Facility Specific Standard Variance Data Sheet

Directions: Please complete this form electronically. Record information in the space provided. Select checkboxes by double clicking on them. Do not delete or alter any fields. For citations, include page number and section if applicable. Please ensure that all data requested are included and as complete as possible. Attach additional sheets if needed.

Section I: General Information

A. Name of Permittee: Wisconsin Power and Light Company

B. Facility Name: WPL Nelson Dewey Generating Station

C. Submitted by: Wisconsin Department of Natural Resources

D. State: Wisconsin **Substance:** Mercury **Date completed:** March 24, 2016

E. Permit #: WI-0002381-07 **WQSTS #:** (EPA USE ONLY)

F. Duration of Variance **Start Date:** July 1, 2016 **End Date:** June 30, 2021

G. Date of Variance Application: December 30, 2015

H. Is this permit a:
☐ **First time submittal for variance**
☒ **Renewal of a previous submittal for variance** *(Complete Section X)*

I. Description of proposed variance:
The proposed effluent mercury variance is 4.68 ng/L daily maximum. This will replace the WQBEL limit of 1.3 ng/L monthly average and is a reduction from the current variance limit of 9.01 ng/L daily maximum.

Citation: An alternative mercury effluent limitation under s. NR 106.145, Wis. Adm. Code, represents a variance to water quality standards authorized by s. 283.15, Wis. Stats.

J. List of all who assisted in the compilation of data for this form

Name	Email	Phone	Contribution
Keith Pierce	Keith.Pierce@Wisconsin.gov	608-266-1198	All sections
Nasrin Mohajerani	Nasrindokht.Mohajerani@Wisconsin.gov	retired	Effluent limits, data analysis

Section II: Criteria and Variance Information

A. Water Quality Standard from which variance is sought: 1.3 ng/L Wildlife Criterion

B. List other criteria likely to be affected by variance: 1.5 ng/L Human Threshold Criterion

C. Source of Substance: Source of substance is unknown. The approach taken in this variance request is to focus on the most likely set of sources (see Section IX.B) and evaluate the result.

D. Ambient Substance Concentration: 2.12 ng/L mean, 2.89 ng/L 30-day P99 (see attached calculations). The river site number 24 near Buffalo approximately 100 miles north has a mean background level of 4.69 ng/L (see WQBEL memo).
☒ **Measured** ☐ **Estimated**
☐ **Default** ☐ **Unknown**

E. If measured or estimated, what was the basis? Include citation.
Based on 58 grab samples measured by permittee at facility intake monthly from January 2011 through October 2015 (Sampling Point 705). The 30-day P99 was calculated using the reasonable potential evaluation procedures in s. NR 106.05, Wis. Adm. Code (see attached calculations).

F. Average effluent discharge rate: 2.56 MGD (annual average) **Maximum effluent discharge rate:** 3.65 MGD (peak daily)

The implementation of retirement will affect flow rates.

G. Effluent Substance Concentration: 2.26 ng/L 30-day P99 and 1.87 ng/L mean
☒ **Measured** ☐ **Estimated**
☐ **Default** ☐ **Unknown**

H. If measured or estimated, what was the basis? Include Citation.
The concentrations were calculated using the permit required monitoring for mercury from January 2011 through October 2015. See the WQBEL memo dated February 25, 2016.

I. Level currently achievable (LCA): 4.68 ng/L daily maximum

J. Variance Limit: 4.68 ng/L daily maximum

What data were used to calculate the LCA, and how was the LCA derived? The LCA was calculated using the permit required monitoring for mercury. The permittee collected 58 valid test results for mercury from January 2011 through October 2015. The LCA is set at the 1-day P99 as a daily maximum. See the WQBEL memo dated January 20, 2016.

Citation: s. NR 106.145(5), Wis. Adm. Code.

K. Explain the basis used to determine the variance limit (which must be ≤ LCA). Include citation.
The variance limit is set at the LCA using the 1 Day P99 as a daily maximum limit. The limit is established in accordance with s. NR 106.145(5), Wis. Adm. Code.

L. Select all factors applicable as the basis for the variance provided under 40 CFR 131.10(g). Summarize justification below: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☒ 6

Section NR 106.145(1), Wis. Adm. Code, outlines several findings that justify variances for mercury. The Department considers treating to produce effluent at concentrations to meet the limit to be technically and economically infeasible. The Department intended that this conclusion be generally applicable to all dischargers of mercury which produce large volumes of effluent with extremely low mercury concentrations.
Citation: Assessing the Economic Impacts of the Proposed Ohio EPA Water Rules on the Ohio Economy, April 24, 1997, Ohio Environmental Protection Agency, Division of Surface Water and Foster Wheeler Environmental Corporation and DRI/McGraw-Hill in support of Amended and New Rules in OAC Chapters 3745-1,-2, and -33.

Section III: Location Information

A. Counties in which water quality is potentially impacted: Grant

B. Receiving waterbody at discharge point: Mississippi River

C. Flows into which stream/river? Main stem **How many miles downstream?** N/A

D. Coordinates of discharge point (UTM or Lat/Long): Lat: 42.7257/Long: -91.0159

E. What are the designated uses associated with this waterbody?
Warmwater sportfish, non-public water supply

F. What is the distance from the point of discharge to the point downstream where the concentration of the substance falls to less than or equal to the chronic criterion of the substance for aquatic life protection?
Zero: ambient mercury concentrations in surface water resulting from the variance will be substantially less than levels that result in direct toxicity to aquatic organisms. EPA's current chronic aquatic life criterion for mercury is 0.9081 µg/L, which is approximately three orders of magnitude greater than the wildlife criteria (0.0013 µg/L). Wisconsin's criteria are 0.44 µg/L and 0.83 µg/L for chronic and acute toxicity, respectively.

G. **Provide the equation used to calculate that distance:** See above.

H. **Identify all other variance permittees for the same substance which discharge to the same stream, river, or waterbody in a location where the effects of the combined variances would have an additive effect on the waterbody:** None. The nearest variance for mercury is approximately 22 miles upriver at Prairie Du Chien WWTF, permit number 0020257-08, variance limit of 4.6 ng/L daily maximum.

Please attach a map, photographs, or a simple schematic showing the location of the discharge point as well as all variances for the substance currently draining to this waterbody on a separate sheet

I. Is the receiving waterbody on the CWA 303(d) list? If yes, please list the impairments below. ☒ Yes ☐ No ☐ Unknown

River Mile	Pollutant	Impairment
Mississippi River at River Mile 608 in Pool 11	**PCBs**	Contaminated Fish Tissue
Mississippi River at River Mile 608 in Pool 11	**Phosphorus**	Water Quality Use Restriction
Mississippi River at River Mile 608 in Pool 11	**Mercury**	Contaminated Fish Tissue

Section IV: Pretreatment (Not applicable)

Section V: Public Notice

A. Has a public notice been given for this proposed variance? See below. ☒ Yes ☐ No

B. If yes, was a public hearing held as well? See below. ☐ Yes ☐ No ☒ N/A

C. What type of notice was given? See below. ☒ Notice of variance included in notice for permit ☐ Separate notice of variance

D. Date of public notice: Scheduled April 7, 2016 **Date of hearing:** Scheduled May 25, 2016

E. Were comments received from the public in regards to this notice or hearing? See above. ☐ Yes ☐ No See above.

Section VI: Human Health

A. Is the receiving water designated as a Public Water Supply? ☐ Yes ☒ No

B. Applicable criteria affected by variance: 1.5 ng/L Human Threshold Criterion

C. Identify any expected impacts that the variance may have upon human health, and include any citations:

- The proposed variance will not adversely affect human health directly through the drinking water because public water supply is not a designated use for the river.
- Wisconsin's fish consumption advisory program is designed to mitigate the effect of any ambient mercury concentration above the 1.5 ng/L water quality criterion for the protection of the fish-consuming human population by providing advice to the public to guide them on the amount of fish that may be consumed safely.
- Given the lack of wastewater treatment technologies capable of reducing mercury concentrations to achieve a 1.3 ng/L effluent limit, granting a variance in this situation is consistent with protecting the public health, safety and welfare because of the substantial public health and safety benefits of providing wastewater treatment, the continued commitment towards further mercury pollutant minimization, the Wisconsin fish advisory program, and the limited impact of the elevated effluent concentrations given the background mercury concentrations.
- DNR's findings suggest that mercury in walleye from Wisconsin lakes changed in the range of –0.5 to 0.8% per year depending on geographical position in the state during the period of 1982–2005. These trends may reflect geographically differing temporal trends in the amount of mercury deposited to Wisconsin lakes. However, long-term changes in other factors, such as water chemistry, fish growth rates, and lake levels, known to impact mercury bioavailability and accumulation may also be important. (Temporal trends of mercury concentrations in Wisconsin walleye (Sander vitreus), 1982–2005, Paul W. Rasmussen, Candy S. Schrank, Patrick A. Campfield. Ecotoxicology (2007) 16:541–550)

Section VII: Aquatic Life and Environmental Impact

A. Aquatic life use designation of receiving water: Warmwater sportfish - s. NR 104.25, Wis. Adm. Code.

B. Applicable criteria affected by variance: Acute = 0.83 µg/L
Chronic = 0.44 µg/L

C. Identify any environmental impacts to aquatic life expected to occur with this variance, and include any citations:

The discharge at the concentration proposed with this variance is much less than the aquatic life criteria. This variance is not likely to adversely affect aquatic life. Long term monitoring indicates that mercury impacts are decreasing.

- Ambient mercury concentrations resulting from the variance will be substantially less than levels that result in direct toxicity to aquatic organisms. EPA's current chronic aquatic life criterion for mercury is 0.9081 µg/L, which is approximately three orders of magnitude greater than the wildlife criteria (0.0013 µg/L). Wisconsin's criteria are 0.44 and 0.83 µg/L for chronic and acute toxicity, respectively.
- Bald eagles (Haliaeetus leucocephalus) consume fish and waterfowl from surface waters, which puts them at risk of exposure to toxic levels of mercury due to bioaccumulation of mercury in their prey organisms. However, despite the potential for exposure, ambient surface water data show that in recent decades, mercury levels have not increased and bald eagle populations have continued to grow. This indicates that current ambient concentrations of mercury and mercury concentrations in prey organisms do not appear to be limiting recovery of bald eagle populations in Wisconsin. Although this variance will allow additional time to identify and control sources of mercury in discharges, the pollutant minimization component of the variances should result in a net reduction in the amount of mercury discharged to Wisconsin surface waters further reducing any risk to bald eagles. In addition, the pollutant minimization program will encourage other pollution prevention efforts which have a beneficial indirect effect of reducing the use and production of products and processes that use or contribute mercury to the environment. These efforts will also benefit bald eagles.
- Refer also to the discussion about mercury in walleye from Wisconsin lakes (above).

D. List any Endangered (LE) or Threatened (LT) species known or likely to occur within the affected area, and include any citations:

The following species are listed for Grant County:
Aconitum noveboracense, Northern Wild Monkshood, LT, Rare Plants
Cumberlandia monodonta, Spectacle Case, LE, Rare Mussels and Clams
Lampsilis higginsii, Higgins' Eye, LE, Rare Mussels and Clams
Lespedeza leptostachya, Prairie Bush-clover, LT, Rare Plants
Platanthera leucophaea, Prairie White-fringed Orchid, LT, Rare Plants
Plethobasus cyphyus, Bullhead, LE, Rare Mussels and Clams
Somatochlora hineana, Hine's Emerald, LE, Rare Dragonflies and Damselflies

Citation: and National Heritage Index (http://dnr.wi.gov/topic/NHI/Data.asp?tool=county

Section VIII: Economic Impact and Feasibility

A. What modifications would be necessary to comply with the current limits? Include any citations.

The Department did not evaluate what actions or modifications or other changes would be needed to meet limits based on the water quality standard. As discussed below, the Department considers treating to produce effluent at concentrations to meet the limit to be technically and economically infeasible.

B. Identify any expected environmental impacts that would result from further treatment, and include any citations:

Treatment will likely require construction and operation of brick and mortar infrastructure. Most treatments will require the following with associated impacts:

- slightly more water consumption
- slightly more energy use
- use of chemicals
- disposal of waste containing mercury and other pollutants
- brick and mortar and land for infrastructure

C. Is it technically and economically feasible for this permittee to modify the treatment process to reduce the level of the substance in the discharge? ☐ Yes ☒ No ☐ Unknown

In general, the Department considers treating to produce effluent at concentrations to meet the limit to be technically and economically infeasible. Specifically, for the Nelson Dewey facility, any evaluation of technical and economic feasibility is complicated by the ongoing retirement. As a result of retirement and continuing implementation of a PMP, mercury concentrations and mass of discharge are expected to continue to decline.

In 2010, another Alliant Energy location ran a two week pilot test with a mercury control technology on an effluent discharge. The pilot test was able to reduce mercury in the effluent by up to 80%. However, the pilot test was not able to achieve the 1.3 ng/L wildlife criterion for mercury. For this facility, if 80% reduction could be obtained the treatment would result in wastewater at around 0.5 ng/L on a 30-day P99 basis [(1 – 0.8) x 2.26 ng/L].

The pilot project treated effluent from a coal combustion residual pond system at 35 gallons per minute ("gpm"). The cost to purchase and install the 35 gpm system was between $750,000 to $1,000,000 dollars (not including inflation). A system that would need to be installed on the discharge of Outfall 002 would be required to treat up to 2,500 gpm based on data from pre-retirement; actual flows after retirement will be less. In addition, a building with heating and electricity to house the treatment system would need to be engineered and constructed. The Department has determined that it is appropriate to determine that treatment is not technically and economically feasible at this time, but during the term of the permit after retirement has been implemented data can be gathered to allow complete evaluation of feasibility of treatment of wastewater after retirement. The data will include concentration, flow rate, flow volume, temporal aspects and other variables.

An analysis of trends of mercury in the discharge and mercury measured in intake shows that the background levels of mercury in the intake water are probably a significant component of any discharge. When discharge data is grouped by calendar quarter the trend indicates there is a seasonal fluctuation in concentration (see attached figure). This is likely caused by Spring weather effects on the Mississippi River. When intake data and discharge data are compared, the trend indicates that discharge concentration is comparable or even less that intake concentration (see

attached figure). In conclusion, the quality of the Mississippi River is expected to be the most significant factor in post-retirement discharges.

D. If treatment is possible, is it possible to comply with the limits on the substance? ☐ Yes ☒ No ☐ Unknown

E. If yes, what prevents this from being done? Include any citations.
See above.

F. List any alternatives to current practices that have been considered, and why they have been rejected as a course of action, including any citations:
Following retirement any remaining mercury discharge will not be the result of continued use of coal or other fuels. Retirement will consist of various steps to clean and stabilize the site. All steps will be part of a normal retirement process; there are no meaningful alternatives to the practices that are followed for a standard retirement of a steam electric power plant. The permittee has addressed additional measures in the PMP for retirement activities.

Section IX: Compliance with Water Quality Standards

A. Describe all activities that have been, and are being, conducted to reduce the discharge of the substance into the receiving stream. This may include existing treatments and controls, consumer education, promising centralized or remote treatment technologies, planned research, etc. Include any citations.

The following actions were taken in the term of the current permit to reduce mercury discharge levels in an effort to meet or make progress towards meeting the mercury water quality based effluent limits (see December 30, 2015 variance application):

CHEMICALS
In 2009, the facility switched from mercury cell sodium hydroxide to membrane-grade sodium hydroxide. The cost of membrane-grade sodium hydroxide is substantially more expensive than that of the mercury cell variant. However, with the use of reverse osmosis, the amount of sodium hydroxide purchased is typically reduced by up to 90%. In the future, the facility will continue to review new chemicals considered for use for mercury.

LABORATORY REAGENTS
Expired reagents are disposed of properly and alternative methods and/or reagents are used. In the future, the facility will continue to use alternative methods or reagents, when practical, that could reduce the use of mercury at the site.

PROCESS MONITORING EQUIPMENT
Alternate monitoring methods and/or equipment, which contain no or lower concentrations of mercury, will continue to be replaced on an as-needed basis, when feasible. Such replaced equipment that did contain mercury will continue to be collected and properly disposed of.

ELECTRICAL EQUIPMENT
Switches and relays are replaced with non-mercury containing devices. Replaced equipment that did contain mercury are collected and properly disposed of.

LIGHTING EQUIPMENT
Light bulbs and batteries are located throughout the facility and may contain small amounts of mercury. As such, the facility utilizes a Used Light Bulb Program that includes the safe handling, storage, and ultimate disposal or recycling of lighting equipment. Recycling activities are employed for lead-acid batteries, NiCad dry batteries, and lamps. Table 1 of the variance application provides a summary of mercury reduction activities from 2011 thru 2014.

FLUE GAS MERCURY REDUCTIONS
In 2012, the facility completed installation and commenced use of a calcium bromide system to reduce mercury emission from Units 1 and 2. This system was designed to reduce mercury emissions from both Units by about one third. This will not applicable after retirement.

MERCURY CONTINUOUS EMISSIONS MONITORING *("CEM")*
A mercury CEM is installed in the stack for both Unit 1 and Unit 2 boilers that continuously monitors the mercury concentration. Once per week, the CEM performs an auto-calibration that utilizes a mercury chloride solution. This solution is ultimately captured and properly disposed of. This will not applicable after retirement.

B. Describe all actions that the permit requires the permittee to complete during the variance period to ensure reasonable progress towards attainment of the water quality standard. Include any citations.

- Monitoring of mercury.
- Implementation of the mercury PMP activities.
- Submittal of annual reports to provide the Department with an update of the effluent mercury concentration trends.

Section X: Compliance with Previous Permit *(Variance Reissuances Only)*

A. Date of previous submittal: 12/30/2009 **Date of EPA Approval:** 07/30/2010

B. Previous Permit #: WI-002381-06 **Previous WQSTS #:** (EPA USE ONLY)

C. Effluent substance concentration: 0.14 – 4.6 ng/L **Variance Limit:** 9.01 ng/L daily maximum

D. Target Value(s): 9.01 ng/L daily maximum **Achieved?** ☒ Yes ☐ No ☐ Partial

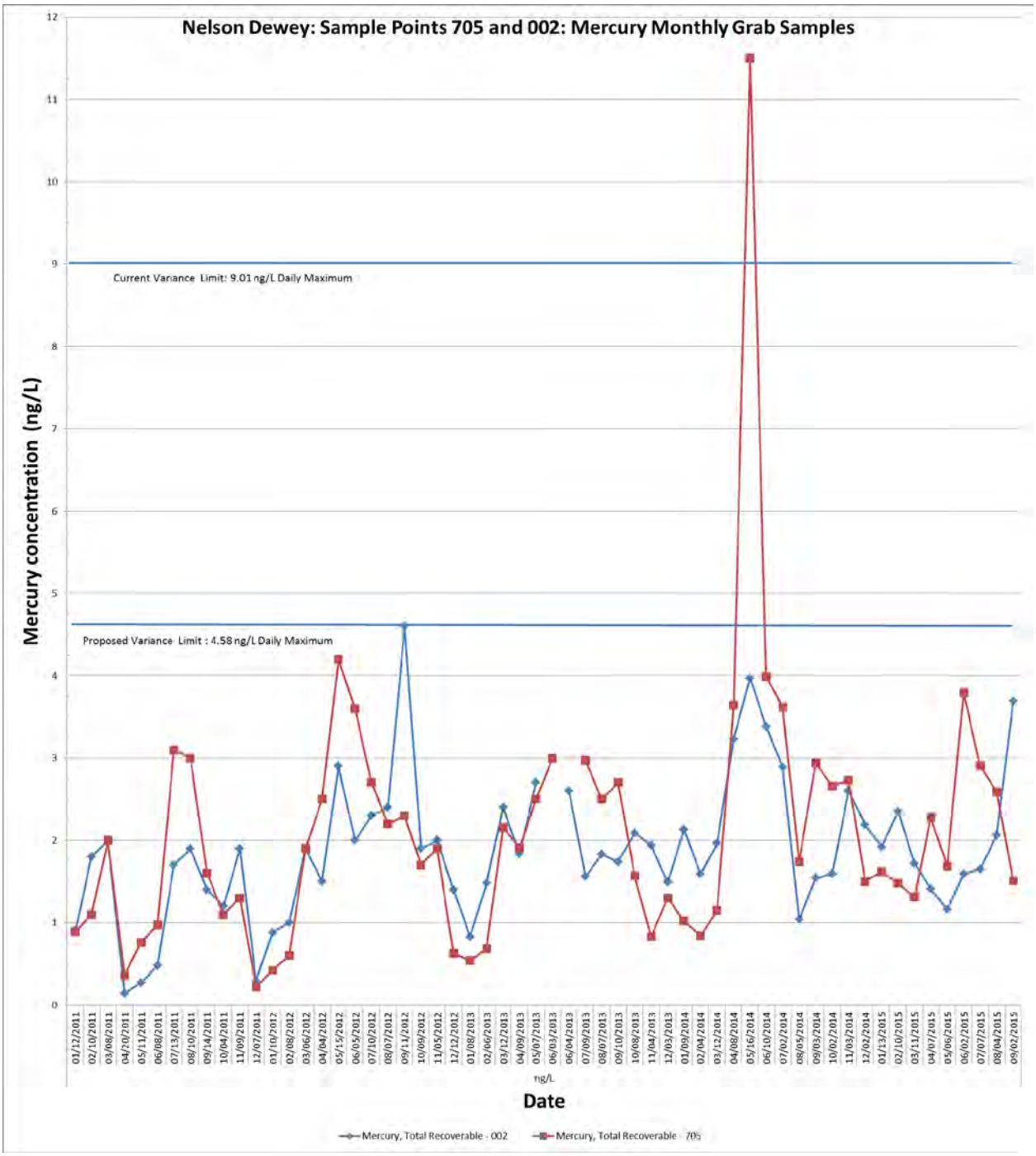
E. For renewals, list previous steps that were to be completed. Show whether these steps have been completed in compliance with the terms of the previous variance permit. Attach additional sheets if necessary.

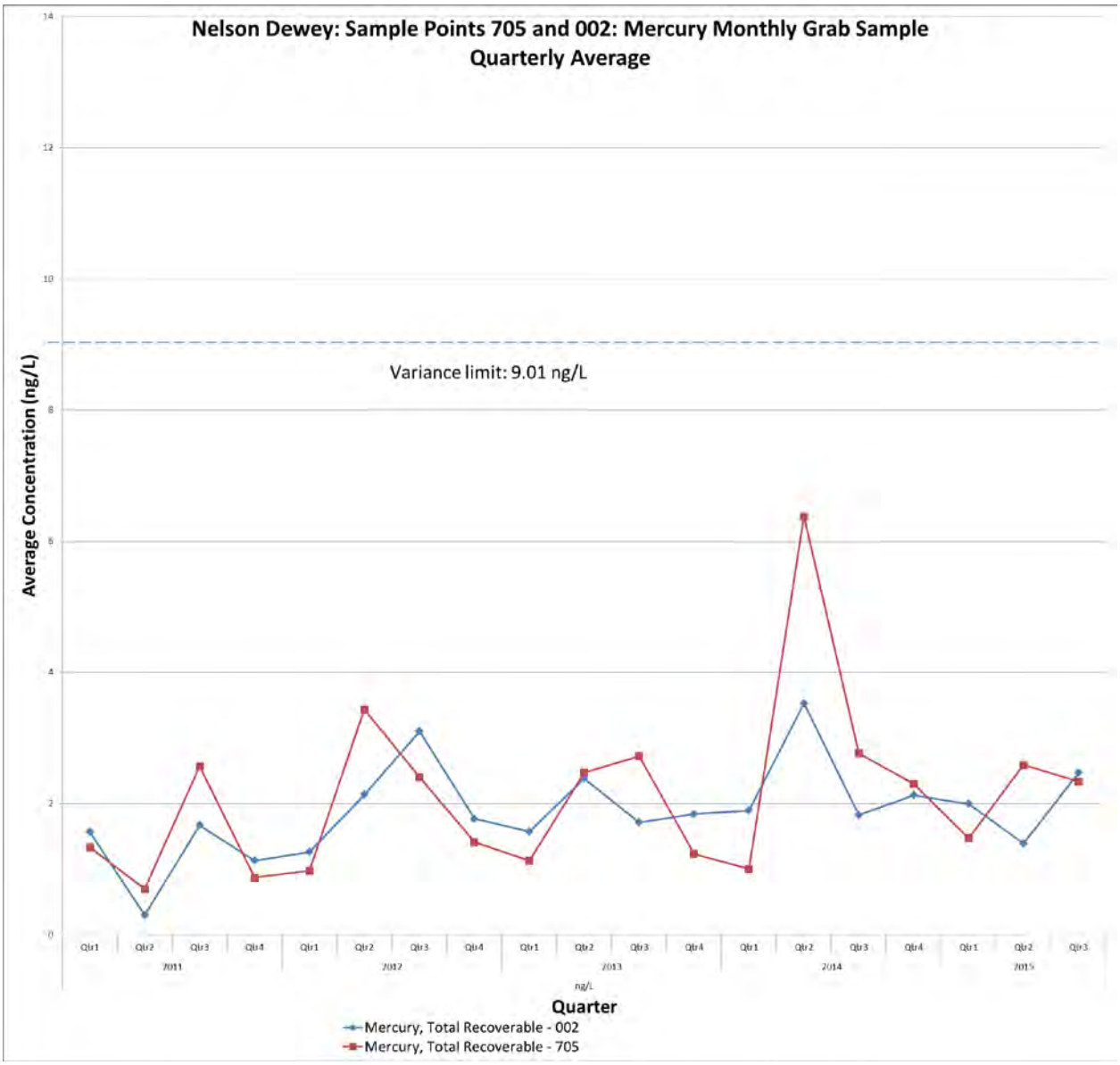
Condition of Previous Variance	Compliance
Monitor with monthly grab samples	☒ Yes ☐ No
Daily maximum limit of 9.01 ng/L	☒ Yes ☐ No
Annual PMP steps and reports	☒ Yes ☐ No

VARIABILITY ANALYSIS - OCER INFLUENT 705

SUBSTANCE:	Mercury		
NUMBER OF VALUES:	---		
TOTAL	58		
DETECTED	58		
NON-DETECTED	0		
d	0		
m	2.116793		
mean of all data			
s	1.60954		
	---	---	---
n	1	4	30
d^n	0	0	0
p	0.99	0.99	0.99
	3.034854	3.034854	3.034854
Z_p	2.326785	2.326785	2.326785
1+(s/m)^2	1.578158	1.578158	1.578158
(sigma_d)^2	0.456259	0.456259	0.456259
mu_d	0.521773	0.521773	0.521773
(sigma_dn)^2	0.456259	0.135002	0.019089
mu_dn	0.521773	0.682401	0.740358
P_99 exponent	2.093445	1.537324	1.06183
	---	---	---
P_99	8.112813	4.652126	2.891658
	---	---	---
minimum	0.22		
maximum	11.5		

Concentration (ng/L)	Date
0.89	01/12/2011
1.1	02/10/2011
2	03/08/2011
0.36	04/20/2011
0.76	05/11/2011
0.97	06/08/2011
3.1	07/13/2011
3	08/10/2011
1.6	09/14/2011
1.1	10/04/2011
1.3	11/09/2011
0.22	12/07/2011
0.42	01/10/2012
0.6	02/08/2012
1.9	03/06/2012
2.5	04/04/2012
4.2	05/15/2012
3.6	06/05/2012
2.7	07/10/2012
2.2	08/07/2012
2.3	09/11/2012
1.7	10/09/2012
1.9	11/05/2012
0.63	12/12/2012
0.54	01/08/2013
0.687	02/06/2013
2.16	03/12/2013
1.91	04/09/2013
2.5	05/07/2013
3	06/03/2013
2.97	07/09/2013
2.5	08/07/2013
2.7	09/10/2013
1.57	10/08/2013
0.828	11/04/2013
1.3	12/03/2013
1.02	01/09/2014
0.839	02/04/2014
1.15	03/12/2014
3.64	04/08/2014
11.5	05/16/2014
3.99	06/10/2014
3.62	07/02/2014
1.74	08/05/2014
2.94	09/03/2014
2.66	10/02/2014
2.73	11/03/2014
1.5	12/02/2014
1.62	01/13/2015
1.48	02/10/2015
1.31	03/11/2015
2.28	04/07/2015
1.69	05/06/2015
3.79	06/02/2015
2.9	07/07/2015
2.59	08/04/2015
1.51	09/02/2015
2.56	10/06/2015


Nelson Dewey: Sample Points 705 and 002: Mercury Monthly Grab Samples
Current Variance Limit: 9.01 ng/L Daily Maximum
Proposed Variance Limit : 4.58 ng/L Daily Maximum
Mercury concentration (ng/L)
ng/L
Date
Mercury, Total Recoverable - 002
Mercury, Total Recoverable - 705


Nelson Dewey: Sample Points 705 and 002: Mercury Monthly Grab Sample
Quarterly Average
Variance limit: 9.01 ng/L
Average Concentration (ng/L)
14
12
10
8
6
4
2
0
Qtr1
Qtr2
Qtr3
Qtr4
2011
2012
2013
2014
2015
ng/L
Quarter
Mercury, Total Recoverable - 002
Mercury, Total Recoverable - 705