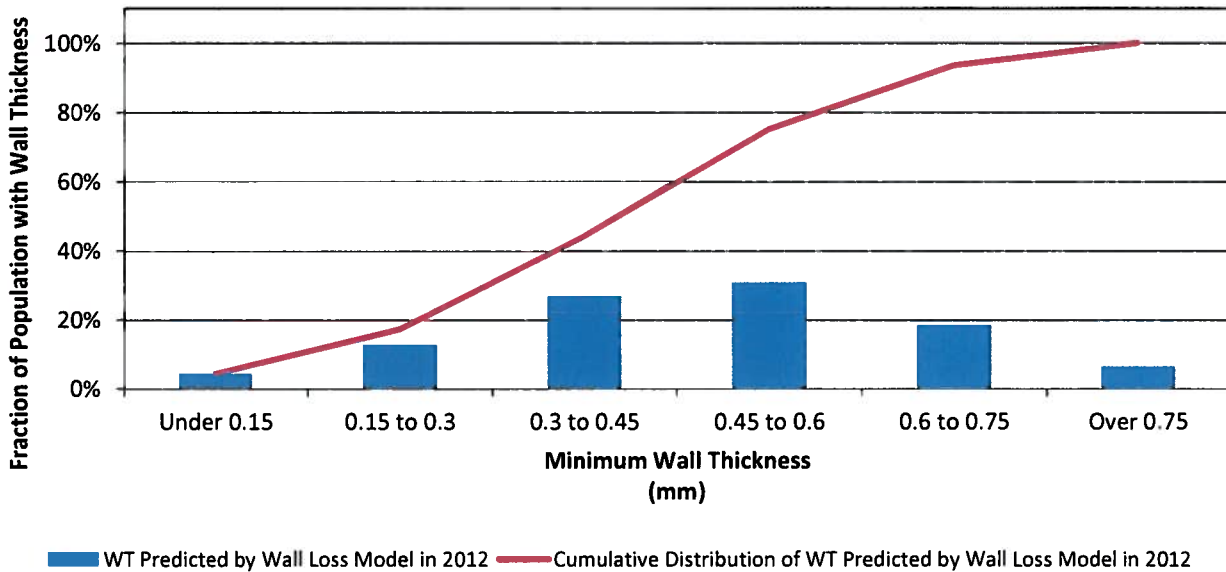
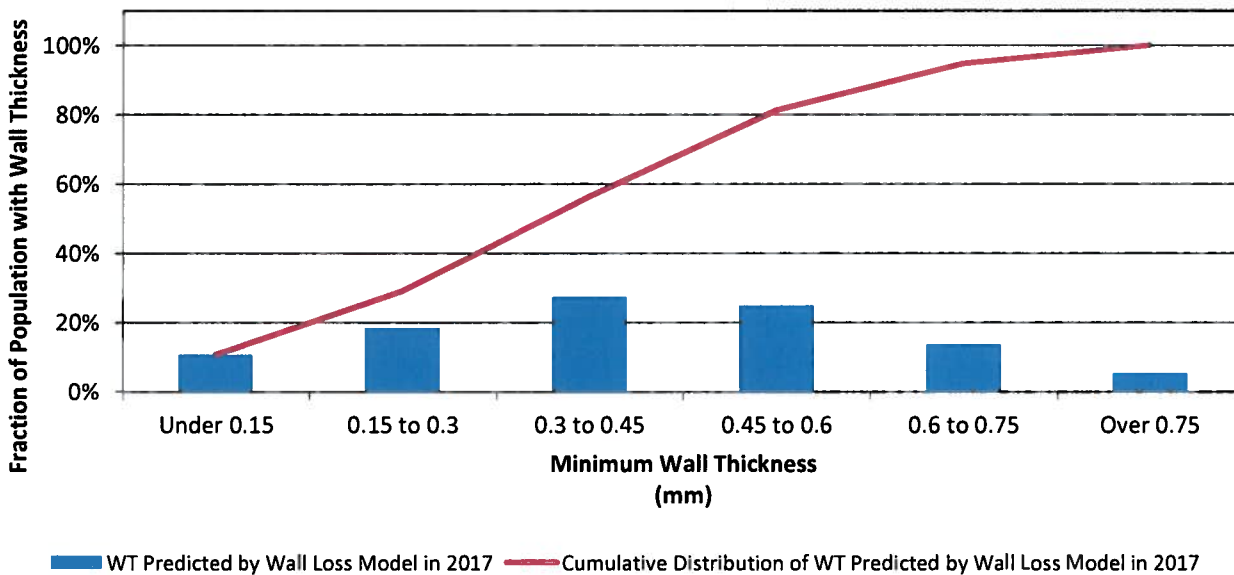


Figure 5.3: Histogram of Minimum Wall Thickness Loss for the Population as of December 2017





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Figure 5.4: Histogram of Minimum Wall Thickness Loss for the Population as of December 2022

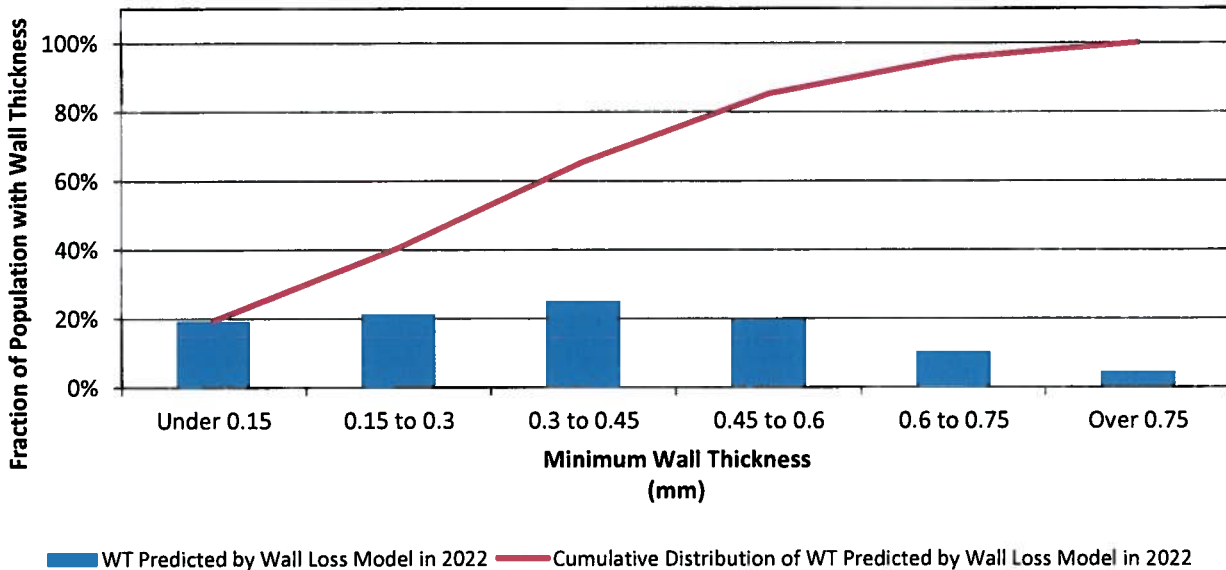
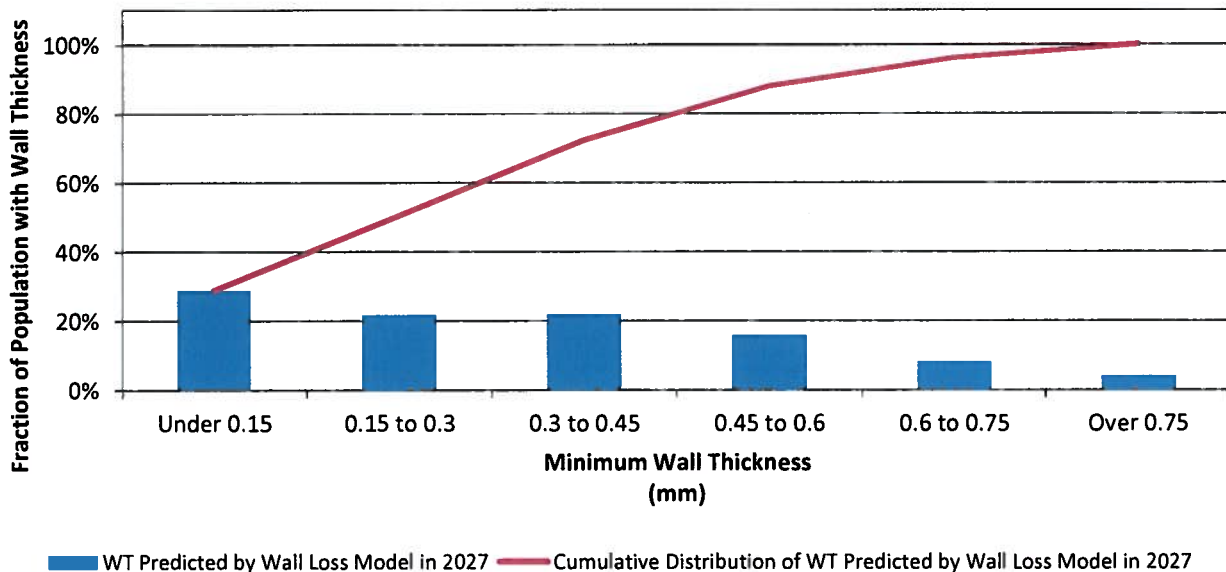


Figure 5.5: Histogram of Minimum Wall Thickness Loss for the Population as of December 2027





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5.1.2 Estimating the Failure Rate and Remaining Life of the Population

Using the wall loss projection through time, the model can be used to estimate the proportion of AMP-CR systems that will have a wall thickness below the failure threshold (approximately 0.05 mm for copper tube at 60 psig⁹). This projection is shown in **Figure 5.6**, with the cumulative distribution function (CDF—the complement of the reliability function, which is the proportion of the population that has failed by time t) of the distribution of fitting failure times and the wall loss projections. The CDF was calculated as the proportion of fittings with a wall thickness below the failure threshold, for a system at 60 psig for illustrative purposes.

⁹ The minimum wall required for a 1/2" nominal OD copper tube to hold the pressures from 10 psig to 80 psig is shown below.

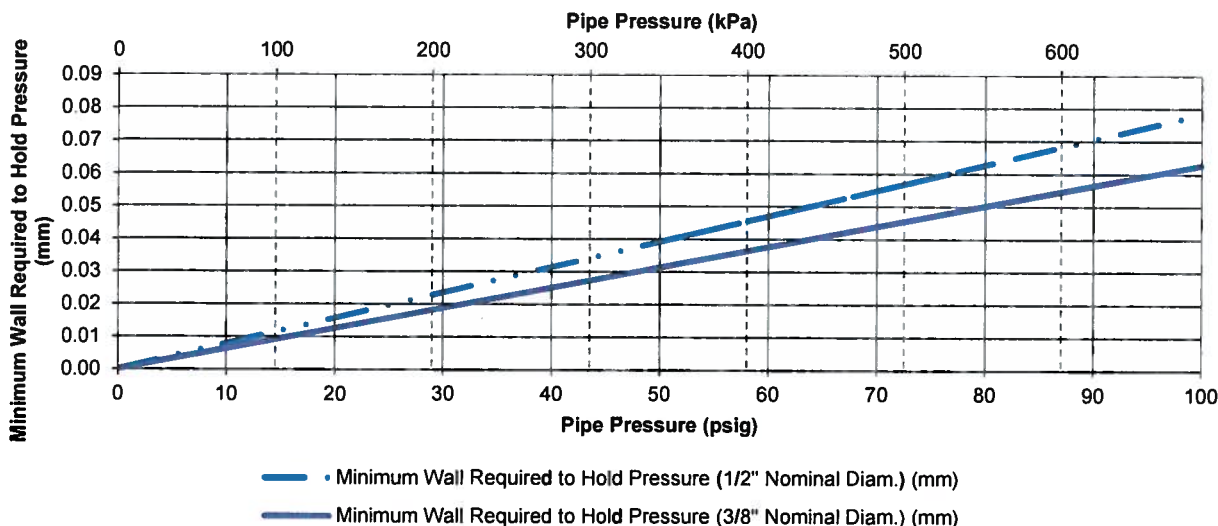
Pressure (psig)	Pressure (kPa)	Minimum Wall Required (1/2" Nominal Diam.) (mm)	Minimum Wall Required (3/8" Nominal Diam.) (mm)
10	69	0.01	<0.01
20	138	0.02	0.01
30	207	0.02	0.01
40	276	0.03	0.02
50	345	0.04	0.03
60	414	0.05	0.03
70	483	0.05	0.04
80	552	0.06	0.04

Using the yield stress of copper (70 MPa) and the diameter of standard 1/2" copper tubing (5/8" specified, equal to 15.875 mm) or standard 3/8" copper tubing (1/2" specified, equal to 12.700 mm), the equation can be rearranged to estimate the minimum wall thickness required to hold a given pressure:

$$t_{min} = P \cdot \frac{d}{2 \cdot \sigma_{yield}}$$

where t_{min} = minimum wall thickness in mm, P = internal pressure in MPa, d = tube diameter (15.875 mm) and σ_{yield} = 70 MPa.

This function is plotted below for reference.





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Figure 5.6: Wall Loss Model Projections with Age, and CDF of Fitting Failure Ages

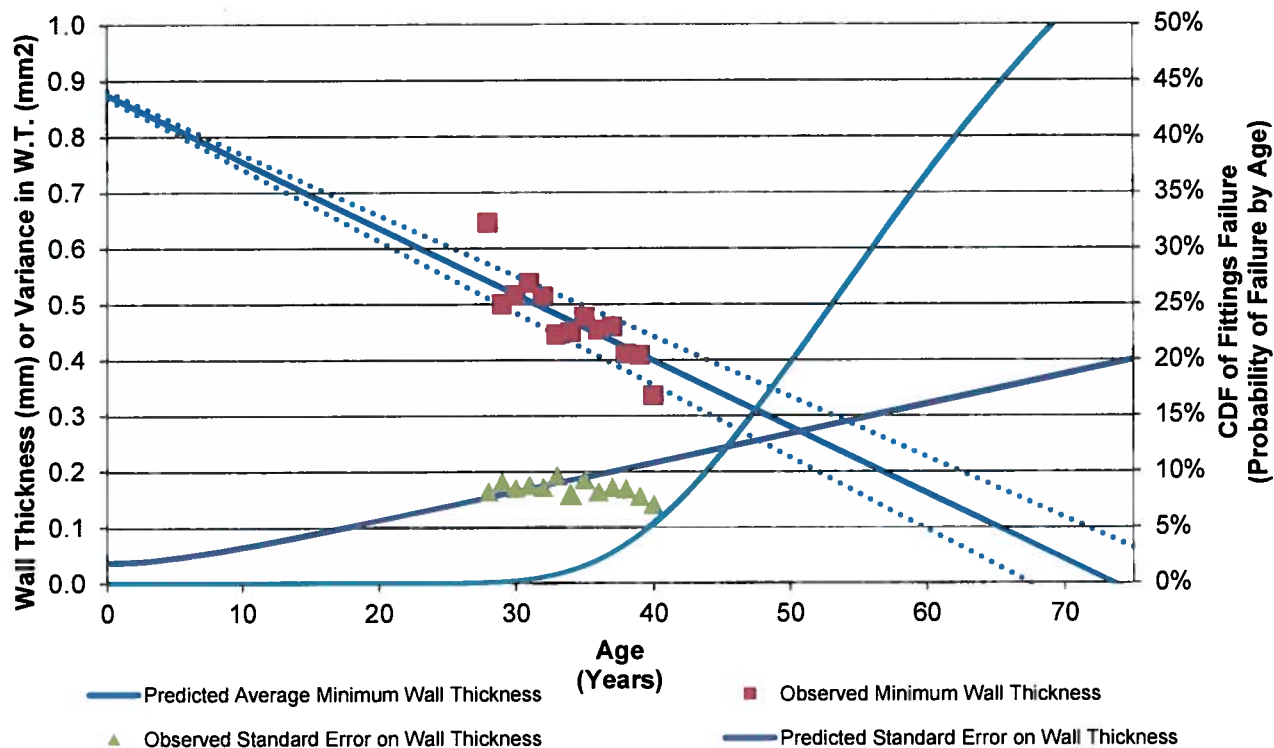


Table 5.3 provides the projected leaks by year with the 95% confidence limits through to 2025. The projected leak rate is in good agreement with the observed leak rate through 2007-2011, showing the good predictive capability of the model. Figure 5.7 provides a plot of the projected leak rates through 2025. The annual leak rate is projected to increase from the current level of roughly 600 (reported leaks for 2011) to 2100 by 2017, with 95% confidence limits of 1800 to 2500.

Based on the 95% confidence limits for the Wall Loss model, it is projected that there will be between roughly 6,700 and 9,300 leaks through the next five years (2013-2017). This projected increase in failure rates is in line with the tripling in leak rates observed through the five year period between 2007 and 2011 (from 204 to 606 failures per year). It is also consistent with the observation that 3.5% of the AMP-CR population (roughly 11,000 systems) currently has a minimum wall thickness less than 0.15 mm, or 1/6 of the original pipe wall thickness. If this trend continues, there are projected to be between 33,000 and 44,000 cumulative failures by 2025.



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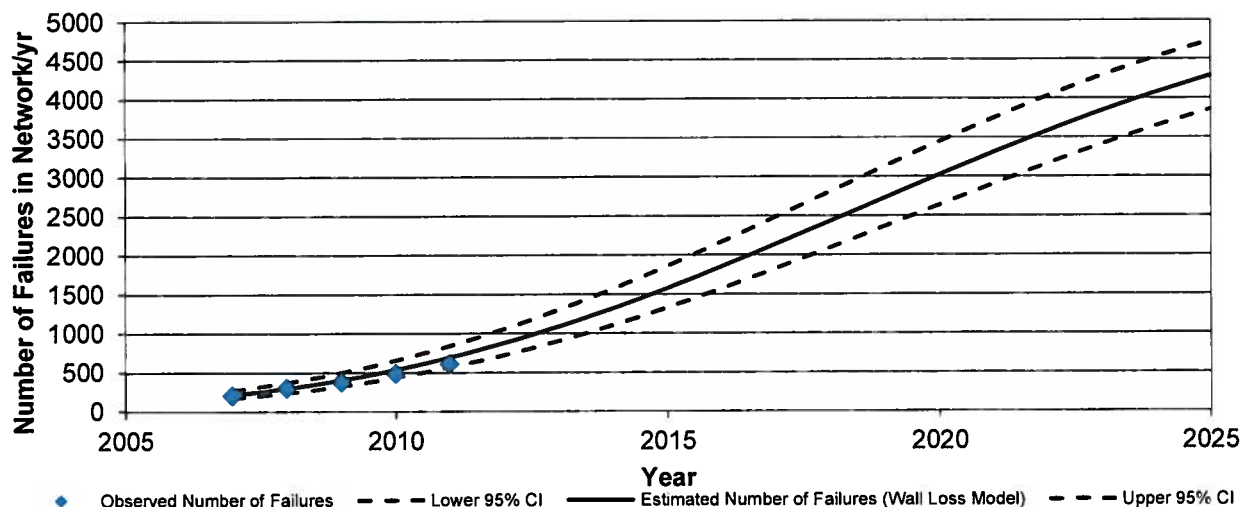
Table 5.3: Projected Future Leaks with 95% Confidence Limits Based on Wall Loss Model

Year	Observed		Cumulative			Yearly		
	Cumulative	Yearly	Lower	Estimated	Upper	Lower	Estimated	Upper
2007	204	204	170	220	270	170	220	270
2008	501	297	410	510	640	240	300	370
2009	880	379	740	920	1,100	330	410	500
2010	1,365	485	1,200	1,500	1,800	440	540	660
2011	1,971	606	1,700	2,100	2,600	570	690	840
2012			2,500	3,000	3,700	720	880	1,100
2013			3,400	4,100	5,000	900	1,100	1,300
2014			4,500	5,400	6,600	1,100	1,300	1,600
2015			5,800	7,000	8,400	1,300	1,600	1,900
2016			7,400	8,900	11,000	1,600	1,900	2,200
2017			9,200	11,000	13,000	1,800	2,100	2,500
2018			11,000	13,000	16,000	2,100	2,400	2,800
2019			14,000	16,000	19,000	2,400	2,700	3,100
2020			16,000	19,000	22,000	2,600	3,000	3,400
2021			19,000	22,000	26,000	2,900	3,300	3,700
2022			22,000	26,000	30,000	3,200	3,600	4,000
2023			26,000	30,000	35,000	3,400	3,800	4,300
2024			29,000	34,000	39,000	3,600	4,100	4,500
2025			33,000	38,000	44,000	3,900	4,300	4,700



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Figure 5.7: Projected Future Leak Rate with 95% Confidence Limits Based on Wall Loss Model



The Wall Loss model may be used to provide an estimate of the distribution of remaining life for the AMP-CR asset base. The time to failure of 5% and 50% of the AMP-CR population are provided for the total asset base by installation year and by flow rate in **Table 5.4**, and for the currently-operating asset base in **Table 5.5**.

As seen in **Tables 5.4** and **5.5**, the mean remaining life of the population as a whole ranges from approximately 20 to 50 years, depending on the flow rate of the service. Five percent of the AMP-CR population is expected to have failed within 3 to 10 years, again depending on flow rate.



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Table 5.4: Remaining Life Statistics for the Whole AMP-CR Asset Base. (5% and 50% columns correspond to the number of years from now until 5% and 50% of installed assets will have failed, respectively.)

Install Year	Flow Rate (m ³ /yr)													
	500		1000		2000		3000		4000		5000		6000	
	5%	50%	5%	50%	5%	50%	5%	50%	5%	50%	5%	50%	5%	50%
1972	3	40	2	37	0	32	0	27	0	23	0	19	0	16
1973	4	41	3	38	1	33	0	28	0	24	0	20	0	17
1974	5	42	4	39	2	34	1	29	0	25	0	21	0	18
1975	6	43	5	40	3	35	2	30	0	26	0	22	0	19
1976	7	44	6	41	4	36	3	31	1	27	0	23	0	20
1977	8	45	7	42	5	37	4	32	2	28	1	24	0	21
1978	9	46	8	43	6	38	5	33	3	29	2	25	1	22
1979	10	47	9	44	7	39	6	34	4	30	3	26	2	23
1980	11	48	10	45	8	40	7	35	5	31	4	27	3	24
1981	12	49	11	46	9	41	8	36	6	32	5	28	4	25
1982	13	50	12	47	10	42	9	37	7	33	6	29	5	26
1983	14	51	13	48	11	43	10	38	8	34	7	30	6	27
1984	15	52	14	49	12	44	11	39	9	35	8	31	7	28
Installation-Weighted Average	10	45	9	42	7	37	6	32	4	29	3	25	3	22

Table 5.5: Remaining Life Statistics for the Currently Operating AMP-CR Asset Base. (5% and 50% columns correspond to the number of years from now until 5% and 50% of currently operating assets will have failed, respectively.)

Install Year	Flow Rate (m ³ /yr)													
	500		1000		2000		3000		4000		5000		6000	
	5%	50%	5%	50%	5%	50%	5%	50%	5%	50%	5%	50%	5%	50%
1972	6	41	5	38	4	33	3	29	2	25	2	22	2	19
1973	6	42	5	39	4	34	3	30	3	26	2	22	2	20
1974	7	43	6	40	5	35	4	30	3	26	2	23	2	20
1975	7	44	6	41	5	35	4	31	3	27	3	24	2	21
1976	8	44	7	41	6	36	5	32	4	28	3	24	2	21
1977	9	45	8	42	6	37	5	32	4	28	3	25	3	22
1978	9	46	9	43	7	38	6	33	5	29	4	26	3	23
1979	10	47	9	44	8	39	7	34	5	30	4	26	3	23
1980	11	48	10	45	9	40	7	35	6	31	5	27	4	24
1981	12	49	11	46	10	41	8	36	7	32	6	28	5	25
1982	13	50	12	47	10	42	9	37	8	33	6	29	5	26
1983	14	51	13	48	11	43	10	38	8	34	7	30	6	27
1984	15	52	14	49	12	44	11	39	9	35	8	31	7	28
Installation-Weighted Average	10	45	9	42	8	37	7	33	6	29	5	25	4	23



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5.2 Leak Rate Model Based on Repair History

In order to verify the projections from the Wall Loss model, a completely separate analysis was conducted based on the observed leak history. Using the repair data provided, observed failure rates as a function of the ages of the installed fitting systems were calculated. These data are shown in **Figure 5.8** for the failure rates from repair information provided over the 2007 to 2011 period. A Weibull model was fit to these data (**Figure 5.9**); the Weibull model, expressed in its reliability model form, is given as:

$$R(t) = \exp\left(-\left(\frac{t - t_0}{\eta}\right)^\beta\right),$$

where:

$R(t)$ = Reliability function, the proportion of the population that has not failed by time t

t_0 = time before which no failures occur

η = eta, the characteristic life or time at which 63.2% of the population has failed

β = beta, the shape parameter¹⁰

The Weibull model can also be expressed in terms of the probability density function (PDF) of failures in the population, i.e. the observed fraction of the population that will fail at a given age t , which is given as:

$$f(t) = \frac{\beta}{\eta} \left(\frac{t - t_0}{\eta}\right)^{\beta-1} \cdot \exp\left(-\left(\frac{t - t_0}{\eta}\right)^\beta\right)$$

Another convenient form of the model is as a hazard function, which is the failure rate at time t of members of the population that have not yet failed by time t . The hazard function has the form:

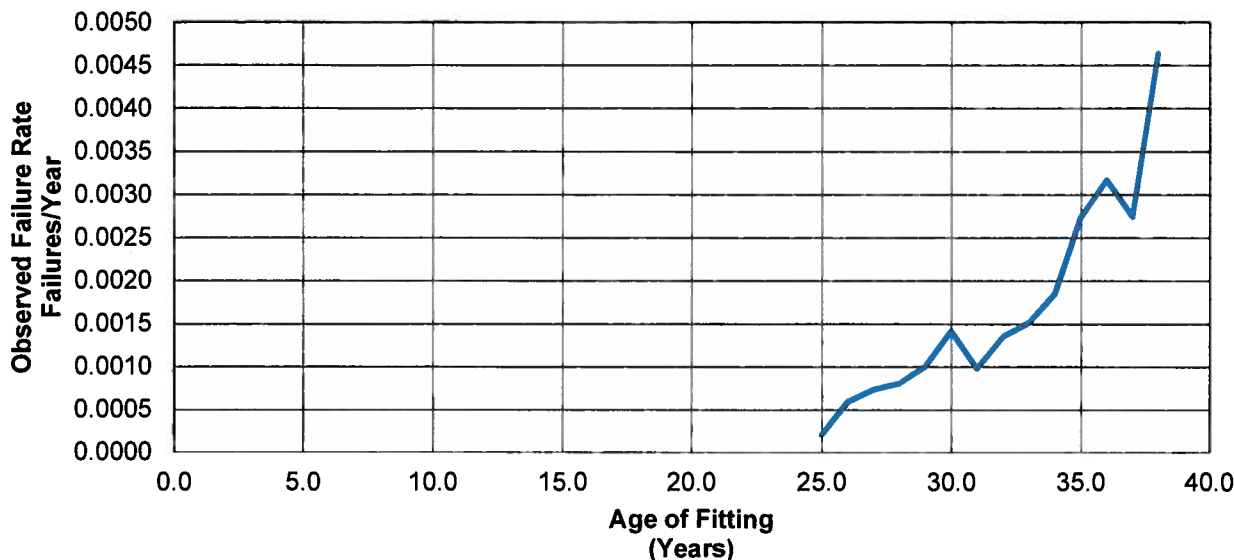
$$h(t) = \frac{\beta}{\eta} \left(\frac{t - t_0}{\eta}\right)^{\beta-1}$$

¹⁰ Beta provides an indication of the nature of the failure rate, for $\beta = 1$ there is a constant failure rate, for $\beta > 1$ the failure rate is increasing and for $\beta < 1$ the failure rate is decreasing.



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Figure 5.8: Observed Failure Rate versus AMP-CR System Age based on Repair Data



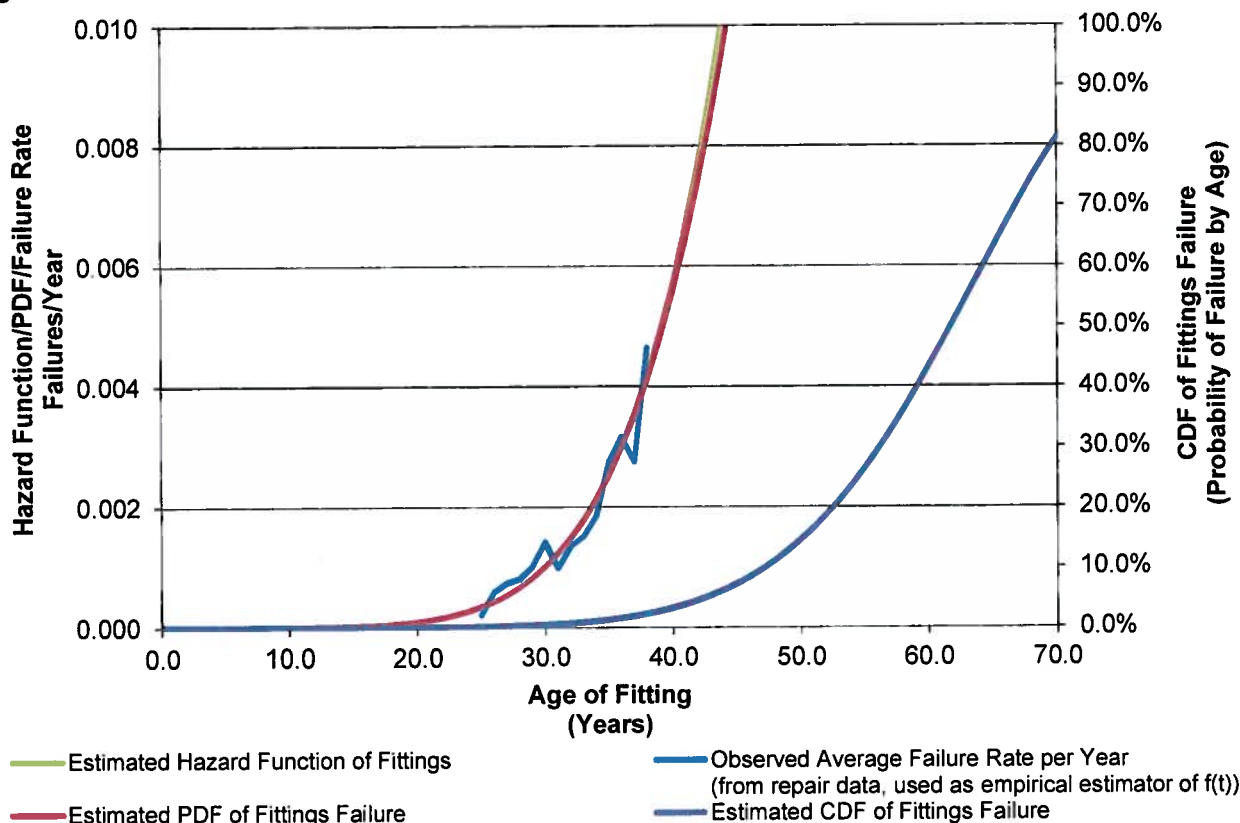
The Weibull PDF ($f(t)$) was fit to the calculated failure rate versus age data to obtain the Weibull parameters: $\beta = 7.0$, $\eta = 65.1$ years and $t_0 = 0.0$ years. The resulting fit to the data is shown in **Figure 5.9**, including the PDF, hazard function, and the CDF.

The results of the Weibull analysis provide two key findings. First, a beta of 7 is indicative of an accelerating failure rate and suggests the AMP-CR asset base is entering the extreme wear out phase. This is consistent with the observed failure mechanism (corrosion failures are typically observed to accelerate with time). Second, the Weibull analysis provides the ability to estimate the mean remaining life of the population and to forecast future leakage rates. These projections are examined in the following section.



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Figure 5.9: Hazard Function, PDF and CDF for Repair Data Leak Rate Model





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5.3 Comparison of Leak Rate Forecast Models Against Observed Failure Rates

The two models developed were compared against each other and the observed failures of AMP-CR assets in the Enbridge distribution system. Both models show excellent agreement with Enbridge's experience, as shown in **Table 5.6**, and with each other, as shown in **Figure 5.10**. The actual and projected annual leak rates are plotted in **Figure 5.11**.

Table 5.6: Observed versus Projected Failures by Year

Year	Observed Failures		Projected Failures				Percent Error ¹			
	Cumulative	Yearly	Weibull Model		Wall Loss Model		Weibull Model		Wall Loss Model	
			Cumulative	Yearly	Cumulative	Yearly	Cumulative	Yearly	Cumulative	Yearly
2007	204	204	240	240	220	220	18.9%	18.9%	5.5%	5.5%
2008	501	297	540	300	510	300	7.4%	-0.6%	2.7%	0.8%
2009	880	379	900	360	920	410	1.7%	-5.7%	4.6%	7.0%
2010	1,365	485	1,300	430	1,500	540	-2.9%	-11.4%	6.7%	10.6%
2011	1,971	606	1,800	510	2,100	690	-6.7%	-15.2%	9.0%	14.3%
2012			2,400	610	3,000	880				
2013			3,200	720	4,100	1,100				
2014			4,000	850	5,400	1,300				
2015			5,000	1,000	7,000	1,600				
2016			6,200	1,200	8,900	1,900				
2017			7,500	1,400	11,000	2,100				
2018			9,100	1,600	13,000	2,400				
2019			11,000	1,800	16,000	2,700				
2020			13,000	2,100	19,000	3,000				
2021			15,000	2,300	22,000	3,300				
2022			18,000	2,700	26,000	3,600				
2023			21,000	3,000	30,000	3,800				
2024			24,000	3,400	34,000	4,100				
2025			28,000	3,800	38,000	4,300				

¹Note: Calculations based on unrounded numbers.



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Figure 5.10: Comparison of Estimated Cumulative Distribution Functions for Models

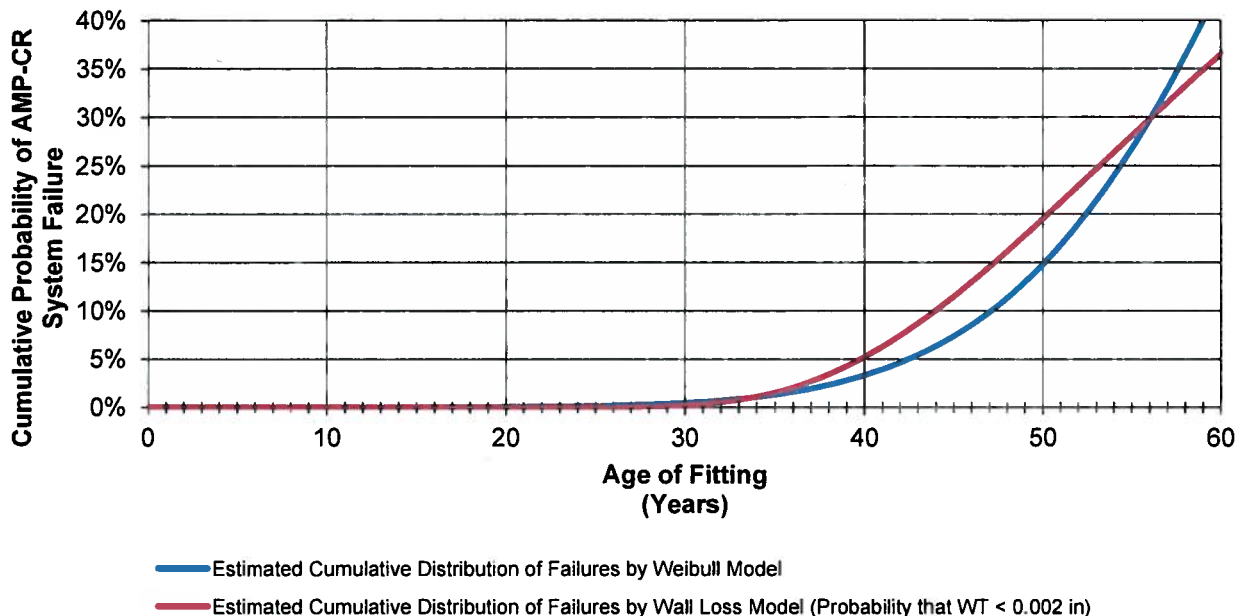
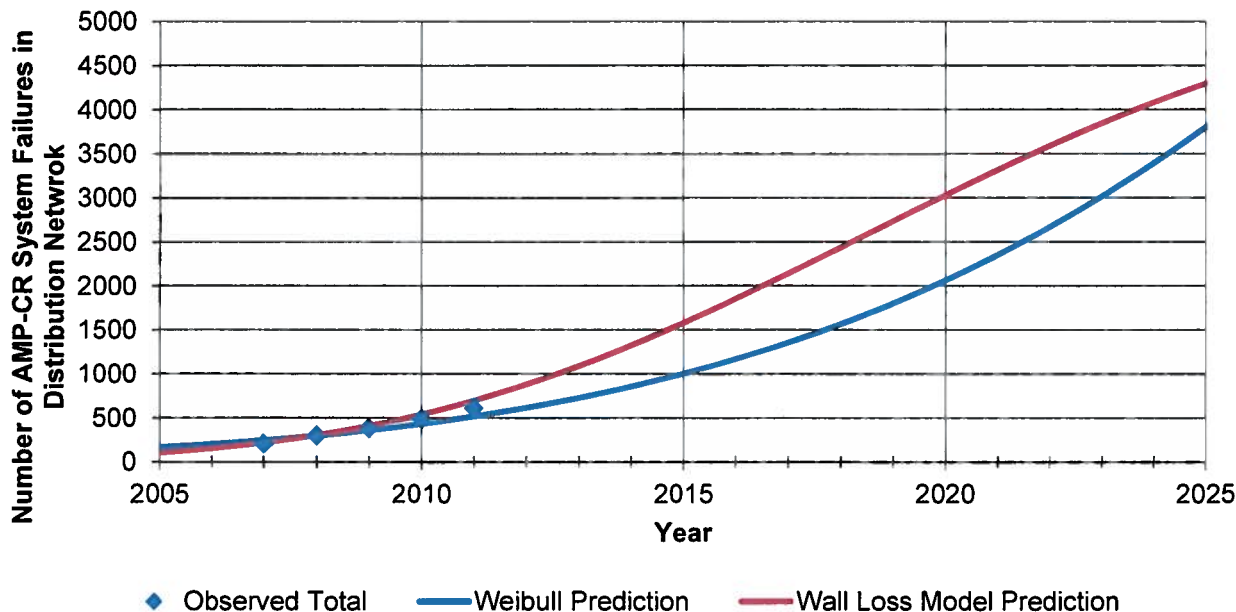


Figure 5.11: Projected Number of Network-Wide Failures by Year



The agreement of the two completely independent models with each other and with the observed leak history suggests that the Wall Loss model developed in this project provides a good forecast of expected system performance.



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5.4 Discussion of Model Projection Accuracy and Limits of Confidence

There is a high level of confidence in the general trends and magnitude of the leak rate projections from the Wall Loss model based on the following:

- Excellent agreement was observed between the model projected distribution of wall losses and the actual measured distribution, indicating that the Wall Loss model captures the observed corrosion mechanism (**Section 5.1.1, Figure 5.1**).
- The Wall Loss model failure projections were verified based on comparison with projections from an independently developed model based on the AMP-CR repair data supplied by Enbridge. The models were in excellent agreement.
- Both models were further verified by comparison with past observed leak history. Again excellent agreement was observed.

It is important to realize that all models are approximations of reality with inherent uncertainties. While the agreement of the two different modeling approaches, one based on the observed leak history and one based on observed wall loss rates, suggests that the resulting projections are likely a realistic forecast of future leak rates, in using these projections to guide decision making, there needs to be consideration that they are only estimates of future behavior.

With the above in mind, however, it is seen that the two models proved excellent predictive power to the present. The predictions of the two models are in agreement despite their independent derivation, and their predictions are in agreement with observations of the failure history of the population in service. Thus, there is a very high degree of confidence in the projections of the models in the near- and mid-term.

The model projections through the next five year period are believed to provide a good estimate of expected performance based on the model validations discussed above. Projections beyond the next five year period should be considered as directional only. It is recommended that the models be checked versus actual observed leak rates moving forward as a check of future forecast ability. It is also important to consider that changes to the system (e.g. replacements, increased leak surveys, etc.) may lead to a change in future observed leak rates.

Beyond 2025 there are potential limitations to the model's accuracy and, hence, the confidence in its predictions. First among these is that the model is based on failure behavior observed up to approximately 40 years of age; beyond 2025 all AMP-CR systems will be at ages older than this. Furthermore, as the AMP-CR asset base has only recently entered the wear-out phase of its life, projections of the failure behaviour based upon the repair histories necessarily make failure time predictions of some 99% of the AMP-CR systems based on the approximate first 1% that have failed. For this reason, leak rate projections beyond 2025 have not been provided.



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6.0 Risk Ranking of AMP Fitting-Copper Riser Systems

Risk rank models for the AMP-CR population have been developed based on the analysis of the field specimens. An analysis of the key variables considered in development of the risk rank models is presented in this section. The primary variables that appear to significantly impact the minimum wall thickness are the age of the AMP-CR system and the gas flow rate. Operating pressure and proximity to the gate station (as a possible proxy for mercaptan concentration as dosing occurs at the gate station) are not seen to have a statistically significant impact at the 95% confidence level; however, the effect of system pressure may be included in the risk ranking models that were developed based on wall loss rates. There is also no statistically significant difference in the wall loss rates by operating area, soil type, moisture condition of soil, coating type or length from the AMP fitting to the riser, to the grade or to the foundation wall.

Two risk rank models were developed, an age based model and an age-flow rate model. Based on a 20-year replacement schedule, an asset replacement program based on risk rank removals offers a significant reduction in projected in-service failures over the course of the program, with roughly 20% fewer failures projected compared to a random replacement program. Although flow rate is seen to play a key role in the corrosion mechanism, the risk rank model based on age-flow rate results in only roughly a 3% further reduction in in-service failures compared to the risk rank model based on age alone. This is believed to be largely due to the limited historical flow data (seven years or roughly 15 to 25% of the AMP-CR system lifetimes) available for model development coupled with the roughly one quarter of the AMP-CR systems showing higher corrosion rates than the general population (where corrosion is occurring at the defect).

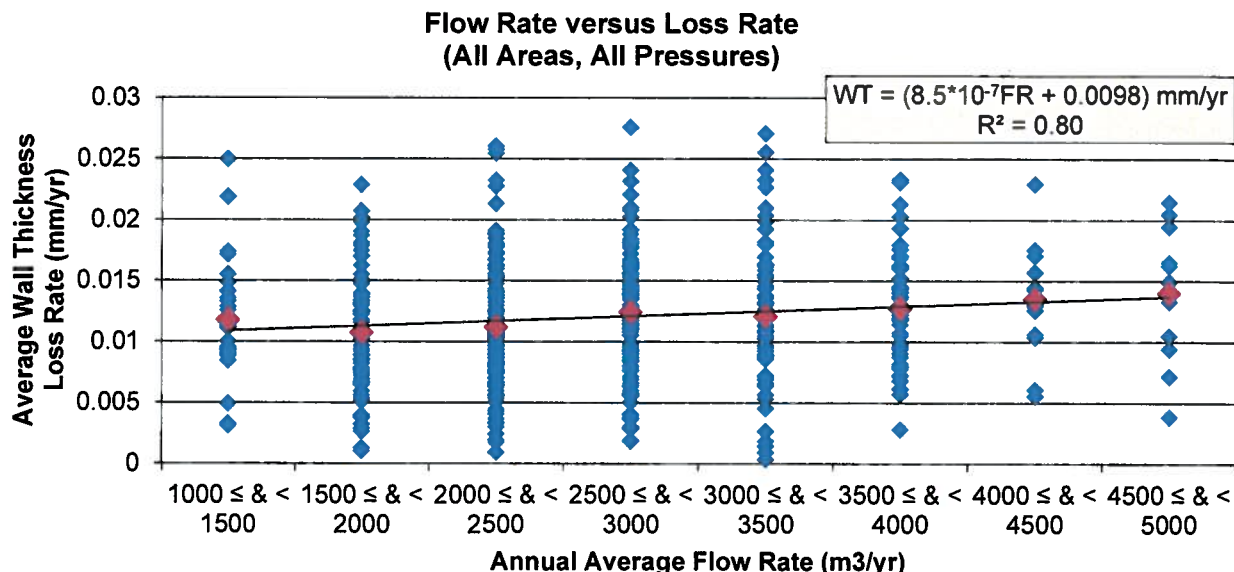
6.1 Analysis of Key Variables

Figure 6.1 shows the observed correlation between wall thickness loss rate and average annual flow rate based on the last seven years of usage data. The R^2 of 0.80 for the average wall thickness loss rates shows good general correlation. There is, however, significant scatter in the wall thickness loss rates within each of the flow rate ranges and overlap between the ranges. This is partially due to the use of only the last seven years of flow data for correlation. Over the 30 to 40 year history of the AMP-CR systems, significant variations in gas usage rate for a given installation are possible (switching from gas to electric stoves or heating (or vice versa), installation of a gas fireplace, etc.). Given the strong observed impact of flow on the corrosion process, any such changes would be expected to result in significant changes in the corrosion rate for a given installation.



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Figure 6.1: Comparison of Annual Average Flow Rate versus Wall Thickness Loss



Due to difficulties in obtaining the past flow history data, Enbridge is uncertain how much additional flow data might be available. This is believed to be a primary limiting factor to the selective capability of any risk ranking model developed for the AMP-CR systems. Clearly, it will be a significant benefit to Enbridge if this barrier can be overcome as it would enable performance projections that would allow for effective operational and maintenance planning for AMP fitting replacement in the highest risk areas. This would facilitate a significant reduction in risk in the system in the most cost effective manner.

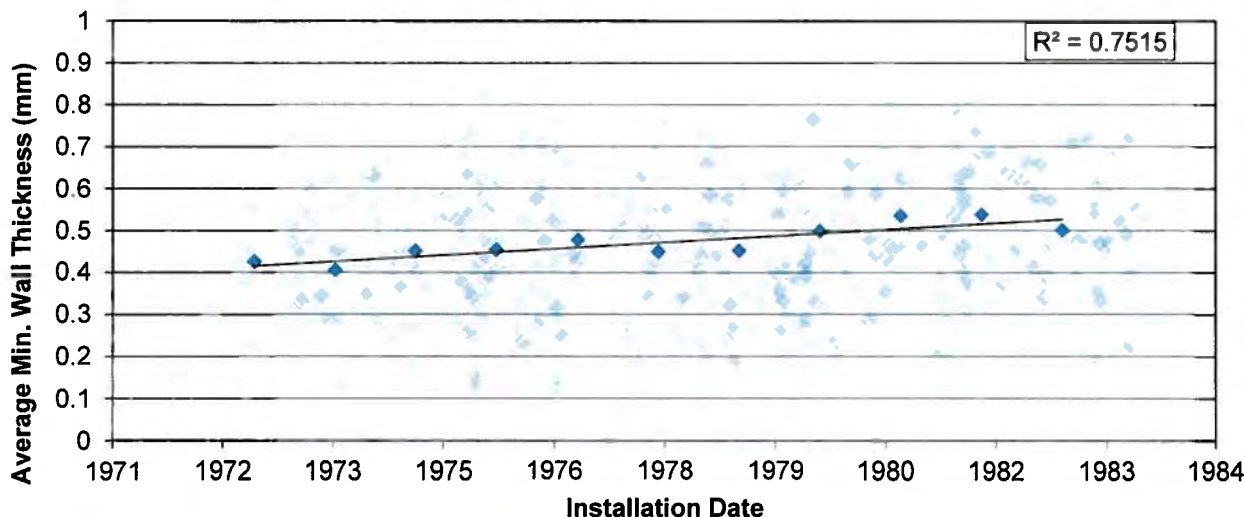
Figure 6.2 shows the minimum wall thickness as a function of installation year (age) of the AMP-CR systems. As discussed previously, age is seen to be correlated with wall loss because the observed mechanism for wall loss is localized corrosion, which is a time-dependent process. As shown in **Section 5**, good predictive models have been developed to account for the impact of age on minimum wall thickness. One of the risk rank models developed is based on a simple age based replacement program.



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Figure 6.2: Analysis of the Minimum Wall Thickness for AMP Fittings-Copper Riser Specimens

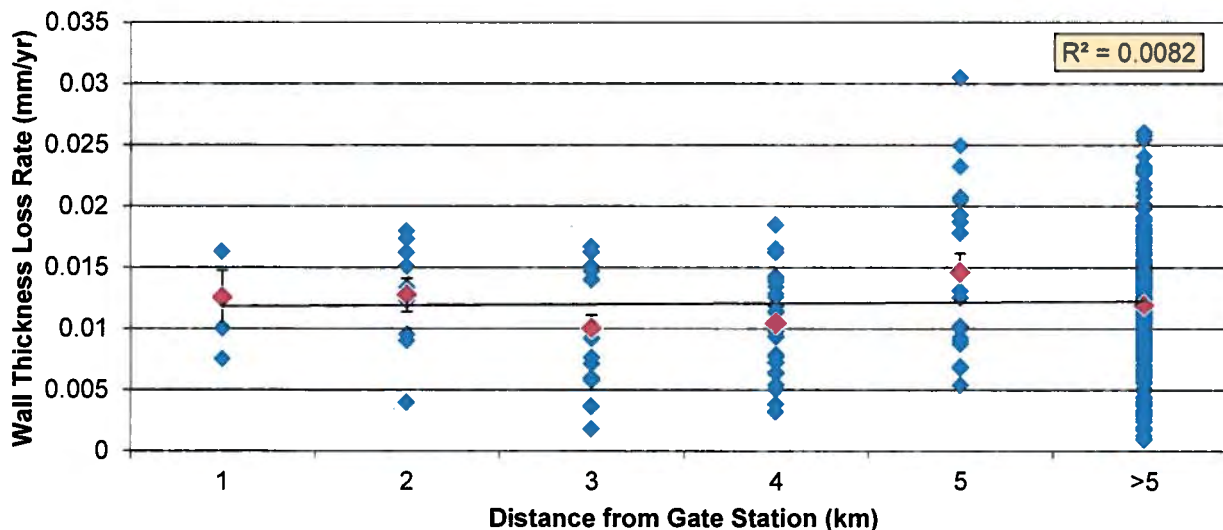
**Average Minimum Wall Thickness
(For Installation Year 1973-1983)**



As shown in **Figure 6.3**, no correlation is observed between the wall thickness loss rate and proximity to the gate station where odorants are introduced into the system. This does not, therefore, appear to be a key variable in wall thickness loss rate.

Figure 6.3: Analysis of Wall Thickness Loss Rate by Distance from Gate Station

Average Wall Thickness Loss Rate by Distance from Gate Station

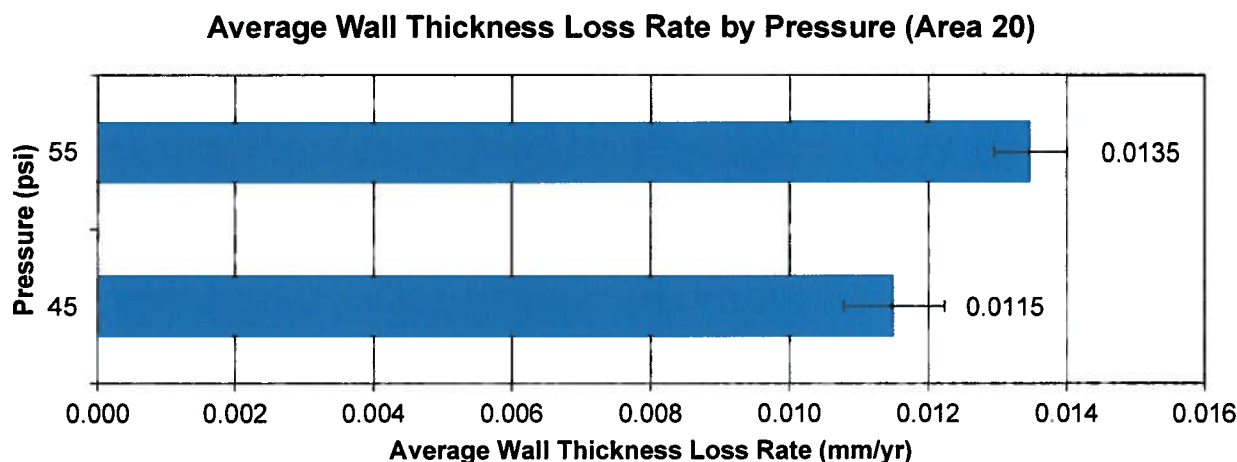




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As pressure can impact turbulence (by increasing the Reynolds Number for a given volumetric flow rate), the impact of pressure on wall thickness loss rate was examined. **Figure 6.4** shows the wall thickness loss rate as a function of pressure in the Enbridge distribution system for Area 20. While the mean wall thickness loss rate differs by approximately 15%, due to scatter in the data at the 95% confidence level, there is no statistically significant impact of pressure observed on wall thickness loss rates¹¹, suggesting pressure is not a key variable in distinguishing between wall thickness loss rates. This observation may be a consequence of the limited pressure range within this system.

Figure 6.4: Analysis of Wall Thickness Loss Rate versus Pressure of Specimens in Area 20



Note: Error bars are 1 standard error of the observed wall thickness loss rate in the population.

Wall thickness loss rate was also compared to the following in **Figures 6.5** through **6.10**:

- Soil type
- Moisture condition of soil
- Coating type
- Length from the AMP fitting to the riser
- Length from the AMP fitting to the grade
- Length from the AMP fitting to the foundation wall

None of these variables were seen to have any statistically significant impact.

¹¹ A Student t-test performed on the average wall thickness loss rate between the two pressure groups for Area 20 shows with a 95% confidence level that there is no significant difference between the two wall thickness loss rate averages (t-score = 2.2, p-value = 0.06).



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Figure 6.5 Analysis of Wall Thickness Loss Rate by Soil Type

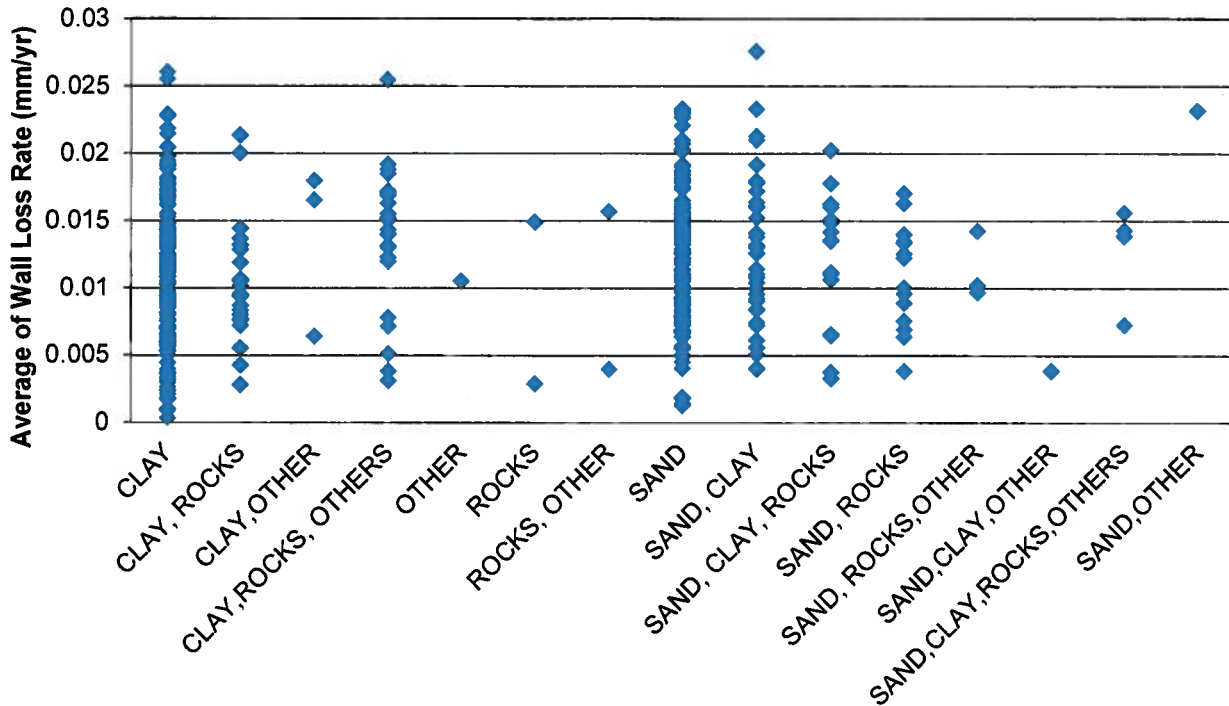
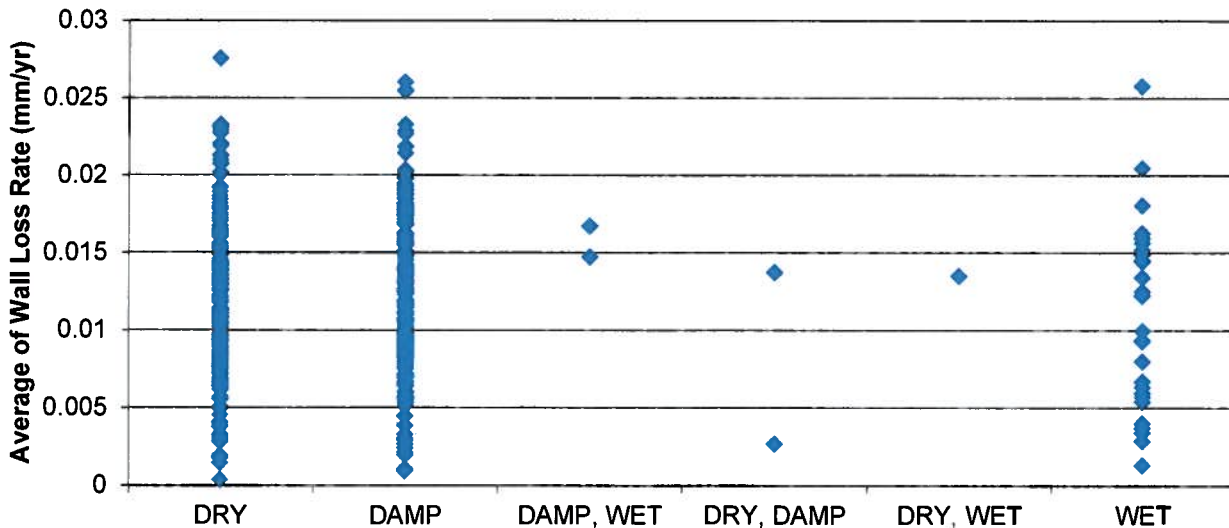


Figure 6.6 Analysis of Wall Thickness Loss Rate by Moisture Condition of Soil





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Figure 6.7 Analysis of Wall Thickness Loss Rate by Coating Type (M is Mastic, T is Tape, and B is Both)

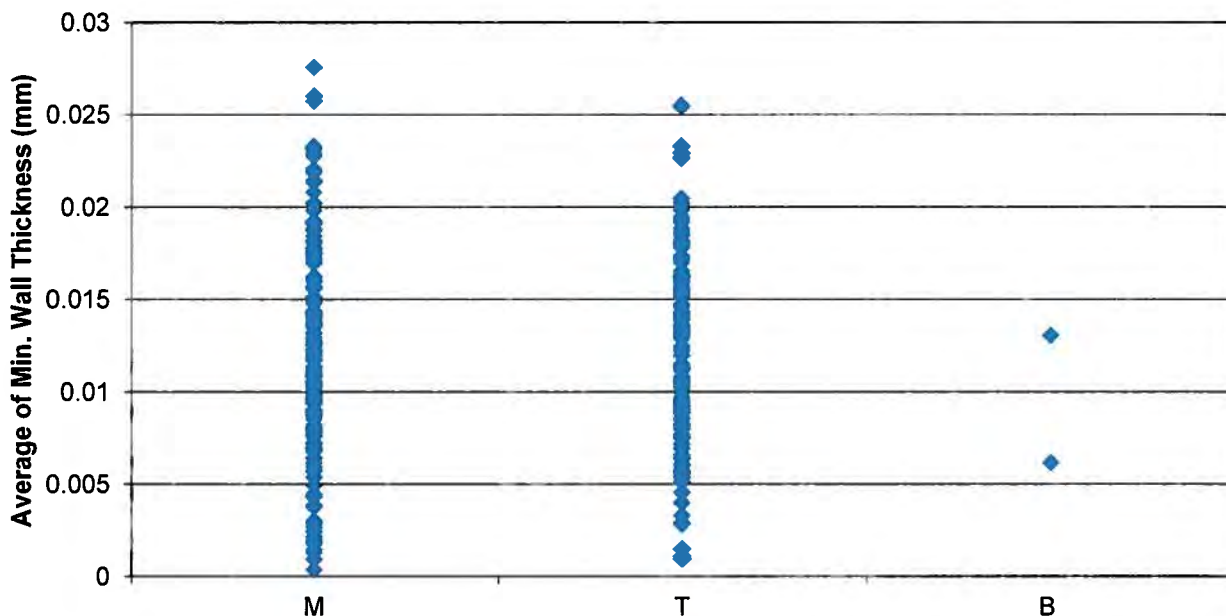
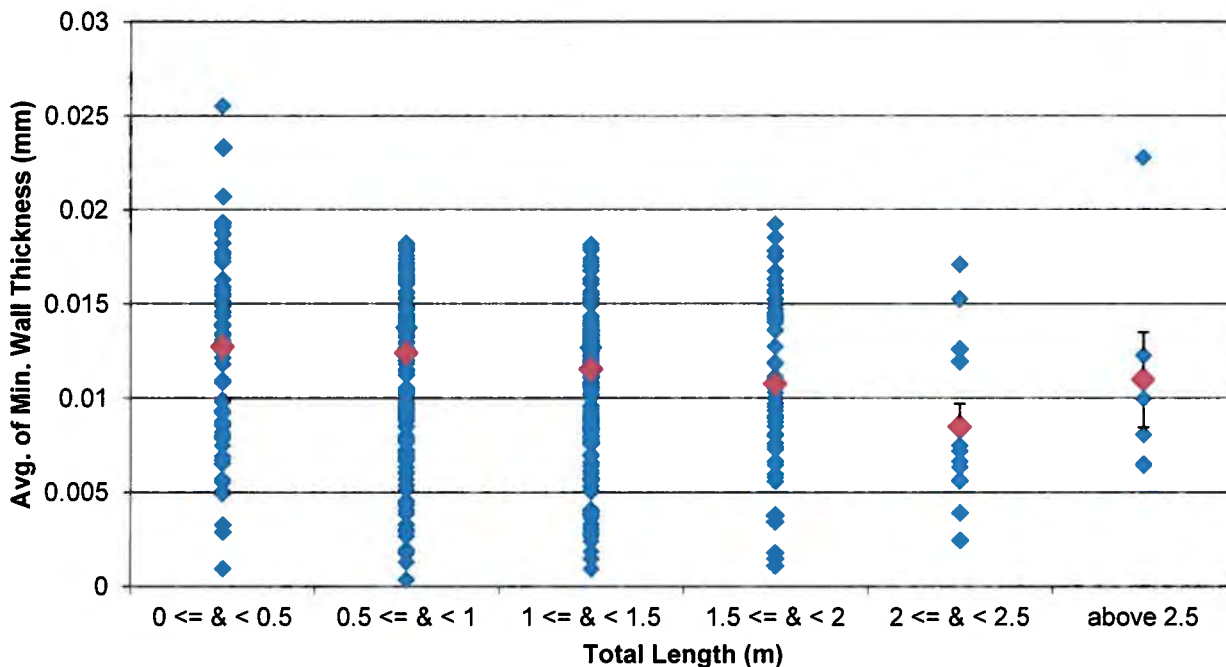


Figure 6.8: Analysis of Wall Thickness Loss Rate by the Length from the AMP Fitting to the Riser





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Figure 6.9: Analysis of Wall Thickness Loss Rate by the Length from the AMP Fitting to the Grade

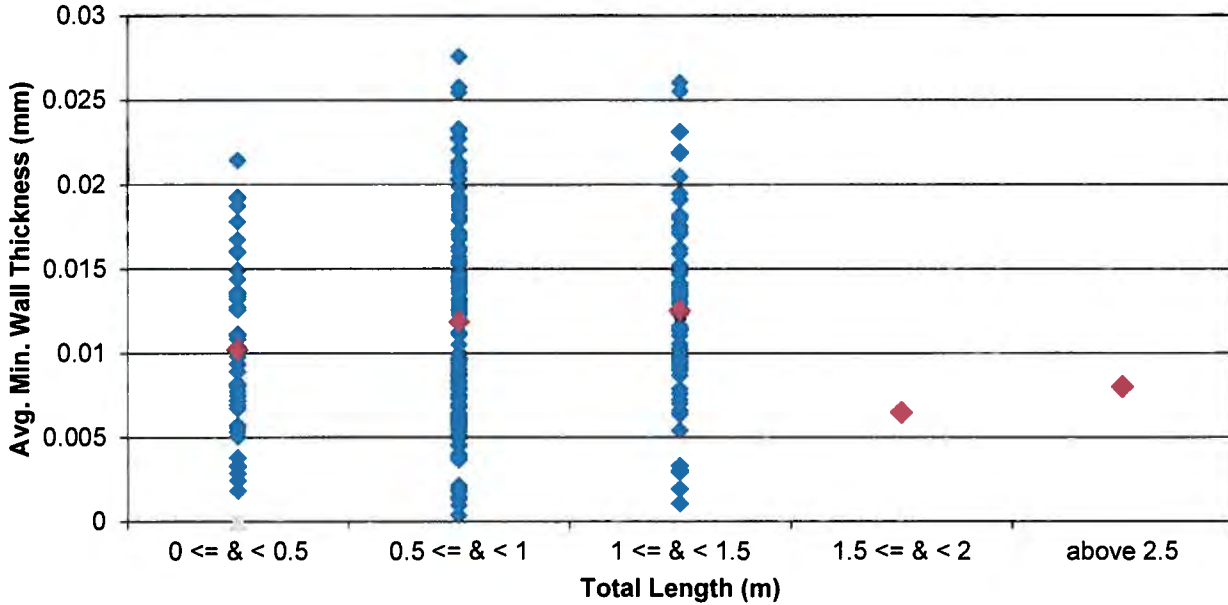
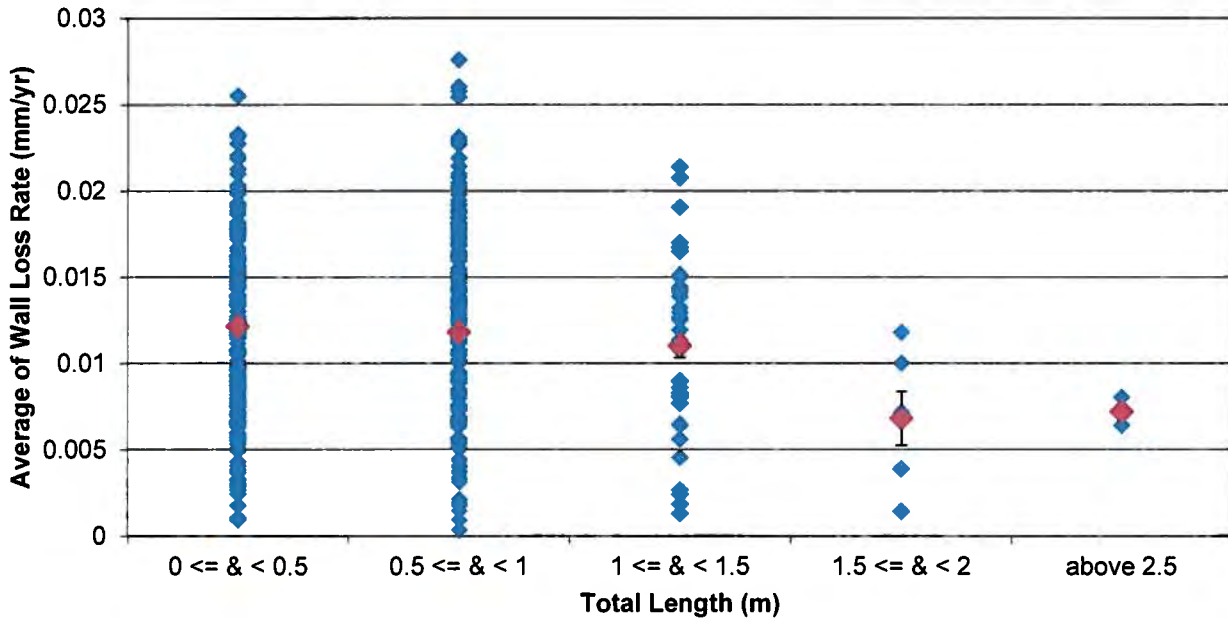


Figure 6.10: Analysis of Wall Thickness Loss Rate by the Length from the AMP Fitting to the Foundation Wall





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6.2 Recommended Risk Ranking Model

The preceding suggests that the most important factors affecting wall thickness in the AMP-CR population are age and flow rate of the gas through each fitting. Two risk rank models were, therefore, developed. One based simply on age and one that accounts for both the aging of the asset and the flow rate through it.

The age-flow rate model is based on the model presented in **Section 5.1**, and combines it with information from the analysis of the relationship between gas flow rate and wall thickness.

As with the model shown in **Section 5.1**, the model is based on the assumption of normally distributed initial wall thicknesses and normally distributed wall loss rates. However, in this latter case, the mean of the wall loss rate distribution is a linear function of the average annual flow rate of the AMP-CR system. As it was found that there was little change in the sample standard deviation of the wall loss rate with changes in flow rate, a constant was assumed for this parameter. Thus, the distribution of wall thickness for the copper riser in the AMP-CR system is given as a function of the system's age and its average annual flow rate by:

$$N_{t_{age}} \sim Normal\left(\mu_{initial\ W.T.} - t_{age} * \mu_{yrdiff}(Flow\ Rate), t_{age}^2 \cdot \sigma_{yrdiff}^2 + \sigma_{initial\ W.T.}^2\right)$$

where:

- t_{age} = Specimen age in years,
- $\mu_{initial\ W.T.}$ = Mean original wall thickness (0.8741 mm),
- $\sigma_{initial\ W.T.}$ = Sample standard deviation (0.0376 mm),
- σ_{yrdiff} = Sample standard deviation of the wall loss rate (0.0053 mm/yr);

$\mu_{yrdiff}(Flow\ Rate)$ is the mean of the annual wall loss distribution, and is given by:

$$\mu_{yrdiff}(Flow\ Rate) = \mu_0 + \mu_1 \cdot (Flow\ Rate)$$

where:

- μ_0 = Estimated mean wall loss rate at minimal flow (0.00977 mm/yr),
- μ_1 = Slope of the mean wall loss rate per m³ of flow per year
(8.49.10⁻⁷ (mm/yr)/(m³/yr)),
- $Flow\ Rate$ = The flow rate of the gas through the system, measured in m³/yr.

The annual number of failures that would be observed in the installed AMP-CR population are shown below in **Table 6.1**, using as the failure criterion the point when the wall thickness falls below the minimum required to contain 60 psig of pressure. The model appears more accurate than both the Weibull model applied to the repair data and the Wall Loss model that does not account for flow over the limited available data range examined.



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Standard statistical tests indicate that the model fits the data well. The normalized residuals¹² of this model compared to the observations from the exhumed specimens are shown below in **Figure 6.11**, indicating that the model of the wall thickness distribution matches the observed one very well. The Kolmogorov-Smirnoff (K-S) statistic comparing the predicted Z-Scores of the model with the Gaussian (Standard Normal) distribution is 0.0384. The corresponding p-value of this K-S statistic is 0.893—well above the 95% confidence threshold of 0.05.

Table 6.1: Predicted level of failures in the AMP-CR using the Risk Ranking Model

Year	Observed Failures		Predicted Number of Failures using Wall Loss Model (Flow-Dependent Loss Rate)		Percent Error ¹					
					Weibull Model		Wall Loss Model (Average Loss Rate)		Wall Loss Model (Flow-Dependent Loss Rate)	
	Cum.	Yearly	Cum.	Yearly	Cum.	Yearly	Cum.	Yearly	Cum.	Yearly
2007	204	204	169	169	14.70%	14.70%	12.69%	12.69%	-17.26%	-17.26%
2008	501	297	410	241	4.00%	-3.70%	8.50%	10.20%	-18.17%	-18.79%
2009	880	379	744	335	-1.40%	-8.40%	15.71%	12.57%	-15.40%	-11.74%
2010	1,365	485	1,196	452	-5.70%	-13.60%	19.81%	15.15%	-12.37%	-6.88%
2011	1,971	606	1,791	595	-9.20%	-17.20%	23.99%	17.86%	-9.13%	-1.84%

¹Note: Calculations based on unrounded numbers.

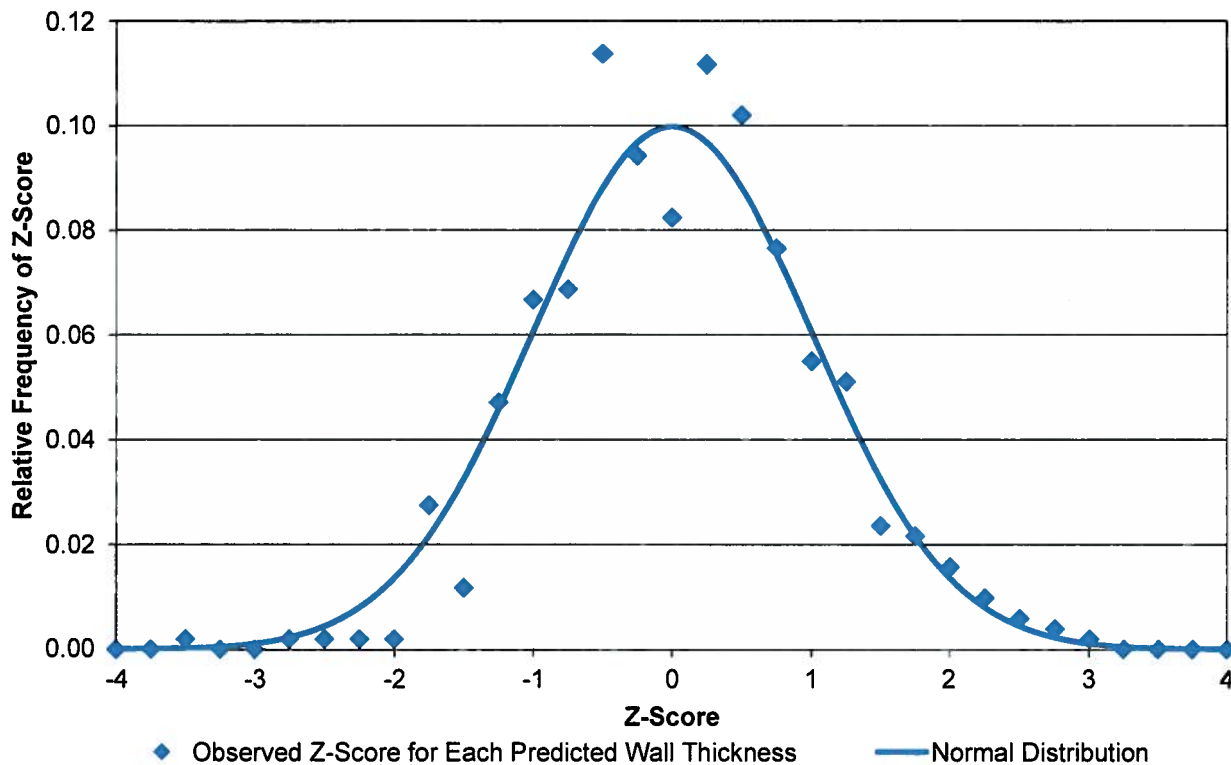
It should be noted that this model implicitly includes system pressure as an explanatory variable for the failure rate of the fittings, as the failure criterion is the point when the wall thickness falls below the minimum required to contain a certain level of pressure. This may permit greater specificity in selecting systems for replacement. It should be noted, however, that there is only approximately a two year difference in projected lifetime between systems at 40 psig and 60 psig operating pressures for AMP-CR systems experiencing typical wall loss at minimum flow rates.

¹² The normalized residual chosen was the Z-Score, the difference between the mean predicted minimum wall thickness of a particular AMP-CR specimen and the measured minimum wall thickness, divided by the predicted standard deviation of the predicted minimum wall thickness distribution. It was selected because the predictive model used is based on the Normal distribution.



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Figure 6.11: Normalized residuals of the minimum wall thickness observations from exhumed specimens





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6.3 Application of Recommended Risk Ranking Model for the AMP-CR Asset Replacement Program

The developed Risk Ranking Models (RRM) were applied to optimize a simulated asset replacement program for the AMP-CR asset base. Four different programs were considered:

1. A replacement program where the AMP-CR population is replaced on an as-needed basis—where replacement occurs only on failure;
2. A replacement program where the population is replaced proactively on an age-replacement basis (i.e. oldest assets replaced first) over a 20-year period;
3. A replacement program where the population is replaced proactively on a risk basis that incorporates both flow and age over a 20-year period;
4. A replacement program where the population is replaced on a random basis over a 20-year period.

The latter three programs require the replacement of approximately 15,000 AMP-CR systems per year over the 20-year time period. For modeling purposes the number of fittings replaced each year in programs 2, 3, and 4 were made identical, so as to provide a clearer comparison of their relative effectiveness.

As presented in **Figure 6.12** and **Tables 6.2** and **6.3** below, the as-needed replacement program results in a significantly higher projected failure rate as compared to the three proactive programs. The risk-based proactive replacement programs offer a significantly improved level of system reliability as compared to the random replacement program, as shown in **Figure 6.13**, avoiding approximately 5,000 in-service failures (approximately 18% of the projected total) over the 20-year replacement period. This avoidance of approximately 5,000 failures can be achieved with the same level of replacement and minimum additional planning.

The age-and-flow risk-based program results in an estimated avoidance of approximately 700 in-service failures over the 20-year time period compared to the age-only risk-based program. This avoidance of approximately 700 failures can be achieved with the same level of replacement and minimum additional planning. While the elimination of approximately 700 failures is significant, the risk rank model based on age-flow rate results in only roughly a 3% further reduction in in-service failures compared to the risk rank model based on age alone. This is believed to be largely due to the limited historical flow data (seven years or roughly 15 to 25% of the AMP-CR system lifetimes) available for model development coupled with the roughly one quarter of the AMP-CR systems showing higher corrosion rates than the general population (where corrosion is occurring at the defect).



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Figure 6.12: Predicted level of failures in the AMP-CR population with alternative proactive replacement programs considered

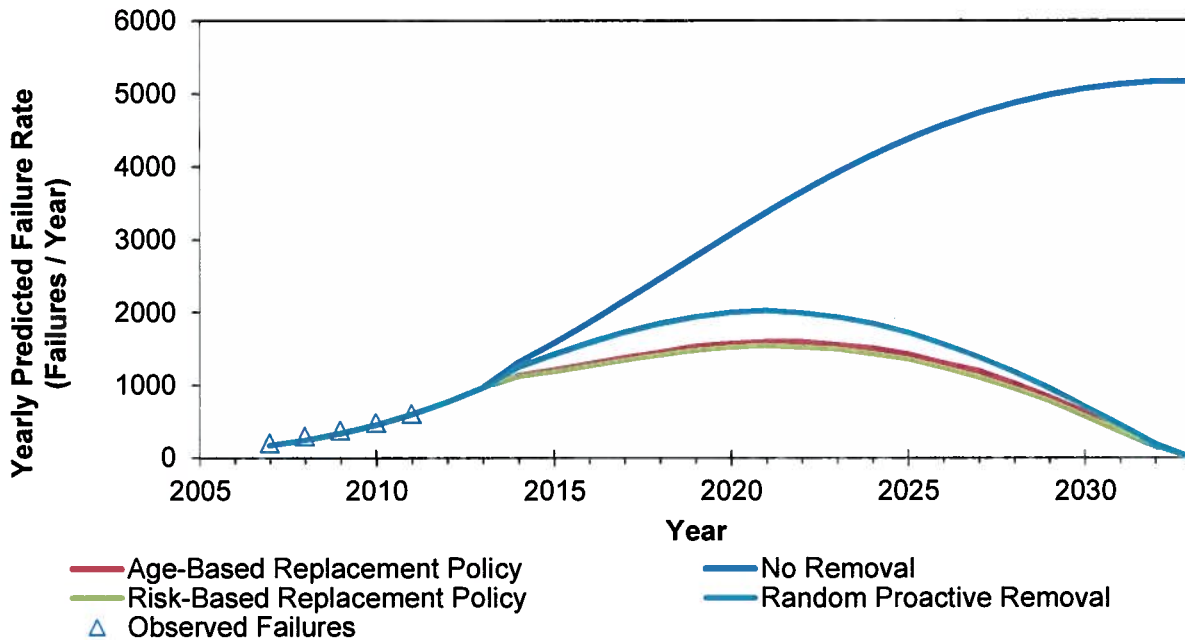
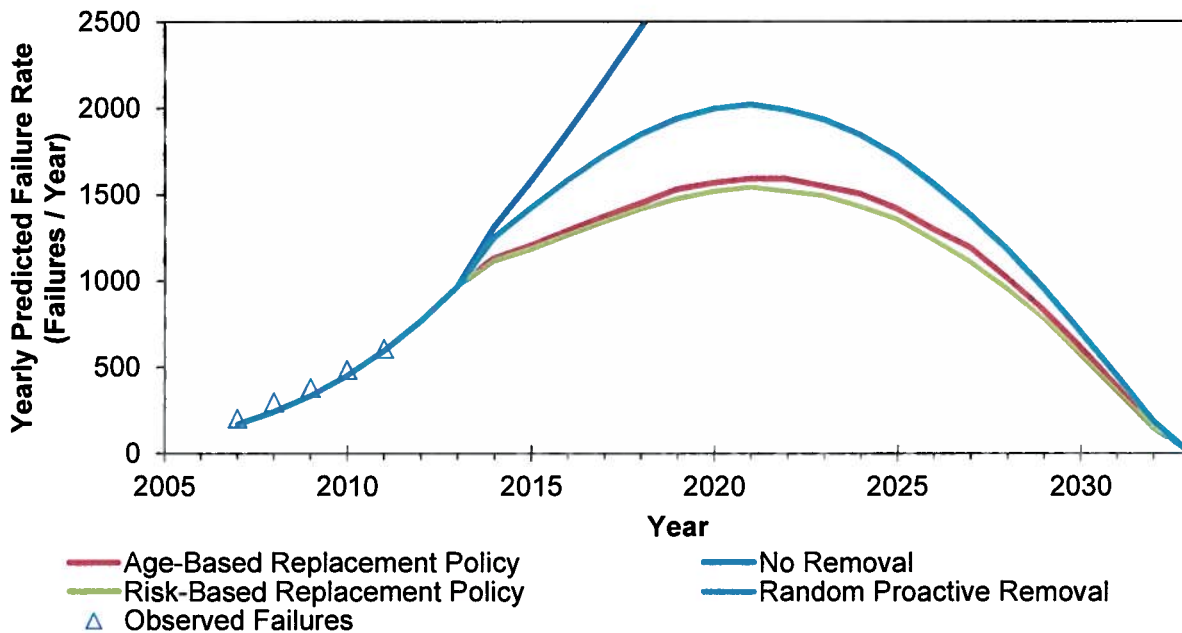


Figure 6.13: Predicted level of failures in the AMP-CR population with alternative proactive replacement programs considered





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Table 6.2: Predicted Cumulative failures in the AMP-CR population with alternative replacement programs considered

Year	Observed Failures		Program 1		Number Removed in Proactive Programs by Year	Program 2	Program 3	Program 4
			No Proactive Removal			Age-Only Risk Based Proactive Removal	Age-and-Flow Risk-Based Proactive Removal	Random Proactive Removal
	Cum.	Yearly	Cum.	Yearly		Cum.	Cum.	Cum.
2007	204	204	170	170		170	170	170
2008	501	297	410	240		410	410	410
2009	880	379	740	330		740	740	740
2010	1365	485	1,200	450		1,200	1,200	1,200
2011	1971	606	1,800	590		1,800	1,800	1,800
2012			2,600	770		2,600	2,600	2,600
2013			3,500	960	14,000	3,500	3,500	3,500
2014			4,800	1,300	16,000	4,700	4,600	4,800
2015			6,400	1,600	15,000	5,900	5,800	6,200
2016			8,300	1,900	15,000	7,100	7,100	7,800
2017			10,000	2,200	15,000	8,500	8,400	9,500
2018			13,000	2,500	15,000	10,000	9,800	11,000
2019			16,000	2,800	15,000	11,000	11,000	13,000
2020			19,000	3,100	15,000	13,000	13,000	15,000
2021			22,000	3,400	16,000	15,000	14,000	17,000
2022			26,000	3,600	15,000	16,000	16,000	19,000
2023			30,000	3,900	15,000	18,000	17,000	21,000
2024			34,000	4,200	15,000	19,000	19,000	23,000
2025			38,000	4,400	16,000	21,000	20,000	25,000
2026			43,000	4,600	15,000	22,000	21,000	26,000
2027			47,000	4,700	15,000	23,000	23,000	28,000
2028			52,000	4,900	15,000	24,000	23,000	29,000
2029			57,000	5,000	16,000	25,000	24,000	30,000
2030			62,000	5,100	15,000	26,000	25,000	31,000
2031			68,000	5,100	15,000	26,000	25,000	31,000
2032			73,000	5,200	11,000	26,000	25,000	31,000
2033			78,000	5,200	0	26,000	25,000	31,000



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Table 6.3: Predicted Yearly failures in the AMP-CR population with alternative replacement programs considered

Year	Observed Failures		Program 1		Number Removed in Proactive Programs by Year	Program 2	Program 3	Program 4
			No Removal			Age-Only Risk Based Proactive Removal	Age-and- Flow Risk- Based Proactive Removal	Random Proactive Removal
	Cum.	Yearly	Cum.	Yearly		Yearly	Yearly	Yearly
2007	204	204	170	170		170	170	170
2008	501	297	410	240		240	240	240
2009	880	379	740	330		330	330	330
2010	1365	485	1,200	450		450	450	450
2011	1971	606	1,800	590		590	590	590
2012			2,600	770		770	770	770
2013			3,500	960	14,000	960	960	960
2014			4,800	1,300	16,000	1,100	1,100	1,300
2015			6,400	1,600	15,000	1,200	1,200	1,400
2016			8,300	1,900	15,000	1,300	1,300	1,600
2017			10,000	2,200	15,000	1,400	1,300	1,700
2018			13,000	2,500	15,000	1,400	1,400	1,800
2019			16,000	2,800	15,000	1,500	1,500	1,900
2020			19,000	3,100	15,000	1,600	1,500	2,000
2021			22,000	3,400	16,000	1,600	1,500	2,000
2022			26,000	3,600	15,000	1,600	1,500	2,000
2023			30,000	3,900	15,000	1,500	1,500	1,900
2024			34,000	4,200	15,000	1,500	1,400	1,800
2025			38,000	4,400	16,000	1,400	1,400	1,700
2026			43,000	4,600	15,000	1,300	1,200	1,600
2027			47,000	4,700	15,000	1,200	1,100	1,400
2028			52,000	4,900	15,000	1,000	950	1,200
2029			57,000	5,000	16,000	830	780	950
2030			62,000	5,100	15,000	620	570	700
2031			68,000	5,100	15,000	390	350	450
2032			73,000	5,200	11,000	150	140	180
2033			78,000	5,200	0	0	0	0

For the purposes of risk ranking, the AMP-CR asset base can be ranked based purely on age or through the use of the age-flow model. As flow history data was not available for the entire AMP-CR asset base, an overall risk rank based on this model was not possible. If this data becomes available the asset base can be risk ranked based on sorting the AMP-CR systems by lowest to highest predicted mean wall thickness values calculated based on the equation at the start of **Section 6.1**; they are repeated in brief below for clarity.

$$WT(t_{age}, Flow Rate) = 0.8741 \text{ mm} - t_{age} * \left[0.00977 \text{ mm/yr} + 8.49 \cdot 10^{-7} \frac{\text{mm/yr}}{\text{m}^3/\text{yr}} \cdot Flow Rate \right]$$

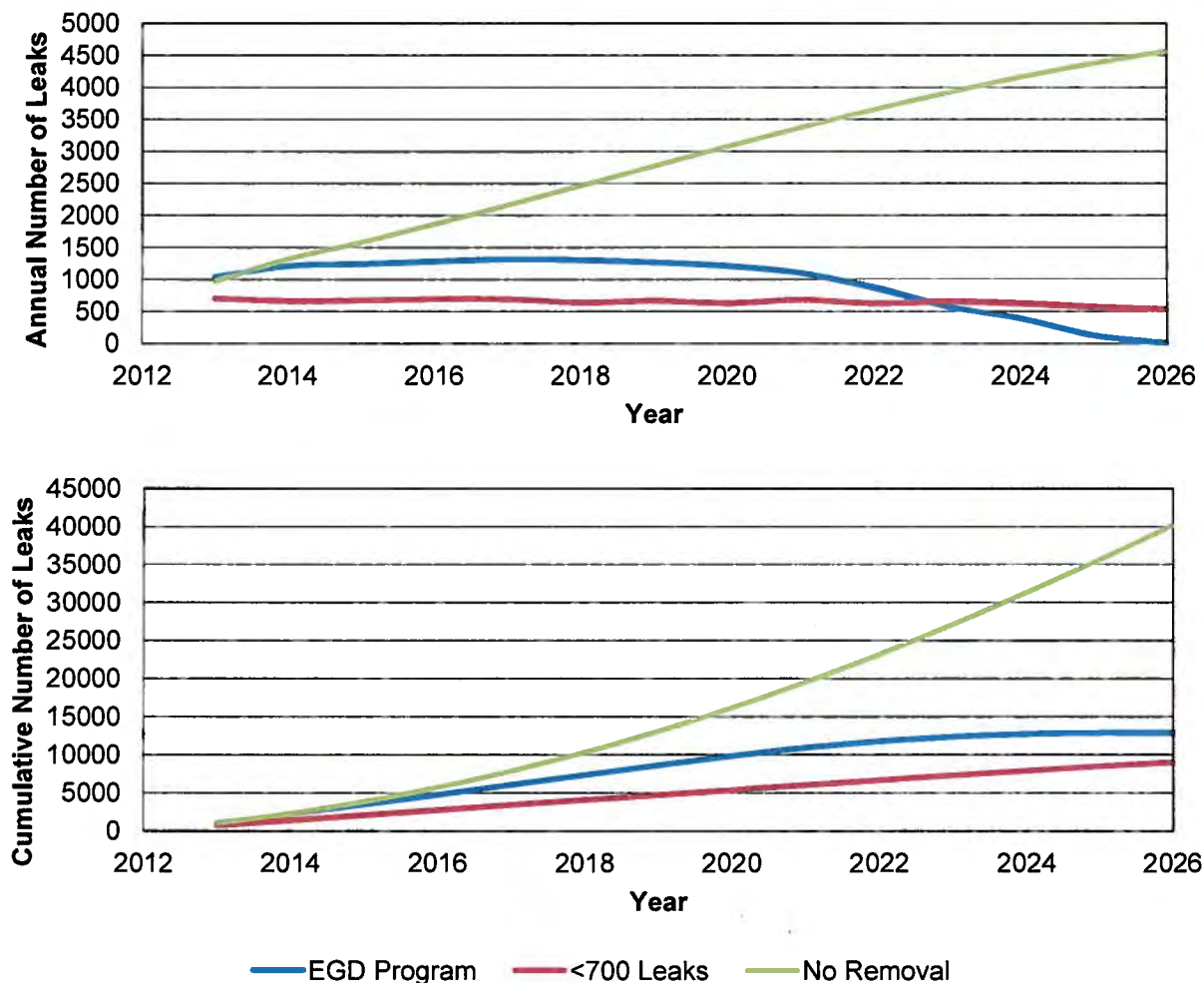


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6.3.1 Evaluation of Additional Replacement Scenarios

In addition to the above replacement program simulations, two additional replacement scenarios were developed and evaluated in consultation with Enbridge. The first of these was a scenario in which a sufficient number of high-risk AMP-CR systems were removed to reduce the overall annual number of failures experienced in the AMP-CR population to below 700 per year. The second scenario represented a potential accelerated replacement program, outlined in **Table 6.4**, that would remove the entire AMP-CR population from service by 2026. As can be seen in **Figure 6.14** and **Table 6.4**, both of these scenarios significantly reduce the number of leaks in the EGD network caused by AMP-CR system failures.

Figure 6.14: Predicted level of failures in the AMP-CR population with alternative scenarios from EGD; both Annual (top) and Cumulative (bottom) estimates are provided.





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Table 6.4: Predicted level of failures in the AMP-CR population with alternative scenarios from EGD

	EGD Potential Program Predicted Failures			< 700 Leaks Program Predicted Failures		
	Cum.	Yearly	Number Removed	Cum.	Yearly	Number Removed
2013	1,034	1,034	2,500	698	698	36,677
2014	2,240	1,206	4,500	1,356	658	29,278
2015	3,473	1,233	18,058	2,026	670	23,318
2016	4,751	1,278	18,177	2,720	693	20,924
2017	6,061	1,310	19,366	3,411	691	23,255
2018	7,359	1,298	22,792	4,047	636	27,907
2019	8,621	1,262	23,746	4,715	667	13,406
2020	9,828	1,207	23,580	5,341	627	19,977
2021	10,923	1,095	26,345	6,021	679	6,121
2022	11,786	863	34,698	6,644	623	17,102
2023	12,354	568	37,836	7,291	648	5,965
2024	12,734	380	24,837	7,913	622	9,152
2025	12,853	118	29,900	8,477	564	11,203
2026	12,853	0	14,141	9,003	526	7,182

6.3.2 Specificity of Risk Ranking Model in Replacement Targeting

The specificity that is achieved with the model permits a 15-25% improvement (i.e. reduction) in failure rate over the course of a removal program compared to a random removal program. This specificity is largely limited by the nature of the AMP-CR assets and the specifics of the failure mechanism. As discussed below, the only apparent potential means of increasing model specificity would be to obtain more complete flow history data for the assets.

In an ideal maintenance program, the time to failure of each individual asset is known with a high degree of accuracy and precision. Unfortunately, it is rare for a failure mode to be well-behaved to such an extent that the time to failure of the asset is known precisely with only static system variables. Hence inspection, condition monitoring, and other programs are used to increase the accuracy and precision of the estimate of this time. For buried non-pigable pipeline assets, like the AMP-CR system population, direct inspection of the asset condition is not feasible or cost-effective. The failures of such systems are stochastic, or non-deterministic, and must be treated in a probabilistic manner. That is, the lifetime of each individual asset cannot be directly calculated or estimated based on measurable parameters (like direct corrosion assessment of transmission lines enables) and the performance must be statistically inferred through analysis of like populations through correlation of performance with the variables that can be measured. Thus, we are left to attempt to provide an estimate of the times of failure of the AMP-CR assets based upon installation



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parameters (such as system pressure) and the only available condition variables (the flow rate of the gas through the asset and the age of the asset) based on statistical inference.

The specificity of such a modeling approach is dependent upon two key factors: the available correlation variables and the statistical variability of the asset population. This study has shown that there are only two measurable installation parameters that had a statistically significant effect on the wall thickness loss rate, and hence on the assets' times to failure: the age of the AMP-CR system and the flow rate. Within each of these measurable variables a relatively high degree of statistical scatter is observed in the wall thickness loss rates and observed field failures. It has also been observed that the presence of an installation defect in an AMP-CR system has a significant impact on the wall thickness loss rate of the system, creating a sub-population of roughly 25% of the asset base that has a different response to these variables. There appears to be no practical way to determine which AMP-CR systems may have a greater likelihood of having a defect, as no statistical difference in defect rates by installation year or installation area were observed. The nature of the AMP-CR system, therefore, imposes limitations on the level of specificity that can be achieved in risk rank modeling.

Thus, we are left with a model of the times to failure of the AMP-CR population based on the assets' ages and their attached services' gas flow rates. The combination of these two parameters explains a significant portion of the variation in the times to failure of the AMP-CR assets, as would be expected based upon the turbulent gas flow-accelerated corrosion failure mode observed in the exhumed specimens. The specificity of the wall loss model in selecting the systems with the nearest times to failure is, however, limited due to the largely-random nature of this failure mode and the limited precision with which the gas flow rate is known (based on only seven years of data).

Given the observed impact of flow rate on wall thickness loss rates, there is the potential that model specificity could be improved with the inclusion of more complete flow rate data. This would still not address, however, the issue of roughly a quarter of the population containing defects in the tubing wall that appear to be randomly distributed.

Given the current accuracy of the Wall Loss Model in predicting the distribution of wall thicknesses in the AMP-CR population (as can be seen for example in Figure 6.11) and the other limiting factors inherent in the AMP-CR system discussed above, it does not appear that additional sampling and analysis efforts would result in noticeable improvements in model specificity.



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7.0 Conclusions

Based on the samples provided and the analysis conducted, the following conclusions are drawn:

Characterization of Mechanism:

- The AMP-CR systems appear to be failing as a result of time-dependent localized internal sulphidation corrosion of the copper tubing associated with flow turbulence.
- The minimum wall resulting from the corrosion is observed primarily at the AMP fitting outlet roughly three quarters of the time and at defects (indentations in the tubing wall apparently due to installation) downstream of the fitting outlet the remaining quarter of the time.
- The localized corrosion at the AMP Fitting outlet can potentially lead to a circumferential crack in the copper riser and hence full rupture of the riser, leading to significantly higher gas release rates than the pinhole failure mechanism.
- For those systems with the minimum wall at a downstream defect, corrosion rates at the defect are generally 10 to 20% higher than at the fitting outlet, with some specimens showing corrosion rates 50 to 100% higher.
- The entire population of exhumed fittings examined is experiencing this corrosion mechanism to some extent.
- The primary variables impacting the minimum remaining wall thickness of the specimens are age (wall loss increases with age) and flow rate (wall loss increases with flow rate).
- Operating pressure, proximity to the gate station (as a possible proxy for mercaptan concentration as dosing occurs at the gate station), operating area, soil type, moisture condition of soil, coating type or length from the AMP fitting to the riser, to the grade or to the foundation wall are not seen to have any statistically significant impact on wall loss rates.



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Model & Forecasting Future Leak Rates:

- A leak rate forecasting model (Wall Loss Model) was developed based on the AMP-CR specimens examined. The model used the measured wall thicknesses of the field specimens to derive wall loss rates and project future wall loss. Based on a minimum wall thickness for pressure containment, projected failure rates were derived based on these wall loss projections.
- The observed field leak rates are projected to increase at an accelerating rate, roughly doubling through the next five year period and increasing by four to six fold through the next ten years.
- The percentage of the population at higher risk (with a wall thickness of less than 0.15 mm, roughly 1/6 of the original wall thickness) is roughly 3.5% currently and is projected based on the Wall Loss model to be 11% in 2017, 19% in 2022 and 29% in 2027. This corresponds to roughly 11,000, 35,000, 60,000 and 92,000 AMP-CR systems in 2012, 2017, 2022 and 2027, respectively.
- Based on the 95% confidence limits for the Wall Loss model, it is projected that there will be roughly 6,700 to 9,300 cumulative leaks through the next five years (2013-2017). This projected increase in failure rates is in line with the tripling in leak rates observed through the five year period between 2007 and 2011 (from 204 to 606 failures per year). It is also consistent with the observation that 3.5% of the AMP-CR population (roughly 11,000 systems) currently has a minimum wall thickness less than 0.15 mm, or 1/6 of the original pipe wall thickness. If this trend continues, it is projected that there will be between 33,000 and 44,000 cumulative failures by 2025.
- There is a high level of confidence in the general trends and magnitude of the leak rate projections as based on the following:
 - Excellent agreement was observed between the model projected distribution of wall losses and the actual measured distribution, indicating that the Wall Loss model captures the observed corrosion mechanism.
 - The Wall Loss model failure projections were verified based on comparison with projections from an independently developed model based on the AMP-CR repair data supplied by Enbridge. The models were in good agreement.
 - Both models were further verified by comparison with past observed leak history. Again excellent agreement was observed.



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Risk Ranking:

- Two risk rank approaches were developed; an age based approach and an age-flow rate based approach.
- Based on a 20-year replacement schedule, an asset replacement program based on risk rank removals offers a significant reduction in experienced in-service failures over the course of the program, with roughly 20% fewer failures projected.
- Flow rate is seen to play a key role in the corrosion mechanism. However, inclusion of flow rate into the risk rank model used to guide a simulated replacement program results in only a small (3%) reduction in failures over the course of the program compared to a risk rank model based on age alone. This is believed to be largely due to the limited historical flow data (seven years or roughly 15 to 25% of the AMP-CR system lifetimes) available for model development coupled with the roughly one quarter of the AMP-CR systems showing higher corrosion rates than the general population (where corrosion is occurring at the defect).
- The flow rate analysis was conducted based on the limited flow history data that could be extracted from the Enbridge database, approximately seven years' worth of data for each exhumed AMP-CR service. As the available flow history represents only 15%-25% of the total history of each installation, the model's ability to specifically risk rank the AMP-CR installations is likely more limited than it would be with a full set of flow histories. There will be a significant benefit to Enbridge if this barrier to generating complete operational histories of services can be overcome as it would enable more accurate performance projections that would allow for effective operational and maintenance planning, not only for AMP-CR replacement but other reliability initiatives. This would facilitate a significant reduction in risk in the system in the most cost effective manner.



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A handwritten signature in blue ink, appearing to read 'K. Oliphant'.



Issued by

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Executive Vice President

A handwritten signature in blue ink, appearing to read 'W. Luff'.

Reviewed by

William Luff, M.A.Sc.
Technical Lead – Pipeline Reliability

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Appendix A

Sample Analysis Procedure

1. Initial Cleaning and Marking OF 12 O'CLOCK POSITION

- Lightly clean the pipe with water to enable cutting per procedure that follows
- Clearly mark the 12 o'clock position on plastic pipe and copper tube (for first 20 cm) with indelible marker (this is needed to identify top and bottom portions of copper tube for dimensioning after cutting)
- Record:
 - In the Database, record the following information for each sample:
 - Pipe type (Yellow (Y), Grey(G), Orange(O), Aldyl(A))
 - Field applied coating type (Tape(T), Mastic(M) or Both(B))
 - Condition of coating (Bad(B) or Good(G))
 - Corrosion on outer diameter (Low(L), Medium(M), High(H))
 - Copper coating condition (Okay(O) or Friable(F))
 - Corrosion on inner diameter (Low(L), Medium(M), High(H))
 - Condition of fitting (note is damage/cracking apparent)
 - Color of fitting (Blue(B) or White(W))
- Any samples with unusual features outside those listed above should be flagged for examination by Technical Lead.

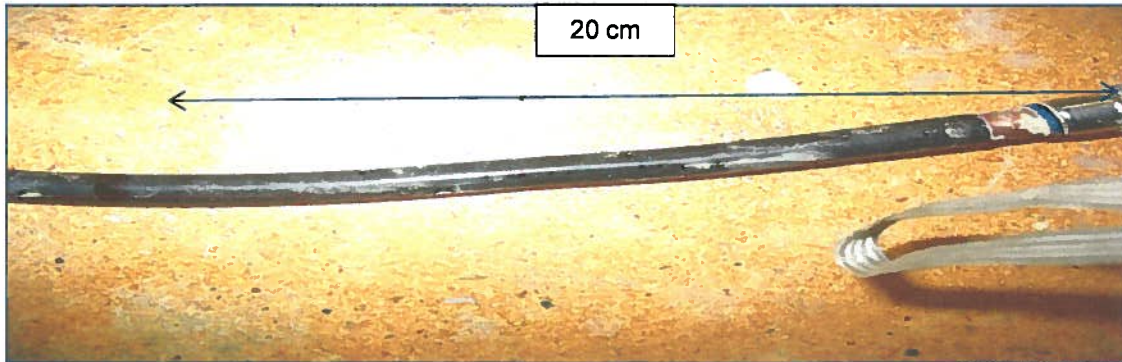




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2. Mark 20 cm from Crimp Shoulder:

- a. Mark the pipe at 20 cm from the shoulder of the crimp ring. This is the cut point for the copper tubing and the reference point for identification of dimension features.



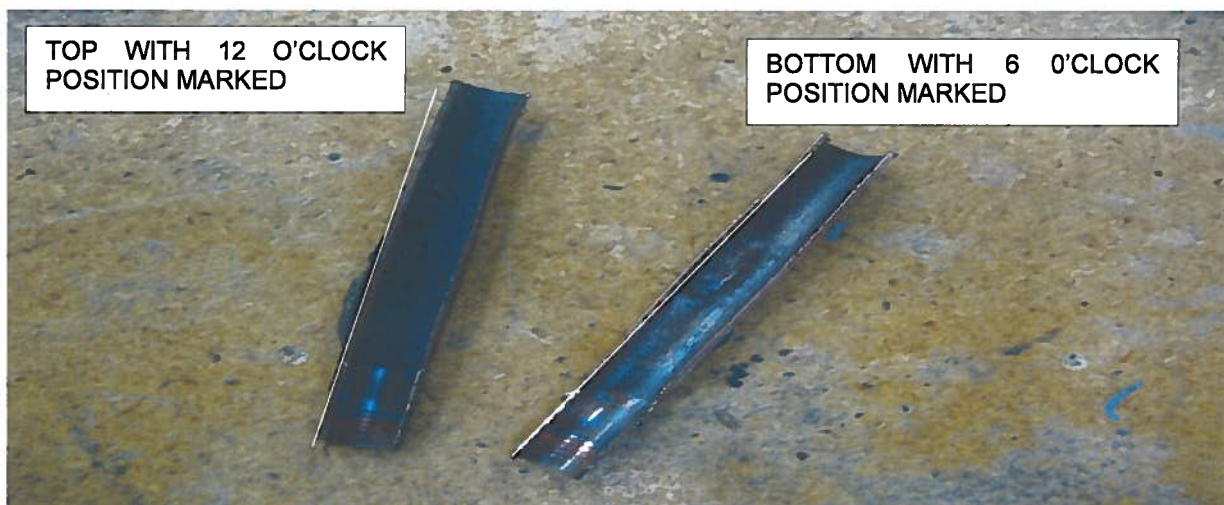
- b. Cut fitting at crimp shoulder



- c. Cut 20 cm from crimp then 10 cm from the cut pipe end



3. Cut open the pipe end that was in the fitting in half and photograph, marking the top and bottom halves



- a. Place cut samples for measurement in sealed bag marked with Sample ID. Place bag in Conditioning Room for Dimensioning (Condition at 73°F, 50% RH for 24 hours minimum prior to dimensioning).



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4. Dimensioning

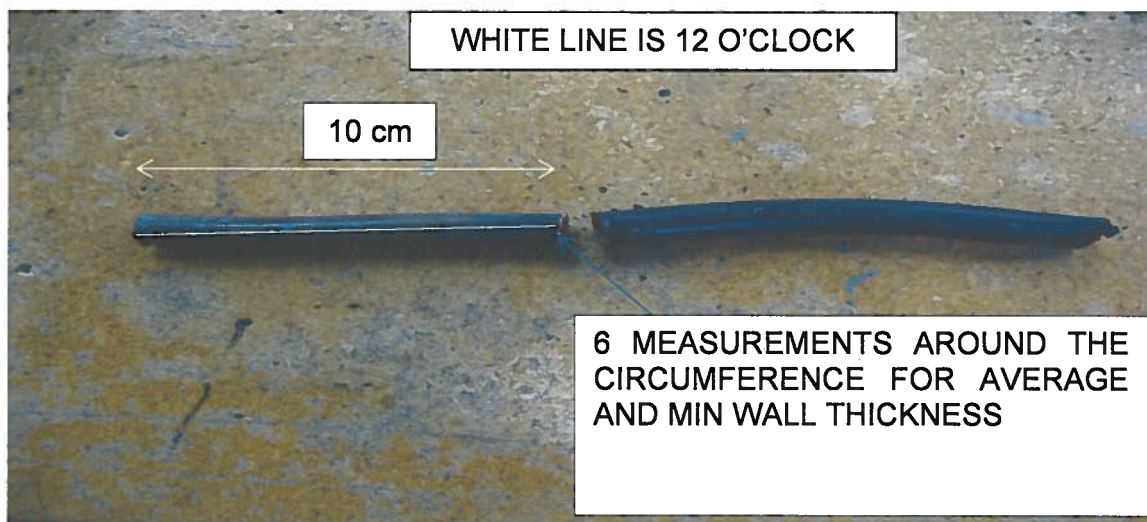
a. Wall thickness measurements at the 20 cm mark

1ST	2 ND	3RD	4TH	5TH	6TH

b. Measure thinnest wall in each pipe half.

- If there is a failure, min wall thickness = 0mm

	Minimum wall	Distance from Defect
TOP		
BOTTOM		





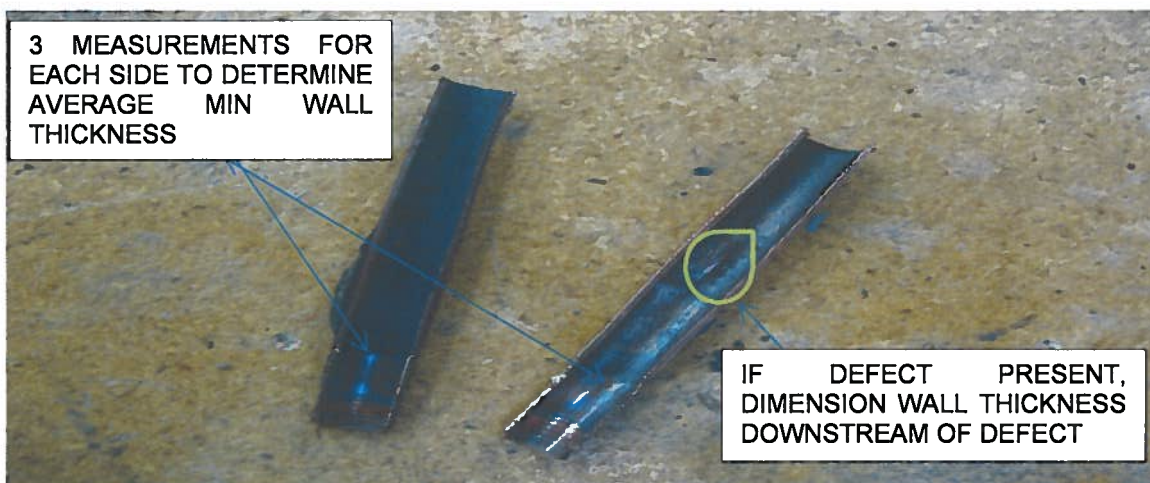
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c. Wall thickness measurements at fitting end

	1 ST	2ND	3RD
TOP			
BOTTOM			

d. Defect Profile

HEIGHT	
WIDTH	
LENGTH	
POSITION FROM CUT END	





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Appendix B

Analysis of Leaking Specimens

The specimens observed to have a leaking copper riser were further analyzed to provide details about the location of the leak. Of the eleven leaking specimens that were included in the primary analysis, ten were available to be examined. One specimen was returned to EGD and was not available for further examination. In addition to these ten specimens, an additional specimen was included that was sent to Jana following the analysis detailed in this report (Jana STN 13-179, EGD PMTS ID 1189450) for a total of eleven specimens.

Of the eleven leaking specimens analyzed:

- Five experienced leaks in the area immediately after the AMP fitting outlet. Four of the five were large circumferential cracks.
- Two experienced larger leaks not at the AMP fitting outlet.
- Four experienced pinhole leaks.

Dimensions of the leaks on each specimen are provided in **Table B1** below; the specimens are grouped by the type of leak observed. Photographs of the observed failure locations are provided in **Table B2**.

Table B1: Summary of AMP Fitting-Copper Riser Failures

Area of Specimen	Leak Type	Jana STN	EGD PMTS ID	Description of Leak
Downstream of Fitting	Pinhole Leak	12-415	1906172	Ø2.2 mm (exterior) Ø1.9 mm (interior)
		12-659	1871264	Ø0.9 mm (exterior) Ø0.9 mm (interior)
		12-1096	1105086	Ø1.5 mm (exterior) Ø1.6 mm (interior)
		12-1151	1576752	Ø0.6 mm (exterior) Ø0.6 mm (interior)
	Large Crack	12-730	1852451	11.2 mm x 15 mm
		13-179	1189450	15.8 mm, longitudinal
Area After AMP Fitting Outlet	Circumferential Crack	12-946	2000153	12 mm around circumference
		12-1091	1484512	12 mm around circumference
		12-1140	2024332	13 mm around circumference
		12-1154	2339153	18 mm around circumference
	Small Crack	12-414	Not Recorded (Work Request # 8052812)	Ø1.8 mm (exterior) Ø0.8 mm (interior)
(Not Observed)*		12-735	1771999	(Not Observed)

* Specimen was returned to EGD and not available for further examination.



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Table B2-A: Photographs of AMP Fitting-Copper Riser Failure Locations

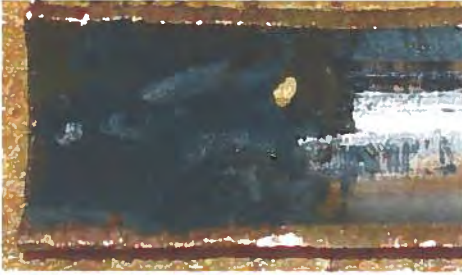
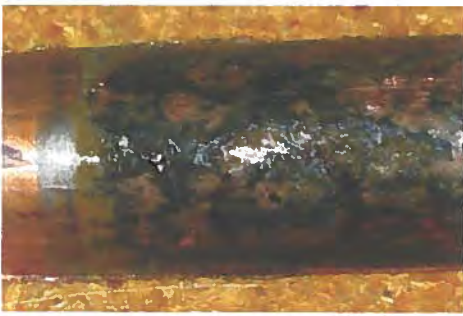
Jana STN	EGD PMTS ID	Interior Photograph of Leak	Exterior Photograph of Leak
12-414	Not Recorded (Work Request # 8052812)		
12-415	1906172		
12-659	1871264		
12-730	1852451		
12-735	1771999	(Not Photographed)	

Table B2-B: Photographs of AMP Fitting-Copper Riser Failure Locations

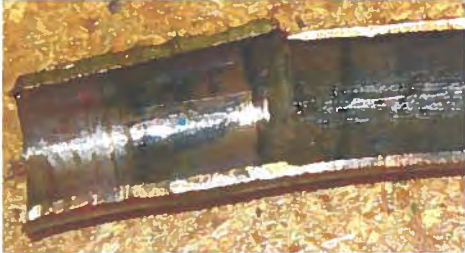
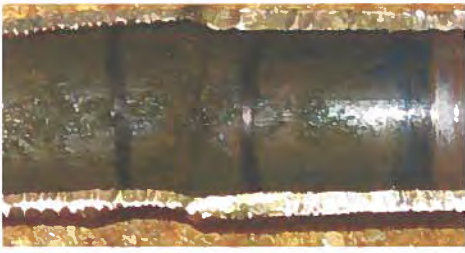
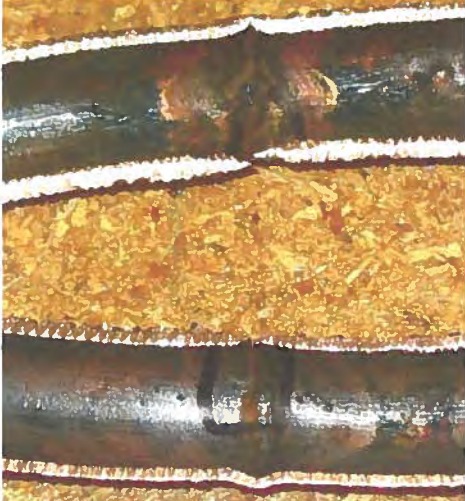
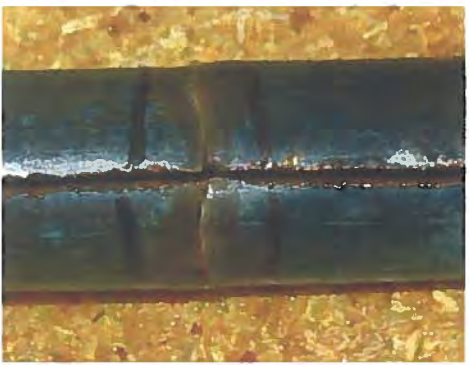
12-946	2000153		
12-1091	1484512		
12-1096	1105086		
12-1140	2024332		

Table B2-C: Photographs of AMP Fitting-Copper Riser Failure Locations

12-1151	1576752		
12-1154	2339153		
13-179	1189450		



AMP FITTING SAMPLING STUDY REPORT

January 2012

Report Prepared By:

Neerajah Raviraj, P. Eng.



EXECUTIVE SUMMARY

AMP Fittings were installed by Enbridge Gas Distribution (EGD) between 1969 to the end of 1984 on Intermediate Pressure (IP) Polyethylene (PE) Services. The AMP fittings are a transition fitting connecting the PE pipe from the main to copper tubing. The inserted portion of the copper tubing fails as a leak or blockage due to internal Copper Sulphide (CuS) corrosion caused by Hydrogen Sulphide (H₂S) in the gas. H₂S is a reactive compound that exists in our natural gas in trace quantities and when combined with turbulent flows and/or liquid deposits, it has the potential to corrode the inside wall of the copper tubing.

Over time, it has been observed through Enbridge's Material Evaluation Centre's (EMEC) Material Fault Reporting Program that the copper can develop a leak immediately downstream of the AMP Fitting. The primary risk of concern with regards to AMP Fittings is the potential for a gas leak to migrate into a building.

The intent of the Sampling Study is to randomly select existing AMP Fittings in the system and analyze their condition to uncover potential trends that may help EGD's Integrity Management group to assess risk first and subsequently design an AMP Fitting replacement program, if needed.

- There's approximately 270,000 to 400,000 AMP Fittings in the EGD system. In Area 10 (Toronto) holds 29% of all AMP fittings were installed, 20% in Area 20 (Mississauga), 16% in Area 60 (Ottawa), 13% in Area 30 (Richmond Hill/Markham), 10% in Area 80 (Niagara), 8% in Area 40 (Whitby/Peterborough) and 4% in Area 50 (Barrie).
- The sample size was calculated using the EGD's Quality Assurance (QA) Manual's Sample Size formula and resulted in 61 samples per region. The samples were randomly selected for each region using Excel's random number generator. The samples were representative of the percentages of AMP Fittings installed in each year.
- The sampling procedures included pre-inspection, locates, barholing, gas testing using Gas Sentry, procedures to follow if leaks were detected before excavation, excavation, soap testing, procedures to follow if leaks were detected after excavation, data to record on information sheets, sample collection methods, riser replacement instructions as per the Operations and Maintenance Manual and backfill instructions.
- Of 311 samples analyzed by EMEC, 14 were found to be leaking, or 4.5% of the AMP Fittings sampled were leaking. Three samples were found leaking before excavation (1% of samples tested), 6 Samples were found leaking after excavation (2% of samples tested) and 5 samples were found to be leaking upon submission to EMEC (1.5% of samples tested). Three samples were classified as "A" leaks in the field, 4 were classified as "B" leaks and 2 were classified as "C" leaks.
- The average wall loss of all sampled AMP Fittings was 20% with the potential to increase as cyclic CuS deposits break away and the parent copper tubing material is exposed to further corrosion. However, there is no evidence in this study to support the suspected trend of older AMP Fittings experiencing greater wall thickness loss due to internal corrosion.

There are several conclusions and recommendations that have emerged from conducting the AMP Sampling Study and are included in the Conclusions/Recommendations portion of this report.



BACKGROUND

AMP Fittings were installed by Enbridge Gas Distribution between 1969 and end of 1984 on Intermediate Pressure (IP) Polyethylene (PE) Services. It is estimated that there are currently 270,000 – 400,000 AMP fitting in service. The AMP fittings are located on average 0.7 m from building foundations at an average depth of 0.8 m.

The AMP fittings are the below grade transition fitting connecting the PE pipe from the main to copper tubing which becomes the riser to the meter set. The inserted portion of the copper tubing fails as a leak or blockage due to internal Copper Sulphide (CuS) corrosion caused by Hydrogen Sulphide (H₂S) in the gas. H₂S is a reactive compound that exists in our natural gas in trace quantities and when combined with turbulent flows and/or liquid deposits, it has the potential to corrode the inside wall of the copper tubing. With turbulent flows, there is a potential for the corrosion products to be removed, leaving the parent copper tubing to be attacked once again.

Over time, it has been observed through EMEC's Material Fault Reporting Program that the copper can develop a leak immediately downstream of the AMP Fitting. Failures produce moderate leaks due to pinholes or cracks in the copper tubing. Blockage from CuS (black flake deposit) build up can result in poor pressure. The proximity of the AMP Fitting to building walls, typically about 1m, with pressures ranging from 10-55 psig, presents a likelihood that gas can migrate into the building, especially because the paths for the gas to migrate above ground are restricted, which drastically heightens the consequence of even a minor leak. The primary risk of concern with regards to AMP Fittings is the potential for exposing occupants of buildings to hazardous atmospheres should the worst case scenario materialize.

Previous EMEC testing and evaluations have determined that the copper tubing connection at the AMP fitting will corrode over time becoming thin and cracked in the area adjacent to the end of the AMP Fittings insert stiffener. It was confirmed through chemical analysis testing as per ASME B88-09 that the chemical composition of the copper has remained consistent over the years. In November 2011 a leaking AMP Fitting Assembly was submitted to the EMEC for evaluation consisting of NTS 3/8 copper tubing with an NTS 1/2 AMP Fitting and PE tubing (File # LE11-063). The failure was in Area 60 (Ottawa Area) with an installation year of 1977. The field report indicated a reading of 36% gas-in-air was recorded above the AMP Fitting. The service was exposed and when the dirt was removed from around the AMP Fitting, it broke apart.

Previous failures have been tracked also by the Distribution System Integrity Management Program (DSIMP) since 2007 (data complete to Sept 2009). Material Fault reports, as the one mentioned above, Leak Indication Reports and "AMP" notations in STORMS supplement data collection for 1997 – 2007. It is estimated for 2010 there have been 448 failures causing a below ground leak based on information from Leak Survey.



OBJECTIVE

The objective of the AMP Fitting Sampling Program is to:

- Analyze AMP fittings that have not failed yet
- Determine the rate of failure
- Determine a trend to help design the replacement program
- Confirm DSIMP's projected failure rate
- Clarify the magnitude of the issue and
- Determine if a replacement program is needed

The intent of the Sampling Study is to randomly select existing AMP Fittings in the system and analyze their condition to uncover potential trends that may help EGD's Integrity Management group to assess risk first and subsequently design an AMP Fitting replacement program, if needed.

PROJECT TEAM

• Project Manager	– Neerajah Raviraj
• Project Coordinator	– Lisa Robbens
• Technical Expert	– Steve Misketis
• Technical Support and Analysis	– Leslie Eakins / Ryan Doggart
• Data Support Expertise	– Moira Hunt
• Business Sponsor ESTS	– John McClintock
• Business Sponsor Ops	– Bruce Rozycki
• Regional Lead (10) - Toronto	– Franca Romita, Costantino Vacca
• Regional Lead (20) - Mississauga	– Jason McArthur
• Regional Lead (30) - Richmond Hill/ Markham	– Mike Ovsonka, Amerigo D'Alessandro
• Regional Lead (40) - Whitby/ Peterborough	– Chris McGivery
• Regional Lead (50) - Barrie	– Jason McArthur
• Regional Lead (60) - Ottawa	– Peter Valiquet, Allison Bramwell
• Regional Lead (80) - Niagara	– Guy Blair

BUDGET

Budget for the Sampling Program:

- \$200,000 (John McClintock's budget) +
- \$250,000 (Operations Regional budget) = \$450,000 Total

The cost will first come from John's budget and then if needed transfer over to Operations Regional budget.



SAMPLE BY POPULATION SIZE

The sample size was calculated using the QA Manual's Sample Size formula:

N – Total Population Size (assume 270,000) = 270,000

U – Confidence Level (use QA's confidence level of 85%) = 1.4395

A – Precision Level (use QA's precision level of +/- 5%) = 0.05

P – Rejection Rate (use QA's rejection rate of 8%) = 0.08

n – Sample Size

$$n = \frac{(U \times U \times N \times P \times (1 - P))}{(A \times A \times N) + (U \times U \times P \times (1 - P))}$$

$$n = \frac{(1.4395 \times 1.4395 \times 270000 \times 0.08 \times (1 - 0.08))}{(0.05 \times 0.05 \times 270000) + (1.4395 \times 1.4395 \times 0.08 \times (1 - 0.08))}$$

$$n = 61$$

Since, at the time of calculation, the total population broken down by region was yet unknown, a sample size per region could not be calculated. The QA manual shows the sample size topping out at 61 when a total population of 8,000 is reached. It was assumed that each region has at least 8,000 AMP fitting. Therefore a sample of 61 would be required in each region.

It was assumed that the samples from Area 60 would be representative of the conditions in Area 90; therefore Area 90 was not sampled.

A sample of 61 + 10 will be selected from each area (the 10 extra are for the occurrence of hard to access fittings). If additional addresses were needed (above and beyond the extra 10), a site with similar year installed and characteristics was chosen (for example next door neighbor).

The random number generator in excel was used to generate a random list of sample sites for each area. The samples were representative of the percentages of AMP Fittings installed in each year. For example, if 5% of the AMP Fittings in a region were installed between 1969 and 1972, then 5% of the samples were randomly selected from that age range.



CORRECT POPULATION

The population was generated from an extract from PMTS with the following parameters:

All:

- ½" Plastic Services
Installed between 1969 and 1984 (later omit 83/84 based on information from Bruce Rozycki stating that by 1984 the transition to a different riser assembly took place).

The following are the events/work that was identified by Steve Rogers to eliminate certain addresses from the final results (these work types would indicate that the riser was replaced or service abandoned resulting in no AMP fitting at these locations):

- PIPE_ASSET_CHANGE
- SERV_ABANDON_WITH_MAIN
- SERV ALT
- SERV_CUTOFF_MAIN
- SERV_PIPE_RELAY
- SERV_RECONNECT
- SERV_RELAY
- SERV_REPAIR_BELOW
- SERVICE ALTERATION (LEGACY)

Figure 1 shows total potential AMP Fittings system wide by area whereas Figure 2 shows total potential AMP fittings by installation year. These graphs do not exclude the job types captured above and include 1983 and 1984 locations.

There's approximately 270,000 to 400,000 AMP Fittings in the EGD system. The total number of locations graphed in both figures 1 and 2 is 341, 640. In Area 10 (Toronto) holds 29% of all AMP fittings were installed, 20% in Area 20 (Mississauga), 16% in Area 60 (Ottawa), 13% in Area 30 (Richmond Hill/Markham), 10% in Area 80 (Niagara), 8% in Area 40 (Whitby/Peterborough) and 4% in Area 50 (Barrie).

The samples were representative of the percentages of AMP Fittings installed in each year. For example, if 5% of the AMP Fittings in a region were installed between 1969 and 1972, then 5% of the samples were randomly selected from that age range.



Total Potential AMP Fittings in System - by Region

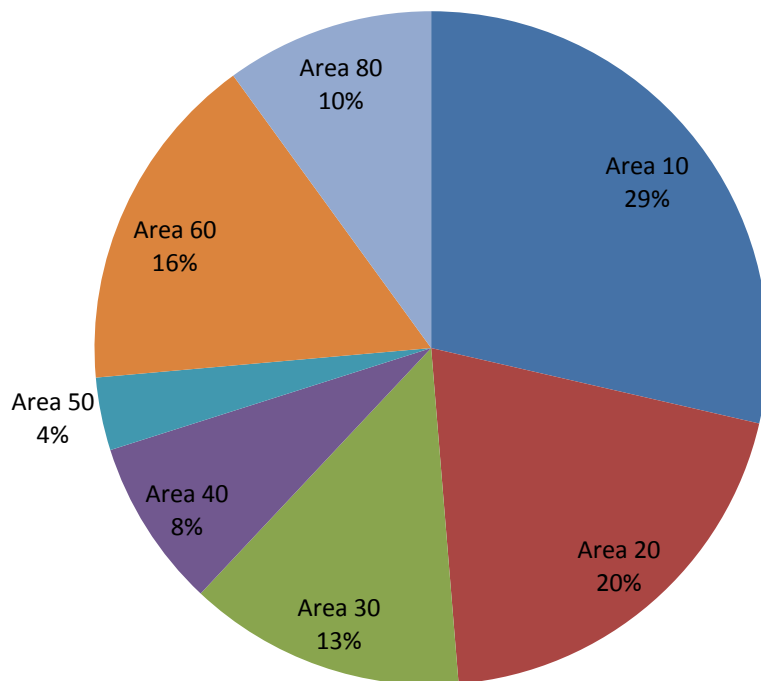


Figure 1 - Total Potential AMP Fittings System Wide by Region

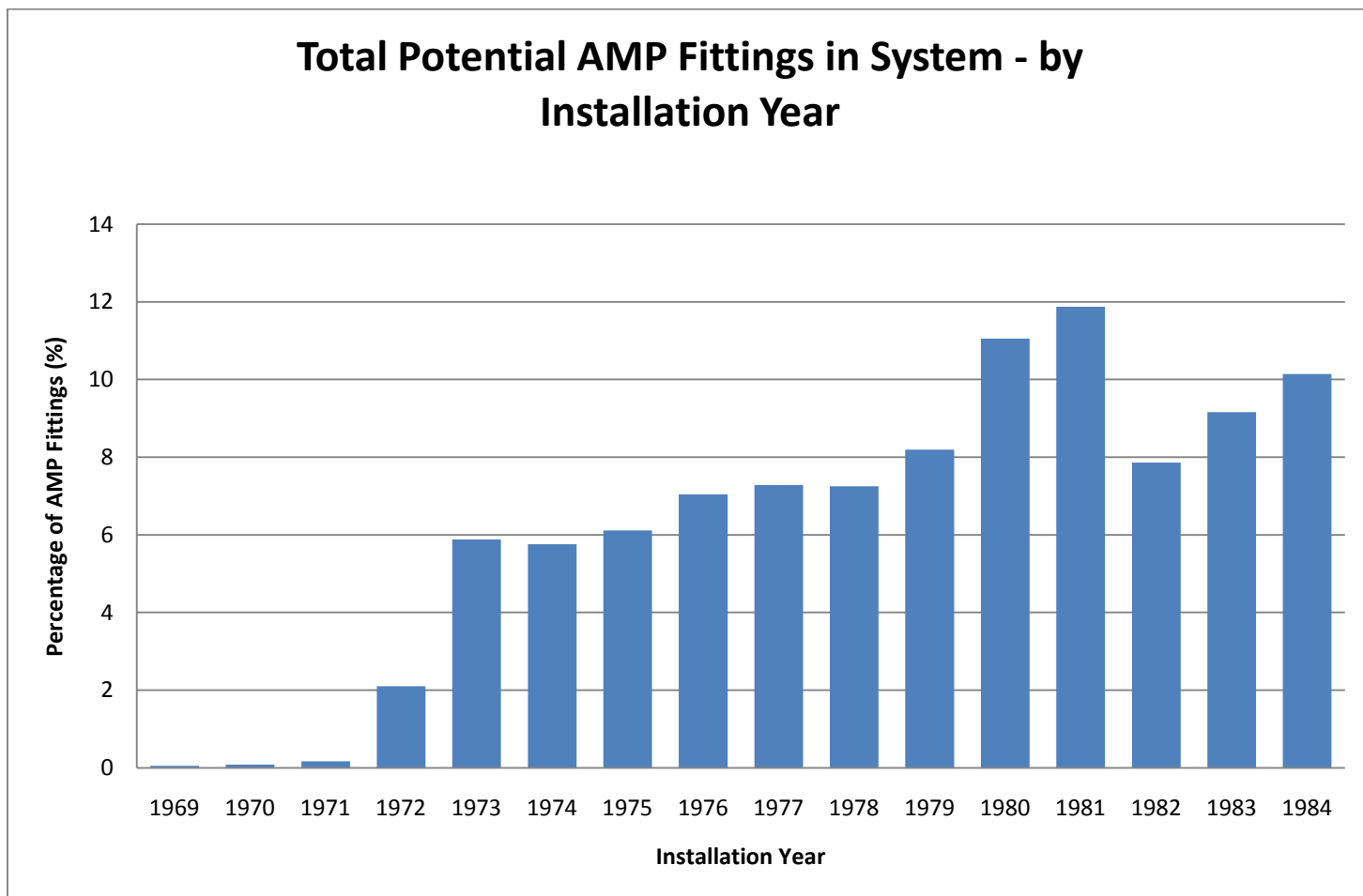


Figure 2 - Total Potential AMP Fittings in System by Installation Year



INFORMATION CAPTURE

The following information was captured in the field and in the EMEC lab:

- PMTS Information
 - Admin Area
 - Grid
 - Postal Code
 - Street Number
 - Street Name
 - Municipality
 - Year of Original Install Date
 - Service Type
 - PE AMP Fitting – yes/no
 - Premise ID
 - PMTS Asset ID
 - Line Item
 - Pressure Class
 - NPS
 - WR Number
- Before Excavation
 - Leaking – yes/no
 - If yes, size of leak
 - Picture Number
- After Excavation
 - Leaking – yes/no
 - If yes, size of leak
 - Soil Conditions
 - Moisture Condition
 - Picture Number
 - Distance from AMP fitting to Riser
 - Depth of AMP fitting
 - Distance from AMP fitting to foundation wall
 - Date Work Completed
 - Work Performed by
- EMEC Information
 - Date Received
 - Condition of Material Received
 - Location of Leak on Field Sample
 - Type of Service (PE Orange, PE Aldyl A, Other)
 - Wall Thickness of Copper
 - Suspected Cause of Leak
 - Picture Number
 - Date AMP Fitting tested in EMEC



See Appendix A for 'PMTS Information', 'Before Excavation' information, 'After Excavation' information and 'EMEC Information' – collectively referred to as 'Data Collection Sheets'.

See Appendix B for Information Sheet used by field when sampling.



SAMPLE COLLECTION PROCEDURE

See Appendix C for the AMP Fitting Sampling Procedures. The procedures included:

- Pre-inspection
- Locates
- Information Sheet
- Pictures before Excavation
- Barholing
- Procedures if Leaking
- Excavation
- Soap Test
- Leaking after excavation
- Picture after excavation
- Record Soil Data
- Take Measurements
- Collect Sample
- Replace Riser
- Backfill

It was determined that we do not need to relay Aldyl A services (unless it makes sense to do so). A kick-off meeting was held with all regional representatives and Work Management Centre (WMC) to review the sampling procedures.

See Appendix D for Kick-Off Meeting Agenda. The work was targeted to be completed by end of June.

Sample collection was completed using barholing method and gas testing using Gas Sentry.



RESULTS OF THE SAMPLING PROGRAM

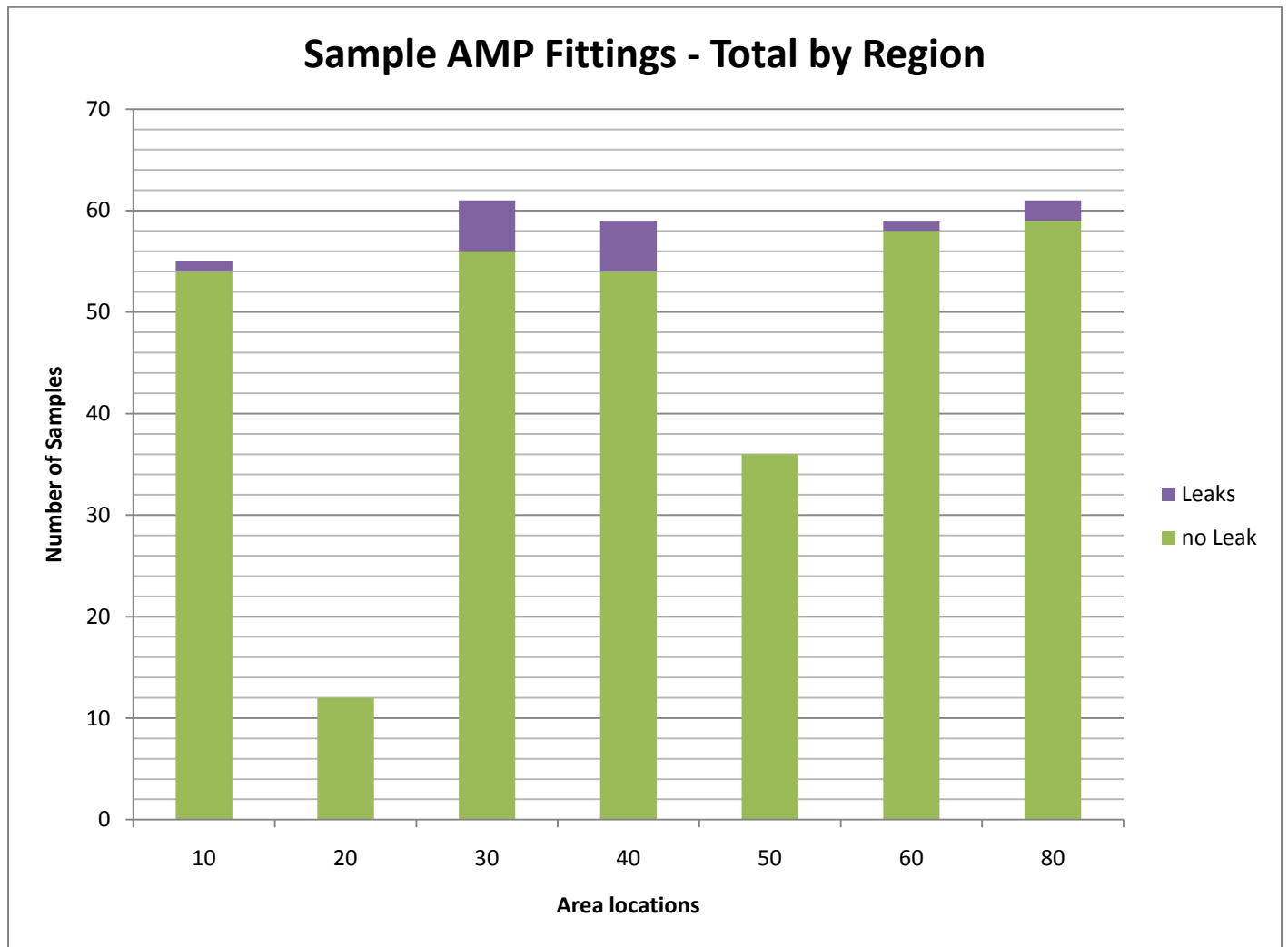


Figure 3 - Total AMP fittings sampled per region received by EMEC.

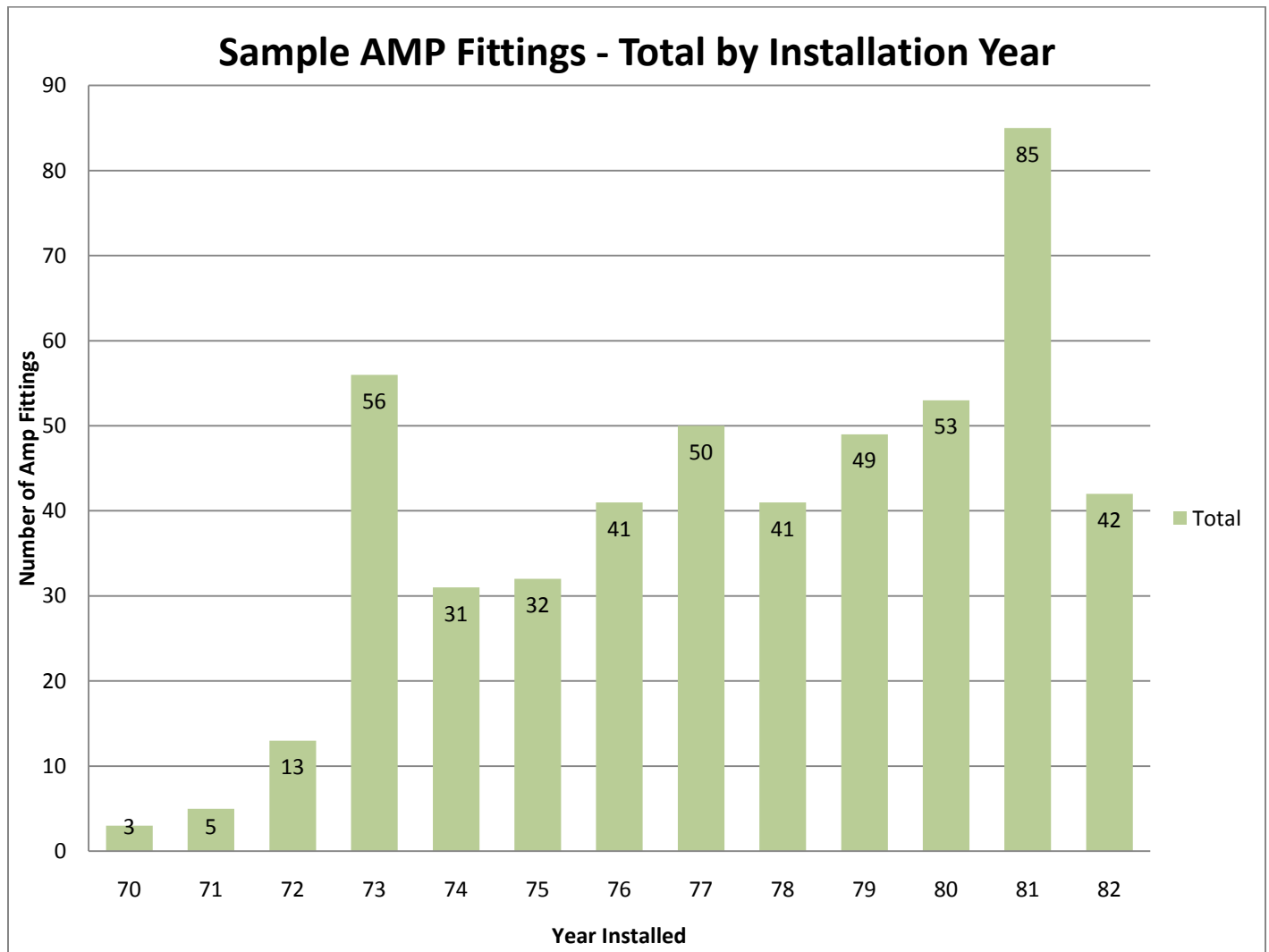


Figure 4 - Total number of samples to be tested by installation year

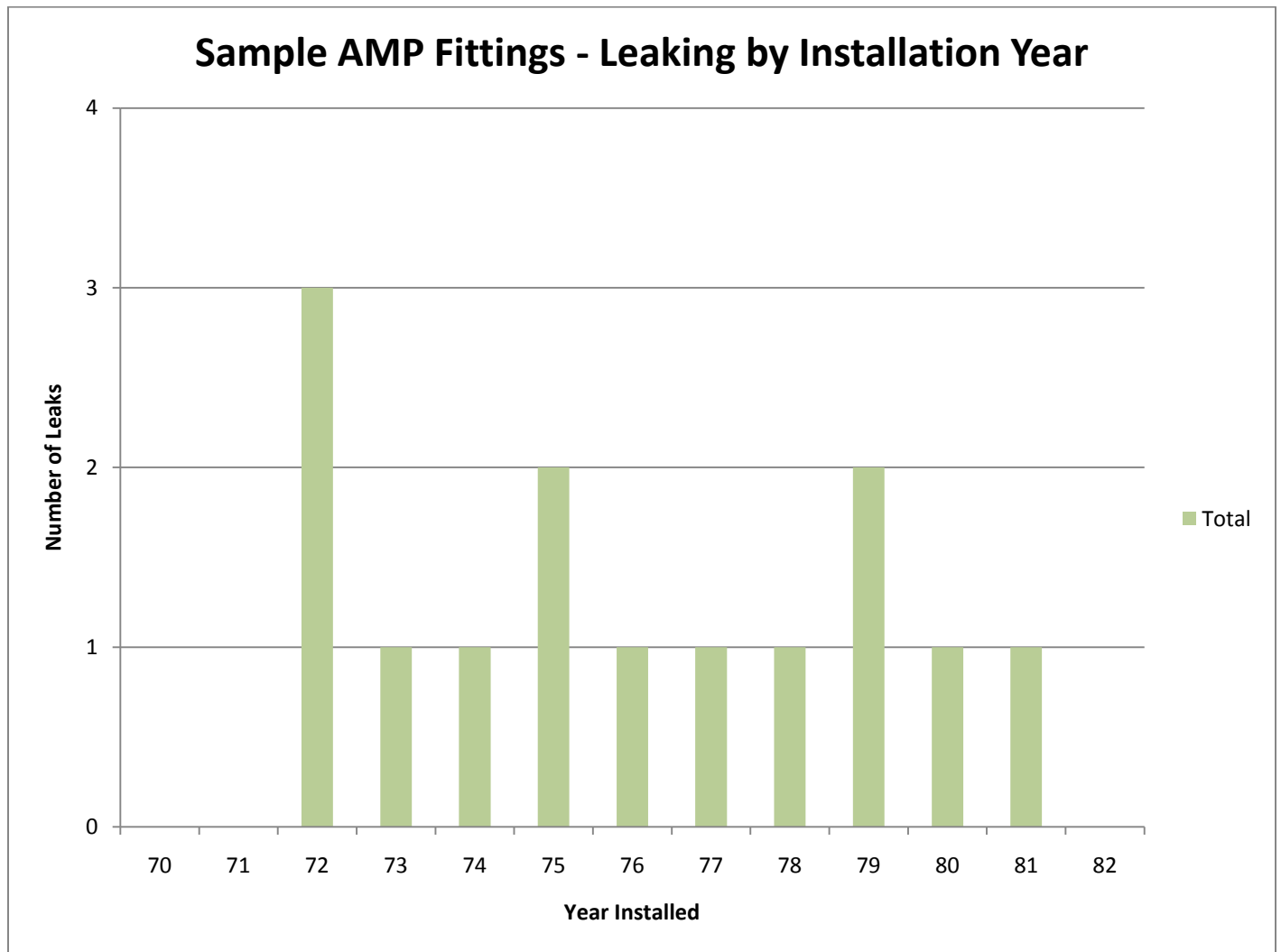


Figure 5 - Number of leaking AMP fittings by installation year received by EMEC

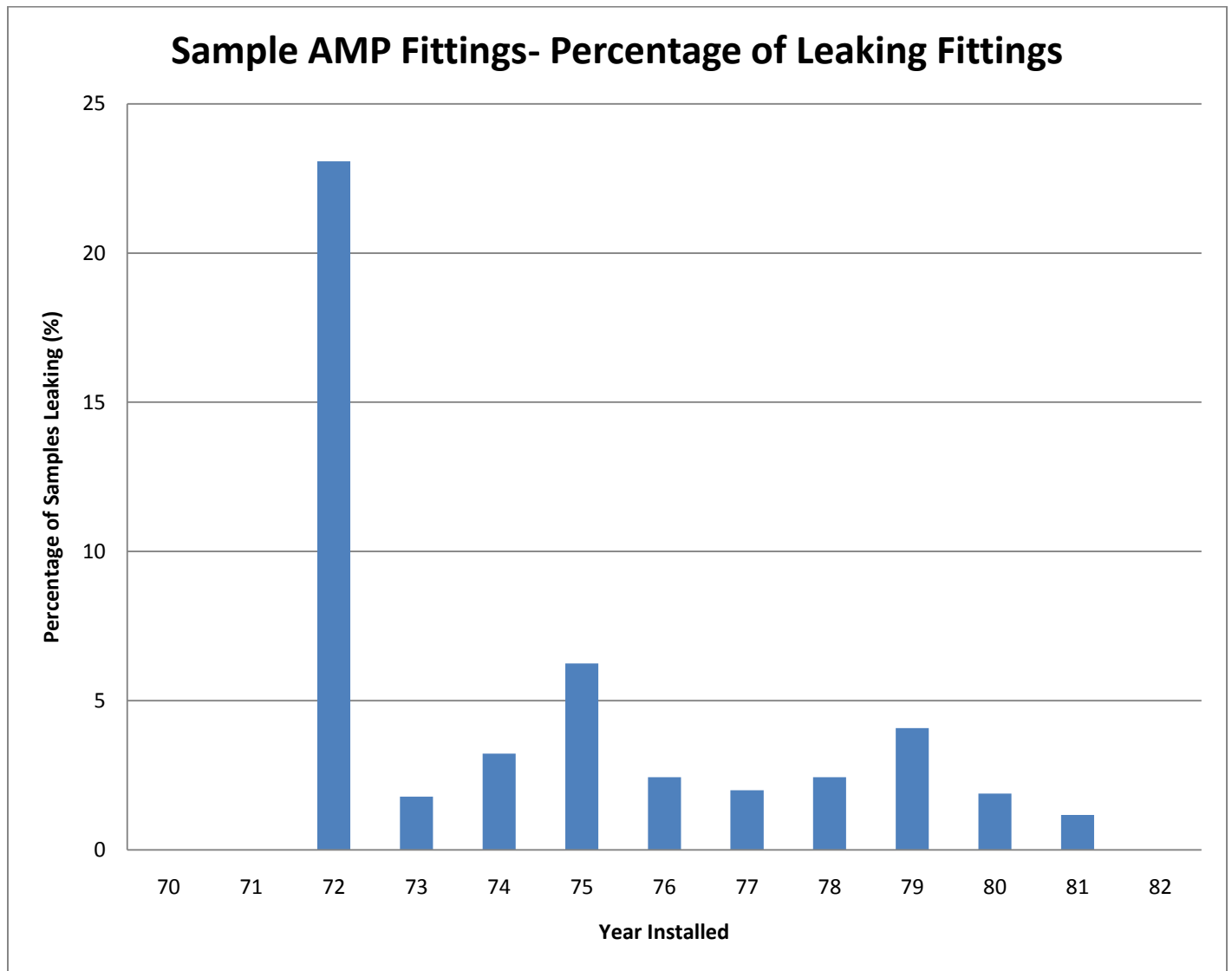


Figure 6 - Percentage of leaking AMP fitting samples by installation date received by EMEC

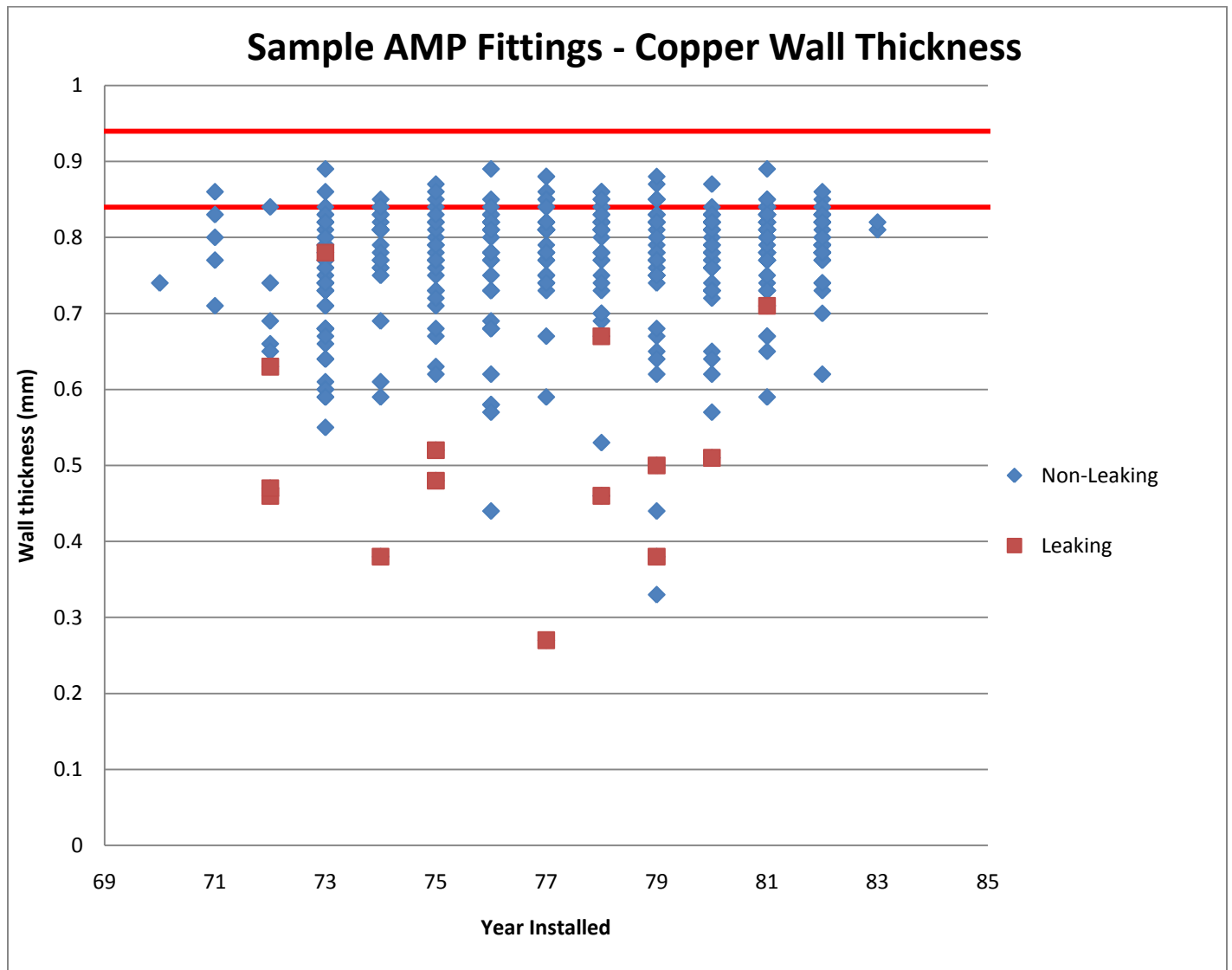


Figure 7 - Present wall thickness of copper sample by installation year

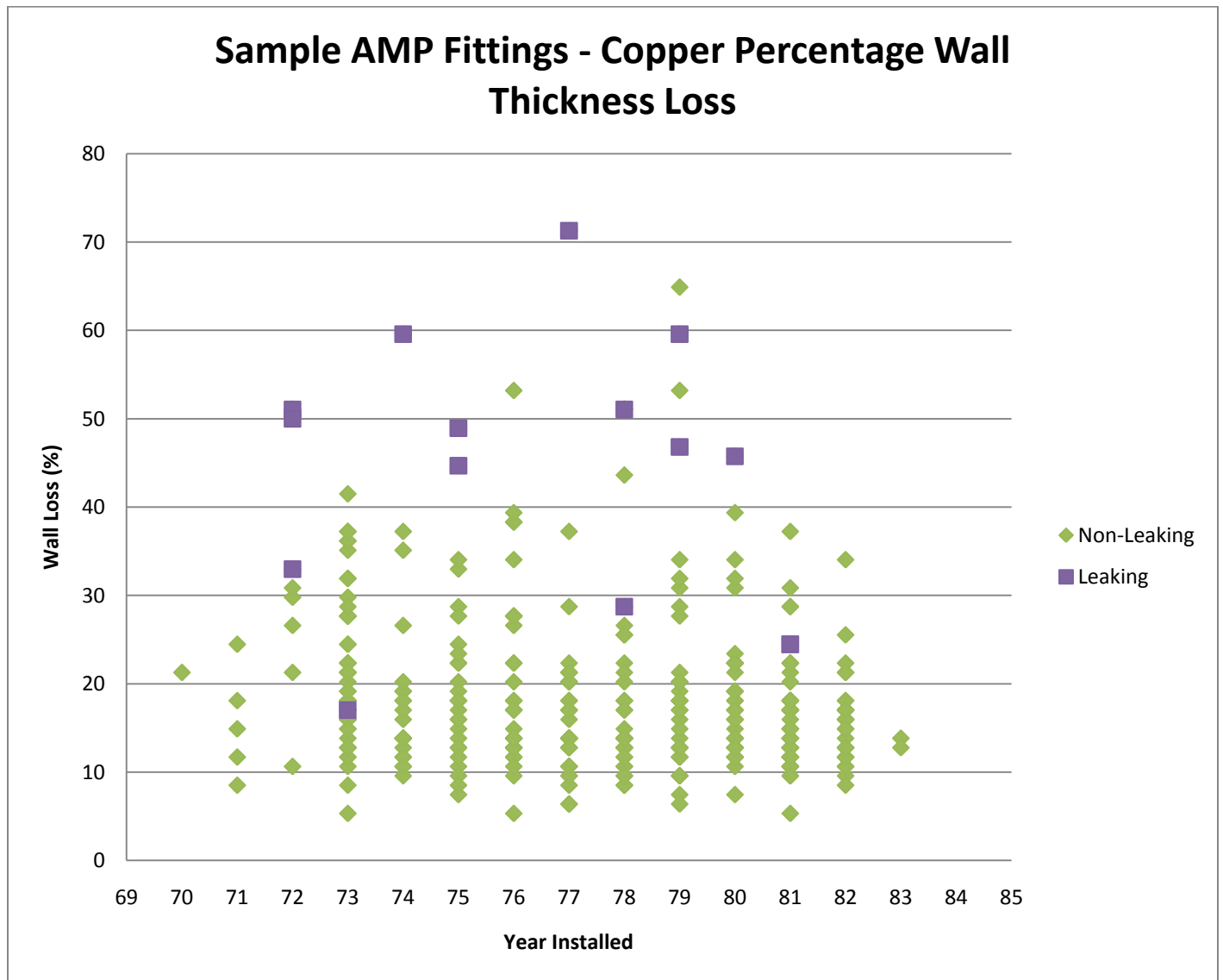


Figure 8 - Percentage wall loss of copper sample by installation year

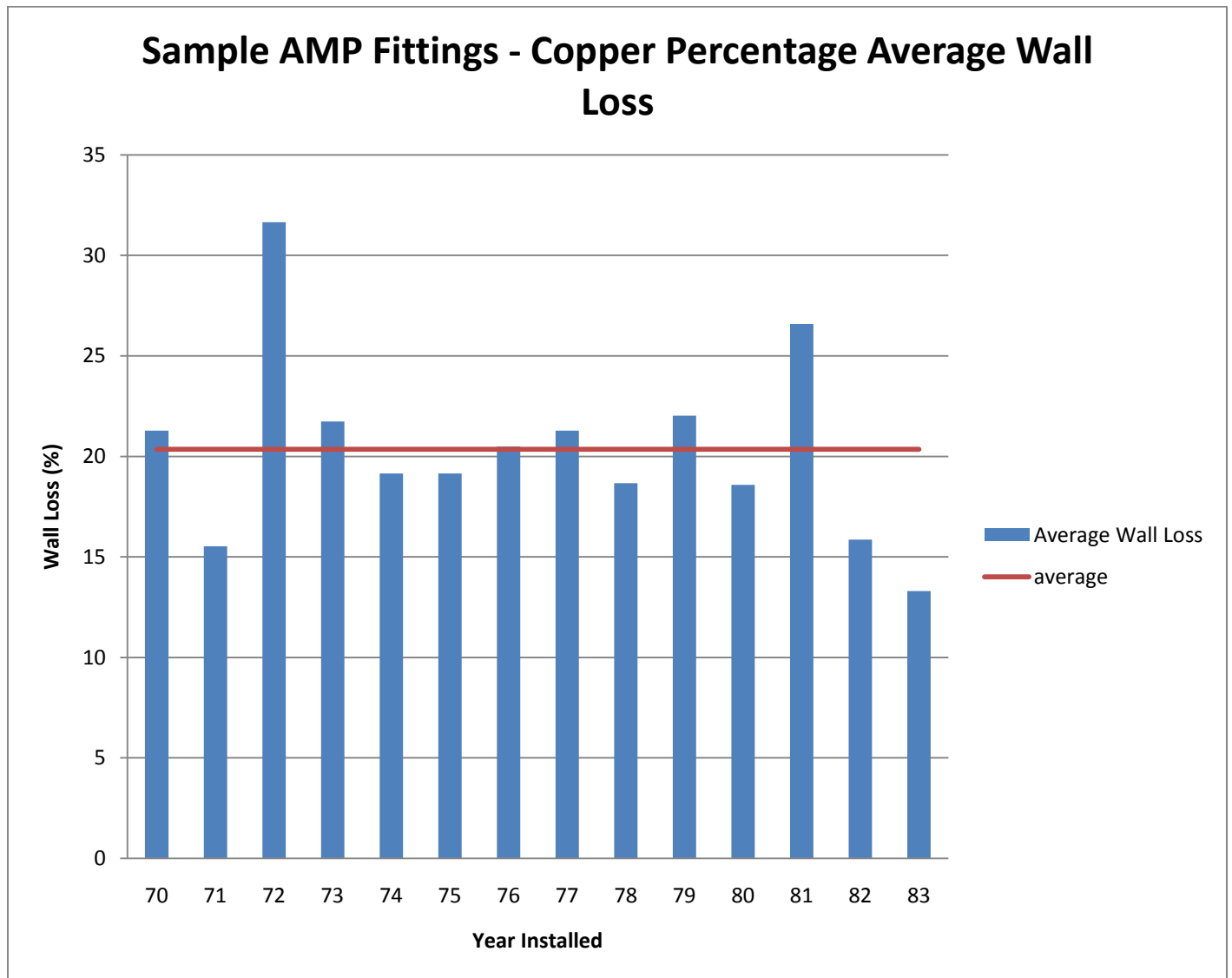


Figure 9 - Percentage average copper wall loss of sample by installation year



DISCUSSION AND INTERPRETATION

Not all AMP Fittings selected have been removed for analysis. Area 10 is missing 7 samples, whereas, Area 20, has supplied a total of 12. Areas 30 & 80 have supplied all 61 samples. Area 40 has supplied 56 AMP Fittings and Area 50 has supplied 36 samples. Area 60 has supplied 59 of the required 61 samples. See Figure 3 for more information. Figure 4 shows the samples by installation year, which is representative of the percentages of AMP fittings installed in each year.

Even though all areas did not submit their 61 samples and in some instances, the randomly chosen site was replaced with another site (similar in installation year /characteristics and due to access issues), considering the 311 locations were dispersed throughout the various locations and installation years, and only 61 samples are required for a population size of 270 000, the 311 samples are a valid representation of the conditions system wide.

- Of 311 samples analyzed by EMEC, 14 were found to be leaking, or 4.5% of the AMP Fittings sampled were leaking. Three samples were found leaking before excavation (1% of samples tested), 6 Samples were found leaking after excavation (2% of samples tested) and 5 samples were found to be leaking upon submission to EMEC (1.5% of samples tested).
- Three samples were classified as “A” leaks in the field, 4 were classified as “B” leaks and 2 were classified as “C” leaks from the 9 samples that were either leaking before and after excavation.
- Three of the leaking AMP Fitting were found on fittings installed in 1972 and 2 were found on each of 1975 and 1979. One leak each was found in the following installation years, 1973, 1974, 1976, 1977, 1978, 1980 and 1981. See Figure 4 for more information.
- 8 of the Samples were located on PE Orange type (TR 418), whereas, 6 were located on PE Aldyl A.
- There were 2 types of suspected cause of leak, Internal Corrosion and Damage/Removal. Damaged or damaged during removal leaking samples are included in total number of leaking because they are thought to be fragile enough, or suspected to be corroded enough to be damaged. 5 Samples were suspected of leaking due to Internal Corrosion, 2 of these were installed in 1972, 2 were installed in 1979 and 1 was installed in 1974. 4 samples were suspected of leaking due to Damage/Removal. 5 Samples were suspected of leaking due to a combination of Internal Corrosion and Damage/Removal, 1 was installed in 1980, 2 were installed in 1975 and 1 in each of 1978 and 1976. See Figure 5 for more information.
- Due to the different number of samples selected in each installation year, percentage of leaking AMP fittings per installation year was also graphed. 23% of the Amp Fitting samples installed in 1972 had a leak. 6% of the AMP fitting samples installed in 1975 had a leak. 4% of the AMP fitting samples installed in 1979 had a leak. 3% of the AMP fitting samples installed in 1974 had a leak. 2% of the Amp Fitting samples installed in 1976, 1977 and 1978 had a leak. Less than 2% of the Amp fitting installed in 1973, 1980 and 1981 had a leak. Zero percent of all other installation year samples had a leak. See Figure 6 for more information.
- Wall thickness of the copper tubing, at the location immediately downstream of the Amp fitting, was measured and graphed (see Figure 7 for more details). This graph shows that there is no evidence in this study to support the suspected trend of older AMP Fittings experiencing greater wall thickness loss due to internal corrosion.



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- Figure 8 shows the same information as a percentage average wall loss per installation date with the average wall loss of all sampled AMP Fittings of 20%.

ADMIN AREA CD	Year of Original Install Date	LEAKING BEFORE EXCAVATION	SIZE OF LEAK BEFORE (%LEL)	LEAKING AFTER EXCAVATION	SIZE OF LEAK AFTER (A, B, C)	TYPE OF SERVICE		SUSPECTED CAUSE OF LEAK (INTERNAL OR EXTERNAL CORROSION / PIPE FAILURE)
						PE ORANGE	PE ALDYL A	
10	1972	X	10/100 %		A ESCAPE		X	Internal Corrosion
30	1972						X	Internal Corrosion
30	1977			X	A ESCAPE		X	Internal Corrosion / Removal
30	1980			X	B LARGE BUBBLES	X		Internal Corrosion / Removal
30	1979			X	A ESCAPE	X		Internal Corrosion
30	1974						X	Internal Corrosion
40	1981			X	B LARGE BUBBLES	X		Internal Corrosion / Damaged
40	1975					X		Internal Corrosion / Damaged
40	1978	X	4/100%		B LARGE BUBBLES	X		Internal Corrosion / Broken
40	1979	X	20/100%		C SMALL BUBBLES	X		Internal Corrosion
40	1975					X		Internal Corrosion / Broken
60	1976					X		Internal Corrosion / Damaged
80	1973			X	C SMALL BUBBLES		X	Internal Corrosion / Damaged
80	1972			X	B LARGE BUBBLES		X	Internal Corrosion / Removal

Figure 10 – Summary of EMEC information for each 'leaking' AMP fitting sample



CONCLUSIONS AND RECOMMENDATIONS

The result of the AMP Fitting Sampling Study indicates a failure rate of 4.5% of the total number sampled, which is a conservative approach. One percent of the samples were found leaking before excavation, 2 % of the samples were found leaking after excavation and 1.5% of the samples were found to be leaking upon submission to EMEC. Damaged or damaged during removal leaking samples are included in total number of leaking because they are thought to be fragile enough, or suspected to be corroded enough to be damaged.

The conclusions that have emerged from conducting the AMP Fitting Sampling Study are:

- With potentially 270,000 - 400,000 AMP fittings in the system and a failure rate of 4.5% (the conservative approach), the failures with AMP Fittings can grow into an unmanageable problem.
- The data through the study showed no evidence to support the suspected trend of older AMP Fittings experiencing greater wall thickness loss due to internal corrosion. However, the average wall loss of all sampled AMP Fittings was 20% with the potential to increase as cyclic CuS deposits break away and the parent material is exposed to further corrosion.
- The cause of leaks at AMP Fittings could have been due to other parameters such as gas flow rate and settlement. However the analysis of these parameters was not a part of this study due to the additional resources that would have been required. The study of these and other parameters should only be conducted if a replacement program can be practically designed around the prioritization of such parameters.

The recommendations that have emerged from conducting the AMP Fitting Sampling Study are:

- Implement an AMP Fitting replacement program as this would be a proactive approach to ensure effective management of a potential problem in future years with leaks associated to AMP Fittings. The replacement program should be started immediately and ramped up as more information about AMP Fittings becomes available.
- The implementation of a replacement program should be used as an opportunity to further analyze AMP Fittings for trending purposes since this study yielded no trends. These trends, if found, can be used to further prioritize risks associated with AMP Fittings and help direct the replacement program.
- The actual number of AMP Fittings and locations need to be established before implementing an AMP Fitting replacement program. Investigate additional use of AMP Fittings post 1984 as a part of this process.
- In the absence of trends from this study, the prioritization of risk associated with AMP Fittings should be focused on earlier installation years since cyclic corrosion can occur multiple times to older AMP fitting installations. On-going analysis of samples from older installation years (1969-1972) should be conducted to confirm a failure rate.
- Increase leak survey frequency of entire services with install dates from 1969 to 1984. This will give data on not only AMP Fittings but also on the pre-1985 service plastic that are also being studied and considered for replacement.



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Appendix A – Data Collection Sheets

AMP FITTING SAMPLING PROGRAM 2011 - PMTS INFORMATION							
WR #	ASSET ID	AREA	CITY	ADDRESS	DATE INSTALLED	TYPE OF SERVICE	
						MP	IP

FIELD INFORMATION BEFORE EXCAVATION - BARHOLE				
LEAKING		IF "YES" SIZE OF LEAK		PICTURE #
YES	NO	% LEL	% GAS	

FIELD INFORMATION AFTER EXCAVATION - SOAP TEST																		
LEAKIN G		IF "YES" SIZE OF LEAK			SOIL CONDITIONS				MOISTURE CONDITION IN SOIL				PICT URE #	DISTA NCE FROM AMP FITTING TO RISER (LENG TH OF COPPE R IN METE RS)	DEPTH OF AMP FITTING TO FOUNDATI ON WALL (METERS)	DISTANCE FROM AMP FITTING TO FOUNDAT ION WALL (METERS)	DATE WOR K COM PLETE D	WORK PERFO RMED BY
YE S	N O	A ESCA PE	B LG. BUBB LES	C SM. BUBB LES	SA ND	CL AY	RO CK	OTH ER	D RY	DA MP	W ET	WAT ER						



AMP FITTING SAMPLING STUDY REPORT 2012

EMEC INFORMATION													
DATE RECEIVED	CONDITION OF MATERIAL RECEIVED	LOCATION OF LEAK ON FIELD SAMPLE	TYPE OF SERVICE			WALL THICKNESS OF COPPER (mm)		SUSPECTED CAUSE OF LEAK (INTERNAL OR EXTERNAL CORROSION / PIPE FAILURE)	COATED COPPER TUBING		PICTURE #	DATE AMP FITTING TESTED IN EMEC	EMEC TESTING PERFORMED BY
			PE ORANGE	PE ALDYL A	OTHER	AMP FITTING (THINNEST LOCATION)	20CM UPSTREAM FROM AMP FITTING		YES	NO			



Appendix B - Information Sheet for Field Sampling

Information Sheet			
PMTS Information			
W.R. #	PMTS Asset ID:		
Area:	City:		
Province:	Address:		
Postal Code:	Main Size:	Grid:	
Date Installed:	Type of Service:	MP	IP
Field Information			
BEFORE EXCAVATION - BAR HOLE			
Leaking?	YES	NO	
If "Yes", size of the leak?	(%LEL)		
Picture #:			
AFTER EXCAVATION - SOAP TEST			
Leaking?	Yes	NO	
If "Yes", size of the leak?	A Escape	B lg. bubbles	C sm. bubbles
Soil Condition:	Sand	Clay	Rock Other
Moisture Condition in Soil:	Dry	Damp	Wet Water
Picture #:			
Distance from AMP fitting to riser (length of copper) in meters:			
Depth of AMP fitting from grade in meters:			
Distance from AMP fitting to foundation wall in meters:			
Date Work Completed:			
Work Performed by:			
Print Name			

Appendix C – AMP Fitting Sampling Procedures

Amp Fitting Sampling Procedures

1. Pre-inspection

- i. Before an excavation is planned, the company's field personnel must survey the proposed area and complete the field pre-inspect form, figure 1.8.2 of O&M manual.
- ii. Send field pre-inspect form to Work Management Centre.

2. Locates

- i. Obtain locates in accordance with Section 4.1 of O&M Manual – Locates Obtained by the Company.

3. Information Sheet

- i. On Information Sheet, ensure PMTS Information has been pre-populated and is correct.
- ii. On Information Sheet, fill in the Work Request number as provided by Work Management Centre.

4. Pictures before Excavation

- i. Pictures may be useful to capture non-typical sites.
- ii. Ensure it is safe to take pictures before doing so.
- iii. If pictures are taken, please note picture # on the Information Sheet.



5. Barholing

- i. Barhole at location where Amp Fitting is suspected to be located.
- ii. Refer to Section 5.5.4.1 in O&M manual – Barholing Procedure.
- iii. Refer to Section 3.1 – Leak Surveys.
- iv. At a minimum complete three readings.





6. Leaking? - Yes

- i. Re-assess situation and treat as leak situation as per Section 5.5 of O&M manual – Leak Investigation.
- ii. On Information Sheet, Indicate 'Yes' for Leaking.
- iii. On the Information Sheet, write the %LEL reading.

7. Leaking? - No

- i. Indicate 'No' on Information Sheet.

8. Excavate

- ii. Follow Section 4.2 – Excavating to expose gas service.
- iii. Expose at least 1 foot of copper and 2.5 feet of the plastic.



9. Soap test

- i. Soap Test Amp fitting and attached few inches of copper service to check for leaks.

10. Leaking - Yes

- i. Re-assess situation and treat as leak situation as per Section 5.5 of O&M manual – Leak Investigation.
- ii. On Information Sheet, Indicate 'Yes' for Leaking.
- iii. On the Information Sheet, write the %LEL reading.
- iv. Indicate Leak Class on Information Sheet.

11. Leaking - No

- i. Indicate 'No' on Information Sheet.

12. Pictures after Excavation

- i. Ensure it is safe to take pictures before doing so.
- ii. If pictures are taken, please note picture # on the Information Sheet.





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13. Record Soil Data

- i. Indicate soil condition (Sand, Clay, Rock or Other) on Information Sheet.
- ii. Indicate moisture condition of soil (Dry, Damp, Wet or Water) on Information Sheet.

Notes:

14. Take Measurements

- i. Measure total length of copper service and note on Information Sheet.
- ii. Measure depth of AMP fitting from grade, in meters, and note on Information Sheet.
- iii. Measure distance from AMP fitting to foundation wall, in meters, and note on Information Sheet.

15. Collect Sample

- i. Collect 2 feet of plastic and 1 foot of copper with amp fitting for sampling purposes.
- ii. Tape sample ends with duct tape.
- iii. On Information Sheet, ensure 'Date Work Completed' & 'Work Performed by' sections are completed.
- iv. Put completed Information Sheet into small bag.
- v. Put sample and Information Sheet bag into big bag.
- vi. Send complete sample bag to EMEC Lab for analysis.

16. Replace Riser

- i. Replace riser in accordance with O&M manual.

17. Backfill

- i. Follow section 4.8 of O&M Manual – Backfilling.



Appendix D – Kick-Off Meeting Agenda

Amp Fitting Sampling - Kick-Off Meeting Agenda

May 12, 2011

1. Introductions
2. Purpose of Sampling Program
 - a. Background
 - b. Samples Testing
3. Scope and Schedule
 - a. 61 + 10 Samples
 - b. Sampling Completion Date
4. Sampling Procedures
 - a. How to Sample
 - b. Improvements to Procedure
5. Work Order Type & Creation
 - a. Work Request Types
 - b. Creation
6. Information Storage
7. Sample Bags
8. Questions

AMP Fittings Study - 2012



Prepared by: Oscar Khazam and Fred Butrico

Date: 10/03/2013

AMP Fittings Study - 2012



Executive Summary

AMP Fittings are mechanical fittings used in residential applications for the below-ground transition between an NTS ½ plastic service line and a copper riser. Enbridge Gas Distribution (EGD) installed these fittings on new services from 1969 to 1984. There are approximately 320,000 AMP Fittings in the EGD system.

EGD has experienced a corrosion leak failure rate associated with these fittings of approximately 30% increase per year over the past 6 years. This increasing failure rate is of concern, as the failure of the fitting poses a significant safety risk to our customers. These fittings are in direct proximity to residential premises, and as such, failures associated with this fitting will cause underground leaks which have the potential to enter a building, particularly in the winter months, when the ground is frozen and the leaking gas is unable to vent to atmosphere. This potential leak migration could also occur during summer under driveways or sidewalks.

In order to identify the failure mechanism and understand the issues associated with this mode of failure, Distribution System Integrity (DSI) has conducted this study to gain an understanding of the contributors to the internal corrosion, and understand the performance of the fittings throughout the population, thus determining the expected residual life of the AMP Fitting – copper tubing system. It is the intention of EGD to ensure the replacement of these fittings occurs in advance of the failure curve. Statistical sampling and laboratory analyses of AMP Fittings from differing vintages throughout the franchise area show that the observed leakage rates will continue to increase with time at an accelerating rate.

In this study, the mechanism of failure associated with these fittings is internal corrosion of the copper tubing approximately one centimeter downstream of the AMP Fitting. When odourized gas flows through the copper riser assembly, the copper slowly corrodes leaving a copper sulphide (Cu_2S) coating on the internal tubing wall. As gas continues to flow through the AMP Fitting, turbulence created from the change in internal diameter from the AMP Fitting insert to the copper tubing has a tendency to remove the corrosion product leaving the copper surface fresh to new attack by the natural gas. The corrosion and thinning of copper can be attributed to normal traces of reactive hydrogen sulphide (H_2S) in the natural gas.

These leaks are currently handled under EGD's Emergency Management Plan with a response time requirement of 45 minutes. With the projected accelerating increase in the number of leaks on an annual basis, it is unlikely the current workforce will be able to respond to the volume of leaks in a timely manner. It is clear from this analysis and the risks associated with AMP Fitting failures that a targeted program is needed to mitigate the risks associated with AMP Fittings to ensure that customer and public safety is uncompromised.

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Based on the analysis conducted, the most significant conclusions are:

- The AMP Fitting – copper tubing systems appear to be failing as a result of time-dependent localized internal sulphidation corrosion of the copper.
- Primary variables impacting the minimum remaining wall thickness of the AMP Fittings are vintage (wall loss increases with age) and flow rate (wall loss increases with flow rate).
- The analysis of the historic failure data confirms that leaks appear to develop due to localized time-dependent corrosion.
- The entire population of exhumed fittings examined to date is experiencing this corrosion mechanism to some extent.
- Operating pressure, soil type, moisture condition of soil, coating type or length from the AMP fitting to the riser, to the grade or to the foundation wall are not seen to have any statistically significant impact on wall loss rates.
- The Wall Loss model and Weibull model suggest that field leak rates are projected to increase at an accelerating rate, roughly doubling through the next five year period and increasing by four to six fold through the next ten years.

The recommended replacement program consists in the removal of all of the AMP Fittings from the EGD system through a 23 year targeted replacement program. This program will involve the progressive replacement of 4,000 AMP Fittings in 2014 to 10,000 in 2016 to continue at 15,000 AMP Fitting replacements annually. To the extent possible, Enbridge will look for efficiencies in managing the replacement of these fittings through synergies with other asset replacement programs as warranted like the Aldyl “A” replacement program. Additionally, the Leak Survey Group will perform a leak survey for every AMP fitting location on a yearly basis starting in 2015 to reduce the risk of having a sustained undiscovered leak. Reevaluation of the program is needed in response to the actual leak rate experienced, which may mean accelerating or decelerating the replacement of AMP Fittings.

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1.1 Overview

The importance to understand and define the study was reinforced once research regarding the issue was performed. A brief historical background on AMP Fittings, previous analyses, the purpose and scope of the study, and the project objectives and deliverables, are described in this section.

1.2 AMP Fitting

The AMP Fitting is a mechanical coupling used on tubing that was first developed in 1966 by AMP Incorporated of Harrisburg Pennsylvania and was soon modified for use on natural gas distribution systems upon a request made by Oklahoma Natural Gas. This fitting was subsequently sanctioned for use by EGD in the late 1960's as a below grade coupling for polyethylene (PE) services, as well as, a transition from PE services to copper risers. At the time, the unavailability of a plastic transitional riser made the AMP Fitting the chosen configuration for new residential services.

The three components of an AMP Fitting include a nylon body with integrated brass insert and two stainless steel rings as shown **Figure 1.1.1**.

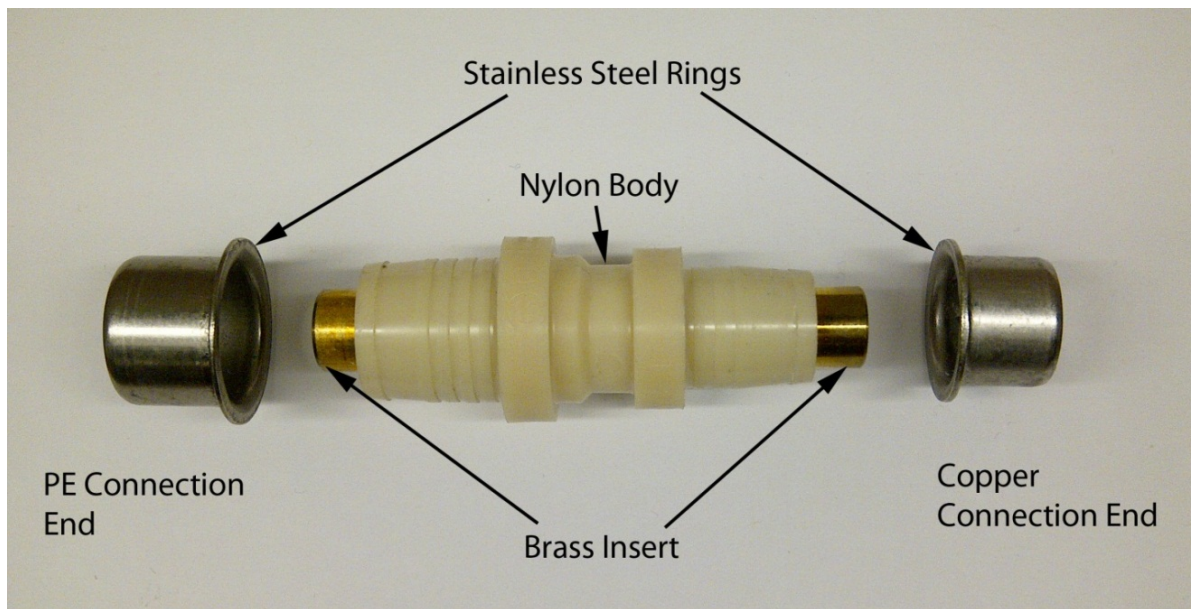


Figure 1.1.1: AMP Fitting Components

Its design provided a relatively simple and quick method of coupling PE tubing to copper tubing while providing a gas tight seal. This was achieved using a specialized hand tool supplied by the manufacturer that pressed the stainless steel rings over the nylon body, effectively compressing the inserted tubing ends between the nylon body and brass insert. A completed AMP Fitting assembly including the PE and

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copper tubing connections is shown in **Figure 1.1.2**. Once completed, the AMP Fitting assembly was typically wrapped in a protective tape or coated prior to backfilling the excavation.

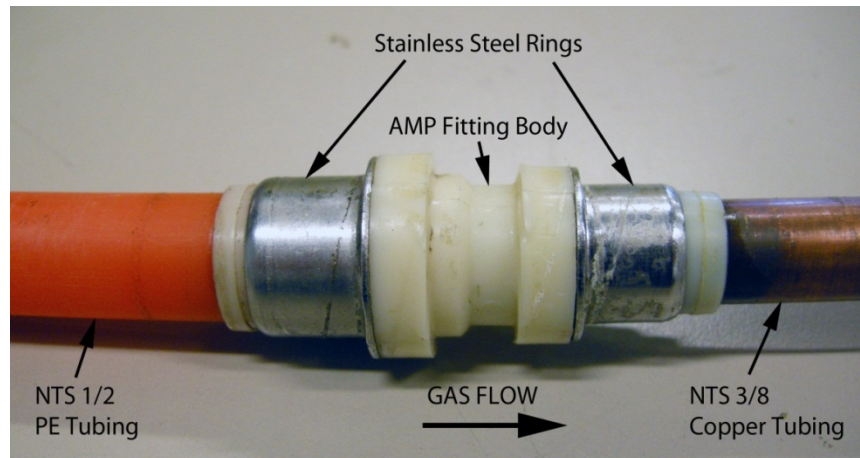


Figure 1.1.2: AMP Fitting Assembly

Historically, AMP Fittings in the EGD system have typically been installed on Intermediate Pressure (IP) services, between 0.5 to 1.5 meters from the vertical portion of the riser and usually located within 1 meter of the foundation wall, depending on the orientation of the building and service line. **Figure 1.1.3** shows a typical AMP Fitting installation in relation to the foundation wall and residential meter set.

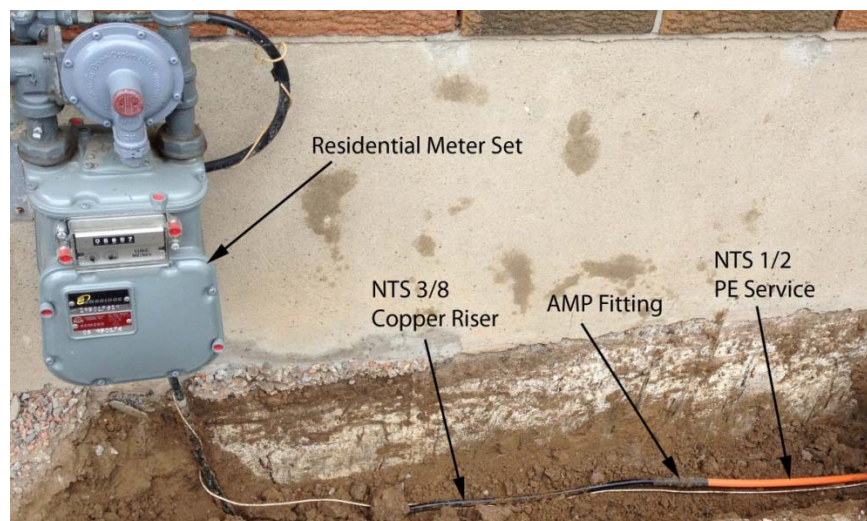


Figure 1.1.3: Typical AMP Fitting Installation

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1.3 Copper Riser

Copper risers installed downstream of AMP Fittings in the EGD system are composed of Type L annealed copper tubing, manufactured from copper alloy C12200 that possesses a minimum of 99.95% pure copper as specified in ASTM B88 *Standard Specification for Seamless Copper Water Tube*. The dimensions for NTS ¾ copper tubing installed in the EGD system have remained constant throughout the years of installation, exhibiting a manufactured wall thickness of (0.889 ± 0.102) mm based on copper tubing records (Engineering specification sheet) as shown **Table 1.2.1**.

Table 1.2.1: New Type L Copper Tubing Dimensions and Tolerances

Nominal Tubing Size (NTS)	Average Outside Diameter (mm)	Average Outside Diameter Tolerance (mm)	Average Wall Thickness (mm)	Average Wall Thickness Tolerance (mm)	Minimum Wall Thickness (mm)	Maximum Wall Thickness (mm)
3/8	12.700	± 0.060	0.889	± 0.102	0.787	0.991

The copper tubing was also supplied with a protective Polyvinyl Chloride (PVC) black coating not less than 0.76 mm in thickness. However, at the connection point the PVC coating was removed to allow insertion into the AMP Fitting.

1.4 Background

AMP Fittings were predominately installed in the EGD system from 1969 to 1984 on IP NTS ½ PE services that transitioned to NTS ¾ copper riser assemblies. Although estimates from the previous AMP Fitting Study place the total population of AMP Fittings in the EGD system somewhere between 270,000 and 400,000, the PMTS extract applied for this study established a total population of approximately 320,000 installed locations or unique Premise IDs.

Previous studies have shown pin-hole to moderate sized leaks had been documented at AMP Fitting locations through Leak Survey Inspections and Material Fault Reports. The leaks were isolated to the copper tubing and typically within a few centimeters from the AMP Fitting outlet. Previous investigations have concluded these small cracks or pin-hole perforations in the copper tubing resulted from thinning of the copper tubing wall caused by trace amounts of naturally occurring hydrogen sulphide (H_2S) and mercaptan within the natural gas. This gaseous compound reacts with the copper to produce a thin layer of copper sulphide (Cu_2S) corrosion on the inside wall of the copper tubing. The Cu_2S corrosion film typically forms a protective barrier against further corrosion; however the friable nature of this corrosion product is susceptible to flaking from the inner wall. As the Cu_2S gradually flakes

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from the inner wall, it exposes fresh copper material to the gas flow and continues the copper tubing corrosion process and subsequent reduction of the wall thickness. The copper wall progressively thins over time, ultimately resulting in a small perforation of the copper wall, creating a leak path for the natural gas to escape.

In order to determine if there has been any change in the chemical composition of copper risers used over the years in the EGD system, two copper riser samples installed in 1971 and 1983 were removed from service and subjected to a chemical analysis according to ASTM E 1097-07. The results indicate that both samples satisfy the chemical composition limits of ASTM B 88-09 grade UNS C12200 pure copper, confirming that the chemical composition of the copper risers used in the EGD system has remained consistent throughout the years of installation.

AMP Fitting repair data has been documented in the Distribution System Integrity Management Program (DSIMP). In total, 1971 leaks or “failures” had been repaired from 2007 through 2011 where the data identifies a clear trend of increasing leakage rates with the age of the fitting, as well as, a general trend of increasing leak rates through the 5 year reporting period. Additional details can be found in Section 5.6.

This increased failure rate is of concern, as the failure of the fitting poses a significant safety risk to our customers. These fittings are in direct proximity to residential premises, and as such failures of this fitting will cause underground leaks which have the potential to enter a building, particularly in the winter months, when the ground is frozen and the leaking gas is unable to vent to atmosphere. This potential leak migration could also occur during summer under driveways or sidewalks.

1.5 Purpose

The AMP Fitting Study is an Operational Risk Management (ORM) initiative to expand on the AMP Fitting Sampling Study Report 2011 commissioned by Engineering. Additionally, it is included in the 2012 ten year Asset Management Plan to understand the condition and performance of this asset. Specifically, data obtained from this study will be utilized to quantify the failure rates associated with AMP fittings, develop a model for forecasting future leak rates based on estimating the residual life associated with the expected corrosion rates, and forecast future leakage rates for the installed asset base that, when combined, will provide a risk ranking for the total installed fitting population. This information will be applied to collectively develop an optimal, risk based course of action and mitigation program for the total AMP Fitting population.

1.6 Scope

Although EGD installed various sizes and configurations of AMP Fittings that also included AMP Fitting Tees and PE tubing to PE tubing AMP Fittings, the scope of this study is exclusively focused on AMP

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Fittings that were installed to connect NTS ½ PE gas service tubing to NTS ¾ copper riser tubing in the EGD system as the majority of historical failures are associated with copper degradation.

1.7 Project Objectives

The AMP Fitting Study outlined the following objectives:

- Enhance, document and refine the population of services with AMP Fittings.
- Extract a random sample of AMP Fittings from the full EGD AMP Fitting population and collect data pertaining to AMP fitting location, local environmental conditions and AMP fitting and copper tubing condition.
- Determine root cause and contributors to AMP Fitting related failures through physical analysis of field samples.
- Subsequently use this information to further determine the parameters used to establish the best course of corrective action for a continuous mitigation program.
- Examine leak survey frequencies of services with AMP Fittings and predict failure rates.
- Define recommendations and plan for the next stage of the mitigation program.

1.8 Project Deliverables

The AMP Fitting Study subscribed to the following deliverables:

- Identify the location and age of all assets that currently have a plastic service, with a transitional AMP Fitting to a copper service riser.
- Extract samples (approximately 700) representing the entire population.
- Sampling analysis results.
- Defined prioritized methodology for forecasting leaks.
- Deliver a report with recommendations for an Asset Mitigation Program for 2013 and beyond.
- Examine and recommend leak survey frequencies of services with AMP Fittings.

2.0 AMP Fitting Population

2.1 Overview

In order to determine the total AMP Fitting population, a PMTS extract was produced by Integrity Analytics & Reporting that queried specific service and main criteria including: nominal pipe size, pipe material, service status, original install date and maintenance type. Through this data extract a total installed asset population of 319,043 AMP Fittings throughout the EGD system (Not including St. Lawrence Gas) was identified and utilized for the modeling in this report. As field surveys are completed and repairs and replacements occur over time the total population of AMP fittings will change.



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2.2 Integrity Analytics & Reporting

Identifying the total population of AMP Fittings in the EGD system was performed with assistance from the Integrity Analytics & Reporting group. The specific selection criteria were determined for each service and main attribute required to capture the entire AMP Fitting population shown in **Table 2.2.1**.

Table 2.2.1: AMP Fitting PMTS Extract Criteria

Nominal Pipe Size	Pipe Material	Service Status	Original Install Date	Maintenance Type
½ inch	PE	Active	Services installed on or before 12/31/1984	No Limits placed in the search criteria
		Inactive		
	Plastic	Pending Cut-off		
	Plastic Liner	Reactivated		
		Temporary Cut-off		

2.3 Distribution of Population

Using the selection criteria indicated above, the PMTS extract returned a total 319,043 AMP Fitting installed locations across the entire EGD system. The installation of all AMP Fitting by franchise area is shown in **Figure 2.2.1**.

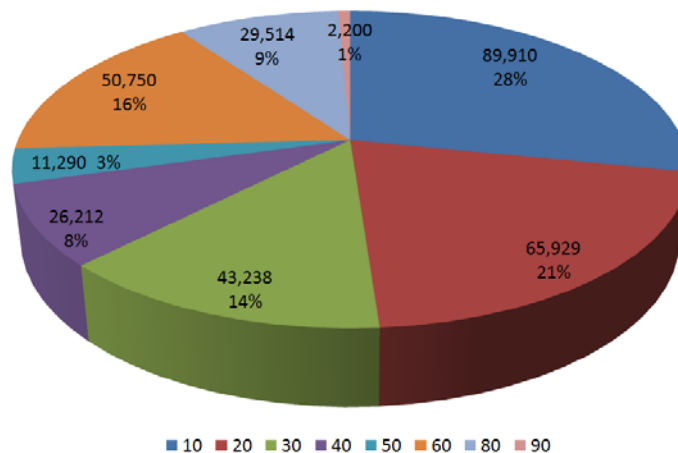


Figure 2.2.1: Total AMP Fitting Installations by Franchise Area

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3.0 Statistical Analysis

3.1 Overview

As stated before, this project was executed to continue the AMP Fitting Sampling Study Report 2011 prepared by the Engineering Department by sampling and analyzing a new list of random AMP Fittings in the EGD system. A statistical approach was needed to evaluate the most efficient and representative sample population. A combination of randomness, high confidence level and optimization of available resources for sampling were the determining factors that were taken into consideration when designing a statistical strategy for the project. The following chapter briefly describes the scenarios analyzed, the distribution of samples within the EGD system, as well as the instructions developed to provide guidance to field personnel regarding the extracting of the AMP Fitting samples and important in-situ information.

3.2 Statistical Strategy

After defining the AMP Fitting population in the EGD system as explained above, it was necessary to analyze different scenarios to obtain the most efficient and representative sample of the EGD system. A Stratified Sampling method was used. This method consisted of dividing the population into different homogeneous groups, called strata, and then selecting independent random samples in each stratum. The stratification criterion chosen was AMP Fitting vintage. This statistical method and stratification criterion were chosen to ensure that all vintages were represented in the sample. Design effect, response rate, population proportion and margin of error are the parameters needed for the calculations to obtain the amount of samples in each stratum. Standard values were used in the calculations of the total amount of samples. These values are summarized in **Table 3.2.1**.

Table 3.2.1: Statistical Sampling Methodology

Design effect	1
Response rate	90%
Population proportion	4.50%
Margin of error	5%

Seven different scenarios were evaluated in total where different strata were evaluated. A high confidence level and available field resources for sampling were the most important factors to determine which scenario was suitable for the project. This consisted of separating the AMP Fitting population in two strata (Prior 1979 = Group 1 and After 1979 = Group 2). Historical leak data suggested higher leak rates for AMP Fittings installed prior to 1979, as listed in **Table 5.6.1**. As a result, a higher confidence level was desired for Group 1 of the AMP Fitting sample. **Table 3.2.2** shows the parameters and calculation results of the selected scenario.

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Table 3.2.2: Sample Stratification by Vintage

	Vintage	Total of AMP Fittings	Percentage	Confidence level	Sample Size
Group 1	1969-1979	159,051	49.85%	95%	427
Group 2	1980-1984	159,992	50.15%	90%	303
					730

3.3 Sample Totals

A total of 730 samples were calculated to be required to obtain the desired confidence levels. However, before a random selection was performed to obtain the 730 AMP Fitting locations, a proportional division by regions was performed to ensure that all areas of the population were represented in the sample. The proportion was based on the percentage of AMP Fittings in each franchise area in each group. **Table 3.2.3** shows a summary of the sample stratification by franchise area.

Table 3.2.3: Sample Stratification by Franchise Area

Areas	Group 1 (%)	Sample size	Group 2 (%)	Sample size	Total of samples
10	25.4	108	31.0	94	202
20	24.5	105	16.9	51	156
30	10.1	43	17.0	51	94
40	9.1	39	7.4	22	61
50	4.8	21	2.3	7	28
60	12.2	52	19.6	59	111
80	13.6	58	4.9	15	73
90	0.3	2	1.0	3	5
Total	100	428	100	302	730

3.4 Sampling Instructions

Instructions were developed to fulfill the requirements of the 2012 AMP Fitting Study as one of the ORM initiatives for 2012. These instructions were developed and used to retrieve AMP Fitting samples and important specific information from the field. All this information was recorded in information sheets supplied for every single location. The Instruction and Information Sheet can be found in **Appendix A**. Examples of some of the information recorded are:

- Leak detection and classification
- Soil type (Sand, Clay, Rocks, Others)
- Moisture condition of soil (Dry, Damp, Wet, Water)

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- Total length (in meters) from the AMP Fitting to the riser, AMP Fitting to the grade and AMP Fitting to the foundation wall.

It is important to mention that in the elaboration process for these instructions, compliance with policies and procedures established by the company was taken into consideration. Standard procedures as per the Construction & Maintenance Manual – 2012 were included to facilitate the work for field personnel.

4.0 Quality Assurance and Sample Analysis

4.1 Overview

After choosing random sample locations as discussed in Section 3.3, EGD field personnel and third party contractors were trained on how to extract the samples and to record the key information from the field. The Work Management Center created all the Work Requests to get the work out to Operations personnel and start the sampling process. This section contains the results of the sampling process in all the areas, in addition the sample methodology performed by JANA Labs to analyze the samples. This methodology was specifically developed for this analysis to be able to obtain all the relevant information to discover and understand the mechanisms that are causing the accelerated corrosion in the copper tubing downstream of the AMP Fitting.

4.2 Sample Results

Samples including their respective Information Sheets were collected and sent to VPC from all different franchise areas as per the instructions in **Appendix A**. These sample packages were QA'd on arrival and then sent to JANA Labs for analysis. A total of 559 samples were extracted from the field. Specifics of sample totals by franchise area can be seen in **Table 4.2.1**. It can also be appreciated in **Table 4.2.1** the percentage of completion by franchise area. This value consists in both the samples extracted plus the locations where no AMP Fitting was found (Anodeless Riser or Chicago Fitting found). Even though no AMP Fittings were extracted at these locations, they were counted as a successful sample for the percentage of completion calculation, because one of the objectives of the study is to enhance, document and refine the population of services with AMP Fittings. In all the franchise areas, a total of 74 locations were identified with no AMP Fittings found. This represents 10.4% of the total sample size.

It is important to mention that customer focus and efficient use of field crews was part of the study strategy. In several occasions as identified by pre-inspections, original sample locations were identified as difficult to access locations (e.g. underneath a deck or AC unit) or could cause a major issue to a customer (e.g. under concrete driveway or award winning garden). These sample locations were replaced by nearby locations with the same characteristics as the original (vintage, service type, etc.)

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where the AMP Fitting was easier to extract. This replacement process reduced customer impact and augmented the efficiency of the sampling process. The percentage of completion for all the franchise areas combined was 88%. This value is close to the response rate assumption of 90% needed to achieve 95% and 90% sampling confidence level in Groups 1 and 2, respectively (See **Section 3.2**).

Table 4.2.1: Results of AMP Fitting Sample Field Extraction

Areas	Sample size (Group 1)	Sample extracted/No AMP found (Group 1)	Sample size (Group 2)	Sample extracted/No AMP found (Group 2)	Total of samples extracted	Percentage of completion (%)
10	108	88/7	94	73/10	161	88%
20	105	85/2	51	40/8	125	86%
30	43	31/0	51	30/12	61	77%
40	39	25/3	22	15/4	40	77%
50	21	10/0	7	1/0	11	29%
60	52	44/8	59	43/16	87	100%
80	58	57/1	15	13/2	70	100%
90	2	2/0	3	2/1	4	100%
Total	428	342/21	302	217/53	559	88%

4.3 Sample Analysis Methodology

As stated before, JANA Labs conducted all the sampling analysis. EGD collaborated with Jana with the intentions of identifying the best set of testing, measurements and observations to be able to identify the corrosion mechanisms and record as much sample details as possible. The following procedure was applied for the analysis of the samples:

1. Lightly clean the pipe with water.
2. Clearly mark the 12 o'clock position on plastic and copper tube (for first 20 cm) with indelible marker.
3. Performed visual inspection of the sample and record:
 - a. Pipe type = Yellow (Y), Grey (G), Orange (O) or Aldyl"A" (A)
 - b. Field applied coating = Tape (T), Mastic (M) or both (B)
 - c. Condition of coating = Bad (B) or Good (G)
 - d. Corrosion on outer diameter = Low (L), Medium (M) or High (H)
 - e. Copper coating condition = Okay (O) or Friable (F)
 - f. Corrosion on inner diameter = Low (L), Medium (M) or High (H)
 - g. Condition of fitting = note if apparent damage or cracking
 - h. Color of fitting = Blue (B) or White (W)

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NOTE: Any samples with unusual features outside those listed above should be flagged for technical examination.

4. Mark the copper pipe at 20 cm from the shoulder of the crimp ring.
5. Cut tubing at 20 cm mark.
6. Cut fitting at crimp shoulder.
7. Cut tubing at 10 cm from the cut pipe end.
8. Cut open the pipe end that was in the fitting in half by the 3 or 9 o'clock position.
9. Mark the top half with (T) and the bottom half with (B) and photograph both halves as per

Figure 4.3.1.

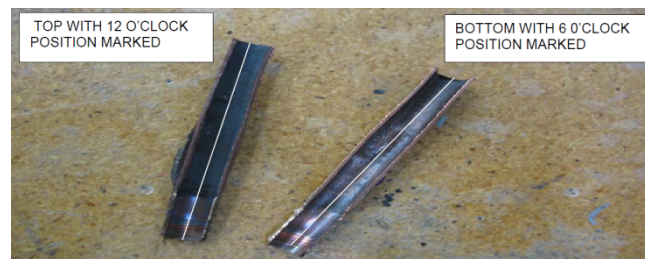


Figure 4.3.1: Installed Orientation on Dissected NTS 3/8 Copper Tubing Sample

10. Collocate cut samples for measurement in sealed bag marked with sample DSI ID.
11. Place bag in Conditioning Room for dimensioning (Condition at 23 °C, 50% RH for 24 hours prior to dimensioning).
12. Take and record 6 wall thickness measurements around the circumference at the 20 cm mark.
13. Take and record 3 wall thickness measurements around half the circumference at the fitting end tubing 0 cm mark (top half) (See figure X for reference).
14. Take and record 3 wall thickness measurements around half the circumference at the fitting end tubing 0 cm mark (bottom half) (See figure X for reference).
15. Take and record the minimum wall thickness measurement in both halves.
16. If defect observed in the copper tubing, measure height, width, length and position from the cut end.
17. Take and record 5 wall thickness measurements downstream from the defect, include distance from defect in the records (See **Figure 4.3.2** for reference).

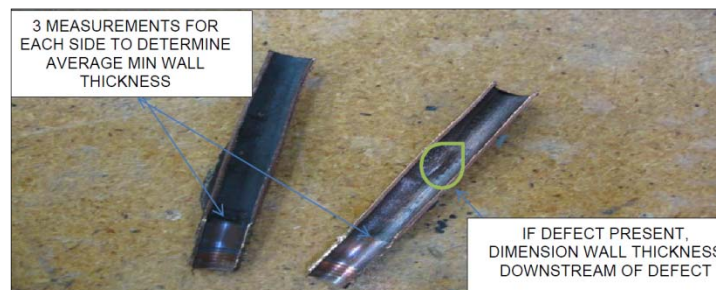


Figure 4.3.2: Wall Thickness Measurements of Dissected NTS 3/8 Copper Tubing Sample

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5.0 Discussion of Results

5.1 Overview

In order to characterize the current state of the copper immediately downstream of the AMP Fitting asset base, a sampling program was developed and AMP Fitting removal was initiated as described in the previous two sections. Samples were randomly selected within different areas of the EGD system and across the various installation periods. They were exposed, retrieved and then shipped to JANA Labs for analysis. The specific details of each installation were recorded in the field and upon inspection at JANA Labs. The specimens were then dissected for analysis to determine the specific mechanism leading to field leaks and to characterize the current state of the samples. This section describes the discussions of results based on the analysis of 518 of the 559 specimens collected. Due to collection and transportation issues, 41 samples could not provide usable results. An analysis was conducted on this initial sample set and the findings are summarized in this section.

5.2 Wall Thickness

The key variable of interest in the study was the minimum wall thickness. Based on the 2011 AMP Fitting study, it was determined that there was significant scatter observed in the measured minimum wall thickness. One of the key deliverables in this project was to examine and determine the key variables impacting this observed scatter. As expected, similar significant scatter for minimum wall thicknesses for the retrieved samples (See **Figure 5.2.1**) was also observed, even within a given installation year. The determination in part (or all) of this scatter is related to variations in gas flow rates through the fittings and will be discussed later in this section.

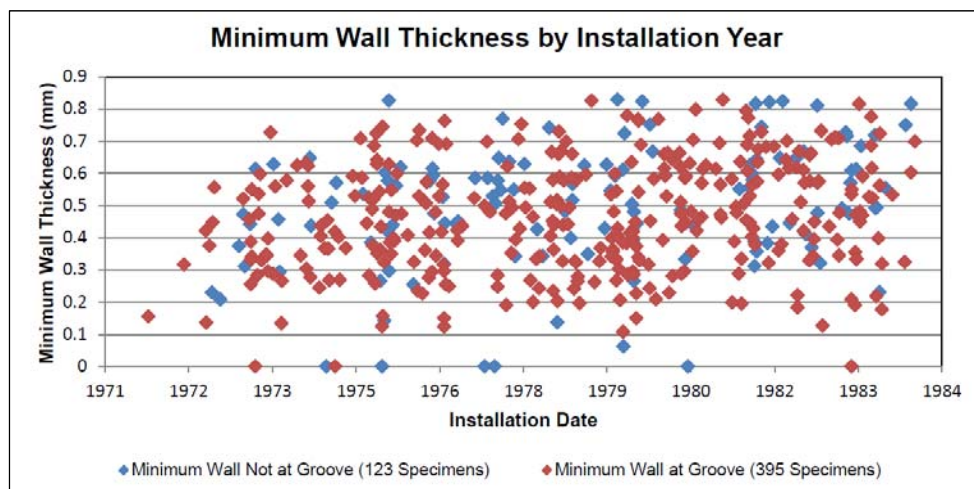


Figure 5.2.1: Localized Corrosion at Fitting Outlet and Downstream From Fitting

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As shown in **Figure 5.2.2**, the overall minimum wall thicknesses of the samples examined to date are roughly normally distributed with an overall mean of 0.47 mm, a median of 0.47 mm and a standard distribution of 0.18 mm. This analysis was also performed by separating the location of the minimum wall thickness into “at the groove” location (approximately 1 cm after AMP Fitting brass insert) or “not at the groove” location. Similar results were obtained from this analysis (See **Table 5.2.1**). As a reference, distributions of the minimum wall thickness “at the groove” and “not at the groove” are located in Appendix B (**Figures B.1** and **B.2**, respectively). The next section describes more in depth why corrosion is observed “not at the groove” and “at the groove”.

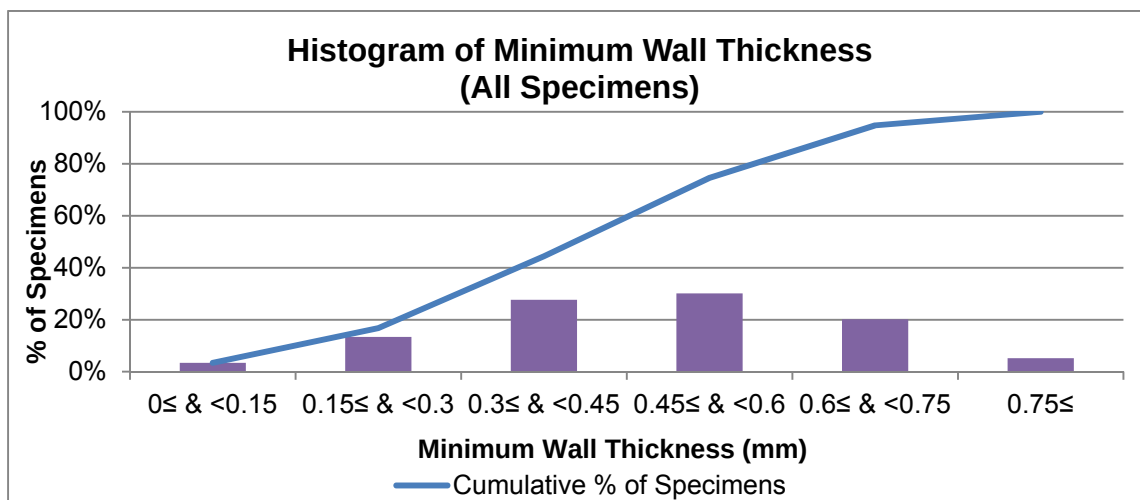


Figure 5.2.2: Histogram of Minimum Wall Thickness for All Specimens Analyzed to Date

Table 5.2.1: Comparison of Mean, Median and Standard Deviation of Minimum Wall (in mm)

Minimum Wall	Mean	Median	Standard Deviation
Overall	0.47	0.47	0.18
Not at Groove	0.50	0.52	0.19
At Groove	0.47	0.46	0.17

A breakdown of the percentage of samples by minimum wall thickness by franchise area is shown in **Table 5.2.2**. Roughly 45% of the specimens examined have a wall thickness that is less than half of the original wall thickness (roughly 0.9 mm), approximately 14% of the specimens have wall thicknesses that are less than a third of the original wall thickness and roughly 3% have wall thicknesses less than one sixth the original wall. While the analysis is preliminary as not all samples have been examined and there is some over-representation from the older fittings, it is believed to be directionally correct. In addition, it can be seen that the copper tubing in all franchise areas is corroding at roughly the same rates showing no influence from installation location of the AMP Fitting in the EGD system.

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Table 5.2.2: Percentage of Specimens in Each Minimum Wall Thickness Bin for Each Area

Area	Minimum Wall Thickness Bins (mm)					
	0<&<0.15	0.15<&<0.3	0.3<&<0.45	0.45<&<0.6	0.6<&<0.75	0.75<
10	4.55%	9.09%	29.22%	29.87%	20.78%	6.49%
20	0.96%	25.86%	30.17%	25.00%	18.10%	-
30	1.89%	15.09%	30.19%	37.74%	7.55%	7.55%
40	2.63%	10.53%	28.95%	36.84%	21.05%	-
60	6.10%	10.98%	24.39%	26.83%	19.51%	12.20%
80	3.08%	6.15%	23.08%	38.46%	27.69%	1.54%
90	-	25.00%	25.00%	-	50.00%	-
All	3.53%	13.33%	27.65%	30.59%	19.61%	5.29%

The trend of lower minimum wall thickness for the older installation years is clearly visible in **Table 5.2.3**. For the 1972 installation year, no specimen with a minimum wall thickness greater than 0.6mm was observed. This is an important observation as it suggests that the entire population is subject to localized corrosion, just at differing rates. Likewise, for the 1984 installation year, no specimen with a minimum wall below 0.3 mm was observed in the exhumed specimens analyzed. Both these results are consistent with the observed leakage rates (based on the EGD repair history) of 1.37% and 0.1%, respectively (See Section 5.6).

Table 5.2.3: Percentage of Specimens in Each Minimum Wall Thickness Bin for Each Installation Year

Install Year	Minimum Wall Thickness Bins (mm)					
	0<&<0.15	0.15<&<0.3	0.3<&<0.45	0.45<&<0.6	0.6<&<0.75	0.75<
1972	14.29%	14.29%	57.14%	14.29%	-	-
1973	3.33%	16.67%	33.33%	33.33%	13.33%	-
1974	9.09%	15.15%	36.36%	24.24%	15.15%	-
1975	5.88%	13.73%	33.33%	29.41%	15.69%	1.96%
1976	2.27%	20.45%	27.27%	29.55%	18.18%	2.27%
1977	6.25%	9.38%	18.75%	43.75%	15.63%	6.25%
1978	1.92%	19.23%	26.92%	36.54%	15.38%	-
1979	3.17%	15.87%	41.27%	17.46%	12.70%	9.52%
1980	1.96%	15.69%	19.61%	33.33%	21.57%	7.84%
1981	-	7.55%	18.87%	35.85%	30.19%	7.55%
1982	2.33%	4.65%	32.56%	20.93%	32.56%	6.98%
1983	2.08%	10.42%	16.67%	39.58%	27.08%	4.17%
1984	-	-	12.50%	25.00%	37.50%	25.00%
All	3.29%	13.57%	27.91%	30.43%	19.96%	4.84%

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Table 5.2.4 and **Table 5.2.5** provide a summary of the average minimum wall thickness and average wall thickness loss rate by franchise area and installation year, respectively. Based on an analysis of variance test (ANOVA), at a 95% confidence level there is a statistically significant difference in the variation of the average minimum wall thickness with installation year. No statistically significant difference was found in the average wall thickness loss rate by installation year, however, suggesting that the observed difference in average wall thickness with installation year is primarily related to age. No statistically significant difference exists in the average minimum wall and average wall thickness loss rates by franchise area, suggesting that there is not a significant difference in the corrosion mechanism throughout the EGD system.

Table 5.2.4: Averages and Standard Deviations of Minimum Wall Thickness by Franchise Area

Area	# of Specimens	Average Min. Wall (mm)	Standard Deviation of Min. Wall (mm)	Average Wall Thickness Loss Rate (mm/yr)	Standard Deviation of Wall Thickness Loss Rate (mm/yr)	Repair Data Leak Rate (%)
Overall	518	0.4761	0.1730	0.0118	0.0051	0.62
10	154	0.4834	0.1740	0.0115	0.0053	0.62
20	116	0.4316	0.1560	0.0129	0.0047	0.54
30	54	0.4724	0.1754	0.0122	0.0053	0.87
40	38	0.4687	0.1559	0.0122	0.0044	0.51
50	4	0.5353	0.1631	0.0101	0.0052	0.42
60	82	0.5001	0.1884	0.0115	0.0057	0.57
80	66	0.5116	0.1767	0.0103	0.0046	0.9
90	4	0.4948	0.2328	0.0104	0.0071	n/a

Table 5.2.5: Averages and Standard Deviations of Minimum Wall Thickness by Installation Year

Install Year	# of Specimens	Average Min. Wall (mm)	Standard Deviation of Min. Wall (mm)	Average Wall Thickness Loss Rate (mm/yr)	Standard Deviation of Wall Thickness Loss Rate (mm/yr)	Repair Data Leak Rate (%)
1971	1	0.1560	0	0.0170	0	n/a
1972	7	0.3549	0.1408	0.0124	0.0043	1.37
1973	30	0.4249	0.1579	0.0107	0.0042	1.60
1974	33	0.4055	0.1582	0.0123	0.0042	1.39
1975	51	0.4514	0.1587	0.0112	0.0044	0.92
1976	44	0.4532	0.1659	0.0117	0.0048	0.76
1977	32	0.4770	0.1803	0.0115	0.0051	0.67
1978	52	0.4489	0.1586	0.0124	0.0047	0.49
1979	63	0.4519	0.1798	0.0127	0.0056	0.71
1980	52	0.4988	0.1805	0.0118	0.0056	0.50
1981	53	0.5347	0.1559	0.0110	0.0051	0.40
1982	44	0.5371	0.1920	0.0114	0.0059	0.37
1983	48	0.5011	0.1645	0.0129	0.0057	0.30
1984	8	0.6323	0.1569	0.0086	0.0060	0.10

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5.3 Failure Mechanism

The AMP Fitting – copper tubing systems appear to be failing as a result of time-dependent localized internal sulphidation corrosion of the copper tubing associated with flow turbulence at the AMP Fitting outlet. This localized corrosion results in wall loss, pinhole formation or ductile ballooning and cracking of the pipe are shown in **Figure 5.3.1** and **Figure 5.3.2**, respectively.

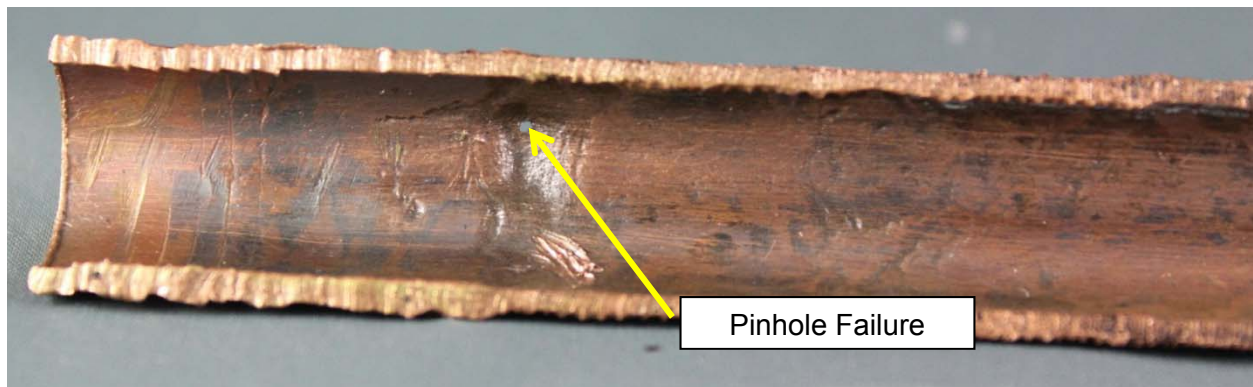


Figure 5.3.1: Pinhole Corrosion Failure Downstream of AMP Fitting

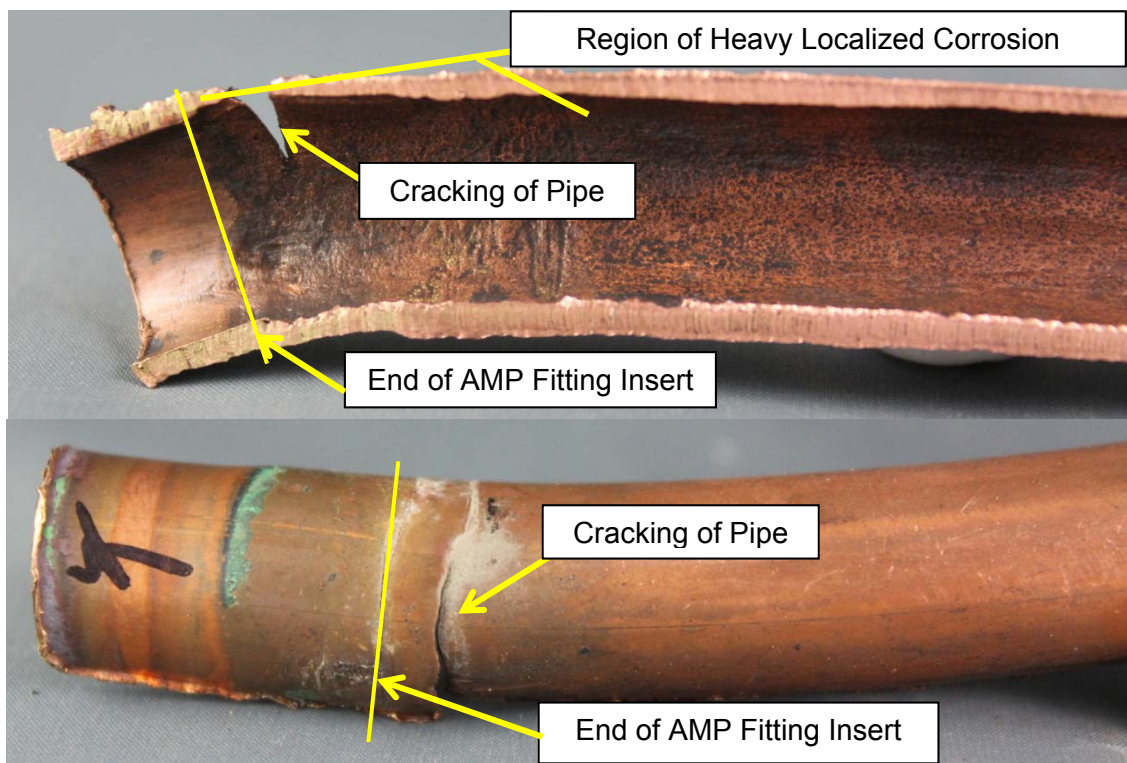


Figure 5.3.2: Localized Corrosion Failure at AMP Fitting Outlet

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The copper tubing is corroding due to sulphidation, resulting in a friable black scale on the inner copper tube surface as shown in **Figure 5.3.3**. **Figure 5.3.4** shows the presence of sulphur and copper in the scale, as determined by SEM-EDX (Scanning Electron Microscopy-Energy Dispersive X-ray) analysis. Sulphidation of copper occurs in gas distribution lines in the presence of hydrogen sulphide (H_2S) and is normally not an issue as the scale forms a passivation layer.

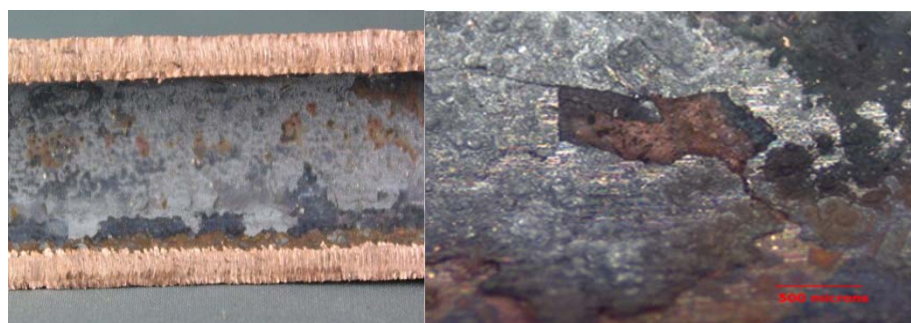


Figure 5.3.3: Black Friable Copper Sulphate Scale on Inner Pipe Wall

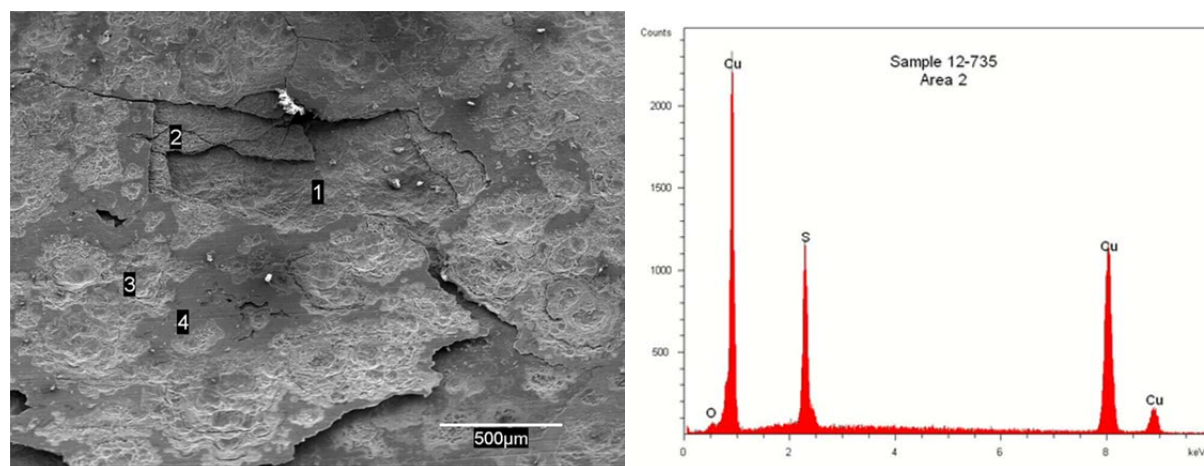


Figure 5.3.4: Black Scale Composed of Copper and Sulphur

The observed copper sulphidation is seen to be a time-dependent, localized phenomenon. The minimum wall thickness of the analyzed field specimens is shown in **Figure 5.3.5**. The maximum corrosion (low minimum wall thickness) is observed predominately in the region of the fitting outlet (76% of specimens – shown in red in **Figure 5.3.5**) with some specimens showing localized pitting or flow channels beyond the fitting outlet region (24% of specimens – shown in blue in **Figure 5.3.5**). Low overall general corrosion rates are observed for the copper tubing as measured 20 cm downstream from the fitting (**Figure 5.3.6**), with many specimens showing a slightly thicker wall than the unexposed tubing due to the presence of the scale layer (Roughly 0.9 mm on average - measured under the insert region).

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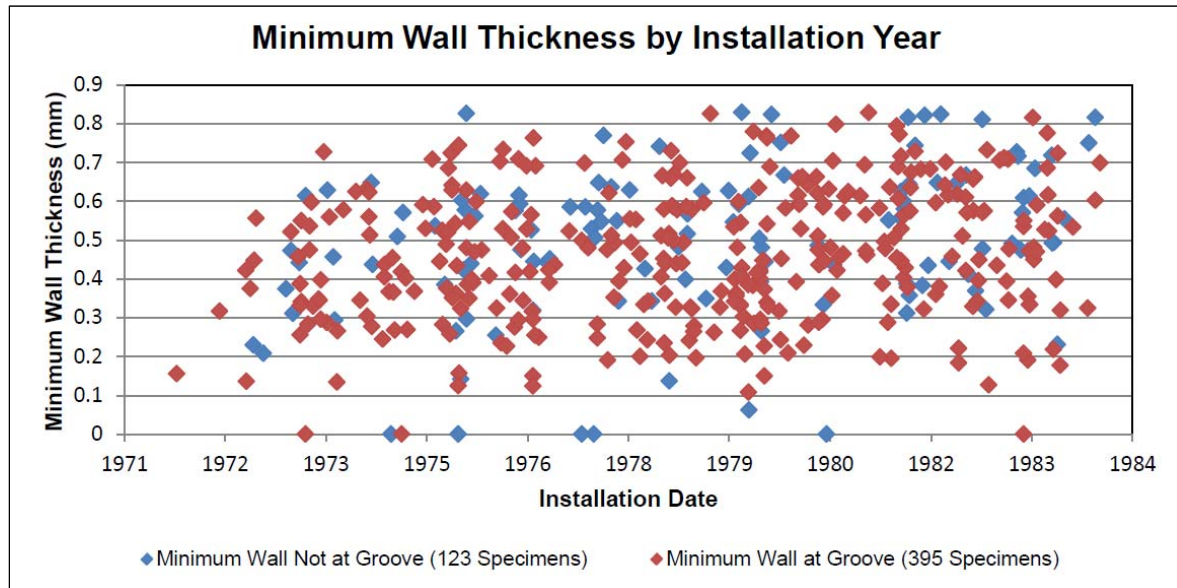


Figure 5.3.5: Localized Corrosion at Fitting Outlet and Downstream From Fitting

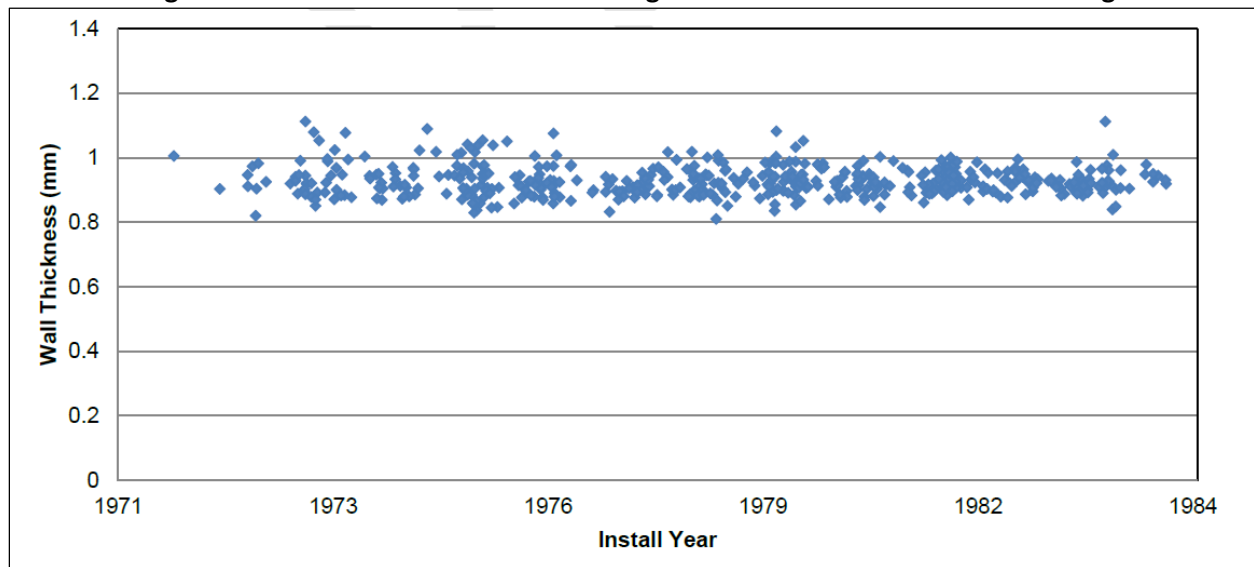


Figure 5.3.6: Wall Thickness 20mm Downstream from AMP Fitting

Figure 5.3.7 shows the time dependence of the sulphidation process. The average wall thickness decreases with the age of the AMP Fitting – copper tubing system. This time dependence appears to be solely a function of the different time available for corrosion, as no statistical difference in the corrosion rate by installation year is observed (**Figure 5.3.8**). Based on an analysis of variance test (ANOVA) at a 95% confidence level, no statistical difference in the wall loss rates was observed.

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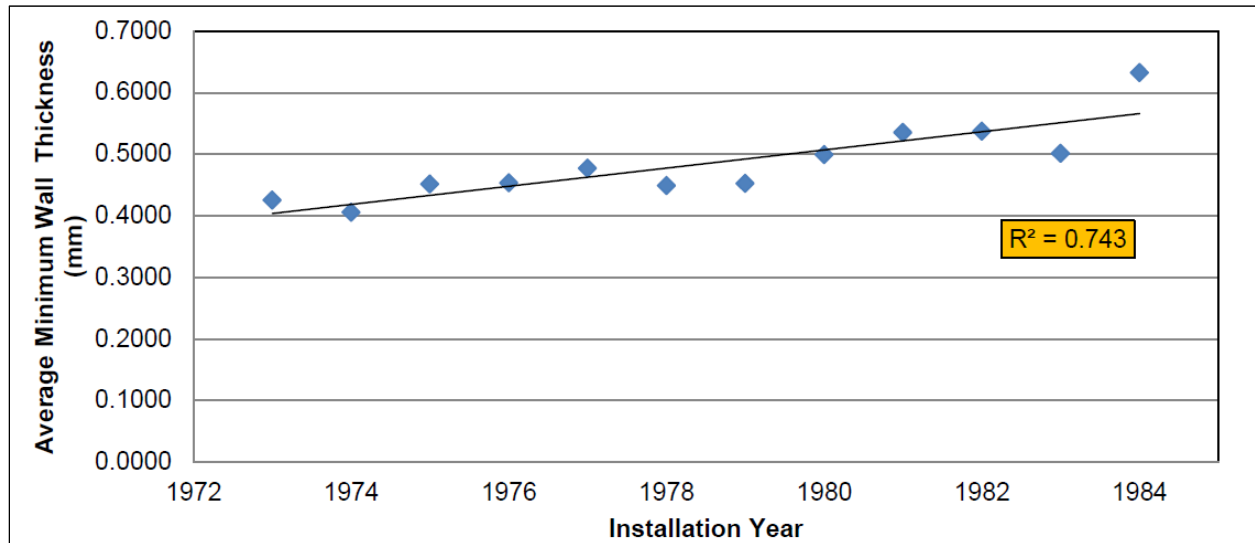


Figure 5.3.7: Wall Thickness Decreases with Increasing Age of AMP Fitting – copper tubing system

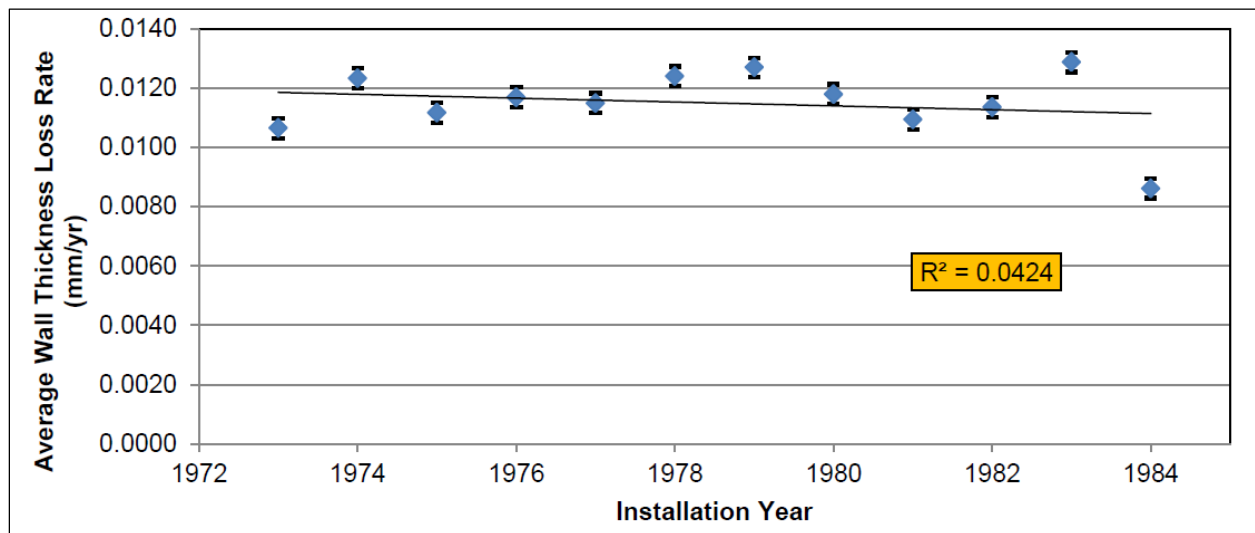


Figure 5.3.8: Comparison of Average Corrosion and Corrosion Rates by Year of Installation

Overall, therefore, leaks appear to develop due to localized time-dependent corrosion. The broad scatter in the measured minimum wall thickness of the exhumed specimens suggests that another key factor, or other key factors, is also involved in the corrosion process. One potential mechanism of accelerated localized corrosion is the formation of liquid pools of water in which corrosion rates can be significantly higher than in a pure gas environment. No physical evidence of this was observed in the specimen analysis, however. As shown in **Figure 5.3.9**, the minimum wall is found to be almost evenly

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distributed between the top and bottom of the pipe. If liquid pooling was present, the minimum wall would be expected to be predominately in the bottom of the pipe where the liquid would pool.

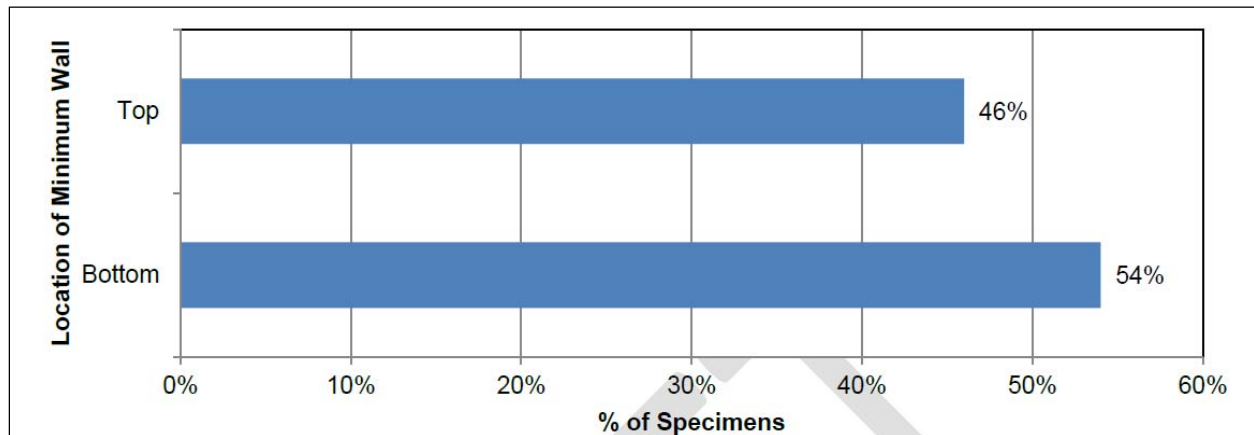


Figure 5.3.9: Minimum Wall Evenly Distributed Between the Top and Bottom of the Pipe

5.4 Flow

Flow turbulence appears to be playing a significant role in the corrosion process explaining at least part of the broad scatter in minimum wall thicknesses. As shown previously in **Figure 5.3.5**, the minimum wall is located in a corrosion groove at the fitting outlet, a high turbulence area, 76% of the time. The remaining 24% of the minimum walls were observed at tubing defect areas that were also regions of high turbulence. Wearing corrosion patterns observed with SEM analysis are shown in **Figure 5.4.1**. It appears that turbulent flow is flaking off the friable copper sulphide (Cu_2S) scale, exposing a fresh copper surface and preventing a stable Cu_2S film from forming a passivating layer.

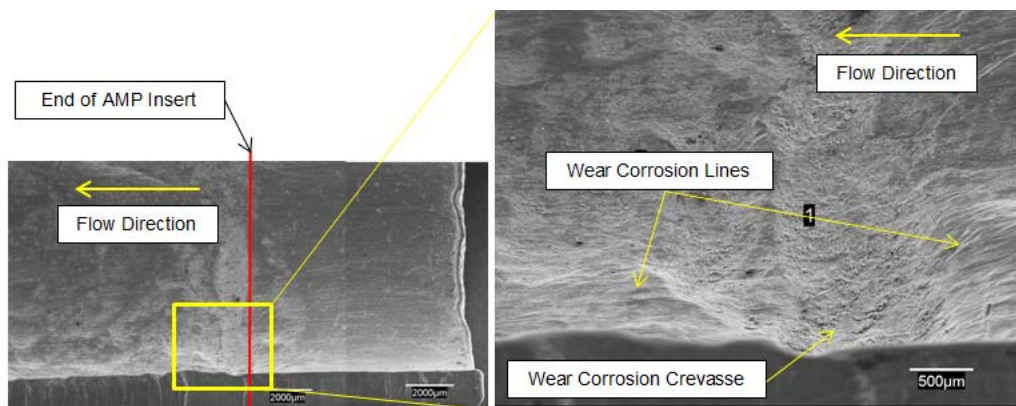


Figure 5.4.1: Wear Corrosion Patterns on Inner Tube Surface

Limited flow history data was available for analysis. Based on the last seven years of flow history, however, a general correlation ($R^2=0.80$) is seen between the average annual flow rate and the average

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wall thickness loss rate (**Figure 5.4.2**). Combined, the location of the corrosion, the visual evidence of wear corrosion in the flow direction and the correlation between average wall loss rate and average flow rate provide strong evidence that flow rate is a critical variable in the observed corrosion.

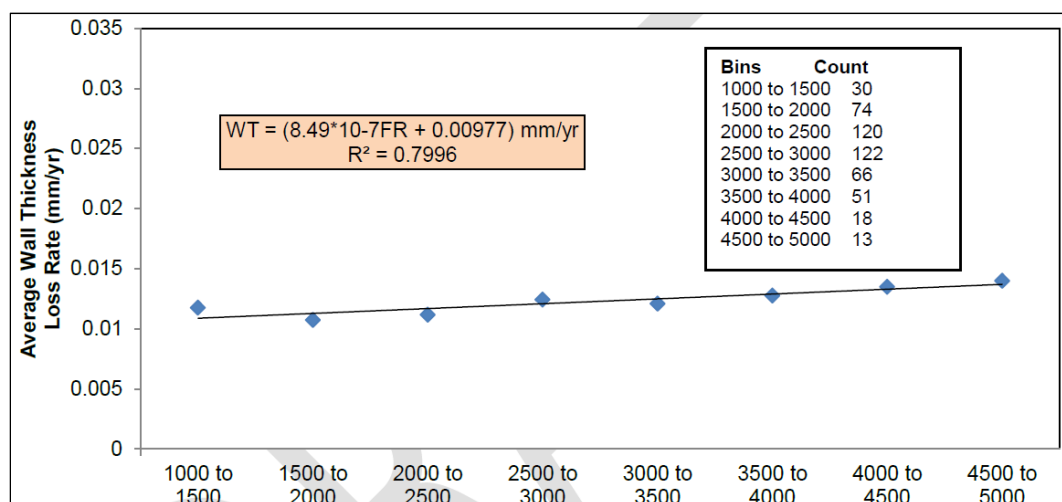


Figure 5.4.2: Analysis of Average Annual Flow Rate versus Average Wall Thickness Loss Rate for Area 20

Overall, the data examined to date provide strong evidence that leaking in the AMP Fitting – copper tubing system is occurring due to time-dependent internal localized sulphidation corrosion of the copper tubing associated with flow turbulence at the AMP Fitting outlet.

5.5 Pressure

Preliminary analysis of the available data and analysis of the preliminary leak rate projections highlight some key findings: The entire population of the AMP Fitting – copper tubing population examined (518 samples) is experiencing the above described failure mechanism to some extent. That is, while there are large differences between the rates at which the corrosion mechanism is occurring, some level of localized corrosion is seen in all the specimens examined to date. The observed issue appears, therefore, to be a systemic one and not isolated to a specific group, or subpopulation, within the EGD system.

In theory, there is an impact of the operating pressure. At a higher operating pressure the remaining wall thickness should be greater to contain the flowing gas. Therefore, there is a higher chance of leaks occurring in locations with higher operating pressures. As well as pressure can impact turbulence (increases the Reynolds Number), the impact of pressure on wall thickness loss rate was examined. **Figure 5.5.1** shows the wall thickness loss rate as a function of pressure in the Enbridge distribution system for Area 20. No statistically significant impact of pressure is observed, suggesting pressure is not a key variable in distinguishing between wall thickness loss rates. This may be a consequence of the limited pressure range within this system.

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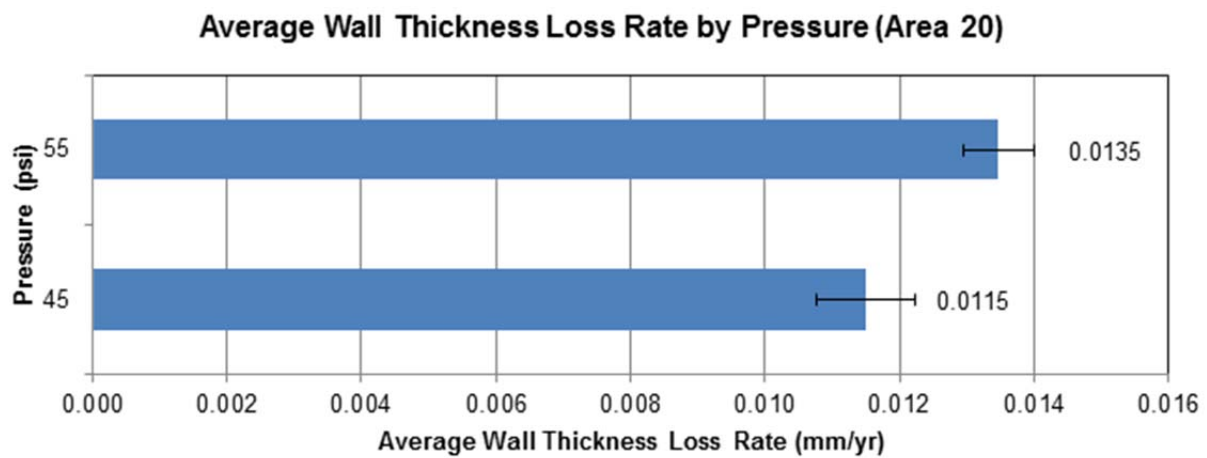


Figure 5.5.1: Analysis of Pressure versus Average Wall Thickness Loss Rate for Area 20

Wall thickness loss rate was also compared to the following in **Figures 5.5.2** through **5.5.7**:

- Soil type
- Moisture condition of soil
- Coating type
- Length from the AMP fitting to the riser
- Length from the AMP fitting to the grade
- Length from the AMP fitting to the foundation wall

None of these variables are seen to have any statistically significant impact.

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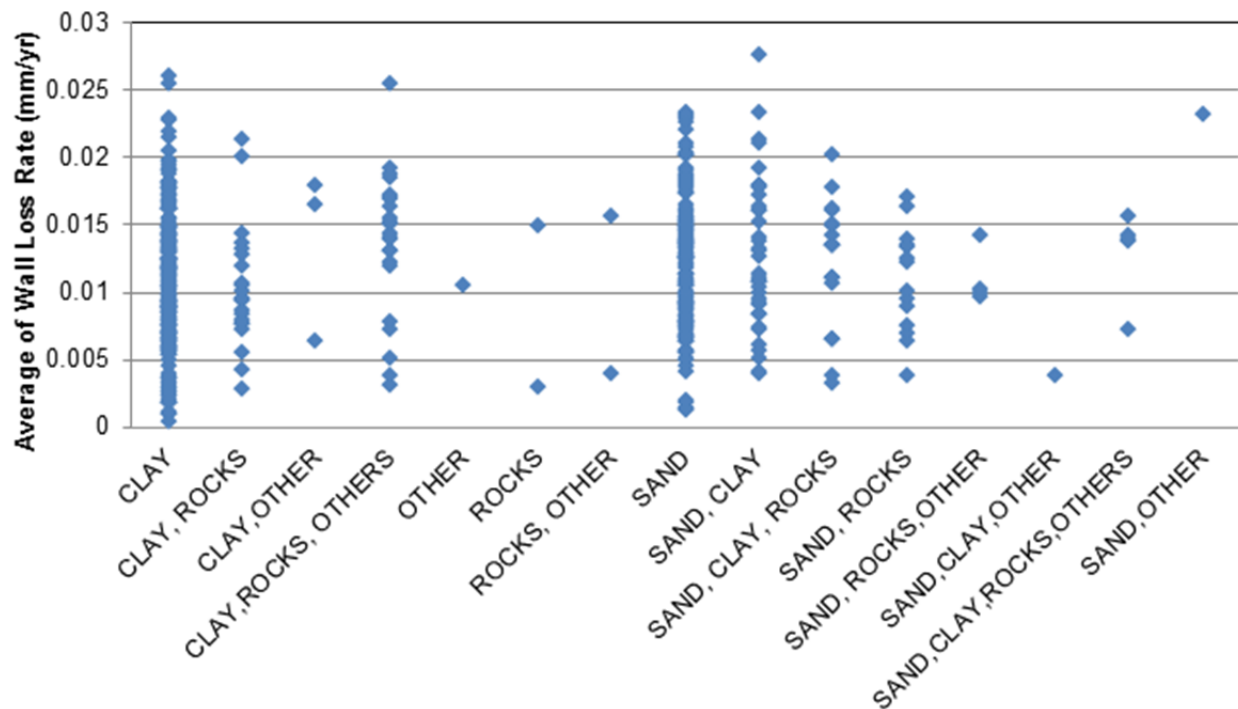


Figure 5.5.2 Analysis of Wall Thickness Loss Rate by Soil Type

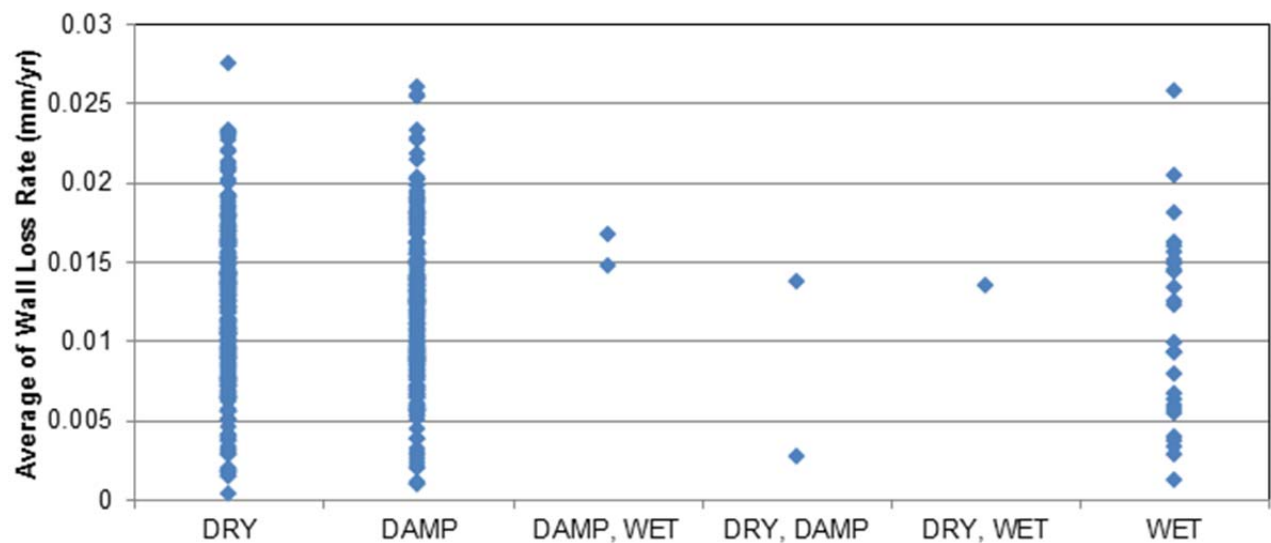


Figure 5.5.3 Analysis of Wall Thickness Loss Rate by Moisture Condition of Soil

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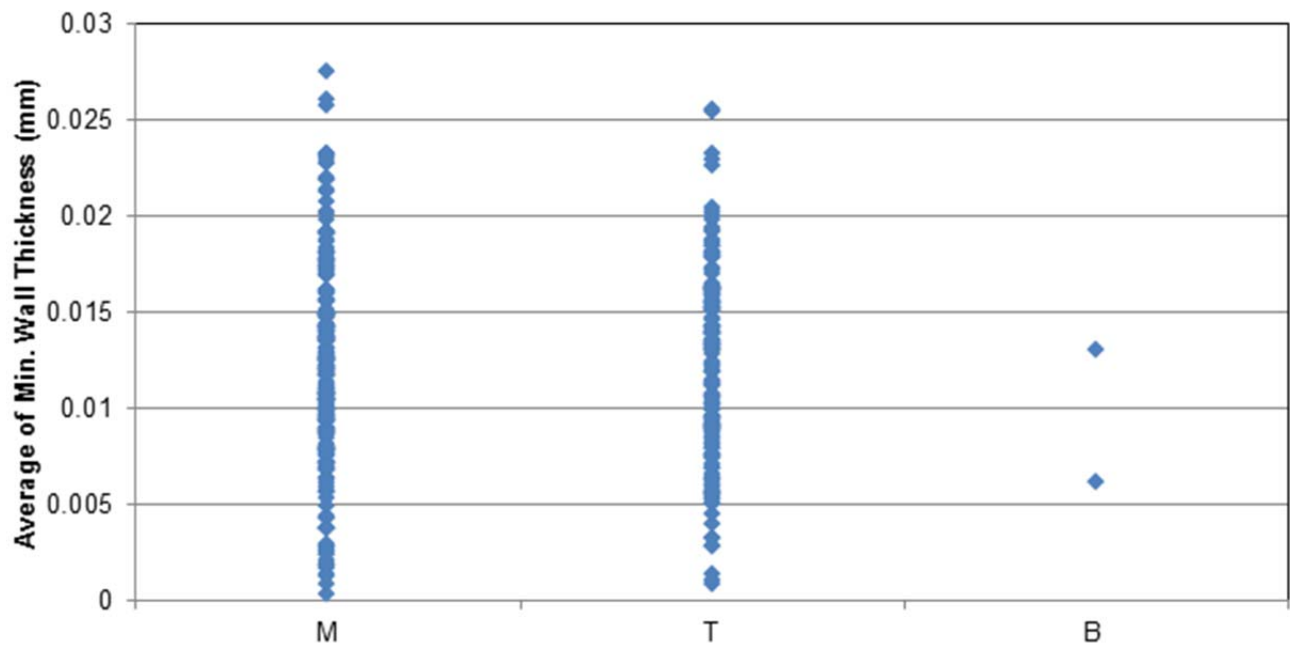


Figure 5.5.4 Analysis of Wall Thickness Loss Rate by Coating Type

(M is Mastic, T is Tapecoat, and B is Bare)

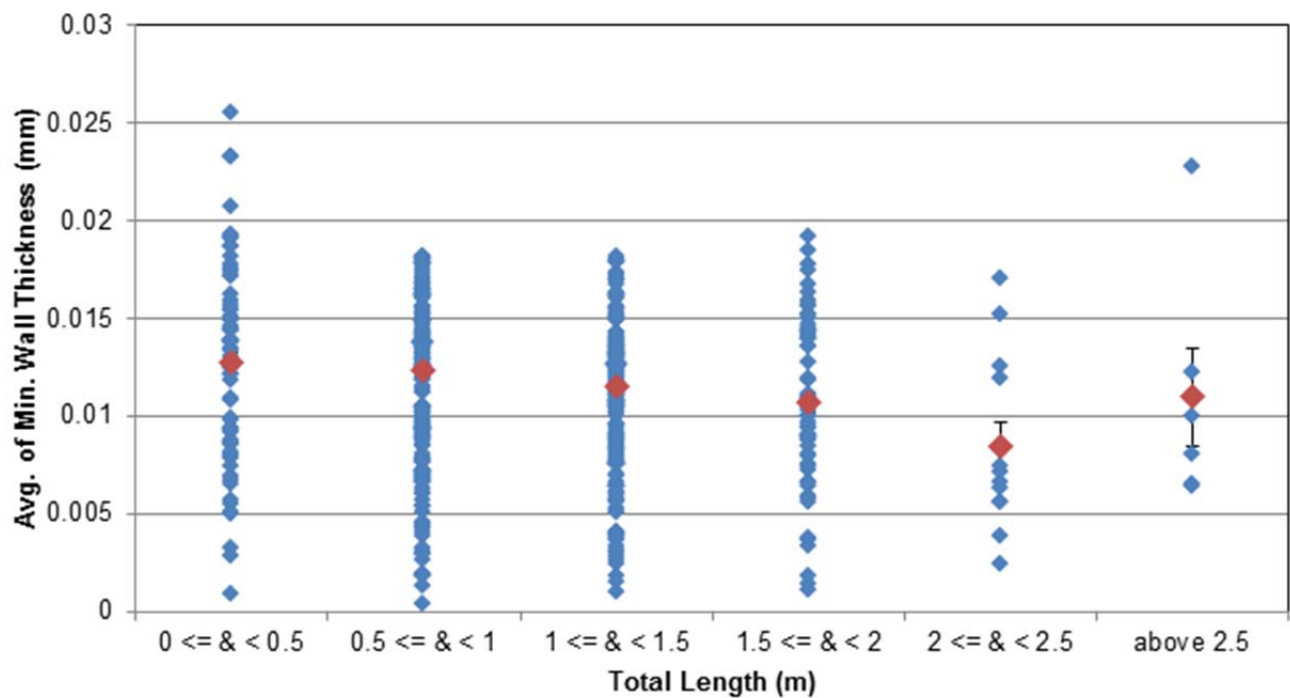


Figure 5.5.5: Analysis of Wall Thickness Loss Rate by the Length from the AMP Fitting to the Riser

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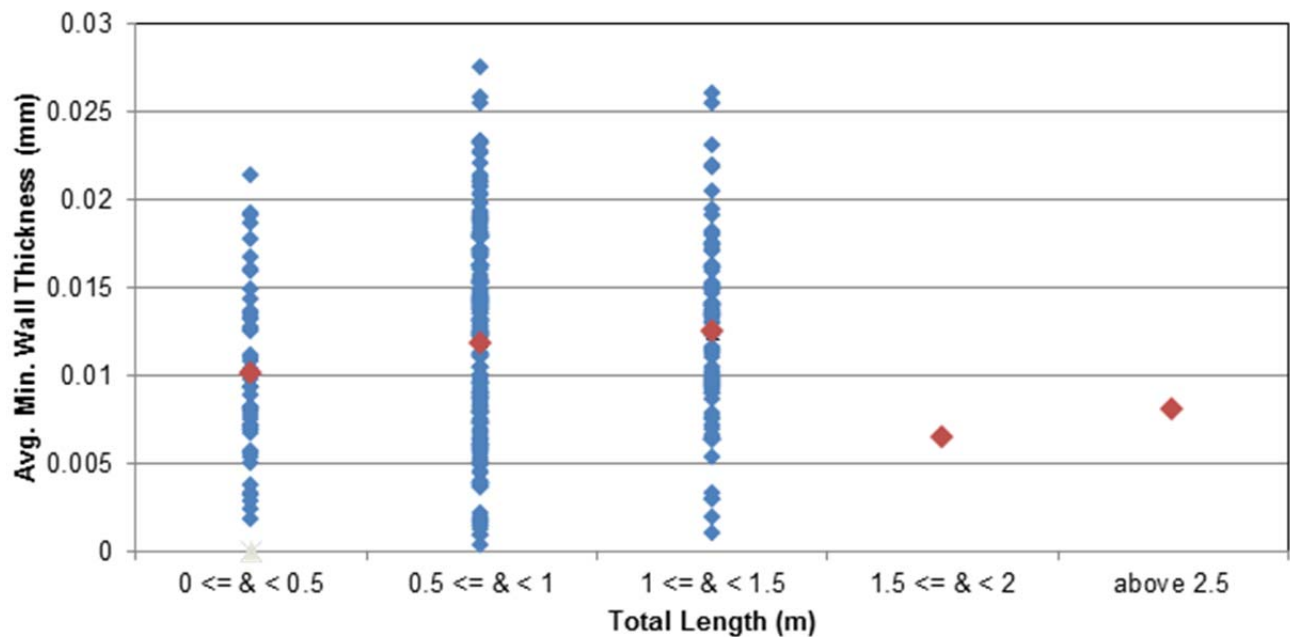


Figure 5.5.6: Analysis of Wall Thickness Loss Rate by the Length from the AMP Fitting to the Grade

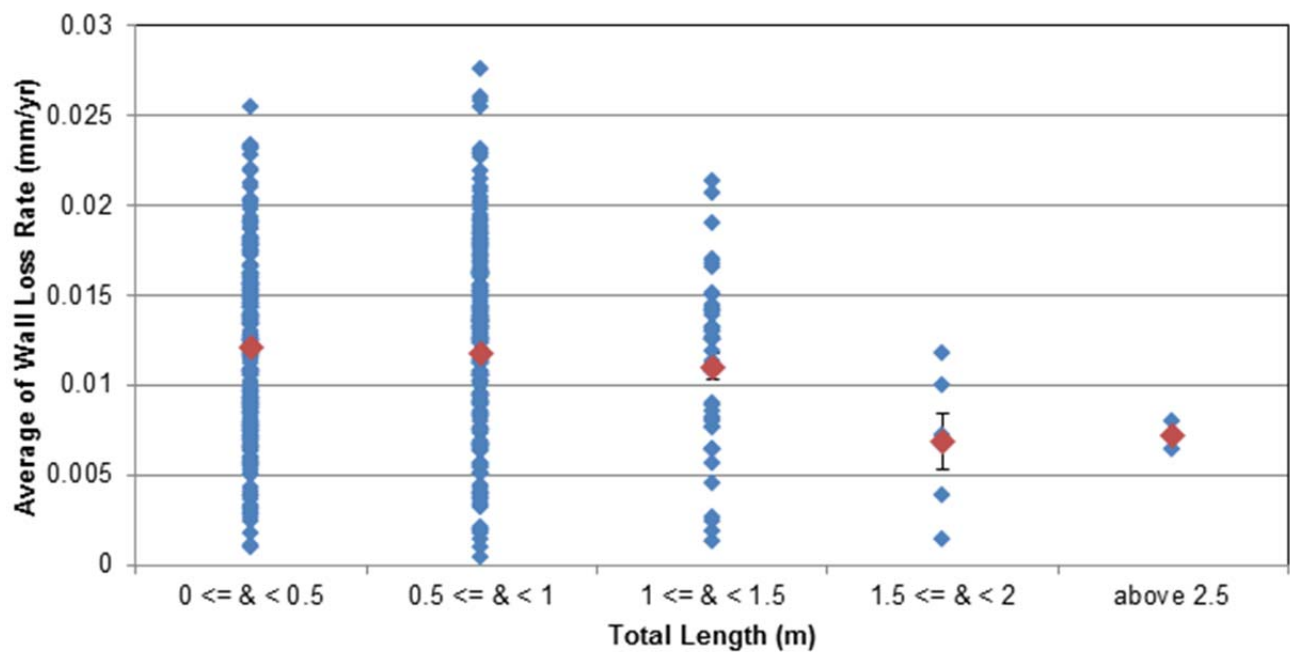


Figure 5.5.7: Analysis of Wall Thickness Loss Rate by the Length from the AMP Fitting to the Foundation Wall

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Therefore, the primary variables impacting the remaining minimum wall thickness, and hence projected residual lifetime, are age and flow rate histories as shown above. Age and flow are the variables upon which an installation-specific risk prioritization model could be built.

5.6 Failure History Analysis

AMP Fitting repair data retrieved from the Material Fault Report Program and the Leak Survey Inspection Program has been documented in the Distribution System Integrity Management Program (DSIMP) from 2007 through 2011. Analysis of the repair history data was used in conjunction with the AMP Fitting field sample data to determine the mechanism of failure and characterize the extent of the issue in the field. The field repair data summarized in **Table 5.6.1** below shows the total installed asset population for each installation year and the leak repairs by year for the period from 2007 through 2011.

Table 5.6.1: Summary of AMP Fitting Repair Data

Year of Install		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	Total
Total Installed		6420	18058	18177	19366	22792	23746	23580	26345	34698	37836	24837	29900	32721	318476
Leak Repairs by Year	2007	12	25	30	23	17	14	15	19	15	11	12	11	0	204
	2008	14	54	45	38	25	23	19	20	20	16	13	7	3	297
	2009	12	50	39	37	36	19	13	58	32	35	17	17	14	379
	2010	21	85	69	30	42	39	22	35	53	37	20	23	9	485
	2011	29	73	66	51	52	65	46	54	54	51	29	30	6	606
Total Leaks		88	287	249	179	172	160	115	186	174	150	91	88	32	1971
% Leak Rate		1.37	1.60	1.39	0.92	0.76	0.67	0.49	0.71	0.50	0.40	0.37	0.30	0.10	0.62

The data shows a clear trend of increasing leakage rate with increasing fitting age, consistent with the flow erosion mechanism. This is seen clearly in **Figure 5.6.1**. The leak rates range from 0.1% for the 1984 installation year to 1.6% for the 1973 installation year with an overall leakage rate of 0.62%. There is also a general trend of increasing leak rates between the 2007 and 2011 reporting periods with a total of 204 leaks in 2007 rising to 606 leaks in 2011.

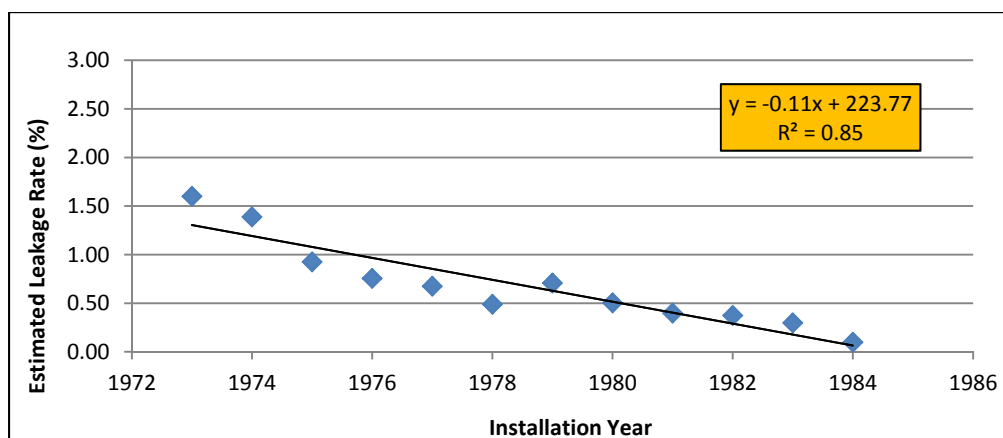


Figure 5.6.1: Leakage Rate versus Installation Year

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As shown in **Figure 5.6.2**, there is a general correlation between the average measured minimum wall thickness ($R^2=0.75$ based on exponential fit) and the observed field leak rates based on the repair data compared for each installation year. This provides an additional point of connection between the observed corrosion and field leaks. The exponential fit also shows that the failure rates appear to increase significantly once a certain minimum wall thickness is reached. This has important consequences for the aging of the overall population. The analysis indicates that leaks appear to develop due to localized time-dependent corrosion.

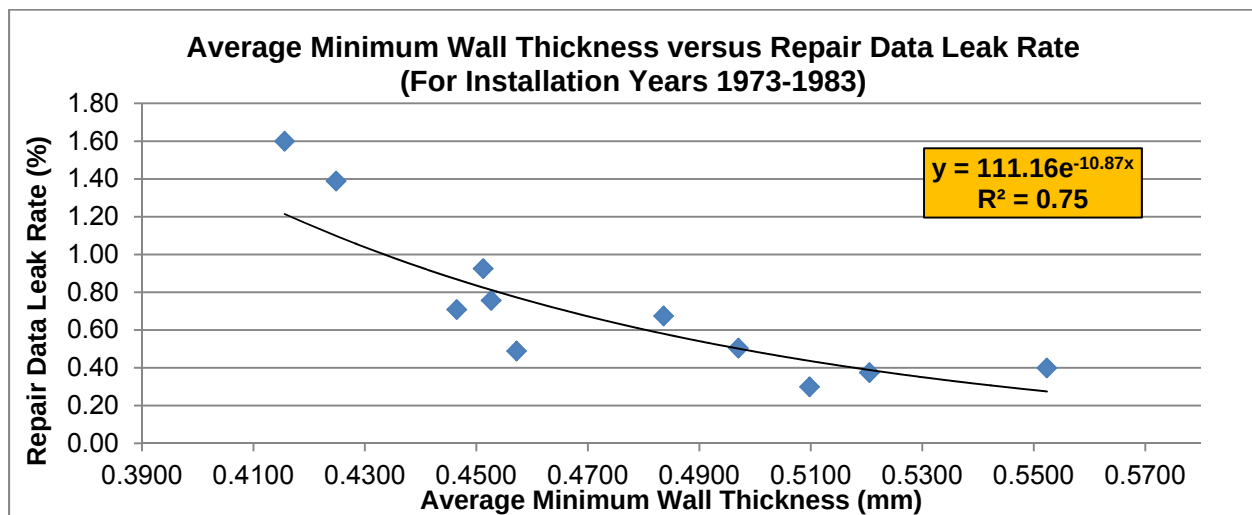


Figure 5.6.2: Comparison of Average Minimum Wall Thickness versus Repair Data Leak Rate

These conclusions indicate the accelerating rate of AMP Fitting leak failures will significantly increase the level of safety risk associated with full population of approximately 320,000 AMP Fittings in the EGD system. In addition to the impact on safety risk, the accelerating increase of AMP Fitting leak failures combined with the significant increase in leak failures when a certain minimum wall thickness is reached, clearly indicates the projected number of AMP fitting failures may become increasingly difficult to manage.

5.7 AMP Fitting Data Analysis Using GIS

The AMP Fitting study incorporated the use of the Geographical Information System (GIS) for cluster analysis of data related to the total population, the sample population, and the failure location population.

A plot of the failure data using GIS as shown in **Figure 5.7.1** was produced to identify any noticeable trends or “hot spots” when viewing the failure data from a geographical perspective. A thorough

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examination of the plotted locations did not reveal any observable correlation between the failures and the total population.

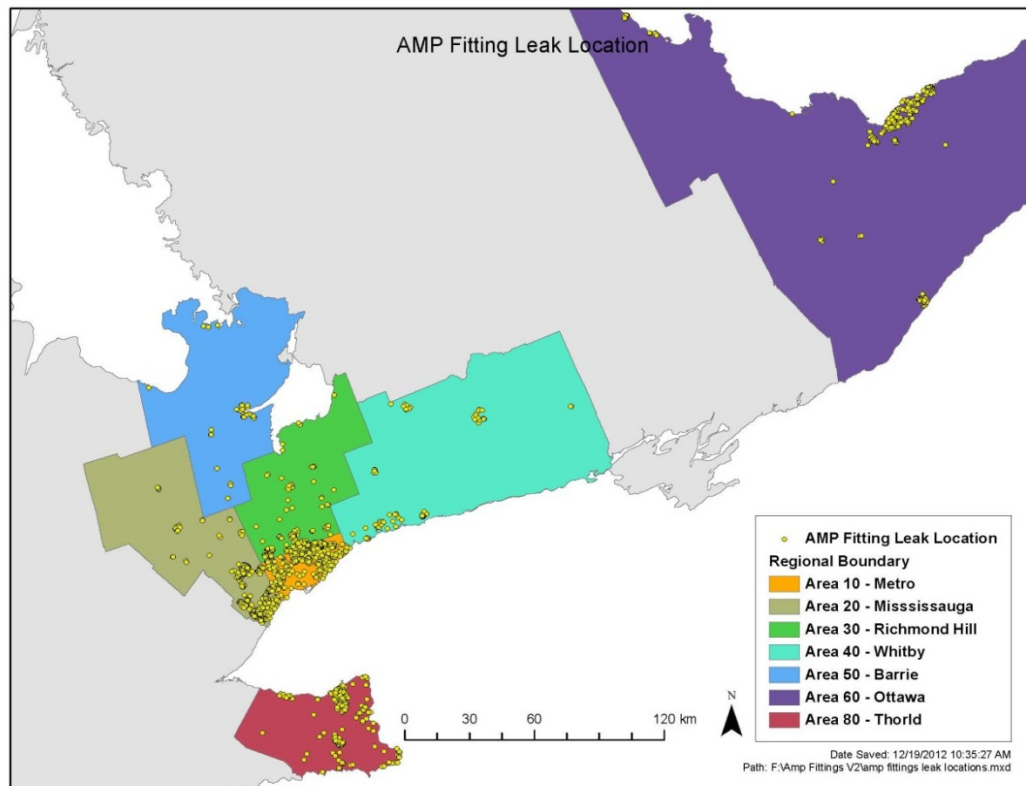


Figure 5.7.1: AMP Fitting Leak Locations across EGD System

The data was also analyzed to investigate for any correlation between odorant concentrations and failure locations. This was accomplished by plotting the failure locations in relation to their distance from the nearest gate station and subsequent odorant injection site. The distances were marked in 1 km concentric circles around each gate station up to 5 km. The analysis did not reveal any observable correlation between AMP Fitting failures and their corresponding linear distance from the nearest odorant injection point or gate station.

5.8 AMP Fitting Failure Models

A leak rate forecasting model was developed based on the samples examined. The model used the measured wall thicknesses of the samples to derive wall loss rates and project future wall loss. Based on a minimum wall thickness for pressure containment, projected failure rates were derived based on these wall loss projections. Based on the modeling, it is projected that the observed leakage rates will

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continue to increase with time at an accelerating rate, roughly doubling through the next five year period and increasing by four- to six-fold through the next ten years.

The model projections through the next five year period are believed to provide a good estimate of expected performance. The model projections through to 2025 are believed to provide reasonable approximations (order of magnitude). Beyond 2025, model projections were not provided due to potential modeling uncertainties. Further confirmation of the model projections can be made through comparison with future observed leak rates.

To further test the validity of the model, Wall Loss model projections were compared to the actual wall loss for the sample population with installation years 1972-1984. The model projects a similar distribution of specimens in each minimum wall thickness bin to the actual distribution, as shown in **Table 5.8.1**

Table 5.8.1: Percentage of Sample Specimens in Each Minimum Wall Thickness Bin

	<0.15	0.15<&<0.3	0.3<&<0.45	0.45<&<0.6	0.6<&<0.75	0.75<
Wall Loss Model	4.39%	12.91%	26.94%	30.88%	18.39%	6.48%
Actual	3.53%	13.33%	27.65%	30.59%	19.61%	5.29%

Figure 5.8.1 provides the projected leaks by year with the 95% confidence limits through to 2025. The projected leak rate is in agreement with the observed leak rate through 2007-2011, showing the predictive capability of the model. The annual leak rate is projected to increase from the current level of roughly 600 (reported leaks for 2011) to 2100 by 2017, with 95% confidence limits of 1800 to 2500. Based on the 95% confidence limits for the Wall Loss model, it is projected that there will be between roughly 6,700 and 9,300 leaks through the next five years (2013-2017). This projected increase in failure rates is in line with the tripling in leak rates observed through the five year period between 2007 and 2011 (from 204 to 606 failures per year). It is also consistent with the observation that 3.5% of the AMP-CR population (roughly 11,000 systems) currently has a minimum wall thickness less than 0.15 mm, or 1/6 of the original pipe wall thickness. If this trend continues, there are projected to be between 33,000 and 44,000 cumulative failures by 2025. For complete projected future leaks with 95% confidence limits based on wall loss model see Table B.1 (Appendix B).

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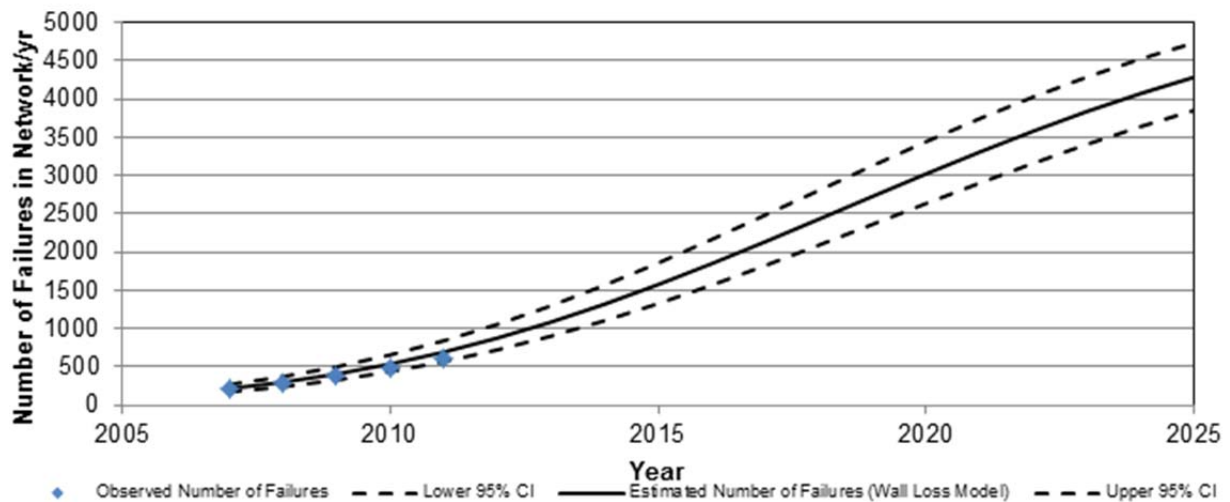


Figure 5.8.1: Projected Future Leak Rate with 95% Confidence Limits Based on Wall Loss Model

The Wall Loss model may be used as well to provide an estimate of the distribution of remaining life for the AMP Fitting asset base. The mean remaining life of the population as a whole ranges from approximately 20 to 50 years, depending on the flow rate of the service. Five percent of the AMP Fitting population is expected to have failed within 3 to 10 years, again depending on flow rate.

In order to verify the projections from the Wall Loss model, a completely separate analysis was conducted based on the observed leak history. Using the repair data provided, observed failure rates as a function of the ages of the installed fitting systems were calculated. These data are shown in **Figure 5.8.2** for the failure rates from repair information provided over the 2007 to 2011 period. A Weibull model was the model used to fit to these data.

The Weibull Probability Density Function (PDF) was fit to the calculated failure rate versus age data to obtain the Weibull parameters: $\beta = 7.0$, $\eta = 65.1$ years and $t_0 = 0.0$ years. The resulting fit to the data is shown in **Figure 5.8.2**, including the PDF, hazard function, and the cumulative distribution function (CDF). The results of the Weibull analysis provide two key findings. First, a beta of 7 is indicative of an accelerating failure rate and suggests the AMP Fitting asset base is entering the extreme wear out phase. This is consistent with the observed failure mechanism (corrosion failures are typically observed to accelerate with time). Second, the Weibull analysis provides the ability to estimate the mean remaining life of the population and to forecast future leakage rates.

The two models developed were compared against each other and the observed failures of AMP Fitting assets in the Enbridge Distribution System. Both models show excellent agreement with Enbridge's experience, as shown in **Table 5.8.2**, and with each other, as shown in **Figure 5.8.3**. The agreement of the two completely independent models with each other and with the observed leak history suggests that the Wall Loss model developed in this project provides a good forecast of expected system performance.

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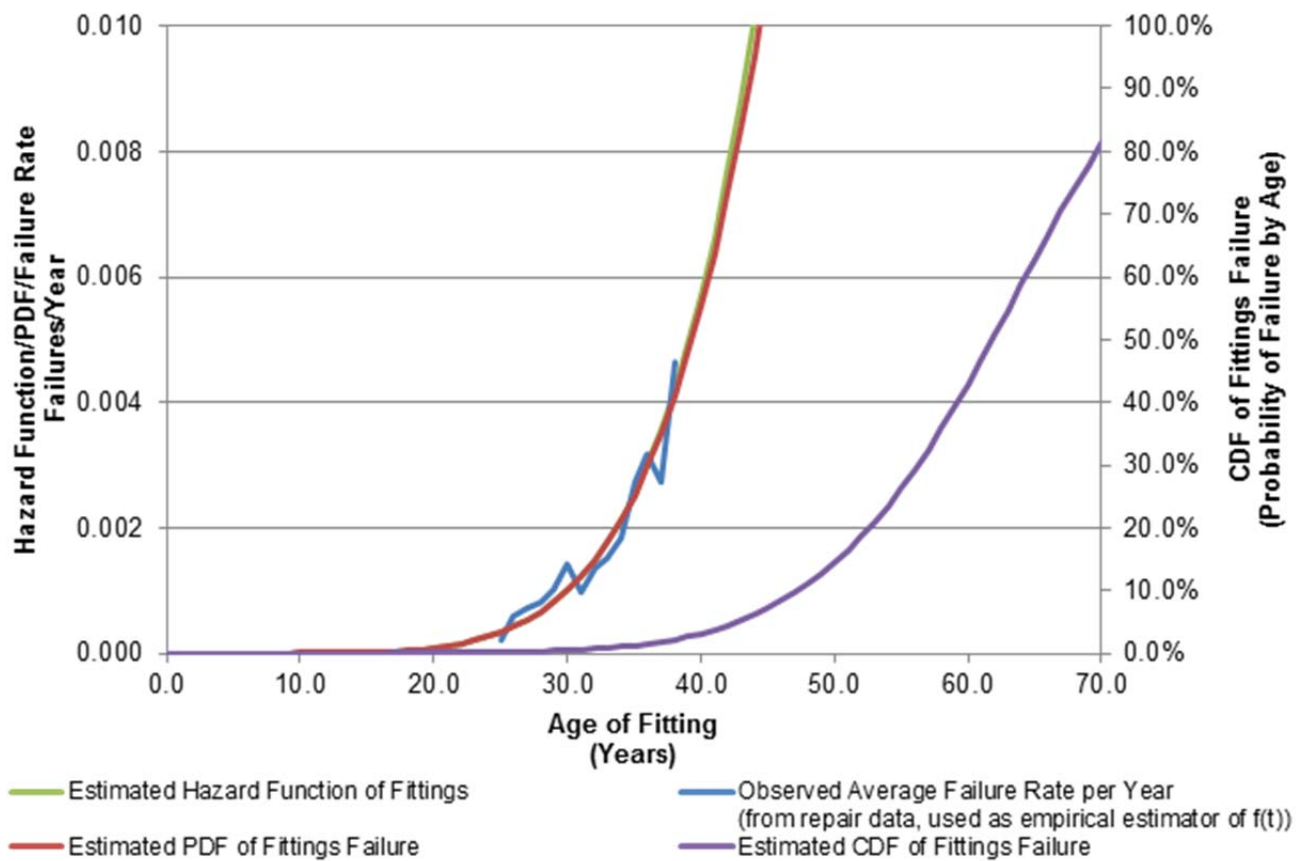


Figure 5.8.2: Hazard Function, PDF and CDF for Repair Data Leak Rate Model

Table 5.8.2: Observed versus Projected Failures by Year

	Observed Failures		Projected Failures				Percent Error ¹			
			Weibull Model		Wall Loss Model		Weibull Model		Wall Loss Model	
Year	Cumulative	Yearly	Cumulative	Yearly	Cumulative	Yearly	Cumulative	Yearly	Cumulative	Yearly
2007	204	204	240	240	220	220	18.9%	18.9%	5.5%	5.5%
2008	501	297	540	300	510	300	7.4%	-0.6%	2.7%	0.8%
2009	880	379	900	360	920	410	1.7%	-5.7%	4.6%	7.0%
2010	1,365	485	1300	430	1500	540	-2.9%	-11.4%	6.7%	10.6%
2011	1,971	606	1800	510	2100	690	-6.7%	-15.2%	9.0%	14.3%

AMP Fittings Study - 2012

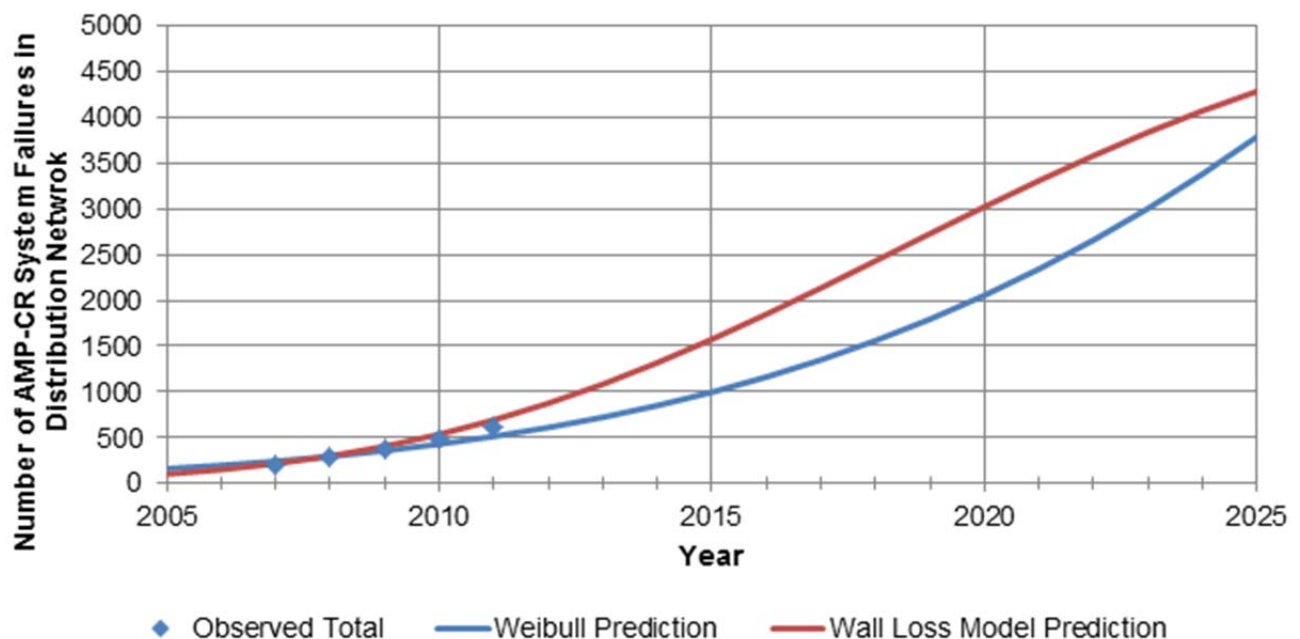


Figure 5.8.3: Projected Number of Network-Wide Failures by Year

There is a high level of confidence in the general trends and magnitude of the leak rate projections from the Wall Loss model based on the following:

- o Excellent agreement was observed between the model projected distribution of wall losses and the actual measured distribution, indicating that the Wall Loss model captures the observed corrosion mechanism.
- o The Wall Loss model failure projections were verified based on comparison with projections from an independently developed model based on the AMP Fitting repair data. The models were in excellent agreement.
- o Both models were further verified by comparison with past observed leak history. Again excellent agreement was observed.

It is important to realize that all models are approximations of reality with inherent uncertainties. While the agreement of the two different modeling approaches, one based on the observed leak history and one based on observed wall loss rates, suggests that the resulting projections are a realistic forecast of future leak rates. It is important to mention that the predictions of the two models are in agreement despite their independent derivation, and their predictions are in agreement with observations of the failure history of the population in service. Thus, there is a very high degree of confidence in the projections of the models in the near- and mid-term.

AMP Fittings Study - 2012



The model projections through the next five year period are believed to provide a good estimate of expected performance based on the model validations discussed above. Projections beyond the next five year period should be considered as directional only. It is recommended that the models be checked versus actual observed leak rates moving forward as a check of future forecast ability. It is also important to consider that changes to the system (e.g. replacements, increased leak surveys, etc.) may lead to a change in future observed leak rates.

Beyond 2025 there are potential limitations to the model's accuracy and, hence, the confidence in its predictions. First among these is that the model is based on failure behavior observed up to approximately 40 years of age; beyond 2025 all AMP Fitting systems will be at ages older than this. Furthermore, as the AMP Fitting asset base has only recently entered the wear-out phase of its life, projections of the failure behaviour based upon the repair histories necessarily make failure time predictions of some 99% of the AMP Fitting systems based on the approximate first 1% that have failed. For this reason, leak rate projections beyond 2025 have not been provided.

AMP Fittings Study - 2012



6.0 Conclusions

- The AMP Fitting – copper tubing systems appear to be failing as a result of time-dependent localized internal sulphidation corrosion of the copper tubing associated with flow turbulence at the AMP fitting outlet.
- The entire population of exhumed fittings examined to date is experiencing this corrosion mechanism to some extent.
- The minimum wall resulting from the corrosion is observed primarily at the AMP fitting outlet roughly three quarters of the time and at defects (indentations in the tubing wall apparently due to installation) downstream of the fitting outlet the remaining quarter of the time.
- The primary variables impacting the minimum remaining wall thickness of the AMP Fittings are vintage (wall loss increases with age) and flow (wall loss increases with flow rate).
- Operating pressure, soil type, moisture condition of soil, coating type or length from the AMP fitting to the riser, to the grade or to the foundation wall are not seen to have any statistically significant impact on wall loss rates.
- The analysis of the historic failure data confirms that leaks appear to develop due to localized time-dependent corrosion.
- No “hot spots” or noticeable trends when viewing the failure data from a geographical perspective with the help of GIS.
- No correlation found between odourant concentrations and failure locations.
- Excellent agreement was observed between the model projected distribution of wall losses and the actual measured distribution, indicating that the Wall Loss model captures the observed corrosion mechanism.
- The Wall Loss model failure projections were verified based on comparison with projections from an independently developed model based on the AMP Fitting repair data (Weibull model). The models were in good agreement.
- The Wall Loss model and Weibull model suggest that field leak rates are projected to increase at an accelerating rate, roughly doubling through the next five year period and increasing by four to six fold through the next ten years.

7.0 Recommended Remediation Strategy

7.1 Overview

The preceding data analysis determined the leak failure mechanism results from time-dependent internal localized sulphidation corrosion of the copper tubing associated with flow turbulence at the AMP Fitting outlet. This conclusion was subsequently used to develop a model for a mitigation process that incorporated the primary variables affecting AMP Fitting failures including fitting vintage and gas flow. Finally, the main and service material were also incorporated into the mitigation plan since remediation for AMP Fittings in these systems may benefit from synergies arising from other anticipated

AMP Fittings Study - 2012



mitigation programs (e.g. Aldyl"A" PE pipe). This section describes the different mitigation options available for consideration and recommends a remediation strategy.

7.2 Remediation Strategies

Distribution System Integrity is in the initial stages of a comprehensive second phase study on DuPont Aldyl"A" PE Pipe that will determine with greater confidence the expected remaining service life of Aldyl"A" pipe in the EGD system. The results of this study are expected in late 2013 and the potential for a Aldyl"A" replacement program may provide significant synergy opportunities for the replacement of AMP Fittings on Aldyl"A" services. Subsequently, AMP Fittings installed on Aldyl"A" services connected to Aldyl"A" mains, specifically those on older vintages (pre 1973), may benefit from an integrated replacement program.

Further refinement of the mitigation plan may likely target AMP Fittings installed on Aldyl"A" services with Aldyl"A" mains, operating with medium to high gas flows and throughout the IP range to be included in a collective replacement program for both PE mains and services, including the copper riser. Currently, the replacement of AMP Fittings and associated copper risers may be performed in accordance with the procedures outlined in Sections 29 and 35 of the Construction and Maintenance Manual 2012.

Leak Survey Inspection frequency for NTS ½ PE services identified as having an AMP fitting will be surveyed yearly beginning in 2015. This inspection program will be modified as additional data is collected to determine frequency, severity and risk of leaks. Anodeless risers and services that have a grey plastic coated sheath and an above grade brass Chicago Fitting do not have AMP Fittings and can be inspected as per Enbridge Leak Survey Inspection policy.

After the explained above, a selection of remediation strategies could be performed to mitigate in the short or long term of the AMP Fitting population. These remediation strategies are:

- Replacement of PE Main and Service
- Service Relays
- AMP Fitting & Copper Riser Replacement
- Condition Monitoring – Leak Survey

The numerous remediation strategies and vintage diversity of mains and services suggest the need for a detailed grouping of AMP Fittings to be performed. Vintage, flow, pressure, main and service type were the variables selected for this categorization. This approach would allow us for better planning and a most optimal solution. An example of the proposed grouping can be seen in **Figure 7.2.1**

AMP Fittings Study - 2012

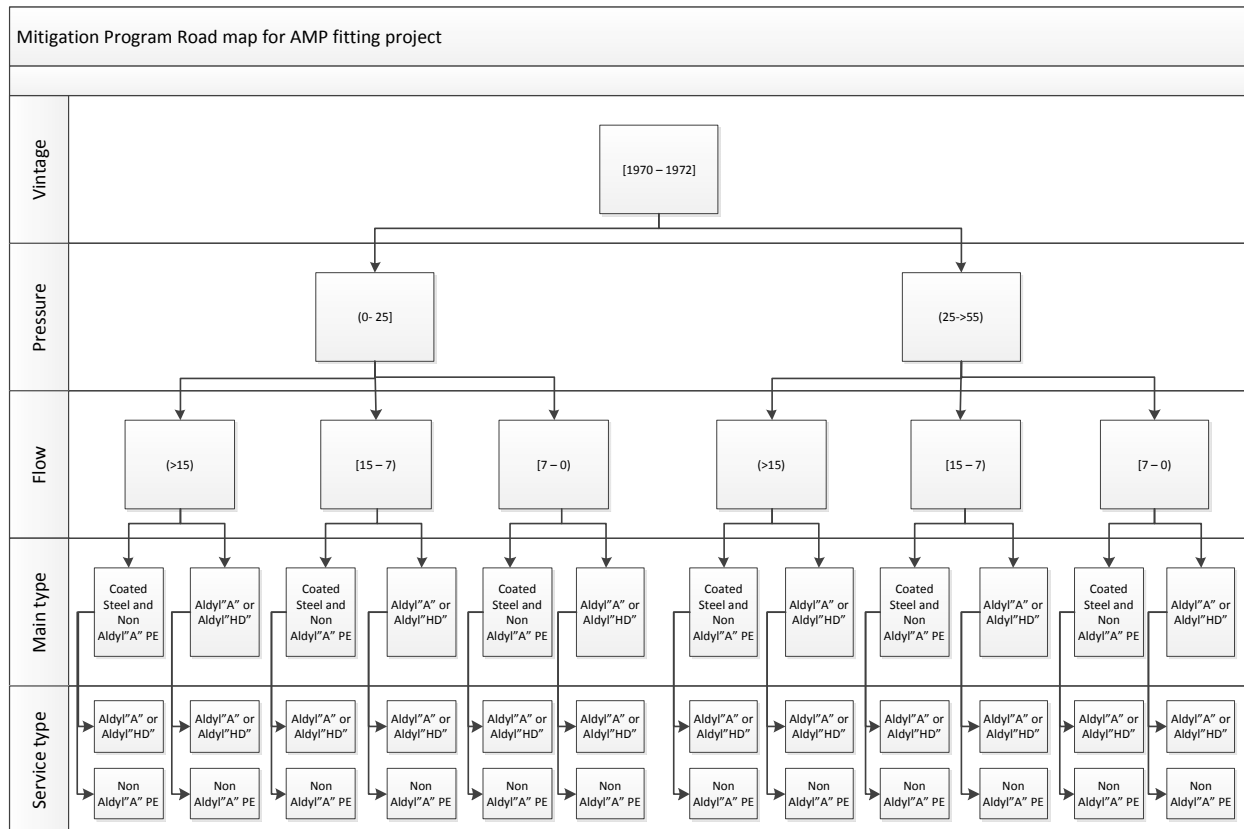


Figure 7.2.1: Mitigation road map for AMP Fitting project

7.3 Replacement & Prioritization

Leak rate forecasting models were developed based on the repair data supplied by Leak Survey and the AMP Fitting samples examined to date. These models are currently considered as directional only when used for long range plans. The model will be continually refined as new data becomes available and repairs and replacements take place in the field. This model will allow EGD to risk rank the AMP Fitting population to complete performance projections that would allow for effective operational and maintenance planning for the AMP Fitting remediation strategy in the highest risk locations. The preliminarily developed models are in good agreement with one another and project that the observed leakage rates will continue to increase with time at an accelerating rate. However, inclusion of the other potential key variables, as an example the capacity of emergency response to leaks due to AMP Fittings, in the models is expected to contribute in a more accurate future strategy.

In order to manage the risks associated with AMP Fittings, DSI contacted BANAK Inc. to develop an optimal strategy that will balance these four maintenance options (See Section 7.2), subject to maintenance resource requirements. BANAK Inc. evaluated the proposed models to project future leak probabilities. After evaluation, the model most applicable to 20 year forecasts uses the Weibull distribution that best fits to the observed failure data from the 2007 to 2011 time period, which is the

AMP Fittings Study - 2012



Weibull distribution with $\beta = 7.0$ and $\eta = 65.1$. BANAK Inc. identified a possible source of uncertainty in these parameter estimates. The first is that it does not account from the number of AMP fittings that failed before 2007. Excluding these “left truncated” failure times can have the effect of over-estimating β and under-estimating η . BANAK Inc. considered this possibility and have selected $\beta = 6.5$ and $\eta = 70$ as alternative values for one of the scenarios.

Comparison between scenarios was done by calculating the grand total of the Discounted Capital and Discounted O & M costs, referred as Net Present Value (NPV). This number is multiplied by the capital recovery factor to option the Equivalent Annual Cost (EAC). These calculations required a number of assumptions and conditionals like the probability of an incident per number of leaks, and an average cost consequence of an incident. As well as series of costs associated to these calculations like the average cost to perform a service re-lay or the average cost of a single leak survey. The five scenarios simulated by BANAK Inc. were as follows:

1. The Weibull (7, 65.1) distribution is used as per the Jana report.
2. The Weibull (7, 65.1) distribution is used as per the Jana report, but 70% of all work (both planned and unplanned) is taken to be service re-lay and cost as such.
3. The Weibull (6.5, 70) distribution is used, as it is possible that the data used in the Jana Report might cause over- and under- estimation of the two parameters.
4. The Weibull (7, 65.1) distribution is used, but we assume only 90% of the population actually has AMP fittings in place, at random.
5. The Weibull (7, 65.1) distribution is used, and the amount of planned work is fixed at 4000 in 2014, 6000 in 2015, and 15,000 thereafter, no matter how much unplanned work is expected to occur.

The Figure 7.3.1 below identifies program replacement impact on the leak rates for Scenario 5 as presented as the most optimal scenario by BANAK Inc. It can be seen in this figure the leak profile that is anticipated if the AMP fitting replacement program is not undertaken, the anticipated number of annual leaks that will occur during the replacement program period and the planned rate of annual replacement which will be completed under the program. The replacement optimization was developed for the AMP Program that takes into consideration the following:

- Level of risk associated with the number of leaks required to be managed
- Capacity for emergency response early in the program
- Capacity to perform the replacement program early in the program
- Program cost

The suggested replacement program consists in the removal all of the AMP Fittings from the EGD system through a 23 year targeted replacement program. This program will involve the progressive replacement of 4,000 AMP Fittings in 2014 to 10,000 in 2016 to continue a 15,000 AMP Fittings annually. To the

AMP Fittings Study - 2012



extent possible, Enbridge will look for efficiencies in managing the replacement of these fittings through synergies with other asset replacement programs as warranted like the Aldyl “A” replacement program as suggested in Section 7.2. Reevaluation of the program is needed in response to the actual leak rate experienced, which may mean accelerating or decelerating the replacement of AMP Fittings. It is important to mention the evaluation of alternative replacement rates over time showed that any material decrease in the annual replacement rate led to an unacceptable increase in the annual anticipated leak rate.

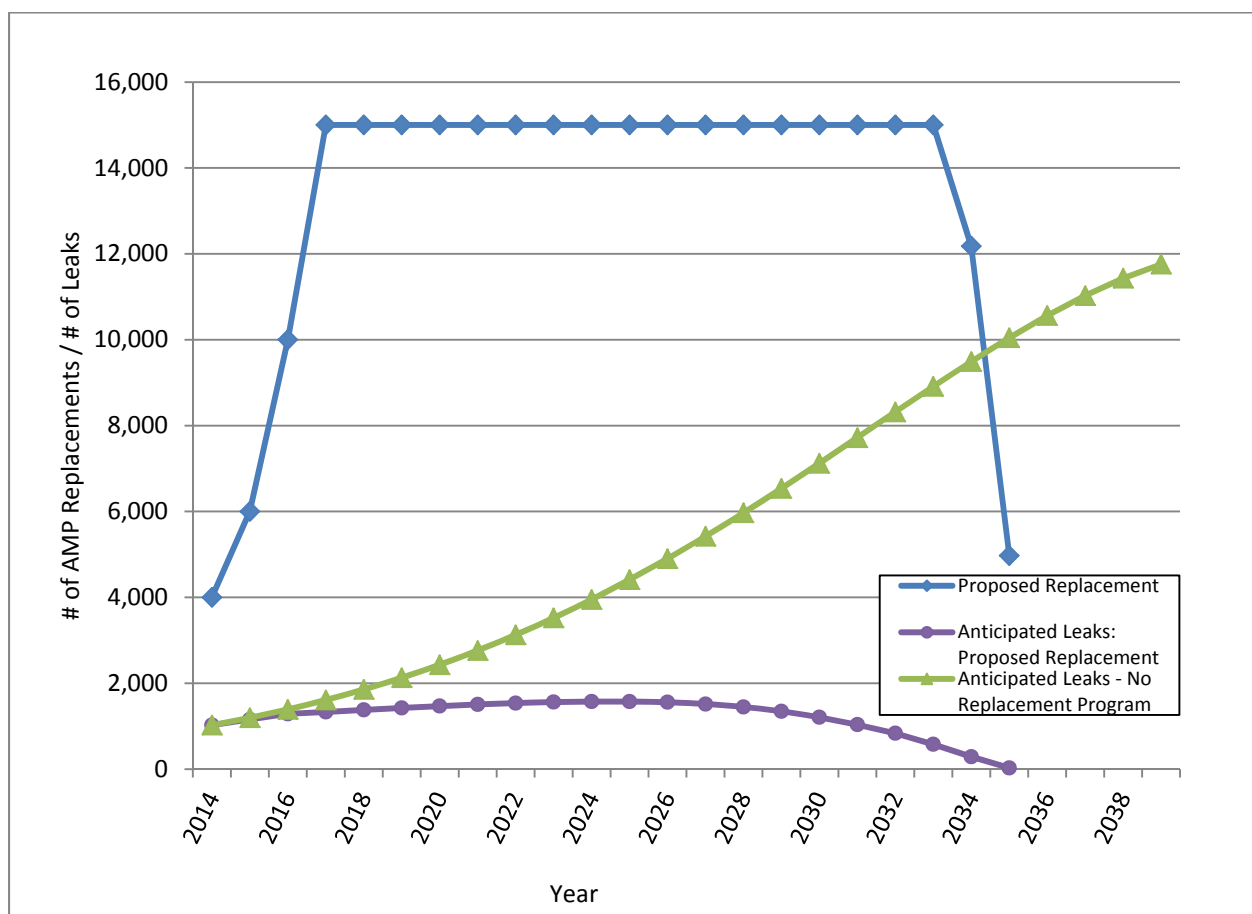


Figure 7.3.1: AMP Fitting Replacement Rate and Forecasted Leak Profiles

AMP Fittings Study - 2012



Appendix A

2012 AMP Fitting Sampling Instructions

The following instructions are developed to fulfill the requirements of the 2012 AMP Fitting Study as one of the ORM initiatives for 2012. These instructions are used to retrieve AMP Fitting samples. These instructions apply to all employees, contractors and company representatives and all activities related with this work shall comply with the policies and procedures established by the company. Ensure a Leak Survey Investigation (LSI) is created, if a below ground leak is discovered.

Preliminary planning

1. Prior to excavation, survey proposed area and complete Field Pre-Inspect Form as per [Figure 7-5](#) and [Figure 7-6](#) of C&M Manual. Submit filled Pre-Inspect Form to WMC.
2. Obtain locates as per [Section 7.0 Job Planning](#) of C&M Manual.
3. Ensure PMTS Information is pre-populated and correct on the Information Sheet. If not, make changes as required and enter Work Request number as provided by WMC.

Leak Survey

4. Pogey bar hole above the AMP Fitting estimated location (within 1 m from riser) as per [Section 32.5.3 Centering and Classifying](#) of C&M Manual.
5. Follow applicable leak survey procedures as per [Section 31.1 Leak Surveys](#) of C&M Manual.
6. If no leaks are detected, check "NO" box in the "Leak Detected" row (Leak Survey – Pogey bar section).
7. If a leak is detected, re-assess and treat as a leak situation as per [Section 32.0 Emergency Practices](#) and [Section 32.5 Leak Investigation](#) of the C&M Manual.
 - a. Check "YES" box in the "Leak Detected" row (Leak Survey – Pogey bar section).
 - b. Record the "size of leak (% L.E.L.)" (Leak Survey – Pogey bar section).
 - c. Record "location of leak" (Leak Survey – Pogey bar section).
 - d. Check proper "Leak Classification" (Leak Survey – Pogey bar section).

Excavation

8. Excavate without hydro excavator to expose sufficient length of service line on either side of the AMP Fitting to facilitate sample removal, as per [Section 8.0 Excavating](#) of C&M Manual. Expose the fitting carefully without damaging the copper tubing.
9. Perform a soap test on the AMP Fitting and attached 10 cm of the connected copper and PE service lines.

AMP Fittings Study - 2012



10. If no leaks are detected, check “NO” box in the “Leak Detected” row (AMP Fitting Soap Test section).
11. If a leak is detected, re-assess and treat as a leak situation as per Section [32.0 Emergency Practices](#) and [Section 32.5 Leak Investigation](#) of the C&M Manual
 - a. Check “YES” box in the “Leak Detected” row (AMP Fitting Soap Test section).
 - b. Check proper “Leak Classification” (AMP Fitting Soap Test section).

Sampling and measurements

12. Record soil type and moisture condition of the soil on Information Sheet (Soil Observations at AMP Fitting Location section).
13. Measure and record the “Total length from AMP Fitting to the riser”, “Total length from AMP Fitting to the grade” and “Total length from AMP Fitting to the foundation wall” in meters (AMP Fitting Measurements section).
14. Mark with a black marker a straight line to indicate the 12 o’clock position on plastic portion of the sample.
15. Take pictures of exposed AMP Fitting and riser. Refer to back of Information Sheet for specific photograph details.
16. Email pictures to oscar.khazam@enbridge.com with “DSI ID” (located at top right corner of the Information Sheet) in the subject title.
17. Collect one sample that contains 30 cm of plastic before the AMP Fitting until 30 cm of copper after the AMP Fitting.
18. Tape both ends of the sample to avoid internal contamination and place the sample inside of the provided clear plastic bag.

Remainder of work

19. Install new service riser as per [Section 29.2.9 Service Riser](#) of the C&M Manual.
20. Backfill site and Energize service as per [Section 20.0 Backfill](#) and [Section 25.0 Energizing, Purging, Abandonment and Flaring](#) of the C&M Manual.
21. Fill “Date Work Completed”, “Work Performed by (EGD or contractor)” and “PSI or Operations Supervisor name” and place completed Information Sheet inside of the provided clear plastic bag. Ensure the bag is closed with either tape or twist tie.

Note: Contact Oscar Khazam (647-534.8763) or Fred Butrico (416-518.6506) for any question or concern

AMP Fittings Study - 2012



PMTS Information

Work Request #:		PMTS Asset ID:
Address:		DSI ID:
Municipality:		Date Installed:
Province:	Area:	Type of Service:

Field Information

LEAK SURVEY – Pogey bar section				
Leak detected:	YES ☐		NO ☐	
If "YES", size of leak (% L.E.L.):				
If "YES", location of leak:				
Leak classification:	A ☐	B ☐	C ☐	
AMP FITTING SOAP TEST				
Leak Detected:	YES ☐		NO ☐	
Leak Classification:	A ☐	B ☐	C ☐	
SOIL OBSERVATIONS AT AMP FITTING LOCATION				
Soil type:	Sand ☐	Clay ☐	Rocks ☐	Other ☐
Moisture condition of soil:	Dry ☐	Damp ☐	Wet ☐	Water ☐
AMP FITTING MEASUREMENTS				
Total length (in meters) from the AMP Fitting to the riser:				
Total length (in meters) from the AMP Fitting to the grade:				
Total length (in meters) from the AMP Fitting to the foundation wall:				
PICTURES & OBSERVATIONS				
Pictures taken of (see reverse for details):		Excavation View ☐		Close-up View ☐
OBSERVATIONS & COMMENTS:				
PERSONNEL INFORMATION				
Date Work Completed:				
Work Performed by (EGD or contractor):				
PSI or Operations Supervisor name:				

AMP Fittings Study - 2012



AMP Fitting – Preferred Sample Pictures

Excavation View



Close-up View



AMP Fittings Study - 2012



Appendix B

2012 AMP Fitting Complementary Figures and Tables

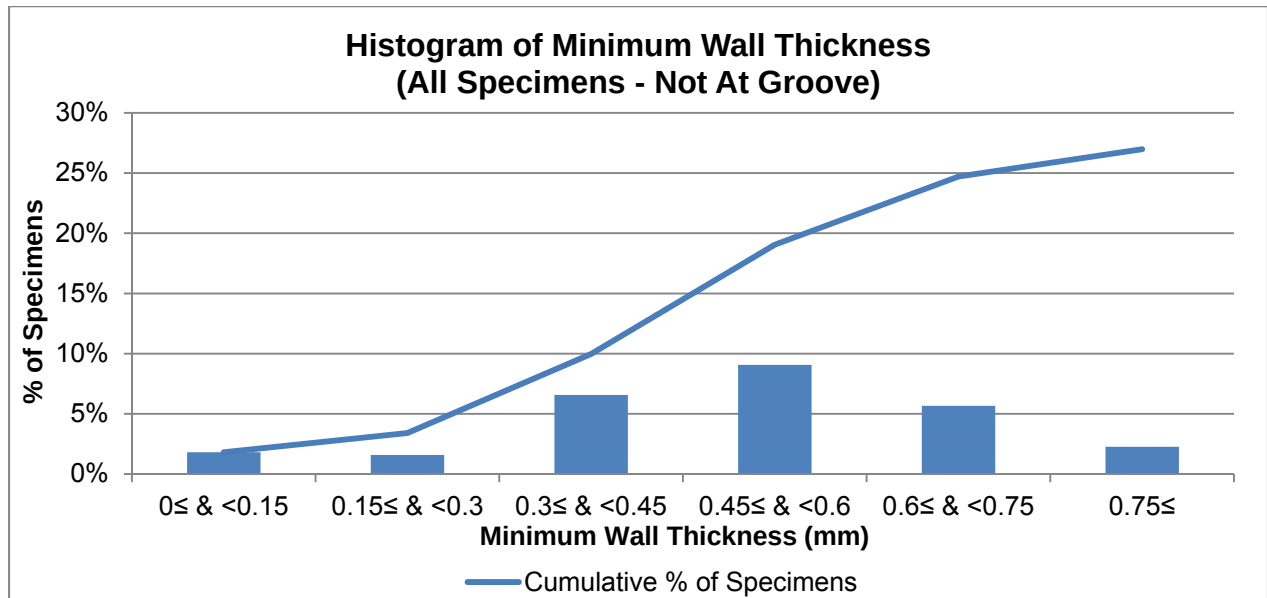


Figure B.1: Histogram of Minimum Wall Thickness for Specimens with Minimum Wall Not Located at Groove

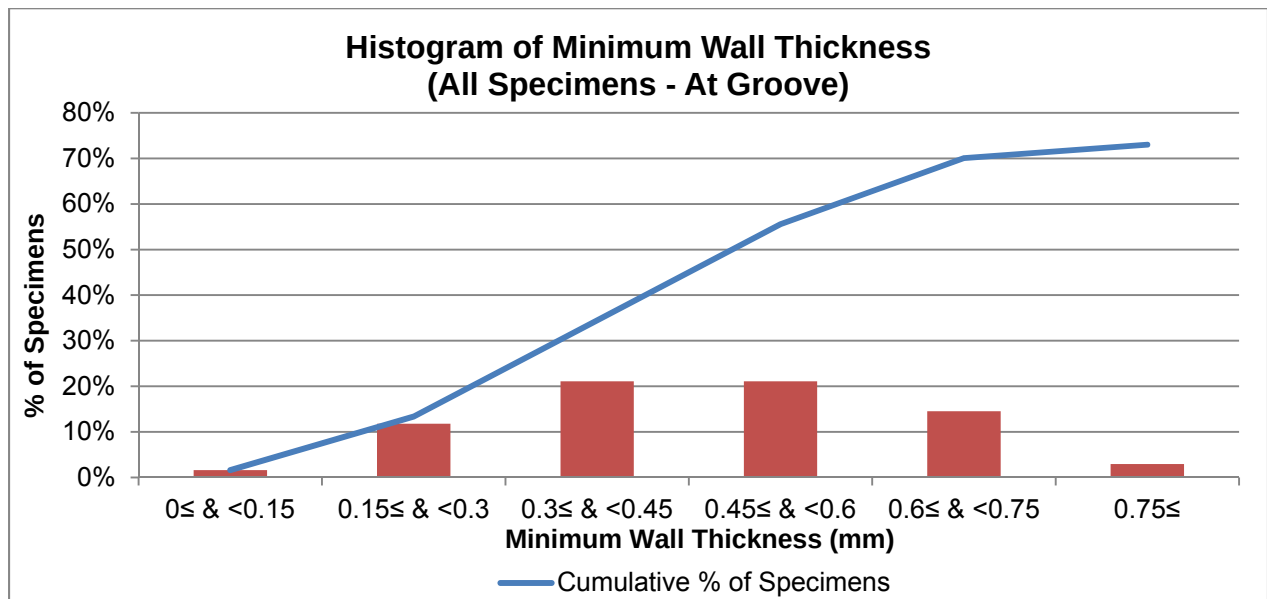


Figure B.2: Histogram of Minimum Wall Thickness for Specimens with Minimum Wall Located at Groove

AMP Fittings Study - 2012



Table B.1: Projected Future Leaks with 95% Confidence Limits Based on Wall Loss Model

Year	Observed		Cumulative			Yearly		
	Cumulative	Yearly	Lower	Estimated	Upper	Lower	Estimated	Upper
2007	204	204	170	220	270	170	220	270
2008	501	297	410	510	640	240	300	370
2009	880	379	740	920	1100	330	410	500
2010	1,365	485	1200	1500	1800	440	540	660
2011	1,971	606	1700	2100	2600	570	690	840
2012			2500	3000	3700	720	880	1100
2013			3400	4100	5000	900	1100	1300
2014			4500	5400	6600	1100	1300	1600
2015			5800	7000	8400	1300	1600	1900
2016			7400	8900	11000	1600	1900	2200
2017			9200	11000	13000	1800	2100	2500
2018			11000	13000	16000	2100	2400	2800
2019			14000	16000	19000	2400	2700	3100
2020			16000	19000	22000	2600	3000	3400
2021			19000	22000	26000	2900	3300	3700
2022			22000	26000	30000	3200	3600	4000
2023			26000	30000	35000	3400	3800	4300
2024			29000	34000	39000	3600	4100	4500
2025			33000	38000	44000	3900	4300	4700

AMP Fittings Study - 2012



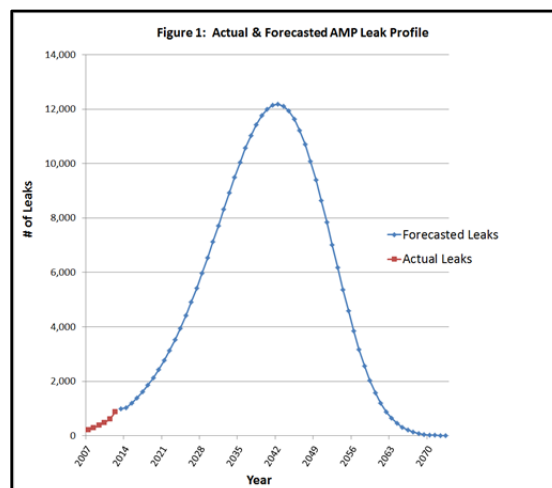
Appendix C

AMP Fitting Replacement Program –Evidence to OEB

Summary

The objective of the AMP Fitting Replacement Program is to reduce the risk associated with the increasing failures of the copper piping downstream of these AMP fittings. An AMP fitting is a mechanical fitting (see Figure 2 which shows a typical AMP fitting), installed between 1969 and 1984, on below ground residential gas service lines, in order to transition from a plastic service line to a copper riser. Approximately 320,000 AMP Fittings have been installed across the Enbridge system. The program involves the replacement of the AMP Fittings and copper riser together with increased leak survey monitoring on all services with AMP Fittings. The main objective is to replace the AMP fittings and risers before the riser starts to leak.

Over the past six years, Enbridge has experienced an increased rate of leaks on AMP fittings over its historical rates. Between 2007 and 2012, detected and reported leaks related to AMP fittings have been identified as increasing at the rate of approximately 30% per year. In 2011, 608 leaks were reported related to AMP fittings. Due to the increase seen in the leak rates, Enbridge commenced a targeted leak survey program for AMP fittings in 2012, which found 880 or 172 more than the previous year. In the same year Enbridge also commenced 2 studies to examine a sampling of AMP fittings to determine the condition of these assets, the mechanism of the failure, the projected life expectancy and the optimal response. The conclusion of these studies is that AMP related leaks are likely to continue to increase at an accelerated rate, roughly doubling from the 2012 number over the next five years and increasing four to six fold within the next 12-14 years. Specifically the leak forecast developed by BANAK Inc generates the following leak rate profile (See Figure 1). Based on this study Enbridge recognized that this leak rate is not acceptable and requires an appropriate response. The AMP Fitting Replacement Program is that response.



AMP Fittings Study - 2012



This program commenced in 2012/13 (leak surveys and replacements) and continues. Enbridge has increased its leak survey monitoring and over the next three years will leak survey 100% of the services with AMP fittings annually. Leaks associated with AMP fittings are below ground leaks and are addressed under the current emergency response protocol. Enbridge determined that the replacement over time of all AMP fittings based on risk and operational capacity best ensures continued compliance with the safe and reliable delivery of gas.

The total forecasted three year capital requirement to implement the program for the years 2014 to 2016 is \$43.7 million as listed in Table 1.

Table 1: Capital Cost Summary (\$000)				
	Budget	Forecast		
Year	2013	2014	2015	2016
Spend	\$4,000	\$8,543	\$13,100	\$30,046
Units	2,000	4,000	6,000	13,600
Unit Cost (\$)	\$2,000	\$2,135	\$2,183	\$2,209

Background

Two basic characteristics of natural gas are that it is lighter than air and when it is released from containment, it will follow the path of least resistance. In most cases, a release of gas will result in the gas escaping to the atmosphere with minor consequences. However if the release of gas follows a path of least resistance into a confined space (egg. customer's home), increasing the probability of ignition, serious consequences can result.

Enbridge has experienced an increase in the leak rate related to these fittings over the past years. This increased leak rate associated with this configuration is of concern. The leaks associated with the copper riser can vary from a pinhole leak to a full circumferential crack and failure, depending on the influencing factors such as external loading and/or impingement. Impingement occurs when rocks and hard materials in the trench are in direct contact with the copper riser and can potentially cause localized damage. The fitting and the riser are in the majority of cases in direct proximity to customer home or building (seen in Figure 3). In a worst case scenario, these leaks have the potential to enter customer's homes or building, particularly in the winter months, when the ground is frozen and the leaking gas is less able to vent to atmosphere. Contributing to this risk is the freeze/thaw cycle which fatigues the already corroded copper riser. Under these circumstances there is a possibility that the migrating natural gas can accumulate inside the customer's home or building. The accumulation of natural gas in an enclosed space could create a hazardous situation should it reach the lower explosive limit (approximately 4% gas-in-air).

AMP Fittings Study - 2012



Figure 2: Typical AMP fitting

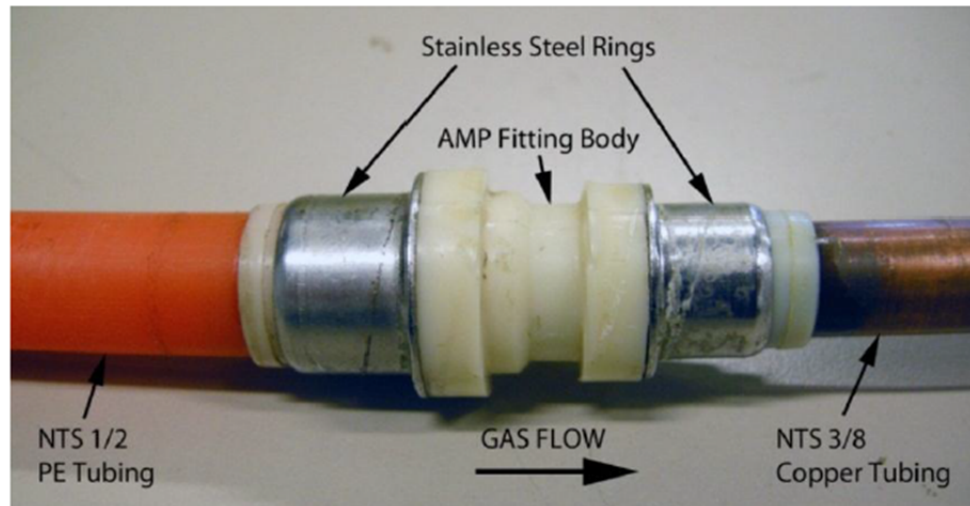
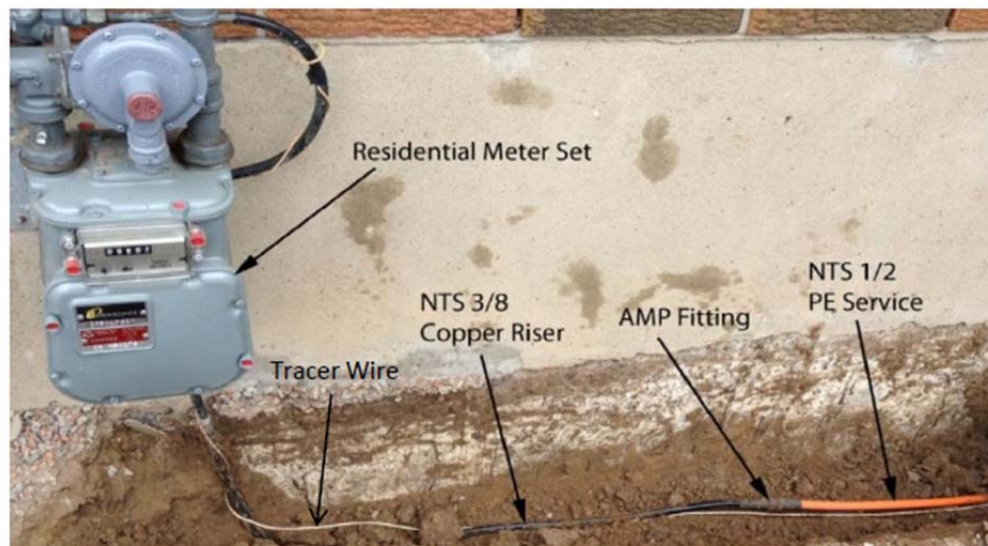
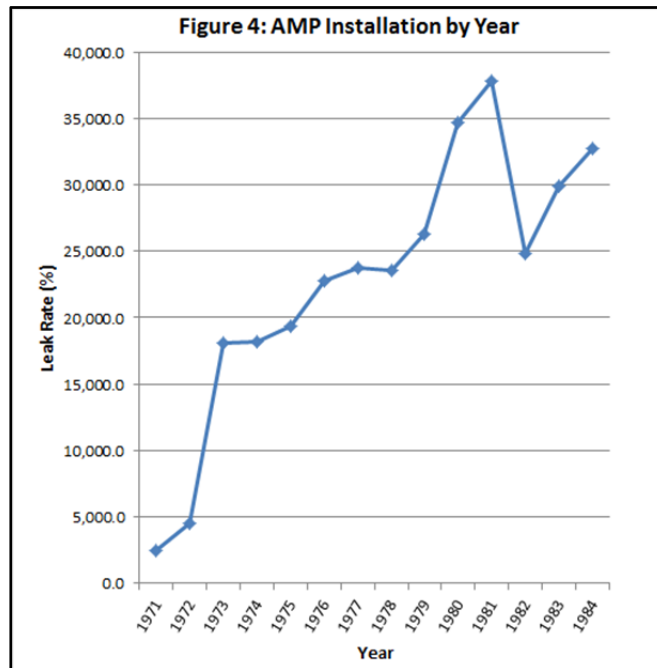


Figure 3: Typical AMP fitting installation

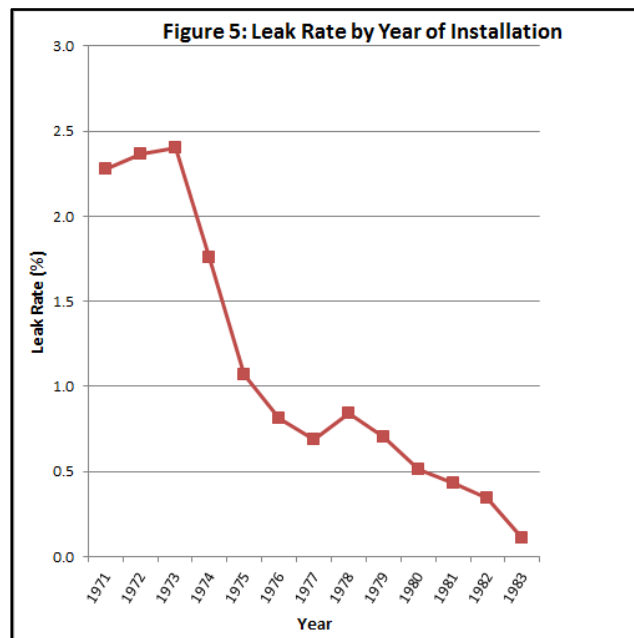


In Figure 4 below, Enbridge sets out the profile of the installation of the AMP fittings and copper risers over the relevant period. As can be seen from Figure 4, the pace of installations increased significantly after 1973. From the period that these fittings and risers were installed the total remaining in service are approximately 320,000.

AMP Fittings Study - 2012



As can be seen in Figure 5 below, the actual rate, as detected by the Company, of the AMP fitting related leaks is highest in respect to the oldest installations (data collected from 2007 to 2012). The leak rate for these older AMP fittings is approximately 2.3 %. In 2012, a total of 880 leaks related to AMP fittings were detected which represented 47% of the Company's total below ground leaks for that year. Based on the studies that Enbridge commissioned (as discussed below), the expectation is that this leak rate will accelerate and include more recent installations.



AMP Fittings Study - 2012



In 2012, approximately 59% of AMP leaks were detected by the Company's leak survey program with the remaining 41% of AMP leaks being identified outside the program (called in by the public or found by service technicians or other gas company representatives). Enbridge has undertaken incremental leak surveys to date which were limited in scope targeting the older installations of AMP fittings and copper risers. In future the Company will be undertaking annual surveys of all remaining AMP fitting and copper riser installations.

AMP Fitting Studies 2012

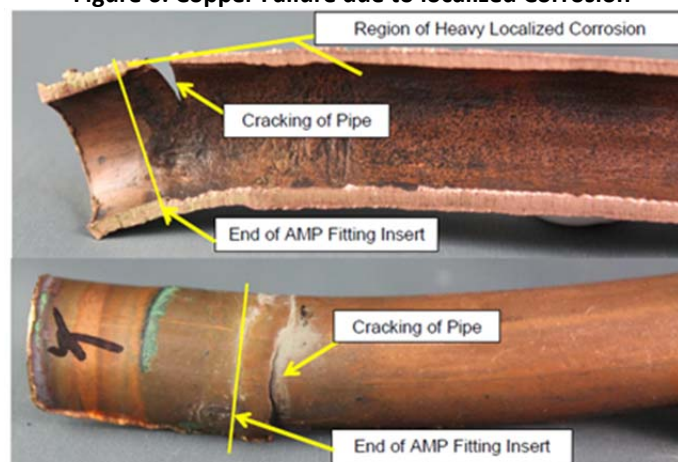
In response to the increased number of leak incidents associated with these fittings, Enbridge commissioned two studies in 2012 to understand the:

- condition,
- failure mechanism and,
- expected frequency of leaks, and
- optimal response to the problem.

One study, performed by Jana Laboratories Inc., consulting engineers with expertise in defect failure analysis of pipelines, determined, following the analysis of a broadly representative sample of 700 exhumed AMP fittings, that all of these fittings demonstrated corrosion. This contributed to Jana's opinion that the amp fitting system is failing at an accelerating pace. Indeed, on page 2 of the Jana report, it was reported that leak rates are projected to increase at an accelerating rate, increasing by four to six fold in the next 10 years.

Jana concluded that the mechanism of failure, or leak, is associated with corrosion of the copper riser downstream of the fitting (See Figure 6).

Figure 6: Copper Failure due to localized Corrosion



AMP Fittings Study - 2012



The failure mechanism has been determined to be impacted by the age of the fitting and risers and the gas flow rate through the assembly. The corrosion is a result of trace and expected levels of hydrogen sulphide (H_2S) in the natural gas and is associated with flow turbulence at the AMP Fitting outlet. The primary variables impacting the minimum remaining life of the copper riser are its age (wall loss increases with age), flow rate (wall loss increases with flow rate), and imperfections in the copper downstream of the fitting. Such imperfections increase turbulence and therefore accelerate wall loss. Higher flow rates (consistent with customers with higher gas consumption rates) effectively accelerate the corrosion through a combined erosion and corrosion mechanism. The flow rate is a significant contributor in that it accelerates the corrosion mechanism by causing scouring of the riser's copper wall as the gas flows through the it (analogous to the erosion mechanism of a river on a river bank due to turbulent flow).

Conclusion

The AMP fittings and copper risers leak rates are unacceptable and the situation is likely to worsen over time. A targeted remediation program is therefore recommended to stabilize and manage the forecasted accelerating increase in risk associated with the increase in leak rates. In order to achieve the greatest optimization, the remediation program will involve implementation of a long term AMP fittings replacement program and annual leak monitoring of the entire AMP Fitting population (ramped up starting in 2012 and over the next three years). To the extent possible, Enbridge will look for efficiencies in managing the replacement of these fittings through synergies with other asset replacement programs as warranted. On an annual basis, the AMP fitting program will be re-evaluated to measure how the leaks track with the forecasted leak rate, and the program pace will be re-evaluated based on the data.

Program Description

A replacement optimization has been developed for the AMP Program that takes into consideration the following:

- level of risk associated with the number of leaks required to be managed,
- capacity for emergency response early in the program,
- capacity to perform the replacement program early in the program, and
- program cost.

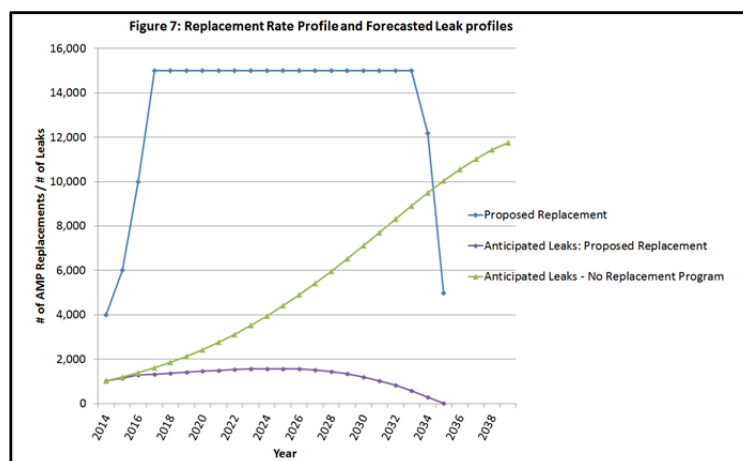
The program design utilized the results of the Jana AMP study and the second study completed in 2013 by BANAK Inc., *Program Optimization Approach*, to determine the optimal program. This program considers the proactive replacement of AMP fittings and copper risers in combination with replacements that are triggered by a detected leak.

AMP Fittings Study - 2012



Today, the replacement profile shown in Figure 7 has been identified as the optimal replacement profile for 2013 to 2016. This profile will be evaluated on an ongoing basis so that Enbridge can remain ahead of the failure curve in an optimized way, to the extent practical.

The Figure 7 below identifies program replacement impact on the leak rates. The green curve represents the leak profile that is anticipated if the AMP fitting replacement program is not undertaken. The “Anticipated Leaks: Proposed Replacements” represented by the purple curve, shows the anticipated number of annual leaks that will occur during the replacement program period. The program “Proposed Replacements” represented by the blue curve show the planned rate of annual replacement which will be completed under the program. Over the forecast period this replacement rate will increase from 4,000 replacements in 2014 to 10,000 in 2016.



The Company intends to reevaluate the program as needed, which may mean accelerating or decelerating, in response to the actual leak rate experienced. The Company did evaluate alternative replacement rates over time and concluded that any material decrease in the annual replacement rate led to an unacceptable increase in the annual anticipated leak rate.

Capital Requirements

The total forecasted three year capital cost to implement the replacement program for the years 2014 to 2016 is \$43.7 million as listed in **Table 2**. These costs include the material, labour and restoration costs needed to replace the AMP and copper riser as defined above.

Table 1: Capital Cost Summary (\$000)				
	Budget	Forecast		
Year	2013	2014	2015	2016
Spend	\$4,000	\$8,543	\$13,100	\$30,046
Units	2,000	4,000	6,000	13,600
Unit Cost (\$)	\$2,000	\$2,135	\$2,183	\$2,209

AMP Fittings Study - 2012



Appendix D

AMP Fitting Asset Management Plan: Optimizing the Repair, Replace, Inspect decision

Submitted by

BANAK Inc.

May 15, 2013

AMP Fittings Study - 2012



Executive Summary

We have produced a wide variety of asset management policies for the general problem of replacing the AMP fitting asset base. Each policy has O&M and Capital costs, and a measurable risk of incidents. The results are summarized in the accompanying file "Summary.xlsx".

Background

Enbridge Gas Distribution (EGD) is Canada's largest gas distribution utility serving about 2 million customers in central and eastern Ontario, southwestern Quebec and parts of northern New York State. EGD is required to justify its expenditures in and rates charged to customers in Ontario before the Ontario Energy Board (OEB) from time to time.

One aspect of EGD's planned upcoming submission to the OEB will be concerned with the manner in which AMP fittings will be managed. AMP fittings connect a plastic service line and a copper riser that connects to a customer's home. These copper risers are known to be in some degraded state and there is the potential for loss of performance due to this degradation. In upcoming years these connections to residential customers will need to be subjected to an asset management plan that includes the possibility of (i) unplanned repair based on customer report, (ii) unplanned repair based on an inspection policy, (iii) preventive replacement up to the AMP fitting, and/or (iii) preventive replacement up to the gas main ("service re-lay").

EGD eventually wishes to develop an optimal strategy that will balance these four maintenance options, subject to maintenance resource requirements. EGD has already taken a sample of copper risers and subjected the sample to laboratory testing for the purpose of developing estimates of the population distribution of degradation. EGD has also provided other operational and financial data as required to produce an optimal asset management decision.

Methodology, Assumptions, and Data

A "policy" will consist of a mix of asset strategies as follows:

1. The number of AMP fittings that will be subject to preventive replacement.
2. The expected number of AMP fittings repairs that will be unplanned, based on customer report, leak survey, or an unforeseen incident based on the projected probabilities of each of these events in a given year.

All AMP fittings still installed are subject to an annual leak survey.

We assume that all preventive work is done on the oldest AMP fittings first, and that leak surveys target the oldest AMP fittings.

AMP Fittings Study - 2012



For any policy we compute a net present value based on discounted annual costs after taxes, and we compute an equivalent annual cost, since not all scenarios are of the same length. In addition we compute the expected number of incidents each year.

The future probabilities of leaks and their detection were obtained from the January 31, 2013 report by Jana Laboratories entitled “AMP Fitting/Copper Riser Reliability Study” (the Jana Report).

The Jana Report proposes several methods to project future leak probabilities. The method we believe is the most applicable to 20 year forecasts uses the Weibull distribution that best fits to the observed failure data from the 2007 to 2011 time period, which is the Weibull distribution with $\beta = 7.0$ and $\eta = 65.1$. Projections very far into the future using this model should be re-evaluated regularly.

There are two possible sources of uncertainty in these parameter estimates. The first is that it does not account from the number of AMP fittings that failed before 2007. Excluding these “left truncated” failure times can have the effect of over-estimating β and under-estimating η . We will consider this possibility and have selected $\beta = 6.5$ and $\eta = 70$ as alternative values. In addition, it was found in about 10% of surveyed cases that there is not an AMP fitting in place. We will also consider this possibility.

In general, maintenance resources are constrained. The leak survey will cover 50% in 2014, 80% in 2015, and 100% thereafter. It is considered that 1000 unplanned repairs can be managed per year without incurring increased costs or risk. It is generally planned to have the capacity to perform 4000 preventive actions in 2014, 6000 in 2015, and we will consider the possibility to perform up to 20,000 planned repairs if necessary.

We require an estimate of a probability of an incident per number of leaks, and an average cost consequence of an incident. EGD has tentatively provided a probability of 1 incident per 100,000 discovered leaks, with a cost of \$14,600,000 per incident. The probability of an incident is 1 in 50,000 for undiscovered leaks (undiscovered due to lack of leak survey coverage in 2014 and 2015 and not relevant after 2015) and 1 in 50,000 for leaks that exceed the resources required to perform 1000 reactive maintenance actions per year.

The average cost to perform a reactive repair is \$1,525. This is a weighted average of \$1,400 for the repair and a 13% chance of incurring an extra \$740 cost should the repair be prompted by a customer report (due to an \$80 emergency call cost and a 50% increase in the cost of the emergency repair itself in these cases.)

The average cost to perform a preventive repair is \$1,400.

AMP Fittings Study - 2012



The average cost to perform a service re-lay is \$3,500. This is subject to a 30% premium if the re-lay is unplanned, performed in response to a leak survey or customer report. Each re-lay must be leak surveyed in the following year.

The average cost of a single leak survey is \$4, which is considered to be a maintenance cost and not a capital expenditure. Note that the cost of a leak survey is strictly speaking a capital cost when it leads to a repair/re-lay, but the dollar amount is so low that we will not consider this.

All costs above are given in 2013 dollars. These costs are to be subject to 2% annual inflation. The discount rate to be used is 5.878%. It is assumed that repairs have no salvage value at the end of any scenario. The capital cost allowance is 6% and the Ontario corporate tax rate used is 26.5%.

Capital and O&M expenditures are assumed to take place at the beginning of the year for cash flow purposes. EGD will adjust these results to follow their actual accounting practices.

Results

We have provided several Excel spreadsheets with replacement policies and their financial implications. Here is a description of table headers:

Total	Number of AMP fittings at beginning of year
Leaks	Number of actual leaks
D.Leaks	Number of detected leaks
Replace	Number of AMP fittings replaced
Relay	Number of planned service re-lays
Leaktest	AMP fittings to be leak surveyed
Expected.Incidents	Expected number of incidents that year
O.M	Pre-tax O&M with inflation
Capital	Pre-tax capital expenditures with inflation
Discounted.Capital	After-tax discounted capital expenditures
Discounted.O.M	After-tax discounted O&M

The grand total of the Discounted.Capital and Discounted.O.M is the net present value, or “NPV”. This number is multiplied by the capital recovery factor to obtain the equivalent annual cost, or “EAC”, which can be used to compare policies with different time horizons.

AMP Fittings Study - 2012



Note that the Relay column lists the number of planned re-lays. All unplanned work is under the one heading D.leaks, which could be a combination of local repairs and re-lays.

The policies are variations on four scenarios. The planning horizon is long enough for all AMP fittings to be removed.

The five scenarios are as follows:

1. The Weibull (7,65.1) distribution is used as per the Jana report ("Jana Weibull Model.xlsx").
2. The Weibull (7,65.1) distribution is used as per the Jana report, but 70% of all work (both planned and unplanned) is taken to be service re-lay and costed as such. ("Jana 70relay Model.xlsx").
3. The Weibull (6.5, 70) distribution is used, as it is possible that the data used in the Jana Report might cause over- and under- estimation of the two parameters. ("Jana Weibull Modified.xlsx").
4. The Weibull (7,65.1) distribution is used, but we assume only 90% of the population actually has AMP fittings in place, at random. ("Jana Weibull 90percentAMP.xlsx")
5. The Weibull (7,65.1) distribution is used, and the amount of planned work is fixed at 4000 in 2014, 6000 in 2015, and 15,000 thereafter, no matter how much unplanned work is expected to occur. ("Jana 15000 Planned Limit.xlsx")

For each scenario from 1 to 4 above we generate a policy that targets a range in the expected amount of unplanned work, and the amount of required planned work is allowed to ramp up to as much as 20,000 per year and then ramp down to no less than 8,000 per year.

Finally also provide the results for one special case of no planned work at all, with planning horizon of 60 years, in the file "No Planned.xlsx".

The main results are summarized in the file "Summary.xlsx".

The O&M costs are computed as the number of Leak Surveys (including any for the previous years' service re-lays, if applicable) multiplied by the cost, plus the expected number of incidents multiplied by the cost, times one minus the tax rate, and then discounted.

The present value of the capital expenditure in that year is calculated as follows:

PV : Present Value

i : interest rate for discounting

A : Acquisition cost

U_n : the undepreciated capital cost

AMP Fittings Study - 2012



CT: corporate tax rate

n : number of years remaining in this policy

$$PV = A \left[1 - \left(\frac{CT \times CCA}{i + CCA} \right) \left(\frac{1 + i/2}{1 + i} \right) \right] - \frac{i \times CT \times U_n}{(i + CCA)(1 + i)^n}$$

This value is then discounted to today's dollars.

The capital recovery factor, used to convert net present value to equivalent annual cost, is:

$$\frac{i}{1 - r^N},$$

where N is the total number of years in the policy.

A summary of all results is contained in the spreadsheet "Summary.xlsx".

SEC INTERROGATORY #113

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/5/1, p. 4] Please confirm that, prior to the current version of Section 3.2 of CSA Z662-11, the Applicant had an integrity management program as described in that section. If that previous integrity management program did not fully comply with that section, please identify the material ways in which it did not comply.

RESPONSE

The Integrity Management Program started in 2001 with a TSSA Director's Order requiring pipeline companies to create an Integrity Management Program for pipelines operating at or over 30% SMYS. Please refer to EB-2012-0459, Exhibit B2, Tab 5, Schedule 2, Attachment 5, page 2 of 10, Background.

As stated in Exhibit B2, Tab 5, Schedule 1, page 4, "the most significant change from the 2007 to the 2011 version of the CSA Z662, and the corresponding 2008 and 2012 TSSA CAD was the requirement for the Company to apply Integrity Management processes to all distribution operating assets (previously limited to operating assets with an SMYS above 30%)." As such, the Company extended the Integrity Management Program to the entire distribution system instead of the focus on the assets operating above 30% SMYS.

Witnesses: L. Lawler
J. Sanders

SEC INTERROGATORY #114

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/5/1, p. 8] Please provide, for each new or expanded integrity management program initiative:

- a. The business case or other document showing incremental future savings from the initiative.
- b. The outcomes against which the initiative's success will be measured, including details of the metrics to be used, and the targets or expectations of achievement for each year of the initiative.

RESPONSE

- a) These initiatives were identified in the Risk Register and are required to maintain system integrity, safety and reliability. Business cases have not been created, as the Company does not build business cases associated with system integrity, safety and reliability. The intent of Integrity Management is to reduce risk. Decisions are not driven with the goal of saving money. All initiatives have been designed to manage assets over their lifecycle by balancing performance, risk and expenditures, while keeping customer impacts in mind.

The rationale for each of the initiatives is set out in the evidence. As explained, for each initiative Enbridge considered alternatives and chose the appropriate approach.

Witnesses: L. Lawler
J. Sanders

It is not expected that the new or expanded integrity management initiatives will yield incremental savings in the near future. In the longer term, depending on the initiative, savings would be expected. For example with the AMP program, over time, as more AMP fittings are removed, there will be a reduction in the costs associated with repairing AMP fittings through emergency response. In the short term, the incremental leak survey program will yield additional leaks to be mitigated through the maintenance repair program, thus creating additional costs.

- b) Initiative success will be measured in terms of risk reduction, system reliability and improved safety. More specifically, outcomes will be measured through the number of excavation damages per 1,000 locates, the service leaks repaired per mile of service, the total number of Grade 1 (A) leaks eliminated or repaired during the year and the outages per 1,000 customers. These metrics are presented in Exhibit A2, Tab 11, Schedule 2. These measure asset performance and reliability.

SEC INTERROGATORY #115

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/5/2, Attach 2, p. 3] Please advise whether the 1995 event is the most recent such event relating to compression couplings.

RESPONSE

Although the 1995 event is the most recent event experienced by EGD, these fittings remain a concern, and the Company continues to mitigate the risk associated with this asset. For the period of 2007 to 2012, the Company has replaced approximately twenty seven compression couplings that had failed/leaked or were damaged by a third party, or presented a hazard to public safety. Industry events associated with these types of fittings have occurred more recently. Due to the increasing number of catastrophic incidents associated with the failure of mechanical compression fittings due to pull-out, the US Department of Transportation's Pipeline and Hazardous Material Safety Administration ("PHMSA") issued a final rule requiring all operators to collect and report annually on all mechanical compression fitting failures.

As identified in the pre-filed evidence at Exhibit B2, Tab 5, Schedule 2, Attachment 2, pages 5 and 6, the Company experienced a near miss in 2012 when contractors performing municipal works digging with heavy excavation equipment exposed compression couplings on a 12 inch high pressure gas main, that were not recorded in EGD's records.

Had this work continued per the construction plan, the results could have led to a loss of containment of natural gas as well as injury to the public or the workers. Compression

Witnesses: L. Lawler
J. Sanders

couplings are a risk to public and worker safety, and the Company will continue to proactively search out these fittings and remediate as appropriate.

Witnesses: L. Lawler
J. Sanders

SEC INTERROGATORY #116

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/5/2, Attach 2, p. 8] Please confirm that the primary problem with the current practice relating to compression couplings is that excavators do not call Ontario One Call.

RESPONSE

The primary problem with the current practice relating to compression couplings is that EGD does not have records identifying where all of these fittings are installed. Understanding where these fittings are located is critical to ensuring public and worker safety during excavation by parties external to the Company. Although the Company has a Compression Coupling Investigation ("CCI") process as identified in the pre-filed evidence at Exhibit B2, Tab 5, Schedule 2, Attachment 2, page 8, there is the potential for human error, as seen in the near miss associated with the compression couplings found at Martingrove and Burnhamthorpe, also discussed in the evidence referenced above. When excavators are not made aware that Compression couplings exist in the area, they do not take the precautions specific to excavation in the vicinity of compression couplings. This is further impacted by some excavators' practices of not calling Ontario One Call.

Witnesses: D. Lapp
L. Lawler
J. Sanders

SEC INTERROGATORY #117

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/5/2, Attach 4, p. 3] Please provide the evaluation document for Phase 1.

RESPONSE

There is no single evaluation document for Phase 1 of the Maximum Operating Pressure ("MOP") Verification Program. Approximately 500 km of Enbridge's pipelines were evaluated under the 2012 MOP Verification Program, resulting in over twenty projects that included a comprehensive review and analysis of over 750,000 pages of documentation. The Company has considered findings from each of the projects in determining that it is prudent to continue with a program to verify and maintain the MOP of the highest pressure pipelines.

Several specific examples from the 2012 evaluation findings are outlined below:

- Unsuitable test records necessitated the installation of a pressure regulating station to limit operating pressures;
- Records indicating underrated components as having been installed. These required field verification or replacement; and
- Interim lowering of operating pressure of pipelines due to insufficient pipeline information and the acquisition of new information about existing pipelines.

These specific examples identified a need for remedial actions and to obtain further information on these pipelines in support of their ongoing operation. They also support the continuing MOP Verification Program on additional pipelines as the information

Witnesses: J. Sanders
N. Thalassinis

gathered and reviewed in 2012 is expected to be consistent with the type of information expected to be found on other pipelines scheduled for future review.

Witnesses: J. Sanders
N. Thalassinou

SEC INTERROGATORY #118

INTERROGATORY

Issue B18: Is the rate base for each of 2014, 2015 and 2016 appropriate, including:

- a. Opening rate base;
- b. Forecast level of Capital expenditures;
- c. Forecast Customer additions;
- d. Proposed Capital additions;
- e. Allocation of the cost and use of capital assets between utility and nonutility (unregulated) operations;
- f. Working capital allowance; and
- g. All other components of and adjustments to rate base

[B2/5/2, Attach 4, p. 8] Please provide details of the \$1.342 million of consulting fees included in the budget. Please provide estimates of similar consulting fees for each of 2013, 2017, and 2018.

RESPONSE

The budgeted consulting fees in 2014 through 2016 are associated with the following activities:

- Design and implementation of process enhancements to meet new industry standards for verifying and managing Maximum Operating Pressures (“MOP”)
- Change management of process enhancements
- Technology support of MOP repository development and enhancement
- Project management during process planning, resourcing and deliverable phases

Consulting requirements are heavily focused on one-time process activities that are concentrated primarily in the earlier phases of the program. As a result, consulting requirements decline by 25% in 2015 and a further third in 2016 stabilizing at that level in 2017 and 2018 when focused on sustainment and improvement mode. Forecasts for 2013, 2017 and 2018 can be found in Table 1.

Table 1: Consulting Estimate Detail (\$000)	
Year	Forecast
2013	770
2017	300
2018	300

Witnesses: L. Lawler
J. Sanders

BOARD STAFF INTERROGATORY #65

INTERROGATORY

ISSUE B19: Is the preliminary Allowed Revenue amount for each of 2017 and 2018 appropriate, including:

a. Is the preliminary depreciation amount appropriate?

Evidence Ref: D1/T5/S1

Do the proposed depreciation rates contain an excess amount that will continue to increase the long-term liability for SRC on the corporation's balance sheet?

RESPONSE

Please see the response to Board Staff Interrogatory #47, found at Exhibit I.B17.EGDI.STAFF.47

Witnesses: B. Yuzwa
L. Kennedy - Gannett Fleming

BOARD STAFF INTERROGATORY #66

INTERROGATORY

ISSUE B19: Is the preliminary Allowed Revenue amount for each of 2017 and 2018 appropriate, including:

a. Is the preliminary depreciation amount appropriate?

Evidence Ref: D1/T5/S1

Will the proposed depreciation rates recover only the underlying economic value of the related fixed assets? Please explain.

RESPONSE

Please see the response to Board Staff Interrogatory #48, found at Exhibit I.B17.EDGI.STAFF.48.

Witnesses: B. Yuzwa
L. Kennedy - Gannett Fleming

BOARD STAFF INTERROGATORY #67

INTERROGATORY

ISSUE B19: Is the preliminary Allowed Revenue amount for each of 2017 and 2018 appropriate, including:

a. Is the preliminary depreciation amount appropriate?

Evidence Ref: D1/T5/S1

Please discuss the choice of average service life procedure by Enbridge, versus equal life group procedure, since Gannett Fleming has stated in its depreciation study as of December 31, 2010 that "the ELG procedure provides a superior match of the consumption of service values of the assets in service to the depreciation expense". [EB-2011-0354/D2/T2/S1/Page 40]

RESPONSE

Please see the response to Board Staff Interrogatory #49, found at Exhibit I.B17.EGDI.STAFF.49.

Witnesses: B. Yuzwa
L. Kennedy - Gannett Fleming

ENERGY PROBE INTERROGATORY #26

INTERROGATORY

Ref: Exhibit E1, Tab 2, Schedule 2 & Exhibit E1, Tab 1, Schedule 1

Please provide a table for 2017 and 2018 similar to Tables 1 through 4 in Exhibit E1, Tab 1, Schedule 1, that reflects the forecasts for 2017 and 2018 shown in Exhibit E1, Tab 2, Schedule 2.

RESPONSE

Please refer to the company's updated evidence in Exhibit E1, Tab 1, Schedule 1, which now includes cost of capital tables for 2017 and 2018.

Witnesses: P. Bhatia
K. Culbert
S. Kancharla

CCC INTERROGATORY #28

INTERROGATORY

Issue B20 – Is the preliminary rate base for each of 2017 and 2018 appropriate, including the method for establishing that preliminary level?

What is the purpose of presenting preliminary rate base figures for 2017 and 2018 for approval at this time, if they are going to be re-filed in 2016?

RESPONSE

The purpose of presenting preliminary 2017 and 2018 rate base figures, in the originally filed Exhibit F1, Tab 1, Schedule 3, Appendix A, dated: 2013-07-26, was to allow for the derivation of preliminary 2017 and 2018 Allowed Revenue amounts as per the Company's proposed Customized IR plan at that time. However, as per Updated Exhibit A2, Tab 3, Schedule 1, the Company has updated its proposed rate adjustment process, under which the preliminary 2017 and 2018 rate base figures would become final figures, with the exception of gas in storage and working cash amounts, for use in determining 2017 and 2018 Allowed Revenues. Gas in storage and working cash amounts are proposed to be adjusted annually in conjunction with the annual update of the gas supply plan.

Witnesses: K. Culbert
R. Small