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1.1 Odor Monitoring

Odor monitoring will be conducted for the duration of sludge handling and dewatering activities. The odor monitoring has been developed based on the findings in the Impoundment Basin Odor Characterization Results Report. The results of the characterization indicated that there is a reasonable off site odor potential for the proposed IB decommissioning activities. Based on the odor characterization analytical data, nearly all the odor is a result of hydrogen sulfide. Other concentrations that were detected in the laboratory analyzed sample (i.e. toluene, mercaptans) present low relative odor or health risk potential. Since benzene is the primary constituent of concern in the IB sludge, it was detected with a Draeger Tube during odor characterization, and has relatively low exposure limits, benzene will also be monitoring. The objective of the monitoring is to ensure the protection the public from potentially harmful chemicals and offensive odors.

In addition to the details presented in this section, the selected contractor to implement the work plan will prepare a Health and Safety (H&S) Plan and Odor Mitigation Plan. These plans will be submitted to the MDEQ as an addendum to this work plan prior to mobilizing to site.

1.1.1 Relevant Standards

Of paramount importance is to protect the public from potentially harmful chemicals. The Occupational Safety and Health Association (OSHA), Permissible Exposure Limit (PEL) for hydrogen sulfide is 20 parts per million (ppm) as a ceiling. The National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (REL) for hydrogen sulfide is 10 ppm_v as a 10 minute ceiling. According to the on-line NIOSH Pocket Guide to Chemical Hazards, hydrogen sulfide is a colorless gas with a strong odor of rotten eggs. The sense of smell becomes quickly fatigued to hydrogen sulfide.

The OSHA time-weighted average limit (TWA) for benzene is 1 ppm indicating that a site worker shall not be exposed to an airborne concentration of benzene in excess of 1 ppm as an 8-hour time-weighted average. The short-term exposure limit (STEL) for benzene is 5 ppm indicating that a site worker shall not be exposed to an airborne concentration of benzene in excess of 5 ppm averaged over any 15 minute period. The NIOSH REL as a 10-hour TWA is 0.1 ppm and as a 15 minute STEL is 1 ppm.

In accordance with Mississippi regulations the public should be protected from unreasonable odors in ambient air. Hercules proposes the following as objective and measurable standards to address odor.

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- Field olfactometer readings collected from odors at the property boundary omitted by and downwind of the IB do not exceed 2 dilution to threshold (D/T).

- Hydrogen sulfide concentrations emitted by the IB and collected at the property boundary do not exceed 0.01 ppm.

The D/T ratio is a measure of the number of dilutions needed to make the odorous ambient air "non-detectable". D/T is equal to the volume of carbon filtered air divided by the volume of odorous air. The use of subjective standards will be permitted only by MDEQ staff or the Site Health and Safety Officer.

1.1.2 Monitoring Equipment

Monitors will be used both in the work area and at the property fence line to protect the public from exposure.

At the fence line, hydrogen sulfide will be monitored using an OdaLog DiCom system (from Detection Instruments Corporation). This system has an H2S measurement range of 0.005 to 2 ppm. It can be programmed to take a measurement at a frequency of every 10 to 60 minutes. Using the system's ability to transmit a 4 to 20 mA signal, an alarm will be transmitted to a central monitoring location when a measured concentration exceeds a predetermined level (0.05 ppm). Odors will also be monitored at the fence line with a Nasal Ranger ® (developed by St. Croix Sensory) consistent with the Odor Characterization effort. Lastly, a dust monitoring instrument will be used to monitor dust since truck traffic will be required during the removal of the dewatered sludge from the site.

Hydrogen sulfide in the work area will be monitored with a RAEGuard EC (by RAE Systems Inc.) with a hydrogen sulfide sensor, or equivalent. The monitor will be equipped with an alarm which will be initiated if a hydrogen sulfide concentration of 10 ppm is reached and procedures detailed in the contractor's H&S Plan will be implemented. Benzene will be monitored in the work area and fence line with an UltraRae 3000 (by RAE Systems) photo ionization detector (PID) set in the benzene specific mode, or equivalent. The Ultra Rae 3000 meter can detect benzene concentrations between 0.05 ppm and 200 ppm. If a PID reading is measured which exceeds the equivalent of 0.1 ppm, an alarm will be initiated and procedures detailed in the contractor's H&S Plan will be implemented. Hydrogen sulfide is flammable with a lower explosive limit (LEL) of 4 percent. Other compounds such as methane can also be present. Therefore, potentially explosive conditions will be monitored in the work area using a Lower Explosive Limit (LEL) meter. If a reading greater than

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10% LEL is observed, then sludge removal and dewatering activities will cease until a remedy is determined to address the potentially explosive conditions.

1.1.3 Monitoring Parameters

Fence line monitoring for benzene, odors, and H_2S will be conducted when the sludge is being removed from the IB and dewatered. The fence-line monitoring will only be conducted during sludge removal and dewatering because there should be not be elevated emissions when the sludge is in a quiescent condition. An anemometer will be used to monitor wind speed and direction. Extra caution will be employed when the wind is in the direction of the neighbors and there is a low wind speed. The following table summarizes the monitoring parameters, threshold concentration, location, measuring device and frequency. The threshold is the concentration at which an action will be required as required by the H&S Plan and/or Odor Mitigation Plan developed by the contractor.

Compound/Parameter	Threshold Concentration	Monitor Locations	Monitoring Device	Monitoring Frequency
Benzene	0.1 ppm	Work Area and Fence Line	UltraRae 3000 benzene specific PID or equivalent.	30 minutes
Hydrogen Sulfide	0.01 ppm	Fence Line	OdaLog DiCom	10 minutes
	10 ppm	Work Area	RAEGuard EC	30 minutes
Odor	2 D/T	Fence Line, midpoint between fence line and dewatering and IB area.	Nasal Ranger	30 minutes
Explosive Conditions	10% LEL	Work Area	To Be Determined	30 minutes
Dust	>100 mg/m^3 above background	Fence Line	To Be Determined	As needed during sludge hauling activities.

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The results of the monitoring described above will be documented and included in the IB decommissioning completion report or as requested by MDEQ during the implementation of the work.

1.1.4 Odor Mitigation

The selected IB sludge removal and dewatering contractor will be required to select a mitigation approach and prepare an Odor Mitigation Plan prior to mobilization to the site. The subcontractor will also be required to prove its effectiveness on site prior to full scale implementation of sludge removal and dewatering. MDEQ will be notified when this demonstration will be completed.

One or a combination of the following mitigation approaches, or other appropriate technologies will be utilized by the contractor to avoid the migration of offensive odors off site during the removal and dewatering of sludge from the IB.

- **Water Barrier**: By maintaining a water barrier on the IB and removing (i.e. pumping) sludge from beneath this barrier, odors emitted directly from the IB can be significantly reduced. In addition, removal of the sludge using hoses or piping would minimize the exposure of the sludge to ambient air.

- **Containment structures:** The most effective approach to controlling emissions from a source is to contain, capture and treat them. When dealing with an area source such as the IB, a temporary structure could be installed over it such as a Sprung structure. The need for such a structure would be greatest if the sludge were to be removed mechanically such as by dredging equipment. The air within the structure would be conveyed to a treatment system. A Sprung structure consists of an aluminum frame and a membrane that is attached to the frame. The membrane is made of a polyester fabric with either a polyurethane or Tedlar coating. Sprung structures are available in widths ranging from 50 feet to 200 feet and of varying lengths. They have been used in a wide range of applications such as enclosing remediation/excavation sites, municipal salt storage facilities, and to enclose vehicle maintenance operations.

  The sludge dewatering operation should be conducted in an enclosed space such as a building or a temporary structure. As noted in the Section 1.1.1, a ventilation system consisting of an air supply and exhaust should be provided. The air supply portion of the system would be designed to provide fresh air to the breathing zone of the workers. The exhaust air from the enclosed space would be discharged to a treatment system before being exhausted to the ambient air. Treatment of the air would need to be sufficient enough to avoid exceedances to the threshold values stated previously.

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- **Chemical Addition:** Given the high hydrogen sulfide concentrations measured in the Impoundment Basin Odor Characterization Results Report, the addition of chemicals to sludge before dewatering could be implemented. The chemicals are intended to react with the hydrogen sulfide contained in the sludge to minimize emissions during and after dewatering. The chemicals to be considered should include: an alkali such as lime that would raise the pH of the sludge and convert hydrogen sulfide to a non-volatile ion; iron salts, that would convert dissolved sulfide to a non-volatile precipitate; and oxidants that would convert sulfide to sulfate, a non-volatile ion. Proprietary chemicals that appear to have application could also be used.

- **Hydraulic Removal of Sludge:** As stated previously, the sludge will likely be removed from the IB hydraulically. Pumps will be used to remove the sludge from under the water surface. It will be pumped to the sludge dewatering equipment. This approach will produce minimal emissions and has been proven to be effective at similar projects.

- **Foaming Agents:** Aqueous foam formulations have been used successfully to control emissions from landfills, open excavations and from ponds. The foams form a flexible membrane and minimize emissions. The effectiveness of foams controlling emissions varies with compounds and there effective life also varies. Therefore, the evaluation of foams should consider the compounds that are to be controlled and their required service life. Foaming agents may prove to be most beneficial once nearly all the sludge is removed and the overlying water is pump out in order to access the residual sludge at the bottom of the IB.

- **Counteractants/Masking Agents:** There are liquid products that are applied in as a mist which are reported to react with various odors/volatile compounds and serve to neutralize odors. The actual effectiveness of these materials is difficult to quantify. Other vapor phase products are intended to simply replace an offensive odor with a more acceptable one. This later approach is challenging because what is acceptable to one individual may be offensive to another. The use of counteractants and masking agents are a last resort and are typically used for large area sources where the option of containing, capturing and treating an emission source is deemed too difficult and expensive.

The Odor Mitigation Plan will be deemed effective if:

- Nasal Ranger readings collected from odors at the property boundary omitted by and downwind of the IB do not exceed 2 D/T.

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- Hydrogen sulfide concentrations emitted by the IB and collected at the property boundary do not exceed 0.01 ppm.

The contractor will be required to prepare a contingency plan as part of the Odor Mitigation Plan submittal (prior to mobilization to the site) in the event that the selected approach does not perform to the standards presented above. In the event that unforeseen circumstances occur and a significant change to the Odor Mitigation Plan is required, MDEQ will be notified.

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