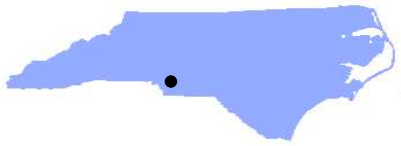
NCDEQ/DWR
FACT SHEET FOR NPDES PERMIT DEVELOPMENT

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; Renewal		
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:	May 10, 2016
Drainage Area (mi^2):	635 (Catawba River)		
Summer 7Q10 (cfs)	95		
Winter 7Q10 (cfs):	95		
30Q2 (cfs)	314		
Average Flow (cfs):	2470		
IWC (%):	23.6 (Outfall 002 and 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
This revised draft permit incorporates changes made subsequent to a Public Hearing held on April 8, 2015 seeking comments to the original draft NPDES wastewater permit renewal for Allen Steam Station.

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.

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 proposes to build a new Retention Basin in 2018 to reroute all waste streams that are currently discharged to the Ash Pond. This change is necessary to decommission the existing Ash Pond and meet the requirements of Coal Ash Management Act. After the Retention Basin is completed, all the waste streams previously discharged to Ash Pond will be re-routed to the Retention Basin, and the discharges to Ash Pond will cease.

- 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, treated 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 Ash Pond. 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. Internal Outfall 005 and Internal Outfall 007 might be operational at the same time during the transition period.

- Proposed Outfall 006 is the new Retention Basin discharge. 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.
  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, treated 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.

- Proposed 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.

- Proposed 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.

- Proposed 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, OUTFALL 006, OUTFALLS 103, 104, 108 AND 108B.

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, Calculations included: As, Be, Cd, Chlorides, Total Phenolic Compounds, Cr, Cu, CN, Pb, Hg, Mo, Ni, Se, Ag, Zn, Co, Sulfate, Ba, B, and Al (please see attached). The flow of 18.9 MGD was used in the RPA as the highest reported flow during the last permit cycle. The RPA concludes that the limits for Ag are necessary to protect the receiving stream. In addition, the WQBELs for Cu will be substituted for TBELs, since WQBELs are more stringent.

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 ash ponds by removing the interstitial water. The facility's highest discharge rate from the dewatering process will be 1.0 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 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, Zn, Sulfate, Ba, Sb, Tl, B, Al, and Pb (please see attached). The flow of 1.0 MGD was used in the RPA. The RPA indicated no need for water-quality based limits during the dewatering phase.

c) RPA for Toe Drains (Outfalls 103, 104, 108, and 108B).
The RPA was also conducted for the combined Toe Drains 103, 108, and 108B flow. Separate RPA was conducted for Toe Drain 104 because it is discharges to a different stream (UT to Catawba River). Calculations included: As, Cd, Chlorides, Cr, Cu, F, Pb, Hg, Mo, Ni, Se, Zn, Sulfate, Sb, Al, B, Ba, and Tl (please see attached). The analysis indicates no reasonable potential to violate the water quality standards or EPA criteria for all toe drains. The flow volume for the combined Toe Drains discharging to Catawba River (103, 108, and 108B) flow was measured at 0.0084 MGD during initial sampling. However, the flow of 0.1 MGD was used for the RPA to incorporate a safety factor and account for potential increase

in flow volume. The flow volume for Toe drain 104 was measured 0.0008 MGD during initial sampling. However, the flow of 0.01 MGD was used for the RPA to incorporate a safety factor and account for potential increase in flow volume.

d) RPA for New Retention Basin (Outfall 006).
The RPA that was conducted for Outfall 002 was used for Outfall 006 since the Retention Basin will be receiving all the waste streams that were previously discharged to Ash Pond. The only change was the flow volume, the new basin is designed for 3.3 MGD, this number was used for RPA.

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 AND INTERNAL OUTFALL 007.

The new federal 40 CFR 423 Technology Based Effluent Limits (TBELs) have been added to the permit:
Total Arsenic – 8.0 µg/L (Monthly Average); 11.0 µg/L (Daily Maximum)
Total Selenium – 12.0 µg/L (Monthly Average); 23.0 µg/L (Daily Maximum)
Total Mercury – 356.0 ng/L (Monthly Average); 788.0 ng/L (Daily Maximum)
Nitrate/nitrite as N – 4.4 mg/L (Monthly Average); 17.0 mg/L (Daily Maximum)

The federal rule 40 CFR 423 states that "dischargers must meet the effluent limitations for FGD wastewater in this paragraph by a date determined by the permitting authority that is as soon as possible beginning November 1, 2018, but no later than December 31, 2023".

Duke provided the justification for the proposed deadline of December 31, 2023 and the DWR concurred with the compliance date. This deadline incorporates an uncertainty due to the proposed EPA rulemaking that might result in different deadlines and/or BAT determinations.

The existing FGD system for the facility is unable to meet the proposed As and Se limit with 100% consistency. Therefore, Duke needs to optimize the performance of the existing system or install the membrane ultrafiltration to meet the proposed FGD limits with 100% compliance. 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. Duke is involved in a large scale decommissioning of ash ponds, excavation of coal ash, landfilling of coal ash, construction of new treatment systems for FGD wastewater and other wastes, and conversion to zero liquid discharge for bottom ash. Under these circumstances, Duke is unable to develop comprehensive documentation required by 316(b) rule during this renewal.

INSTREAM MONITORING-OUTFALL 002

The permit required semi-annual upstream and downstream monitoring near the ash pond discharge. The upstream site (Station 250) is approximately 1.1 miles upstream of the discharge and downstream location (Station 235) is approximately 3 miles downstream of the discharge. These monitoring stations have been established through the BIP monitoring program, which was required to maintain the 316(a) temperature variance. 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 – Chronic P/F @ 20% using Ceriodaphnia
Recommended Requirement:	Outfall 002 – Chronic P/F @ 23.6% using Ceriodaphnia
	Outfall 006 – Chronic P/F @ 23.6% using Ceriodaphnia

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

The Division will increase the Instream Waste Concentration from 20% to 23.6% due to the increased wastewater flow, reported as 18.9 MGD. 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), 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 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 Technology Based Effluent Limits for Total Arsenic, Total Mercury, Total Selenium, and Nitrate/nitrite as N (Outfall 005 and Outfall 007) are based on the requirements of 40 CFR 123.
- The Whole Effluent Toxicity limit (Outfall 002 and Outfall 006) is based on the requirements of 15A NCAC 2B .0500.

PROPOSED CHANGES

- The Toe Drains Outfalls 103, 104, 108, and 108B (Please see A. (12.), A. (13.), A. (14.), and A. (15.)) were added to the permit.
- The turbidity limit was added to the permit (Outfall 002) to meet the state turbidity standard per 15A NCAC 2B .0211(3) (k).
- The pH limits were added to the permit (Outfalls 002A and 002B) to meet the state pH standard per 15A NCAC 2B .0200.
- The Technology Based Effluent Limits for Total Arsenic, Total Mercury, Total Selenium, and Nitrate/nitrite as N were added to the permit (Outfall 005) and are based on the requirements of 40 CFR 123.
- Monitoring for Chlorides was removed from the permit (Outfall 002) based on the results of Reasonable Potential Analysis.
- Monitoring for COD, Total Cadmium, Total Chromium, Chlorides, Total Nickel, Total Silver, Total Zinc and Total Beryllium was removed from the permit (Internal Outfall 005) based on the results of the discharge evaluation.
- 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. (26.)**]

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 Applicable State Law Special Condition was added to the permit to meet the requirements of Senate Bill 729 (Coal Ash Management Act, please see Special Condition A. (27.)).
- The Additional Conditions and Definitions Special Condition was added to the permit. Please see Special Condition A. (19).
- Monitoring for Bromide was added to the Outfall 002 and the Instream Monitoring Special Condition (Please see A. (24.)) to address the comment from the Public Water Supply Section.
- Monitoring for Hardness was added to Outfall 002 and the Instream Monitoring Special Condition A. (24.) to assist in implementation of the new dissolved standards.
- The Outfall 006 was added to the permit to accommodate a future retention basin discharge.
- The IWC for the Whole Effluent Toxicity Test (Outfall 002) was increased to 23.6% based on the new flow data.
- The monitoring frequency for the Whole Effluent Toxicity was increased to Monthly (Outfall 002-dewatering) to address the EPA comment.
- The monitoring frequency for the Total Arsenic, Total Selenium, and Total Mercury was increased to Weekly (Outfall 002 - dewatering) to address the EPA comment.
- The monitoring frequency for the Total Arsenic, Total Selenium, Total Mercury, and Nitrate/nitrite was reduced to Quarterly based on the evaluation of the effluent data (Internal Outfall 005).
- The daily maximum limit for TSS was reduced to 50.0 mg/L (Outfall 002) to meet the requirements of 40 CFR 423.
- The Decanting and Dewatering Special Conditions in the footnotes were added to Outfall 002, please see A. (2.) and A. (3.).
- The Outfall 008 was added to the permit to accommodate discharge from the emergency spillway of the retired Ash Pond.
- The total silver limits were added to the permit (Outfall 002) based on the results of the Reasonable Potential Analysis.
- The groundwater compliance boundary map was added to the permit.
- The Compliance Boundary special condition was added to the permit, please see A. (28.).

PROPOSED SCHEDULE

Draft Permit to Public Notice:	April 18, 2018 (est.)
Permit Scheduled to Issue:	June 18, 2018 (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) 807-6386 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.

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 sheet labeled DPCs.

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