Exh. DCG-3
Docket UE-190882
Witness: David C. Gomez

BEFORE THE WASHINGTON
UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**DOCKET UE-190882**

EXHIBIT TO
TESTIMONY OF

David C. Gomez

STAFF OF
WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION

Talen MT, De Minimis Notification and MDEQ Response;
Tinuum Refined Coal System, January 4, 2018

January 10, 2020

DEQ
Montana Department of Environmental Quality

Air, Energy & Mining Division

January 4, 2018

Jim Parker, PE
Talen Montana, LLC
Colstrip Steam Electric Station
303 N Broadway, Ste 400
Billings, MT 59101

Sent via email to: james.parker@talenenergy.com

RE: Montana Air Quality Permit (MAQP) # 0513-09

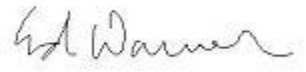
Dear Mr. Parker:

On December 22, 2017, the Montana Department of Environmental Quality-Air Quality Bureau (Department) received a de minimis notification from Talen Montana, LLC (Talen) - Colstrip Steam Electric Station (CSES). This correspondence is a resubmittal of a notification provided on October 6, 2017. Talen is planning to retrofit the coal handling systems for Units 1, 2, 3 and 4 at the CSES by applying an emission reduction fuel additive-The Tinuum Refined Coal System. There will be no change to the combustion units and their potential emissions will not change. Talen has resubmitted the notification to reflect a change in planned operations of the Tinuum Refined Coal System. The original plan assumed that the water used for Tinuum system would be heated by electric heaters. However, Talen has determined that propane-fired heaters will be used instead. Therefore, the total potential emissions from the project will now include additional emissions from propane combustion and increased road traffic from the delivery of propane. The December 22, 2017 notification includes the updated maximum potential emission from the project, which continue to be less than the de minimis threshold of 5 tons per year (tpy) of any individual pollutant. The correspondence requests concurrence from the Department that this activity is not prohibited under the current MAQP #0513-09, is a de minimis change in accordance with Administrative Rules of Montana (ARM) 17.8.745, and that no further notification, reporting or permitting action related to this retrofit project is required.

The proposed project does not have a potential to emit any pollutant by more than 5 tpy. The proposed project does not violate any conditions of MAQP #0513-09 or the Title V Operating Permit #OP0513-13. This project is considered a de minimis change under ARM 17.8.745. The correspondence has fulfilled the notification requirements of ARM 17.8.745(1) (b) and 17.8.1224(1)(e).

If you have any questions or concerns, please contact me by phone at (406) 444-2467 or by e-mail at ewarner@mt.gov.

Sincerely,



Ed Warner
Lead Engineer – Permitting Services Section
Air Quality Bureau

Enclosure
cc: jmerkel@mt.gov
jraty@mt.gov
hrash@mt.gov

James M Parker PE, MANAGER ECS •

303 N Broadway St., Ste 400 • Billings, MT 59101 •

406 237 6932 (O), 406 281 2999 james.parker@talenenergy.com

TALEN ENERGY

December 22, 2017

Mr. Ed Warner
Air Quality Bureau
Montana Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

RE: UPDATED DE MINIMIS NOTIFICATION FOR CHANGES TO COAL HANDLING SYSTEMS, COLSTRIP POWER PLANT, MAQP # 0513-09 – Tinuum Refined Coal System

Dear Mr. Warner:

Talen Montana, LLC (Talen), as designated operator[1] , is proposing to make changes to the coal handling systems for Units 1, 2, 3 and 4 at the Colstrip Power Plant (Colstrip). Talen desires to implement these changes as soon as the proper permitting review and activities are agreed upon with Montana Department of Environmental Quality and completed. The proposal involves physical changes, related to addition of an emission reduction fuel additive – the Tinuum Refined Coal System[2] - limited to the existing coal handling systems. No change to the combustion units will result from this project. The only anticipated change in potential air emissions will be a small increase in particulate emissions from the coal handling and plant road emitting units as described further in this notification.

With this letter we are updating our October 6, 2017 DE MINIMIS NOTIFICATION FOR CHANGES TO COAL HANDLING SYSTEMS, COLSTRIP POWER PLANT, MAQP # 0513-09 – Tinuum Refined Coal System. This update consists of the inclusion of small propane water heaters not in the original design of the Tinuum system. Electric water heaters of the original design have been deemed infeasible, upon further review by Colstrip and Tinuum engineering staff, due to site specific constraints of the Colstrip facility.

Talen has evaluated the proposed project for potentially applicable air quality permitting requirements and has concluded that the change can be appropriately permitted through a de minimis change as described in the Administrative Rules of Montana (ARM) at ARM 17.8.745.

---

[1] The other owners of the Colstrip Steam Electric Station (in different shares for Units 1 and 2 and for Units 3 and 4) are NorthWestern Corporation d/b/a NorthWestern Energy, Puget Sound Energy, Inc., Portland General Electric Company, Avista Corporation, and PacifiCorp.

[2] The Tinuum Refined Coal System is an IRS section 45 qualified fuel additive that has demonstrated a reduction of at least 20 percent of un-refined coal, uncontrolled emissions of nitrogen oxide (NOx) and at least 40 percent of un-refined coal, uncontrolled emissions of either sulfur dioxide (SO_2) or mercury (Hg) released when burning the refined coal. IRS rules require emission reduction verification every six months. Attachment 6 contains one such verification for subbituminous coal.

This notification includes an overview that describes the proposed project, discusses potential emissions, and compares the project to the various criteria of a de minimis change. The intent of this notification is to provide the Montana Department of Environmental Quality (MDEQ) with adequate information to support Talen's conclusion that the project is a de minimis change.

****

Description of Proposed Change – Installation of Tinuum Refined Coal System

Introduction

The refined coal system is a process whereby coal delivered to Colstrip is treated with proprietary chemicals - M45-PC-A1, M45-PC-A2, and M45-PC-B[3] - which refine the coal and are designed with the intent to lower emissions of nitrogen oxides (NOx) and mercury (Hg) from the Colstrip boilers without impact to other boiler emissions.

The refined coal project will include the installation of two granular product storage silos, each equipped with a bin vent filter, and associated small propane burners for heating mixture water. The two solid, granular products will be used to reduce NOX emissions from the Colstrip boilers. The product storage silo bin vent filters will provide point source emissions of particulate matter. The refined coal project will also include the use of proprietary product totes which will store the liquid mercury control reagent, M45-PC-B, as well as associated pumps, piping and spray equipment. The mercury control reagent will be sprayed onto delivered coal prior to combustion in the Colstrip facility boilers. There are no emission increases associated with the storage and use of the M45-PC-B mercury control reagent.

Process Flow

Figures 1 and 2 provide a process flow diagram (Figure 1) and aerial view of the proposed location of facilities and material delivery route (Figure 2). Figure 3 provides the expected general arrangement of the facilities.

M45-PC A1 and M45-PC A2 will be delivered separately by enclosed bulk transport trucks (usually 20 tons per load). The M45-PC A1 will be unloaded from the delivery truck by an enclosed pneumatic conveyor system into the M45-PC A1 storage silo. The silo will be equipped with an active bin vent filter. A dehumidifier will be fitted to the silo fill line, between additive deliveries, to keep the material within the silo dry and free flowing by slightly pressurizing the silo with dry air to prevent humid outside (ambient) air from entering the silo. A similar silo storage system will be installed for the M45-PC A2 material. The M45-PC A1 silo has a working capacity of approximately 4,000 cubic feet. The M45-PC A2 silo has a working capacity of approximately 4,000 cubic feet.

Flexible enclosed screw conveyors will transport the material stored in the silos to the enclosed M45-PC^{TM} feed hopper based on the feed hopper level. Then, the M45-PC A combined material will be transferred from the feed hopper by an enclosed continuous cup elevator to a mix tank

[3] SDS are provided in Attachment 7

where the material is mixed with heated water, with the resulting slurry being transferred and metered on to the existing coal conveyor belts.

Five small propane water heaters will be installed to heat the water destined for mixing with the M45-PC-A. Of the five, one is designated as a spare and up to four heaters could be in service, depending upon demand.. Each propane burner is rated at ¼ MMBtu per hour. These burners will be used to maintain the required mix water temperature of 120^{O} F. Propane will be delivered by truck to a 1000-gallon tank located within the process area. Each delivery truck will weigh approximately 17 and 16 tons prior to and after offloading, respectively.

The M45-PC B will be stored in poly totes (275 gal totes) onsite (two totes: one in the conex[4] trailer and one located in the storage building, both atop spill containment skids). The liquid M45-PC B material will be pumped through stainless steel tubing and applied to the coal at the same location that the M45-PC A is applied.

Material Balance

The Tinuum refined coal system is a mixture of two reagents to aid in NOx and Hg control. The additive for NOx control consists of the ammonia-based compound urea that reduces NOx to nitrogen, water and carbon dioxide. The second compound, magnesium hydroxide ("$Mg(OH)_2$") is an inert material that protects urea from higher temperatures in the boiler. The refined coal system also uses a potassium iodide product to convert elemental mercury to ionic mercury that is readily captured in existing emission control equipment. The products are applied directly to the coal on the conveyor belts prior to storage in the coal bunkers and combustion in the boilers.

All the urea decomposes to ammonia upon coal ignition. Due to exposure to the high temperatures throughout the boiler, all the ammonia is consumed before it exits the boiler, eliminating any concerns related to "ammonia slip". Some of the ammonia is consumed in the burner zone of the furnace. However, the second chemical (described below) allows some of the ammonia to survive (as long as the primary flames are fuel-rich) and to react with NOx at the point of overfire air injection. All the remaining ammonia is consumed in the second stage flames and converted to molecular nitrogen, carbon dioxide and water.

The second component of the NOx additive is a magnesium compound that is converted to MgO as it passes through the combustion zone. MgO is a common boiler additive that helps improve boiler heat transfer by managing slagging conditions in boilers. Some of the MgO will find its way to waterwall tubes and convective surfaces where it acts like the "flour in a cake pan" to facilitate slag removal from those surfaces. Any MgO that sloughs off the tubes (about 10 percent) will report to the bottom ash. The remaining MgO will be transported to the scrubbers.

MgO has been added to the Colstrip scrubbers in the past to enhance SO_2 removal. In addition, MgO is a component of the alkaline ash remaining after Rosebud coal has been combusted. MgO and the other alkaline substances in the ash react with the SO_2 in the scrubber, resulting in native SO_2 removal approaching 80% on Units 1&2. CaO (lime[5]) is supplemented to the Units 3&4

[4] The conex is a drop-off that houses the tote and pumps for the M45-PC B and also the PLC control system for the refined coal system.

[5] MgO and CaO are both forms of lime added to the Colstrip scrubbers

scrubbers and this addition, along with the benefits of previous MgO additions and native removal from the alkaline ash, result in a nominal 95% SO2 removal rate on Units 3&4.

Engineering review of the fate of the Tinuum System MgO has indicated that this material will facilitate SO_2 removal by completely reacting with the SO_2 in the scrubber. Table 1 shows the chemical equations illustrating how MgO is consumed in the scrubber. The byproduct of this reaction ($MgSO_4$) is water soluble and becomes part of the dissolved solids of the scrubber water system. As a consequence of the above reactions, the Tinuum MgO is likely to enhance the native SO_2 removal in Units 1&2 and reduce the amount of CaO currently added for SO_2 removal to Units 3&4.

Table 1. Colstrip MgO Scrubber Chemistry

Tinuum Refined Coal Process MgO Chemistry in Colstrip Scrubbers
$MgO+H_2O=Mg(OH)_2$
$Mg(OH)_2+SO_2=MgSO_3+H_2O$
$MgSO_3+½O_2=MgSO_4$

Iodine is used for mercury control and is delivered as a solution of potassium iodide (KI). KI is currently added to Units 1&2 and has been added to Units 3&4 as the mercury control oxidizer. KI will likely react to form several compounds including HgI_2, HI, I_2, and K_2O. Due to the low iodine treatment rates used by Tinuum (2 to 5 ppm on the coal), speciation measurements to determine the specific form of iodine after combustion are impossible using currently available technologies. The primary mercury removal mechanisms are adsorption onto carbon surfaces and absorption in scrubbers where present.

Nature of Emissions Impacts

As a result of the addition of the Tinuum Refined Coal System, it is possible that emissions of NOx, mercury and SO_2 may be reduced from the Colstrip boiler emitting units (EUs 1-4). Since Colstrip currently employs reduction systems for these same pollutants (i.e. – does not have emissions representative of burning "un-refined" coal), it is not possible to quantify the exact amount of expected emission reductions from this specific facility as explained below.

Due to the nature of the SO_2 and mercury removal systems, emission reductions as a result of Tinuum could be slight since this addition may just result in a reduction of the chemicals used in, or slight enhancement of reductions from, the current systems. Since no chemical additions occur for NOx reductions, it is more likely that emissions reductions from the Tinuum chemical addition will be measurable. It is expected that these potential reductions will be up to 20% from our current low level of controlled emissions, based on expected reductions from SNCR application at Colstrip estimated during the Regional Haze process. [6]

[6] See 40 CFR Part 52, Approval and Promulgation of Implementation Plans; State of Montana; State Implementation Plan and Regional Haze Federal Implementation Plan; Final Rules, 77 Fed. Register 57864, September 18, 2012

Boiler PM emissions will be unaffected. All the Tinuum chemicals are consumed either during the combustion process or within the scrubbers.

Consequently, no changes to the boiler emissions are expected or estimated for this deminimis determination. Only emissions increases expected from the delivery, storage, and mixing of the MP-45-PC-A and B chemicals need to be evaluated. These will be evaluated as additional emissions from the existing coal handling and plant road emitting units.

Emissions Sources

The Tinuum System emission points are proposed to be included with the current emission points of the coal handling facilities (EU07 and EU08) identified in Colstrip's Title V Permit OP0513-13. In addition, plant road (EU 13) emissions will increase slightly.

The following sources of additional emissions are considered:

- Plant roads, resulting from increased solid product and propane delivery truck traffic,
- MP-45-PC A and MP-45 PC B storage silos as a result of material loading, and
- MP-45-PC^{TM} hopper resulting from hopper loading and mixing of the MP-45-PC A and B chemicals.
- Propane water heaters

Emission Impacts

Attachments 1 through 5 contain the calculations for the emissions estimates associated with the four sources listed above. These calculations are based upon the use of EPA's AP-42 emission factors from chapters 13.2.1 and 13.2.2 for delivery truck traffic on plant roads, chapter 13.2.4 for the silo operations impacting the coal handling system, and chapter 1.5 for the propane heaters. Maximum potential coal usage by the units is assumed. Although Talen utilizes dust control measures - suppressant application, watering and sweeping – to control fugitive dust, emissions for this source are calculated assuming no controls. Likewise, for the silo operations – silo delivery and material mixing – the equipment supplied comes with inherent controls (bin vent filters and roll-up doors), but these have not been used in the calculations of emissions. The emissions calculations for the propane heaters inherently assume no control. Therefore, these estimates are conservative; actual emissions will likely be significantly lower.

Potential PM emission increases associated with the delivery, storage, material handling, and propane consumption related to the operation of the refined coal system are estimated to be no greater than 0.5 tons/year of PM, 0.1 tons/year of PM10 and 0.0 tons/year of PM2.5. Non-PM emissions from propane consumption related to the operation of the refined coal system are estimated to be no greater than 0.2 tons/yr of NOx, 0.0 tons/year of SO2, 0.1 tons/year of CO, and 0.0 tons/year of TOC. These estimated maximum emissions increases in potential emissions are below the de minimis level of five tons specified in ARM 17.8.745 (1)(a). Table 2 gives a breakdown of these emissions estimates by source.

Table 2. Breakdown of Tinuum Refined Coal Process Emissions

	PM		PM_{10}		$PM_{2.5}$	
Haul Roads	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Paved (delivery trucks)	0.24	0.15	0.05	0.03	0.01	0.01
Unpaved (delivery trucks)	0.32	0.21	0.08	0.05	0.01	0.01
Paved (Propane delivery trucks)	0.01	0.00	0.00	0.00	0.00	0.00
UnPaved (Propane delivery trucks)	0.01	0.01	0.00	0.00	0.00	0.00
Total Haul Roads	**0.58**	**0.37**	**0.14**	**0.09**	**0.02**	**0.01**
Handling						
Truck load-in to silo A1/ silo venting	0.04	0.02	0.02	0.01	0.00	0.00
Truck load-in to silo A2/ silo venting	0.04	0.03	0.02	0.02	0.00	0.00
Silo A1 to feed hopper	0.01	0.02	0.01	0.01	0.00	0.00
Silo A2 to feed hopper	0.02	0.03	0.01	0.02	0.00	0.00
Total Handling	**0.11**	**0.10**	**0.05**	**0.05**	**0.01**	**0.01**
Propane Consumption (PM)						
(Note: All PM is PM 2.5 for propane consumption)	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**
Total =	**0.7**	**0.5**	**0.2**	**0.1**	**0.0**	**0.0**

Propane Consumption (Non PM)	**Nox**		**SO2**		**CO**		**TOC**	
	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Total Propane Consumption (Non PM)	**0.1**	**0.2**	**0.0**	**0.0**	**0.1**	**0.1**	**0.0**	**0.0**

Note: These totals were conservatively calculated as un-controlled emissions; maximum potential coal usage is assumed and as specified in Attachments 1-5, the plant roads receive annual dust suppressant application, sweeping, and water application resulting in an estimated 50% control efficiency. Likewise, Attachments 1-5 specify expected PM control efficiencies of 99% for the silo bin vent filters and 50% for the mixing operation facility roll-up doors. The emissions calculations for the propane heaters inherently assume no control.

Table 2 shows emissions estimates most representative (although conservative) of the Tinuum system as it will operate at Colstrip. Emissions were also evaluated assuming the propane heating system operated at full capacity (including the spare) for 8,760 hours, in addition to the other conservative assumptions for the values in Table 2. Table 3 shows these estimates: 0.5 tons/year of PM, 0.1 tons/year of PM10 and 0.1 tons/year of PM2.5, 0.8 tons/yr of NOx, 0.0 tons/year of SO2, 0.4 tons/year of CO, and 0.1 tons/year of TOC. Attachments 8-10 show the portion related to increased propane usage of the calculations summarized by Table 3.

Table 3. Breakdown of Tinuum Refined Coal Process Emissions, Full Capacity Propane Usage Assumption

	PM		PM_{10}		$PM_{2.5}$	
Haul Roads	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Paved (delivery trucks)	0.24	0.15	0.05	0.03	0.01	0.01
Unpaved (delivery trucks)	0.32	0.21	0.08	0.05	0.01	0.01
Paved (Propane delivery trucks)	0.03	0.02	0.01	0.00	0.00	0.00
UnPaved (Propane delivery trucks)	0.05	0.03	0.01	0.01	0.00	0.00
Total Haul Roads	**0.64**	**0.41**	**0.15**	**0.10**	**0.02**	**0.01**
Handling						
Truck load-in to silo A1/ silo venting	0.04	0.02	0.02	0.01	0.00	0.00
Truck load-in to silo A2/ silo venting	0.04	0.03	0.02	0.02	0.00	0.00
Silo A1 to feed hopper	0.01	0.02	0.01	0.01	0.00	0.00
Silo A2 to feed hopper	0.02	0.03	0.01	0.02	0.00	0.00
Total Handling	**0.11**	**0.10**	**0.05**	**0.05**	**0.01**	**0.01**
Total =	**0.7**	**0.5**	**0.2**	**0.1**	**0.0**	**0.0**
Propane Consumption (PM)						
(Note: All PM is PM 2.5 for propane consumption)	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.04**
Total =	**0.7**	**0.5**	**0.2**	**0.1**	**0.0**	**0.1**

Propane Consumption (Non PM)	**Nox**		**SO2**		**CO**		**TOC**	
	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Total Propane Consumption (Non PM)	**0.2**	**0.8**	**0.0**	**0.0**	**0.1**	**0.4**	**0.0**	**0.1**

Evaluation of Proposed Tinuum Refined Coal Project With Respect to ARM 17.8.745 – De minimis Rule

Emissions changes resulting from these modifications will be de minimis as defined by ARM 17.8.745 (a) – i.e. < 5 tons per year (as shown by the discussion above) – and our notification, installation and operation of the Tinuum Refined Coal System at Colstrip: 1) will not violate any condition of the units' air quality permits or applicable rules; 2) do not constitute physical changes or changes in the method of operation that would qualify as a major modification under ARM 17.8, subchapters 8, 9, or 10; 3) will not affect the plume rise or dispersion characteristics of the units' emissions in a manner that would cause or contribute to a violation of an ambient air quality standard or an ambient air increment, as defined in ARM 17.8.804; and 4) does not constitute an artificial splitting of a project into smaller projects to avoid permitting requirements. Therefore, installation of the Tinuum Refined Coal System qualifies for the de minimis permitting exclusion of ARM 17.8.745.

The application of the Tinuum Refined Coal System will not trigger any permitting requirements for greenhouse gases (GHG), because it does not result in significant increases of other applicable pollutants.

****

In conclusion, Talen is planning to retrofit Colstrip Power Plant with a Tinuum Refined Coal System. Talen believes that this activity is permitted under its current air permits and qualifies as a de minimis change as that term is defined by MDEQ rules. We are submitting this notification per the requirements of ARM 17.8.745(1) (b) and 17.8.1224 (1) (e). We request written concurrence from MDEQ that these activities are permitted under our current air permit, are de minimis changes, and that no further notification, reporting, or permitting action related to these retrofits is required.

I hereby certify that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete. If you should have any questions, please contact me.

Sincerely

James M Parker, PE
Designated Representative
(JMP/jmp)

Enclosures – Figures 1-3 and Attachments 1-10

Figure 1 – Tinuum Refined Coal System Process Flow Diagram

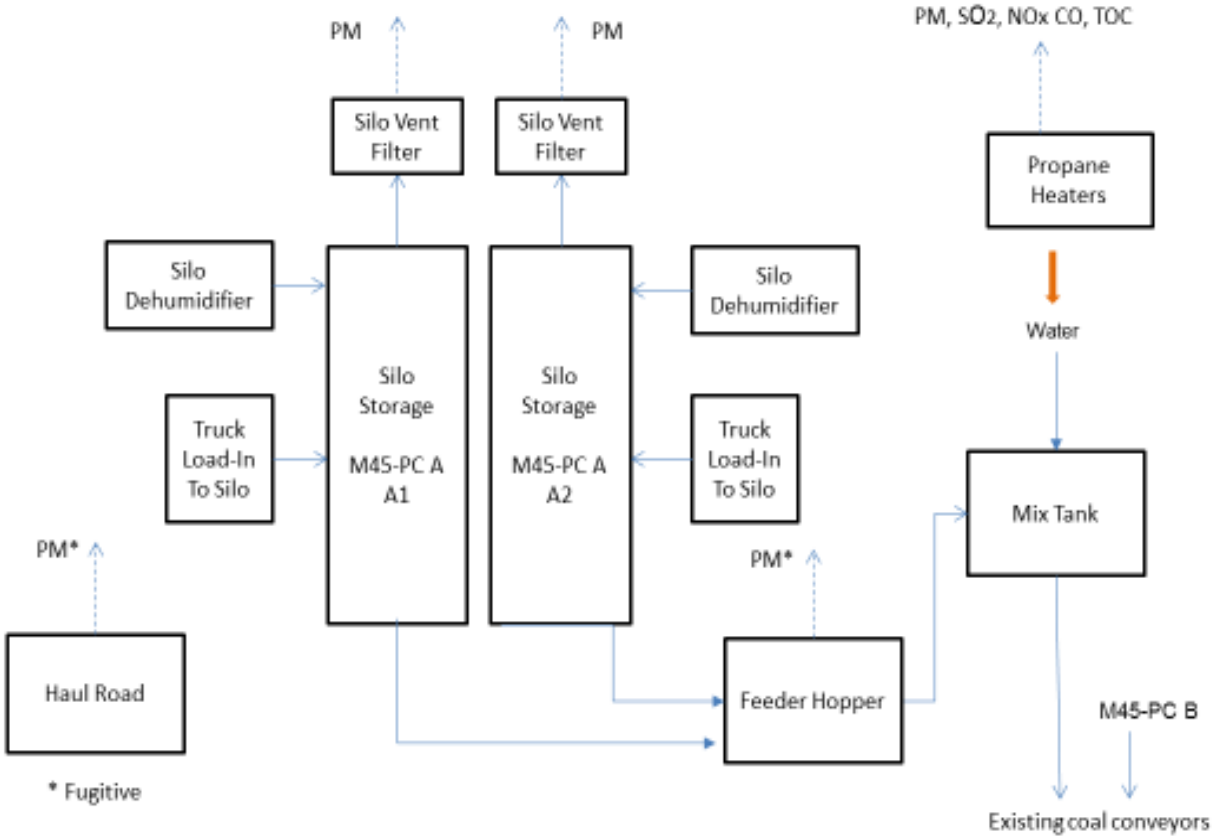
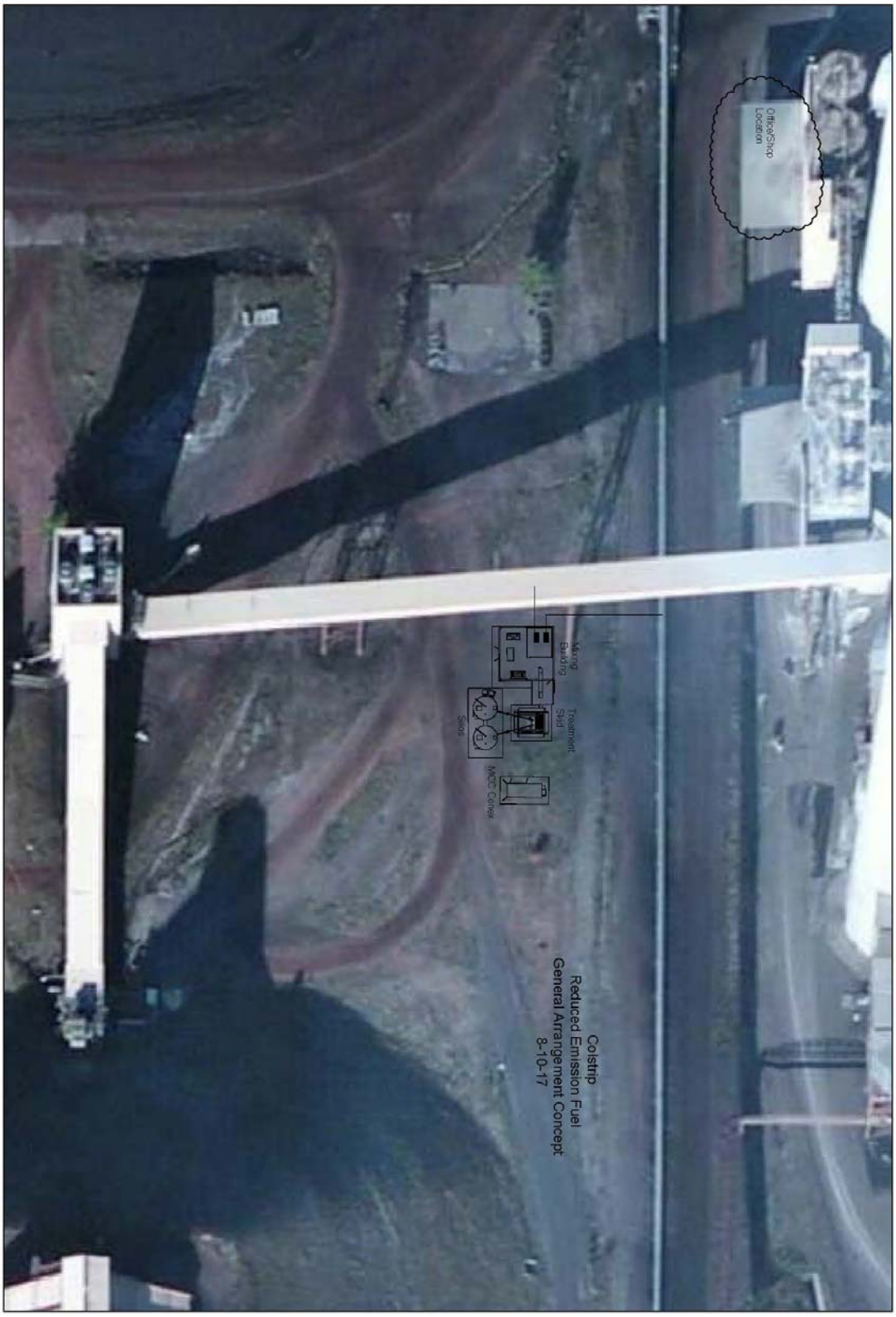


Figure 2 – Tinuum Refined Coal System Facilities Location and Delivery Truck Route

Figure 3 – Tinuum Refined Coal System Facilities General Arrangement



Attachment 1 – Tinuum Refined Coal System Emission Calculations
-Inputs-

Inputs Coal Additives				Comments
(delivery)	Average Truck Load:	20	tons	
	Truck Loaded:	36	tons	
	Truck Unloaded:	16	tons	
	Coal Usage:	11,416,114	tpy	
	M45PC A Usage:	0.225	%, wt. coal	(0.15 Mg, 0.075 Urea) = 0.225: 0.15 Water add rate
	M45PC A Usage:	25,686	tpy	
	Moisture M45PC Additives:	3.0	%	Minimum moisture content for M45PC A1 & A2
	Capacity of M45PC A feed hopper	9.1	tons	Mg and Urea mixed in hopper
	Paved Road (delivery trucks) :	2,192	feet	One Way
	Unpaved Road (delivery trucks):	160	feet	One Way
	Number of days with 0.01" of precipitation:	90	dy/yr	Taken from Figure 13.2.1-2 in AP-42
	Mean wind speed:	11.2	mph	NOAA Recorded Avg. Wind Speed

Inputs Propane				Comments
(delivery)	Average Truck Load:	1	tons	
	Truck Loaded:	17	tons	
	Truck Unloaded:	16	tons	
	Propane Usage:	64	tpy	
	Paved Road (delivery trucks) :	2,192	feet	One Way
	Unpaved Road (delivery trucks):	160	feet	One Way
	Number of days with 0.01" of precipitation:	90	dy/yr	Taken from Figure 13.2.1-2 in AP-42
	Mean wind speed:	11.2	mph	NOAA Recorded Avg. Wind Speed

Inputs Propane (consumption)			Comments
Average Assumed Water Inlet Temperature:	40	Deg.F	
Average Water Outlet Temperature:	120	Deg.F	
Annual Water Consumption:	17,125.90	tons	0.15% of assumed coal feed rate of 11,416,114 tons
Annual Required Heat Input:	2,761	MMBtu	161,213.2 Btu/ton water for 80 Deg.F temp. rise
Propane Heating Value:	91,330	Btu/gal	Reference: US Dept. of Energy - 2017
Annual Propane Consumpation:	30,227	gal	
	64	tons	4.23 lb/gal sp. wt.

Attachment 2 – Tinuum Refined Coal System Emission Calculations
-Calculation of Coal Additive Delivery Haul Road Emissions-

Delivery Trucks

AP-42 Unpaved Road Equations 13.2.2
Delivery Truck Traffic on Unpaved Plant Roads

E= k(s/12)^a*(W/3)^b*[(365-P)/365]

E = emission factor (lb/VMT)		
k = PM size multiplier (lb/VMT)	4.90	Taken form Table 13.2.2-2 in AP-42
k = PM_{10} size multiplier (lb/VMT)	1.50	Taken form Table 13.2.2-2 in AP-42
k = $PM_{2.5}$ size multiplier (lb/VMT)	0.15	Taken form Table 13.2.2-2 in AP-42
s = surface material silt content (%)	5.10	Taken form Table 13.2.2-1 in AP-42 Western surface coal mining plant road
W = mean vehicle weight (tons)	26	
P = number of days with 0.01" of precipitation	90	Taken from Figure 13.2.1-2 in AP-42
a for PM =	0.70	Taken form Table 13.2.2-2 Industrial Roads
b for PM =	0.45	Taken form Table 13.2.2-2 Industrial Roads
a for PM_{10} =	0.90	Taken form Table 13.2.2-2 Industrial Roads
b for PM_{10} =	0.45	Taken form Table 13.2.2-2 Industrial Roads
a for $PM_{2.5}$ =	0.90	Taken form Table 13.2.2-2 Industrial Roads
b for $PM_{2.5}$ =	0.45	Taken form Table 13.2.2-2 Industrial Roads

AP-42 Paved Road Equations 13.2.1
Delivery Truck Traffic on Paved Plant Roads

E = [k*(sL)^0.91 * (W)^1.02] * (1-P/4N)

E = emission factor (lb/VMT)		
k = PM size multiplier (lb/VMT)	0.011	Taken from Table 13.2.1-1 in AP-42
k = PM_{10} size multiplier (lb/VMT)	0.0022	Taken from Table 13.2.1-1 in AP-42
k = $PM_{2.5}$ size multiplier (lb/VMT)	0.00054	Taken from Table 13.2.1-1 in AP-42
sL = silt loading (g/m^2)	1	Best estimate (2001, Golder Port Trans. Study)
W = mean vehicle weight (tons)	26	
P = number of days with 0.01" of precipitation	90	
N = number of days in averaging period	365	

Haul Roads (Delivery Trucks)		**Haul Roads PM Emission Control Efficiency**
		50 % Control Efficiency is expected for Colstrip Power Plant Roads because:
Unloaded Truck Weight (ton)	16	1) unpaved haul roads receive annual application ot dust suppressant chemical
Loaded Truck Weight (ton)	36	2) paved roads are swept
Paved Trip Length (miles)	0.83	3) all plant roads are watered for dust control as necessary
Unpaved Trip Length (miles)	0.060606061	[note that calculations neglect any impact from controls]

	VMT	PM Emission Factor	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Control Efficiency	PM Emissions		PM_{10} Emissions		$PM_{2.5}$ Emissions	
	(VMT/yr)	(lb/VMT)	(lb/VMT)	(lb/VMT)	(%/100)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Paved Haul Road	1066.36883	0.286439701	0.057	0.014	0.000	0.238	0.153	0.048	0.031	0.012	0.007
Unpaved Haul Road	77.83714091	5.359713833	1.383	0.138	0.000	0.325	0.209	0.084	0.054	0.008	0.005
					Total		0.36		0.08		0.01

Attachment 3 – Tinuum Refined Coal System Emission Calculations
-Calculation of Propane Delivery Haul Road Emissions-

Delivery Trucks

AP-42 Unpaved Road Equations 13.2.2
Delivery Truck Traffic on Unpaved Plant Roads

E= k(s/12)^a*(W/3)^b*[(365-P)/365]

E = emission factor (lb/VMT)		
k = PM size multiplier (lb/VMT)	4.90	Taken form Table 13.2.2-2 in AP-42
k = PM_{10} size multiplier (lb/VMT)	1.50	Taken form Table 13.2.2-2 in AP-42
k = $PM_{2.5}$ size multiplier (lb/VMT)	0.15	Taken form Table 13.2.2-2 in AP-42
s = surface material silt content (%)	5.10	Taken form Table 13.2.2-1 in AP-42 Western surface coal mining plant road
W = mean vehicle weight (tons)	16.55	
P = number of days with 0.01" of precipitation	90	Taken from Figure 13.2.1-2 in AP-42
a for PM =	0.70	Taken form Table 13.2.2-2 Industrial Roads
b for PM =	0.45	Taken form Table 13.2.2-2 Industrial Roads
a for PM_{10} =	0.90	Taken form Table 13.2.2-2 Industrial Roads
b for PM_{10} =	0.45	Taken form Table 13.2.2-2 Industrial Roads
a for $PM_{2.5}$ =	0.90	Taken form Table 13.2.2-2 Industrial Roads
b for $PM_{2.5}$ =	0.45	Taken form Table 13.2.2-2 Industrial Roads

AP-42 Paved Road Equations 13.2.1
Delivery Truck Traffic on Paved Plant Roads

E = [k*(sL)^0.91 * (W)^1.02] * (1-P/4N)

E = emission factor (lb/VMT)		
k = PM size multiplier (lb/VMT)	0.011	Taken from Table 13.2.1-1 in AP-42
k = PM_{10} size multiplier (lb/VMT)	0.0022	Taken from Table 13.2.1-1 in AP-42
k = $PM_{2.5}$ size multiplier (lb/VMT)	0.00054	Taken from Table 13.2.1-1 in AP-42
sL = silt loading (g/m^2)	1	Best estimate (2001, Golder Port Trans. Study)
W = mean vehicle weight (tons)	16.55	
P = number of days with 0.01" of precipitation	90	
N = number of days in averaging period	365	

Haul Roads (Delivery Trucks)

Unloaded Truck Weight (ton)	16
Loaded Truck Weight (ton)	17.1
Paved Trip Length (miles)	0.83
Unpaved Trip Length (miles)	0.060606061

Haul Roads PM Emission Control Efficiency

50% Control Efficiency Assigned to Colstrip Power Plant Roads Because:
1) unpaved haul roads receive annual application of dust suppressant chemical
2) paved roads are swept
3) all plant roads are watered for dust control as necessary

	VMT	PM Emission Factor	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Control Efficiency	PM Emissions		PM_{10} Emissions		$PM_{2.5}$ Emissions	
	(VMT/yr)	(lb/VMT)	(lb/VMT)	(lb/VMT)	(%)/100	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Paved Haul Road	48.309	0.181	0.036	0.009		0.007	0.004	0.001	0.001	0.000	0.000
Unpaved Haul Road	3.526	4.374	1.128	0.113		0.012	0.008	0.003	0.002	0.000	0.000
				Total			0.012		0.003		0.000

Attachment 4 – Tinuum Refined Coal System Emission Calculations
-Silo Emission Calculations-

Silo Vent Filter

From Aggregate and Handling Storage Piles AP-42 13.2.4
E = k(.0032) * [(U/5)^1.3 / (M/2)^1.4]

E = emissions factor (lb/ton)		
k = PM particulate size multiplier	0.74	SH
k = PM_{10} particulate size multiplier	0.35	SH
k = $PM_{2.5}$ particulate size multiplier	0.053	SH
U = mean wind speed (mph)	11.2	JM
M = material moisture content (%)	3	SH

Bin Vents		Roll-up door			
Controlled:	99% Efficiency	Controlled:	50% Efficiency	Uncontrolled:	
E_{PM}	3.83E-05 lb/ton	E_{PM}	1.91E-03 lb/ton	E_{PM}	3.83E-03 lb/ton
$E_{PM\ 10}$	1.81E-05 lb/ton	$E_{PM\ 10}$	9.06E-04 lb/ton	$E_{PM\ 10}$	1.81E-03 lb/ton
$E_{PM\ 2.5}$	2.74E-06 lb/ton	$E_{PM\ 2.5}$	1.37E-04 lb/ton	$E_{PM\ 2.5}$	2.74E-04 lb/ton

[note that the calculations neglect the impact of controls in emission estimates]

Description	Hourly Thruput (lb/hr)	Annual Thruput (tpy)	PM Emission Factor (lb/ton)	PM Emissions (lb/hr)	PM Emissions (tpy)	PM_{10} Emission Factor (lb/ton)	PM_{10} Emissions (lb/hr)	PM_{10} Emissions (tpy)	$PM_{2.5}$ Emission Factor (lb/ton)	$PM_{2.5}$ Emissions (lb/hr)	$PM_{2.5}$ Emissions (tpy)	Notes
Truck load-in to silo A1/silo venting	20,000.00	8,562.09	3.83E-03	0.038	0.016	1.81E-03	0.018	0.008	2.74E-04	0.003	0.001	Hourly Thruput = truck delivery rate
Truck load-in to silo A2/silo venting	20,000.00	17,124.17	3.83E-03	0.038	0.033	1.81E-03	0.018	0.016	2.74E-04	0.003	0.002	Hourly Thruput = truck delivery rate
Silo A1 to feed hopper	6,066.67	8,562.09	3.83E-03	0.012	0.016	1.81E-03	0.005	0.008	2.74E-04	0.001	0.001	Hourly Thruput = 1/3 hopper capacity; assume 50% control
Silo A2 to feed hopper	12,133.33	17,124.17	3.83E-03	0.023	0.033	1.81E-03	0.011	0.016	2.74E-04	0.002	0.002	Hourly Thruput = 2/3 hopper capacity; assume 50% control
			Total		0.10			0.05			0.01	

Number of Hours to Unload Truck: 2 hr
40000 lb/truck
20000 lb/hr

Attachment 5 - Tinuum Refined Coal System
Propane Heater Emission Calculations

AP 42 Table 1.5-1 Emission Factors for Propane Combustion

PM Total*	0.7	lb/1000 gallons
SO2	0.02	lb/1000 gallons
NOx	13	lb/1000 gallons
CO	7.5	lb/1000 gallons
TOC	1	lb/1000 gallons
Propane Heating Value	91.33	mmBtu/1000 gallons
Sulfur Content of Fuel**	0.2	gr/100 ft^3 propane
Number of burners operational	4	
Max Heating Hourly Capacity for each burner	0.25	mmBtu/hr
Max Heating Yearly Capacity Demand	2761	mmBtu/yr

**All PM are PM2.5*

**Vendor data

	Hourly Emissions	Annual Emissions
	lb/hr	tpy
PM2.5	0.008	0.011
PM	-	-
PM10	-	-
SO2	0.0002	0.0003
NOx	0.142	0.197
CO	0.082	0.113
TOC	0.011	0.015

Attachment 6 – Tinuum Refined Coal System Emission Reduction Certification

[redacted]

EERC M-45-PC™ CERTIFICATION

Applied to:

[redacted]

[redacted]

Applicable to plant starting:
AUGUST 31, 2017

Conducted by:
TINUUM SERVICES LLC

CONTENTS

TABLES

1.0 INTRODUCTION

On August 31, 2017, Tinuum Services LLC (Tinuum), the operating company of Tinuum Group (TG), a majority owned venture of ADA-ES (Littleton, CO) and NexGen Resources (Aurora, CO), recertified the M-45-PC™ technology on 100% subbituminous coal at the Energy & Environmental Research Center's (EERC) combustion test facility (CTF) located at 15 North 23rd St, Stop 9018, Grand Forks, ND 58202. When applied to feedstock coal pre-combustion, M-45-PC™ facilitates the reduction of nitrous oxides (NO_x) emissions and mercury (Hg) emissions in a pulverized coal (PC)-boiler. The slurry mixture of the M-45-PC-A1™ and the M-45-PC-A2™ chemicals reduces the NOx exiting the PC boiler, and the liquid M-45-PC-B™ component enhances the amount of mercury captured in the ash.

1.1 TEST OBJECTIVES

- Burn 100% subbituminous coal without and with M-45-PC™
- Measure NO_x and Hg emissions without and with M-45-PC™
- Collect other relevant emissions data without and with M-45-PC™

1.2 OVERVIEW OF M-45-PC™ CERTIFICATION TEST AND POLLUTANTS TESTED

The CTF configuration was set up to resemble a PC-boiler by injecting pulverized coal and primary air into the boiler via a forced-draft fan. The CTF is designed with available secondary air, tertiary air, and overfire air with an induced-draft fan to maintain a slight vacuum through the system and out the stack. During this specific test, the CTF was equipped with an electrostatic precipitator (ESP) for particulate control. No activated carbon injection system (ACI) was used during this test. Continuous Emission Monitoring (CEM) analyzers were set up to measure O_2, NO_x, SO_2, CO, CO_2, and Hg throughout the stack. Specifically, Hg and NO_x measurements were obtained from the duct at the outlet of the ESP. Emission concentrations of NO_x and Hg were converted to emission rates in pounds per trillion British thermal unit (lb/TBtu) and pounds per million British thermal units (lb/MMBtu) respectively.

2.0 TEST RESULTS

Table 2.1 provides a summary of the treatment rates of M-45-PC™. Table 2.2 provides the reductions of NO_x and Hg during the test. Note the treatment rate of the M-45-PC-B™ is proprietary and cannot be published in this non-confidential report. Questions can be directed to Steve Harvey, Vice President, Environmental, Tinuum Services, at telephone 314-336-1369.

Refined Coal Identification No.	M-45-PC-A1, wt%	M-45-PC-A2, wt%	M-45-PC-B, ppm
Refined Coal 1-1	0.075	0.15	2.00
Refined Coal 1-2	0.070	0.14	1.75

Table 2.1 M-45-PC™ Treatment Rates

	O_2, %	NO_x, ppm	NO_x, ppm corrected to 3.5% O_2	NO_x, lb/MMBtu	NO_x Reduction, %
Feedstock Coal 1	5.28	159	177	0.241	–
Refined Coal 1-1	5.19	123	136	0.185	23.24
Refined Coal 1-2	5.52	120	135	0.175	27.39

	O_2, %	CO_2, %	$Hg_{(T)}$, µg/dNm^3 corrected to 3.5% O_2	$Hg_{(T)}$, lb/TBtu	$Hg_{(T)}$ Reduction, %
Feedstock Coal 1	5.28	14.24	1.696	1.340	–
Refined Coal 1-1	5.19	14.36	0.936	0.740	44.78
Refined Coal 1-2	5.52	14.06	1.015	0.777	42.01

Table 2.2 M-45-PC™ Emission Reduction Rates

The emissions of NO_x and Hg have been verified and reported as final by EERC in the report entitled "Evaluation of Subbituminous Coal for NO_x and Hg Reductions – August 31, 2017", EERC fund no. 22559 dated September 15, 2017. The NO_x emissions for the Feedstock Coal 1 was 0.241 lb/MMBtu. The Hg emissions for the Feedstock Coal 1 was 1.340 lb/TBtu. Refined Coal 1-1 NO_x emissions were 0.185 lb/MMBtu, for a 23.24% total reduction and Hg emissions were 0.740 lb/TBtu, for a 44.78% total reduction. Refined Coal 1-2 NO_x emissions were 0.175 lb/MMBtu, for a 27.39% total reduction and Hg emissions were 0.777 lb/TBtu, for a 42.01% total reduction.

3.0 PLANT APPLICABILITY

Based on the emission reduction rates achieved, Refined Coal 1-1 and Refined Coal 1-2 were above the necessary 20% NO_x reduction and 40% Hg reduction criteria required for qualification of the Section 45 Internal Revenue Code for the production of refined coal. Under Notice 2010-54 Section 6.03(2)(a), *Demonstration Pilot-Scale Combustion Furnace*, the demonstration of the reductions in a pilot-scale combustion furnace satisfies the requirements of Section 6.03(1)(c)(i),(ii),(v), and (vi) within Notice 2010-54, allowing this test to be applied to a refined coal facility at a full-scale, PC-boilers burning 100% subbituminous coal with an ESP to collect tax credits.

Tinuum operates a refined coal facility (Facility) at [redacted] located at [redacted]. [redacted] burns 100% subbituminous coal and utilizes an ESP as an air pollution control device. This cover letter verifies that the EERC report entitled “Evaluation of Subbituminous Coal for NO_x and Hg Reductions – August 31, 2017”, EERC fund no. 22559 dated September 15, 2017, entitles the Facility to produce refined coal for a six month period starting September 1, 2017.

4.0 COAL SAMPLING

Coal samples were not collected from the Feedstock Coal 1 and the Refined Coal 1-1 and Refined Coal 1-2 piles.

Attachment 7 – Tinuum Refined Coal System
Coal Additive Safety Data Sheets

1. CHEMICAL PRODUCTS AND COMPANY IDENTIFICATION

Product Name: M-45-PC™ Coal Additive A Liquid
Issue Date: May 29, 2015
Revision: New
Product Description: Proprietary chemical additive to reduce nitrous oxide (NOx) emissions from coal-fired boilers.
Supplier: Tinuum Group, LLC
425 South Woods Mill Road, Suite 250
Town & Country, Missouri 63017
Tel: (314) 336-1345 Fax: (314) 336-1597
Emergency Telephone Number: For emergency assistance involving chemicals, please contact CHEMTREC (800) 424-9300.

2. HAZARDS IDENTIFICATION

GHS Classification

Eye Irritation	Category 2B
Skin Irritation	Category 5
Ingestion	Category 5
Inhalation	Category 3

HMIS Classification

Health=1 Fire=0 Reactivity=0

Hazard Statements

H320 Causes eye irritation
H335 May cause respiratory irritation
H303+H313 May be harmful if swallowed or in contact with skin

Precautionary Statements

P281 Wear Personal Protective Equipment as required
P305+P351+P338 If in Eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P501 Dispose of contents/containers in accordance with local regulations.
P304+P341 If Inhaled: If breathing is difficult, remove to fresh air and keep at rest in a comfortable position.

GHS Labels:

Signal Word: Caution

3. COMPOSITION / INFORMATION ON INGREDIENTS

Component	% wt. (typical)	CAS No.
Magnesium Hydroxide	45 - 49	1309-42-8
Calcium as CaO	< 3	1305-78-8
Urea	21 – 25	57-13-6
Biuret ($H_2NCONHCONH_2$)	< 1	106-19-0
Water	25 – 35	

4. FIRST AID MEASURES

Emergency and First Aid Procedure

Eyes: Flush eyes with tepid water for at least 15 minutes. Seek medical attention if irritation develops or persists or if visual changes occur.

Skin: Thoroughly wash exposed areas with mild soap and water. Wash clothing before reuse. If irritation or other symptoms develop, seek medical attention.

Inhalation: If irritation develops, move to fresh air and monitor. If symptoms of respiratory distress occurs or victim is not breathing, obtain medical assistance.

Ingestion: First aid is not normally required, however, If appreciable quantities are ingested and victim is conscious, give 1-2 glasses or water or milk.

5. FIREFIGHTING MEASURES

Flash Point: Not combustible.

Explosive Limit: Not considered to be an explosion hazard

Flammable Limits: Not flammable.

UEL (LEL): No data available

Extinguishing Media: Use media appropriate for surrounding material

Hazardous Products of Combustion: Will not support combustion, however, if involved in a fire may decompose to toxic fumes. Water spray may be useful in minimizing or dispersing vapors.

Special Firefighters Procedure: Use NIOSH approved self-contained breathing apparatus for protection against the degradation of products of surrounding materials.

6. ACCIDENTAL RELEASE MEASURES

Steps to be taken in case material is released: Ventilate area of leak or spill. Isolate the hazard area and keep unnecessary and unprotected people away. Spill may generate slippery conditions. If conditions warrant, clean-up personnel should wear approved respiratory protection, glove and goggles to prevent irritation from contact and/or inhalation.

Waste disposal method: Collect material in appropriate container for recycling or disposal. Disposal should be done in accordance with federal, state, and local regulations.

7. HANDLING AND STORAGE

Handling: Use proper personal protective equipment when working with or around this product. Do not enter confined spaces without following proper entry procedures such as 29CFR 1910.146

Storage: Keep isolated from incompatible materials. Do not heat or contact with strong oxidizers, including nitric acid or hypochlorites.

8. PRECAUTIONS TO CONTROL EXPOSURE / PERSONAL PROTECTION

Exposure Limits:
OSHA PEL (TWA) – Not established.
ACGIH TLV (TWA) – Not established.

Respiratory Protection: Provide NIOSH approved respiratory protection in accordance with 29 CFR 1910.134 for levels of exposure incurred.

Other Protective Equipment: The use of eye protection, gloves, and impervious protective clothing is recommended to prevent skin irritation where direct contact with skin may occur. Wash contaminated clothing and dry before use. Wash hands after handling this product before eating or drinking.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Appearance……Liquid
Color……White, grayish mixture
Odor……..Ammonia odor
Specific Gravity……1.48
Density, lbs. /gal……12.36
pH……..Under 10 in solution
% Volatile by Volume……N/A
Vapor Pressure ……..……...N/A
Freezing Point……..……30^0C
Boiling Point ……..……N/A
Melting Point ……..……...N/A

10. STABILITY AND REACTIVITY

Stability: Stable under normal handling and storage conditions.

Hazardous Polymerization: None

Incompatibility: Avoid contact with all strongly oxidizing agents including hypochlorites and nitric acid. Contact can generate heat, fires, explosion and release toxic fumes. Incompatible with maleic anhydride.

Hazardous Decomposition Products: Ammonia, cyanuric acid, biuret, carbon dioxide and/or nitrogen oxides.

11. TOXICOLOGICAL INFORMATION

Not listed as a carcinogenic by OSHA, IARC, or NTP. No definitive information available on mutagenecity, target organs, or developmental toxicity.

12. ECOLOGICAL INFORMATION

Some of the components may be environmentally toxic in concentrated form. Do not release to surface waters. Notify local health and wildlife officials and operators of any nearby water intakes of contamination or discharge into or leading to waterways.

13. WASTE DISPOSAL CONSIDERATIONS

Collect material in appropriate container for disposal. This product does not exhibit any characteristics of a hazardous waste. Processing, use, or contamination of product may change the waste management options. Disposal should be done in accordance with federal, state, and local regulations.

14. TRANSPORT INFORMATION

DOT Class: Not regulated for transportation

Shipping Name: Not required

Hazard Class: N/A

Packaging Group: N/A

Reportable Quantity (RQ): NA

Labels Required: None

Placard: None

15. REGULATORY INFORMATION

CERCLA Hazardous Substance (40 CFR 302.4): None of the chemicals have an RQ

RCRA Hazardous Waste (40 CFR 261.33): Not hazardous waste

TSCA Status: Component chemicals are listed on the TSCA inventory.

SARA Section 302/304: NA

SARA Section 311/312 Hazard Categories:

Health	Immediate (acute)	Yes
Health	Delayed (chronic)	Yes
Physical	Fire	No
Physical	Sudden release of pressure	No
Physical	Reactive	No
	Nuisance Mist/Dust only	Yes

SARA Section 313: NA

16. OTHER INFORMATION

For Industrial Use Only

Emergency Assistance: For Emergency Assistance Involving Chemicals Call CHEMTREC (800) 424-9300.

NOTICE:

The information contained herein is the best available to Tinuum Group as of this date. To the best of Tinuum's knowledge the information contained herein is reliable and accurate as of this date, however accuracy, suitability or completeness is not guaranteed. Users are responsible to verify this data for their own particular use and they assume all risks of their reliance upon information contained herein. This information relates only to the product designated herein and does not relate to its use in combination with any other material or in any other process. Tinuum shall not under any circumstances be liable for incidental or consequential damages as a result of reliance upon information contained herein.

NO WARRANTY: TINUUM DOES NOT MAKES ANY WARRANTY OF MERCHANTABILITY OR OF ANY OTHER KIND WITH RESPECT TO INFORMATION CONTAINED HEREIN, EITHER EXPRESSED OR IMPLIED. TINUUM ASSUMES NO LIABILITY WITH RESPECT TO THE USE OF INFORMATION CONTAINED HEREIN.

LIMIT OF LIABILITY: Tinuum shall not be liable for, and Buyer assumes responsibility for personal injury and property damage resulting from the handling, possession, use, storage or resale of the product, whether used alone or in combination.

1. CHEMICAL PRODUCTS AND COMPANY IDENTIFICATION

Product Name: M-45-PC™ Solid Coal Additive A1
Issue Date: May 29, 2015
Revision: New
Product Description: Proprietary chemical additive to reduce nitrous oxide (NOx) emissions from coal-fired boilers.
Supplier: Tinuum Group, LLC
425 South Woods Mill Road, Suite 250
Town & Country, Missouri 63017
Tel: (314) 336-1345 Fax: (314) 336-1597
Emergency Telephone Number: For emergency assistance involving chemicals, please contact CHEMTREC (800) 424-9300.

2. HAZARDS IDENTIFICATION

GHS Classification

Eye Irritation	Category 2B
Skin Irritation	Category 5
Ingestion	Category 5
Inhalation	Category 5

HMIS Classification

Health=1 Fire=0 Reactivity=0

Hazard Statements

H320 Causes eye irritation
H303+H313+H333 May be harmful if swallowed, in contact with skin, or if inhaled

Precautionary Statements

P281 Wear Personal Protective Equipment as required
P305+P351+P338 If in Eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P501 Dispose of contents/containers in accordance with local regulations.
P304+P341 If Inhaled: If breathing is difficult, remove to fresh air and keep at rest in a comfortable position.

GHS Labels:

Signal Word: Caution

3. COMPOSITION / INFORMATION ON INGREDIENTS

Component	% wt. (typical)	CAS No.
Urea, granular or prill	98 – 99	NA

4. FIRST AID MEASURES

Emergency and First Aid Procedure

Eyes: Flush eyes with large amounts of water for at least 15 minutes. Seek medical attention if irritation develops or persists or if visual changes occur.

Skin: Thoroughly wash exposed areas with mild soap and water.

Inhalation: If irritation develops, move to fresh air and monitor. If symptoms of respiratory distress occurs or victim is not breathing, obtain medical assistance.

Ingestion: First aid is not normally required, however, If swallowed and symptoms develop, seek medical attention.

5. FIREFIGHTING MEASURES

Flash Point: Not combustible.

Explosive Limit: Not considered to be an explosion hazard

Flammable Limits: Not flammable.

Extinguishing Media: Use media appropriate for surrounding material

Hazardous Products of Combustion: Will not support combustion, however, if involved in a fire may decompose to toxic fumes. Water spray may be useful in minimizing or dispersing vapors.

Special Firefighters Procedure: Use NIOSH approved self-contained breathing apparatus for protection against the degradation of products of surrounding materials.

6. ACCIDENTAL RELEASE MEASURES

Steps to be taken in case material is released: Ventilate area of leak or spill. Carefully clean up and place materials into a suitable container, being careful to avoid creating excessive dust. Vacuuming or wet sweeping may be used to avoid dust dispersal. If conditions warrant, clean-up personnel should wear approved respiratory protection, glove and goggles to prevent irritation from contact and/or inhalation.

Waste disposal method: Collect material in appropriate container for recycling or disposal. Disposal should be done in accordance with federal, state, and local regulations.

Precautions to be taken in handling and storing: Use procedures to minimize contact and to prevent material from becoming airborne.

7. HANDLING AND STORAGE

Handling: Use proper personal protective equipment when working with or around this product. Do not enter confined spaces without following proper entry procedures such as 29CFR 1910.146. Minimize dust generation during material handling and transfer.

Storage: Keep dry and isolated from incompatible materials. Do not heat or contact with strong oxidizers, including nitric acid or hypochlorites.

8. PRECAUTIONS TO CONTROL EXPOSURE / PERSONAL PROTECTION

Exposure Limits:
OSHA PEL (TWA) – 15 mg/m^3 nuisance dust; 5 mg/m^3 respirable dust.
ACGIH TLV (TWA) – 10 mg/m^3 inhalable and respirable dust particulates not otherwise classified.

Respiratory Protection: Provide NIOSH approved respiratory protection if atmospheric levels of dust will exceed prescribed limits. If ammonia vapors are present, use protective equipment and limit exposure according to the ammonia concentration present.

Other Protective Equipment: Use chemical safety goggles or protective glasses and face-shield to protect eyes when handling or during spill cleanup. Eyewash station in work area is recommended. Wear impervious gloves for chemical protection. Wear impervious protective clothing to prevent skin irritation where direct contact with skin may occur. Wash contaminated clothing and dry before use.

Ventilation: Provide sufficient ventilation in both volume and air flow patterns to control dust concentrations to below allowable exposure limits.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Appearance……Granular solid
Color……White crystals or white powder
Odor……Slight ammonia odor
Solubility……Not soluble in water
Specific Gravity……1.33
Density, lbs. /ft^3……Approximately 46 lbs. /ft^3 loose
% Volatile by Volume……Not volatile
Vapor Pressure ……N/A
Vapor Density……N/A
Freezing Point……N/A
Boiling Point ……Decomposes at 135^{0}C
Melting Point ……N/A
pH ……7.5 – 9.5 in 10% solutions

10. STABILITY AND REACTIVITY

Stability: Stable under normal handling and storage conditions.

Hazardous Polymerization: None

Incompatibility: Avoid contact with all strongly oxidizing agents including hypochlorites and nitric acid. Contact can generate heat, fires, explosion and release toxic fumes.

Hazardous Decomposition Products: Ammonia, cyanuric acid, biuret, carbon dioxide and/or nitrogen oxides.

Conditions to avoid when stored: Heat, incompatibles.

11. TOXICOLOGICAL INFORMATION

Not listed as a carcinogenic by OSHA, IARC, or NTP. No definitive information available on mutagenicity, target organs, or developmental toxicity.

12. ECOLOGICAL INFORMATION

Some of the components of this product may be environmentally toxic in concentrated form. Do not release to surface waters. Notify health and wildlife officials and operators of any nearby water intakes of contamination or discharge into or leading to waterways.

13. WASTE DISPOSAL CONSIDERATIONS

Collect material in appropriate container for disposal. Processing, use, or contamination of product may change the waste management options. Disposal should be done in accordance with federal, state, and local regulations.

14. TRANSPORT INFORMATION

DOT Class: Not regulated for transportation

Shipping Name: Not required

Hazard Class: N/A

Packaging Group: N/A

Reportable Quantity (RQ): NA

Labels Required: None

Placard: None

CERCLA Hazardous Substance (40 CFR 302.4): NA

15. REGULATORY INFORMATION

RCRA Hazardous Waste (40 CFR 261.33): NA

TSCA Status: Component chemicals are listed on the TSCA inventory.

SARA Section 302: NA

SARA Section 311/312 Hazard Categories:

Health	Immediate (acute)	Yes
Health	Delayed (chronic)	No
Physical	Fire	No
Physical	Sudden release of pressure	No
Physical	Reactive	No
	Nuisance Mist/Dust only	No

SARA Section 313: NA

WHMIS Classification: NA

16. OTHER INFORMATION

For Industrial Use Only

Emergency Assistance: For Emergency Assistance Involving Chemicals Call CHEMTREC (800) 424-9300.

NOTICE:

The information contained herein is the best available to Tinuum Group as of this date. To the best of Tinuum's knowledge the information contained herein is reliable and accurate as of this date, however accuracy, suitability or completeness is not guaranteed. Users are responsible to verify this data for their own particular use and they assume all risks of their reliance upon information contained herein. This information relates only to the product designated herein and does not relate to its use in combination with any other material or in any other process. Tinuum shall not under any circumstances be liable for incidental or consequential damages as a result of reliance upon information contained herein.

NO WARRANTY: TINUUM DOES NOT MAKES ANY WARRANTY OF MERCHANTABILITY OR OF ANY OTHER KIND WITH RESPECT TO INFORMATION CONTAINED HEREIN, EITHER EXPRESSED OR IMPLIED. TINUUM ASSUMES NO LIABILITY WITH RESPECT TO THE USE OF INFORMATION CONTAINED HEREIN.

LIMIT OF LIABILITY: Tinuum shall not be liable for, and Buyer assumes responsibility for personal injury and property damage resulting from the handling, possession, use, storage or resale of the product, whether used alone or in combination.

1. CHEMICAL PRODUCTS AND COMPANY IDENTIFICATION

Product Name: M-45-PC™ Solid Coal Additive A2
Issue Date: May 29, 2015
Revision: New
Product Description: Proprietary chemical additive to reduce nitrous oxide (NOx) emissions from coal-fired boilers.
Supplier: Tinuum Group, LLC
425 South Woods Mill Road, Suite 250
Town & Country, Missouri 63017
Tel: (314) 336-1345 Fax: (314) 336-1597
Emergency Telephone Number: For emergency assistance involving chemicals, please contact CHEMTREC (800) 424-9300.

2. HAZARDS IDENTIFICATION

GHS Classification

Eye Irritation	Category 2B
Skin Irritation	Category 5
Ingestion	Category 5
Inhalation	Category 2

HMIS Classification

Health=1 Fire=0 Reactivity=0

Hazard Statements

H320 Causes eye irritation
H335 May cause acute respiratory irritation
H303+H313 May be harmful if swallowed or in contact with skin
H335 Repeat chronic overexposure may cause lung damage

Precautionary Statements

P281 Wear Personal Protective Equipment as required
P305+P351+P338 If in Eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P501 Dispose of contents/containers in accordance with local regulations.
P304+P341 If Inhaled: If breathing is difficult, remove to fresh air and keep at rest in a comfortable position.

GHS Labels:

Signal Word: Caution

3. COMPOSITION / INFORMATION ON INGREDIENTS

Component	% wt. (typical)	CAS No.
Brucite Magnesium Hydroxide	100	1309-42-8

Typical Chemical Analysis

Magnesium as MgO	60 – 62
Calcium as CaO	2 – 3
LOI (water of formation)	30 – 33

This product contains trace amounts of respirable crystalline silica (quartz)

4. FIRST AID MEASURES

Emergency and First Aid Procedure

Eyes: Flush eyes with large amounts of water for at least 15 minutes. Seek medical attention if irritation develops or persists or if visual changes occur.

Skin: Thoroughly wash exposed areas with mild soap and water.

Inhalation: If irritation develops, move to fresh air and monitor. If symptoms of respiratory distress occurs or victim is not breathing, obtain medical assistance.

Ingestion: First aid is not normally required, however, If appreciable quantities are ingested and victim is conscious, give 1-2 glasses or water or milk. Seek medical attention. Wash hands and face before consuming food products.

5. FIREFIGHTING MEASURES

Flash Point: Not combustible.

Explosive Limit: Not considered to be an explosion hazard

Flammable Limits: Not flammable.

UEL (LEL): No data available

Extinguishing Media: Use media appropriate for surrounding material

Hazardous Products of Combustion: None

Special Firefighters Procedure: Use NIOSH approved self-contained breathing apparatus for protection against the degradation of products of surrounding materials.

6. ACCIDENTAL RELEASE MEASURES

Steps to be taken in case material is released: Ventilate area of leak or spill. Carefully clean up and place materials into a suitable container, being careful to avoid creating excessive dust. Vacuuming or wet sweeping may be used to avoid dust dispersal. If conditions warrant, clean-up personnel should wear approved respiratory protection, glove and goggles to prevent irritation from contact and/or inhalation.

Waste disposal method: Collect material in appropriate container for recycling or disposal. Disposal should be done in accordance with federal, state, and local regulations.

Precautions to be taken in handling and storing: Use procedures to minimize contact and to prevent material from becoming airborne.

7. HANDLING AND STORAGE

Handling: Minimize dust generation during material handling or transfer

Storage: No special storage instructions.

8. PRECAUTIONS TO CONTROL EXPOSURE / PERSONAL PROTECTION

Exposure Limits:
OSHA PEL (TWA) – 15 mg/m^3 as nuisance dust particulate.
ACGIH TLV (TWA) – 10 mg/m^3 as total dust; 5 mg/m^3 as respirable dust.

Respiratory Protection: Provide NIOSH approved respiratory protection in accordance with 29 CFR 1910.134 for levels of exposure incurred.

Other Protective Equipment: The use of eye protection, gloves, and impervious protective clothing is recommended to prevent skin irritation where direct contact with skin may occur. Wash contaminated clothing and dry before use. Wash hands after handling this product before eating or drinking.

Ventilation: Provide sufficient ventilation in both volume and air flow patterns to control dust concentrations to below allowable exposure limits.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Appearance……Free flowing mixture of coarse and fine particles.
Color……White, grayish mixture
Odor……Odorless
Solubility……Insoluble
Specific Gravity……2.45
Density, lbs. /ft³……> 75 lbs./ft^3
% Volatile by Volume……Not volatile
Vapor Pressure ……N/A
Vapor Density……N/A
Freezing Point……N/A
Boiling Point ……Loses H_2O at 350^0C
Melting Point ……N/A
pH ……7.5 – 9.5 in 10% solutions

10. STABILITY AND REACTIVITY

Stability: Stable under normal handling and storage conditions.

Hazardous Polymerization: None

Incompatibility: Incompatible with maleic anhydride. Soluble in aqueous acid, generating heat and steam.

Hazardous Decomposition Products: Heat and steam.
Conditions to avoid when stored: Heat, incompatibles.

11. TOXICOLOGICAL INFORMATION

Chronic exposure to respirable quartz-containing dust in excess of appropriate TLVs has caused silicosis. Crystalline silica has been designated by IARC and NTP as carcinogenic.

12. ECOLOGICAL INFORMATION

No information found on adverse environmental effects of this product.

13. WASTE DISPOSAL CONSIDERATIONS

.
Collect material in appropriate container for disposal. Processing, use, or contamination of product may change the waste management options. Disposal should be done in accordance with federal, state, and local regulations.

14. TRANSPORT INFORMATION

DOT Class: Not regulated for transportation

Shipping Name: Not required

Hazard Class: N/A

Packaging Group: N/A

Reportable Quantity (RQ): NA

Labels Required: None

Placard: None

15. REGULATORY INFORMATION

CERCLA Hazardous Substance (40 CFR 302.4): None of the chemicals have an RQ

RCRA Hazardous Waste (40 CFR 261.33): Not hazardous waste

TSCA Status: Component chemicals are listed on the TSCA inventory.

SARA Section 302/304: NA

SARA Section 311/312 Hazard Categories:

Health	Immediate (acute)	Yes
Health	Delayed (chronic)	No
Physical	Fire	No
Physical	Sudden release of pressure	No
Physical	Reactive	No
	Nuisance Mist/Dust only	Yes

SARA Section 313: NA

16. OTHER INFORMATION

For Industrial Use Only

Emergency Assistance: For Emergency Assistance Involving Chemicals Call CHEMTREC (800) 424-9300.

NOTICE:

The information contained herein is the best available to Tinuum Group as of this date. To the best of Tinuum's knowledge the information contained herein is reliable and accurate as of this date, however accuracy, suitability or completeness is not guaranteed. Users are responsible to verify this data for their own particular use and they assume all risks of their reliance upon information contained herein. This information relates only to the product designated herein and does not relate to its use in combination with any other material or in any other process. Tinuum shall not under any circumstances be liable for incidental or consequential damages as a result of reliance upon information contained herein.

NO WARRANTY: TINUUM DOES NOT MAKES ANY WARRANTY OF MERCHANTABILITY OR OF ANY OTHER KIND WITH RESPECT TO INFORMATION CONTAINED HEREIN, EITHER EXPRESSED OR IMPLIED. TINUUM ASSUMES NO LIABILITY WITH RESPECT TO THE USE OF INFORMATION CONTAINED HEREIN.

LIMIT OF LIABILITY: Tinuum shall not be liable for, and Buyer assumes responsibility for personal injury and property damage resulting from the handling, possession, use, storage or resale of the product, whether used alone or in combination.

1. CHEMICAL PRODUCTS AND COMPANY IDENTIFICATION

Product Name: M45-PC Coal Additive B
Issue Date: May 29, 2015
Revision: New
Product Description: Proprietary chemical additive to reduce mercury emissions from coal fired boilers.
Supplier: Tinuum Group, LLC
425 South Woods Mill Road, Suite 250
Town & Country, Missouri 63017
Tel: (314) 336-1345 Fax: (314) 336-1597
Emergency Telephone Number: For emergency assistance involving chemicals, please contact CHEMTREC (800) 424-9300.

2. HAZARDS IDENTIFICATION

GHS Classification

Eye Irritation	Category 2B
Skin Irritation	Category 3
Environmental	Category 4

HMIS Classification

Health=2 Fire=0 Reactivity=0

Hazard Statements

H317 May cause allergic skin reaction
H335 May cause respiratory irritation

Precautionary Statements

P101	If medical advice is needed, have product container or label at hand.
P233	Keep container tightly closed
P260	Avoid breathing vapors; mists
P264	Wash hands thoroughly after handling
P270	Do not eat, drink, or smoke when using this product.
P280	Wear protective gloves/protective clothing/eye protection
P235 + P410	Keep in a cool place. Protect from sunlight

GHS Labels:

Signal Word: Warning

3. COMPOSITION / INFORMATION ON INGREDIENTS

Component	% wt. (typical)
Proprietary blend of halide salts in aqueous solution.	40-50%

4. FIRST AID MEASURES

Emergency and First Aid Procedure

Eye: Eye irritation. Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. If irritation persists get medical assistance.

Skin: Itching or burning of the skin. Immediately flush the skin with plenty of water while removing contaminated clothing and shoes. If irritation persists get medical attention. Wash contaminated clothing before reuse.

Inhalation: Remove exposed person from exposure areas to fresh air.

Ingestion: If victim is conscious, immediately give 2 to 4 glasses of water and induce vomiting by touching fingers to back of throat. Get immediate medical attention.

5. FIREFIGHTING MEASURES

Suitable Extinguishing Media: Use dry chemical, foam, or carbon dioxide to extinguish fire. Water may be ineffective but should be used to cool fire-exposed containers, structures and to protect personnel. Use water to dilute spills and to flush them away.

Fire Fighting Procedures: Exposed firefighters must wear NIOSH-approved positive pressure self-contained breathing apparatus with full-face mask and full protective clothing. Cool down the containers and equipment exposed to heat with a water spray.

Unusual Fire and Explosion Hazards: No acute hazard. Avoid breathing vapors or mist.

Combustion Products: Irritating or toxic substances may be emitted upon thermal decomposition. Thermal decomposition products may include potassium oxides and iodine fumes.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with skin and eyes. Do not breathe vapors or mist. (Also see Section 8).

Sweep up the spilled product. Collect the product and place it in a suitable (e.g. plastic) container. Wash spill area with water.

Do not flush to sewer or waterways. Prevent release to the environment if possible. Refer to Section 15 for spill/release reporting information.

For disposal of residues refer to Section 13.

7. HANDLING AND STORAGE

Handling: Avoid contact with eyes, skin or clothing. Keep container closed. Use good personal hygiene practices. Wash hands before eating, drinking, smoking. Remove contaminated clothing and clean before re-use.

Storage: Store in the original closed containers secure from children, pets or livestock. Store away from sunlight. Store away from oxidizers. Empty containers may contain residue. Do not cut, grind, drill, or weld on or near containers unless precautions are taken against these hazards.

8. PRECAUTIONS TO CONTROL EXPOSURE / PERSONAL PROTECTION

Engineering Controls: Local exhaust or general dilution ventilation should be in the facility. Provide mechanical ventilation for confined spaces. Safety shower and eyewash should be in the facility.

Personal Protective Equipment:

Eye Protection: Wear chemical safety goggles and face shield. Have eye-wash stations available where eye contact can occur.

Skin Protection: Avoid skin contact. Wear appropriate protective and garments to prevent bodily contact. Recommended protective materials include: PVC, Butyl, Neoprene and Viton rubber.

Respiratory Protection: Respiratory protection must be provided in accordance with OSHA 29 CFR 1910.134 or EC 89/686/EEC.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Physical state	Liquid
Appearance:	Clear solution
Odor:	None
Odor threshold	N/A
pH:	6 to 9
Melting point:	N/A
Boiling point	N/A
Flash point:	N/A
Evaporation rate (Water=1):	N/A
Flammability:	Non flammable
Vapor pressure:	N/A
Vapor density (Air=1):	N/A
Specific gravity (Water=1)	1.47 /25 ºC)
Solubility in water:	Freely soluble
Octanol/Water partition coefficient:	log Kow = 0.04
Decomposition temperature:	N/A
Apparent density:	N/A
Molecular weight:	166.0 g/mol (KI) – 18.0 g/mol (H2O)

10. STABILITY AND REACTIVITY

Stability: Stable under normal conditions of use. Protect from sunlight.

Incompatibility: Incompatible with oxidizers, metals and strong acids.

Hazardous Reactions/Decomposition Products: Oxidation products may include iodine fumes, hydrogen iodide and potassium oxides.

11. TOXICOLOGICAL INFORMATION

Signs and Symptoms of Overexposure:

Eye Contact: May cause irritation and burning.

Skin Contact: May cause irritation to sensitive skin.

Inhalation: Inhalation may be irritating to mucous membranes.

Ingestion: May cause angioneurotic edema, cutaneous and mucosal hemorrhage, fever or lymph node enlargement.

Acute Effects:

Eye Contact: May cause irritation, pain and redness.

Skin Contact: May cause irritation. May cause sensitization in persons previously exposed.

Inhalation: Inhalation may cause mucus membrane and lung irritation.

Ingestion: May cause severe gastrointestinal burns.

Chronic Effects: Chronic exposure may cause thyroid adenoma, goiter, iodism, skin rashes, headaches, running nose, weakness, anemic and general depression. The use of iodides for asthma in pregnancy has caused fetal death and deformity.

Medical Conditions Aggravated by Exposure: Preexisting

respiratory tract diseases

Acute Toxicity Values:

Oral $_{LD50}$ (Mouse fasting) [1] = 1,962 mg/kg body weight

Oral $_{LD50}$ (Mouse fed) [1] = 2,068 mg/kg body weight

Eye irritation (Rabbits) [2]: Slight reaction

Do not release to surface waters.

12. ECOLOGICAL INFORMATION

Bioaccumulation:

Octanol/water partition coefficient:
log Pow = 0.04 . Not potentially
bioaccumulable (log Pow <1).

Ecotoxicity:

LC_{50} (Oncornhynchusmykiss, Rainbow trout) [3] = 896 mg/L/96 hr LC_{50} (Dreissena polymorpha, Zebra mussel) [4] = 226 mg/L/24 hr

13. WASTE DISPOSAL CONSIDERATIONS

Waste Classification: Non-hazardous

Disposal Methods: Recycle or dispose in a chemical landfill in accordance with all local, state or federal regulations. Dispose packaging at an authorized site.

14. TRANSPORT INFORMATION

DOT Class: Not regulated for transportation

Shipping Name: Not required

Hazard Class: N/A

Packaging Group: N/A

Reportable Quantity (RQ): NA

Labels Required: None

Placard: None

15. REGULATORY INFORMATION

Comprehensive Environmental Response and Liability Act of 1980 (CERCLA):
Not listed for CERCLA Section 103 - Comprehensive Environmental Response, Compensation and Liability Act (Superfund). Releases to air, land or water of these hazardous substances which exceed the Reportable Quantity (RQ) must be reported to the National Response Center, (800-424-8802). Listed at 40 CFR 302.4.

Toxic Substances Control Act (TSCA):

Listed for TSCA, Flag XU - Toxic Substances Control Act. Requirement to submit a pre-manufacturing notice before commencing the manufacture or import a new substance. Flag XU means a substance exempt from reporting under the Inventory Update Rule.

Clean Water Act (CWA):

Potassium iodide is not a hazardous substance under the Clean Water Act. Consult Federal, State and local regulations for specific requirements.

Clean Air Act (CAA):

Potassium iodide is not a hazardous substance under the Clean Air Act. Consult Federal, State and local regulations for specific requirements.

Superfund Amendments and Reauthorization Act (SARA) Title III Information:

SARA 302 EHS RQ: Not listed for SARA 302 EHS RQ - Reportable Quantity of Extremely Hazardous Substance listed at 40 CFR 355.

SARA 302 EHS TPQ: Not listed for SARA 302 EHS TPQ - Threshold Planning Quantity of Extremely Hazardous Substance. An asterisk (*) following the Threshold Planning Quantity signifies that if the material is a solid and has a particle size equal to or larger than 100 micro-meters, the Threshold Planning Quantity = 10.000 LBS.

SARA Section 313 : Not listed for SARA Section 313 Chemicals - Toxic Substance subject to annual release reporting requirements listed at 40 CFR 372.65.

16. OTHER INFORMATION

For Industrial Use Only

Emergency Assistance: For Emergency Assistance Involving Chemicals Call CHEMTREC (800) 424-9300.

NOTICE:

The information contained herein is the best available to Tinuum Group as of this date. To the best of CCG's knowledge the information contained herein is reliable and accurate as of this date, however accuracy, suitability or completeness is not guaranteed. Users are responsible to verify this data for their own particular use and they assume all risks of their reliance upon information contained herein. This information relates only to the product designated herein and does not relate to its use in combination with any other material or in any other process. Tinuum shall not under any circumstances be liable for incidental or consequential damages as a result of reliance upon information contained herein.

NO WARRANTY: TINUUM DOES NOT MAKES ANY WARRANTY OF MERCHANTABILITY OR OF ANY OTHER KIND WITH RESPECT TO INFORMATION CONTAINED HEREIN, EITHER EXPRESSED OR IMPLIED. TINUUM ASSUMES NO LIABILITY WITH RESPECT TO THE USE OF INFORMATION CONTAINED HEREIN.

LIMIT OF LIABILITY: Tinuum shall not be liable for, and Buyer assumes responsibility for personal injury and property damage resulting from the handling, possession, use, storage or resale of the product, whether used alone or in combination.

Attachment 8 – Tinuum Refined Coal System
-Inputs – Full Capacity Continuous Propane Use Assumption-

Inputs Propane				Comments
(delivery)	Average Truck Load:	1	tons	
	Truck Loaded:	17	tons	
	Truck Unloaded:	16	tons	
	Propane Usage:	254	tpy	
	Paved Road (delivery trucks) :	2,192	feet	One Way
	Unpaved Road (delivery trucks):	160	feet	One Way
	Number of days with 0.01" of precipitation:	90	dy/yr	Taken from Figure 13.2.1-2 in AP-42
	Mean wind speed:	11.2	mph	NOAA Recorded Avg. Wind Speed

Inputs Propane (consumption)			Comments
Average Assumed Water Inlet Temperature:	40	Deg.F	
Average Water Outlet Temperature:	120	Deg.F	
Annual Water Consumption:	17,125.90	tons	0.15% of assumed coal feed rate of 11,416,114 tons
Annual Assumed Heat Input:	10,950	MMBtu	Assumption only; not related to water consumption
Propane Heating Value:	91,330	Btu/gal	Reference: US Dept. of Energy - 2017
Annual Assumed Propane Consumpation:	119,895	gal	
	254	tons	4.23 lb/gal sp. wt.

Attachment 9 – Tinuum Refined Coal System
-Calculation of Propane Delivery Haul Road Emissions-
-Full Capacity Continuous Propane Use Assumption-

AP-42 Unpaved Road Equations 13.2.2
Delivery Truck Traffic on Unpaved Plant Roads

E= k(s/12)^a*(W/3)^b*[(365-P)/365]

E = emission factor (lb/VMT)		
k = PM size multiplier (lb/VMT)	4.90	Taken form Table 13.2.2-2 in AP-42
k = PM_{10} size multiplier (lb/VMT)	1.50	Taken form Table 13.2.2-2 in AP-42
k = $PM_{2.5}$ size multiplier (lb/VMT)	0.15	Taken form Table 13.2.2-2 in AP-42
s = surface material silt content (%)	5.10	Taken form Table 13.2.2-1 in AP-42 Western surface coal mining plant road
W = mean vehicle weight (tons)	16.55	
P = number of days with 0.01" of precipitation	90	Taken from Figure 13.2.1-2 in AP-42
a for PM =	0.70	Taken form Table 13.2.2-2 Industrial Roads
b for PM =	0.45	Taken form Table 13.2.2-2 Industrial Roads
a for PM_{10} =	0.90	Taken form Table 13.2.2-2 Industrial Roads
b for PM_{10} =	0.45	Taken form Table 13.2.2-2 Industrial Roads
a for $PM_{2.5}$ =	0.90	Taken form Table 13.2.2-2 Industrial Roads
b for $PM_{2.5}$ =	0.45	Taken form Table 13.2.2-2 Industrial Roads

AP-42 Paved Road Equations 13.2.1
Delivery Truck Traffic on Paved Plant Roads

E = [k*(sL)^0.91 * (W)^1.02] * (1-P/4N)

E = emission factor (lb/VMT)		
k = PM size multiplier (lb/VMT)	0.011	Taken from Table 13.2.1-1 in AP-42
k = PM_{10} size multiplier (lb/VMT)	0.0022	Taken from Table 13.2.1-1 in AP-42
k = $PM_{2.5}$ size multiplier (lb/VMT)	0.00054	Taken from Table 13.2.1-1 in AP-42
sL = silt loading (g/m^2)	1	Best estimate (2001, Golder Port Trans. Study)
W = mean vehicle weight (tons)	16.55	
P = number of days with 0.01" of precipitation	90	
N = number of days in averaging period	365	

Haul Roads (Delivery Trucks)

Unloaded Truck Weight (ton)	16
Loaded Truck Weight (ton)	17.1
Paved Trip Length (miles)	0.83
Unpaved Trip Length (miles)	0.060606061

Haul Roads PM Emission Control Efficiency

50% Control Efficiency Assigned to Colstrip Power Plant Roads Because:
1) unpaved haul roads receive annual application of dust suppressant chemical
2) paved roads are swept
3) all plant roads are watered for dust control as necessary

	VMT	PM Emission Factor	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Control Efficiency	PM Emissions		PM_{10} Emissions		$PM_{2.5}$ Emissions	
	(VMT/yr)	(lb/VMT)	(lb/VMT)	(lb/VMT)	(%)/100	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Paved Haul Road	191.725	0.181	0.036	0.009		0.027	0.017	0.005	0.003	0.001	0.001
Unpaved Haul Road	13.994	4.374	1.128	0.113		0.048	0.031	0.012	0.008	0.001	0.001
				Total			0.048		0.011		0.002

Attachment 10 – Tinuum Refined Coal System
-Calculation of Propane Consumption Emissions-
-Full Capacity Continuous Propane Use Assumption-

Assume 5 heaters operating at capacity for 8760 hours per year

Heat Output =	10950	MMBtu	per year
Propane Usage =	119.895	1000 gallo	per year
Number of Heaters =	5	units	

AP 42 Table 1.5-1 Emission Factors for Propane Combustion

PM Total*	0.7	lb/1000 gallons
SO2	0.02	lb/1000 gallons
NOx	13	lb/1000 gallons
CO	7.5	lb/1000 gallons
TOC	1	lb/1000 gallons
Propane Heating Value	91.33	mmBtu/1000 gallons
Sulfur Content of Fuel**	0.2	gr/100 ft^3 propane

	Hourly Emissions	Annual Emissions
	lb/hr	tpy
PM2.5	0.0096	0.0420
PM	-	-
PM10	-	-
SO2	0.0003	0.0012
NOx	0.1779	0.7793
CO	0.1026	0.4496
TOC	0.0137	0.0599

**Vendor data

All PM are PM2.5

DEQ
Montana Department
of Environmental Quality

Air, Energy & Mining Division

October 25, 2017

Jim Parker, PE
Talen Montana, LLC
Colstrip Steam Electric Station
303 N Broadway, Ste 400
Billings, MT 59101

Sent via email to: james.parker@talenenergy.com

RE: Montana Air Quality Permit (MAQP) # 0513-10

Dear Mr. Parker:

On October 6, 2017, the Montana Department of Environmental Quality-Air Quality Bureau (Department) received a de minimis notification from Talen Montana, LLC (Talen) - Colstrip Steam Electric Station (CSES). Talen is planning to retrofit the coal handling systems for Units 1, 2, 3 and 4 at the CSES by applying an emission reduction fuel additive-The Tinuum Refined Coal System. There will be no change to the combustion units and their potential emissions will not change. The potential to emit for particulate matter will increase from the coal handling and plant road emitting units by less than the de minimis threshold of 5 tons per year (tpy). The correspondence requests concurrence from the Department that this activity is not prohibited under the current MAQP #0513-10, is a de minimis change in accordance with Administrative Rules of Montana (ARM) 17.8.745, and that no further notification, reporting or permitting action related to this retrofit project is required.

The potential to emit particulate matter will increase by less than 5 tpy as a result of this project. The proposed project does not violate any conditions of MAQP #0513-10 or the Title V Operating Permit #OP0513-09. This project is considered a de minimis change under ARM 17.8.745. The correspondence has fulfilled the notification requirements of ARM 17.8.745(1) (b) and 17.8.1224(1)(e).

If you have any questions or concerns, please contact me by phone at (406) 444-1452 or by e-mail at lpatterson@mt.gov.

Sincerely,

Loni Patterson
Environmental Engineer
Air Quality Bureau

Enclosure
cc: jmerkel@mt.gov
jraty@mt.gov
hrash@mt.gov
ewarner@mt.gov