City of Caldwell
Waste Water Treatment Plant

Local Limits Evaluation: Copper

The Copper Local Limits Evaluation is intended to fulfill the Local Limits Evaluation requirement for 2017 as described in NPDES Permit # ID-0021504

October 2017

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LIST OF ACRONYMS

AHL	Allowable Headworks Loading
BNR	Biological Nutrient Removal
CIU	Categorical Industrial User
COP	Clarifier Optimization Package
DAFT	Dissolved Air Flow Thickener
EPA	Environmental Protection Agency
GPD	Gallons Per Day
IU	Industrial User
MAHL	Maximum Allowable Headworks Loading
MAIL	Maximum Allowable Industrial Loading
MCRT	Mean Cell Retention Time
MDL	Minimum Detection Limit
MGD	Million Gallons per Day
NPDES	National Pollutant Discharge Elimination System
POC	Pollutant of Concern
POTW	Publicly Owned Treatment Works
RAS	Return Activated Sludge
SIU	Significant Industrial User
UV	Ultra Violet
WWTP	Waste Water Treatment Plant

APPENDICES

A. City of Caldwell NPDES Permit Number ID0021504

B. City of Caldwell Sewer Use and Management Ordinance

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I. INTRODUCTION

1.1 Background

The City of Caldwell has been issued NPDES Permit Number ID0021504 (Appendix A), in compliance with provisions of the Clean Water Act. Through the NPDES Permit, the EPA has the ability to control the discharge of pollutants from POTWs into receiving waters. The City of Caldwell's NPDES permit requires a Local Limits Evaluation for Copper. This evaluation is to satisfy that requirement and to protect the operations of the City POTW as well as the integrity of the receiving waters.

II. PROCEDURE

2.1 Introduction

The primary guidance used to conduct the Copper Local Limits Evaluation was the EPA Local Limits Development Guidance (EPA 833-R-04-002A)[1]. This document provided instruction for removal efficiency calculations, allowable headwork loading calculations and sludge quality calculations.

Copper is already designated as a National POC, so it is necessary for its levels to be controlled to meet Federal, State, and local requirements.

2.2 Description of the City of Caldwell WWTP

The City of Caldwell Waste Water Treatment Plant (operated by the City of Caldwell) operates a Class IV Biological Nutrient Removal (BNR) system, with a service population of 50,000.

The Caldwell WWTP treats all of its wastewater through an activated sludge system. This process begins with screening and grit removal, followed by solids removal through two primary clarifiers. The clarifier effluent is pumped to a selector basin comprised of four individual cells. These cells are used for denitrifying and phosphorus removal. The flow from the selector basin proceeds to three aeration basins where ammonia is removed via nitrification. These basins are operated in plug flow mode, with over 1,500 fine bubble diffusers in each basin. These diffusers are fed with four 250hp aeration blowers. The system is operated with a mean cell retention time (MCRT) from ten days in the summer to up to fourteen to fifteen days in the winter. Solid inventories range from 80,000 lbs volatile in the summer to 140,000 lbs volatile during the winter months. Flows from these aeration basins proceed to three final clarifiers, which uses a clarifier optimization package (COP) consisting of a mechanical scraper system to continually move sludge towards the hopper, resulting in a fresher and denser sludge. Return activated sludge (RAS) pumps return the sludge back to the activated sludge system, while the final clarifier effluent proceeds to the UV filtration system, which uses ultraviolet light to disinfect any disease-causing bacteria. The UV treated final effluent is then released to the Boise River.

Thickening of the waste solids from the final clarifiers is accomplished through a Dissolved Air Flow Thickener (DAFT), with solids thickened to 4 – 5% with an efficiency of 99%. Concentrated solids are them pumped to two anaerobic digesters, which heat to a temperature of 100 degrees Celsius for at least fifteen days. The sludge is then pumped to two sludge lagoons, where it is stored and thickened. The lagoons are drained to a sludge press, which presses water out of the sludge cake. The cake is disposed of via landfill.

2.3 POTW Flows and Residual Solids Production

The City of Caldwell WWTP is designed for a current maximum capacity of 18.5 MGD Final Effluent. Current flow is much lower, with an average of 7.2 MGD and a maximum of 11.9 MGD in 2016.

Sludge after anaerobic digestion is stored in lagoons, thickened, and disposed of via landfill.

2.4 Industrial and Non-Industrial Flows

Currently three industrial users hold City issued wastewater discharge permits. One of these industrial users is a significant user while the other two are categorical users. The Industrial Users are as follows:

Industrial User	Class	Category	Permit No.	Expiration Date	Process
Darigold 520 Albany Street Caldwell, ID 83605	SIU	40 CFR 405.44 and 405.104	DAR-0003	04/01/2020	Dairy: Butter, Dry Milk
Fiberguide Technologies 3409 E. Linden Street Caldwell, ID 83605	CIU	40 CFR 433.17	FIB-0001	01/11/2020	Fiber Optic Cable Manufacturing
Inspire Technologies 3709 East Cleveland Blvd. Caldwell, ID 83605	CIU	40 CFR 496.18	2006.01	08/01/2016*	Silicon and ceramic part cleaning

* A current permit is under revision to be signed and in effect as soon as possible.

Darigold had an average flow of 279,288 MGD in 2016, while both categorical users had a flow of less than 1000 GPD.

2.5 Current Local Limit for Copper

The City of Caldwell Sewer Use and Management Ordinance includes a local limit of copper of 1.8 mg/L as a daily maximum discharge limit. A copy of the Sewer Use and Management Ordinance is available in Appendix B.

III. DATA

3.1 POTW Monitoring Data

Copper monitoring was performed at the headworks (influent), the final effluent (effluent), after primary treatment (primary), and after secondary treatment (secondary). It was also performed on each industrial user, as well as on the north and south channel waste streams, and biosolids from anaerobic digesters. All relevant sampling data from the start date of the current NPDES permit was included in calculations. Samples were taken as twenty-four hour composites (except for the Boise River Upstream samples, which were taken as grab samples as per NPDES permit), in consecutive days when possible. Samples were sent to Analytical Laboratories Inc. located in Boise, Idaho for copper and low level copper analysis. Analysis were conducted by EPA methods 200.7 and 200.8 for all samples except for sludge (biosolid) samples, which were analyzed using SW 846 6010. Sludge samples were taken from the anaerobic digesters.

3.2 Industrial Monitoring Data

The City conducts sampling at each permitted Industrial User effluent at least twice annually. Two of the three permitted Industrial Users are also required by their discharge permits to sample their effluent throughout the year. The copper data from these analysis was gathered and used to assist with determinations regarding the source of copper loadings.

3.3 Collection System Monitoring Data

The City of Caldwell WWTP has two channels (North and South) which feed influent into the headworks. Samples were taken at each of these channels as well. All permitted Industrial users flows are received through the North Channel. This makes it possible to compare copper level results from each and determine if a considerable percent of copper loadings to the headworks come from the permitted Industrial Users.

3.4 Receiving Stream Background Data

NPDES permit ID 0021504 allows the City of Caldwell to discharge treated effluent into the Boise River, at 43°40’39”N, 116°42’3”W. Metal testing is conducted upstream from the discharge site, at the Chicago Street bridge, quarterly, including copper analysis. These analyses were gathered and averaged to show background copper levels.

3.5 Data Collection

Analysis results were listed with the MDL, method information, flow from that day for each respective sampling point, and the resulting loading (where applicable). Sludge samples taken in August of 2017 were each taken as two composite samples from both digesters and analyzed separately. Results were averaged for each day to show one result.

Data collected from copper analyses are summarized in the following tables:

Influent Composite Copper Data						
Date	**Time**	**Results (mg/L)**	**MDL (mg/L)**	**Method**	**Flow (MGD)**	**Loading (lbs)**
3/28/2017	7:15 AM	0.051	0.002	EPA 200.8	7.3297	3.1176
3/30/2017	8:00 AM	0.034	0.002	EPA 200.8	8.7297	2.4754
3/29/2017	7:38 AM	0.023	0.002	EPA 200.8	7.6871	1.4745
9/12/2017	8:09 AM	0.038	0.002	EPA 200.8	8.243	2.6124
9/14/2017	7:24 AM	0.054	0.002	EPA 200.8	8.1068	3.6510
9/19/2017	7:45 AM	0.063	0.002	EPA 200.8	7.5918	3.9889
9/20/2017	7:50 AM	0.696	0.002	EPA 200.8	7.4922	43.4895
9/22/2017	8:13 AM	0.034	0.002	EPA 200.8	7.6287	2.1632
9/26/2107	8:10 AM	0.062	0.002	EPA 200.8	7.3264	3.7883
9/27/2017	8:19 AM	0.04	0.002	EPA 200.8	7.3384	2.4481
9/28/2017	8:41 AM	0.047	0.002	EPA 200.8	7.2170	2.8289
9/29/2017	7:59 AM	0.04	0.002	EPA 200.8	7.0462	2.3506
10/3/2017	7:20 AM	0.038	0.002	EPA 200.8	6.8969	2.1858
10/4/2017	6:30 AM	0.036	0.002	EPA 200.8	6.9477	2.0860
AVERAGES		**0.090**			**7.5415**	**5.6186**

Figure 3.01 (above): Influent Composite Copper Analysis Results

Final Effluent Composite Copper Data						
Date	Time	Results (mg/L)	MDL (mg/L)	Method	Flow (MGD)	Loading (lbs)
11/8/2016	7:55 AM	* 0.0025	0.005	EPA 200.7	6.1492	0.1282
12/13/2016	8:12 AM	0.003	0.001	EPA 200.8	6.4998	0.1626
1/10/2017	7:25 AM	0.003	0.001	EPA 200.8	7.5334	0.1885
2/7/2017	7:47 AM	* 0.0025	0.005	EPA200.7	8.9301	0.1862
3/7/2017	8:22 AM	* 0.0025	0.005	EPA 200.7	8.8021	0.1835
4/6/2017	7:41 AM	0.003	0.001	EPA 200.8	9.0903	0.2274
5/9/2017	7:43 AM	0.003	0.002	EPA 200.8	9.7304	0.2435
6/8/2017	8:28 AM	0.004	0.002	EPA 200.8	11.3808	0.3797
9/12/2017	8:13 AM	0.005	0.002	EPA 200.8	9.6776	0.4036
9/14/2017	7:31 AM	0.004	0.002	EPA 200.8	9.3970	0.3135
9/19/2017	8:06 AM	0.005	0.002	EPA 200.8	8.8864	0.3706
9/20/2017	8:29 AM	0.005	0.002	EPA 200.8	8.8470	0.3689
9/21/2017	7:46 AM	0.006	0.002	EPA 200.8	8.7262	0.4367
9/22/2017	8:13 AM	0.005	0.002	EPA 200.8	8.9465	0.3731
9/26/2017	8:30 AM	0.007	0.002	EPA 200.8	8.4388	0.4927
9/27/2017	8:30 AM	0.006	0.002	EPA 200.8	8.4394	0.4223
9/28/2017	8:43 AM	0.006	0.002	EPA 200.8	8.3428	0.4175
9/29/2017	8:07 AM	0.005	0.002	EPA 200.8	8.1920	0.3416
10/3/2017	7:30 AM	0.005	0.002	EPA 200.8	8.0452	0.3355
10/4/2017	6:40 AM	0.005	0.002	EPA 200.8	8.1843	0.3413
AVERAGES		**0.0044**			**8.6120**	**0.3158**

*Samples measuring below the MDL were calculated as 1/2 the MDL as described in chapter 5-6 of the EPA's Local Limits Development Guidance.

Figure 3.02 (above): Effluent Composite Copper Analysis Results

Primary Effluent Composite Copper Data				
Date	Time	Results (mg/L)	MDL (mg/L)	Method
9/14/2017	8:28 AM	0.022	0.002	EPA 200.8
9/19/2017	7:38 AM	0.019	0.002	EPA 200.8
9/20/2017	8:35 AM	0.052	0.002	EPA 200.8
9/21/2017	8:46 AM	0.021	0.002	EPA 200.8
9/22/2017	8:27 AM	0.019	0.002	EPA 200.8
9/26/2017	8:15 AM	0.027	0.002	EPA 200.8
9/27/2017	8:25 AM	0.023	0.002	EPA 200.8
9/28/2017	9:15 AM	0.017	0.002	EPA 200.8
9/29/2017	8:47 AM	0.019	0.002	EPA 200.8
10/4/2017	8:00 AM	0.023	0.002	EPA 200.8
AVERAGE		**0.024**		

Figure 3.03 (above): Primary Effluent Composite Analysis Results

Secondary Composite Copper Data				
Data	Time	Results (mg/L)	MDL (mg/L)	Method
9/14/2017	8:40 AM	0.005	0.002	EPA 200.8
9/19/2017	8:05 AM	0.006	0.002	EPA 200.8
9/20/2017	8:30 AM	0.006	0.002	EPA 200.8
9/21/2017	8:54 AM	0.006	0.002	EPA 200.8
9/22/2017	8:34 AM	0.005	0.002	EPA 200.8
9/26/2017	8:28 AM	0.006	0.002	EPA 200.8
9/27/2017	8:28 AM	0.005	0.002	EPA 200.8
9/28/2017	9:19 AM	0.005	0.002	EPA 200.8
9/29/2017	8:52 AM	0.005	0.002	EPA 200.8
10/4/2017	6:41 AM	0.005	0.002	EPA 200.8
AVERAGE		**0.005**		

Figure 3.04 (above): Secondary Composite Copper Analysis Result

North Channel Composite Copper Data				
Data	Time	Results (mg/L)	MDL (mg/L)	Method
9/20/2017	7:45 AM	0.016	0.002	EPA 200.8
9/21/2017	8:18 AM	0.012	0.002	EPA 200.8
9/22/2017	8:30 AM	0.009	0.002	EPA 200.8
9/26/2017	8:00 AM	0.014	0.002	EPA 200.8
9/27/2017	8:17 AM	0.012	0.002	EPA 200.8
9/29/2017	9:01 AM	0.012	0.002	EPA 200.8
10/3/2017	9:10 AM	0.011	0.002	EPA 200.8
10/4/2017	7:58 AM	0.021	0.002	EPA 200.8
AVERAGE		**0.013**		

Figure 3.05 (above): North Channel Composite Copper Analysis Results

South Channel Composite Copper Data				
Data	Time	Results (mg/L)	MDL (mg/L)	Method
9/20/2017	7:47 AM	0.065	0.002	EPA 200.8
9/21/2017	8:06 AM	0.014	0.002	EPA 200.8
9/22/2017	8:45 AM	0.023	0.002	EPA 200.8
9/26/2017	8:05 AM	0.164	0.002	EPA 200.8
9/27/2017	8:15 AM	0.031	0.002	EPA 200.8
10/3/2017	9:15 AM	0.021	0.002	EPA 200.8
10/4/2107	7:55 AM	0.012	0.002	EPA 200.8
AVERAGE		**0.047**		

Figure 3.06 (above): South Channel Composite Copper Analysis Results

Sludge Copper Data						
Data	Time	Results (mg/kg)	MDL (mg/kg)	Method	% Solids	Disposal Flow (MGD)
3/28/2017	15:10 PM	9.4	0.1	SW 846 6010	2.9	0.050483
3/30/2017	16:10 PM	8.4	0.1	SW 846 6010	2.9	0
3/29/2017	15:20 PM	8.9	0.1	SW 846 6010	2.9	0.059823
8/22/2017	15:25 PM	10.8	0.1	SW 846 6010	2.95	0.038394
8/23/2017	16:35 PM	10.3	0.1	SW 846 6010	2.9	0.049524
8/24/2017	17:05 PM	10.5	0.1	SW 846 6010	3.0	0.035555
AVERAGES		**9.717**			**2.925**	**0.038963**

Figure 3.07 (above): Sludge Composite Copper Analysis Results

Darigold				
Data	Time	Results (mg/kg)	MDL (mg/L)	Method
4/26/2017	10:30 AM	0.013	0.002	EPA 200.8
10/5/2017	11:15 AM	0.015	0.002	EPA 200.8
AVERAGE		**0.014**		

Figure 3.08 (above): Darigold Copper Sampling Results

Fiberguide				
Data	Time	Results (mg/kg)	MDL (mg/L)	Method
4/26/2017	10:15 AM	0.063	0.002	EPA 200.8
10/5/2017	10:42 AM	0.061	0.002	EPA 200.8
AVERAGE		**0.062**		

Figure 3.09 (above): Fiberguide Copper Sampling Results

Inspire				
Data	Time	Results (mg/kg)	MDL (mg/L)	Method
4/27/2017	16:00 PM	0.014	0.002	EPA 200.8
10/3/2017	16:20 PM	0.050	0.002	EPA 200.8
AVERAGE		**0.032**		

Figure 3.10 (above): Inspire Copper Sampling Results

Boise River Upstream Copper Data						
Data	Time		Results (mg/L)	MDL (mg/L)	Method	Flow (MGD)**
1/26/2017	16:25 PM	*	0.0025	0.005	EPA 200.7	387.5355
4/26/2017	16:24 PM	*	0.001	0.002	EPA 200.8	5550.200
7/12/2017	12:43 PM	*	0.001	0.002	EPA 200.8	899.0884
AVERAGES			0.002			2278.9413
*Samples measuring below the MDL are calculated as 1/2 the MDL as described in chapter 5-6 of the EPA's Local Limits Development Guidance.						
**Flow was taken from USGS data station for each day grab samples were taken.						

Figure 3.11 (above): Boise River Upstream Copper Data

3.6 Appropriateness of Data

In the case of Final Effluent analysis results returned with values below the MDL, a value of half of the MDL was used, as recommended in chapter five, section six of the EPA's Local Limits Development Guidance[1]. As previously mentioned, sludge samples taken in August of 2017 were each taken as two composite samples from both digesters and analyzed separately. Results were averaged for each day to show one result. Sludge samples taken in March of 2017 were taken as composite samples from both digesters combined.

Boise River background copper data results were all below the MDLs, and literature values did not appear to be available for the Caldwell Boise River area, therefore half of the MDL value was used for each value below the MDL as recommended by the EPA Local Limits Development Guidance[1].

Neither literature nor default data was used in calculations or figures

VI. ENVIRONMENTAL CRITERIA

4.1 NPDES Permit Limits

Effluent copper has monthly average limits of 19.8 ug/L and 1.40 lb/day, and a maximum daily limit of 2.81 lb/day, from April through June. Effluent copper does not have limits from July through March, but levels are still reported on DMRs. Influent copper does not have limits either but are also reported on DMRs.

4.2 Water Quality Standards

The EPA has set forth a list of National Primary Drinking Water Regulations, including maximum contamination levels or treatment techniques (whichever is relevant) and public health goals. For Copper the treatment technique action level is 1.3 mg/L, and the public health goal is also 1.3 mg/L[2].

The Idaho Department of Environmental Quality's Idaho Administrative Code has set forth Water Quality Standards, including standards for Copper for both human health for consumption of water and fish, and for aquatic life. The Administrative Code lists the quality standard for the human health consumption of water and fish at 1300 ug/L (1.3 mg/L)[3]. It lists two qualities for aquatic life. The continuous concentration is 11 ug/L (0.011 mg/L)[3] while the maximum concentration is 17 ug/L (0.017 mg/L)[3].

4.3 Sludge Use and Disposal

Sludge is currently disposed of via landfill after the dewatering process, and not used for agricultural purposes. Sludge surface disposal does not have a copper regulation level. However, when calculating sludge-quality based MAHLs, the City of Caldwell has used the monthly average pollutant concentration value from 40 CFR 503.13, which lists a copper level of 1500 mg/kg.

The Idaho Department of Environmental Quality refers back to Federal Regulations in the Idaho Administrative Code (IDAPA 58.01.16 Wastewater Quality Standards)[4].

4.4 Inhibition for Biological Processes

Though the City of Caldwell has not experienced inhibition problems for many years, AHLs will still be calculated based on biological process inhibition criteria to prevent future loadings that may cause issues with our activated sludge treatment process. Literature inhibition values used are from Appendix G of the EPA Local Limits Development Guidance[1] Appendices. The reported range of activated sludge inhibition threshold for copper is 1 mg/L, while the reported range of nitrification inhibition threshold level for copper is 0.05 to 0.48 mg/L.

V. HEADWORKS LOADING CALCULATIONS

5.1 Allowable Headworks Loadings

The Allowable Headworks Loading (AHL) must be calculated to allow the development of local limits. AHLs were calculated using NPDES limit criteria, and the water quality standards discussed in section 4.2. The lowest of these calculations was then selected as the Maximum Allowable Headworks Loading (MAHL).

Effluent removal efficiencies from the headworks must be calculated before AHLs. This was accomplished using Equation 5.01 (below):

$$R_{potw} = \frac{\bar{I} - \bar{E}_{potw}}{\bar{I}}$$

$$R_{potw} = \frac{\overline{0.090} - \overline{0.004}}{\overline{0.090}} = 0.956$$

Equation 5.01 (Above): Mean removal efficiency from headworks to plant effluent. See Influent and Effluent Copper Data Results in Figures 3.01 and 3.02 for averages used in this calculation.

$R_{potw} =$ Plant removal efficiency from headworks to plant effluent, as decimal

$I =$ POTW influent pollutant concentration at headworks, mg/L

$E_{potw} =$ POTW effluent pollutant concentration, mg/L

Next, an NPDES based AHL was calculated as in Equation 5.02 (below):

$$AHL_{npdes} = \frac{(8.34)(C_{npdes})(Q_{potw})}{(1 - R_{potw})}$$

$$AHL_{npdes} = \frac{(8.34)(0.0198\ mg/L)(8.6120\ MGD)}{(1 - 0.956)}$$

$AHL_{npdes} = 32.32$ lb/day

Equation 5.02 (Above): NPDES based AHL. See Effluent Copper Data Results in Figure 3.01 for averages used in this calculation.

$AHL_{npdes} =$ AHL based on NPDES permit limit, lb/day

$C_{npdes} =$ NPDES permit limit, mg/L

$Q_{potw} =$ POTW average flow rate, MGD

$R_{potw} =$ Plant removal efficiency from headworks to plant effluent, as decimal

$8.34 =$ Conversion factor

Next, water quality AHLs were calculated using State and Federal water quality standards, using Equations 5.03 and 5.04, respectively:

$$AHL_{wq} = \frac{(8.34)[C_{wq}(Q_{str} + Q_{potw}) - (C_{str} * Q_{str})]}{(1 - R_{potw})}$$

$$AHL_{wq} = \frac{(8.34)\left[0.011\frac{mg}{L}(2278.94\ MGD + 8.61 MGD) - \left(0.002\frac{mg}{L} * 2278.94\ MGD\right)\right]}{(1 - 0.956)}$$

$AHL_{wq} = 3905.62$ lb/day

Equation 5.03 (Above): State Water Quality Standard based AHL. See Section 4.2 for a description of State of Idaho water quality standards.

$AHL_{wq} =$ AHL based on water quality criteria, lb/day

$C_{str} =$ Receiving stream background concentration, mg/L

$C_{wq} =$ Water Quality Standard

$Q_{str} =$ Receiving stream (upstream) flow rate, MGD

$Q_{potw} =$ POTW average flow rate, MGD

$R_{potw} =$ Plant removal efficiency from headworks to plant effluent (as decimal

$8.34 =$ Conversion factor

$$AHL_{wq} = \frac{(8.34)[C_{wq}(Q_{str} + Q_{potw}) - (C_{str} * Q_{str})]}{(1 - R_{potw})}$$

$AHL_{wq} =$ AHL based on water quality criteria, lb/day

$C_{str} =$ Receiving stream background concentration, mg/L

Water Quality Standard

$$AHL_{wq} = \frac{(8.34)\left[1.3\frac{mg}{L}(2278.94\ MGD + 8.61 MGD) - \left(0.002\frac{mg}{L} * 2278.94\ MGD\right)\right]}{(1-0.956)}$$

$$AHL_{wq} = 554169.93 \text{ lb/day}$$

$C_{wq} =$

$Q_{str} =$

$Q_{potw} =$

$R_{potw} =$

$8.34 =$

Equation 5.04 (Above): Federal Water Quality Standard based AHL. See Section 4.2 for a description of Federal water quality standards.

5.2 Sludge Based AHLs

Because the State of Idaho refers back to Federal Regulations (40 CFR 503.13) for sludge quality, only one sludge based AHL was calculated, which is therefore also the MAHL for sludge. It was calculated using the monthly average pollutant concentration value from 40 CFR 503.13, which lists a copper level of 1500 mg/kg. It should be noted that the specific gravity of sludge was assumed to be that of water, as recommended by the EPA Local Limits Development Guidance[1] (EPA 833-R-04-002A). The sludge based AHL/MAHL can be seen below:

$$AHL_{sldg} = \frac{(8.34)(C_{slgstd})(PS/100)(Q_{sldg})(G_{sldg})}{R_{potw}}$$

$$AHL_{sldg} = \frac{(8.34)(1500\ mg/kg)(2.925/100)(0.039 \text{ MGD})(1\ kg/L)}{0.956}$$

$$AHL_{sldg} = 14.93\ lb/day$$

Equation 5.05 (Above): Federal Regulation Sludge Based AHL. See Section 4.3 for a description of Federal Regulations on sludge.

$AHL_{npdes} =$ AHL based on sludge, lb/day

$C_{slgstd} =$ Sludge standard, mg/kg dry sludge

$PS =$ Percent solids of sludge to disposal

$Q_{sldg} =$ Total sludge flow rate to disposal, MGD

$R_{potw} =$ Plant removal efficiency from headworks to plant effluent, as decimal

$G_{sldg} =$ Specific gravity of sludge, kg/L

$8.34 =$ Unit conversion factor

5.3 Inhibition Based AHLs

AHLs have been calculated based on biological process inhibition criteria to prevent future loadings that may cause issues with our activated sludge treatment process, as shown in the equations 5.07 and 5.08. First, the removal efficiency form headworks to primary treatment effluent, had to be calculated as in the equation below:

$$R_{prim} = \frac{\bar{I} - \bar{E}_{prim}}{\bar{I}}$$

$$R_{prim} = \frac{\overline{0.090} - \overline{0.024}}{\overline{0.090}} = 0.733$$

Equation 5.06 (Above): Mean removal efficiency from headworks to primary effluent, as decimal. See Influent and Primary Effluent Copper Data Results in Figures 3.01 and 3.03 for averages used in this calculation.

$R_{prim} =$ Removal efficiency from headworks to primary treatment effluent, as decimal

$I =$ POTW influent pollutant concentration at headworks, mg/L

$E_{prim} =$ Primary treatment effluent pollutant concentration, mg/L

Inhibition Based AHLs were calculated as below, with the activated sludge inhibition threshold mentioned in Section 4.4 used in Equation 5.07, and the lowest nitrification inhibition threshold mentioned in Section 4.4 used in Equation 5.08:

$$AHL_{sec} = \frac{(8.34)(C_{inhib2})(Q_{potw})}{(1 - R_{prim})}$$

$$AHL_{sec} = \frac{(8.34)(1\ mg/L)(8.6120\ MGD)}{(1 - 0.733)}$$

$$AHL_{sec} = 269.00\ lb/day$$

Equation 5.07 (Above): Activated sludge inhibition threshold based AHL. See Equation 5.06 for primary removal efficiency calculation, and see Figure 3.03 for Primary Effluent Copper Data Results averages.

$AHL_{sec} =$ AHL based on secondary treatment inhibition, lb/day

$C_{inhib2} =$ Inhibition criterion for secondary treatment, mg/L

$Q_{potw} =$ POTW average flow rate, MGD

$R_{prim} =$ Removal efficiency from headworks to primary treatment effluent, as decimal

$8.34 =$ Conversion factor

$$AHL_{sec} = \frac{(8.34)(C_{inhib2})(Q_{potw})}{(1 - R_{prim})}$$

$$AHL_{sec} = \frac{(8.34)(0.05\ mg/L)(8.6120\ MGD)}{(1 - 0.733)}$$

$$AHL_{sec} = 13.45\ lb/day$$

Equation 5.08 (Above): Nitrification inhibition threshold based AHL. See Equation 5.06 for primary removal efficiency calculation, and see Figure 3.03 for Primary Effluent Copper Data Results averages.

$AHL_{sec} =$ AHL based on secondary treatment inhibition, lb/day

$C_{inhib2} =$ Inhibition criterion for secondary treatment, mg/L

$Q_{potw} =$ POTW average flow rate, MGD

$R_{prim} =$ Removal efficiency from headworks to primary treatment effluent, as decimal

$8.34 =$ Conversion factor

Therefore, the lowest Inhibition Based AHL is that for Nitrification inhibition.

5.4 Determination of the Maximum Allowable Headworks Loading (MAHL)

The MAHL is the most stringent of AHLs determined in Equations 5.02 through 5.08. For the City of Caldwell, the MAHL is therefore the Nitrification Inhibition Threshold AHL, calculated in Equation 5.08, at 13.45 lb/day.

5.5 Actual Loadings vs. MAHL

In order to calculate the percentage of the MAHL received at the City of Caldwell WWTP, and ultimately evaluate the Local Limits for copper, equation 5.09 was used as below:

$$L_{\%} = \frac{L_{INFL}}{MAHL} \times 100$$

$$L_{\%} = \frac{5.62\ lb/day}{13.45\ lb/day} \times 100$$

n

$$L_{\%} = 41.78\%$$

Equation 5.09 (Above): Actual Loadings vs. MAHL. See Figure 3.01 for influent loading average. The MAHL was calculated in Equation 5.08.

$L_{\%} =$ Percentage of the MAHL

$L_{INFL} =$ Current influent loading (average or highest daily), lb/day

$MAHL =$ Calculated MAHL lb/day

5.6 Maximum Allowable Industrial Loadings (MAILs)

Due to the City's low actual loading versus the MAHL of 41.78%, and the nature of industries in the City of Caldwell, as well as the relatively low Copper concentrations from each IU combined with low flows from IUs, and the nature of each IU, the City did not calculate MAILs.

VI. COLLECTION BASED LIMITS

6.1 Prohibited Discharges

40 CFR 403.5(b) requires POTWs to implement specific prohibitions for discharges regarding pollutants which may create fire or explosion hazards, corrosives, pollutants which may cause obstruction, pollutants which may cause interference, excessive heat, certain oils, pollutants resulting in gases, vapors or fumes which may cause danger to POTW workers, and trucked or hauled pollutants except at designated discharge sites. The City Sewer Use and Management Ordinance outlines these regulations in §403.5: National pretreatment standards: Prohibited discharges. A copy of the City Sewer Use and Management Ordinance is available in Appendix B.

VII. CONCLUSIONS AND RECOMMENDATIONS

7.1 Recommended Local Limits for Copper

Currently, as show in Section 5.5 (Actual Loadings vs. MAHL), the current copper loading is below the established threshold. Therefore, the City of Caldwell will keep the current local limit for copper, and review its loading next year, as recommended in the EPA Local Limits Development Guidance[1], Section 7.1.1 (Comparison of Current Loadings with MAHLs).

7.2 Recommendations for Future Sampling Plans

In the future it would be beneficial to pair all copper sampling events, so the ADRE (Average Daily Removal Efficiency) may be used, as opposed to the MRE (Mean Removal Efficiency). Future sampling should also always use EPA method 200.8, instead of EPA method 200.7, as EPA 200.8 has a lower MDL and therefore shows a more accurate picture of copper levels.

Sludge samples should also be taken in a uniform manner, either from both digesters at each sampling event, or as a composite from both at each sampling event.

REFERENCES

(1) EPA: Local Limits Development Guidance (EPA 833-R-04-022A) [PDF]. (2004, July). United States Environmental Protection Agency, Office of Wastewater Management 4203.

(2) National Primary Drinking Water Regulations (EPA 816-F-09-004) [PDF]. (2009, May). EPA: Office of Ground Water and Drinking Water.

(3) IDAPA 58.01.02 - WATER QUALITY STANDARDS [PDF]. (n.d.). Idaho Administrative Code, Department of Environmental Quality.

(4) IDAPA 58.01.16 - WASTEWATER RULES [PDF]. (n.d.). Idaho Administrative Code, Department of Environmental Quality.

APPENDIX A

APPENDIX B