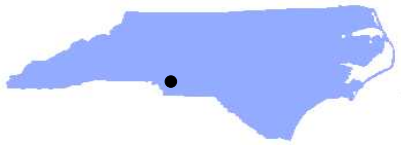
NCDEQ/DWR
FACT SHEET FOR NPDES PERMIT Major Modification

Duke Energy Carolinas, LLC – Allen Steam Station
NC0004979

Facility Information			
Applicant/Facility Name:	Duke Energy Carolinas, LLC – Allen Steam Station		
Applicant Address:	P.O. Box 1006, Charlotte, North Carolina 28201		
Facility Address:	253 Plant Allen Road, Belmont, North Carolina 28012		
Permitted Flow	No limit		
Type of Waste:	~100% industrial Primary SIC Code: 4911 – Electric Services		
Facility/Permit Status:	Class I/Active; Major Modification		
County:	Gaston County		
Miscellaneous			
Receiving Stream:	Catawba River (11-123.5), South Fork Catawba River (Lake Wylie)	Regional Office:	Mooresville
Stream Classification:	WS-IV B (Catawba River) and WS-V B (South Fork Catawba River)	State Grid / USGS Quad:	G14 NE
303(d) Listed?	Yes (Catawba River Only)	Permit Writer:	Sergei Chernikov, Ph.D.
Subbasin:	03-08-34	Date:	October 30, 2020
Drainage Area (mi^2):	635 (Catawba River)		
Summer 7Q10 (cfs)	95		
Winter 7Q10 (cfs):	95		
30Q2 (cfs)	314		
Average Flow (cfs):	2470		
IWC (%):	4.7 (Outfall 002) 5.4 (Outfall 006)	001: Lat. 35° 11' 23" N Long. 81° 00' 45" W 002: Lat. 35° 10' 30" N Long. 81° 00' 23" W 002A: Lat. 35° 11' 34" N Long. 81° 00' 22" W 002B: Lat. 35° 11' 36" N Long. 81° 00' 30" W 004: Lat. 35° 11' 35" N Long. 81° 00' 22" W 006: Lat. 35° 11' 35" N Long. 81° 00' 22" W 007: Lat. 35° 11' 55" N Long. 81° 00' 36" W 008: Lat. 35° 10' 55" N Long. 81° 00' 24" W	

SUMMARY
Duke Energy requested a Major Modification for Allen Steam Station to incorporate latest changes to the Effluent Guidelines, expedite ash pond dewatering operations, and facilitate a long term facility closure plan.

Duke Energy's Allen Steam Station is a coal fired steam electric plant in Gaston County. Units 1, 2, and 3 are scheduled to retire by December 31, 2024 and Units 4 and 5 by December 31, 2028.

The facility is subject to the effluent guidelines - 40 CFR 423.12. The facility is also subject to the Cooling Water Intake Structure Rule (316(b) Rule) per 40 CFR 125.95 and Coal Ash Management Act (State Law).

The facility built a new Retention Basin in 2018 and all waste streams that have previously discharged to the Ash Pond are now re-routed to the Retention Basin. This change was necessary to decommission the existing Ash Pond and meet the requirements of Coal Ash Management Act.

Below is description of the existing outfalls:

- Outfall 001 is comprised of once through, non-contact condenser cooling water. This outfall discharges to the South Fork Catawba River.

- Outfall 002 is the ash basin discharge. This outfall includes domestic wastewater, stormwater from the coal pile area, miscellaneous stormwater flows, ash sluice, wastewater from turbine non-destructive testing, a yard drain sump, water treatment filter backwash, extracted groundwater, laboratory wastes, and the power house sump at Unit 5. The domestic waste is pre-treated by a septic tank. Outfall 002 wastewater is treated using chemical coagulation, settling, and pH neutralization. This outfall discharges to the Catawba River. Upon construction of the new Retention Basin, the waste streams currently discharging through Outfall 002 will be rerouted to the new Retention Basin (Outfall 006). This outfall discharges to the Catawba River. Outfall 002 and Outfall 006 might be operational at the same time during the transition period.

- Outfall 002A is an intermittent discharge of emergency overflows from coal yard sump (discharge from coal handling and storage areas). This outfall discharges to the Catawba River.

- Outfall 002B is an intermittent discharge of emergency overflows from power house sump (floor wash water, boiler blowdown, water treatment waste, condensates, equipment cooling water, sealing water and miscellaneous leakage). This outfall discharges to the Catawba River.

- Outfall 003 is miscellaneous once through non-contact cooling water and seal water. This outfall discharges to the South Fork Catawba River.

- Outfall 004 is also miscellaneous once through non-contact cooling water. This outfall includes a small amount of intake screen backwash and car wash rinse water. This outfall discharges to the Catawba River.

- Outfall 005 is internal, discharging to the Retention Basin. It is comprised of flue gas desulfurization wastewater. The treatment facilities at this outfall consist of flow equalization, pH stabilization using lime addition, chemical precipitation, clarification, gravity filtration, biological selenium removal, aerated sludge holding, and a sludge filter press.

- Outfall 006 is the new Retention Basin discharge. This outfall discharges to the Catawba River. Outfall 002 and Outfall 006 might be operational at the same time during the transition period. This outfall includes domestic wastewater, stormwater from the coal pile area, miscellaneous stormwater flows, ash sluice, wastewater from turbine non-destructive testing, a yard drain sump, water treatment filter backwash, extracted groundwater, wastewater from the Ash Pond dewatering process, bottom ash purge from the submerged flight conveyers (purge volume not to exceed 10% of the water systems volume), laboratory wastes, CCR landfill leachate, and the power house sump at Unit 5. The domestic waste is pre-treated by a septic tank. Outfall 002 wastewater is treated using chemical coagulation, settling, and pH neutralization. This outfall discharges to the Catawba River.

- Outfall 007 is the emergency spillway of the new Retention Basin. The spillway is designed for a flood greater than 100-year event. Sampling of this spillway is waived due to unsafe conditions associated with sampling during overflow event. This outfall discharges to the Catawba River.

- Outfall 008 is the emergency spillway of the retired Ash Pond. The spillway is designed for a flood greater than 100-year event. Sampling of this spillway is waived due to unsafe conditions associated with sampling during overflow event. This outfall discharges to the Catawba River.

- Toe Drain Outfalls 103, 104, 108, and 108B - 4 potentially contaminated toe drains. These outfalls discharge to the Catawba River, except for outfall 104, which discharges to unnamed tributary to Catawba River.

On December 15, 2016 the station personnel observed a minor drainage from a corrugated metal pipe along Catawba River, the coordinates of the pipe are 35^{0}11'20.6" N, 81^{0}0'27.55" W. The facility inspected the pipe and determined it is clogged by debris 10 feet from the opening. The flow from this pipe is extremely small, only about 114 GPD. The analysis of the water indicate that most parameters of concern are either below detection level or below water quality standards. Based on the analysis of the sample and on the flow amount it is likely a groundwater infiltrating into the pipe. The facility has grouted the pipe to eliminate discharge of the groundwater.

TOE DRAINS –OUTFALLS 103, 104, 108, and 108B
The facility identified 4 unpermitted toe drains from the ash settling basin.

The locations of the toe drains are identified below and are depicted on the map attached to the permit.

Table 1. Discharge Coordinates and Assigned Outfall Numbers

Discharge ID of toe drains	Latitude	Longitude	Outfall number
S-3	**35^{0}10.512'**	**81^{0}0.360'**	**103**
S-4	**35^{0}10.541'**	**81^{0}0.364'**	**104**
S-8	**35^{0}10.710'**	**81^{0}0.384'**	**108**
S-8B	**35^{0}10.689'**	**81^{0}0.391'**	**108B**

Each outfall discharges through its own effluent channel meeting the requirements in 15A NCAC 2B .0228.

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)-OUTFALL 002 AND OUTFALL 006

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 Dewatering of Ash pond (Outfall 002).
To meet the requirements of the Coal Ash Management Act of 2014, the facility needs to dewater ash ponds by removing the interstitial water. The facility's highest discharge rate from the dewatering process will be increased from 1.0 MGD to 3.0 MGD to assure timely closure. 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 the 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, Mo, Hg, Ni, Se, Ag, Zn, Sulfate, Ba, Sb, Tl, B, and Al (please see attached). The flow of 3.0 MGD was used in the RPA.

b) RPA for New Retention Basin (Outfall 006).
The Retention Basin will be receiving all the waste streams that were previously discharged to Ash Pond. However, the RPA that was conducted for Outfall 002 was modified for Outfall 006 by adding interstitial concentration data provided by Duke to evaluate impacts from the CCR landfill leachate. The flow volume was also increased from 3.3 MGD to 3.5 MGD based on the latest estimates that incorporate flor from the CCR landfill. The RPA was conducted for As, Cd, Chlorides, Cr, Cu, F, Pb, Mo, Hg, Ni, Se, Ag, Zn, Sulfate, Ba, Sb, Tl, B, and Al,(please see attached). The flow of 3.5 MGD was used in the RPA. The RPA indicated a need for water-quality based limits for As.

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.

FGD TECHNOLOGY BASED EFFLUENT LIMITS-INTERNAL OUTFALL 005

The latest update to the Effluent Guidelines (40 CFR 423) allows the facilities that retire early to eliminate Technology Based Effluent Limits (TBELs) for As, Se, Hg, and Nitrate/nitrite and substitute them with limits for TSS and Oil and Grease. This change will be implemented in this permit modification. The narrative standard of proper operation and maintenance of the FGD treatment system will also be added to the permit modification.

The existing FGD system for the facility is unable to meet the numerical As and Se limit with 100% consistency. Review of the FGD discharge data from 1/1/2011 through 8/2/2016 indicates that:

a) Se daily maximum limit would have been violated 5 times out of 141 if it was implemented during the last renewal.
b) As daily maximum limit would have been violated 17 times out of 68 if it was implemented during the last renewal.

MERCURY EVALUATION- OUTFALL 002

The State of North Carolina has a state-wide mercury impairment. The 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	2010	2011	2012	2013	2014
Annual average concentration (ng/L)	1.6	1.18	6.9	0.93	0.83
Maximum sampling result (ng/L)	2.4	1.8	22.6	1.6	1.0
Number of samples	4	4	4	4	3

The allowable mercury concentration for this facility is 50.9 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 – OUTFALL 001

The facility has a temperature variance. In order to maintain the variance the facility has to conduct annual biological and chemical monitoring of the receiving stream to demonstrate that it has a balanced and indigenous macroinvertebrate and fish community. The latest BIP (balanced and indigenous population) report was submitted to DWR in November of 2014. The DWR has reviewed the report and concluded that the receiving stream near Allen Steam Station has a balanced and indigenous macroinvertebrate and fish community.

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 following materials shall be submitted:

— §122.21(r)(2) Source Water Physical Data
— §/22.21(r)(3) Cooling Water Intake Structure Data
— §122.21(r)(4) Source Water Baseline Biological Characterization Data
— §/22.21(r)(5) Cooling Water System Data
— §122.21(r)(6) Chosen Method(s) of Compliance with the Impingement Mortality Standard (**the chosen method will be defined after the site-specific BTA determination is made**)
— §122.21(r)(7) Entrainment Performance Studies
— §122.21(r)(8) Operational Status
— §122.21(r)(9) Entrainment Characterization Study
— §122.21(r)(10) Comprehensive Technical Feasibility and Cost Evaluation Study

— §122.21(r)(11) Benefits Valuation Study

—§122.21(r)(12) Non-water Quality and Other Environmental Impacts Study

Currently, the facility withdraws a water for all five units through a single CWIS located in a small embayment on the west bank of Lake Wylie. The CWIS is flush with the shoreline and is approximately 247.2 feet long. The CWIS is divided into 15 screens bays, three per unit. Each screen bay is 14 feet wide and equipped with a trash rack and traveling water screen.

The trash racks prevent large debris from entering the CWIS protects the traveling screens from damage. Typically, debris loading on the trash racks is minimal. Top elevation of the trash racks is 580 feet with an overall height of 34.5 feet. The width of each trash rack is approximately 14 feet. The trash rack bars are made of steel bars that are 4 inches by 0.375 inch spaced 3-inches on center, which provides 2.6-inch clear bar spacing.

After water flows through the trash racks, it then passes through an isolation gate. The dimensions for the isolations gates are as follows:

- Units 1 and 2: six feet by eight feet
- Units 3, 4, and 5: eight feet by eight feet

Downstream of the isolation gates, are 15 traveling screens - three traveling screens per unit. Each screen is ten feet wide with an invert elevation of 544.5 feet. The intake bays constrict down to 11 feet 2 inches wide at the traveling screens compared to the approximately 14 feet wide at the trash racks. The traveling screens consist of #12 gauge wire mesh with 3/8 inch square mesh openings. A high-pressure front wash spray system is used to remove impinged fish and debris from the traveling screens. The fish is returned through front trough that travels ~421 ft south of CWIS where it joins a 72 inch corrugated metal drain pipe and travels an additional ~374 ft back to the lake.

Each unit has two circulating water pumps located downstream of the traveling screens.

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 modified traveling screens with the fish return system is one of the pre-approved compliance alternatives for impingement. The rule requires to make a site specific determination for entrainment. In the absence of the comprehensive information required by the 316(b) rule the DEQ has determined that the existing traveling screen system which includes a fish handling return system meets the criteria of the interim BTA.

INSTREAM MONITORING-OUTFALL 002

The permit required semi-annual upstream and downstream monitoring near the ash pond discharge. The upstream site is approximately 250 meters upstream of Outfall 006 and downstream location is approximately 250 meters downstream of Outfall 006. The monitored parameters are: As, Cd, Cr, Cu, Hg, Pb, Se, Zn, turbidity, and Total Dissolved Solids (TDS). The majority of the results are below detection level (Hg, As, Cd, Cr, Pb, Se), the rest of the results are below water quality standards (Cu, Zn, TDS). No parameter demonstrated any increase in the concentration at the monitoring stations below the discharge.

It is required that the monitoring of the instream stations will continue during the next permit cycle. It is also required that the facility uses low level method 1631E for all Hg analysis.

FISH TISSUE MONITORING-NEAR OUTFALL 002

The permit required fish tissue monitoring for As, Se, and Hg near the ash pond discharge once every 5 years. This frequency is consistent with EPA guidance. Redear sunfish and largemouth bass tissues were analyzed for these trace elements. The results were below action levels for Se and Hg (10.0 μg/g – Se, 0.4 μg/g – Hg, NC) and screening value for As (1.2 – μg/g, EPA). These results are consistent with the previous monitoring results.

TOXICITY TESTING-OUTFALL 002 AND OUTFALL 006

Current Requirement:	Outfall 002 dewatering – Chronic P/F @ 1.6% using Ceriodaphnia
Recommended Requirement:	Outfall 002 dewatering – Chronic P/F @ 4.7% using Ceriodaphnia
Current Requirement:	Outfall 006 – Chronic P/F @ 5.1% using Ceriodaphnia
Recommended Requirement:	Outfall 006 – Chronic P/F @ 5.4% using Ceriodaphnia

This facility has passed all toxicity tests during the previous permit cycle (20 out of 20).

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

COMPLIANCE SUMMARY

During the last permit cycle, the facility has exceeded limits 4 times, please see attached. Three limit violations were for temperature (Outfall 001) and one limit violation was for Fe (Outfall 002).

PERMIT LIMITS DEVELOPMENT

- The temperature limits (Outfall 001) are based on the North Carolina water quality standards (15A NCAC 2B .0200) and 316(a) Thermal Variance.
- The limits for Oil and Grease and Total Suspended Solids (Outfalls 002, 002A, 002B, 004 (oil and grease only for 004), 005 (TSS only for 005), 006, 103, 104, 108, and 108B) were established in accordance with 40 CFR 423.
- The BOD limits (Outfalls 002, 002A, and 006) were established in accordance with 40 CFR 122.123.
- The pH limits (Outfalls 002, 002A, 002B, 006, 103, 104, 108, and 108B) in the permit are based on the North Carolina water quality standards (15A NCAC 2B .0200).
- The fecal coliform limits (Outfall 002, 002A, and Outfall 006) in the permit are based on the North Carolina water quality standards (15A NCAC 2B .0200).
- The limits for Total Copper and Total Iron (Outfalls 002, 002A, 002B, and 006) were established in accordance with 40 CFR 423.
- The turbidity limit in the permit (Outfall 002) is based on the North Carolina water quality standards (15A NCAC 2B .0200).
- The total silver limits in the permit (Outfall 002) are based on the North Carolina water quality standards (15A NCAC 2B .0200).
- The total silver and total arsenic limits in the permit (Outfall 006) are based on the North Carolina water quality standards (15A NCAC 2B .0200).
- The Whole Effluent Toxicity limits (Outfall 002 and Outfall 006) are based on the requirements of 15A NCAC 2B .0500.

PROPOSED CHANGES

- The Bottom Ash Purge was added to the list of waste streams discharged to the Retention Basin.

- The wastewater generated by the dewatering process and extracted groundwater were added to the to the Retention Basin to achieve timely closure of the Ash Pond and provide greater operational flexibility.
- The flow limit for dewatering operations was increased from 1.0 MGD to 3.0 MGD to achieve timely closure of the Ash Pond.
- The Upstream and Downstream monitoring locations were moved to monitor discharge from the Retention Basin.
- The pH limits at the Internal Outfall 005 were removed to be consistent with the requirements in 40 CFR 423.
- The Technology Based Effluent Limits for Total Arsenic, Total Mercury, Total Selenium, and Nitrate/nitrite as N were removed from the permit (Outfall 005 – FGD wastewater) based on the latest update to the 40 CFR 423 and due to the early retirement of the Allen Steam Station. The Monthly Average and Daily Maximum numeric limits for these parameters were replaced with the Quarterly Average numeric limits for Total Arsenic, Total Selenium, and Total Mercury and a narrative limit that requires the facility to **properly operate and maintain the existing FGD wastewater treatment equipment.**
- The Technology Based Effluent Limits for TSS and Oil and Grease were added to the permit (Outfall 005) based on the latest update to the 40 CFR 423.
- The Annual Progress Report requirement was added to the permit (see Special Condition A. (19.) based on the latest update to the 40 CFR 423.
- The RPA for Retention Basin was conducted by adding the highest reported concentration of the contaminants in the interstitial wastewater. The flow volume was also increased from 3.3 MGD to 3.5 MGD based on the latest estimates that incorporate flor from the CCR landfill. The limits for As were added as a result of this RPA (Outfall 006).
- The RPA for Ash Basin dewatering phase was conducted by increasing flow from 1.0 MGD to 3.0 MGD. No new limits were added as a result of this RPA (Outfall 002).
- The Special Condition that requires electronic submittal of all discharge monitoring reports was changed based on the latest update to the NPDES Electronic Reporting Rule (See Special Condition A. (26.)).
- The Toxicity Test Instream Waste Concentrations for dewatering and Retention basin have been adjusted (Outfall 002 dewatering and Outfall 006) to account for the increased flow volume.

PROPOSED SCHEDULE

Draft Permit to Public Notice:	April 6, 2020 (est.)
Permit Scheduled to Issue:	May 31, 2021 (est.)

STATE CONTACT

If you have any questions on any of the above information or on the attached permit, please contact Sergei Chernikov at (919) 707-3606 or sergei.chernikov@ncdenr.gov.

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)
   $$= \frac{(\text{Permitted Flow, cfs} * \text{Avg. Effluent Hardness, mg/L}) + (\text{s7Q10, cfs} * \text{Avg. Upstream Hardness, mg/L})}{(\text{Permitted Flow, cfs} + \text{s7Q10, cfs})}$$
   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.

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 sheet labeled DPCs.

4. The 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