Heavy Water Management Building Project: Campus Plan F1
Background Groundwater Review
Ontario Power Generation - Darlington Nuclear (OPG-DN)

Kinectrics Report: K-415072-004-TM-0004-R00
September 13, 2013

Kinectrics Inc
Analytical and Waste Services

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Dated: September 13, 2013

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REVISIONS

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Memo

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PGL File #: 3821-01.03

DATE: September 16, 2013

TO: Ruth Burany, Kinectrics Inc.

FROM: Archana Uprety, PGL
Salima Jaffer, PGL
Will Gaherty, PGL

Re: Heavy Water Management Building Project: Campus Plan F1 Background Groundwater Review – Ontario Power Generation – Darlington Nuclear (OPG-DN)

PGL was retained by Black and McDonald to evaluate the existing groundwater condition in the wells near Campus Plan F1 area (F1) and develop a groundwater monitoring program to support the F1 soil management plan.

1.0 INTRODUCTION

F1 will receive soil excavated from the Protected Area during the excavation and construction work associated with the new D2O Heavy Water Management Building. A 2009 spill event in the Protective Area at the Heavy Water Management Building foot-print means excavated soil may be impacted with tritium. Therefore, OPG has requested the development of a groundwater monitoring program for F1.

2.0 PURPOSE

The purpose/objective of this memo is to:

- Review existing reports provided by OPG to determine up and downgradient tritium concentration in groundwater at F1;
- Review the reports to identify overburden and shallow bedrock groundwater-flow directions;
- Identify gaps in available data provided by OPG; and
- Develop a groundwater monitoring program to support the F1 soil management plan.

Our technical memo presents a review of existing wells, results of the groundwater programs from existing reports provided by OPG and the proposed groundwater monitoring program.

3.0 DATA

PGL reviewed specific sections (groundwater flow direction and analytical data) of the below listed reports provided by OPG:

- EcoMetrix Incorporated – *Darlington Nuclear Generating Station Groundwater Monitoring Program Design*, March 2012;
- Genivar – *OPG Darlington Nuclear Site Delineation of Areas of Elevated pH in vicinity of Former Truck Wash Area, August 2009*. OPG File Number: NK38-REP-07010-0266518; and

- CH2M HILL (Excerpt 3 pages) – *Ontario Power Generation Inc. New Nuclear – Darlington Project Geological and Hydrogeological Environment Existing Environmental Conditions* Technical Support Document, 2008. OPG File Number: NK054-REP-07730-00005.

PGL reviewed data from 3 groundwater wells at F1 and 25 wells nearby to determine existing groundwater conditions. The groundwater wells that were selected for review based on groundwater-flow direction, and proximity to F1 (Figure 3 and 4.4). Results were compared to Ontario Regulation 153/04 Table 3 Standards.

In aggregate, data was available from 17 of the 28 wells:

1) EcoMetrix contained maximum values measured from 2008 to 2012 from 12 wells for benzene, toluene, ethylbenzene, and xylenes (BTEX), petroleum hydrocarbons (PHC) fractions F1 to F4, metals/inorganics, volatile organic compounds (VOCs), tritium and gamma.
2) Two wells were analyzed for tritium only in February and June 2008.
3) Groundwater samples collected from the three wells at F1 were analyzed for dissolved metals and inorganic parameters in December 2008.

There were exceedences of:

- Chloride in two wells;
- Selenium in one well;
- PHC fraction F3 in one well which a had concentration of 522 µg/L; and
- One well which had a concentration of 130Bq/L tritium, exceeding the F1 New Build limit of 100Bq/L.

All analytical results in the remaining wells were below the Table 3 Standards (See Table A).

Table A: Data Review

Groundwater Wells (EcoMetrix, March 2012)		
Well ID	**Analyzed Parameters**	**Exceedence**
MW010-18	-	NA
MW011-31	-	NA
MW012-5	-	NA
MW044-34	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	None
MW045-10	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	None
MW046-6	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	None
MW047-92	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	Chloride (37.2 M µg/L) exceeds the Table 3 Standards (2.3 M µg/L)
MW048-31	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	
MW049-20	-	NA
MW050-7	-	NA

Table A: Data Review (continued)

Groundwater Wells (EcoMetrix, March 2012)		
Well ID	**Analyzed Parameters**	**Exceedence**
MW052-15	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	Tritium (130 Bq/L) exceeds the F1 New Build limit of 100 Bq/L
MW053-31	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	PHC F3 (522µg/L) exceeds the Table 3 Standards (500µg/L).
MW054-20	-	NA
MW055-14	-	NA
MW056-85	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	Chloride (15.3M µg/L) exceeds the Table 3 Standards (2.3M µg/L)
MW057-27	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	Chloride (5.29M µg/L) and Selenium (234.7µg/L) exceed the Table 3 Standards (2.3M µg/L, 63µg/L, respectively)
MW058-6	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	None
MW059-12	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	None
MW063-98	No analytical	NA
MW064-40	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	None
MW065-25	-	NA
MW066-8	-	NA
MW106-29	-	NA
Groundwater Wells (C2M HILL, 2008)		
MW051-7	Tritium	None
MW105-6	Tritium	None
Groundwater Wells at F1 (Genivar, August 2009)		
MW08-12	Metals and inorganics	None
MW08-13	Metals and inorganics	None
MW08-14	Metals and inorganics	None

Notes: N/A = Not applicable
- = Not analyzed
M = Millions
Results evaluated against Ontario Regulation 135/04 Table 3
Last set of numbers in MW notation refer to depth of well in meters. For example, MW10-18 is 18 meters deep. This does not apply to the three wells at F1

GROUNDWATER FLOW DIRECTION

Based on the EcoMetrix report, overburden groundwater-flow direction is towards the southeast and the shallow groundwater-bedrock flow is towards the south.

3.1 DATA GAPS

PGL reviewed groundwater data from 28 wells; 11 wells did not have any analytical results available and 3 of the wells (at F1) were only analyzed for metals and inorganics. Therefore, a total of 14 wells did not have background tritium results available for review. The groundwater wells with no tritium results include the following wells: F1 wells (MW08-12 to MW08-14), and 11 downgradient wells (MW010-18, MW011-31, MW012-5, MW49-20, MW050-14, MW054-20, MW055-14, MW063-98, MW065-25, MW066-8, and MW106-29).

4.0 PROPOSED GROUNDWATER MONITORING PROGRAM

As part of the long-term strategy for groundwater protection at F1, PGL recommends a groundwater-monitoring and sampling program. No new wells are required. Eight existing groundwater wells were selected for the monitoring program which includes existing wells near and downgradient of F1 and wells with limited or no available analytical results. This includes the following wells:

- One upgradient well (MW105-6);
- Three F1 wells (MW08-12 to MW08-14); and
- Four downgradient wells (MW050-14, MW051-7, MW058-6, and MW059-12).

PGL recommends that the wells selected for the monitoring program that do not have baseline tritium results (MW08-12 to MW08-14, and MW050-14) be sampled for tritium before any soil is staged at F1.

PGL recommends quarterly monitoring and sampling as presented in Table B. The monitoring and sampling will begin approximately four months after F1 is in use and will be continued for as long as soil is staged at F1.

Table B: F1 Groundwater Monitoring program

Objective	Monitor tritium concentrations in wells in close proximity to F1.		
Monitoring Well	**Frequency**	**Analysis Parameter**	**Considerations**
MW08-12	Quarterly	Tritium	At F1
MW08-13	Quarterly	Tritium	At F1
MW08-14	Quarterly	Tritium	At F1
MW050-14	Quarterly	Tritium	South Site Boundary
MW051-7	Quarterly	Tritium	South Site Boundary
MW058-6	Quarterly	Tritium	Southeast Site Boundary
MW059-12	Quarterly	Tritium	Southeast Site Boundary
MW105-6	Quarterly	Tritium	North Site Boundary
Method detection limit for tritium:		100 Bq/L	

5.0 STANDARD LIMITATIONS

PGL prepared this memo for our client and its agents exclusively. PGL accepts no responsibility for any damages that may be suffered by third parties as a result of decisions or actions based on this report. The memo's purpose is to transmit and interpret monitoring data and so will need to be used in conjunction with previous reports by PGL or others. As is true for all environmental investigations, potential remains for the presence of unknown, unidentified, or unforeseen surface or subsurface contamination. More or different investigation may be required if other risks are identified. The data presented in this report is valid for the date of sampling, but site conditions may change with time.

The findings and conclusions are Site-specific and were developed in a manner consistent with that level of care and skill normally exercised by environmental professionals currently practicing under similar conditions in the area. Changing assessment techniques, regulations, and site conditions means that environmental investigations and their conclusions can quickly become dated, so this memo is for use now. The memo should not be used after that without PGL review/approval.

The project has been conducted according to our instructions and work program. Additional conditions and limitations on our liability are set forth in our work program/contract. No warranty, express or implied, is made.

Attachments: Figure 3 – Genivar – Groundwater Monitoring Wells Locations
Figure 4.4 – EcoMetrix – Groundwater Monitoring Wells Locations

DATE : June 2009	**Groundwater Flow Direction**	GENIVAR
SCALE : See Map		
FILE No. : MA-08-256-00-MA	**OPG Darlington Nuclear Site**	FIG No.: 3 / REV
APP'VD : M.H.		

Ontario Power Generation

Groundwater Monitoring Well Locations - Site Wide

EcoMetrix INCORPORATED | ONTARIO POWER GENERATION | Figure 4.4