

Denver Zoological Foundation

Response to email comments (received August 1, 2014)

Date revised: August 4, 2014

Justin's questions:

1. Has the Zoo had discussions with Metro Wastewater regarding any required permitting to discharge condensate or other process waters to the sanitary sewer as a result of the WTE operations? [DZF will include Metro Wastewater in the EDOP as a stakeholder for all future discussions on process water permitting.](#)

Page 12 of the Zoo's response details that they will consult with CDPHE, and that final determination cannot be made until the system is operational—but it is unclear if they have worked with Metro Wastewater. Jon Novick also addressed the potential for discharge of glycol and that it should be addressed as needed with Metro. [See responses below.](#)

2. Page 20 in Schedule 6 of the Zoo's response describes that the Zoo will perform laboratory testing to characterize waste ash and process water waste. They do not state specific State regulations in regards to compliance, but they do mention Federal (RCRA) regulations and that they will "manage our waste streams in accordance with federal, state, and local regulations." We discussed that they should include particular reference to Colorado hazardous waste regulations (Colorado Hazardous Waste Regulations 6 CCR 1007-3). [DZF will add the reference to the section.](#)
3. Schedule 6 (section D on page 20) discusses the possibility that waste could be characterized as hazardous and result in a change of generator status to an LQG. The response states that the Zoo is developing a procedure to address that change and that they will share with the City and CDPHE when available. The Zoo at this time has not stated that they understand that financial responsibility for proper disposal (in addition to meeting all safety and compliance requirements) will come from their budget. Their written response should include acknowledgement that the City will not take on additional financial burdens to dispose of hazardous waste volumes generated by the WTE, but will be available to consult on proper management and disposal. This applies to waste ash, scrubbing liquid, etc that is generated by this new process and equipment. [It was understood that the costs were the responsibility of DZF's, we included that statement in the EDOP.](#)

Current language in section 11.2.3 (K): [DZF will manage our waste streams in accordance with federal, state and local regulations, including but not limited to requirements identified in Subpart C of 40 CFR part 2 and utilization of CDPHE's Beneficial Use Determination \(BUD\) to characterize the ash and any other waste components generated in the process.](#)

4. A definitive frequency of waste analysis is not given, and no statement of waste analysis prior to the finished equipment being moved from the BEEDL to the Zoo was addressed. Please confirm that ash and process water waste will be analyzed and results provided to the City prior to movement to and operation of the equipment at the Zoo. [The system cannot be operated at the BEEDL, and equipment has to be moved to the zoo in order to obtain necessary samples. To be further discussed in meeting on Thursday.](#)

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5. Testing of ash to address the potential for TENORM (Technologically Enhanced Naturally Occurring Radioactive Materials) was a previous analysis the City has specified however this is not included in the Zoo's response that this testing will occur. [A response was included in correspondence sent through legal contacts Kelly and Jessica. Kelly forwarded the message per Jessica's request to Diane DeLillio on August 1, 2014. Here is the response.](#)

[Additional Note](#) - We did not include in the EDOP Supplement #2 an affirmative requirement of DZF to obtain radioactive analyses to address the potential for Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM) in the ash byproduct. This was not included as DZF does not predict a potential to create TENORMs. Below is additional technical information from DZF, and DZF recommends that DZF and DEH discuss further this request. If DZF and DEH agree this analysis needs to be obtained, then DZF will obtain it. But we did not want to make it a mandatory requirement per the EDOP prior to further discussion.

***[DZF Technical Response]** "The Denver Zoo waste management facility does not predict a potential to create TENORMs. Please review the following statement for calculations and a theoretical rationalization. Naturally Occurring Radioactive Materials (NORMs) are ubiquitous in soil, rock, and soil latent fuel such as coal. Technology Enhanced Naturally Occurring Radioactive Material (TENORM) may occur as byproducts of particle accelerators, nuclear power plants, and as a result of processes that concentrate trace amounts of naturally occurring radionuclides, such as heavy elements belonging to the radioactive series headed by the three long-lived isotopes uranium-238, uranium-235, and thorium-232. Uranium is ubiquitous to soil in average concentrations of 3 – 4 ppm (for every millions pounds of soils, there is 3 – 4 pounds of uranium). As a reminder, coal will not be included in the Denver Zoo waste management fuel stream. The production of ash is 6 – 18% according to tested and simulated calculations. At 430 lb/hr of fuel, the rate of ash production has a maximum potential to generate 130 lb/hr. About 45% of most soil is comprised of minerals. NORM's reside in the mineral portion of the soil. The conversion of minerals to ash is about 90%, making the overall conversion of soil to ash about 40.5% by mass. It would require more than 130 lb/hr of soil (>10 – 30% soil to fuel ratio) for the overall ash content to be above ubiquitous soil levels. The residual soil/sand attached to typical herbivore waste accounts for less than 4% by mass. Given the maximum portion of herbivore waste in the fuel stream at 30% (as a percentage described within "Mixture of biomass and operations waste" in Table 11.23. (A-2)), the result of soil in the fuel stream is nearly 1.20%. The operational values of soil to fuel ratio is at least 20 times below that required to keep the NORM levels at their naturally occurring levels."*

Jon Novick's questions

Related to the Zoo's response to the comment on the need for SPCC Plan:

- The response indicates that the Zoo will be developing an SPCC for the Elephant Passage Facility and that it will be extended to the entire Zoo. The SPCC only addresses oils. Please include the SPCC Plan by reference in the EDOP. [Section 11.2.2. B](#) includes a statement, "DZF's SPCC Plan for Denver Zoo will be updated if and when oil volumes in the Waste Management Building meet the reporting thresholds to be included in the SPCC." Whether or not the oil products

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inside the Waste Management Building are subject to the SPCC Plan, the Equipment that will hold oil products inside the Waste Management Building will have secondary containment.

The response also indicates that the largest amount of oil present in the Waste to Energy facility will be 30 gallons contained in a hydraulic reservoir associated with "Equipment #1". Table 11.2.3(C2), as updated, indicates that "Equipment #9" will contain up to 625 gallons of water / rapeseed oil / TBD oil please confirm if this tank will be covered by the SPCC plan. If not, the Zoo should develop some sort of a contingency plan should a spill occur. When developed, please provide DEH a copy of the plan for review and approval. Clarification on Equipment #9, the system is still under development and the extent of oil used in a water/oil emulsion will be used is to be determined. However, water content should exceed 92% of the total volume (~625), thereby making oil only 8% (<50gal). This piece of equipment will be sitting inside the Waste Management Building, in the event of a spill materials will be contained within the building. Section 11.2.2. B includes a statement, "DZF's SPCC Plan for Denver Zoo will be updated if and when oil volumes in the Waste Management Building meet the reporting thresholds to be included in the SPCC." Whether or not the oil products inside the Waste Management Building are subject to the SPCC Plan, the Equipment that will hold oil products inside the Waste Management Building will have secondary containment.

- Table 11.2.3(C2) also indicates that "Equipment #11" will contain up to 20,000 gallons of 50% glycol / 50% water mix. The following comments apply to that tank:
 - DEH acknowledges that the glycol / water mix does not need to be included in the SPCC Plan, however; given the large quantity of glycol, the proximity of the facility to Duck Lake, and the potential impact of glycols on aquatic life in the event of a spill, the Zoo should develop some sort of a contingency plan should a spill occur. When developed, please provide DEH a copy of the plan for review and approval. DZF is constructing a secondary containment wall around these tanks and associated heat transfer equipment located inside the Waste Management Building. This secondary containment will hold 110% of the largest volume tank in the building. DZF will include a statement in the EDOP (Section 11.2.2 B) that includes the need to add these tanks and secondary containment in a monthly PM schedule.
 - Will corrosion inhibitors be added to the tank containing the glycol / water mix? If so, please provide details on the type and amount of corrosion inhibitors to DEH. Based on our construction records, it appears an inhibitor was included in the mixture (see MSDS). Items listed as inhibitor- Dipotassium Phosphate and Deionized Water
 - DEH recommends that only propylene glycol be used in the Waste to Energy Facility. When released to water, both forms of glycol exert a high oxygen demand. Ethylene glycol is also toxic to aquatic life (propylene glycol is not. Based on our construction records the mixture in the glycol tanks is 50% propylene glycol and 50% water.

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- Any drains in the Waste to Energy Facility which could potentially drain a release from the tank containing the glycol / water mix should be connected to the sanitary sewers. [The drain adjacent to these tanks is tied to sanitary sewer.](#)
- DEH recommends that the Zoo contact the Metro Wastewater Reclamation District to determine what type, if any, of permit is needed if a release of glycols were to occur. Please include details on any required Metro permit in the EDOP. [DZF will contact Metro to discuss potential for release of glycol/water mixture to sanitary sewer and any necessary permits or reporting requirements. We will include language in EDOP.](#)

The Zoo has not adequately addressed the comment on start-up timing and operational efficiency. DEH recognizes that it is not possible to assess operational efficiency until the system is actually up and running. [With that in mind, we would like to see a statement in the EDOP acknowledging the possibility that the system may not be operating at peak efficiency during start up and shut down and that appropriate operational procedures and contingency plans will be developed to ensure upsets during those timeframes are minimized.](#) Please also include a statement that DEH will be provided with a copy of those documents for review and approval once they have been prepared. [We will add some language to this effect in the EDOP. Please note that DZF will have to address these conditions specifically as part of our CDPHE construction air permit and subsequent Title V operating permit.](#)