Board Staff Interrogatory #197

Interrogatory

Reference:
Exhibit F2 / Tab 1 / Schedule 1 / Attachment 2 / p. 6

Question(s):

a) Please file Table 1 at Exhibit F2 / Tab 1 / Schedule 1 / Attachment 2 / p. 6 for each year 2008-2019 (as available). If targets were set on a rolling average basis for those years (which are comparable to the actuals that are presented), please also provide the relevant targets.

Response

Targets are set on an annual basis, while benchmarking results for most metrics are presented on a rolling average basis.

The corresponding tables containing benchmarking results for each year are found as follows:

- **2008-2015**: Provided below
- **2016-2018**: Ex. L-F2-01-SEC-121, Attachment 1, p. 9 (2016), Attachment 2, p. 6 (2017) and Attachment 3, p. 6 (2018)
- **2019**: Ex. F2-1-1, Attachment 2, p. 6, Table 1

2008 Benchmarking Results

Table 2: Plant Level Performance Summary

Metric	Best Quartile*	Median*	Pickering A	Pickering B	Darlington
Safety					
All Injury Rate	1.12	N/A	0.73 ⇧	0.96 ⇧	1.04 ⇧
2-Year Industrial Safety Accident Rate	0.05	0.09	0.14 ⇩	0.07 ⇧	0.04 ⇧
2-Year Collective Radiation Exposure (man-rem per unit)	62.15	81.84	44.2 ⇧	95.81 ⇧	72.83 ⇧
Airborne Tritium (TBq) Emissions per Unit	48.0	101.0	101.0 ⇧	50.7 ⇧	40.0 ⇩
Fuel Reliability (microcuries per gram)	0.000001	0.000165	0.00059 ⇧	0.00159 ⇩	0.00025 ⇧
2-Year Reactor Trip Rate (# per 7,000 hrs)	0.00	0.33	1.22 ⇩	0.26 ⇔	0.00 ⇔
3-Year Auxiliary Feedwater System Unavailability	0.0014	0.0020	0.0119 ⇧	0.0040 ⇧	0.0017 ⇧
3-Year Emergency AC Power Unavailability	0.0024	0.0076	0.0061 ⇩	0.0091 ⇧	0.0020 ⇔
3-Year High Pressure Safety Injection Unavailability	0.0001	0.0037	0.0012 ⇧	0.0001 ⇧	0.0001 ⇧
Reliability					
WANO NPI (Index)	95.19	62.46	60.84 ⇧	60.93 ⇔	95.67 ⇔
2-Year Forced Loss Rate (%)	0.68	3.79	37.90 ⇩	18.19 ⇩	0.93 ⇧
2-Year Unit Capability Factor (%)	90.97	84.31	56.6 ⇩	73.17 ⇔	91.99 ⇔
2-Year Chemistry Performance Indicator (Index)	1.00	1.01	1.13 ⇧	1.25 ⇩	1.00 ⇔
1-Year Online Elective Maintenance (work orders/unit)	218	278	425 ⇧	695 ⇧	311 ⇧
1-Year Online Corrective Maintenance (work orders/unit)	4	7	14 ⇧	28 ⇧	11 ⇧
Value for Money					
3-Year Total Generating Costs per MWh ($/Net MWh)	28.66	32.31	92.27 ⇧	58.68 ⇔	30.08 ⇔
3-Year Non-Fuel Operating Costs per MWh ($/Net MWh)	18.06	21.28	82.62 ⇧	50.95 ⇔	25.10 ⇔
3-Year Fuel Costs per MWh ($/Net MWh)	5.02	5.37	2.64 ⇔	2.68 ⇔	2.62 ⇔
3-Year Capital Costs per MW DER	32.79	46.22	32.07 ⇩	32.44 ⇧	18.79 ⇔

*Panel used for WANO quartile and median data was All COG CANDU

⇧ = overall upward trend during reporting period

⇩ = overall declining trend during reporting period

⇔ = consistent performance during the reporting period

Green = best quartile performance/max NPI points achieved if applicable
White = 2nd quartile performance
Yellow = 3rd quartile performance
Red = lowest quartile performance

Table 2: Plant Level Performance Summary

2009 Benchmarking Results

Metric	NPI Max	2009 Actuals				
		Best Quartile	Median	Pickering A	Pickering B	Darlington
Safety						
All Injury Rate (#/200k hours worked)		1.13	N/A[1]	1.11	0.64	0.75
2-Year Industrial Safety Accident Rate (#/200k hours worked)	0.20	0.03	0.07	0.21 ⇩	0.11	0.06
2-Year Collective Radiation Exposure (man-rem per unit)	80.00	67.78	93.58	78.01	93.10 ⇧	61.44 ⇧
Airborne Tritium Emissions (Curies) per Unit[2]		1,878	3,784	7,073 ⇩	1,628 ⇧	1,081
Fuel Reliability (microcuries per gram)	0.000500	0.000001	0.000041	0.000041 ⇧	0.000056 ⇧	0.000247
2-Year Reactor Trip Rate (# per 7,000 hours)	0.50	0.00	0.21	0.74	0.27	0.00
3-Year Auxiliary Feedwater System Unavailability (#)	0.0200	0.0002	0.0036	0.0063	0.0043	0.0000
3-Year Emergency AC Power Unavailability (#)	0.0250	0.0021	0.0093	0.0106	0.0107	0.0059
3-Year High Pressure Safety Injection Unavailability (#)	0.0200	0.0000	0.0006	0.0011	0.0001	0.0001
Reliability						
WANO NPI (Index)		92.6	70.8	61.1	70.2	95.1 ⇧
2-Year Forced Loss Rate (%)	1.00	0.42	1.98	26.66	14.63	1.13 ⇩
2-Year Unit Capability Factor (%)	92.0	91.2	85.2	68.0	77.7 ⇧	90.2 ⇩
2-Year Chemistry Performance Indicator (Index)	1.01	1.00	1.04	1.09 ⇧	1.11	1.01
1-Year Online Elective Maintenance (work orders per unit)		201	245	364	644	286
1-Year Online Corrective Maintenance (work orders per unit)		2	5	14	24	12
Value for Money						
3-Year Total Generating Costs per MWh ($ per Net MWh)		30.68	35.77	95.41	54.64	32.77
3-Year Non-Fuel Operating Costs per MWh ($ per Net MWh)		18.50	21.94	82.70	48.37	26.94
3-Year Fuel Costs per MWh ($ per Net MWh)		5.35	5.83	3.24	3.13	3.11
3-Year Capital Costs per MW DER (k$ per MW)		38.02	50.14	48.26 ⇩	20.81	21.19
Human Performance						
Human Performance Error Rate (# per ISAR hours)		0.00758	0.01332	0.01579	0.01052	0.00710

Notes

1. No median benchmark available.
2. 2009 benchmark data unavailable. 2008 used for benchmark and results.

Green = maximum NPI points achieved or best quartile performance

White = 2nd quartile performance

Yellow = 3rd quartile performance

Red = worst quartile performance

⇩ Declining Benchmark Quartile Performance vs. 2008

⇧ Improving Benchmark Quartile Performance vs. 2008

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2010 Plant Level Performance Summary

Metric	NPI Max	2010 Actuals				
		Best Quartile	Median	Pickering A	Pickering B	Darlington
Safety						
All Injury Rate (#/200k hours worked)		0.88	N/A[1]	0.77	0.60	0.74
Rolling Average Industrial Safety Accident Rate (#/200k hours worked)	0.20	0.05	0.10	0.14 ⇧	0.07	0.09
Rolling Average Collective Radiation Exposure (Person-rem per unit)	80.00	68.64	96.73	138.30 ⇩	93.00	71.55
Airborne Tritium Emissions (Curies) per Unit[2]		2,041	3,784	3,790 ⇧	1,953	969
Fuel Reliability (microcuries per gram)	0.000500	0.000001	0.000036	0.003460 ⇩	0.000205	0.000241
2-Year Reactor Trip Rate (# per 7,000 hours)	0.50	0.06	0.22	0.77	0.24	0.12
3-Year Auxiliary Feedwater System Unavailability (#)	0.0200	0.0000	0.0006	0.0003	0.0000	0.0000
3-Year Emergency AC Power Unavailability (#)	0.0250	0.0008	0.0077	0.0088	0.0125	0.0067
3-Year High Pressure Safety Injection Unavailability (#)	0.0200	0.0000	0.0005	0.0010	0.0000	0.0001
Reliability						
WANO NPI (Index)		86.7	77.4	47.7 ⇩	72.6	94.1
Rolling Average Forced Loss Rate (%)	1.00	1.40	3.35	22.52	5.06	1.84
Rolling Average Unit Capability Factor (%)	92.0	91.7	83.7	63.3	80.2	89.4
Rolling Average Chemistry Performance Indicator (Index)	1.01	1.00	1.02	1.24 ⇩	1.09 ⇧	1.03 ⇩
1-Year Online Elective Maintenance (work orders per unit)[3]		213	261	333 ⇧	544	281
1-Year Online Corrective Maintenance (work orders per unit)[3]		2	4	14	29	9
Value for Money						
3-Year Total Generating Costs per MWh ($ per Net MWh)		32.54	38.53	90.21	54.79	33.55
3-Year Non-Fuel Operating Costs per MWh ($ per Net MWh)		19.00	23.13	75.51	48.49	27.09
3-Year Fuel Costs per MWh ($ per Net MWh)		5.92	6.37	3.70	3.70	3.71
3-Year Capital Costs per MW DER (k$ per MW)		46.30	62.80	62.80	17.41	21.28
Human Performance						
18-Month Human Performance Error Rate (# per 10k ISAR hours)		0.00700	0.01000	0.01150	0.00920	0.00700

Notes

1. No median benchmark available.
2. 2008 data is used for non-OPG CANDU plants because 2010 data is unavailable at the time of benchmarking.
3. Last backlog benchmark in 2010 was as of June 1, 2010.

Green = maximum NPI points achieved or best quartile performance

White = 2nd quartile performance

Yellow = 3rd quartile performance

Red = worst quartile performance

⇩ Declining Benchmark Quartile Performance vs. 2009

⇧ Improving Benchmark Quartile Performance vs. 2009

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2011 Plant Level Performance Summary

Metric	NPI Max	2011 Actuals			
		Best Quartile	Median	Pickering	Darlington
Safety					
All Injury Rate (#/200k hours worked)		0.89	N/A[1]	0.31	0.18
Rolling Average Industrial Safety Accident Rate (#/200k hours worked)	0.20	0.00	0.06	0.04	0.09
Rolling Average Collective Radiation Exposure (Person-rem per unit)	80.00	59.90	110.07	110.07 ⇧	71.12
Airborne Tritium Emissions (Curies) per Unit[2]		969	3,366	2,565	969
Fuel Reliability Index (microcuries per gram)	0.000500	0.000015	0.000154	0.000175 ⇧	0.001133 ⇩
2-Year Reactor Trip Rate (# per 7,000 hours)	0.50	0.00	0.10	0.60 ⇩	0.21
3-Year Auxiliary Feedwater System Unavailability (#)	0.0200	0.0000	0.0026	0.0044	0.0000
3-Year Emergency AC Power Unavailability (#)	0.0250	0.0005	0.0067	0.0107	0.0067
3-Year High Pressure Safety Injection Unavailability (#)	0.0200	0.0000	0.0001	0.0001	0.0000
Reliability					
WANO NPI (Index)		91.4	84.6	66.1	92.8
Rolling Average Forced Loss Rate (%)	1.00	1.14	1.90	10.34	1.80
Rolling Average Unit Capability Factor (%)	92.0	90.5	85.6	72.5	89.6
Rolling Average Chemistry Performance Indicator (Index)	1.01	1.00	1.01	1.10	1.03
1-Year On-line Deficient Maintenance Backlog (work orders per unit)[3]		260	378	301	266
1-Year On-line Corrective Maintenance Backlog (work orders per unit)[3]		33	52	160	121
Value for Money					
3-Year Total Generating Cost per MWh ($ per Net MWh)		34.21	41.28	65.86	33.05 ⇧
3-Year Non-Fuel Operating Cost per MWh ($ per Net MWh)		20.78	24.40	56.54	26.42
3-Year Fuel Cost per MWh ($ per Net MWh)		6.50	7.20	4.27	4.24
3-Year Capital Cost per MW DER (k$ per MW)		48.39	72.19	32.54	18.54
Human Performance					
18-Month Human Performance Error Rate (# per 10k ISAR hours)		0.00500	0.00700	0.00669 ⇧	0.00587 ⇩

Notes

1. No median benchmark available.
2. 2010 data is used because 2011 results were unavailable at the time of benchmarking.
3. INPO set a new standard for classifying work order backlogs with the issuance of AP-928 Work Management Process Description, revision 3, in June 2010.

New metrics have been implemented industry-wide to ensure more effective and accurate comparisons between utilities. Data collected is as of September 2011.

Green = maximum NPI points achieved or best quartile performance

White = 2nd quartile performance

Yellow = 3rd quartile performance

Red = worst quartile performance

⇩ Declining Benchmark Quartile Performance vs. 2010

⇧ Improving Benchmark Quartile Performance vs. 2010

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2012 Plant Level Performance Summary

Metric	NPI Max	2012 Actuals			
		Best Quartile	Median	Pickering	Darlington
Safety					
All Injury Rate (#/200k hours worked)		1.01	N/A[1]	0.33	0.34
Rolling Average Industrial Safety Accident Rate (#/200k hours worked)	0.20	0.00	0.03	0.03	0.10
Rolling Average Collective Radiation Exposure (Person-rem per unit)	80.00	40.50	83.32	124.06 ⇩	58.55
Airborne Tritium Emissions (Curies) per Unit[2]		1,196	2,577	2,491	973
Fuel Reliability Index (microcuries per gram)	0.000500	0.000001	0.000048	0.000129	0.000194 ⇧
2-Year Reactor Trip Rate (# per 7,000 hours)	0.50	0.000	0.104	0.517 ⇧	0.208
3-Year Auxiliary Feedwater System Unavailability (#)	0.0200	0.0000	0.0003	0.0116	0.0000
3-Year Emergency AC Power Unavailability (#)	0.0250	0.0005	0.0026	0.0037	0.0000
3-Year High Pressure Safety Injection Unavailability (#)	0.0200	0.00000	0.00006	0.0001	0.0000
Reliability					
WANO NPI (Index)		98.3	89.1	64.7	96.3 ⇩
Rolling Average Forced Loss Rate (%)	1.00	0.65	1.03	9.23	2.02 ⇩
Rolling Average Unit Capability Factor (%)	92.0	93.78	92.08	75.62	92.0 ⇧
Rolling Average Chemistry Performance Indicator (Index)	1.01	1.00	1.01	1.10	1.03
1-Year On-line Deficient Mairtenance Backlog (work orders per unit)		222	313	232	203 ⇧
1-Year On-line Corrective Maintenance Backlog (work orders per unit)		8	28	118	66
Value for Money					
3-Year Total Generating Cost per MWh ($ per Net MWh)		36.30	43.40	67.16	31.67
3-Year Non-Fuel Operating Cost per MWh ($ per Net MWh)		21.76	24.65	57.21	24.76
3-Year Fuel Cost per MWh ($ per Net MWh)		7.24	8.03	5.00	4.69
3-Year Capital Cost per MW DER (k$ per MW)		52.46	70.96	31.84	17.66
Human Performance					
18-Month Human Performance Error Rate (# per 10k ISAR hours)		0.00400	0.00700	0.00800 ⇩	0.00760 ⇩

Notes

1. No median benchmark available.
2. 2011 data is used because 2012 results were unavailable at the time of benchmarking.
   New metrics have been implemented industry-wide to ensure more effective and accurate comparisons between utilities. Data collected is as of December

Green = maximum NPI points achieved or best quartile performance

White = 2nd quartile performance

Yellow = 3rd quartile performance

Red = worst quartile performance

⇩ Declining Benchmark Quartile Performance vs. 2011

⇧ Improving Benchmark Quartile Performance vs. 2011

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2013 Plant Level Performance Summary

Metric	NPI Max	2013 Actuals			
		Best Quartile	Median	Pickering	Darlington
Safety					
All Injury Rate (#/200k hours worked)		0.69	N/A[1]	0.37	0.21
Rolling Average Industrial Safety Accident Rate (#/200k hours worked)	0.20	0.00	0.03	0.02	0.07
Rolling Average Collective Radiation Exposure (Person-rem per unit)	80.00	57.64	63.70	107.60 ⇩	64.80
Airborne Tritium Emissions (Curies) per Unit[2]		1,014	2,410	2,410	885
Fuel Reliability Index (microcuries per gram)	0.000500	0.000002	0.000165	0.000212	0.001888 ⇩
2-Year Reactor Trip Rate (# per 7,000 hours)	0.50	0.00	0.12	0.44 ⇧	0.12
3-Year Auxiliary Feedwater System Unavailability (#)	0.0200	0.0000	0.0009	0.0174	0.0000
3-Year Emergency AC Power Unavailability (#)	0.0250	0.0009	0.0042	0.0037	0.0000
3-Year High Pressure Safety Injection Unavailability (#)	0.0200	0.00000	0.00010	0.0001	0.0000
Reliability					
WANO NPI (Index)		90.7	80.1	67.5	90.8 ⇧
Rolling Average Forced Loss Rate (%)	1.00	0.58	1.70	8.50	2.52
Rolling Average Unit Capability Factor (%)	92.0	92.03	89.05	75.77 ⇩	90.44 ⇩
Rolling Average Chemistry Performance Indicator (Index)	1.01	1.00	1.01	1.10	1.01 ⇧
1-Year On-line Deficient Maintenance Backlog (work orders per unit)		209	280	215	184
1-Year On-line Corrective Maintenance Backlog (work orders per unit)		17	30	124	32 ⇧
Value for Money					
3-Year Total Generating Cost per MWh ($ per Net MWh)		38.79	44.89	67.16	34.42
3-Year Non-Fuel Operating Cost per MWh ($ per Net MWh)		22.76	25.83	57.15	26.69
3-Year Fuel Cost per MWh ($ per Net MWh)		7.87	8.63	5.48	4.98
3-Year Capital Cost per MW DER (k$ per MW)		50.88	66.83	29.47	21.56
Human Performance					
18-Month Human Performance Error Rate (# per 10k ISAR hours)		0.00200	0.00500	0.01050 ⇩	0.00670

Notes

1. No median benchmark available.
2. 2012 data is used because 2013 results were unavailable at the time of benchmarking.

Green = maximum NPI results achieved or 1st quartile performance

White = 2nd quartile performance

Yellow = 3rd quartile performance

Red = 4th quartile performance

⇩ Declining Benchmark Quartile Performance vs. 2012

⇧ Improving Benchmark Quartile Performance vs. 2012

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2014 Plant Level Performance Summary

Metric	NPI Max	2014 Actuals			
		Best Quartile	Median	Pickering	Darlington
Safety					
All Injury Rate (#/200k hours worked)		0.66	N/A[1]	0.22	0.31
Rolling Average[2] Industrial Safety Accident Rate (#/200k hours worked)	0.20	0.00	0.02	0.03	0.06
Rolling Average[2] Collective Radiation Exposure (Person-rem per unit)	80.00	42.25	61.60	82.24	69.06
Airborne Tritium Emissions (Curies) per Unit[3]		1,014	2,410	2,390	1,831 ⇩
Fuel Reliability Index (microcuries per gram)	0.000500	0.000001	0.000001	0.001580 ⇩	0.000158 ⇧
2-Year Reactor Trip Rate (# per 7,000 hours)	0.50	0.00	0.05	0.36	0.00
3-Year Auxiliary Feedwater System Unavailability (#)	0.0200	0.0000	0.0015	0.0181	0.0000
3-Year Emergency AC Power Unavailability (#)	0.0250	0.0001	0.0024	0.0000	0.0000
3-Year High Pressure Safety Injection Unavailability (#)	0.0200	0.00000	0.00003	0.0000	0.0000
Reliability					
WANO NPI (Index)		92.9	85.8	64.3	92.1 ⇩
Rolling Average[2] Forced Loss Rate (%)	1.00	1.03	1.29	10.08	2.85
Rolling Average[2] Unit Capability Factor (%)	92.0	89.44	86.49	74.50	89.41
Rolling Average[2] Chemistry Performance Indicator (Index)	1.01	1.00	1.00	1.04 ⇧	1.00
1-Year On-line Deficient Maintenance Backlog (work orders per unit)		159	212	276 ⇩	176 ⇩
1-Year On-line Corrective Maintenance Backlog (work orders per unit)		11	20	160	20 ⇧
Value for Money					
3-Year Total Generating Cost per MWh ($ per Net MWh)		38.71	44.61	67.93	37.73
3-Year Non-Fuel Operating Cost per MWh ($ per Net MWh)		22.68	25.83	56.94	28.55
3-Year Fuel Cost per MWh ($ per Net MWh)		8.08	8.79	5.74	5.13
3-Year Capital Cost per MW DER (k$ per MW)		49.08	63.95	34.20	31.30
Human Performance					
18-Month Human Performance Error Rate (# per 10k ISAR and contractor hours)		0.00200	0.00400	0.00890	0.00620

Notes
1. No median benchmark available.
2. Indicates a 2-Year Rolling Average for Pickering and a 3-Year Rolling Average for Darlington.
3. 2012 data is used because 2013 and 2014 results were unavailable at the time of benchmarking.

Green = maximum NPI results achieved or best quartile performance

White = 2nd quartile performance

Yellow = 3rd quartile performance

Red = 4th quartile performance

⇩ Declining Benchmark Quartile Performance vs. 2013

⇧ Improving Benchmark Quartile Performance vs. 2013

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2015 Plant Level Performance Summary

Metric	NPI Max	2015 Actuals			
		Best Quartile	Median	Pickering	Darlington
Safety					
All Injury Rate (#/200k hours worked)		0.69	N/A[1]	0.44	0.22
Rolling Average[2] Industrial Safety Accident Rate (#/200k hours worked)	0.20	0.00	0.00	0.05	0.08
Rolling Average[2] Collective Radiation Exposure (Person-rem per unit)	80.00	38.17	48.53	97.72	79.55
Airborne Tritium Emissions (Curies) per Unit[3]		1,192	1,784	2,409 ⇩	1,313
Fuel Reliability Index (microcuries per gram)	0.000500	0.000001	0.000001	0.000421 ⇧	0.000122
2-Year Reactor Trip Rate (# per 7,000 hours)	0.50	0.00	0.06	0.17	0.13
3-Year Auxiliary Feedwater System Unavailability (#)	0.0200	0.0000	0.0050	0.0115	0.0000
3-Year Emergency AC Power Unavailability (#)	0.0250	0.0006	0.0041	0.0030	0.0000
3-Year High Pressure Safety Injection Unavailability (#)	0.0200	0.0000	0.0000	0.0000	0.0000
Reliability					
WANO NPI (Index)		93.5	89.4	68.5	83.7 ⇩
Rolling Average[2] Forced Loss Rate (%)	1.00	0.38	1.46	6.85	3.65
Rolling Average[2] Unit Capability Factor (%)	92.0	91.31	88.05	77.32	83.96 ⇩
Rolling Average[2] Chemistry Performance Indicator (Index)	1.01	1.00	1.00	1.06 ⇩	1.00
1-Year On-line Deficient Maintenance Backlog (work orders per unit)		116	160	251 ⇩	174 ⇩
1-Year On-line Corrective Maintenance Backlog (work orders per unit)		7	15	125	24 ⇩
Value for Money					
3-Year Total Generating Cost per MWh ($ per Net MWh)		38.93	44.38	67.36	44.38 ⇩
3-Year Non-Fuel Operating Cost per MWh ($ per Net MWh)		22.60	25.89	56.49	33.19 ⇩
3-Year Fuel Cost per MWh ($ per Net MWh)		7.97	8.73	5.71	5.18
3-Year Capital Cost per MW DER (k$ per MW)		47.33	63.63	33.86	43.52
Human Performance					
18-Month Human Performance Error Rate (# per 10k ISAR and contractor hours)		0.00100	0.00300	0.00550 ⇧	0.00310

Notes
1. No median benchmark available.
2. Indicates a 2-Year Rolling Average for Pickering and a 3-Year Rolling Average for Darlington.
3. 2014 data is used because 2015 results were unavailable at the time of benchmarking.

Green = maximum NPI results achieved or best quartile performance

White = 2nd quartile performance

Yellow = 3rd quartile performance

Red = 4th quartile performance

⇩ Declining Benchmark Quartile Performance vs. 2014

⇧ Improving Benchmark Quartile Performance vs. 2014

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