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### **Purpose and Scope**

The purpose of Big Ox Energy – Riceville, LLC’s Working Near Biogas Equipment Program is to ensure the safety of our employees by establishing appropriate procedures for each location where there is a risk of ignition or explosion from Biogas.

This program outlines responsibilities for all Big Ox Energy - Riceville, LLC employees, proper storage and use methods and required employee training. All employees are required to follow the procedures outlined in this program. Any deviations from this program must be immediately brought to the attention of the Plant Manager.

### **Hazardous Atmosphere**

A hazardous atmosphere is an atmospheric condition that may expose workers to a risk of death, incapacitation, and impairment of ability to escape unaided, injury or acute illness. Testing of hazardous areas is required prior to entry into an area of concern. Employees or contractors shall not enter ANY area containing hazardous concentrations of toxic gases unless properly trained, protected, and utilizing calibrated air monitoring equipment.

### **Gas Hazards Equipment**

- Each employee shall use a portable gas monitor as required in all high gas or potentially high hazard areas.
- The gas monitor must be calibrated prior to use per manufacturer's recommendations and contain a current calibration sticker on the monitor providing the date of last calibration.
- Bump test are required to be completed at the beginning of each day the monitor is in use per the manufacturer's guidelines to insure the monitor is functioning correctly.

### **Head Space in Tanks and Vessels**


The upper section of a tank or vessel above the liquid is often referred to as the "headspace." When processing flammable gas or liquids, ignitable vapor concentrations form in the headspace of vessels, containers and storage tanks. Static electricity and other potential ignition sources could be present in the absence of adequate safeguard measures.

In enclosed spaces such as vessel and tank headspaces, formation of flammable mixtures requires only a small amount of liquid.

### **Ignition Sources**

A variety of potential ignition sources could be present at times in or around atmospheric storage tanks and atmospherically operated process vessels. Ignition sources have the potential to cause fires and/or explosions in areas where flammable vapors/gases are potentially present in the air. Ignition sources are typically created during Hot Work activities. Ignition sources include:

- sparks (e.g., from electrical tools and equipment; welding, cutting and grinding; static electricity)
- use of lighters, matches, cigarettes
- open flames (e.g., portable torches and heating units)
- surfaces with enough heat to vaporize a combustible material (e.g., catalytic converter of an automobile in dry grass)

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- combustion engines or sources (e.g. vehicles/equipment, generators, compressors, mowers)

However, static electricity can also occur inside the vessel.

Some solvents and liquids are more prone to generating and accumulating static electricity charges. Toluene, acetone and methanol have reputations for generating or accumulating static electricity charges. It is possible to determine the charge generation rate and charge relaxation rate; however, these calculations are beyond the scope of this article.


Liquid flowing into a vessel can generate an electric charge that could accumulate in the vessel. This accumulated charge could discharge between the liquid surface and the vessel wall, resulting in ignition if the vapors are in the flammable range. Freefalling liquid significantly increases generation of static charges. Agitation with low liquid level can cause splashing and freefalling droplets, which can significantly increase generation of static charges. Higher liquid flow velocity (corresponding to higher fill rates) also increases the rate of generation of static electricity. The extreme case of static electricity discharge is lightning. A lightning-induced spark could ignite the flammable vapor at the exit of a vent and the flame front could propagate back into the vessel.

Electrical equipment (including instrumentation) within processing areas also presents a potential source of ignition. These potential ignition sources may include agitator motors, pumps, ventilation fan motors, forklifts, lighting fixtures, and electrical relays or power distribution equipment. Temporary ignition sources such as welding, cutting, burning, electrically powered hand tools and devices, unrated vehicles and equipment could provide ignition sources that could come into contact with flammable vapor concentrations in or near the vessel.

#### Engineering Controls

- Flash arrestors should be installed in all vent lines to prevent an external flame front flashback into the vapor headspace of the vessel.
- Some areas surrounding digester tanks and processing areas should be electrical classified as Class I Division 2. In summary, Division 2 indicates an area where flammable vapors are present but are normally contained in closed containers and equipment. In Division 2 areas, flammable vapor concentrations are not normally present but could be present due to upsets or credibly expected infrequent events (spills, releases).
- Some smaller appropriate portions of the area, such as those near the biogas pipe should be Class I Division 1, where flammable vapor concentrations normally exist during operation. These Division 1 areas would include a) the immediate vicinity of the hatches and openings on top of the vessels; b) sumps; and c) the immediate vicinity of the discharge point of the vent pipe from the top of the vessel to the atmosphere.
- All electrical equipment must be rated for the electrical classification area in which the equipment is installed. **No electrical or electronic devices (including cell phones) are permitted unless they are properly rated, or continuous monitoring shows that gas levels are below 10% LEL**
- See Appendix A for a drawing of classified locations.

#### Administrative Controls


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- SOPs for tasks that involve potential exposure to biogas shall reviewed to verify that relevant risk mitigation options are included.
- Ignition Control Permits shall be completed prior to work in any area that is a classified location.
- Vehicles and equipment left unattended in a Restricted or Hazardous Area shall be shut off and not restarted until Atmospheric Monitoring confirms the absence of hazardous vapors.
- The following precautions shall be made to eliminate or minimize ignition sources:
  - When in Hazardous and Restricted Areas:
    - test for oxygen levels and flammable atmospheres prior to introducing ignition sources and continuously monitor these areas while ignition sources are present
    - if a flammable atmosphere is present, use only explosion-proof electrical installations and explosion-proof electrical equipment o use only intrinsically safe electronic devices unless the air is initially tested and continuously monitored for flammable vapors and the equipment is listed on the ignition control permit
    - shutdown vehicles and equipment whenever possible or when left unattended (do not restart the vehicle or equipment until Atmospheric Monitoring confirms the absence of a flammable atmosphere)
    - use non-sparking tools that are kept clean and free from ferrous or other contaminants which may hamper non-sparking properties
    - control all potential ignition sources
    - smoke only in designated areas
    - ground and bond as required
    - ensure diesel-powered equipment, when in operation, is equipped with an exhaust system fitted with a functional spark arrester (excluding turbocharged equipment); to remain effective, spark arresters shall be periodically blown clean with compressed air through the cleanout plug
    - do not stop vehicles or equipment in areas where there is combustible ground cover like dry grass, weeds or straw
    - leave strike-anywhere matches and lighters with open mechanisms, including disposable lighters in designated areas (e.g., left inside a vehicle or locker)
    - do not position portable light plants and/or generator sets near combustible or flammable material
    - do not drill metals without sufficient lubrication
  - When mechanically cutting pipe, ensure that the appropriate speed is used with sufficient lubrication to reduce potential for excessive heat production.  
inspect and maintain equipment regularly (e.g., friction in a defective or underlubricated equipment bearing can overheat the bearing and cause a fire by vaporizing and igniting lubricating oil)

#### **Pyrophoric iron sulfide**

Pyrophoric iron sulfide is a black deposit that can build up in locations such as storage tanks, seal pots, piping and metal sumps. It develops when sulfur comes in contact with iron. When the deposit dries, it can ignite spontaneously. Precautions include:

- identify equipment where iron sulfide is suspected
- tanks and vessels shall be purged of hydrocarbon vapors before opening.

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- when iron sulfide is suspected to be present, provisions shall be made to keep the inner surfaces of opened equipment wet
- disposal of accumulated iron sulfide shall be handled quickly and carefully to avoid creating a hazard

Pyrophoric iron sulfide deposits may develop in tanks where sour gas (H<sub>2</sub>S) has been stored. These deposits can ignite spontaneously when they dry out. Use water spray to soak iron sulfide at least once every 24 hours, or more frequently if considered necessary by Operations Management.

### **Bonding and Grounding**

Electric charges can build up on an object or liquid when certain liquids (e.g., petroleum solvents, fuels) move in contact with other materials. This can occur when liquids are poured, pumped, agitated, stirred or flow through pipes. This buildup of electrical charge is called static electricity. Static electricity can potentially discharge (cause an explosion) when sufficient amounts of flammable or combustible substances are located nearby.

To prevent the buildup of static electricity and prevent sparks from causing a fire, it is important to bond or ground exposed metal. Bonding is done by making an electrical connection from one metal container to the other. Grounding is done by connecting the container to an already grounded object that will conduct electricity. This ensures that there will be no difference in electrical potential between the two containers and, therefore, no sparks will be formed.

Bonding and/or Grounding shall be completed as required, including, but not limited to the following tasks:

- cutting and separating a pipeline
- separating flanges
- dispensing flammable liquids from bulk drums into a secondary container
- removing an accessory attachment from a fixed Facility (e.g., a mixer from a tank)
- using abrasive blasting equipment to clean tanks
- hydrovacing
- spray painting
- when using compressors, pumps and generators


Bonding and/or grounding may be required for the following tasks:

- drawing samples from the pipeline
- draining oil from the pipeline into a pan

Prior to use and during use, all portable equipment used in Bonding and Grounding work (e.g., welding units, generators, portable light plants, air compressors, etc.) shall be properly grounded, in accordance with manufacturers' specifications and Worksite requirements.

Workers shall:

- wear appropriate hand protection when there is potential exposure to induced high voltage, including when handling pipe, valves, casing or measuring equipment
- avoid breaking, cutting or detaching Bonding cables once they are in place, for as long as a fire hazard exists
- ground or electrically bond containers to each other when transferring liquids

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- only fill portable fuel containers when they are on the ground (never do so in truck beds, on tailgates or in the trunks of vehicles)
- immediately contact Qualified Workers if there are any concerns about induced high voltage and work equipment
- ensure each Bonding or grounding point is clean and free of paint, with a positive connection
- never use chains for Bonding or grounding purposes
- perform visual inspection of the cables and connection as required to ensure positive connection is maintained

**Bonding cables:**

- when drawing oil or product samples from the line, or when loading or offloading at sump tank locations, use an uncovered braided copper wire with an alligator clip brazed/clamped to each end (or use other suitable Bonding cable)
- each pipeline crew shall have at least 2 prefabricated Bonding cables made of minimum 10 gauge stranded copper wire with a spade connector brazed/clamped on each end and at least 2 grounding clamps for attaching the Bonding cable to the pipe
- attach one end of the Bonding cable to a ground consisting of a copper ground rod
  - o Type and depth of copper rod to be used shall be based on job planning requirements

**Entering Buildings Containing Natural Gas Products or Equipment**

Before entering any buildings where natural gas may be present, operate valves as necessary to shut down or bypass the source of gas and/or ventilate the building (e.g., open doors and windows).

The minimum entry criteria for entering buildings containing natural gas products or equipment are:

- at <10% LEL, entry is allowed
- at 10-20% LEL, entry is allowed if:
  - o only Cold Work is planned
  - o Safety Watch is present at all times
- at >20% LEL, entry is allowed for inspecting or opening and closing valves to reduce gas levels provided:
  - o a Safety Watch is present at all times monitoring atmospheric levels
  - o a safety harness and lifeline are used and an Employee trained in their use is present and in control of the lifeline
  - o self-contained breathing apparatus (SCBA) or a supplied-air respirator (SAR) with egress bottle is used

Conduct continuous Atmospheric Monitoring while approaching the work area to verify acceptable conditions. If concentrations are higher than prepared for, exit the area and reassess the situation.