RISK ASSESSMENT INFORMATION RELATED TO U-3 BOILER EMISSIONS

General RCRA Permit Application Requirements – 40 CFR 270.10(k)

RISK ASSESSMENT INFORMATION RELATED TO U-3 BOILER EMISSIONS

1.0 INTRODUCTION

During the September 2018 CPT the following emission results were collected per the CPT Plan dated August 2017.

- Particulate Matter
- CO
- Chromium
- Lead
- Cadmium
- PCDD/PCDF

These emission data are compared to the emission data used for the 2005 Risk Assessment Report per the methodology in the February 2011 Risk Assessment Work Plan. This comparison is included in the following sections.

1.1 Comparison of the Particulate Matter Emission Results

The HWC MACT particulate matter (PM) emission standard for liquid fired boilers that co-fire hazardous waste is 80 mg/dscm corrected to 7 % oxygen while the RCRA Permit limit for PM is 34 mg/dscm corrected to 7 % oxygen. During the 2018 HWC MACT CPT, the unit was spiked with titanium dioxide. The average PM removal efficiency during the 2018 HWC MACT CPT was 99.96 % and the corresponding stack gas concentration was 1.03 mg/dscm corrected to 7 % oxygen. The average PM stack gas concentration during the 2004 CVT was 2.75 mg/dscm corrected to 7 % oxygen.

PM is not a direct input into the risk assessment, but it is an indicator of the ability of the unit to control constituents that are in the solid phase at the baghouse temperatures. Boiler U-3 is equipped with a baghouse that collects solid constituents in the flue gas prior to discharge to the atmosphere. The 2018 HWC MACT CPT results indicate that the baghouse adequately collects ash and other constituents that may be in solid form (i.e., heavy organics or metals constituents) at the baghouse operating temperatures. Further, the demonstrated PM emission results are well below the applicable standards.

1.2 Comparison of Carbon Monoxide Emission Results

The HWC MACT standard requires that carbon monoxide (CO) must be less than 100 ppmdv corrected to 7 % oxygen on an hourly rolling average basis. A comparison of the CO results from the HWC MACT CPT and 2004 CVT are provided in Table 1-1. These results are consistent with those demonstrated during the 1996 RCRA Trial Burn.

The CO data provides an indication of the combustion efficiency of the unit on a continuous basis. The highest value was less than 40 % of the allowable standard. This indicates that even at the extreme operating conditions required for conduct of the HWC MACT CPT, boiler U-3 is capable of effectively treating the organic waste fed to the unit via thermal destruction.

1.3 Comparison of the Metal Emission Results

The HWC MACT emission standards for metals are based on volatility groups as follows:

Group	Metals	Standard (lb/MMBtu in hazardous waste)
Low volatility (LVM)	Cr	1.3×10^{-4}
Semi-volatile (SVM)	Cd and Pb	8.2×10^{-5}
Volatile	Hg	4.2×10^{-5}

Emerald Kalama proposed to spike and measure the emissions of chromium as representative of the LVM group and lead as representative of the SVM group during the 2018 HWC MACT CPT. The maximum theoretical emission calculation (MTEC) approach was proposed for Hg. During the 2004 CVT Emerald Kalama spiked chromium and nickel and measured the emissions during each test run. Chromium is the only overlapping metal emission result for comparison.

The chromium emission results for the two subject tests are included in Table 1-2. The chromium emission results from the 2018 HWC MACT CPT are an order of magnitude less than those measured during the 2004 CVT. These results are consistent with the PM results that indicates the ability of the air pollution control system to collect solid constituents in the combustion gas.

Table 1-1

Comparison of 2018 HWC MACT CPT Results to the 2004 CVT Results for Carbon Monoxide

Parameter	Units	Run 1	Run 2	Run 3	Average	HWC MACT Emission Limit
2018 HWC MACT CPT - CO [a]	ppmv, dry, corrected to 7% O_2	28.0	39.0	43.5	36.8	100
2004 CVT – CO	ppmv, dry, corrected to 7% O_2	16.8	18.9	21.4	19.0	100

Note:

[a] The average value shown is the average for each runs. The average was calculated from data collected during the Method 23 tests.

Table 1-2

Comparison of 2018 HWC MACT CPT Results to the 2004 CVT Results for Chromium

Parameter	Units	Run 1	Run 2	Run 3	Average
2018 HWC MACT CPT – Chromium	g/s	0.31E-05	0.25E-05	0.52E-05	0.36E-05
2004 CVT – Chromium	g/s	2.79E-05	8.60E-05	5.66E-05	5.68E-05

1.4 Comparison of the Dioxin/Furan Emission Results

Dixon/furan emission data were collected during the 2018 HWC MACT CPT to demonstrate compliance with the HWC MACT emission standard. The dioxin/furan results from the 2018 HWC MACT CPT are shown in Table 1-3.

Table 1-3
Dioxin/Furan Emission Results from the 2018 HWC MACT CPT

Parameter/ Test Condition	Units	Average Concentration	HWC MACT Emission Limit
Dioxins/Furans	ng TEQ/dscm corrected to 7 % O_2	0.014	0.400

The demonstrated emissions were consistently an order of magnitude less than the HWC MACT emission limit.

Dioxin/furan emissions were measured during the 1996 Trial Burn and applied in the facility risk assessment. The risk assessment did not indicate a potential for adverse health effects associated with these emissions.

It should be noted that the dioxin and furan congener emission rates from this source are very low – on the order of $1x10^{-12}$ grams (picograms) per second. This concentration is very close to the detection limit of the stack sampling method and analytical method used to measure dioxin/furan emissions. For the purposes of the risk assessment and this comparison, when a congener was reported below the detectable level, the full detection limit was used to evaluate the toxic equivalency to 2,3,7,8 -TCDD. This provides a very conservative approach since many of the congeners were not detected.

A direct comparison of the reported dioxin/furan emission rates measured during the 2018 HWC MACT CPT, the 2004 CVT, and those measured during the 1996 Trial Burn are shown in Table 1-4. Comparison of these results shows that all are on the same order of magnitude as those used for the Risk Assessment.

Table 1-4
Comparison of Dioxin/Furan Emission Results

2018 HWC MACT CPT	2004 CVT	1996 Trial Burn
3.96×10^{-11} g TEQ/sec	7.41×10^{-11} g TEQ/sec	3.26×10^{-11} g TEQ/sec

The difference in these values is not statistically significant considering the constraints of sampling and analysis precision and accuracy. The difference between the values could well be attributed to slight variations in the detection limit achieved on an individual sample basis, since the emission limit reported is based on a number of congeners being reported at the detection limit. It is more appropriate and accurate to state that the rates are the same order of magnitude and therefore comparable.

1.5 Conclusions Regarding Emissions

The commentor requested that emission results from the September 18-19, 2018 HWC MACT CPT be compared to past emissions testing data. It should be noted that the current risk assessment for this facility was executed based on data collected during the 1996 RCRA Trial Burn and the 2004 CVT. The risk assessment protocol was based on the DRAFT HHRAP.

This comparison of 2018 HWC MACT CPT emission data to data collected during the 1996 Trial Burn and the 2004 CVT was included in the previous sections. Note that each test was conducted at extreme operating conditions to provide for operating flexibility and demonstrate worst case emissions. Some of the constituents included in the 2005 risk assessment were measured in the stack emissions during the HWC MACT CPT conducted in September 2018. These include:

- Particulate Matter
- CO
- Chromium
- Dioxins/Furans

The emission rates measured during the 2018 HWC MACT CPT were compared to the emission rates used to conduct the risk assessment. Based on the qualitative analysis discussed in the sections above, Emerald Kalama concluded that the latest emission results from the 2018 HWC MACT CPT are in the same order of magnitude as previous emission tests and would not alter the potential human health and ecological risk results.

2.0 HISTORICAL METALS FEEDRATES

Through 2011, Emerald Kalama analyzed and tracked the feed rate of all RCRA metals. The historical analytical data for waste streams that are still active at the facility is included in Table 2-1.

More recently, only the HWC MACT metals are analyzed – cadmium, chromium, lead and mercury. A summary of data collected over the last three years for the active waste streams for the HWC MACT metals is included as Table 2-2. Note that control of the feed rate of HWC MACT metals and ash by default results in control of all RCRA metals.

The metal and ash feed rates are controlled by calculating the statistically adjusted concentration (UTL at 95 % tolerance) in T-313 feed tank and multiplying by total allowable waste feed rate in order to ensure the HWC MACT metals emissions are less than the regulatory limit on a lbs/MMBtu basis. By default, the feed rates of all RCRA metals are limited to the levels demonstrated as part of the Human Health and Ecological Risk Assessment. The maximum expected feed rates for the RCRA metals are included in Table 2-3.

Table 2-1

Historical Metals Feedrates

				Values Based on 25 lbs/min Feed Rate										
	Waste			Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Nickel	Selenium	Silver	Thallium
	Codes	Date	Smpl	Sb	As	Ba	Be	Cd	Cr	Pb	Ni	Se	Ag	Tl
	Limits	Do Not	Exceed	5.33	2.67	10.67	1.33	1.33	86.67	38	766.67	5.33	5.33	5.33
PROCESS WASTE														
Benzyl Alcohol Waste														
Total Number of Samples				23	23	23	23	23	23	23	23	22	23	23
Max Values				1.16	0.51	1.8	0.51	0.5	9.5	1	75	2.04	2.5	0.5
Average Values				0.39609	0.245	0.38122	0.23239	0.17078	1.68609	0.32187	4.963913	0.53909	0.46087	0.20135
Benzyl Alcohol/Cinnamic Alcohol Waste														
Total Number of Samples				5	18	5	5	5	5	5	5	5	5	5
Max Values				1	5.6	0.5	0.255	0.4	3.9	1.2	2.7	0.58	0.5	0.5
Average Values				0.297	0.50836	0.1944	0.143	0.1524	1.274	0.4704	1.28	0.53	0.2324	0.1724
BOB Waste														
Total Number of Samples				139	75	74	75	77	75	75	81	72	75	75
Max Values				14	0.58	1	0.5	0.92	9.2	1	130	1	1	0.5
Average Values				0.608	0.18757	0.38811	0.19441	0.18978	0.86933	0.37891	5.621235	0.38285	0.40312	0.26956
C6 Aldehyde Waste														
Total Number of Samples				10	10	10	10	10	10	10	10	10	10	10
Max Values				1.014	0.51	1	0.8	0.21	6.4	0.5	10.5	3.66	0.51	0.15
Average Values				0.5824	0.2776	0.215	0.2674	0.1028	1.218	0.242	2.602	0.9123	0.283	0.0688
C8 Aldehyde Waste														
Total Number of Samples				11	11	11	11	11	12	11	10	10	11	11
Max Values				2	1.2	4.7	1.2	0.47	12	0.5	12	2.4	1.2	0.5
Average Values				0.48909	0.31182	0.74636	0.27	0.17091	2.97167	0.27464	2.54	0.671	0.44282	0.24373
C8 Aldehyde / HCA Waste														
Total Number of Samples				20	20	20	20	20	20	20	20	20	20	20
Max Values				0.8	0.8	0.86	0.5	0.2	9.8	0.5	19	1	0.784	0.5
Average Values				0.4508	0.2138	0.37492	0.1723	0.14542	1.8855	0.3109	3.3915	0.4041	0.3842	0.26542
C10 Aldehyde Waste														
Total Number of Samples				10	10	10	10	11	11	11	10	10	10	10
Max Values				1	0.51	0.6	0.51	0.2	1	0.5	5.7	2	0.51	0.2
Average Values				0.521	0.351	0.231	0.351	0.18845	0.80636	0.21573	1.37	0.81	0.501	0.114
Cinnamic Alcohol Waste														
Total Number of Samples				11	11	11	11	11	11	11	11	11	11	11
Max Values				0.5	0.7	0.54	0.5	0.2	2	0.5	23	2	0.59	0.5
Average Values				0.31109	0.24818	0.42455	0.17909	0.12755	0.73636	0.31945	3.354545	0.50455	0.34636	0.23145
Cinnamic Aldehyde Waste														
Total Number of Samples				18	18	18	18	19	19	18	15	15	18	18
Max Values				2.6	0.5	0.5	0.5	0.5	20	1	11	5	1	1
Average Values				0.64722	0.23611	0.40389	0.20306	0.25684	2.63158	0.49056	1.977333	0.99667	0.46167	0.42778
Cinnamic Aldehyde / ACA Waste														
Total Number of Samples				7	7	8	7	9	9	9	7	7	7	7
Max Values				0.9	0.36	0.5	0.36	0.5	1.2	0.5	4.29	0.72	0.5	0.5
Average Values				0.48571	0.22429	0.25175	0.20143	0.17967	0.60222	0.239	0.952857	0.48286	0.304	0.23929
Cinnamic Aldehyde / HCA Waste														
Total Number of Samples				11	11	11	11	11	11	11	11	11	11	11
Max Values				0.7	0.5	0.8	0.5	0.26	9	0.5	3	2	0.8	0.5
Average Values				0.3465	0.20186	0.31182	0.21414	0.13347	2.24545	0.16265	0.744136	0.58736	0.27027	0.21456
DTA Waste														
Total Number of Samples				10	10	10	10	10	10	10	9	9	10	10
Max Values				0.9	0.8	2.4	0.8	0.5	2	1.1	18	2.04	1	0.5
Average Values				0.556	0.3859	0.5564	0.3579	0.2484	1.09	0.4756	5.286667	0.72889	0.595	0.2442
HCA Waste														
Total Number of Samples				24	24	24	24	24	24	24	21	22	24	24
Max Values				1.7	0.51	0.7	0.51	0.97	4.8	0.5	6.5	2	1	0.5
Average Values				0.50458	0.24563	0.351	0.23379	0.2135	1.19708	0.316	1.302381	0.645	0.44125	0.27954
Laboratory Waste														
Total Number of Samples				162	162	162	162	162	162	161	162	162	205	162
Max Values				1.4	1.4	3.3	0.6	1.14	22	18	109	2.3	34	1.1
Average Values				0.35248	0.18007	0.29871	0.16153	0.16856	1.15341	0.45843	8.149259	0.35374	0.57718	0.21948
Oil Waste														
Total Number of Samples				99	98	123	98	99	98	121	97	97	123	98
Max Values				3.8	0.7	40	2.5	1	22	160	37	2	17	0.8
Average Values				0.48096	0.18678	1.6425	0.21711	0.17567	1.23879	2.94615	1.730356	0.32931	0.50226	0.10899
T_1117 Waste														
Total Number of Samples				35	35	37	37	37	36	37	159	35	37	35
Max Values				1.9	0.51	4.3	0.51	0.58	18	10	3000	4.1	0.51	1
Average Values				0.47371	0.25006	0.84038	0.23168	0.195	3.45347	1.43184	126.2934	0.63851	0.42824	0.3574

Table 2-2
Example Hazardous Waste Stream Characterization Summary

Hazardous Waste Profile for Applicable Constituents								
Process Waste Streams	**Cadmium (ppm)**	**Chromium (ppm)**	**Lead (ppm)**	**Mercury (ppm)**	**Chlorine (ppm)**	**Ash (% by wt)**	**Specific Gravity**	**HHV (Btu/lb)**
3PP Crude Waste	2.9E-02	2.8E+01	1.9E-01	2.2E-03	386.7	0.02	0.96	15,756
3PP/Cinnamic Alcohol Waste	3.5E-02	2.8E+01	3.2E-01	2.6E-03	80.0	0.07	0.99	15,656
3PP/ CinAlc/ BOB Waste	3.7E-02	1.0E+01	6.5E-01	4.3E-03	74.2	0.85	1.03	14,817
Benzyl Alcohol Waste	3.0E-02	1.7E-01	1.9E-01	4.4E-02	144.4	0.01	0.95	14,400
Benzyl Alcohol Bottoms Waste	1.3E-02	2.6E-02	2.7E-02	2.1E-02	14.0	0.28	1.07	8,490
BOB Waste	3.7E-02	1.8E-01	1.0E+00	2.6E-03	87.8	1.28	1.07	14,267
BOB/ 3PP Waste	2.0E-02	1.3E+01	6.4E-01	8.6E-03	17.0	0.79	1.10	13,000
BOB/ Cinnamic Alcohol Waste	3.2E-02	6.2E-01	6.8E-01	3.3E-03	121.1	1.16	1.06	14,514
C-8/ C-6 Aldehyde Waste	3.4E-02	2.4E-01	2.5E-01	2.0E-03	98.6	0.02	0.80	16,829
C-8 Aldehyde / HCA Waste	3.2E-02	1.9E-01	2.5E-01	1.9E-03	88.9	0.65	0.89	16,178
C-8 Aldehyde/ HCA/ C-6 Aldehyde Waste	4.4E-02	1.4E-01	4.1E-01	2.2E-03	80.0	0.23	0.88	16,167
C-6 / C-8 / C-10 Waste	3.1E-02	7.6E-01	2.8E-01	3.4E-03	190.0	0.02	0.80	17,500
C-6/ C-10 Waste	2.7E-02	1.3E+00	1.8E-01	3.0E-03	82.0	0.02	0.82	16,050
C-6/ C-10/ HCA Waste	3.8E-02	2.8E-01	2.8E-01	2.1E-02	80.0	0.01	0.88	16,100
C-8 / C-10 Aldehyde Waste	3.6E-02	6.4E-01	2.7E-01	2.1E-03	162.2	0.01	0.81	17,798
C-8 / C-10 / HCA Waste	3.0E-02	3.3E-01	2.1E-01	2.3E-03	80.0	0.02	0.87	16,571
C-8 Aldehyde Waste	1.2E-01	1.6E+00	2.4E-01	4.2E-02	53.8	0.29	0.83	16,678
C-10 Aldehyde Waste	3.8E-02	1.4E-01	2.6E-01	2.0E-03	107.8	0.02	0.81	17,989
C-10/ HCA Waste	2.9E-02	9.0E-02	1.9E-01	2.5E-03	80.0	0.01	0.84	17,750
Cinnamic Alcohol Waste	5.0E-02	1.6E+00	3.2E-01	5.6E-03	101.1	0.03	1.01	15,533
Cinnamic Aldehyde Waste	3.4E-02	2.5E-01	2.7E-01	3.6E-03	227.8	0.23	0.99	15,278
Cinnamic Aldehyde / ACA Waste	3.1E-02	4.4E-01	2.1E-01	3.4E-03	121.1	0.82	0.96	15,367
Cinnamic Aldehyde / HCA Waste	1.0E-01	2.4E+00	1.5E-01	6.5E-02	42.3	0.21	1.07	15,122
Cinnamic Aldehyde / Benzyl Alcohol Waste	2.8E-02	1.3E-01	1.9E-01	5.0E-03	80.0	0.30	0.97	15,300
Cinnamic Aldehyde/ PICA/ ACA Waste	2.9E-02	1.1E-01	2.0E-01	2.0E-03	100.0	0.38	0.82	16,000
PICA/ HCA/ 3PP Waste	2.8E-02	1.3E+01	1.9E-01	2.0E-03	80.0	0.36	0.87	16,000
Cinnamic Aldehyde / PICA Waste	3.6E-02	1.8E-01	2.9E-01	3.0E-03	80.0	0.21	0.97	15,500
DTA Waste	9.4E-02	6.5E-01	2.2E-01	3.8E-02	141.6	0.07	1.05	15,456
HCA Waste	3.0E-02	1.9E-01	2.1E-01	1.9E-03	192.2	1.23	0.90	16,367
HCA / C6 Aldehyde Waste	4.0E-02	1.6E-01	3.6E-01	1.7E-03	80.0	0.01	0.85	16,333
Laboratory Waste	3.4E-02	1.9E+00	2.3E-01	1.6E-02	121.1	0.32	0.91	11,558
MCA	2.5E-02	1.1E-01	2.4E-01	3.2E-03	254.4	0.36	0.95	14,989
Methyl Benzoate Waste	2.9E-02	1.3E-01	3.4E-01	3.0E-03	141.1	0.28	1.06	12,533
Oil Waste	4.8E-01	3.6E-01	1.0E+00	1.0E-02	246.7	0.08	0.78	19,300
PICA Bottoms Waste	2.8E-02	1.5E-01	2.1E-01	2.4E-03	80.0	0.26	0.88	15,850
T-714 Benzene	3.4E-02	1.1E-01	2.8E-01	2.2E-01	87.8	0.01	0.83	16,222
T-1117 Waste	4.4E-02	8.4E-01	4.7E-01	2.4E-03	110.0	0.46	0.96	13,557
TDS Oil Waste	3.3E-02	1.5E-01	3.0E-01	2.0E-03	92.5	3.20	1.00	14,536
Xceltherm XT	3.7E-02	2.2E-01	2.9E-01	3.4E-03	104.3	0.94	0.96	16,357

Note: Concentrations indicated include all data in the waste profile database for streams sampled in most recent 3 years (2018-2021). Waste streams no longer generated are not included in this summary. These data represent average values for each of the parameters shown for waste streams indicated, but values are updated regularly and may vary from this summary at future dates.

Table 2-3
Expected Maximum Feed Rates for RCRA Metals

Metal		Feed Rate (lb/hr)
Antimony		0.008
Arsenic		0.004
Barium		0.016
Beryllium		0.002
Cadmium		0.002
Chromium		0.13
Lead		0.057
Mercury		0.003
Nickel		1.15
Selenium		0.008
Silver		0.008
Thallium		0.008