DEQ/DWR
FACT SHEET FOR NPDES PERMIT DEVELOPMENT
NPDES No. NC0038377, Duke Energy Progress, LLC
Mayo Steam Electric Generating Plant

Facility Information	
Applicant/Facility Name:	Duke Energy Progress/Mayo Steam Electric Generating Plant
Applicant Address:	10660 Boston Road, Roxboro, NC 27573
Facility Address:	(same)
Permitted Flow	Not limited
Type of Waste:	99.8 % Industrial, 0.2% - domestic
Facility/Permit Status:	Existing/Renewal
County:	Person

Miscellaneous

Receiving Stream:	Mayo Reservoir and Crutchfield Branch	Regional Office:	RRO
Stream Classification:	WS-V and C	Quad	A23SW
303(d) Listed?:	No	Permit Writer:	Sergei Chernikov, Ph.D.
Subbasin:	030205 (Roanoke)	Date:	February 9, 2018
Drainage Area (mi^2):	N/A		
Summer 7Q10 (cfs)	0		
30Q2 (cfs):	0		
Average Flow (cfs):	0		
IWC (%):	100% (assumed, no modeling info.)		
Primary SIC Code:			

SUMMARY

This is a renewal for the Mayo Electric Generating Plant. The facility is a coal-fired electric generating plant with one unit rated at a maximum dependable capacity of 745 mw.

This revised draft permit incorporates changes made subsequent to a Public Hearing held on October 4, 2016 seeking comments to the original draft NPDES wastewater permit renewal for Mayo Steam Electric Generating Plant.

Water for plant uses is withdrawn from the Mayo Reservoir as required to make up evaporative losses from the cooling tower, boiler water and drinking water needs. This facility is subject to EPA effluent guideline limits per 40 CFR 423- Steam Electric Power Generating Point Source Category. The facility has a closed cycle cooling system (cooling tower), actual intake flow and design intake flow is less than 125 MGD. The facility has a dry fly ash handling system, dry bottom ash handling system, and one ash pond.

The mixing zone for Chlorides was granted to the facility in December of 2007. The daily maximum limit for Chlorides in the permit was an acute limit, monthly average was allowed to exceed the state water quality standard in the mixing zone, it was set at 672.0 mg/L and was based on the modeling information. However, the Chloride chronic standard was being met at the end of the mixing zone. The size of the mixing zone was established in accordance with the model. The facility requested the removal of the mixing zone with this renewal due to the installation of the Vapor Compressor Evaporator for FGD wastewater. The request was granted.

The facility is located in the Lower Piedmont area of the state, the applicable state water quality temperature standard is 32°C (89.6 F).

In response to North Carolina's Clean Air Initiative (Clean Smokestacks Bill of 2002), which requires the reduction of S0x and N0x from air emissions, the company installed Flue Gas Desulfurization (FGD) system. The FGD is essentially a scrubber system to remove S0x by mixing flue gas with a limestone slurry.

The FGD blowdown generates a flow of approximately 0.254 MGD, with relatively elevated concentrations of metals and chloride. Duke Energy Progress treats the FGD blowdown via VCE (vapor compression evaporator) whose purpose is to evaporate the majority of the waste water produced from the FGD scrubber system. The VCE became operational in February, 2015. It produces two waste streams, both are utilized in the plant processes. The concentrated wastewater is used for moisture conditioning of fly ash prior to sending to the landfill. The second stream is a clean distillate that is utilized to partially replace water withdrawal from Mayo Reservoir. The VCE system eliminates the FGD blowdown stream from Outfall 002, except during severe rain events.

The ash pond dam has two toe drains that are designed for the stability of the dam. The average discharge of both drains is approximately 11,000 gpd, the discharge is routed to the Crutchfield branch. The Crutchfield Branch does not discharge to the Mayo Reservoir.

The facility proposes to build a new Retention Basin to reroute all waste streams that are currently discharged to the ash basin. This change is necessary to decommission the existing ash pond and meet the requirements of Coal Ash Management Act. The Retention Basin will have a cell where various vacuumed sediments and solids can be decanted prior to disposal.

The facility is also constructing a new FGD settling basin, the waste from the basin will be treated by VCE.

The facility operates the following outfalls:

- Outfall 001. Cooling Tower System (lat. - 36° 31'28" long. – 78° 52'56"). Less than once per year the cooling towers and circulating water system are drained by gravity and discharged directly to Mayo Reservoir.

- Outfall 002. Ash Pond Treatment System (lat. - 36^0 32'03" long. – 78^0 53'27"). Outfall 002 discharges directly to Mayo Reservoir. The ash pond receives coal pile runoff, stormwater runoff, cooling tower blowdown, and various low volume wastes such as boiler blowdown, oily waste treatment, wastes/backwash from the water treatment processes including Reverse-Osmosis (RO) wastewater, plant area wash down water, equipment heat exchanger water, groundwater, yard sump overflows, occasional piping leakage from limestone slurry and FGD system, and treated domestic wastewater.

- Internal Outfall 008. Cooling tower blowdown is directly discharged to the ash pond. Cooling tower blowdown is indirectly discharged to Mayo Reservoir via the ash pond treatment system (Outfall 002).

- Internal Outfall 009**.** Discharge from the FGD blowdown treatment system. FGD blowdown is indirectly discharged to Mayo Reservoir via the ash pond treatment system (Outfall 002).

- Outfall 002A. Upon completion of construction, discharge from the new lined retention basin. **The flows from the ash basin will be re-directed to the retention basin when the construction of the retention basin is completed. At that point, the ash basin will no longer accept any wastewater.** Retention basin will accept wastes from holding cell (vacuumed sediments and solids), coal pile runoff, stormwater runoff, cooling tower blowdown, and various low volume wastes such as boiler blowdown, oily waste treatment, wastes/backwash from the water treatment processes, including Reverse-Osmosis (RO) wastewater, plant area wash down water, equipment heat exchanger water, groundwater, occasional piping leakage from limestone slurry and FGD system, chemical metal cleaning waste, and treated domestic wastewater. The wastewater from this outfall discharges to Mayo Reservoir via Outfall 002.

- Internal Outfall 002B. Yard sump overflows (contain all wastes routed to the new retention basin). The wastewater from this outfall discharges to Mayo Reservoir via Outfall 002.

- Internal outfall 011. Domestic wastewater plant. The wastewater from this outfall discharges to Mayo Reservoir via Outfall 002A.

- Outfalls 004 (lat. - 36^0 31'45" long. – 78^0 53'21"), 005 (lat. - 36^0 31'39" long. – 78^0 53'17"), 006c (lat. - 36^0 31'30" long. – 78^0 52'55"), 006d (lat. - 36^0 31'29" long. – 78^0 52'57"), and 006e (lat. - 36^0 31'29" long. – 78^0 52'57"). These are former stormwater outfalls, they primarily contain stormwater and groundwater with some additional dust suppression irrigation, and cooling tower drift. These outfalls discharge to Mayo Reservoir.

ASH POND DAMS

Seepage through earthen dams is common and is an expected consequence of impounding water with an earthen embankment. Even the tightest, best-compacted

clays cannot prevent some water from seeping through them. Seepage is not necessarily an indication that a dam has structural problems, but should be kept in check through various engineering controls and regularly monitored for changes in quantity or quality which, over time, may result in dam failure.

REASONABLE POTENTIAL ANALYSIS(RPA)-ASH POND AND SEEPS

The Division conducted EPA-recommended analyses to determine the reasonable potential for toxicants to be discharged at levels exceeding water quality standards/EPA criteria by this facility. For the purposes of the RPA, the background concentrations for all parameters were assumed to be below detections level. The RPA uses 95% probability level and 95% confidence basis in accordance with the EPA Guidance entitled "Technical Support Document for Water Quality-based Toxics Control." The RPA included evaluation of dissolved metals' standards, utilizing a default hardness value of 25 mg/L $CaCO_3$ for hardness-dependent metals. The RPA spreadsheets are attached to this Fact Sheet.

a) RPA for Decanting of Ash Pond (Outfall 002).
The RPA was conducted for decanting of Ash Pond, the calculations included: As, Be, Cd, Chlorides, Total Phenolic Compounds, Cr, Cu, CN, F, Pb, Hg, Mo, Ni, Se, Ag, Zn, Ba, Sb, SO^4, and Tl (please see attached). The flow of 10.2 MGD was used for the analysis. The discharge data on the EPA Form 2C was used for the RPA, it was supplemented by the analysis of the free standing water in the ash pond. The analysis indicates reasonable potential to violate the surface water quality standards or EPA criteria for the following parameters: Be, Chlorides, and F. The appropriate limits were added or maintained in the permit.

b) RPA for Dewatering of Ash pond (Outfall 002).
To meet the requirements of the Coal Ash Management Act of 2014, the facility needs to dewater two ash ponds by removing the interstitial water and excavate the ash to deposit it in landfills. The facility's highest discharge rate from the dewatering process will be 2.0 MGD. The facility submitted data for the standing surface water in the ash ponds, interstitial water in the ash, and interstitial ash water that was treated by filters of various sizes. To evaluate the impact of the dewatering on the receiving stream the RPA was conducted for the wastewater that will be generated by the dewatering process. To introduce a margin of safety, the highest measured concentration for a particular parameter was used. The RPA was conducted for As, Cd, Chlorides, Cr, Cu, F, Pb, Hg, Mo, Ni, Se, Zn, Ba, Sb, SO4, and Tl. The analysis indicates reasonable potential to violate the surface water quality standards or EPA criteria for the following parameters: As, Cd, Cr (III), Cr (VI), Cu, Pb, Ni, Zn, Ba, and Tl. The appropriate limits were added to the permit.

The proposed permit requires that EPA methods 200.7 or 200.8 (or the most current versions) shall be used for analyses of all metals except for total mercury.

MERCURY EVALUATION- OUTFALL 002 (ASH POND)

The State of North Carolina has a state-wide mercury impairment. A TMDL has been developed to address this issue in 2012. The TMDL included the implementation

strategy, both documents were approved by EPA in 2012. The mercury evaluation was conducted in accordance with the Permitting Guidelines for Statewide Mercury TMDL.

Year	2014	2015	2016
Annual average concentration (ng/L)	1.85	0.91	0.1
Maximum sampling result (ng/L)	7.05	1.18	0.1
Number of samples	28	43	13

The allowable mercury concentration for this facility is 12.0 ng/L. All annual average mercury concentrations are below the allowable level. All maximum sampling results are below the TBEL of 47.0 ng/L. Based on the Permitting Guidelines for Statewide Mercury TMDL, the limits are not required.

CWA SECTION 316(a) TEMPERATURE VARIANCE
This section is not applicable since the facility has a closed cycle cooling system, which is considered a BAT. Effluent temperature is monitored daily at the Outfall 001, 002, and 002A, and instream temperature is monitored semi-annually to assure compliance with the state temperature standard.

CWA SECTION 316(b)
The permittee shall comply with the Cooling Water Intake Structure Rule per 40 CFR 125.95. The Division approved the facility request for an alternative schedule in accordance with 40 CFR 125.95(a)(2). The permittee shall submit all the materials required by the Rule with the next renewal application. The Actual Intake Flow and Design Intake Flow for this station is less than 125 MGD.

The rule requires the Director to establish interim BTA requirements in the permit on a site-specific basis based on the Director's best professional judgment in accordance with §125.90(b) and 40 CFR 401.14. The existing closed-cycle system at Mayo is one of the pre-approved compliance alternatives for impingement in accordance with §125.94(c)(1). EPA also considered it as a pre-approved BTA for entrainment, but excluded it from the rule due to the cost concerns. Based on this information the DEQ has determined that the existing closed-cycle cooling system meets the requirements for an interim BTA.

INSTREAM MONITORING– OUTFALL 002 (ASH POND)
The proposed permit will require a monthly monitoring for total arsenic, total selenium, total mercury, total chromium, dissolved lead, dissolved cadmium, dissolved copper, dissolved zinc, total bromide, total hardness (as $CaCO_3$), turbidity, temperature, and total dissolved solids (TDS).

TOXICITY TESTING-OUTFALL 002 (ASH POND)
Current Requirement: Outfall 002 – Acute P/F @ 90% using *Pimephalis promelas*
Recommended Requirement: Outfall 002 – Acute P/F @ 90% using *Pimephalis promelas*

This facility has passed all toxicity tests (22 out of 22) during the previous permit cycle, please see attached.

For the purposes of the permitting, the long term average flow was used in conjunction with the 7Q10 summer flow to calculate the percent effluent concentrations to be used for WET.

COMPLIANCE SUMMARY

During the last 5 years, the facility had 1 violations of the Fluoride limit (Outfall 002), please see attached.

PERMIT LIMITS DEVELOPMENT

- The Free Available Chlorine limits, Total Chromium Limits, Total Zinc Limits, and Priority Pollutant Limits (Outfall 001 and Outfall 008) were established in accordance with the 40 CFR 423.
- The limits for Oil and Grease and Total Suspended Solids (Outfall 002, Outfall 002A, Outfall 002B, Internal Outfall 009, Internal Outfall 011 (TSS only), Outfall 101, Outfall 102, Outfall 101A, Outfall 102A, Outfall 102B, Outfall 108, Outfall 110, Outfall 004, Outfall 005, Outfall 006a, Outfall 006c, Outfall 006d, Outfall 006e) were established in accordance with the 40 CFR 423.
- The pH limits (Outfall 001, Outfall 008, Outfall 002, Outfall 002A, Outfall 002B, Outfall 101, Outfall 102, Outfall 101A, Outfall 102A, Outfall 102B, Outfall 108, Outfall 110, Outfall 004, Outfall 005, Outfall 006a, Outfall 006c, Outfall 006d, and Outfall 006e in the permit are based on the North Carolina water quality standards (15A NCAC 2B .0200).
- The turbidity limit in the permit (Outfall 002) is based on the North Carolina water quality standards (15A NCAC 2B .0200).
- The Whole Effluent Toxicity limit (Outfall 002) is based on the requirements of 15A NCAC 2B .0500.
- The BOD and Fecal Coliform limits (Outfall 011) were established in accordance with the 40 CFR 133.
- The Technology Based Effluent Limits for Total Arsenic, Total Mercury, Total Selenium, and Nitrate/nitrite as N (Outfall 009) are based on the requirements of 40 CFR 423.
- The Water Quality Based Effluent Limits for Total Beryllium, Total Chlorides, and Total Fluoride in the permit (Outfall 002 – decanting) are based on the North Carolina water quality standards (15A NCAC 2B .0200) and EPA water quality criteria.
- The Water Quality Based Effluent Limits for Total Arsenic, Total Cadmium, Total Chlorides, Chromium (III), Chromium (VI), Total Copper, Total Lead, Total Nickel, Total Zinc, Total Barium, and Total Thallium in the permit (Outfall 002 – dewatering) are based on the North Carolina water quality standards (15A NCAC 2B .0200) and EPA water quality criteria.

PROPOSED CHANGES

- The effluent page for the ash pond with FGD wastewater was removed from the permit since **the facility eliminated the FGD discharge** by installing the Vapor Compression Evaporator (zero liquid discharge system).

- The daily maximum TSS limit was reduced to 50 mg/L from 100 mg/L (Outfall 002) to meet the requirements of 40 CFR 423.
- The limits for Total Beryllium, Total Chlorides, and Total Fluoride (Outfall 002 – decanting) were added to the permit based on the results of Reasonable Potential Analysis.
- The monitoring frequency for Total Copper and Total Arsenic were increased to Monthly from Quarterly (Outfall 002 - decanting) based on the review of the effluent data.
- The monitoring for Total Iron (Outfall 002-decanting) was removed due to the elimination the state standard for Iron during the last triennial review.
- The monitoring frequency for Total Selenium was reduced to Monthly from 2/Month (Outfall 002-decanting) based on the results of the Reasonable Potential Analysis.
- The monitoring for Total Chromium, Turbidity, Total Zinc, Total Mercury, Total Beryllium, Total Chlorides, Total Fluoride, Total Barium, Total Thallium, Total Antimony, Total Boron, and Temperature (Outfall 002-decanting) were added to the permit based on the review of the effluent data.
- The Selenium Study and Crutchfield Branch Special Conditions were eliminated from the permit, they are replaced with Outfalls 101 and 102 for toe drains. Please see A. (8.) and A. (9.).
- The monitoring frequency for the Whole Effluent Toxicity was increased to Monthly (Outfall 002 - Dewatering) to address the EPA comment.
- A separate effluent page for the dewatering of the ash pond (Outfall 002) was added to the permit. Please see Condition A. (4.).
- The following monitoring parameters were eliminated (Outfall 009) to be consistent with the latest update to 40 CFR 423: Total Beryllium, Total Cadmium, Total Chlorides, Total Chromium, Total Copper, Total Fluoride, Total Lead, Total Manganese, Total Nickel, Total Silver, Total Barium, Total Thallium, Total Vanadium, Total Antimony, Total Boron, Total Cobalt, Total Molybdenum, Total Zinc, and TSS.
- The Technology Based Effluent Limits for Total Arsenic, Total Mercury, Total Selenium, and Nitrate/nitrite as N were added to the permit (Outfall 009) based on the requirements in 40 CFR 423.
- The monitoring frequency for Total Arsenic, Total Mercury, Total Selenium, and Nitrate/nitrite as N was reduced to Quarterly (Outfall 009) based on the review of the effluent data.
- The turbidity limit was added to the permit (Outfall 002) to meet the state turbidity standard per 15A NCAC 2B .0211(3) (k).
- The Toe Drain Outfalls 101 and 102 (Please see A. (8.) and A. (9.)) were added to the permit.
- The Domestic Wastewater Treatment Plant Special Condition was added to the permit to assure compliance with the 40 CFR 133.102. Please see Special Condition A. (17.).
- The Additional Conditions and Definitions Special Condition was added to the permit. Please see Special Condition A. (18.).
- Federal regulations require electronic submittal of all discharge monitoring reports (DMRs) and program reports. The final NPDES Electronic Reporting Rule was adopted and became effective on December 21, 2015. The requirement to

begin reporting discharge monitoring data electronically using the NC DWR's Electronic Discharge Monitoring Report (eDMR) internet application has been added to your final NPDES permit. [See Special Condition A. (19.)]

For information on eDMR, registering for eDMR and obtaining an eDMR user account, please visit the following web page: http://deq.nc.gov/about/divisions/water-resources/edmr.

For more information on EPA's final NPDES Electronic Reporting Rule, please visit the following web site: https://www.federalregister.gov/documents/2015/10/22/2015-24954/national-pollutant-discharge-elimination-system-npdes-electronic-reporting-rule

- The Special Condition entitled Compliance Boundary was added to the permit. Please see Special Condition A. (20).
- The special condition entitled "Structural Integrity Inspections of Ash Pond Dam" was added to the permit in accordance with the new EPA requirements. Please see Special Condition A. (21).
- The "Clean Water Act Section 316(b)" Special Condition was added to the permit. Please see Special Condition A. (22.).
- The Fish Tissue Monitoring near Ash Pond Discharge Special Condition was added to the permit. Please see Special Condition A. (23.).
- The Instream Monitoring Special Condition was added to the permit to monitor the impact of the facility on the receiving stream. Please see Special Condition A. (24.).
- The Biocide Special Condition A. (25.) was added to the permit to be consistent with the permitting procedure for power plants.
- The new internal outfall 002A was added to the permit to accommodate construction of the new Retention Basin. Please see A. (5.).
- The new internal outfall 002B was added to the permit to accommodate construction of the new yard sump. Please see A. (6.).
- The former Stormwater Outfalls 004, 005, 006c, 006d, and 006e were added to the permit. Please see A. (10.) through A. (14.).
- The Internal Outfall 011 for domestic wastewater was added to the permit. Please see A. (15.).
- The mixing zone for Chlorides was eliminated and the permit limits were reduced due to the installation of the zero liquid discharge system for the FGD wastewater.
- The Applicable State Law special condition was added to the permit. Please see A. (26.).

PROPOSED SCHEDULE

Draft Permit to Public Notice:	May 1, 2018
Permit Scheduled to Issue:	July 22, 2018

STATE CONTACT

If you have any questions on any of the above information or on the attached permit, please contact Sergei Chernikov at (919) 807-6386 or sergei.chernikov@ncdenr.gov.

CHANGES IN THE FINAL PERMIT

To address the public comments, the following changes have been made in the final permit:

1) The monitoring frequency for As, Se, Hg, and Ag were reduced to weekly from monthly (Outfall 002 – normal operation/decanting).
2) The schedule to submit documentation required for 316(b) was reduced to 3.5 years.
3) The new requirement for the decanting and dewatering stages was added to the permit. The facility shall immediately discontinue the discharge and report to the DEQ if the identified pollutants of concern reach 85% of the allowable level.
4) The turbidity limit was reduced to 25 NTU from 50 NTU (Outfall 002).
5) Toe drain outfalls have been removed from the permit since Duke built a collection structure and established a pumping regime, wastewater from the toe drains is currently pumped from the toe drains to the ash pond.

NPDES Implementation of Instream Dissolved Metals Standards – Freshwater Standards

The NC 2007-2015 Water Quality Standard (WQS) Triennial Review was approved by the NC Environmental Management Commission (EMC) on November 13, 2014. The US EPA subsequently approved the WQS revisions on April 6, 2016, with some exceptions. Therefore, metal limits in draft permits out to public notice after April 6, 2016 must be calculated to protect the new standards - as approved.

Table 1. NC Dissolved Metals Water Quality Standards/Aquatic Life Protection

Parameter	Acute FW, µg/l (Dissolved)	Chronic FW, µg/l (Dissolved)	Acute SW, µg/l (Dissolved)	Chronic SW, µg/l (Dissolved)
Arsenic	340	150	69	36
Beryllium	65	6.5	---	---
Cadmium	Calculation	Calculation	40	8.8
Chromium III	Calculation	Calculation	---	---
Chromium VI	16	11	1100	50
Copper	Calculation	Calculation	4.8	3.1
Lead	Calculation	Calculation	210	8.1
Nickel	Calculation	Calculation	74	8.2
Silver	Calculation	0.06	1.9	0.1
Zinc	Calculation	Calculation	90	81

Table 1 Notes:

1. FW= Freshwater, SW= Saltwater
2. Calculation = Hardness dependent standard
3. Only the aquatic life standards listed above are expressed in dissolved form. Aquatic life standards for Mercury and selenium are still expressed as Total Recoverable Metals due to bioaccumulative concerns (as are all human health standards for all metals). It is still necessary to evaluate total recoverable aquatic life and human health standards listed in 15A NCAC 2B.0200 (e.g., arsenic at 10 µg/l for human health protection; cyanide at 5 µg/L and fluoride at 1.8 mg/L for aquatic life protection).

Table 2. Dissolved Freshwater Standards for Hardness-Dependent Metals

The Water Effects Ratio (WER) is equal to one unless determined otherwise under 15A NCAC 02B .0211 Subparagraph (11)(d)

Metal	NC Dissolved Standard, µg/l
Cadmium, Acute	WER*{1.136672-[*ln* hardness](0.041838)} · *e*^{0.9151 [*ln* hardness]-3.1485}
Cadmium, Acute Trout waters	WER*{1.136672-[*ln* hardness](0.041838)} · *e*^{0.9151[*ln* hardness]-3.6236}
Cadmium, Chronic	WER*{1.101672-[*ln* hardness](0.041838)} · *e*^{0.7998[*ln* hardness]-4.4451}

Chromium III, Acute	WER*0.316 · *e*^{0.8190[*ln* hardness]+3.7256}
Chromium III, Chronic	WER*0.860 · *e*^{0.8190[*ln* hardness]+0.6848}
Copper, Acute	WER*0.960 · *e*^{0.9422[*ln* hardness]-1.700}
Copper, Chronic	WER*0.960 · *e*^{0.8545[*ln* hardness]-1.702}
Lead, Acute	WER*{1.46203-[*ln* hardness](0.145712)} · *e*^{1.273[*ln* hardness]-1.460}
Lead, Chronic	WER*{1.46203-[*ln* hardness](0.145712)} · *e*^{1.273[*ln* hardness]-4.705}
Nickel, Acute	WER*0.998 · *e*^{0.8460[*ln* hardness]+2.255}
Nickel, Chronic	WER*0.997 · *e*^{0.8460[*ln* hardness]+0.0584}
Silver, Acute	WER*0.85 · *e*^{1.72[*ln* hardness]-6.59}
Silver, Chronic	Not applicable
Zinc, Acute	WER*0.978 · *e*^{0.8473[*ln* hardness]+0.884}
Zinc, Chronic	WER*0.986 · *e*^{0.8473[*ln* hardness]+0.884}

General Information on the Reasonable Potential Analysis (RPA)

The RPA process itself did not change as the result of the new metals standards. However, application of the dissolved and hardness-dependent standards requires additional consideration in order to establish the numeric standard for each metal of concern of each individual discharge.

The hardness-based standards require some knowledge of the effluent and instream (upstream) hardness and so must be calculated case-by-case for each discharge.

Metals limits must be expressed as 'total recoverable' metals in accordance with 40 CFR 122.45(c). The discharge-specific standards must be converted to the equivalent total values for use in the RPA calculations. We will generally rely on default translator values developed for each metal (more on that below), but it is also possible to consider case-specific translators developed in accordance with established methodology.

RPA Permitting Guidance/WQBELs for Hardness-Dependent Metals - Freshwater

The RPA is designed to predict the maximum likely effluent concentrations for each metal of concern, based on recent effluent data, and calculate the allowable effluent concentrations, based on applicable standards and the critical low-flow values for the receiving stream.
If the maximum predicted value is greater than the maximum allowed value (chronic or acute), the discharge has reasonable potential to exceed the standard, which warrants a permit limit in most cases. If monitoring for a particular pollutant indicates that the pollutant is not present (i.e.

consistently below detection level), then the Division may remove the monitoring requirement in the reissued permit.

1. To perform a RPA on the Freshwater hardness-dependent metals the Permit Writer compiles the following information:
    - Critical low flow of the receiving stream, 7Q10 (the spreadsheet automatically calculates the 1Q10 using the formula 1Q10 = 0.843 (s7Q10, cfs) $^{0.993}$
    - Effluent hardness and upstream hardness, site-specific data is preferred
    - Permitted flow
    - Receiving stream classification

2. In order to establish the numeric standard for each hardness-dependent metal of concern and for each individual discharge, the Permit Writer must first determine what effluent and instream (upstream) hardness values to use in the equations.

    The permit writer reviews DMR's, Effluent Pollutant Scans, and Toxicity Test results for any hardness data and contacts the Permittee to see if any additional data is available for instream hardness values, upstream of the discharge.

    If no hardness data is available, the permit writer may choose to do an initial evaluation using a default hardness of 25 mg/L (CaCO3 or (Ca + Mg)). Minimum and maximum limits on the hardness value used for water quality calculations are 25 mg/L and 400 mg/L, respectively.

    If the use of a default hardness value results in a hardness-dependent metal showing reasonable potential, the permit writer contacts the Permittee and requests 5 site-specific effluent and upstream hardness samples over a period of one week. The RPA is rerun using the new data.

    The overall hardness value used in the water quality calculations is calculated as follows:
    Combined Hardness (chronic)
    $$= \frac{\text{(Permitted Flow, cfs *Avg. Effluent Hardness, mg/L) + (s7Q10, cfs *Avg. Upstream Hardness, mg/L)}}{\text{(Permitted Flow, cfs + s7Q10, cfs)}}$$
    The Combined Hardness for acute is the same but the calculation uses the 1Q10 flow.
3. The permit writer converts the numeric standard for each metal of concern to a total recoverable metal, using the EPA Default Partition Coefficients (DPCs) or site-specific translators, if any have been developed using federally approved methodology.

4. The EPA default partition coefficients or the "Fraction Dissolved" converts the value for dissolved metal at laboratory conditions to total recoverable metal at in-stream ambient conditions. This factor is calculated using the linear partition coefficients found in *The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion* (EPA 823-B-96-007, June 1996) and the equation:

$$\frac{C_{diss}}{C_{total}} = \frac{1}{1 + \{ [K_{po}] [ss^{(1+a)}] [10^{-6}] \}}$$

Where:
ss = in-stream suspended solids concentration [mg/l], minimum of 10 mg/L used, and
Kpo and *a* = constants that express the equilibrium relationship between dissolved and adsorbed forms of metals. A list of constants used for each hardness-dependent metal can also be found in the RPA program under a numeric standard for each metal of concern is divided by the default partition coefficient (or site-specific translator) to obtain a Total Recoverable Metal at ambient conditions.

In some cases, where an EPA default partition coefficient translator does not exist (ie. silver), the dissolved numeric standard for each metal of concern is divided by the EPA conversion factor to obtain a Total Recoverable Metal at ambient conditions. This method presumes that the metal is dissolved to the same extent as it was during EPA's criteria development for metals. For more information on conversion factors see the June, 1996 EPA Translator Guidance Document.

5. The RPA spreadsheet uses a mass balance equation to determine the total allowable concentration (permit limits) for each pollutant using the following equation:

$$Ca = \frac{(s7Q10 + Qw)(Cwqs) - (s7Q10)(Cb)}{Qw}$$

Where: Ca = allowable effluent concentration (µg/L or mg/L)
Cwqs = NC Water Quality Standard or federal criteria (µg/L or mg/L)
Cb = background concentration: assume zero for all toxicants except NH_3* (µg/L or mg/L)
Qw = permitted effluent flow (cfs, match s7Q10)
s7Q10 = summer low flow used to protect aquatic life from chronic toxicity and human health through the consumption of water, fish, and shellfish from noncarcinogens (cfs)
* Discussions are on-going with EPA on how best to address background concentrations

Flows other than s7Q10 may be incorporated as applicable:
1Q10 = used in the equation to protect aquatic life from acute toxicity
QA = used in the equation to protect human health through the consumption of water, fish, and shellfish from carcinogens

30Q2 = used in the equation to protect aesthetic quality

6. The permit writer enters the most recent 2-3 years of effluent data for each pollutant of concern. Data entered must have been taken within four and one-half years prior to the date of the permit application (40 CFR 122.21). The RPA spreadsheet estimates the 95th percentile upper concentration of each pollutant. The Predicted Max concentrations are compared to the Total allowable concentrations to determine if a permit limit is necessary. If the predicted max exceeds the acute or chronic Total allowable concentrations, the discharge is considered to show reasonable potential to violate the water quality standard, and a permit limit (Total allowable concentration) is included in the permit **in accordance with the U.S. EPA Technical Support Document for Water Quality-Based Toxics Control published in 1991.**

7. When appropriate, permit writers develop facility specific compliance schedules in accordance with the EPA Headquarters Memo dated May 10, 2007 from James Hanlon to Alexis Strauss on 40 CFR 122.47 Compliance Schedule Requirements.

8. The Total Chromium NC WQS was removed and replaced with trivalent chromium and hexavalent chromium Water Quality Standards. As a cost savings measure, total chromium data results may be used as a conservative surrogate in cases where there are no analytical results based on chromium III or VI. In these cases, the projected maximum concentration (95th %) for total chromium will be compared against water quality standards for chromium III and chromium VI.

9. Effluent hardness sampling and instream hardness sampling, upstream of the discharge, are inserted into all permits with facilities monitoring for hardness-dependent metals to ensure the accuracy of the permit limits and to build a more robust hardness dataset.

10. Hardness and flow values used in the Reasonable Potential Analysis for this permit included:

Parameter	**Value**	**Comments (Data Source)**
Average Effluent Hardness (mg/L) [Total as, $CaCO_3$ or (Ca+Mg)]	25.0	Default value
Average Upstream Hardness (mg/L) [Total as, $CaCO_3$ or (Ca+Mg)]	25.0	Default value
7Q10 summer (cfs)	0	Lake or Tidal
1Q10 (cfs)	0	Lake or Tidal
Permitted Flow (MGD)	2.1	For dewatering