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Conducting a Safety Walk-through on a Farm: Hazards of the Manure Handling System, Anaerobic Digester, and Biogas Handling System (A Self-Assessment Guideline for Farmers)

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Conducting a Safety Walk-through on a Farm: Hazards of the Manure Handling System, Anaerobic Digester, and Biogas Handling System (A Self-Assessment Guideline for Farmers)

Abstract

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Keywords

farms, safety, self-assessment

Comments

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**CONDUCTING A SAFETY WALK-THROUGH
ON A FARM:
HAZARDS OF THE MANURE HANDLING
SYSTEM, ANAEROBIC DIGESTER, AND BIOGAS
HANDLING SYSTEM**

A SELF-ASSESSMENT GUIDELINE FOR FARMERS

First Edition

January 2007

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PREFACE

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A SELF-ASSESSMENT GUIDELINE FOR FARMERS
CONDUCTING A SAFETY WALK-THROUGH ON A FARM:
HAZARDS OF THE MANURE HANDLING SYSTEM, ANAEROBIC
DIGESTER, AND BIOGAS HANDLING SYSTEM

By Nellie J. Brown, M.S., C.I.H.

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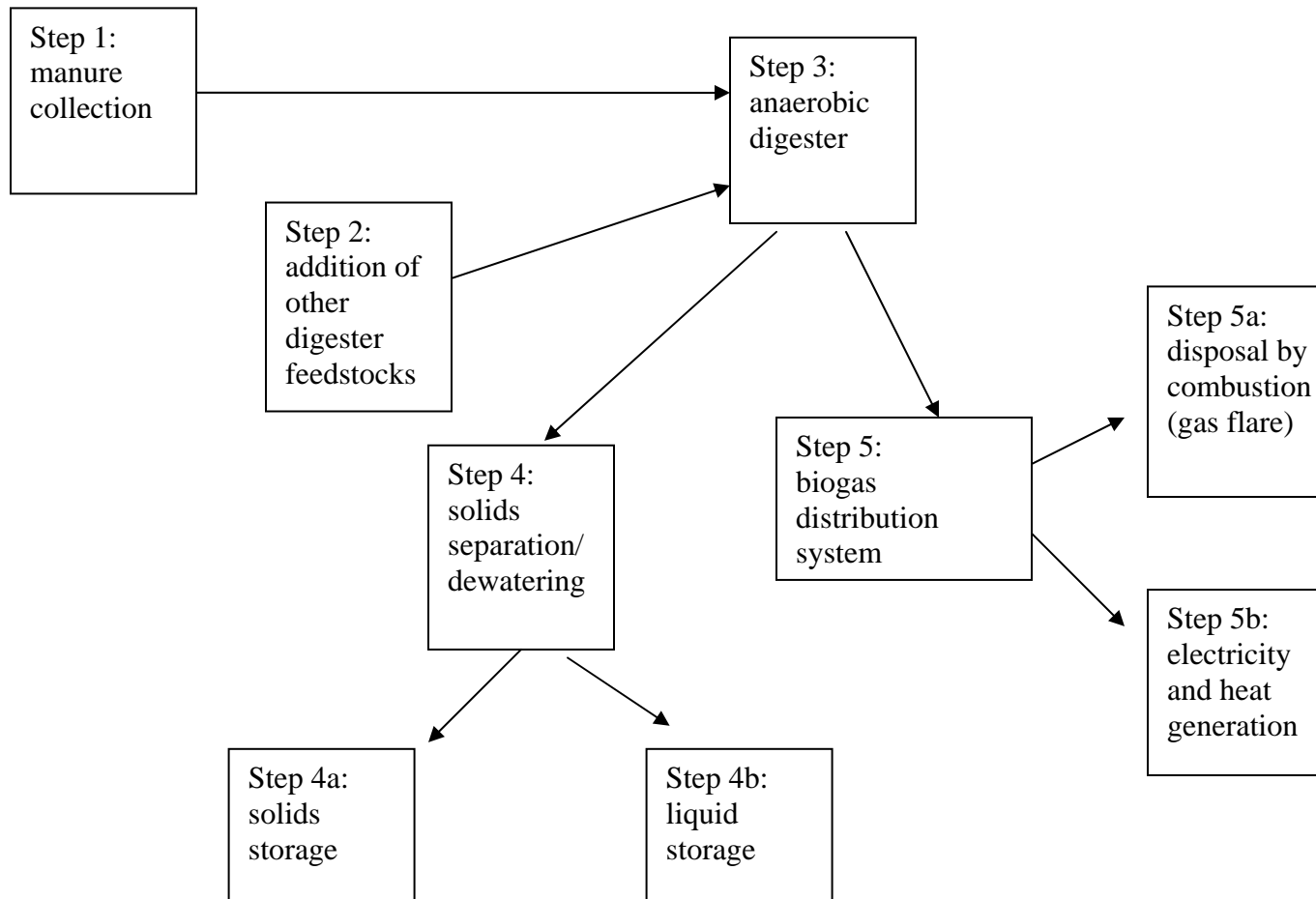
Edited by Brian S. Aldrich, Cornell Manure Management Program

INTRODUCTION

This self-assessment document is intended to be used by farm owners and managers or farm staff who are responsible for the operations and/or maintenance of anaerobic digesters and their related processes. It provides guidance for process and job evaluation with suggestions based upon typical potential hazards for farm digester systems and their associated preventive measures.

START WITH GOOD PROCESS INFORMATION

Obtain, or sketch your own, process layout or process flow diagram. This can be a simple figure composed of blocks and arrows, as shown in the example below. Just make sure you have listed all the steps of your farm's system. If your system differs from this figure, you will need to make the appropriate corrections on the diagram and in the sections that follow.



Next, you will walk through each step and reflect upon how it is done and how people could get hurt or how things could go wrong when that step is done – the rest of this guideline is intended to help you along the way. For each step, it will be useful to consider the following:

From the OPERATIONS point of view: What is done in this step of the operation? What is the intention of this step? If this step were successfully done, how would you know? How could people be injured, made ill, or otherwise adversely affected from operating this step? What if this step were experiencing an operational problem or failure, could someone be hurt, exposed, or adversely affected?

From the MAINTENANCE point of view: What types of repair or servicing are needed here? How could people be injured, made ill, or otherwise adversely affected by doing maintenance tasks?

So far, have you experienced ANY HISTORY OF WORK-RELATED INCIDENTS OR SYMPTOMS? This would be a clear indication of whether problems are possible.

Would there be ANY IMPACT OF NEARBY OPERATIONS OR OVERALL LAYOUT on whether people could be hurt or adversely affected? Some activities are very close to other people or equipment; for example, you might need to work near something that is very noisy even if you are not the person actually doing work on the noisy equipment.

Here are some things to consider as possible causes of process failure: equipment failure, operator error, poor design, sabotage

As you consider how people can be hurt, here are some examples of types of hazards people might encounter...

- chemical: burns, poisoning
- thermal: burns, fire or explosion
- biological: disease, infection, allergy
- ergonomic: strains, sprains, over-exertions (acute or cumulative)
- occupational stress: including shiftwork and scheduling
- physical: radiation, heat stress, cold stress, electromagnetic fields, vibration, noise
- trauma: slips, falls, impact, compression, cuts, amputation
- violence: verbal harassment, threats, physical assaults

...and how people can be hurt, made ill, or otherwise adversely affected:

- Struck-by
- Struck-against
- Caught-between
- Contact-with
- Contacted-by
- Caught-on
- Caught-in
- Fall to the same level
- Fall to below
- Overexertion
- Exposure by inhalation, skin contact, eye contact, skin absorption, or injection (including chemical contact with cuts or abrasions; including high-pressure injection injury from skin contact with leaking high-pressure air or hydraulic lines at greater than 103 psi)
- Engulfed
- Asphyxiation

And finally, before we begin, let us consider one very important kind of workplace danger that can consist of one or more different kinds of hazards – confined spaces. The generation of biogas from manure involves the use of confined spaces such as tanks, pits, wet wells, or dry wells. Hopefully, the operations and maintenance tasks which need to be done for these spaces can be accomplished without having to go into these spaces, and any work around the openings to these spaces can be accomplished by preventing people from falling into them, as well. While the OSHA standard on confined spaces (29 CFR 1910.146 Permit-Required Confined Spaces) does not apply to agriculture, confined space entry is a well-recognized hazard under the general duty clause of the Occupational Safety and Health Act of 1970 – so employers need to provide a safe workplace for their employees (and, of course, would want to provide a safe workplace for themselves, as well).

Why are confined spaces such a concern for us? A confined space is a space which by design:

1. Has limited openings for entry and exit – this produces awkwardness for getting in and out and for rescue if needed
2. Has unfavorable natural ventilation which could contain or produce dangerous air contaminants – so the atmosphere could cause injury or death due to oxygen deficiency, toxicity, or explosion hazard, usually from the gases produced by bacterial decay.
3. Is not intended for continuous employee occupancy – so it wasn't designed to be people-friendly in terms of shape, accessibility, corrosion problems, or ease of maintenance. Equipment may be in the space which could start up while someone is in the space, causing injury or drowning.

Confined space work has produced injury and fatality on farms for example, after entry into manure pits and wells. Often people don't realize that the hazardous conditions may not be seen or smelled or that equipment needs to be inactivated so it can't be started up while someone is in the space. (See further information at the end of this guide.)

STEP 1: MANURE COLLECTION

OPERATIONS: This step takes place in the animal barn and involves the gathering of manure and sending it on to the digester’s receiving tank.

If this step were successfully done, how would you know?

How could people be injured, made ill, or otherwise adversely affected from operating this step?

Would injury or illness be different if this step were experiencing an operational problem or failure?

MAINTENANCE: What types of repair or servicing are needed here?

How could people be injured, made ill, or otherwise adversely affected by doing this maintenance?

ANY HISTORY OF WORK-RELATED INCIDENTS OR SYMPTOMS?

ANY IMPACT OF NEARBY OPERATIONS OR OVERALL LAYOUT?

HOW IS THE MANURE COLLECTED SO THAT IT CAN BE SENT TO THE DIGESTER?	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES

The following are some ideas to assist you:

HOW IS THE MANURE COLLECTED SO THAT IT CAN BE SENT TO THE DIGESTER?	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES
<p>Alley-scraper to draw manure to receiving pits in the floor at one end of the barn?</p> <p>Alley-scraper drawn up and down by steel cable connected to a drive motor and take-up reel which winds up the cable?</p>	<p>Pinchpoints at the drive belt of the drive motor and as the cable is wound onto the take-up reel. Fingers could be caught and crushed. Loose clothing or hair could be caught.</p>	<p>Have guard housing for the motor and take-up reel assembly. Avoid loose clothing and hair (including ties for hoods).</p> <p>When doing repairs, electrically-disconnect the motor and block or chock the belt and take-up reel to prevent movement.</p>
<p>If manure in the barn can freeze in cold weather...</p>	<p>...then frozen manure may cause an overload for the drive motor.</p> <p>Liquid manure and frozen manure may be a slipping hazard.</p>	<p>Avoid entry into alley; use shovel or other long-handled tool to move obstruction.</p> <p>Wear rubber boots or workshoes with nonskid soles to help reduce slipping hazard.</p>
<p>An alley scraper could catch a fallen cow (or person) or a foreign object.</p>	<p>Possible physical trauma, unless this overloads drive motor.</p> <p>Scraper could suddenly be released from the obstacle and strike a person or animal.</p>	<p>Can the drive motor controls automatically shut down the motor if overloaded?</p>
<p>If there is a receiving pit for the manure...</p>	<p>Is it big enough for a person to fit in?</p>	<p>Place a grating over the receiving pit opening that can support the weight of persons standing on it. If metal, check it periodically for corrosion. (Plastics such as fiberglass-reinforced materials may also be available.)</p>
<p>If raw manure is collected or stored in a pit, tank, or vessel....</p>	<p>Pit, tank, or vessel is a confined space and possibly oxygen deficient and/or explosive atmosphere, along with possible engulfment (drowning)</p> <p>Entering the tank for any reason, including falling in, could be serious, even life-threatening.</p>	<p>Can task (such as repair of a pump) be done without entry? Can cleaning be done using a high-pressure water spray? Can the pump be attached to a cable and winch so that it can be hauled out for repair?</p> <p>Falls and unauthorized entry should be prevented by using a lockable hatch cover or equivalent. Presence of confined space should be stated using a warning sign such as: <i>TANK IS A CONFINED SPACE This space may contain toxic gases or lack sufficient oxygen to support life. Entry only after atmospheric monitoring indicates it is safe to do so.</i> (Any warning signage should be in multiple languages if needed.)</p>

STEP 2: ADDITION OF OTHER DIGESTER FEEDSTOCKS

OPERATIONS: This step takes place outside the barn and involves receiving liquid wastes (originating off the farm) and collecting them in a receiving tank for subsequent mixing with manure and feeding to the digester.

If this step were successfully done, how would you know?

How could people be injured, made ill, or otherwise adversely affected from operating this step?

Would injury or illness be different if this step were experiencing an operational problem or failure?

MAINTENANCE: What types of repair or servicing are needed here?

How could people be injured, made ill, or otherwise adversely affected by doing this maintenance?

ANY HISTORY OF WORK-RELATED INCIDENTS OR SYMPTOMS?

ANY IMPACT OF NEARBY OPERATIONS OR OVERALL LAYOUT?

ARE OTHER FEEDSTOCKS RECEIVED AND SENT TO THE DIGESTER?	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES

The following are some ideas to assist you:

ARE OTHER FEEDSTOCKS RECEIVED AND SENT TO THE DIGESTER?	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES
If the delivery truck is coupled to a hose which feeds to the receiving tank...	<p>Could the coupling pinch the hand?</p> <p>Could the coupling come loose and splash someone's eyes or body with liquid waste?</p> <p>Is the liquid waste hazardous, such as acidic or basic?</p>	Nearby eyewash/emergency shower.
If feedstocks are collected or stored in a pit, tank, or vessel....	<p>The pit, tank, or vessel is a confined space and would be expected to have hazards of:</p> <ul style="list-style-type: none"> • oxygen deficiency • carbon dioxide and possibly other gases created during decomposition of feedstock • engulfment (drowning) <p>Entering the tank for any reason, including falling in, could be serious, even life-threatening.</p>	<p>If a task needs to be done in the confined space, such as cleaning or repair of a pump, can the task be done without entry? Can cleaning be done using a high-pressure water spray? Can the pump be attached to a cable and winch so that it can be hauled out for repair?</p> <p>Falls and unauthorized entry should be prevented by using a lockable hatch cover or equivalent.</p> <p>Presence of confined space should be stated using a warning sign such as: TANK IS A CONFINED SPACE <i>This space may contain toxic gases or lack sufficient oxygen to support life. Entry only after atmospheric monitoring indicates it is safe to do so.</i></p>
If foot baths for animals are provided and contain disinfectant, are these contents sent to the digester?	Could chemical exposure occur from spills or splashes?	<p>Nearby eyewash/emergency shower.</p> <p>Wear goggles and chemically-resistant gloves.</p>

STEP 3: ANAEROBIC DIGESTER

OPERATIONS: This step takes place in the digester and involves the decomposition of manure and/or other feedstocks to produce biogas.

If this step were successfully done, how would you know?

How could people be injured, made ill, or otherwise adversely affected from operating this step?

Would injury or illness be different if this step were experiencing an operational problem or failure?

MAINTENANCE: What types of repair or servicing are needed here?

How could people be injured, made ill, or otherwise adversely affected by doing this maintenance?

ANY HISTORY OF WORK-RELATED INCIDENTS OR SYMPTOMS?

ANY IMPACT OF NEARBY OPERATIONS OR OVERALL LAYOUT?

HOW IS THE DIGESTER OPERATED AND MAINTAINED?	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES

The following are some ideas to assist you:

HOW IS THE DIGESTER OPERATED AND MAINTAINED?	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES
<p>In addition to the digester itself, are there other tanks or pits? Examples could include tanks or pits for digester effluent or for containment or access to agitators (mixers) for the digester?</p> <p>Are there any wetwells to collect groundwater from around the digester to reduce its cooling effect?</p>	<p>Digester, tanks, pits, and wetwells are confined spaces and would be expected to have potential hazards of:</p> <ul style="list-style-type: none"> • oxygen deficiency from methane and carbon dioxide • hydrogen sulfide toxicity • methane explosivity • carbon dioxide toxicity • engulfment (drowning) • mechanical hazard from impact by agitator blades or pump impeller blades 	<p>Place fire extinguishers in key locations.</p> <p>Avoid confined space entry: have pumps and agitators attached by steel cables to winches to enable withdrawal for repair. Due to the corrosive nature of atmospheres containing both hydrogen sulfide and moisture, it would be expected that steel cables to pumps and agitators may eventually experience cable failure. To avoid having a cable break and a need for entry to arise, a regular withdrawal of pumps and agitators for cable inspection should be instituted.</p> <p>Unauthorized entry could be prevented by using lockable hatch covers or buildings over open tanks. Where possible, use a fence with lockable gate for tanks, digester, pits, and wells; also a fence around the base of the flare.</p> <p>Use warning signs: <i>TANKS, PITS, AND DIGESTER ARE CONFINED SPACES These spaces may contain toxic or hazardous gases or lack sufficient oxygen to support life. Entry only after atmospheric monitoring indicates it is safe to do so.</i></p>
<p>Does anyone ever need to stand or walk on the digester cover or covers over tanks or pits?</p>	<p>Are these covers strong enough to support a person standing on top?</p> <p>Falling into a tank could produce trauma or engulfment (drowning); serious, potentially life-threatening.</p>	<p>Covers should be of a sturdy material to support weight of workers standing or walking on them.</p> <p>The worker extracting a pump should wear a full body harness and lifeline attached to a fixed point; the length of line should be short enough to prevent the worker falling forward into the tank. An attendant should be present for this task.</p> <p>Tools and lighting used in or near the confined spaces should be non-sparking and not serve as ignition sources.</p>
<p>What if the digester cover needs repair?</p>	<p>Patching of leak in cover could involve inhalation of digester gas. Serious, possibly life-threatening.</p>	<p>Wear respirator- (supplied air respirator or self-contained breathing apparatus (SCBA)) Remove ignition sources.</p>
<p>What if something drops into a tank or pit?</p>	<p>Fall into tank; possible trauma; engulfment (drowning); serious, potentially life-threatening.</p>	<p>To retrieve object, use a special tool or wait for high-enough liquid level to bring a floating object within reach such as by turning pump timer off and not feeding digester for a brief period. Wear a full body harness and lifeline attached to a fixed point; the length of line should be short enough to prevent the worker falling forward into the tank. An attendant should be present for this task.</p>

STEP 4: SOLIDS SEPARATION/DEWATERING

OPERATIONS: This step involves receiving liquid from the digester and separating solids from the liquid.

If this step were successfully done, how would you know?

How could people be injured, made ill, or otherwise adversely affected from operating this step?

Would injury or illness be different if this step were experiencing an operational problem or failure?

MAINTENANCE: What types of repair or servicing are needed here?

How could people be injured, made ill, or otherwise adversely affected by doing this maintenance?

ANY HISTORY OF WORK-RELATED INCIDENTS OR SYMPTOMS?

ANY IMPACT OF NEARBY OPERATIONS OR OVERALL LAYOUT?

HOW IS DEWATERING DONE – HOW ARE SOLIDS SEPARATED FROM THE LIQUID?	HAZARD	PREVENTIVE MEASURE

The following are some ideas to assist you:

HOW IS DEWATERING DONE – HOW ARE SOLIDS SEPARATED FROM THE LIQUID?	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES
<p>If a screw press is used for this purpose, where do the solids go as they exit the press?</p> <p>If they drop through a hole in the floor to be collected on the floor below, is the opening large enough to allow a fall to a lower level?</p> <p>Could fog from water vapor from screw press obscure the hole in the floor?</p> <p>If the solids drop onto a conveyor belt...</p>	<p>Depending upon the height of the sludge cake pile, this may allow a fall to the concrete floor (serious trauma or fatality) or a fall into the pile causing engulfment (asphyxiation).</p> <p>...there are pinch points where hands or clothing could be caught by a drive roller or idler, producing trauma.</p>	<p>A floor hole into which persons can accidentally walk shall be guarded by either a railing with toeboard on all exposed sides or a floor hole cover which, when not in place, shall be protected by a removable railing.</p> <p>Do not wear loose clothing around the conveyor belt.</p> <p>Electrically-disconnect and lockout the conveyor belt before doing any maintenance activity.</p>
<p>Does the screw press become hot or produce steam?</p>	<p>Possible thermal burns from contact with hot screw press.</p>	<p>Lockout screw press and allow it to cool off prior to maintenance. A fan may be used to speed this process.</p>

STEP 4a: SOLIDS STORAGE

OPERATIONS: This step takes place in a barn and involves the receiving of dewatered solids and forming a pile for later removal by payloader for subsequent use (such as land application or animal bedding).

If this step were successfully done, how would you know?

How could people be injured, made ill, or otherwise adversely affected from operating this step?

Would injury or illness be different if this step were experiencing an operational problem or failure?

MAINTENANCE: What types of repair or servicing are needed here?

How could people be injured, made ill, or otherwise adversely affected by doing this maintenance?

ANY HISTORY OF WORK-RELATED INCIDENTS OR SYMPTOMS?

ANY IMPACT OF NEARBY OPERATIONS OR OVERALL LAYOUT?

HOW ARE DEWATERED SOLIDS STORED?	HAZARD	PREVENTIVE MEASURE

The following are some ideas to assist you:

HOW ARE DEWATERED SOLIDS STORED?	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES
If pile is formed by use of a conveyor belt...	...there are pinch points where hands or clothing could be caught by a drive roller or idler, producing trauma.	Do not wear loose clothing around the conveyor belt. Electrically-disconnect and lockout the conveyor belt before doing any maintenance activity.
Does pile produce sufficient steam to obscure workers or equipment in the barn or shed?	People could be hit or run over by payloader; equipment could be damaged by payloader.	When working around payloader, make sure driver can see you.
Standing on top of pile of dewatered solids could cause engulfment.	Avoid climbing onto the pile.	If this becomes necessary, wear body harness and lifeline with attendant standing by to pull person from the pile. Training on the potential hazard. Signage could be used to provide a warning such as: <i>SOLIDS PILE IS AN ENGULFMENT HAZARD. DO NOT CLIMB OR STAND ON PILE.</i>

STEP 4b: LIQUID STORAGE

OPERATIONS: This step involves the receiving of the liquid from the dewatering step and sending it to a lagoon or tank for storage and later removal for subsequent use (land application).

If this step were successfully done, how would you know?

How could people be injured, made ill, or otherwise adversely affected from operating this step?

Would injury or illness be different if this step were experiencing an operational problem or failure?

MAINTENANCE: What types of repair or servicing are needed here?

How could people be injured, made ill, or otherwise adversely affected by doing this maintenance?

ANY HISTORY OF WORK-RELATED INCIDENTS OR SYMPTOMS?

ANY IMPACT OF NEARBY OPERATIONS OR OVERALL LAYOUT?

HOW IS THE LIQUID STORED?	HAZARD	PREVENTIVE MEASURE

The following are some ideas to assist you:

HOW IS THE LIQUID STORED?	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES
If storage takes place in an open or closed tank...	<p>Fall into tank; possible trauma; engulfment (drowning); serious, potentially life-threatening.</p> <p>Such tanks or pits are confined spaces and would be expected to have hazards as described above for other tanks, pits, wells, or the digester.</p>	As described above.
If storage takes place in a lagoon...	Fall into tank; possible trauma; engulfment (drowning); serious, potentially life-threatening.	As described above.

STEP 5: BIOGAS DISTRIBUTION SYSTEM

OPERATIONS: This step involves the receiving of the biogas from the digester and piping it for disposal or subsequent use (such as a generator).

If this step were successfully done, how would you know?

How could people be injured, made ill, or otherwise adversely affected from operating this step?

Would injury or illness be different if this step were experiencing an operational problem or failure?

MAINTENANCE: What types of repair or servicing are needed here?

How could people be injured, made ill, or otherwise adversely affected by doing this maintenance?

ANY HISTORY OF WORK-RELATED INCIDENTS OR SYMPTOMS?

ANY IMPACT OF NEARBY OPERATIONS OR OVERALL LAYOUT?

HOW IS BIOGAS CONVEYED AND DISTRIBUTED FROM THE DIGESTER?	HAZARD	PREVENTIVE MEASURES

The following are some ideas to assist you:

HOW IS BIOGAS CONVEYED AND DISTRIBUTED FROM THE DIGESTER?	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES
<p>Is the biogas distribution system located in the open air or a reception pit?</p> <p>Is the pit open or covered?</p>	<p>If a pit, this would be a confined space and would be expected to have hazards of:</p> <ul style="list-style-type: none"> • oxygen deficiency • methane asphyxiation and explosivity • hydrogen sulfide toxicity <p>Cover needs to support the weight of a person standing on top; fall into pit; possible trauma; potentially life-threatening.</p>	<p>Can replacing water in water seal traps be accomplished without confined space entry?</p> <p>Use non-sparking tools for any maintenance in this area.</p> <p>Use a sign to warn of the confined space hazard: THIS PIT IS A CONFINED SPACE <i>This space may contain toxic or hazardous gases or lack sufficient oxygen to support life. Entry only after atmospheric monitoring indicates it is safe to do so.</i></p> <p>Make cover of a sturdy material to support weight of workers standing or walking on it.</p>
<p>Fire hazard from leaks or flashback Could a flashback occur in close proximity to the digester cover?</p>	<p>Potential explosion hazard.</p>	<p>Fire extinguishers present adjacent to gas pit.</p> <p>Use flame arrestor in gas piping system.</p> <p>A firewall or barrier could be erected to shield the digester from flashback.</p>

STEP 5a: DISPOSAL OF BIOGAS BY COMBUSTION (GAS FLARE)

OPERATIONS: This step involves the receiving of biogas from the biogas distribution system and sending it to the gas flare where it is ignited and burned.

If this step were successfully done, how would you know?

How could people be injured, made ill, or otherwise adversely affected from operating this step?

Would injury or illness be different if this step were experiencing an operational problem or failure?

MAINTENANCE: What types of repair or servicing are needed here?

How could people be injured, made ill, or otherwise adversely affected by doing this maintenance?

ANY HISTORY OF WORK-RELATED INCIDENTS OR SYMPTOMS?

ANY IMPACT OF NEARBY OPERATIONS OR OVERALL LAYOUT?

IS THERE A FLARE TO BURN EXTRA BIOGAS?	HAZARD	PREVENTIVE MEASURE

The following are some ideas to assist you:

IS THERE A FLARE TO BURN EXTRA BIOGAS?	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES
Fire hazard from leaks or a flashback to the gas distribution system.	Potential fire or explosion hazard.	Fire extinguishers present adjacent to gas flare. Use backflow prevention or one-way valve or flame arrestor in gas piping system.

STEP 5b: ELECTRICITY AND HEAT GENERATION

OPERATIONS: This step takes place in the building housing the generator and involves the receiving of biogas from the biogas distribution system and combusting it to produce electricity.

If this step were successfully done, how would you know?

How could people be injured, made ill, or otherwise adversely affected from operating this step?

Would injury or illness be different if this step were experiencing an operational problem or failure?

MAINTENANCE: What types of repair or servicing are needed here?

How could people be injured, made ill, or otherwise adversely affected by doing this maintenance?

ANY HISTORY OF WORK-RELATED INCIDENTS OR SYMPTOMS?

ANY IMPACT OF NEARBY OPERATIONS OR OVERALL LAYOUT?

DO YOU GENERATE ELECTRICITY FROM BIOGAS?	HAZARD	PREVENTIVE MEASURE

The following are some ideas to assist you:

DO YOU GENERATE ELECTRICITY FROM BIOGAS?	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES
Misidentification of piping in generator room; for dealing with leaks and repairs	Potential for fire, explosion, or inhalation	Label piping in generator room to identify contents. Install fire extinguisher in generator building.
Generator noise	Best evaluation would require noise measurements.	Have hearing protection (ear plugs, ear muffs) available. Choose protective equipment based upon the need for adequate noise attenuation. Use sign: " <i>Hearing protection required in this area</i> ".
Oil leaks on floor	Slipping hazard	Have absorbent mats or granules available. Address the leak at the source.
Electrical	Electrical shock; potential for fire or explosion	Signage on outside of building for " <i>high voltage</i> " Have lockout/tagout equipment available. Install fire extinguisher for electrical fires.
Any use of storage batteries?	Potential for irritation or burns to skin or eyes from battery acid	Have emergency eyewash/shower available. Have aprons, face shields and goggles available. Have soda ash or baking soda available to neutralize spills or drips of acid.

SOME OVERALL CONCERNS	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES
Providing adequate warnings of hazards	Fire or explosion hazard. Irritation or burns to eyes and skin	In addition to the signs described above: Signs such as: “no smoking” “fire extinguisher” “emergency eyewash/shower”
Maintenance on equipment and communication with others that equipment is being worked on	Trauma, electrocution, possibly death	Have locks and tags for lockout of electrical circuits, electrical boxes, valves, as needed. Put a tag on the equipment to describe the work in progress.
Handling and thus possible contact with animal wastes and other feedstocks	Exposure to bacteria and fungi; possibly infection, disease, or allergic reaction.	General work practices would include: wearing of gloves, proper handling of contaminated clothing, and good personal hygiene (washing hands before eating or smoking to avoid hand-to-mouth transfer). Also, it is important to keep vaccinations up-to-date, including tetanus.
Farm security, easy access to buildings, equipment, open tanks, pits, or wells	Sabotage, pranks, horseplay	Locks on buildings; security fences (in addition to the above)
If confined space entry becomes necessary, refer to the information at the beginning of this guide.	Potential injury or death	Have locks to lock out equipment before entry so that it can't be powered up while someone is in the space; put a tag on the equipment to describe the work in progress. Have air testing equipment and test the air before entering. Have a blower and hose and use it to ventilate the space if the air test is unacceptable; continue to ventilate and monitor the air while someone is in the space. Have a body harness, lifeline, and retrieval equipment for the person entering the space. Attach the lifeline to a fixed point or retrieval equipment and have a buddy standing by to pull the person out if he needs rescue, preferably with retrieval equipment such as a winch or come-along.
Do the farm staff believe that their jobs involve occupational stresses, such as time pressure, unusual work schedules, long hours of work, production goals, quality standards, or understaffing?	Symptoms such as headaches, high blood pressure, nausea, diarrhea or constipation, irregular menstruation, difficulty with libido, or other stress-related ailments. Stress can cause muscle tension with muscle aches, muscle strain, or physical injury.	Identify the source of stress so that it can be addressed. Provide resources for counseling so that stress reduction and coping information is available.

SOME OVERALL CONCERNS	EXAMPLES OF POTENTIAL HAZARDS	EXAMPLES OF PREVENTIVE MEASURES
<p>Heat stress: hot weather (especially abrupt changes in temperature), becoming overheated from performing physically-demanding work, and working outdoors due to exposure to the ultraviolet light of the sun.</p> <p>(Cold stress: It is assumed that staff could periodically enter farm buildings to warm up and that prolonged work outdoors in connection with the digester was unlikely as a regular procedure. Certainly outdoor work might be needed to perform a major repair or respond to an emergency. Information on cold stress can be added if this potential hazard is considered significant.)</p>	<p>Sweating and the wearing of lighter clothing simply cannot cool the body sufficiently.</p> <p>Heat-related disorders may occur such as heat exhaustion, heat stroke, fainting, or prickly heat rash.</p>	<p>Drink small quantities of liquid frequently (5 – 7 ounces every 15 – 20 minutes); avoid diuretics such as coffee.</p> <p>Wear a sunscreen with SPF of at least 15.</p> <p>Wear a wide brim hat (not a baseball cap).</p> <p>Wear UV-absorbent sunglasses to block 99 – 100% of UVA and UVB radiation.</p> <p>Have a policy to follow in the event of a heat wave.</p> <p>Be prepared to provide first aid if a worker appears disoriented or confused or experiences inexplicable irritability, malaise, dizziness, lightheadedness, headaches, upset stomach, vomiting, decreased or dark-colored urine; fainting or passing out; pale, clammy skin. <i>If sweating stops and skin becomes hot and dry, immediate emergency care with hospitalization is essential.</i></p>