Large Filing Separator Sheet

Case Number: 10-654-EL-BGN
11-757-EL-BGN

File Date: 7/21/11

Section: 3 of 3

Number of Pages: 112

Description of Document: Confidential Release
Exhibit B filed on 3/24/11

- Combined Class I Flammables – **120 gallons**
- Class II Combustible (FP>100°F and <140°F) – **120 gallons**

IF all flammable and combustible liquids are stored in approved storage cabinets (See Figure 2), these limits can be increased by a factor of 2 (i.e., the Class I-A limit could be increased to 60 gallons, and so on).

It Is The Policy Of Vestas That All Flammable And Combustible Liquids That Are Stored INDOORS Be Stored In Approved Storage Cabinets Regardless Of Amount Stored Or Used At Your Facility.
Contact the Site HazMat Coordinator or the Corporate Environmental Manager for assistance in selecting and obtaining appropriate storage cabinets.

4.9 Requirements for Secondary Containment

The UFC defines threshold limits for volumes of hazardous materials above which secondary containment for spill control must be provided.

It is The Policy of Vestas That All Hazardous Materials (Liquids and Solids) Be Stored In an Area or Device Equipped with Some Form of Secondary Containment.
This policy applies to hazardous materials stored indoors AND outdoors. Secondary containment can be provided by installing containment berms/curbs and chemical resistant coatings, storing hazardous materials in approved storage cabinets equipped with secondary containment (See Figure 2), or by using portable containment devices (See Figure 3 and 4), or other means approved by the Corporate Environmental Manager.

Hazardous materials that are in use at a workstation or other area where the material is being used, applied, or consumed do not need to have secondary containment, however, it is strongly encouraged.

5. Operating Requirements

This section provides an overview of the regulatory requirements that pertain to the ongoing storage and management of hazardous materials. The general categories include:

- Storage requirements
- Managing stormwater
- Inspections
- Reporting and recordkeeping

Vestas personnel that use hazardous materials are responsible for assuring that all requirements identified below are fulfilled. Any deviation from, or exception to, these requirements must be reported to Vestas' Corporate Environmental Manager.

5.1 Hazardous Material Storage

This section provides an overview of the requirements that apply to the storage of hazardous materials.

5.1.1 All Vestas Operations

- ► Flammable and combustible liquid storage amounts must not exceed those allowed in Section 4.8.
- ► Indoor storage of flammable and combustible liquids must be done in approved storage cabinets.

- ▶ All hazardous materials must be stored in an area or device that is equipped with secondary containment. See Section 4.9.
- ▶ Hazardous materials that are in use are encouraged to have secondary containment.

5.1.2 Mobile Operations

- ▶ If you know you will be transporting hazardous materials on fleet vehicles to a turbine unit or other location, it is strongly recommended that you place the materials into a tote or other container that will provide secondary containment while in transit.
- ▶ All fleet vehicles used for transporting hazardous materials must be equipped with a spill kit.

5.1.3 Hazardous Material Storage Area Operating Requirements

- ▶ Containers of hazardous materials must be stored in an area equipped with secondary containment.
- ▶ All storage areas must have appropriate warning signs, products must be properly labeled, and storage cabinets must have a list of products posted on the outside of the cabinet.
- ▶ Storage containers and containment areas must be visually inspected WEEKLY for evidence of corrosion, damage, leakage, or other deterioration.

5.2 Making Chemical Changes

Over time, the use of a particular hazardous material may be phased out and new products will become available to perform routine O&M tasks.

- ▶ Prior to the use of any new chemicals, it is essential that you submit the Material Safety Data Sheet (MSDS) and a Chemical Safety Evaluation Request (CSER) to Vestas' Chemical Evaluation Committee for review and approval.
- ▶ To the maximum extent possible, investigate the use of alternative chemicals that are less hazardous.

5.3 Stormwater

All Vestas personnel MUST make a conscious effort to assure that drips, leaks, and minor spillage of hazardous materials are immediately cleaned up with absorbent materials. (Absorbent materials must be collected and placed into a labeled drum or other suitable container until the site HazMat Coordinator or Corporate Environmental Manager can determine if the material needs to be tested.)

- ▶ Do not allow drips, leaks, etc., to enter into site storm drains, ditches, or swales, or percolate into the ground. Preventing the loss of even small amounts of hazardous chemicals into the stormwater system is a top priority for all Vestas personnel.
- ▶ Any precipitation that comes into contact with a hazardous material MUST NOT be allowed to discharge to any storm drain inlet, ditch, swale, etc.
- ▶ If your facility has an outdoor hazardous material storage area that is equipped with secondary containment, precipitation that accumulates within the containment area must first be visually inspected to make sure no leaks or spillage of hazardous materials has occurred into the containment area prior to discharging the accumulated water. If it is suspected or confirmed that leakage has occurred, the water must be collected or tested to confirm if it is suitable for discharge into the storm drainage system.

5.4 Inspections

Each hazardous material storage area must be inspected to assure that the container is in satisfactory condition and to make sure any secondary containment systems are functioning properly and are receiving appropriate preventative maintenance to assure that no unacceptable releases to the environment occur.

Written records for daily visual inspections are recommended, but not required, unless a spill or release is discovered. Written records for weekly and monthly inspections are required.

At a minimum, inspection records **MUST** include the date and time of the inspection, the name of the individual making the observations, a notation of the observations made, and the date and nature of any repairs or other remedial actions.

5.4.1 Visually Inspect or Verify Daily

It is recommended that Facility personnel check areas where hazardous materials are stored every day to make certain the containers are in good condition and no releases are occurring.

5.4.2 Visually Inspect or Verify Weekly

- That container(s) of hazardous materials are stored in a secure and properly maintained area equipped with secondary containment and that there is no evidence of leakage.

5.4.3 Visually Inspect or Verify Monthly

- Check to assure that the list of products stored in any hazardous material cabinet(s) is current;
- Check to assure that an adequate inventory of spill response supplies is available at or near the area where the containers are located; and
- Emergency notification telephone numbers are posted at or near hazardous material storage areas.

5.5 Reporting Requirements

- At a minimum, inspection records MUST include the date and time of the inspection, the name of the individual making the observations, a notation of the observations made, and the date and nature of any repairs or other remedial actions; and
- All spills must be immediately reported (within 15 minutes of discovery) to the site HazMat Coordinator or Corporate Environmental Manager.

5.6 Recordkeeping Requirements

The Site HazMat Coordinator, or designee, must maintain the following records and documents:

- An emergency response Contingency Plan, Spill Prevention Control and Countermeasures Plan, (SPCC) or other plan. (If you are uncertain contact the Corporate Environmental Manager);
- Inspection logs kept for at least 3 years; and
- Training documents, including copies of training materials and personnel attendance log sheets.

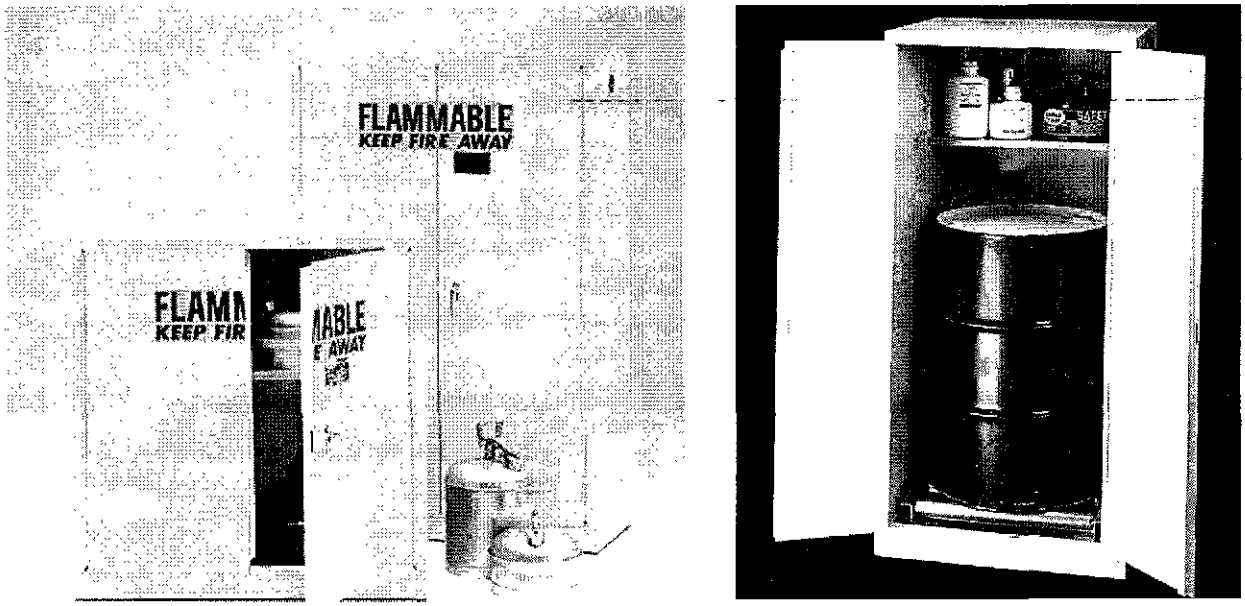


Figure 2: Example of Approved Flammable and Combustible Liquid Storage Cabinets

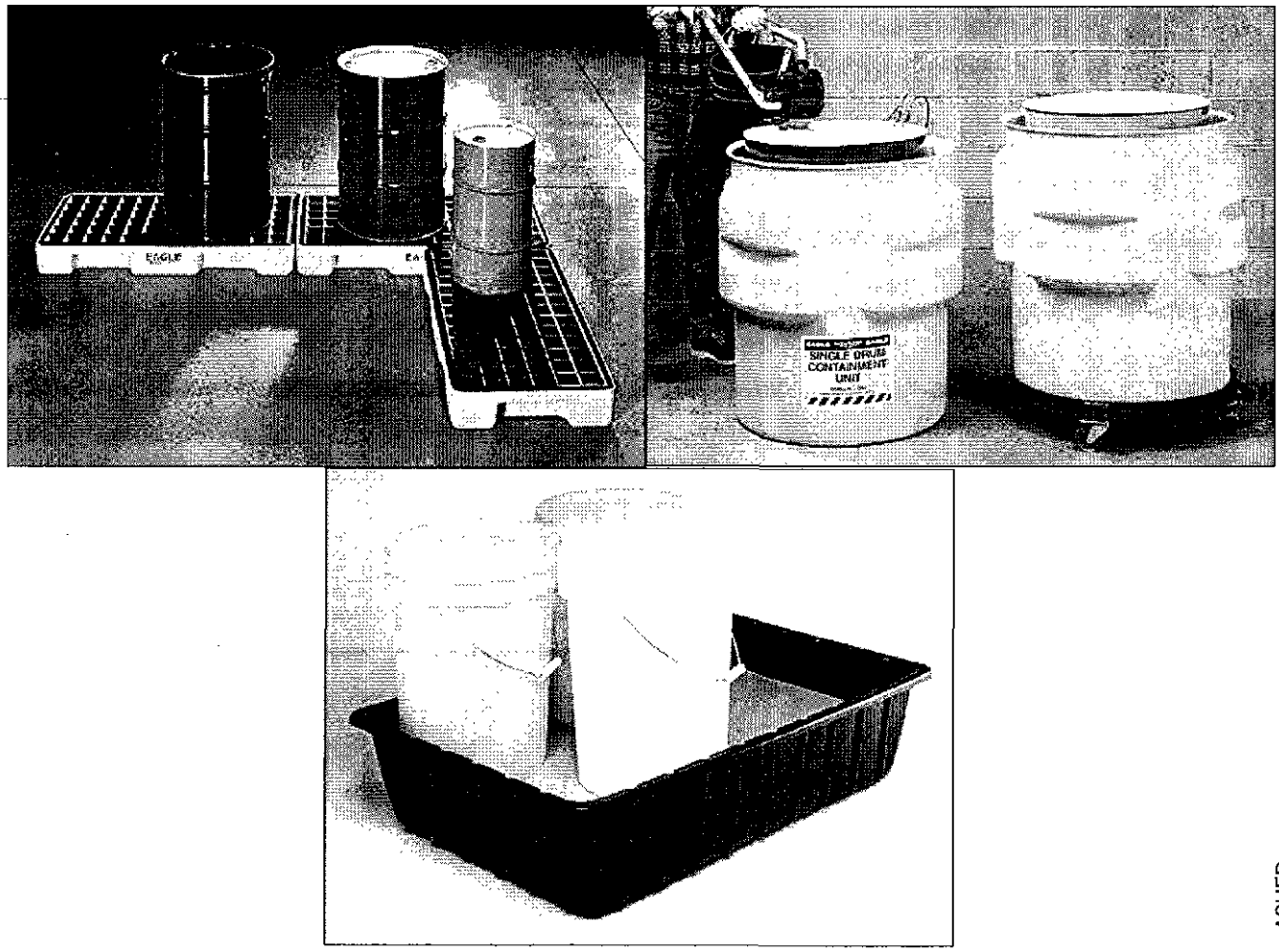
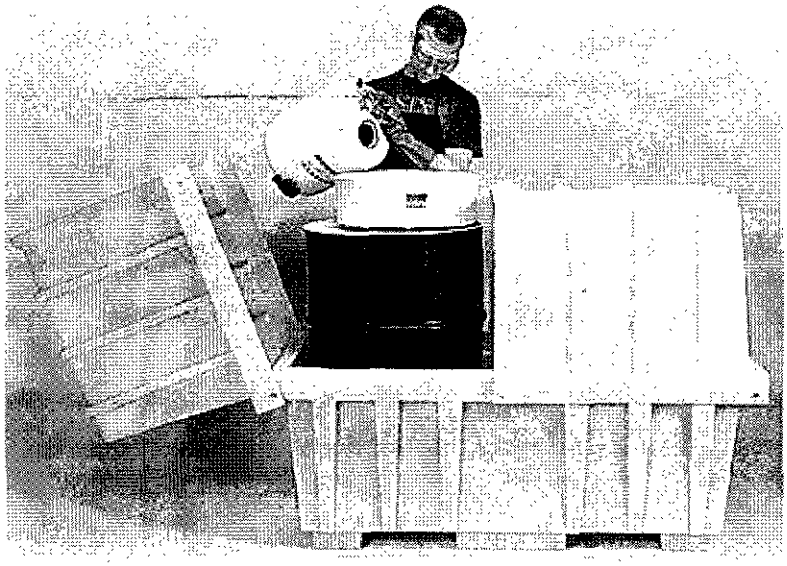


Figure 3: Example of Approved Portable Indoor or Covered Use Secondary Containment Device



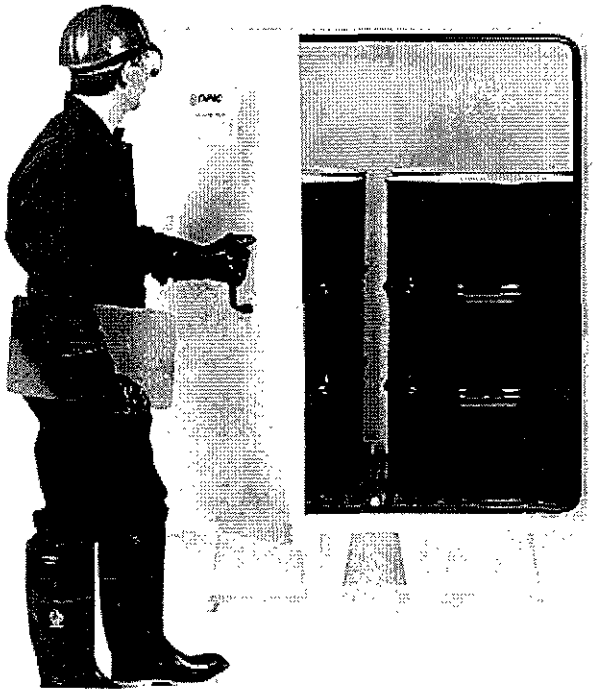


Figure 4: Example of Approved Outdoor Use Portable Secondary Containment Devices

6. History of This Document

Rev. no.:	Date:	Description of changes
00	2006-07-26	First edition – Reformatted & renumbered 25-Jul-2007
01	2010-01-01	Template updates

Contents

Top 10 DO's and DO NOT's for Managing Used/Spent Aerosol Containers	
Do	**Do Not**
► Contact the site HazMat Coordinator or the Corporate Environmental Manager if you have any questions not answered in this document. ► Work with the site HazMat Coordinator or Corporate Environmental Manager to find alternatives to aerosol-based products. ► You are responsible for puncturing and draining all aerosol cans that you produce. ► Place drained aerosol cans into a dumpster or scrap metal bin. ► Make sure the container used for accumulating liquids from puncturing and draining aerosol cans is clearly labeled with the words "Hazardous Waste." ► If you will be operating the can puncturing station, make sure the carbon filter is properly fitted, the anti-static strap is properly attached, and that you have on safety goggles with splash protection prior to puncturing any cans.	► Do NOT dispose of any unpunctured and undrained aerosol cans into the trash. ► Do NOT puncture and drain any aerosol container that contains a STRONG OXIDIZER. ► Do NOT puncture and drain any spent aerosol container that has not been previously approved by Vestas's Chemical Evaluation Committee. ► Do NOT accumulate spent aerosol containers at your site for longer than 90 days before puncturing and draining.

1. Introduction

This document provides an overview of ongoing operation and maintenance (O&M) requirements that are mandated by federal and state environmental regulations for the following waste products produced by Vestas operations:

- Used/Spent Aerosol Containers (e.g., touch-up paints, cleaners, lubricants, etc.).

The target users of this document are all Vestas site service personnel that have occasion to use products that are packaged in aerosol spray containers. This document specifically addresses how used aerosol containers are to be managed and disposed.

2. Process Description

It is the policy of Vestas to only allow aerosol-based products for essential uses where an alternative, non-aerosol product, cannot be safely or effectively substituted.

Over the years, Vestas has endeavored to reduce its use of products that are packaged in aerosol containers. Generally, aerosol products are not viewed as ENVIRONMENTALLY FRIENDLY, though product manufacturers have made strides to eliminate the use of propellants containing chlorofluorocarbons (CFCs).

Aerosol-based products such as spray cleaners, touch-up paints, primers, lubricants, insecticides, etc., normally contain highly flammable non-CFC propellants such as propane derivatives or isobutane. Regardless of the liquid product in the can, the propellant itself is highly flammable and potentially explosive. Most warning labels on the can will say something to the effect "Do not puncture or incinerate." Depending on the product, the contents may also have some hazardous properties. Paints, primers, and lubricants typically will contain solvents that have low flash points. Cleaners may be corrosive or also have a low flash point.

3. How Aerosol Cans are Regulated

This section summarizes key environmental requirements that apply to the handling and management of used/spent aerosol containers at Vestas. These requirements are primarily imposed by state or federal regulations.

3.1 Air Emissions

Vestas' use of aerosol spray products is considered to be an incidental use and are not specifically controlled by prevailing air regulations provided only consumer-type products are used (i.e., products you can readily purchase). Also, Vestas' Chemical Use Committee will review the proposed purchase of new aerosol products (when allowed) to confirm that no use restrictions are imposed by various state or federal air emission regulations.

3.2 Stormwater Discharges

State and local environmental agencies issue stormwater discharge permits based on the type of industrial activity conducted at a site-specific location. If the industrial activity is covered, a permit is required unless a demonstration is made that the potential for hazardous materials to come into contact with stormwater will not occur.

For facilities that have a stormwater NPDES permit, a written Stormwater Pollution Prevention Plan (SWPPP) is required to be prepared. The plan must describe physical and procedural steps that the

permit holder has implemented to reduce or mitigate the chances of contaminating stormwater runoff. At least twice per year, permitted facilities are required to collect and analyze samples from various storm drain inlets for various pollutants to gauge the effectiveness of its pollution prevention practices. These results must be reported to the State each year.

At this time, no Vestas site operation has a stormwater NPDES permit.

As with any chemical product, care must be exercised with aerosol products to prevent the product and propellant from coming into contact with stormwater (such as allowing overspray to contact the ground).

3.3 Wastewater Discharges

Placing (e.g., draining) or spraying the contents of aerosol products into the sanitary sewer (e.g., spraying into a sink) or septic tank system is not permissible.

3.4 Hazardous Wastes

Any used/spent aerosol container that still contains any liquid OR any propellant is considered a hazardous waste and CANNOT be disposed into the trash.

Some states in which Vestas operates have determined that used/discarded aerosol containers are a hazardous waste *unless* they have been *completely* emptied and the propellant has been fully aspirated. That is, if an aerosol container contains any liquid OR any propellant, it is considered a hazardous waste. The two most common situations that occur with aerosol products that result in the can/product being considered a hazardous waste are:

- The spray nozzle clogs before the entire product has been used. What remains is an unusable, but partially filled aerosol product whose contents are still under pressure.
- The propellant is exhausted before all of the can contents have been used. What remains is a partially filled liquid product that cannot be emptied.

The only *legitimate* method to discard use/spent aerosol containers into the trash for disposal or into a scrap metal bin for recycling is to deactivate the container by *puncturing and completely draining* it prior to discarding. Vestas has purchased approved aerosol can deactivation units and installed them at all wind park service sites (See Figure 1). DO NOT use any other method to puncture and drain aerosol containers. Properly deactivated aerosol containers may be discarded into the trash, or metal recycling bin (if available at your location).

4. Required Operating Practices

This section provides an overview of the environmental regulatory requirements that pertain to managing spent aerosol containers including:

- Collection and storage requirements
- Inspections
- Reporting and recordkeeping

Vestas facility personnel that use aerosol products are responsible for assuring that all requirements identified in this document are fulfilled. Any deviation from, or exception to, these requirements must be reported to Vestas's Corporate Environmental Manager.

4.1 Waste Collection Requirements

This section provides an overview of the minimum requirements that Vestas personnel must follow for the collection of used/spent aerosol containers prior to disposal or recycling. This includes aerosol containers that are produced during field/mobile activities. The waste collection requirements below apply unless spent containers are immediately deactivated using an approved device at your facility.

4.1.1 All Vestas Operations

- Used/spent aerosol containers MUST not be disposed of by throwing it in the trash, or placed in a metal recycling bin UNLESS the container has been properly punctured and drained first.

4.1.2 Mobile Operations

- Return all spent aerosol containers to your base Service Center.
- Deactivate the containers using the aerosol can deactivation unit.

4.1.3 Service Centers and Other Fixed Facilities

- If spent aerosol container(s) will not be immediately deactivated in the puncturing unit, place non-leaking spent aerosol containers into an appropriate container such as a 5-gallon closeable top safety container (see Figure 2);
- The employee that uses the aerosol container is ultimately responsible for depressurizing and proper disposal of the empty can.
- Make sure the accumulation container is clearly labeled with the words "Hazardous Waste;"
- The accumulation container must be kept closed, except when emptying or filling, to minimize the potential for spillage;
- If no depressurizing unit is available at your facility, contact Vestas' Corporate Environmental Manager.

4.2 Aerosol Can Puncturing Unit Requirements

- The puncturing unit must be equipped with the minimum features shown in Figure 1 (including a anti-static wire and goggles with splash protection);
- The carbon filter unit must be in good service. (Some carbon filters are packaged with an indicator that changes color when the carbon is spent, others are rated for puncturing a certain number of aerosol cans – check the filter before using the unit);
- See the facility HazMat Coordinator for replacement carbon filters.
- Make sure the liquid accumulation container is clearly labeled with the words "Hazardous Waste;"
- Prior to operating the puncturing device, make sure you are familiar with the operating instructions;
- BEFORE puncturing any container, CHECK the MSDS for the product to verify that the contents DO NOT contain a STRONG OXIDIZER. [See Table 1.]
- The release of strong oxidizers into the accumulation drum at the puncturing station could result in one or more of the following chemical reactions: evolution of heat, toxic gases, or flammable gases, and the potential for fire.
- If you are uncertain if the aerosol container contains a STRONG OXIDIZER, contact Vestas' Corporate Environmental Manager.

- ► Assuming that the contents of the can may be safely drained into the accumulation container, follow the manufacturer's instructions for puncturing and draining the aerosol can(s).
- ► Record the date, number of spent aerosol cans that were punctured and drained, and your name on the log sheet that is located at the puncturing station.

4.3 Making Chemical Changes

Because of the potential chemical incompatibilities of mixing the liquids in aerosol-based products in the accumulation container of the puncturing unit, it is important that all new aerosol products be reviewed and approved by Vestas' Chemical Evaluation Committee prior to purchasing.

If you have spent aerosol containers for products that have not been approved by the Chemical Evaluation Committee, contact the site HazMat Coordinator, or the Corporate Environmental Manager prior to puncturing unapproved containers.

*** **The use of aerosol products that contain lead or chlorinated solvents such as trichloroethylene (TCE), 1,1,1-trichloroethane (TCA), or methylene chloride is strictly forbidden.** ***

4.4 Stormwater

All Vestas Service Site operations personnel are expected to make a conscious effort to assure that drips, leaks, and minor spillage of any chemical product or waste are immediately cleaned up with absorbent materials.

Absorbent materials must be collected and placed into a drum or other suitable container until the site HazMat Coordinator or Corporate Environmental Manager can determine proper disposal methods.

- ► All aerosol can storage is to be conducted under cover or indoors.
- ► Storage and operation of the aerosol can puncturing unit is to be conducted under cover or indoors.

4.5 Inspections

The containers used for accumulating spent aerosol cans, and the puncturing unit/container are required to be under an inspection program to assure that appropriate preventative maintenance is occurring and that no releases to the environment occur.

Written records for daily visual inspections are recommended, but not required, unless a spill or release is discovered. Written records for **WEEKLY** and **MONTHLY** inspections are required.

4.5.1 Visually Inspect or Verify Daily

It is *recommended* that Facility personnel check areas where spent aerosol containers are stored every day to make certain the containers are in good condition and no releases are occurring.

4.5.2 Visually Inspect or Verify Weekly

- ► That container(s) used for accumulating spent aerosol containers are kept closed (i.e., lid or cover is secured);
- ► That container(s) are stored in a secure area and properly maintained so that they do not leak, rupture, or tip over when being opened, handled, or stored;
- ► That each storage container and the container used for draining the punctured cans are marked with the words "Hazardous Waste"; and

- That no spent aerosol cans have accumulated onsite for longer than 90 days without being punctured and drained.

4.5.3 Visually Inspect or Verify Monthly

- Check or estimate the liquid level in the container used for collecting drained liquids. If the container is approximately 75% full, contact the site HazMat Coordinator or the Corporate Environmental Manager to make arrangements for disposal of the waste liquids.
- Check the carbon filter on the puncturing station to make sure the carbon is not exhausted.
- Check to assure that an adequate inventory of spill response supplies is available at or near the area where the containers are located; and
- Emergency notification telephone numbers are posted at or near the can puncturing station.

4.6 Reporting Requirements

- At a minimum, inspection records **MUST** include the date and time of the inspection, the name of the individual making the observations, a notation of the observations made, and the date and nature of any repairs or other remedial actions; and
- All spills must be immediately reported (within 15 minutes of discovery) to the site HazMat Coordinator or Corporate Environmental Manager.

4.7 Recordkeeping Requirements

The Site HazMat Coordinator, or designee, must maintain the following records and documents:

- An emergency response Contingency Plan, Spill Prevention Control and Countermeasures Plan, (SPCC) or other plan. (If you are uncertain contact the Corporate Environmental Manager);
- Inspection logs kept for at least 3 years; and
- Training documents, including copies of training materials and personnel attendance log sheets.

Table 1: List of Strong Oxidizers

(CHECK MSDS to make sure these are NOT in aerosol products that are to be punctured)
Items in ***BOLD ITALICS*** are fairly common ingredients in a number of products, especially cleaning and disinfecting supplies.

Ammonium chlorate
Ammonium dichromate
Ammonium nitridoosmate
Ammonium perchlorate
Ammonium periodate
Ammonium permanganate
Ammonium persulfate
Ammonium tetrachromate
Ammonium tetraperoxychromate
Ammonium trichromate
Antimony perchlorate

Barium bromate
Barium chlorate
Barium iodate
Barium nitrate
Barium perchlorate
Barium permanganate
Barium peroxide
Bromic acid
Bromine
Bromine monofluoride
Bromine pentafluoride
Bromine trifluoride
t-Butyl hypochlorite

Cadmium chlorate
Cadmium nitrate
Calcium bromate
Calcium chlorate
Calcium chlorite
Calcium hypochlorite
Calcium iodate
Calcium nitrate
Calcium perchromate
Calcium permanganate
Calcium peroxide
Chloric acid
Chlorine
Chlorine dioxide
Chlorine fluoroxide
Chlorine monofluoride
Chlorine monoxide
Chlorine pentafluoride
Chlorine trifluoride
Chlorine trioxide
Chromic acid
Chromyl chloride
Cobaltous nitrate
Copper nitrate

Dichloroamine
Dichloroisocyanuric acid

Ethylene chromic oxide

Fluorine
Fluorine monoxide

Guanidine nitrate

Hydrogen peroxide

Iodine pentoxide

Lead chlorite
Lead nitrate
Lithium hypochlorite
Lithium peroxide

Magnesium chlorate
Magnesium nitrate
Magnesium perchlorate
Magnesium peroxide
Manganese nitrate
Mercuric nitrate
Mercurous nitrate

Nickel nitrate
Nitrogen dioxide

Osmium amine nitrate
Osmium amine perchlorate
Oxygen difluoride

Perchloryl fluoride
Phosphorus oxybromide
Phosphorus oxychloride
Potassium bromate
Potassium dichloroisocyanurate
Potassium dichromate
Potassium nitrate
Potassium perchlorate
Potassium permanganate
Potassium peroxide

Silver nitrate
Sodium bromate
Sodium carbonate peroxide
Sodium chlorate
Sodium chlorite
Sodium dichloroisocyanurate
Sodium dichromate
Sodium hypochlorite
Sodium nitrate
Sodium nitrite
Sodium perchlorate
Sodium permanganate
Sodium peroxide
Strontium nitrate
Strontium peroxide
Sulfur trioxide
Sulfuric acid

Trichloroisocyanuric acid

Uranyl nitrate
Urea nitrate

Zinc ammonium nitrate
Zinc nitrate
Zinc permanganate
Zinc peroxide
Zirconium picramate

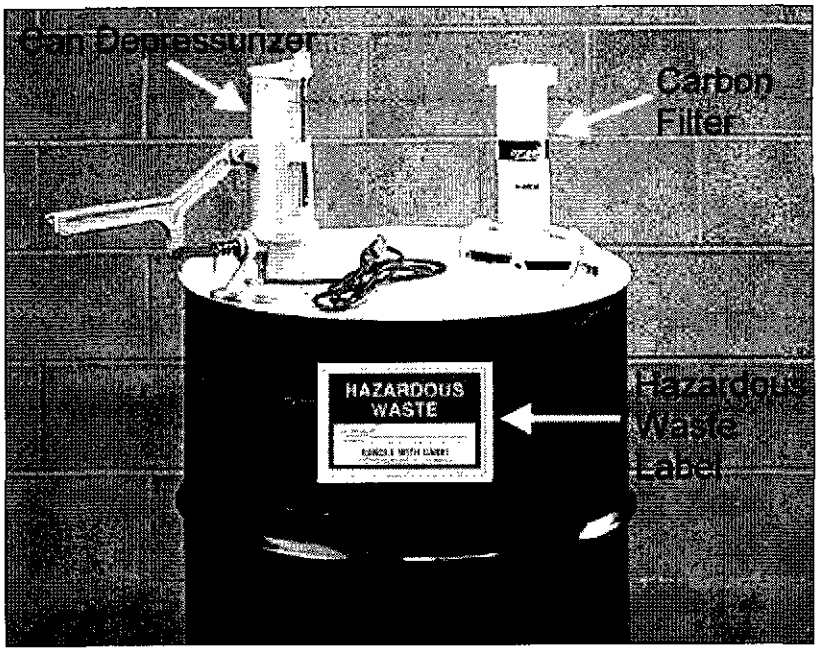


Figure 1 Proper Configuration for Aerosol Can Puncturing Unit

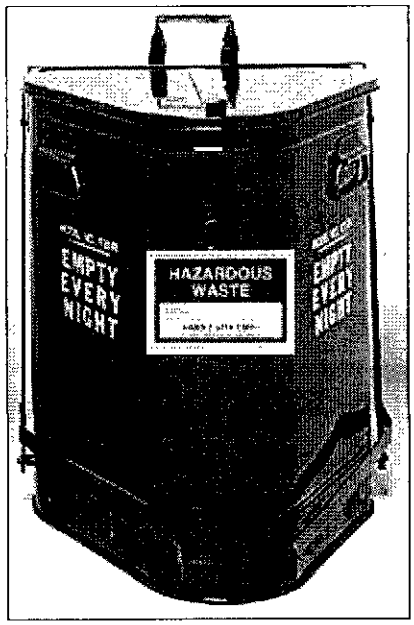


Figure 2 Recommended Spent Aerosol Can Accumulation Container

5. History of This Document

Rev. no.:	Date:	Description of changes
00	2006-07-26	First edition – Reformat and renumber 25-Jul-2007
01	2010-01-01	Template updates

Contents

Top 10 DO's and DO NOT's for Managing Used/Spent Antifreeze and Glycol Containers	
Do	**Do Not**
► Contact the site HazMat Coordinator or the Corporate Environmental Manager if you have any questions not answered in this document. ► Collect all used antifreeze in containers that are in good condition. ► Make sure the container is clearly labeled with the words "Used Antifreeze." ► Each container must be kept closed, except when emptying or filling, to minimize the potential for spillage; ► Spills of used antifreeze must be cleaned up immediately and appropriately managed. ► Work with the site HazMat Coordinator or Corporate Environmental Manager to arrange for proper storage and recycling of use antifreeze	► Do NOT mix used antifreeze with any waste or other material (e.g., solvents, cooling system flushes, used oil, motor fuels). ► Do NOT dispose of antifreeze in the trash, pouring it down the storm sewer, or putting it into septic systems. ► Do NOT allow drips, leaks, etc., including precipitation that comes into contact with antifreeze to enter into site storm drains, ditches, or swales, or percolate into the ground. ► Do NOT store drums of used antifreeze longer than 2 Months with out contacting the Corporate Environmental Manager to arrange for a vendor to pick up the drums.

1. Introduction

This document provides an overview of ongoing operation and maintenance (O&M) requirements that are mandated by federal and state environmental regulations for the following waste products produced by Vestas operations:

- Used Antifreeze and Glycols (ethylene glycol or propylene glycol).

The target users of this document are Vestas service personnel that operate and/or maintain fleet equipment or perform maintenance on wind turbines or other fixed equipment that may contain glycol-based coolants (e.g., emergency generators or closed-loop cooling systems that contain ethylene or propylene glycol).

2. Process Description

Ethylene and propylene glycols are used as a coolant or heat transfer fluid in closed-loop cooling systems such as automobile radiators and other cooling systems. They are typically used in approximately a 50:50 mixture ratio with water. Despite its widespread use, ethylene glycol is a toxic chemical. Because of its sweet taste it is attractive to small children and animals. Propylene glycol is less toxic and has a bitter taste.

Ethylene and propylene glycol are colorless liquids, though the consumer product versions are typically lime green in color (added). Improper disposal or management of used antifreeze can damage aquatic organisms, cause overloading of wastewater treatment systems and contaminate groundwater.

During use, antifreeze can become contaminated with grit, traces of fuel and heavy metals from the engine. Contaminants such as benzene and lead may be high enough that will cause used antifreeze to be a considered a toxic hazardous waste by exceeding the Toxicity Characteristic Leaching Procedure (TCLP) thresholds set for these constituents. Glycols used in non-internal combustion engine applications will often contain low concentrations of chromium and other trace metals from pipe leaching, as well as corrosion inhibitors.

3. How Used Antifreeze is Regulated

This section summarizes key environmental requirements that apply to the handling and management of used antifreeze and ethylene glycol at Vestas. These requirements are primarily imposed by state regulations that are administered by the Department of Environmental Quality (DEQ) or other regulatory agency.

3.1 Air Emissions

Ethylene glycol is listed as a hazardous air pollutant (HAP) generally known or suspected to cause serious health problems. The Clean Air Act, as amended in 1990, directs EPA to set standards requiring major sources to sharply reduce routine emissions of toxic pollutants.

However, Vestas' use of ethylene glycol would be considered and incidental use, and no significant air emissions are expected from the handling or management of ethylene glycol.

3.2 Stormwater Discharges

State and local environmental agencies issue stormwater discharge permits based on the type of industrial activity conducted at a site-specific location. If the industrial activity is covered, a permit is required unless a demonstration is made that the potential for hazardous materials to come into contact with stormwater will not occur.

For facilities that have a stormwater NPDES permit, a written Stormwater Pollution Prevention Plan (SWPPP) is required to be prepared. The plan must describe physical and procedural steps that the permit holder has implemented to reduce or mitigate the chances of contaminating stormwater runoff. At least twice per year, permitted facilities are required to collect and analyze samples from various storm drain inlets for various pollutants to gauge the effectiveness of its pollution prevention practices. These results must be reported to the State each year.

At this time, no Vestas site operation has a stormwater NPDES permit.

Discharges of glycols into stormwater, either directly or indirectly must be avoided at all costs.

3.3 Wastewater Discharges

The discharge of diluted and undiluted, new or used antifreeze is prohibited into the sanitary sewer without a permit or authorization from the local sewerage agency. If poured into a septic system, the antifreeze may damage the system by killing the microorganisms necessary for decomposition.

3.4 Hazardous Wastes

Based on available analytical data, used antifreeze that is recycled and properly managed according to its published "Best Management Practices" (BMPs) generally will not exhibit hazardous waste characteristics. Also, used antifreeze that is managed according to the BMPs and recycled is presumed to be managed in accordance with state hazardous waste regulations.

It is Vestas' policy is to collect used antifreeze in containers and ship it to an approved recycling facility. Onsite recycling with treatment units such as multi-stage cartridge filters or other systems is not permitted.

4. Required Operating Practices

This section provides an overview of the environmental regulatory requirements BMPs that pertain to ongoing operations that produce used or waste antifreeze. The general categories include:

- Collection and storage requirements
- Managing stormwater
- Inspections
- Reporting and recordkeeping

Vestas service personnel that produce used antifreeze, or operate/maintain the waste collection areas are responsible for assuring that all requirements identified below are fulfilled. Any deviation from, or exception to, these requirements must be reported to Vestas' Environmental Manager.

4.1 Waste Collection Requirements

This section provides an overview of the minimum requirements that Vestas personnel must follow for the collection of used antifreeze. Waste antifreeze will most likely be generated inside a the site maintenance shop or be drained from the cooling system(s) in the turbines:

- Antifreeze **MUST NOT** be disposed of by throwing it in the trash, pouring it down the storm sewer, or putting it into septic systems.
- Immediately collect used antifreeze in an appropriate container and transfer it into a compatible container such as a 55-gallon drum that is in good condition;
- **DO NOT** mix used antifreeze with any waste or other material (e.g., solvents, cooling system flushes, used oil, motor fuels);
- Make sure the container is clearly labeled with the words "Used Antifreeze;"
- Each container must be kept closed, except when emptying or filling, to minimize the potential for spillage;
- Spills of new or used antifreeze must be cleaned up immediately and appropriately managed. (Non-recyclable spill cleanup wastes must undergo a hazardous waste determination prior to disposal.); and
- Only one container can be used to accumulate used antifreeze within a single shop area. When filled, it must have the date labeled on the drum, and be moved into the storage area designated by Vestas's Corporate Environmental Manager within 3 days.

4.2 Waste Storage Area Operating Requirements

- Used antifreeze containers MUST be stored in a secure area and properly maintained so that they do not leak, rupture, or tip over when being opened, handled, or stored;
- An aisle space of at least 30 inches must be maintained between rows of containers so that the containers can be inspected;
- Volumes of accumulated used antifreeze should be minimized by routinely recycling to reduce the potential for environmental harm. Contact the Corporate Environmental Manager to arrange for shipment of drums; and
- Filled drums of used antifreeze must NOT be stored onsite for longer than 3 months prior to shipping it offsite to a recycling facility.

4.3 Making Chemical Changes

It is not expected that the composition of waste antifreeze will change substantially over time.

However, if product changes are made (e.g., changing from ethylene glycol to propylene glycol), the material must be reviewed and approved by Vestas' Chemical Evaluation Committee prior to making the change.

5. Stormwater

All Vestas service personnel are expected to make a conscious effort to assure that drips, leaks, and minor spillage of antifreeze and other uses of glycols are immediately cleaned up with absorbent materials. Used absorbent materials must be collected and placed into a drum or other suitable container until the site HazMat Coordinator or Corporate Environmental Manager can determine if the material needs to be tested.

- Do not allow drips, leaks, etc., to enter into site storm drains, ditches, or swales, or percolate into the ground. Preventing the loss of even small amounts of hazardous chemicals into the stormwater system is a top priority for all Vestas personnel.
- Any precipitation that comes into contact with antifreeze MUST NOT be allowed to discharge to any storm drain inlet, ditch, swale, etc.
- Daily visual checks are to be made in yard areas where fleet equipment is parked to detect radiator leaks.
- If your facility has a drum storage area that is equipped with secondary containment, precipitation that accumulates within the containment area must first be visually inspected to make sure no leaks or spillage of antifreeze has occurred into the containment area prior to discharging the accumulated water. If it is suspected or confirmed that leakage has occurred, the water must be collected or tested to confirm if it is suitable for discharge into the storm drainage system.

5.1 Inspections

The used antifreeze containers, waste storage areas, and general facility parking areas are required to be under an inspection program to assure that appropriate preventative maintenance is occurring and that no releases to the environment occur.

Written records for daily visual inspections are recommended, but not required, unless a spill or release is discovered. Written records for **WEEKLY** and **MONTHLY** inspections are required.

5.1.1 Visually Inspect or Verify Daily

It is *recommended* that Facility personnel check areas were antifreeze is used, drained, and stored every day to make certain the containers are in good condition and no releases are occurring. Areas where fleet vehicles are parked should be included in the daily visual inspection. Coolant reservoirs in the turbines should be checked during scheduled service activities.

5.1.2 Visually Inspect or Verify Weekly

- That used antifreeze containers are kept closed (i.e., bungs or cover is secured);
- That used antifreeze containers are stored in a secure area and properly maintained so that they do not leak, rupture, or tip over when being opened, handled, or stored;
- That the container is marked with the words **USED ANTIFREEZE**;
- That the **ACCUMULATION START DATE** (i.e., date when the drum was filled) is legible;
- That at least 30 inches of aisle space is available between drums; and
- If the date on any container is over 60 days old, notify the site HazMat Coordinator or the Corporate Environmental Manager to verify that a shipment is scheduled prior to reaching the 90-day onsite accumulation time limit.

5.1.3 Visually Inspect or Verify Monthly

- That an adequate inventory of spill response supplies is available at or near the area where the containers are located; and
- Emergency notification telephone numbers are posted at or near the storage area.

5.2 Reporting Requirements

- At a minimum, inspection records MUST include the date and time of the inspection, the name of the individual making the observations, a notation of the observations made, and the date and nature of any repairs or other remedial actions; and
- All spills must be immediately reported (within 15 minutes of discovery) to the site HazMat Coordinator or Corporate Environmental Coordinator.

5.3 Recordkeeping Requirements

The Site HazMat Coordinator, or designee, must maintain the following records and documents:

- Proof of shipment that used antifreeze was shipped for recycling (e.g., an invoice or bill of lading for off-site recycling);
- An emergency response Contingency Plan, Spill Prevention Control and Countermeasures Plan, (SPCC) or other plan. (If you are uncertain contact the Corporate Environmental Coordinator);
- Inspection logs kept for at least 3 years; and
- Training documents, including copies of training materials and personnel attendance log sheets.

6. History of This Document

Rev. no.:	Date:	Description of changes
00	2006-07-26	First edition – Reformat and renumber 25-Jul-2007
01	2010-01-01	Template updates
02	2010-07-09	Title to table on Page 2 updated

Vestas®

Used Oil Management

Contents

Top 10 DO's and DO NOT's for Managing Used Oil	
Do	**Do Not**
► Contact the site HazMat Coordinator or the Corporate Environmental Manager if you have any questions not answered in this document. ► Spent oil filters must drained and collected in a labeled drum, then sent to an offsite vendor for crushing and disposal or recycling. ► All tanks and containers of used oil must be labeled with the words "USED OIL," be in good condition, and kept closed except when adding or removing materials. ► All containers or tanks containing used oil must be stored in an area or inside a device that is equipped with secondary containment. ► All Vestas Service personnel MUST make a conscious effort to assure that drips, leaks, and minor spillage of new and used oil is immediately cleaned up with absorbent materials.	► Do NOT mix any solvents, cleaners, thinners, paint waste, antifreeze, or any non-oil liquid with used oil. ► Do NOT dispose or discard any oil or waste oil container until it has been completely emptied. ► Do NOT purchase 'terne plated' oil filter cartridges for use on equipment. These filters, when spent, will be regulated as a hazardous waste. ► It is NOT permissible to burn used oil in space heaters located at Vestas facilities. ► Any precipitation that comes into contact with an oily material or waste that creates a visible oil sheen MUST NOT be allowed to discharge to any storm drain inlet, ditch, swale, etc.

1. Introduction

This document provides an overview of ongoing operation and maintenance (O&M) requirements that are mandated by federal, state, and local environmental regulations for the following activities:

- Generation, collection, accumulation, storage, and disposition of used (waste) oil from internal combustion engine crankcases such as fleet vehicles, turbines, generators, and other fixed/mobile equipment, as well as hydraulic fluids, non-PCB electrical insulating fluids, and other forms of petroleum or synthetic lubricants.

Mismanagement of used oil can lead to the inadvertent production of hazardous wastes, creation of oily stormwater or wastewater, and the generation of oily soil and debris that must be carefully managed at considerable expense to Vestas.

The target users of this document are all Vestas Service personnel that have occasion work with vehicles or wind turbine equipment with fluid reservoirs containing oil that must be changed or replaced. This document specifically addresses how these materials are to be collected, stored, and recycled/disposed when they become unfit (e.g., dirty) for their intended use.

2. Process Description

2.1 What is Used Oil?

State and federal regulations define used oil as any oil that has been refined from crude *or* synthetic oil that was used as a:

- Lubricant
- Electrical insulation fluid (e.g., non-PCB mineral oil from a transformer)
- Hydraulic fluid
- Heat transfer fluid
- Brake fluid
- Refrigeration oil
- Grease
- Machine cutting/cooling oils

Used oil can contain metal contaminants such as chromium, barium, lithium (greases), products of combustion (from internal combustion engines) such as polynuclear aromatic hydrocarbons (PAHs, many of which are suspected to be carcinogenic), additives to inhibit microbial growth or corrosion inhibitors, and viscosity extenders (to keep the oil from degrading under extreme temperature).

2.2 Used Oil is Not

Used oil, while broadly defined, above, does not include:

- Used oil mixed with hazardous waste
- Petroleum and synthetic based products used as a solvent such as a cleaner or degreaser
- Antifreeze (ethylene, triethylene, or propylene glycol)
- Wastewaters resulting from an oil/water separation process
- Oil contaminated soil, rock, building materials, and spill cleanup debris

2.3 Filter Cartridges

In most instances, the generation of used oil also results in the production of used oil filters. These will typically be the spin-off type that comes pre-packaged in a metal filter housing or one that is a stand-alone cartridge that is inserted into a dedicated filter housing on the piece of equipment. The cartridge contains the filter media such as paper and a metal frame. On most light-duty applications, the metal will be galvanized or painted sheet metal and can be readily recycled. Filters from heavy equipment are often 'terne plated' (an alloy of lead and tin). As will be discussed in Section 4 of this module, the regulations are more stringent for 'terne plated' filter cartridges. The purchase and use of this type of cartridge should be avoided if at all possible. Check with your supplier before purchase of all filters to verify that they are not 'terne plated.'

2.4 Empty Containers

Empty containers left over after filling a piece of equipment or crankcase with oil and empty containers left after a used oil hauler 'stingers' waste oil into a tanker truck for transport may be regulated unless they are completely "empty." To the extent possible, Vestas attempts to use suppliers that will take back their bulk empties (e.g., poly or steel drums, etc.). However, a large number of chemical containers end up getting thrown away, scrapped, or recycled. In some cases the residues left in these seemingly "empty" containers may actually cause the container itself to be regulated as a hazardous waste.

A container is considered "empty" if:

- All materials have been removed that can be removed using the practices commonly employed to remove materials from that type of container, e.g., pouring, pumping, tilting, and aspirating, ***and***
- No more than one inch of residue remains on the bottom of the container or inner liner.

Note: You have to satisfy both conditions, above, for the container to be considered "empty."

3. Generalized Process Diagram

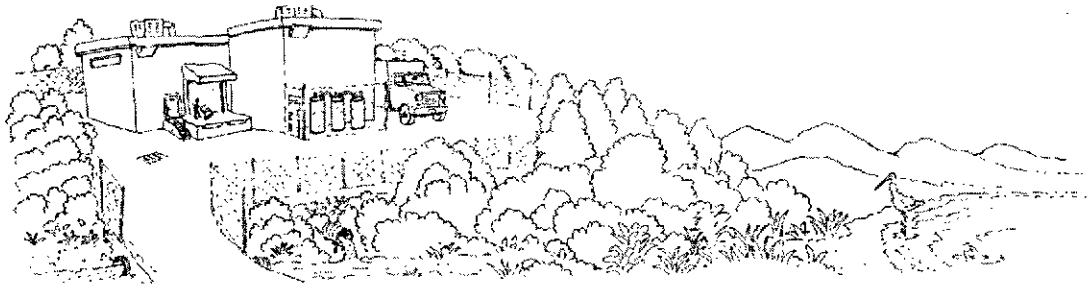


Figure 1 Proper Management of Used Oil is an Essential Environmental Practice at Vestas

4. How Used Oil Is Regulated

This section summarizes key environmental requirements that apply to the onsite management of used or waste oils that are generated by Vestas personnel while performing routine operation and maintenance activities. These requirements are imposed by state and federal environmental regulations.

4.1 Air Emissions

No air emissions should result from our handling of used oils, unless the oil is mixed with volatile organic compounds (VOCs) such as xylene, methyl ethyl ketone, or acetone. If solvents do become mixed with used oil, it will likely be regulated as a hazardous waste. All volatile compounds must be kept separate from used oil.

4.2 Stormwater Discharges

4.2.1 State and local environmental agencies issue stormwater discharge permits based on the type of industrial activity conducted at a site-specific location. If the industrial activity is covered, a permit is required unless a demonstration is made that the potential for hazardous materials to come into contact with stormwater will not occur. Used oil is one of the primary hazardous materials, if managed outdoors or in a manner that can impact stormwater, will require a facility to obtain a permit.

4.2.2 For facilities that have a stormwater NPDES permit, a written Stormwater Pollution Prevention Plan (SWPPP) is required to be prepared. The plan must describe physical and procedural steps that the permit holder has implemented to reduce or mitigate the chances of contaminating stormwater runoff. At least twice per year, permitted facilities are required to collect and analyze samples from various storm drain inlets for various pollutants to gauge the effectiveness of its pollution prevention practices. These results must be reported to the State each year. If results are not within specified criteria, the discharger must implement physical facility improvements (that may include treatment) to assure that the criteria will be met in the future.

4.2.3 At this time, no Vestas site operation has a stormwater NPDES permit.

4.2.4 It is critical that all Vestas non-permitted facilities maintain this "No Exposure" exclusion with the DEQ or other regulatory agencies. All measures must be taken by Vestas to assure that used oil does not enter the stormwater collection system.

4.3 Wastewater Discharges

Placing (e.g., draining) used oil into the sanitary sewer (e.g., draining a cartridge filter into a sink or over a drain), storm sewer, catch basin, or septic tank system is not permissible.

4.4 Hazardous Wastes

Used oil is generally not regulated as a hazardous waste, *provided* it is recycled by being reprocessed or burned for legitimate energy recovery. Federal and state environmental regulations apply to the management of used oil.

It is the policy of Vestas to make sure that all used oil is handled and managed in a manner that assures it will be recycled. If you believe you must dispose of any quantity of used oil, contact Vestas's Corporate Environmental Manager before making any disposal decisions.

The remainder of this section provides an overview of specific used oil management requirements.

4.4.1 Used Oil Collection and Storage

From the time oil is drained from the piece of equipment or vehicle, it must be completely contained until it is transferred to one of Vestas' waste contractors for offsite recycling:

- Used oil must be stored in tanks[1] or containers that are non-leaking and are in good condition. Good condition means the tank or container must not have any signs of severe rusting or apparent structural defects.
- The tanks or containers must be kept tightly closed at all times except to add or remove waste oil to the receptacle.
- Containers and tanks must be clearly labeled with the words "USED OIL" as shown in Figure 2.
- *Any amount of spilled material MUST be cleaned up immediately and properly contained.*

It Is the Policy Of Vestas That All Hazardous Materials (Liquids and Solids), including Used Oil Be Stored In An Area or Device Equipped With Some Form of Secondary Containment.

This policy applies to used oil stored indoors AND outdoors. Secondary containment can be provided by installing containment berms/curbs and chemical resistant coatings, storing used oil in approved storage cabinets equipped with secondary containment (See Figure 3), or by using portable containment devices (See Figure 4 and 5), or other means approved by the Corporate Environmental Manager.

4.4.2 Used Oil from Electrical Equipment

Vestas' service sites are generally new construction and any electrical equipment on the turbine units will be recent manufacture. It is very unlikely that any electrical equipment will contain polychlorinated biphenyls (PCBs).

If you must drain a piece of electrical equipment, or cleanup oil from a leaking transformer, capacitor, ballast, etc., contact the Vestas Corporate Environmental Manager first. We may choose to have an environmental contractor test the oil to verify that the oil does not contain any PCBs. Check the nameplate on the piece of equipment to see if it is stamped with non-PCB.

4.4.3 Used Oil for Dust Suppression

The regulations specifically prohibit the using used oil as a dust suppressant or as a pesticide (e.g., around fence posts or utility poles).

4.4.4 Used Oil Filters

Used oil filters, except 'terne plated' filters, are exempt from the hazardous waste regulations when they are properly processed before disposal or recycling. It is allowable to dispose properly drained filters into normal solid waste receptacles; however, it is Vestas' preference that all facilities make an effort to recycle used filters as scrap metal.

Each Vestas service garage has a 55-gallon container in which drained filters are placed prior to shipment to an offsite vendor for crushing and disposal, or recycling.

Used oil filters are not to be disposed in the general garbage.

[1] If you intend to store used oil in a tank (i.e., anything larger than a 55-gallon barrel), it must first be approved by the Vestas Environmental Department.

4.4.5 Burning Used Oil in Space Heaters

Under certain conditions, the regulations allow used oil to be burned in space heaters at the location where the used oil is generated. **HOWEVER**, this practice is **NOT ALLOWED** at any Vestas facility. Vestas has made the determination that it is not in our best interest to allow facilities to burn their used oil.

4.4.6 Used Oil from Remote or Field Locations

When operations or maintenance activities require that used oil be generated inside a turbine pod or other wind park-related location, all reasonable precautions must be taken to prevent spilling any used (or new) oil and that it be carefully transported back to the Vestas service garage and placed into an appropriate used oil container:

Used oil produced from maintenance of a wind turbine that will be transferred back to the onsite Vestas service garage must be collected into a container that is: **a)** In good condition, **b)** can be closed, **AND, c)** is not leaking. Furthermore, the container must be labeled with the words **USED OIL**.

Upon arrival back at the garage, the used oil **MUST** be transferred into appropriate accumulation containers (e.g., 55-gallon barrel) before your work shift is over. **NO EXCEPTIONS.**

Any Vestas fleet vehicle used to transport a container of used oil, regardless of volume, must have an onboard spill kit equipped with sufficient supplies to completely cleanup a spill.

4.4.7 Fuel and Used Oil

Vestas does not allow the mixing of other fuels with used oil. Mixing gasoline, diesel, kerosene, and other fuels with oil can lower the flash point to below 140°F, which will cause the entire mixture to become regulated as a hazardous waste.

4.4.8 Hazardous Waste and Used Oil

Put simply, placing any quantity of hazardous waste into used oil can make the resulting mixture a hazardous waste that contains used oil[2]. **DO NOT** mix anything that may be considered a hazardous waste such as a solvent (acetone, MEK, toluene, etc.), cleaner, thinner, brake cleaner, electrical contact cleaner, or paint waste with used oil. If mixing does occur, contact the Corporate Environmental Manager so that the mixture can be managed before more used oil is added to the mixture.

4.4.9 Arranging for Waste Oil Shipments

Contact the Site HazMat Coordinator or Vestas' Corporate Environmental Manager for assistance in arranging for the pick-up of used oil. Vestas' Corporate Environmental Department is responsible for procuring qualified contractors to manage our used oil.

[2] The regulations allow small amounts of certain hazardous wastes to be mixed with used oil. However, it is Vestas' policy to prohibit the mixing of any hazardous waste with used oil.

5. Operating Requirements

This section provides an overview of the regulatory requirements that pertain to the generation, storage and management of used oil. The general categories include:

- *Storage requirements*
- Managing stormwater
- Inspections
- Reporting and recordkeeping

Vestas service site personnel that generate or produce used oil are responsible for assuring that all requirements identified below are fulfilled. Any deviation from, or exception to, these requirements must be reported to Vestas's Corporate Environmental Manager.

5.1 Used Oil Storage

This section provides an overview of the requirements that apply to the storage of used oil.

5.1.1 All Vestas Operations

- Any quantity of used oil must be collected into an appropriate metal or plastic container that is non-leaking, is in good condition, and can be closed/sealed.
- The container must be labeled with the words "USED OIL."
- The container must be kept closed except when adding or removing oil.
- All used oil containers or tanks must be stored in an area or device that is equipped with secondary containment.

5.1.2 Mobile Operations

- If you know you will be doing a remote activity that requires you to transport used oil on fleet vehicles, place the materials into a tote or other container that will provide secondary containment while in transit.
- All Vestas fleet vehicles used for transporting hazardous materials must be equipped with a spill kit.

5.1.3 Used Oil Storage Area Operating Requirements

- Containers of used oil must be stored in an area equipped with secondary containment.
- Storage containers and containment areas must be visually inspected WEEKLY for evidence of corrosion, damage, leakage, or other deterioration.

5.2 Stormwater

All Vestas Service personnel MUST make a conscious effort to assure that drips, leaks, and minor spillage of oils (crankcase, turbine, hydraulic, etc.) are immediately cleaned up with absorbent materials. (Absorbent materials must be collected and placed into a drum or other suitable container until the site HazMat Coordinator or Corporate Environmental Manager can determine if the material needs to be tested.)

- ► Do not allow drips, leaks, etc., to enter into site storm drains, ditches, or swales, or percolate into the ground. Preventing the loss of even small amounts of used oil into the stormwater system is a top priority for all Vestas personnel. Oil on water also leaves a telltale sheen that is unmistakable.
- ► Any precipitation that comes into contact with used oil MUST NOT be allowed to discharge to any storm drain inlet, ditch, swale, or into the ground, etc.
- ► If your facility has a outdoor hazardous material/used oil storage area that is equipped with secondary containment, precipitation that accumulates within the containment area must first be visually inspected to make sure no leaks or spillage of hazardous materials has occurred into the containment area prior to discharging the accumulated water. If it is suspected or confirmed that leakage has occurred as evidenced by a sheen or other indication, the water must be collected or tested to confirm if it is suitable for discharge into the storm drainage system.

5.3 Inspections

Each area used for storing used oil must be inspected to assure that each container is in satisfactory condition and to make sure any secondary containment systems are functioning properly and are receiving appropriate preventative maintenance to assure that no unacceptable releases to the environment occur.

Written records for daily visual inspections are recommended, but not required, unless a spill or release is discovered. Written records for weekly and monthly inspections are required.

At a minimum, inspection records **MUST** include the **a)** date and time of the inspection, **b)** the name of the individual making the observations, **c)** a notation of the observations made, and **d)** the date and nature of any repairs or other remedial actions.

5.3.1 Visually Inspect or Verify Daily

It is *recommended* that Facility personnel check areas where used oil is stored every day to make certain the containers are in good condition and no releases are occurring.

5.3.2 Visually Inspect or Verify Weekly

- ► That container(s) of used oil are stored in a secure and properly maintained area equipped with secondary containment and that there is no evidence of leakage.

5.3.3 Visually Inspect or Verify Monthly

- ► Check to assure that an adequate inventory of spill response supplies is available at or near the area where the containers are located; and
- ► Emergency notification telephone numbers are posted at or near the storage area.

5.4 Reporting Requirements

- At a minimum, inspection records MUST include the date and time of the inspection, the name of the individual making the observations, a notation of the observations made, and the date and nature of any repairs or other remedial actions; and
- All spills must be immediately reported (within 15 minutes of discovery) to the site HazMat Coordinator or Corporate Environmental Manager.

5.5 Recordkeeping Requirements

The Site HazMat Coordinator, or designee, must maintain the following records and documents:

- An emergency response Contingency Plan, Spill Prevention Control and Countermeasures Plan, (SPCC) or other plan. (If you are uncertain contact the Corporate Environmental Manager);
- Inspection logs kept at least 3 years;
- Training documents, including copies of training;
- Copy of the annual State Fire Marshal hazardous substance survey forms; and
- Copies of all hazardous waste manifests or shipping papers from all used oil shipments.

Figure 2 Example of Used Oil Label that must be affixed to Tanks and Containers
(Labels are available from the Corporate Environmental Manager)

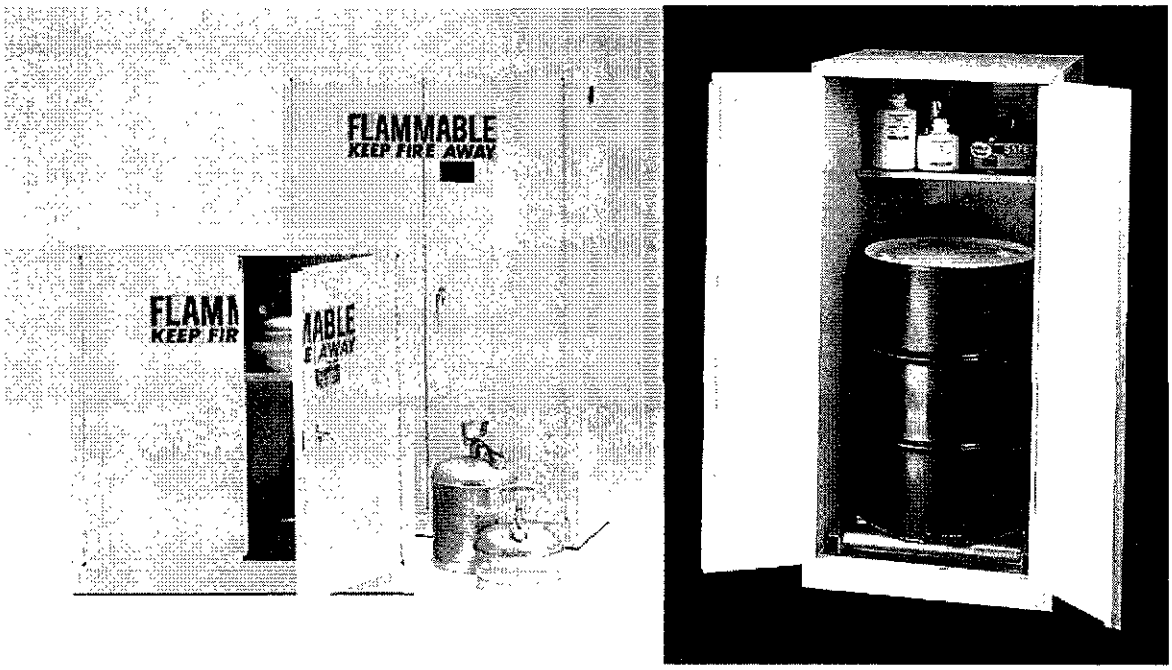


Figure 3 Example of Approved Flammable and Combustible Liquid Storage Cabinets that can be used for Used Oil

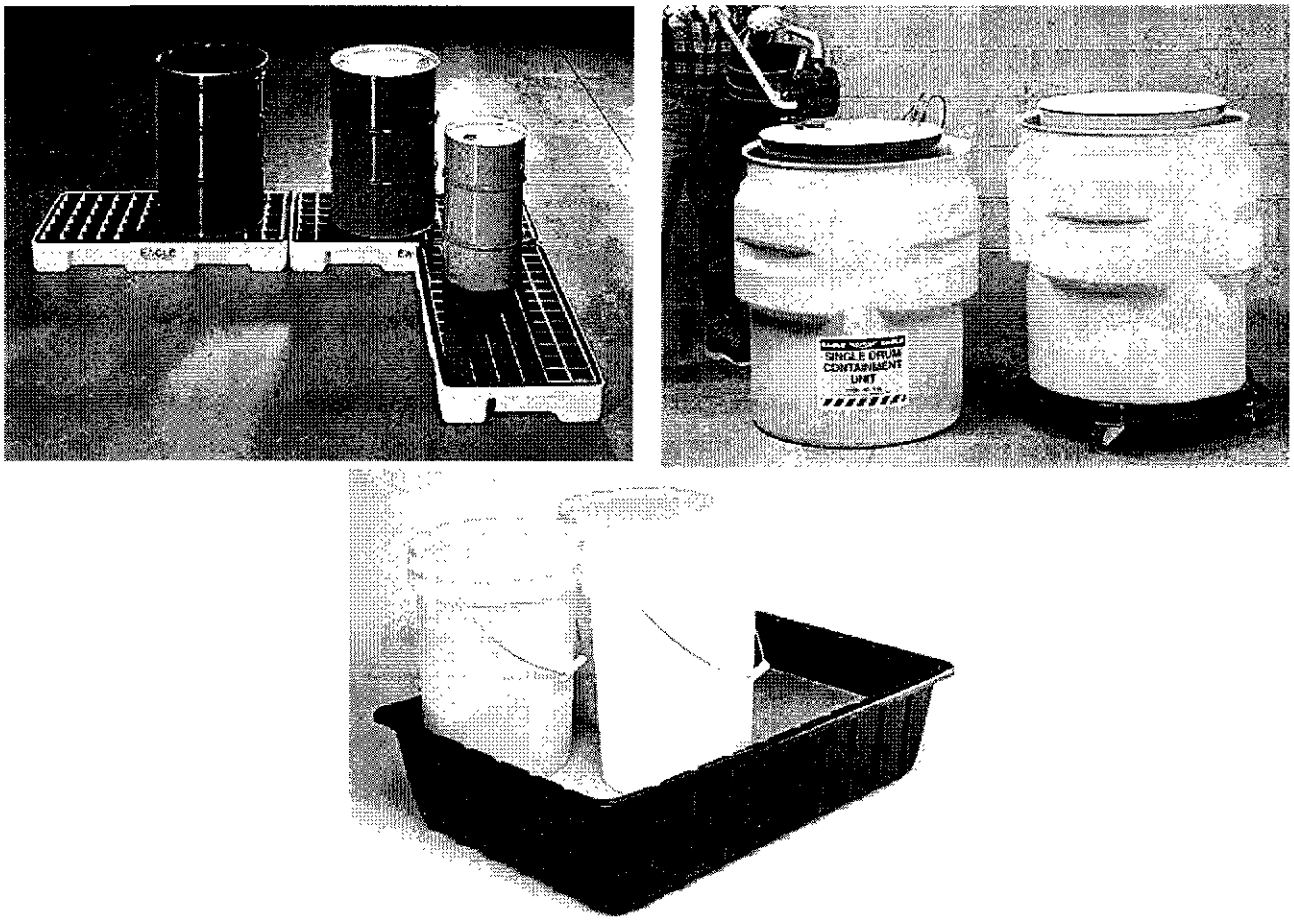


Figure 4 Example of Approved Portable Indoor or Covered Use Secondary Containment Devices Suitable for Used Oil Containers

6. History of This Document

Rev. no.:	Date:	Description of changes
00	2006-07-26	First edition – Reformat and renumbered 25-Jul-2007
01	2010-01-01	Content and template updates

VAME Electrical Safety Manual

Contents

1. Definitions

Approved: 1) accepted, certified, listed, or labeled by a recognized testing laboratory/agency (for example, UL Listed), or 2) acceptable to the authority having jurisdiction.

Arc Flash Hazard: A dangerous condition associated with the possible release of energy caused by an electric arc. An arc flash hazard may exist when energized electrical conductors or circuit parts are exposed or when they are within equipment in a guarded or enclosed condition, provided a person is interacting with the equipment in such a manner that could cause an electric arc. Under normal operating conditions, enclosed energized equipment that has been properly installed and maintained is not likely to pose an arc flash hazard.

Arc Flash Hazard Analysis (AFHA): A study investigating a worker's potential exposure to arc-flash energy, conducted for the purpose of injury prevention and the determination of safe work practices, arc flash protection boundary, and the appropriate levels of PPE.

Arc Flash Suit: A complete FR clothing and equipment system that covers the entire body, except for the hands and feet. This includes pants, jacket, and a beekeeper-type hood fitted with a face shield.

Arc Rating: The value attributed to materials that describes their performance to exposure to an electrical arc discharge. The arc rating is expressed in cal/cm^2 and is derived from the determined value of the arc thermal performance value (ATPV) or energy of breakopen threshold (EBT) (should a material system exhibit a breakopen response below the ATPV value) derived from the determined value of ATPV or EBT. (*Breakopen* is a material response evidenced by the formation of one or more holes in the innermost layer of flame-resistant material that would allow flame to pass through the material.)

Arc Rated: The maximum incident energy resistance demonstrated by a material (or a layered system of materials) prior to break-open or at the onset of a second-degree skin burn. Arc rating is normally expressed in cal/cm^2.

Boundary, Arc Flash Protection: When an arc flash hazard exists, an approach limit at a distance from a prospective arc source within which a person could receive a second degree burn if an electrical arc flash were to occur.

Boundary, Limited Approach: An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists.

Boundary, Prohibited Approach: An approach limit at a distance from an exposed energized electrical conductor or circuit part within which work is considered the same as making contact with the electrical conductor or circuit part.

Boundary, Restricted Approach: An approach limit at a distance from an exposed energized electrical conductor or circuit part within which there is an increased risk of shock, due to electrical arc over combined with inadvertent movement, for personnel working in close proximity to the energized electrical conductor or circuit part.

Circuit Breaker: A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating.

Deenergized: Free from any electrical connection to a source of voltage and from electrical charge; not having a voltage different from that of the earth.

Deenergized Work: Deenergized work shall be considered any work performed on or near equipment and circuits that has been placed in an electrical safe work condition by a Lockout /Tagout procedure that meets the requirements outlined in the VAME LOTO Program.

Deranged Equipment: Electrical equipment that has been subjected to an electrical failure shall be considered deranged equipment until its electrical integrity can be verified by testing and inspection.

Device: A unit of an electrical system that carries or controls electric energy as its principal function.

Disconnecting Means: A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

Disconnecting (or Isolating) Switch (Disconnector, Isolator): A mechanical switching device used for isolating a circuit or equipment from a source of power.

Electrical Hazard: A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.

Electrical Safety: Recognizing hazards associated with the use of electrical energy and taking precautions so that hazards do not cause injury or death.

Electrical Safety Team: A three-member team consisting of an electrical engineer, a technical trainer, and a technician, all thoroughly familiar with electrical safety concepts. The Electrical Safety Team holds various responsibilities outlined in this manual, and reports to VAME HSE for all matters of electrical safety.

Electrically Safe Work Condition: A state in which an electrical conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary. In the generic term, this is a Zero-Energy State.

Enclosed: Surrounded by a case, housing, fence, or wall(s) that prevents persons from accidentally contacting energized electrical conductors or circuit parts.

Enclosure: The case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized electrical conductors or circuit parts or to protect the equipment from physical damage.

Energized: Electrically connected to, or is, a source of voltage.

Energy Control Coordinator: A LOTO Specialist who has been designated by the Site Manager / Construction Manager to be the primary person in charge of the administration of the LOTO Program at the site location. The Energy Control Coordinator's duties are further defined in the VAME LOTO Program (HSE073).

Equipment: A general term, including material, fittings, devices, appliances, luminaries, apparatus, machinery, and the like used as a part of, or in connection with, an electrical installation.

Electrical Hazard: A dangerous condition such that contact or equipment failure can result in electrical shock, arc flash burn, thermal burn, or blast injury.

Electrical Safety Manual: This document.

Electrical Safety Program: The culmination of documents, policies, procedures and programs that exist for the purpose of electrical safety.

Energized Electrical Work Permit: This permit is required to perform work on energized electrical systems. Exceptions are troubleshooting and voltage testing. The form is found in Appendix A.

Energized Work: Energized work shall be considered any work that the employee is exposed to an electrical hazard. An example would be making contact with any object that has the potential of 50 volts (AC or DC) or higher. Energized work is also considered by VAME as any work within the restricted approach boundary where inadvertent movement by the employee could cause contact with any object that has the potential of 50 volts or higher. VAME considers any work that places the employee in a high risk factor due to flash and blast hazard as energized work.

Exposed (as applied to energized electrical conductors or circuit parts): Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to electrical conductors or circuit parts that are not suitably guarded, isolated, or insulated.

Externally Operable: Capable of being operated without exposing the operator to contact with energized electrical conductors or circuit parts.

Feeder: All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit overcurrent device.

Flame-Resistant (FR): The property of a material whereby combustion is prevented, terminated, or inhibited following the application of a flaming or non-flaming source of ignition, with or without subsequent removal of the ignition source.

Fuse: An over-current protective device with a circuit opening fusible part that is heated and severed by the passage of overcurrent through it.

Grounded (Grounding): Connected (connecting) to ground or to a conductive body that extends the ground connection.

Ground-Fault Circuit-Interrupter (GFCI): A device intended for the protection of personnel that functions to deenergize a circuit or portion thereof within an established period of time when a current to ground exceeds the values established for a Class A device. Class A ground-fault circuit-interrupters trip when the current to ground is 6 mA or higher and do not trip when the current to ground is less than 4 mA.

Guarded: Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger.

Hazard Risk Category (HRC): PPE clothing categories identified in NFPA 70E.

Incident Energy: The amount of energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. One of the units used to measure incident energy is calories per centimeter squared (cal/cm^2).

Insulated: Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current. When an object is said to be insulated, it is understood to be insulated for the conditions to which it is normally subject. Otherwise, it is, within the purpose of these rules, uninsulated.

Labeled: Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, which maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Live Parts: Energized conductive components.

Neutral Conductor: The conductor connected to the neutral point of a system that is intended to carry current under normal conditions.

On or Near: On or near refers to work within the limited approach boundary.

Personal Protective Grounds: Grounding conductors that are designed to carry the maximum fault current that could appear at the point of grounding for the time necessary to clear the fault.

Qualified Person: One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved.

Root Cause: An incident's most basic cause that can be reasonably identified, and, when mitigated, will prevent (or significantly reduce the likelihood or consequences of) the incident's recurrence.

Separately Derived System: A premises wiring system whose power is derived from a source of electric energy or equipment other than a service. Such systems have no direct electrical connection, including a solidly connected grounded circuit conductor, to supply conductors originating in another system.

Shock Hazard: A dangerous condition associated with the possible release of energy caused by contact or approach to energized electrical conductors or circuit parts.

Short-Circuit Current Rating: The prospective symmetrical fault current at a nominal voltage to which an apparatus or system is able to be connected without sustaining damage exceeding defined acceptance criteria.

Single-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used in the circuit or system.

Static Grounds: Grounding conductors designed to dissipate induced voltages.

Switch, Isolating: A switch intended for isolating an electric circuit from the source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means.

Switching Device: A device designed to close, open, or both, one or more electric circuits.

Ultimate Point of Isolation: During a grid outage, this is the upstream isolation device that is used for lockout. It still has voltage on the line (grid) side. Other isolation points downstream are all deenergized on both the line and load side.

Unqualified Person: A person who is not qualified to perform electrical work. VAME Level 0 or 1 Unqualified Technician.

Utilization Equipment: Equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting, or similar purposes.

Ventilated: Provided with a means to permit circulation of air sufficient to remove an excess of heat, fumes, or vapors.

Vestas Offsite Manager: The immediate supervisor for the Site Manager or Construction Manager. Their permission is required for certain activities.

Voltage (of a Circuit): The greatest root-mean-square (rms) (effective) difference of potential between any two conductors of the circuit concerned.

Voltage, Nominal: A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g., 120/240 volts, 480Y/277 volts, 600 volts). The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.

Voltage to Ground: For grounded circuits, the voltage between the given conductor and that point or conductor of the circuit that is grounded; for ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit.

Working On (energized electrical conductors or circuit parts): Coming in contact with energized electrical conductor or circuit parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment a person is wearing. There are two categories of "working on": *Diagnostic (testing)* is taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical change to the equipment; *repair* is any physical alteration of electrical equipment (such as making or tightening connections, removing or replacing components, etc.).

2. Program Administration

2.1 Purpose and Policy

2.1.1 VAME believes incidents and injuries are preventable. While the company has an obligation to provide a safe and healthful workplace, each employee has a personal responsibility to maintain that safe environment through safe performance of tasks. Through joint efforts, an incident and injury free work environment can be achieved and maintained.

2.1.2 The purpose of this document is to establish the minimum requirements for an electrical safety program. This written manual has been developed as the written component of VAME's Electrical Safety Program.

2.1.3 The objectives of this manual are to:

a) Establish a method for identifying and mitigating potential electrical hazards in the workplace.

b) Establish VAME's standard practices related to electrical safety in the workplace.

c) Comply with US and Canadian regulatory requirements for electrical safety in the workplace.

2.2 Scope

WARNING: The procedures covered by this publication must be carried out only by persons who are knowledgeable in the operation and maintenance of wind turbines and in the practice of electrical safety and who have been trained and certified by Vestas as Qualified Persons. These instructions are intended only for such Qualified Persons. They are NOT intended to be a substitute for adequate training and experience in safety procedures for this type of equipment. Failure to obtain the proper training and certification and to observe the precautions described in this Electrical Safety Manual may result in serious injury or death.

2.2.1 This program applies to all VAME employees working at wind turbines in the US and Canada. It covers employees and contractors who work on or near exposed energized electrical conductors or circuit components operating at between 50 volts and 40,000 volts.

2.2.2 Each wind farm location's management shall maintain written plans or procedures that, at a minimum, comply with all local, state, provincial and federal laws and regulations that apply to the facility.

2.2.3 Each wind farm location shall comply with the most stringent requirement established either by local law or by this Electrical Safety Manual.

2.3 Responsibilities

Responsibility for complying with the requirements of the Electrical Safety Program ultimately rests with each individual employee. To eliminate hazardous conditions and practices in the workplace, specific responsibilities are designated to certain positions under the Electrical Safety Program.

2.4 Associated Documents

United States. Occupational Safety & Health Administration. OSHA Standards on Electrical Safety - Code of Federal Regulations, Title 29, Subpart J, The Control of Hazardous Energy (Lockout/Tagout), Subpart S, "Electrical" (parts 1910. 331 – 335). Washington, D.C.: OSHA, 1994.

United States. Occupational Safety & Health Administration. OSHA Standards on Electrical Safety - Code of Federal Regulations, Title 29, Subpart R, "Electrical Generation, Transmission & Distribution" (parts 1910.269). Washington, D.C.: 1994.

United States. National Fire Protection Association. Standard for Electrical Safety in the Workplace (NFPA 70E). Quincy, MA: National Fire Protection Association, 2004.

Canada. Canadian Safety Association. CSA Z462-08, Workplace Electrical Safety. Mississauga, ON: Canadian Safety Association, 2008.

VAME Safety Manual

2.5 Program Review

2.5.1 This written program will be reviewed annually by the HSE Department, in conjunction with the Electrical Safety Team.

2.5.2 Additionally, this program shall be reviewed within 90 days of the release of any revision to the referenced standards.

2.6 Electrical Incident Reporting and Investigation Program

2.6.1 All incidents shall be reported and investigated in accordance with VAME Incident Reporting, Investigation, and Prevention Policy.

2.6.2 All electrical HSE Notifications shall be reviewed by the Electrical Safety Team. Post incident investigation reports will be provided to the Electrical Safety Team for review.

2.6.3 A mandatory medical assessment shall immediately follow any electric shock incident or arc flash exposure, however minor. Return to work will require following the Return to Work check sheet (DMS #0008-8015).

2.6.4 In the event of a serious electrical incident, the Electrical Safety Team will conduct a site audit and investigation.

2.6.5 The results of the Electrical Safety Team audit and investigation, including corrective actions, will be forwarded to the management team for review.

2.7 Contractor Requirements

2.7.1 All contractors are expected to comply with the requirements of this section and shall perform all tasks in a manner that assures the safety of the contractor's employees and the safety of VAME employees.

2.7.2 Contractors shall contact the VAME Energy Control Coordinator whenever a need arises to perform work on energized electrical circuitry. The contractor shall assure that an Energized Electrical Work Permit request is completed and approved prior to initiation of the work.

2.7.3 Contractors shall furnish proof that all personnel who will perform electrically related tasks are Qualified for the tasks they will perform before job task (work) begins.

2.7.4 Upon request, the contractor shall provide full disclosure regarding any regulatory citations that have been issued against the company and contacted sub-contractors during the previous five years, the resolution of those citations, and any pending regulatory action(s) against the company.

2.7.5 All equipment necessary for contractor and sub-contract employees to perform electrical work in a safe manner, including personal protective equipment, tools and instruments, warning signs, barriers and barricades, and insulated tools shall be furnished by the contractor to his employees and used as prescribed.

2.7.6 VAME reserves the right to immediately stop any work that is deemed unsafe by VAME until the contractor or sub-contractor corrects the deficiencies.

2.7.7 Repeated instances of unsafe conduct, conditions, and violations of applicable regulatory standards or VAME policy may result in cessation of the project, termination of the contract, and potential removal from consideration for future work.

2.8 Disciplinary Actions for Non-Compliance

2.8.1 Failure to comply with the requirements of this standard may result in disciplinary action up to and including termination.

2.8.2 Failure of a contractor or sub-contractor to follow specified procedures and/or observation of the contractor engaging in activities deemed to be unsafe may result in the immediate cessation of the activity, removal of that company or individual from current and future contracts.

2.9 Electrical Safety Team

VAME shall maintain a small team of employees to help steer the Electrical Safety Program.

2.9.1 Team Composition

The Electrical Safety Team shall be composed of the following mandatory representatives, who shall be designated in writing by the HSE Director:

a) Electrical Engineering: one electrical engineer shall be designated as the Electrical Safety Engineer. The Electrical Safety Engineer shall be a registered professional engineer with experience in power engineering, power systems maintenance, arc flash hazard analysis, and a background in electrical work supervision.

b) Technical Support: one technician from the Technical Support group shall be designated as the Electrical Safety Technician. The Electrical Safety Technician shall be a Level 3 Qualified Technician with site experience as an Energy Control Coordinator.

c) Technical Training: one trainer from the Technical Training department shall be designated as the Electrical Safety Trainer. The Electrical Safety Trainer shall be a Level 3 Qualified Technician with site experience as an Energy Control Coordinator and as an instructor for the LOTO Specialist and the Electrical Safety for Qualified Workers courses.

2.9.2 Team Responsibilities

a) Electrical Safety Program Review

The Electrical Safety Team shall lead the annual review of the Electrical Safety Program. The Electrical Safety Team shall be responsible for ensuring that the Electrical Safety Program remains up to date with new turbine technologies, electrical work tasks and electrical safety standards.

b) Issue Resolution

The Electrical Safety Team shall be the VAME authority in resolving technical or program interpretation questions. As a result of technical interpretations, the Electrical Safety Team will publish an Electrical Safety Notice for issues that merit dissemination. Some technical interpretations may require a revision of the Electrical Safety Manual outside of the normal annual revision cycle. In all cases, all interpretations or revisions shall be communicated in writing to the following groups:

- Technology/Electrical Engineering
- Technical Training
- HSE
- Technical Support
- Construction
- Service

c) Additional Training

When new interpretations or revisions require additional training, the Electrical Safety Team shall coordinate with the Technical Training Department to ensure that adequate and timely training is made available to technicians.

d) Audits

The Electrical Safety Team shall review the results of electrical audits and identify areas where the Electrical Safety Manual or the training program require revisions.

e) Incident Investigation

The Electrical Safety Team shall also perform those duties outlined in section 2.6.

2.10 Internal Auditing

2.10.1 The strength of the Electrical Safety Program rests in large part on the effectiveness of the internal audit program. There will not be any 100% audits. Instead, audit requirements shall focus on those elements that are most critical in improving electrical safety for the technician. These focus elements are determined from incident reporting and are expected to vary over time. Any electrical audit is primarily expected to quantify electrical skill level and safety attitude, as these are the root elements of safe electrical behavior.

2.10.2 There are three types of internal audit required by this program.

a) Site Electrical Audit

A Site Electrical Audit focuses on records, training effectiveness, material condition of equipment, condition of PPE, etc.

b) Personal Electrical Work Practices Audit

A personal work practices audit focuses on one particular technician at a time. The technician is observed performing a particular electrical task and is evaluated on the basis of his or her behavior, technical competency, skill level, and safety attitude.

c) Training Audit

The Training Audit focuses on the training performed by the Technical Training department. The audit will evaluate both the content of the course and the effectiveness of the instructor.

2.10.3 **Periodicity**

a) The site manager shall conduct a Site Electrical Audit and a Personal Electrical Work Practices Audit quarterly. Copies of the audits shall be sent to the Electrical Safety Team for review.

b) The construction manager shall conduct one Site Electrical Audit and a Personal Electrical Work Practices Audit for each project, during the pre-commissioning phase. Copies of the audits shall be sent to the Electrical Safety Team for review.

c) The Electrical Safety Team shall pick three service sites and one construction site per year, and perform an onsite Site Electrical Audit and a Personal Electrical Work Practices Audit quarterly. These audits shall take the place of the regularly scheduled audits.

d) The Electrical Safety Team shall audit each electrical safety course given at the Technical Training Center annually.

2.10.4 **Documentation**

a) All audits shall be documented and kept on file by the Electrical Safety Team.

b) The documentation shall be made available on request to the HSE department.

2.11 External Auditing

2.11.1 The HSE department shall ensure that a qualified external organization is hired to perform an external audit of VAME's Electrical Safety Program.

2.11.2 The external audit shall be scheduled no more than annually, but no less than every three years.

2.11.3 The results of the audit shall be presented to both the HSE department and the Electrical Safety Team. The Electrical Safety Team shall then prepare a report and plan of action within 30 days of receiving the audit report.

3. Employee Electrical Qualification and Safety Training

3.1 Purpose

This section provides overview information on the electrical safety training requirements established for specific job assignments. For an employee to be qualified and authorized to perform a task safely they must have safety training and demonstrated skills as required for that task.

3.2 Responsibilities

Responsibility for complying with the requirements of the Electrical Safety Program ultimately rests with each employee, contractor, sub-contractor, and vendor. To eliminate hazardous conditions and practices in the workplace, specific responsibilities will be designated to certain positions set forth by the employee's direct manager under the Electrical Safety Program.

3.3 Additional Requirements for Canadian Sites

3.3.1 Where Canadian regulations require that electrical work be performed by technicians with certifications above those required elsewhere in this manual, these requirements shall be followed.

3.3.2 Journeymen Electricians, Apprentice Electricians, and High Voltage workers who are hired as Vestas Technicians to comply with Canadian regulations for electrical work shall also meet the training and qualification requirements of Section 3 of this manual.

3.4 General Requirements

3.4.1 All new technicians must receive the Basic Safety Course before receiving job assignments. This training provides an overview of the OSHA, COHS, and VAME requirements prior to employees commencing work. Specialized safety training and/or on-the-job training is provided to each employee based on assigned tasks and duties.

3.4.2 All other employees shall complete a LOTO e-learning course within 30 days of hire to enable the employee to recognize electrical hazards and become aware of the LOTO Program should they visit a wind turbine site.

3.4.3 This section only applies to the electrical safety training requirements. Additional safety training is addressed within the overall safety training program.

Required Electrical Safety Training Topics Covered in This Program
Electrical Safe Work Practices
Electrical Lockout/Tagout
Personal Protective Equipment (PPE)
Personal Protective Grounds
Power Hand Tool inspection, marking and record keeping
Proper use of inspection of calibrated test equipment
Standby person training
Proper use and inspection of insulated tools
Electrical Emergency/Rescue Procedures

3.5 Training Requirements

The employee's immediate manager shall ensure the appropriate level of safety training is provided prior to the employee performing any work in a wind turbine. The immediate manager shall maintain a local record of training in each employee's file and forward an electronic copy to the Technical Training Department. The following is a list of electrical qualification levels at each VAME location.

3.5.1 Level 0 – Escorted Visitor - Unqualified Worker

a) Training Requirements:

Visitor orientation and safety briefing

b) Scope of Work:

- Cannot perform electrical work.
- Cannot enter into the arc flash protection boundary or limited approach boundary.
- Must install LOTO (locks and/or tags) under the supervision of a Level 2 qualified escort.
- Must wear Class 0 clothing and PPE.

3.5.2 Level 1 – Unqualified Worker

a) Training Requirements

Basic Safety Course

b) Scope of Work

- Must install LOTO (locks and/or tags) while in a turbine that is under LOTO.
- Can perform non-electrical work around energized electrical equipment as long as the cabinets are closed and remain closed.
- Cannot enter the limited approach boundary.
- Can work in electrical cabinets that have been properly isolated under the LOTO program.
- Can perform work under instruction as a Level 2 Qualified Worker.

3.5.3 Level 2 - Qualified Worker

a) Training Requirements

- Level 1 certification
- Electrical Safety For Qualified Workers (Part of Fundamentals)
- LOTO Qualified person qualification

b) Scope of Work

Cannot perform those tasks specifically identified as requiring Level 3 qualification. Can perform basic electrical work, including:

- Electrical LOTO.

- Voltage testing.
- Component replacement on locked out parts.
- HV switch operation and transformer grounding.
- Can perform work under instruction as a Level 3 Qualified Worker.

3.5.4 **Level 3 - Qualified Worker**

a) Training Requirements

- Level 2 qualification
- Turbine theory class
- LOTO Specialist qualification

b) Scope of Work

- Can perform all Level 2 work, plus:
- Work under an energized work permit
- Complex troubleshooting
- Interlock bypassing

3.6 Job Qualification Requirements

3.6.1 All escorted visitors shall complete the visitor orientation and safety briefing prior to entering a wind turbine.

3.6.2 All VAME Technicians shall qualify to Level 2, and work to qualify to Level 3.

3.6.3 The Energy Control Coordinator shall qualify to Level 3 as a prerequisite for the position. In addition, this person shall demonstrate in-depth knowledge of the Electrical Safety Program and the LOTO Program and be designated in writing by his/her immediate manager as the Energy Control Coordinator.

3.6.4 VAME Site Managers and Construction Managers shall complete the Electrical Safety for Qualified Workers portion of the Fundamentals Course.

3.6.5 VAME Electrical Engineers shall complete the Electrical Safety for Qualified Workers portion of the Fundamentals Course.

3.7 Training Content

3.7.1 The VAME Technical Training Director shall ensure that the electrical courses developed to qualify technicians meet the following generic requirements outlined in NFPA 70E / CSA Z462.

3.7.2 In addition, training content shall include a mixture of classroom and supervised hands-on exercises.

3.7.3 A qualified person shall be trained and knowledgeable of the construction and operation of equipment or a specific work method and be trained to recognize and avoid the electrical hazards that might be present with respect to that equipment or work method.

3.7.4 Such persons shall also be familiar with:

a) The proper use of the special precautionary techniques, personal protective equipment, including arc-flash, insulating and shielding materials, and insulated tools and test equipment.

b) The skills and techniques necessary to distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment.

c) The skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts.

d) The approach distances specified in Section 4 of this manual and the corresponding voltages to which the qualified person will be exposed.

e) The decision-making process necessary to determine the degree and extent of the hazard and the personal protective equipment and job planning necessary to perform the task safely.

f) Tasks that are performed less often than once per year shall require retraining before the performance of the work practices involved.

g) Employees shall be trained to select an appropriate voltage detector and shall demonstrate how to use a device to verify the absence of voltage, including interpreting indications provided by the device. The training shall include information that enables the employee to understand all limitations of each specific voltage detector that may be used.

3.8 Retraining

3.8.1 Retraining on this program shall be conducted annually.

3.8.2 Retraining on this program shall be conducted following any electrical incident unless VAME determines the incident requires the termination of employment.

3.8.3 An employee shall receive additional training (or retraining) under any of the following conditions:

a) If the supervision or annual inspections indicate that the employee is not complying with the safety-related work practices.

b) If new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices.

3.8.4 **Refresher Training**

The Technical Training department shall put together a monthly electrical safety training lesson on a slideshow or similar method. Monthly topics shall include, but are not limited to:

- Voltage glove inspection
- Electrical approach boundaries
- Energized electrical work permit
- Electrical LOTO
- High-voltage switchgear and electrical grounding
- Basic circuit theory
- Electrical diagrams

- Basic troubleshooting
- Body positioning
- Voltage testers
- Voltage-rated tools
- Electrical incidents review

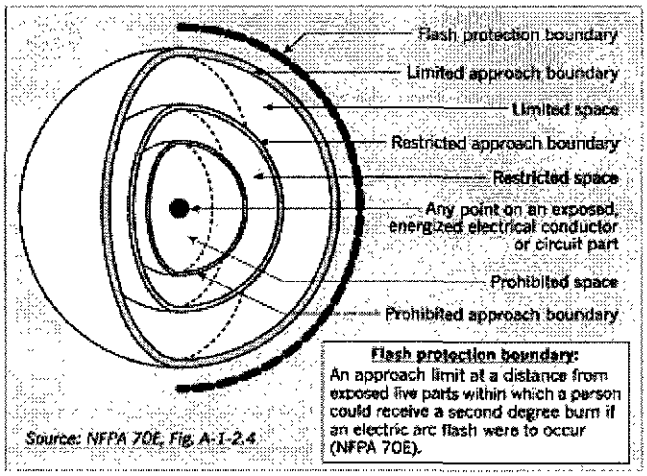
a) The monthly lesson shall be distributed to all sites, and all technicians shall cover the training as a safety meeting discussion topic during the month.

b) The Technical Training department shall track completion of the training.

4. Electrical Approach Boundaries

4.1 General Requirements

Electrical approach boundaries are defined by NFPA 70E/CSA Z462.



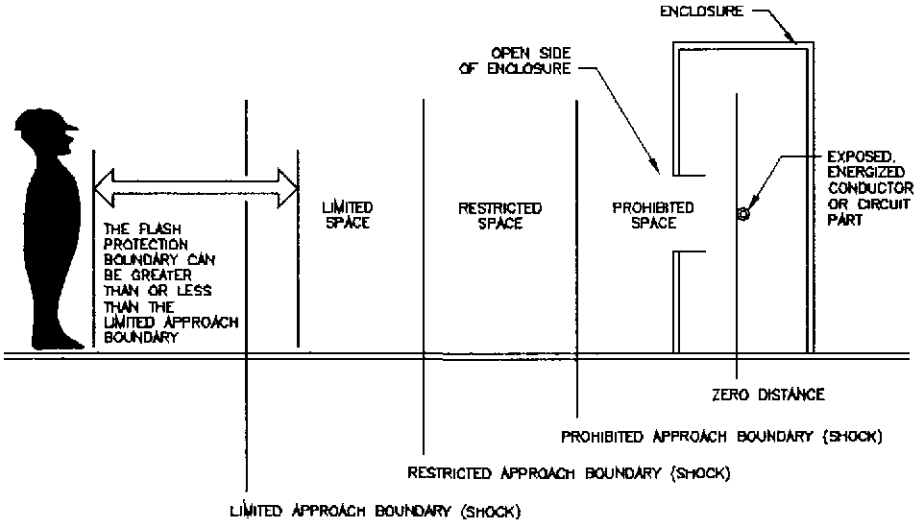


Table 4.1 - Shock Protection Approach Boundaries

Nominal System Voltage Range, Phase to Phase	*Limited Approach Boundary*	*Restricted Approach Boundary*	*Prohibited Approach Boundary*
Less than 50 V	Not Specified	Not Specified	Not Specified
50 V - 300 V	3 ft 6 in	Avoid Contact	Avoid Contact
301 V - 750 V	3 ft 6 in	1 ft 0 in	0 ft 1 in
751 V - 15 kV	5 ft 0 in	2 ft 2 in	0 ft 7 in
15.1 kV - 36 kV	6 ft 0 in	2 ft 7 in	0 ft 10 in

4.2 Shock Protection Boundaries

4.2.1 General

All shock protection boundaries are defined based on equipment voltage alone. Shock protection boundaries are not defined unless an energized conductor is exposed or the worker is physically operating an electrical device.

4.2.2 Limited Approach Boundary

a) The Limited Approach Boundary is the closest distance that an unqualified person can approach exposed energized conductors without escort.

b) An unqualified worker may be escorted within the Limited Approach Boundary by a qualified worker, but may never enter the Restricted Approach Boundary.

4.2.3 Restricted Approach Boundary

a) The Restricted Approach Boundary may only be entered by a qualified worker.

b) All parts of the qualified worker that enter the Restricted Approach Boundary must be insulated from the equipment voltage.

c) All tools that enter the Restricted Approach Boundary must be insulated for the equipment voltage.

4.2.4 Prohibited Approach Boundary

a) Entering the Prohibited Approach Boundary is considered the same as making contact with the exposed energized conductor.

b) An Energized Electrical Work Permit is required to enter the Prohibited Approach Boundary, unless performing voltage testing or troubleshooting.

4.3 Arc Flash Protection Boundary

4.3.1 General

The arc flash protection boundary is defined as the distance from an exposed energized conductor at which the arc flash energy is calculated to be 1.2 cal/cm^2. This is the energy where unprotected, exposed skin would receive a second degree burn in the event of an arc flash.

4.3.2 Working Distance

The arc flash energy is calculated by an Arc Flash Hazard Analysis (AFHA). The AFHA assumes a typical working distance depending on the type of electrical gear. The arc flash energy is calculated at the specified working distance. This energy is the basis for the required arc flash protective equipment.

4.3.3 Requirements

Only qualified workers are permitted to enter the arc flash boundary. All personnel within the arc flash boundary must be suited for the arc flash energy at the working distance.

4.3.4 Application to Wind Turbines

a) The AFHA sets the approach boundary for arc flash based on the available energy. In a wind turbine, the arc flash boundary is set primarily by the physical layout.

b) For electrical work in the nacelle, where access is severely restricted, the arc flash boundary is designated as the plane of the yaw bearing. All personnel in the nacelle during electrical work that requires arc flash PPE will wear the same PPE as the person doing the work. In addition, no one is allowed in the hub or on the roof during this time. Personnel who do not don the required arc flash PPE should move to the yaw deck or below until the electrical work is complete.

c) For electrical work at the bottom of the tower, the arc flash boundary is at the bottom of the tower access stairs. All personnel in the tower during electrical work that requires arc flash PPE will wear the same PPE as the person doing the work. Personnel who do not wish to don the required arc flash PPE should move away from the tower until the electrical work is complete.

4.4 Barricade

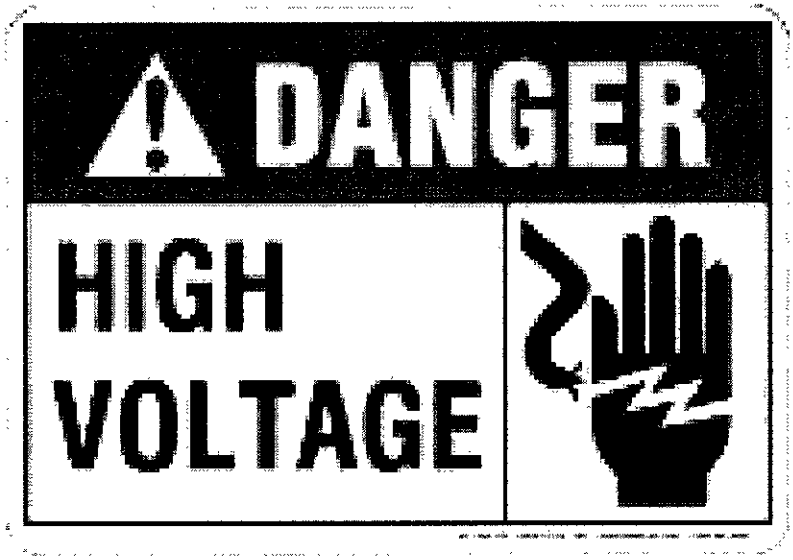
4.4.1 General

All electrical work areas will be signed and barricaded. Personnel entering the work must be fully briefed on the work and fully equipped with the appropriate levels of personal protective equipment.

4.5 Turbine Posting

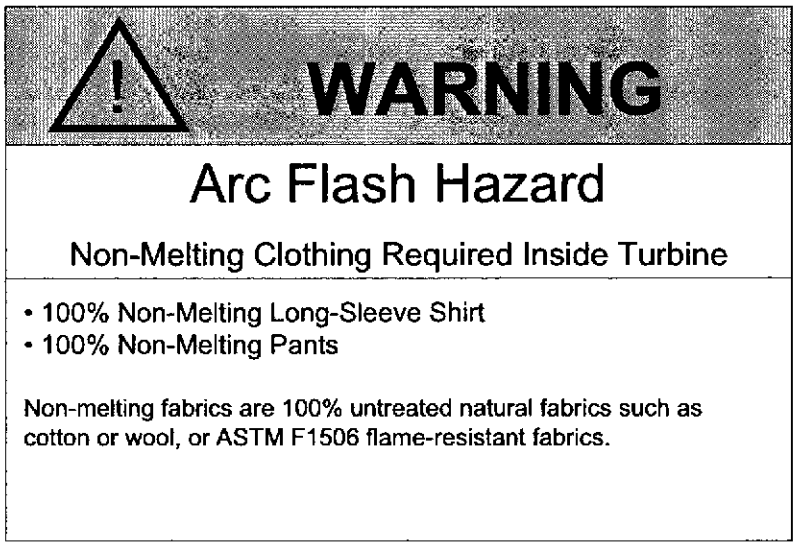
4.5.1 *High Voltage Sign*

All turbines will have a "Danger – High Voltage" sign posted on the turbine door. The sign will conform to ANSI Z535 standards for safety signing.



4.5.2 Arc Flash Hazard – Non-Melting Clothing Sign

All turbines will have a "Warning – Arc Flash Hazard – Non-Melting Clothing Required" sign posted on the turbine door.



5. Electrical Personal Protective Equipment

5.1 Shock Protection PPE

5.1.1 Prohibited Articles

Conductive articles of jewelry, such as watch bands, bracelets, rings, necklaces, metal-framed glasses, PDA's, cell phones, pagers and oversized belt buckles shall be removed from the worker's body whenever entering the Limited Approach Boundary.

5.1.2 Rubber Insulated Protective Equipment

a) Each individual who is assigned protective equipment shall be responsible for the care and storage of the issued equipment.

b) All new protective rubber equipment shall be tested by a certified testing laboratory and documented prior to being issued for service.

c) Rubber insulating protective equipment shall be inspected for damage before each use and immediately following any incident that can reasonably be suspected of having caused damage. Insulating equipment with any of the following defects shall not be used:

- A hole, tear, puncture, or cut.
- Ozone cutting or ozone checking (the cutting action produced by ozone on rubber under mechanical stress into a series of interlacing cracks).
- An embedded foreign object.
- Any of the following texture changes: swelling, softening, hardening, or becoming sticky or inelastic.
- Any other defect that damages the insulating properties

5.1.3 Rubber Insulating Gloves

a) When exposed to electrical hazards of 50 volts or greater, approved rubber insulating gloves shall be used. At no time shall the voltage rating of the glove be exceeded. Gloves shall conform to ANSI/ASTM D120 - Standard Specification for Rubber Insulating Gloves, and ASTM F496 - Specification for In-Service Care of Insulating Gloves and Sleeves.

b) Each Qualified employee shall test their rubber gloves prior to each use. To test gloves for pinholes and other damage, fill the glove with air, roll up the cuff of the glove to make a seal, and squeeze the glove. Then hold the inflated glove close to the face and ear to feel and listen for air escaping from holes.

c) Defective rubber gloves shall not be used and shall be removed from service. If a rubber protective glove is found to be defective, then one of the fingers of the glove shall be cut off. The glove pair shall be exchanged for a new set.

d) Care of Gloves - Gloves in service shall be kept cuff-down in canvas glove bags. Gloves shall not be folded, creased, or rolled while in storage. Gloves shall be protected from heat, ozone, or prolonged exposure to the direct rays of the sun, and from contact with sharp articles or materials likely to damage gloves or cause deterioration of the rubber. Clean only with lukewarm water and mild soap detergent. Do not use solvents, oils, or grease on rubber gloves.

e) Rubber protective gloves shall be tested at intervals not to exceed 6 months (3 months in Oregon).

f) Gloves covered under this written program are designated by voltage rating. The electrical properties that correspond to these classes are shown below in Table 5.1. The voltage glove rating shall be selected based on the equipment's line-to-line voltage rating.

g) The required cuff lengths for the gloves are indicated in Table 5.1.

Table 5.1 – Voltage Requirements

Glove Class	Class Color	Proof Test Voltage AC/DC	Max. Use Voltage AC/DC	Required Cuff Length
0		5,000/20,000	1,000/1,500	14 inches
4	Orange	40,000/70,000	36,000/54,000	16 inches

h) The insulating gloves are to be returned to the individual's Inventory Coordinator or Safety Coordinator to be exchanged every six months (three months in Oregon) for a fresh pair of insulating gloves. A glove test date will be stamped or permanently marked on the inside of the glove. In no case is an issued glove to be used beyond its expiration date, which is 1 year (6 months in Oregon) from the test date.

i) Storage

When not in use, the gloves are to be stored in a glove bag kept in a location as cool, dark, and dry as possible. The gloves should be stored in a horizontal position to minimize the stress on the edge creases. The location shall be free as practicable from ozone, chemicals, oils, solvent, damaging vapors and fumes, and away from electrical discharge and sunlight. Gloves shall be stored in their natural shape. Gloves may be kept inside of protectors or in a bag, box, or container that is designed for and used exclusively for them. Gloves shall not be stored folded, creased, inside out, compressed, or in any manner that will cause stretching or compression.

j) Leather Protectors

The protector leather gloves shall be worn over the insulating rubber gloves to prevent mechanical damage. The leather protector glove shall be sized so that the insulating glove shall not be deformed from its natural shape.

The top cuff of the protector glove shall be shorter than the roller top of the insulating glove by at least the distance specified in Table 5.2 below.

Table 5.2 – Leather Protector Cuff Requirements

Glove Class	Distance (in)
0	0.5
4	4

Leather gloves that have been used for any other purpose shall not be used to protect insulating gloves. Protector gloves shall not be used if they have holes, tears, or other defects that affect their ability to give mechanical protection to the insulating glove.

Care should be exercised to keep the protector gloves as free as possible from oils, grease, chemicals, and other materials that may injure the insulating gloves. Protector gloves that become contaminated with injurious materials to the extent that damage may occur to the insulating glove shall not be used as protector gloves unless they have been thoroughly cleaned of the contaminating substance.

The inner surface of the protector gloves should be inspected for sharp pointed objects. This inspection should be made as often as the rubber gloves are inspected.

k) Cloth Glove Liners

Cloth gloves may be worn inside the insulating gloves for warmth in the winter and to absorb perspiration in the hot weather.

5.1.4 Rubber Insulating Blankets

a) Rubber insulating blankets shall be used to provide additional protection when work is being performed adjacent to exposed, energized parts. Blankets shall conform to ASTM D1048 - Standard Specification for Rubber Insulating Blankets and ASTM F479 - Standard Specification for In-Service Care of Insulating Blankets.

b) Blankets shall be inspected prior to each use. Defective blankets shall not be used and shall be removed from service.

c) Care of Blankets - Blankets shall be stored in a cool, dark, and dry location free from ozone, chemicals, oils, solvents, damaging vapors and fumes, and away from electrical discharges. Blankets shall be stored in a container that is designed for and used exclusively for them and shall not be kept folded, creased, distorted, or compressed in any manner that will cause stretching or compression.

d) Blankets shall be cleaned as necessary to remove foreign substances and shall be wiped clean of any oil, grease or other damaging substances as soon as practicable. Clean only with lukewarm water and mild soap detergent. Rinse thoroughly with water to remove all of the soap or detergent.

e) Rubber insulating blankets shall be tested at intervals not to exceed 12 months (6 months in Oregon).

5.2 Arc Flash PPE

5.2.1 Prohibited Clothing

Synthetic materials, such as acetate, nylon, polyester, polypropylene, spandex, and acrylic will melt when exposed to the heat of an arc blast and should not be worn inside the turbine at any time. Any synthetic material outerwear should be removed once inside the wind turbine.

5.2.2 Clothing Category Ratings

a) Vestas will use three classes of protective clothing: Class 0, Class 2 and Class 4.

b) Class 0 clothing is required by all persons, qualified or unqualified, to enter a turbine.

c) Class 2 clothing is required whenever working within the arc flash boundary of equipment rated from 1.2 cal/cm^2 to 8 cal/cm^2.

d) Class 4 clothing is required whenever working within the arc flash boundary of equipment rated from 8.1 cal/cm^2 to 40 cal/cm^2.

e) Specific arc flash clothing requirements are listed in detail in Table 4.1.

5.2.3 Exceptions to Class 0 Clothing Requirements

a) For Class 0 clothing only, miscellaneous items such as gloves and hats are exceptions to be made as required by the task at hand.

b) The long-sleeve shirt is not required when climbing the turbine, but must be worn both in the bottom of the tower and in the nacelle.

c) The fall protection harness is also a required exception. Remember to remove the fall protection harness and all non-arc-rated outerwear prior to performing electrical work. The fall protection harness must be staged for quick access in case an emergency descent is required.

d) These exceptions do not apply to Class 2 or 4 arc flash PPE.

5.2.4 Layering

a) When wearing arc-rated clothing, the outermost layer must always be arc-rated. Inner layers must be of non-melting clothing all the way to the skin.

b) It is acceptable, but not required, to wear the Class 2 clothing underneath the Class 4 suit.

5.2.5 Limitations

a) Arc-rated clothing is designed to limit the injury to a second-degree burn and protect the face. It will mitigate the seriousness of the burns but will not prevent physical trauma injuries.

b) Incident energies greater than 40 cal/cm² are classified "Dangerous". NFPA 70E has no *clothing class for energies greater than 40 cal/cm². Any task on the electrical equipment is* prohibited. In cases like this, it is recommended that the upstream electrical equipment be turned off before servicing the electrical equipment or modify the electric equipment in order to reduce the incident range so that the equipment can be safely serviced[1].

Table 5.2

VAME Personal Protective Clothing Minimum Requirements for Protection from Flash Energy

[1] Some manufacturers make arc flash suits rated to 100 cal/cm^2. This was based on a previous edition of NFPA 70E that is obsolete. Although 100 cal/cm^2 offers greater flash protection, the blast energy is too great. Engineered fixes shall only be used if they are approved by the VAME Technology/Electrical Engineering department.

NFPA 70E Clothing Category	*Clothing Description*
Class 0	Nonmelting materials (i.e. untreated cotton, wool, rayon or silk, or a blend of these materials) with a fabric weight at least 4.5 oz/yd ^{2} (some dress shirts are too light) : 1. Long-sleeve shirt 2. Pants Protective Equipment: 1. Safety glasses or goggles 2. Leather work shoes
Class 2	FR clothing, minimum arc rating (ATPV) of 8 cal/cm ^{2}: 1. Arc-rated long-sleeve shirt 2. Arc rated pants } or Arc-rated coveralls 3. Arc-rated arc flash suit hood FR Protective Equipment: 1. Hard hat 2. Safety glasses or goggles 3. Hearing protection (ear canal inserts) 4. Leather gloves 5. Leather work shoes
Class 4	FR clothing, minimum arc rating (ATPV) of 40 cal/cm ^{2}: 1. Arc-rated arc flash suit jacket 2. Arc-rated arc flash suit pants 3. Arc-rated arc flash suit hood FR Protective Equipment: 1. Hard hat 2. Safety glasses or goggles 3. Hearing protection (ear canal inserts) 4. Leather gloves 5. Leather work shoes

5.2.6 Standards for Arc-Rated Clothing

a) All clothing used as arc flash PPE shall conform to ASTM F1506. Such clothing is identified by a tag that specifies the arc rating in one of three ways:

- Arc Thermal Performance Value, e.g. ATPV 16.8 cal/cm^2

- Break-Through Energy, e.g. EBT 12.1 cal/cm^2
- Hazard/Risk Category, e.g. HRC 2

b) ATPV refers to the material's ability to resist ignition. EBT refers to the material's ability to resist breaking open. One or the other will be the limiting parameter for the arc-rating. FR clothing that does not have a tag identifying its arc flash rating is not suitable for electrical work.

c) Arc-rated fabric usually is composed of 100% cotton or a cotton-synthetic blend. The fabric is impregnated with a chemical that is activated by the arc flash to prevent ignition. The fabric is then tested to determine the arc rating. Manufacturer's laundry instructions must be followed to ensure FR effectiveness. Some arc-rated fabric is made of Nomex. However, only articles that have an arc rating tag shall be used. Do not assume that all Nomex articles meet the requirements for arc flash.

5.2.7 Inspections

The arc-rated clothing shall be examined by the technician for rips, tears, and/or flaws in the material or workmanship prior to each use. If they are damaged in any way, they shall not be used.

6. Electrical Safe Work Practices

6.1 Requirement for Deenergization

Before beginning any construction or maintenance work that requires activities that will place the employee within the Limited Approach Boundary or the Arc Flash Boundary of exposed energized parts, the equipment shall be placed in an electrically safe work condition.

6.1.1 Exceptions to the Requirement For Deenergization

a) If it can be demonstrated that deenergizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations as specified in the guidelines set forth in OSHA 29 CFR 1910. 333 or 1910.269, then the equipment may remain energized and the work will be classified as energized work. Energized work shall require a VAME Energized Electrical Work Permit.

b) An example of additional or increased hazards include, but are not limited to:

- Removal of illumination for an area

c) An example of energized work being allowed because de-energizing is infeasible due to equipment design or operational limitations are as follows:

- Performing diagnostics or startup
- Performing testing or troubleshooting

6.1.2 Exceptions to the Energized Electrical Work Permit

A VAME Energized Electrical Work Permit is not required to perform visual inspection, voltage testing, or troubleshooting of a circuit. However, the worker shall still follow all requirements for entering the electrical approach boundaries.

6.2 Electrical Lockout (LOTO) and Grounding

6.2.1 Establishing an Electrically Safe Work Condition

An electrically safe work condition shall be achieved when performed in accordance with the VAME LOTO Program and verified by the following process:

a) Determine all possible sources of electrical supply to the specific equipment. Check applicable up-to-date drawings, diagrams, and identification tags.

b) After properly interrupting the load current, open the disconnecting device(s) for each source.

c) Wherever possible, visually verify that all blades of the disconnecting devices are fully open or that drawout-type circuit breakers are withdrawn to the fully disconnected position.

d) Apply lockout/tagout devices in accordance with the VAME LOTO Program.

e) Use an adequately rated voltage detector to test each phase conductor or circuit part to verify they are deenergized. Follow the Test-Verify-Test three-point test method.

f) Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being deenergized could contact other exposed energized conductors or circuit parts, apply ground connecting devices rated for the available fault duty.

6.2.2 Electrical requirements for proper lockout points

a) All lockout points must consist of positive energy isolation devices such as disconnect switches and circuit breakers.

b) All isolating devices used as lockout points must be capable of accepting an approved lockout device that physically prevents the actuation of the isolating device.

c) Fuses are not an acceptable lockout point.

Exception: Certain conditions may require the removal of fuses as the only available lockout point. This requires the approval of the Electrical Safety Team, who will also determine additional steps required to safely remove the fuses and place a lockout device on the fuseholder or cabinet.

d) Where the lockout point requires disconnection of wires, the wire ends must be electrically taped (insulated) and tagged out in such a way that prevents the reconnection of the wires.

e) All lockout points must have a safe and accessible way to verify deenergization. There can be no circuit breakers, fuses, interlocks, contactors, diodes, or automatically controlled devices between the isolation device and the test point.

6.2.3 Grounding requirements

Grounding is required under the following circumstances:

a) Possibility of induced voltages

Where deenergized lines are run next to high-voltage energized lines, the magnetic fields may induce a build-up of static charge in the deenergized conductor. When this is found (through experience), a suitable shorting ground device shall be applied to the deenergized conductors. This could be short lengths of small-gauge bare stranded copper wire connecting the lines to ground

Where capacitor banks may build up a charge, the deenergized capacitor bank shall be shorted out with an approved shorting ground device. The capacitor grounding device shall have a resistor sized to dissipate the expected maximum charge in less than five seconds.

b) Possibility of reenergization

Deenergized equipment might become energized through the following causes:

- Overhead lines fall on bare deenergized conductors
- Temporary generator is installed inadvertently on a locked out circuit
- Miscommunication between customer and contractor at the point of common lockout control.

If these cases are reasonably possible, then grounds must be applied to the circuit that is locked out. Ground straps must be rated to withstand the maximum short-circuit current available at the point of grounding for the time necessary to clear the fault. This rating shall be identified in conjunction with the Arc Flash Hazard Analysis.

c) High voltage equipment

All work performed within the limited approach boundary of equipment rated above 1000 V will require the application of grounds. Ground straps must be rated to withstand the maximum short-circuit current available at the point of grounding for the time necessary to clear the fault. This rating shall be identified in conjunction with the Arc Flash Hazard Analysis.

6.2.4 Voltage testing at the equipment:

a) In addition to placing the equipment in an electrically safe work condition, in accordance with Section 6.2.1, the technician shall also verify absence of voltage after opening the electrical enclosure for the equipment to be worked upon.

b) The voltage test shall follow the test-verify-test three-point test method described in Section 6.3.

6.3 Voltage Testing

6.3.1 Purpose of Voltage Testing

The voltage test performed in conjunction with the lockout procedure is intended to identify remaining system voltage present under the following conditions:

a) Selection of wrong isolation point

In the case where Circuit A is to be isolated, and the device for Circuit B is inadvertently selected as the isolation point.

b) Mechanical or electrical failure of isolation device

The isolation device may fail internally. One or all of the phases may still be closed even though the device shows all external indications of being open.

c) Circuit backfeed or alternate power source

Another source of energy may still be energizing the circuit. This could be a UPS, a temporary generator, incorrect wiring, or other source of energy.

d) Residual charge

A circuit may retain a built-up capacitive charge, or may be powered from a DC supply.

6.3.2 Selection of Voltage Detector

Only Vestas approved voltage detectors may be used to measure voltage.

a) Selection of test probes

Test probes must be selected to match the physical requirements of the test point. Some test points are shielded, and the exposed portion of the test leads must be long enough to reach the conductors.

b) Contact versus Non-Contact

All equipment rated above 1000 V shall only be tested with a non-contact, proximity type voltage detector attached to a live-line tool.

6.3.3 Selection of PPE

a) Shock Protection

Rubber insulated gloves with leather protectors shall be worn for the voltage test. The voltage glove rating shall exceed the rated line-to-line voltage of the equipment to be tested.

b) Arc Flash Protection

Arc flash clothing shall be worn for the voltage test. The arc flash level classification shall exceed the line-side arc flash energy of the device to be tested.

6.3.4 Test-Verify-Test (Three-Point Test Method)

Whenever verifying the absence of voltage, the voltage detector shall be functionally tested before and after verification. The functional test is called the test, while the absence of voltage test on the circuit of interest is called the verification.

Voltage testing requires following the proper procedures for entering electrical approach boundaries, including donning the arc flash and shock protection PPE appropriate for the circuits to be tested.

a) Test, Low Voltage

The test shall consist of measuring voltage on a known energized circuit. The known energized circuit can be:

- A 24 VDC circuit
- A 110 VAC lighting circuit
- A 230 VAC circuit
- The line side power of the disconnect
- A handheld portable device specifically designed for this application

b) Test, High Voltage

Non-contact voltage detectors shall be tested before and after each use. The test shall consist of detecting energized voltage on a known energized circuit. The known live circuit can be:

- An energized fluorescent light fixture
- A handheld portable device specifically designed for this application

c) Verification

Verification shall consist of the following steps, in order:

- Check voltage on each phase, phase-to-ground
- Check voltage on each phase, phase-to-phase

The phase-to-phase check is not possible when using the non-contact voltage detector on high voltage circuits. However, the phase-to-ground voltage check on high voltage circuits is always followed by the application of temporary personal protective grounds.

6.3.5 Grid outage

A grid outage occurs whenever the power to the turbine transformer high voltage disconnect is lost. This can be isolated to a single string or for the entire wind farm. This presents a problem with standard lockout points, as a voltage test is not valid when there is no voltage on the line side of the intended lockout point.

a) Planned Grid Outage

When a grid outage is planned, the Energy Control Coordinator shall establish the electrical lockout and grounding plan in conjunction with the customer. All VAME

technicians working on turbines within the grid outage boundary shall lockout at the ultimate point of isolation where there is still voltage on the line side of the disconnect. The Energy Control Coordinator may elect to set up a group lockout to facilitate the logistics of locking out on the customer's equipment.

Once the lockout is established at the ultimate point of isolation, VAME technicians may prepare for grid energization and lockout at isolation points on the turbines. At the turbine lockout points, VAME technicians shall perform a continuity check through all three phases of the isolation point disconnect(s) in addition to the voltage test. Once the disconnect(s) has (have) been verified open, the disconnect(s) can be locked out.

Sequence:

1. Lockout the grid side of the breaker at the ultimate point of isolation.
2. Open the lockout isolation device.
3. Perform a voltage check on the grid side of the lockout isolation device.
4. Perform a voltage check on the generator or load side of the lockout isolation device.
5. Once absence of voltage has been verified on both sides of the lockout isolation device: Perform a continuity check through all three phases of the lockout isolation device.
6. Lockout the lockout isolation device.

When the customer is ready to reenergize the grid, the Energy Control Coordinator shall require all VAME technicians to exit the towers and clear their lockout of the grid. All technicians shall remain clear of the turbines until the grid is reenergized. Once the grid is reenergized, all electrical lockout points at the turbines shall be retested for absence of voltage. Technicians may then resume work inside the turbines.

b) Unplanned Grid Outage

An unplanned grid outage can occur at any time while technicians are performing electrical work. In the event of an unplanned grid outage, all technicians shall immediately exit the tower. Communications with the customer shall be established to determine the cause of the outage and the proper procedure for resuming work.

If the unplanned grid outage will be extended, then the Energy Control Coordinator shall follow the instructions for a Planned Grid Outage in a) .

Technicians shall not reenter the turbine until cleared by site management.

6.4 Job Manning Requirements

6.4.1 Minimum Requirement

Electrical work shall never be performed alone. The minimum manning requirement for electrical work is two technicians. One technician is required to be a Level 2 Qualified technician, while the second technician must have completed Basic Safety.

The requirement above does not apply to equipment which has been placed in an electrically safe work condition.

6.4.2 Requirement for a Standby Person

A standby person shall be required for the following electrical work conditions:

a) Work on high-voltage equipment

b) Work requiring a Class 4 arc flash suit

c) Work requiring an Electrical Energized Work Permit

6.4.3 Duties of a Standby Person

a) The primary responsibility of the Standby Person is to remain out of harm's way and to initiate the Emergency Response Plan in case of an electrical incident.

b) The Standby Person shall have no other duties.

c) The Standby Person shall not observe the electrical work being performed.

d) The Standby Person shall be a technician who has completed Basic Safety and has a current Cardio-Pulmonary Resuscitation (CPR) certification.

e) The Standby Person shall remain outside of the Arc Flash Boundary and the Limited Approach Boundary for the duration of the work.

f) The Standby Person shall participate in the Job Safety Analysis and shall be fully briefed on the specifics of the job.

g) The Standby Person shall be given an insulated rescue hook.

h) The Standby Person shall have a reliable means to immediately initiate the Emergency Response Plan, either by radio or cell phone.

i) One Standby Person is sufficient for work both uptower and downtower, provided two rescue hooks are staged before the start of the job. However, the Standby Person cannot be used for simultaneous jobs in more than one turbine.

j) In the event of an incident, the Standby Person shall:

- Initiate the Emergency Response Plan
- Assist walking workers in exiting the tower
- Assist conscious workers in administering first aid
- Not approach an unconscious victim, but may use an insulated rescue hook to remove the victim from potentially energized gear.
- Administer CPR to unconscious victims after they have been removed from potentially energized gear.

6.4.4 Requirement for Two Qualified Technicians

a) Two Level 2 qualified technicians shall be required to ground the high-voltage transformer.

b) Two qualified technicians shall be required to perform work under an Electrical Energized Work Permit. At least one shall be a Level 3 Qualified Technician.

c) Two qualified technicians shall be required to perform troubleshooting work. At least one shall be a Level 3 Qualified Technician.

6.4.5 Working Under the Instruction of a Qualified Technician

a) A technician who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who

is under the direct supervision of a qualified technician shall be considered to be a qualified technician for the performance of those duties.

b) A technician working under instruction shall not be considered the Standby Person.

6.5 Basic Electrical Work Practices

6.5.1 Safe Work Approach

a) In accordance with the Safe Work Approach program a Job Safety Analysis (JSA) will be conducted prior to performing electrical work. If determined during the JSA that there is no safe work instruction, technicians are not familiar with the safety hazards, or there is a high risk situation, the technician must prepare a Pre-Task Plan (PTP). The PTP must be approved by the site management or his/her designated delegate. In any event all safety concerns shall be mitigated prior to commencing the task.

b) Knowledge in the specifics of the Job Safety Analysis in itself does not make an employee qualified to work on or near energized or potentially energized exposed electrical parts. Work practices shall be established for each work area, which will include, at a minimum, the specific electrical safety concerns/activities referenced by the JSA. The content and quality of informal and formal field training (On-the-Job-Training or OJT) and classroom training, as well as, establishing levels of experience in electrical safe work practices, shall be consistent with the requirements of the Job Safety Analysis and the specific electrical hazard prevention of any operation being performed.

6.5.2 Alertness

Employees must remain alert at all times when working near exposed electrical parts or in situations where electrical hazards may exist. If alertness appears to be recognizably impaired due to illness, fatigue, or other reasons, that employee is not permitted to work on or near areas containing electrical hazards.

6.5.3 Blind Reaching

Employees must never reach blindly into areas that may contain live circuits.

6.5.4 Illumination

Employees shall not enter the area containing exposed electrical circuits unless adequate illumination is provided. Employees shall not penetrate the Limited Approach Boundary of any piece of equipment containing exposed electrical circuits unless adequate illumination is provided to light the inside of the equipment. This illumination may be in the form of existing lighting, droplights or temporary lighting. When obstructions or lack of illumination prevent proper visibility, the employee is not permitted to perform the task if there is a possibility that exposed parts may be contacted.

6.5.5 Return to work

Qualified workers who leave a worksite unattended must perform a voltage check upon returning to the worksite prior to resuming work.

6.5.6 Body Positioning

a) The worker shall consider how to position his or her body to minimize the chance of incidental contact with exposed energized conductors. The worker shall always position his or her body in such a way as to prevent slipping, tripping or falling into energized equipment.

b) The worker shall not bend over at the waist to perform electrical work, as this could lead to falling into energized gear. Instead, the worker shall get down on the knees at some distance away from the cabinet, then approach the cabinet to perform the work from a kneeling or sitting position.

c) When accessing a cabinet above the worker's eye level, the worker shall use an approved fiberglass step-stool or step-ladder to provide adequate access. Non-approved items such as toolboxes, buckets, or miscellaneous parts are not allowed for access to electrical equipment.

d) When operating a load-rated switch, circuit breaker, or other device specifically designed as a means for a disconnect the worker should also consider his or her body position. The worker should position his or her body to the side of the circuit breaker to minimize the exposure to the body should an arc blast occur during the operation.

e) Doors, hinged panels, and the like shall be secured to prevent their swinging into an employee and causing the employee to contact exposed energized electrical conductors or circuit parts.

6.5.7 Handling of tools

a) A tool often slips when force is applied. When a tool slips, the worker who is providing the force cannot stop the tool (and his or her hand) from moving in an unintended direction. When selecting a body position, the worker should consider what his or her hand would contact if the tool should slip.

b) Conductive materials, tools, and equipment that are in contact with any part of an employee's body shall be handled in a manner that prevents accidental contact with energized electrical conductors or circuit parts. Such materials and equipment include, but are not limited to, long conductive objects, such as ducts, pipes and tubes, conductive hose and rope, metal-lined rules and scales, steel tapes, pulling lines, metal scaffold parts, structural members, and chains.

6.5.8 Cabinet Enclosures

a) All electrical cabinet covers shall be closed and fully bolted or latched when not opened for inspection or work.

b) When temporary cables are required to be placed through a cover opening, the cabinet shall be treated as if it were opened. All electrical approach boundaries and PPE requirements shall be in effect.

6.5.9 Housekeeping

a) Cleaning inside electrical cabinets shall not be performed unless the cabinet has been placed in an electrically safe work condition.

b) Personnel performing cleaning around the exterior of cabinets that have not been placed in an electrically safe work condition shall be mindful to prevent foreign debris, sprays and dusts from entering the cabinet.

c) Flammable materials shall not be left around energized electrical equipment. Where flammable materials are used, they shall be removed from the nacelle prior to energizing any electrical equipment.

d) Combustible materials shall not be stored around electrical equipment. Oily rags shall be removed each time workers leave the turbine.

6.5.10 Deranged Equipment

a) Whenever a piece of electrical equipment has been subjected to a severe electrical failure, it is considered deranged equipment until its electrical integrity can be verified by testing and inspection. The normal means of de-energization may not be sufficient. Indications of severe electrical failure include but are not limited to:

- Smoke, charring or fire
- Arcing, arc flash or arc blast
- Severe physical damage or deformation
- Report of sparking
- Report of electric shock

b) Determining if equipment is deranged is a judgment call. Employees should err on the side of caution. Deranged equipment must be treated with more caution than equipment in normal operating condition. Normal LOTO and deenergization procedures may not be sufficient to provide adequate safety.

c) Prior to beginning work on deranged equipment, a Pre-Task Plan (PTP) must be conducted with a Level 3 Qualified Technician.

d) Any work will begin with extensive voltage tests that include testing of the cabinet external casing and other normally grounded metal surfaces.

6.5.11 Operation of Disconnecting Means

a) Routine Operation

Only load-rated switches, circuit breakers, or other devices specifically designed as disconnecting means shall be used for the opening, reversing, or closing of circuits under load conditions. Cable connectors not of the load-break type, fuses, terminal lugs, and cable splice connections shall not be permitted to be used for such purposes, except in an emergency.

b) Reclosing Circuits After Protective Device Operation

After a circuit is deenergized by a circuit protective device, the circuit shall not be manually reenergized until it has been determined that the equipment and circuit can be safely energized. The repetitive manual reclosing of circuit breakers or reenergizing circuits through replaced fuses shall be prohibited. When it is determined from the design of the circuit and the overcurrent devices involved that the automatic operation of a device was caused by an overload rather than a fault condition, examination of the circuit or connected equipment shall not be required before the circuit is reenergized.

c) Remote Operating Switching Units

Where available, a remote operating switching unit shall be used to open or close an electrical disconnect.

Where the available arc flash energy is calculated to be greater than 40 cal/cm^2 at the working distance required for manual switching, a remote operating switching unit shall be used to open or close an electrical disconnect. If a remote operating switching unit is not available, then another isolation point must be identified to allow a worker to perform the disconnect safely.

6.5.12 Visual Inspection

There is often a requirement to visually inspect energized gear without performing any work. The following guidelines summarize the requirements for visual inspection.

Energized electrical equipment may be visually inspected without placing it in an electrically safe work condition under the following conditions:

a) The exposed energized circuits are not more than 1000 Volts.

b) *Cover panels are hinged or can be removed without risking breaking the plane of the* opening.

c) The equipment is not deranged.

d) Only Level 2 qualified technicians, qualified supervisors, or qualified engineers may perform the visual inspection.

e) Non-qualified personnel must stay at distance no less than 10 feet.

f) The worker must wear the arc flash PPE required by the cabinet label.

g) *The worker must wear Class 0 (1000 V) voltage gloves.*

h) No part of any tool or body may enter:

- For circuits less than 300 Volts: do not cross the plane of the opening.
- For circuits 300-1000 Volts: do not enter the Restricted Approach Boundary.

i) The worker must position his/her body in such a way as to preclude inadvertent movement that would break the plane of the opening or the Restricted Approach Boundary.

j) An energized electrical work permit is not required for a visual inspection.

6.5.13 Overhead Energized Lines

a) Employees must maintain a minimum 11 foot distance from energized overhead lines with any body part, a conductive material, a tool, or piece of equipment unless qualified to perform the work.

b) If contact with energized overhead lines is possible, the lines should be deenergized. These precautions must be taken before work in the area begins.

c) If the lines cannot be deenergized, employees must maintain a safe distance from the *conductors. Employees working in elevated positions must avoid contact with energized* conductors, unless they are qualified, protected, and authorized to do so.

6.6 Electrical Troubleshooting

6.6.1 Definition

Electrical troubleshooting is the process of fault isolation by working within the Limited Approach Boundary of an energized circuit.

6.6.2 Troubleshooting includes:

a) Voltage measurement

b) Current measurement

c) Operation of circuit breakers or disconnects

d) Operation of automatic control devices though interaction with the turbine processor

6.6.3 **Troubleshooting does not include:**

a) Component replacement

b) Scheduled equipment testing & maintenance

c) Installation of wire jumpers

d) Manual operation of motor contactors

e) Disconnecting a wire from its termination point

6.6.4 **Component replacement**

When the troubleshooting process indicates that one of the tasks in 6.6.3 needs to be performed, then the circuit must be placed in an electrically safe work condition. Once the component is replaced or the circuit is modified, the circuit can be reenergized and troubleshooting can resume.

6.7 Energized Electrical Work Permit

6.7.1 **Where Required**

When working on energized electrical conductors or circuit parts that are not placed in an electrically safe work condition (i.e., for the reasons of increased or additional hazards or infeasibility per 6.1.2), work to be performed shall be considered energized electrical work and shall be performed by written permit only.

6.7.2 **Elements of Work Permit**

The energized electrical work permit shall include, but not be limited to, the following items:

a) A description of the circuit and equipment to be worked on and their location

b) Justification for why the work must be performed in an energized condition

c) A description of the safe work practices to be employed

d) Results of the shock hazard analysis

e) Determination of shock protection boundaries

f) Results of the arc flash hazard analysis

g) The arc flash protection boundary

h) The necessary personal protective equipment to safely perform the assigned task

i) Means employed to restrict the access of unqualified persons from the work area

j) Evidence of completion of a job briefing, including a discussion of any job-specific hazards

k) Energized work approval (authorizing or responsible management, safety officer, or owner, etc.) signature(s)

6.7.3 **Authority**

a) The Energized Electrical Work Permit must be completed by a Level 3 Qualified Technician.

b) The Energized Electrical Work Permit must be reviewed and approved by the Energy Control Coordinator.

c) Permission to perform work under an Energized Electrical Work Permit must be granted by the Vestas Offsite Manager.

6.7.4 Form

The form for the Energized Electrical Work Permit is including in Appendix A.

7. Special Tasks

7.1 Infrared inspections

All infrared scans are performed with equipment and/or systems in an energized state due to load current requirements in order to have a successful scan.

7.1.1 Work Distance

During an infrared scan no employee or contractor will break the Restricted Approach Boundary of the electrical equipment that has the doors open or covers removed.

7.1.2 Employee Clothing Requirement

Employees shall wear the personal protective clothing specified by the Flash Hazard Label on the piece of equipment.

7.1.3 Permissions

a) Infrared inspections on low-voltage equipment shall follow the requirements of Visual Inspection in section 6.5.12.

b) Infrared inspections on high-voltage equipment shall require an Energized Electrical Work Permit per section 6.7.

7.2 Portable generator connection and operation

7.2.1 When portable generators will be used, the Energy Control Coordinator shall coordinate with the customer and all contractors to ensure that everyone knows of the possibility of electrical backfeed.

7.2.2 A LOTO Procedure shall be established in accordance with the VAME LOTO Program (HSE073) to prevent electrical backfeed prior to wiring in the portable generator.

7.2.3 The Energy Control Coordinator shall review all existing LOTO Procedures and verify that they are adequate and take into consideration the possibility of electrical backfeed. Rated ground straps shall be installed where required by 6.2.3b) .

7.2.4 Equipment powered from a portable generator rated at less than 600 Volts, 200 kVA, shall be treated as having the potential of a Class 0 arc flash (< 1.2 cal/cm^2). When required to install a larger portable generator, contact the VAME Electrical Engineering department for assistance in determining the required arc flash PPE.

7.2.5 The portable generator wires must be completely removed from the turbine prior to allowing restoration of normal grid power to the turbine.

8. Arc Flash Hazard Analysis

8.1 General

8.1.1 Description of an Arc Flash

Arc flash hazards are present in Vestas wind turbines. An arc flash event presents a dangerous, potentially fatal or life-altering hazard to the technician in three distinct ways:

a) An arc can produce enough flash energy to ignite clothing, burn skin and cause permanent eye damage. The flash is powerful enough to penetrate standard clothing and burn the skin directly. Arc flashes with an incident energy above 1.2 cal/cm^2 will cause a second-degree burn to unprotected skin. When the clothing ignites, the fire continues to burn the victim. Synthetic fabrics such as polypropylene, fleece and acrylics will melt into the skin and significantly aggravate the burn injuries.

b) The arc can produce extremely high temperatures (35,000 degrees F) that vaporize the electrical components. Copper busbar expands over 67,000 times in volume as it transitions from a solid to a gas. This can result in a blast force that propels the technician against obstacles in the background.

c) The blast can also release a burning cloud of copper fragments and smoke. The technician can inhale the cloud, resulting in severe throat and lung injuries. The blast also releases high-velocity projectiles that can seriously injure or kill the worker.

8.1.2 Causes of an Arc Flash

An arc flash is most often initiated by human interaction with electrical equipment. This includes switching a breaker, or performing a voltage test. Sometimes it could be as simple as a loose piece of hardware within the cabinet. As the cabinet is bumped, nudged or otherwise shaken, the hardware can fall onto the buswork and initiate a flash.

8.1.3 Other Hazards

It is important to remember that Vestas technicians are exposed to many hazards, including rotating machinery, confined spaces, physical exertion, fall from heights, and more. Arc flash is another hazard that needs to be addressed. However, at no point should arc flash concerns override other precautions that should be considered. Sound judgment, proper evaluation of hazards, and good work planning should always prevail.

8.2 What is an Arc Flash Hazard Analysis

The available arc flash energy is different from turbine to turbine, and from site to site. The arc flash energy is determined by performing an arc flash hazard analysis (AFHA). The analysis uses sophisticated computer software with turbine and grid specific parameters as inputs to calculate short circuit currents and tripping times.

The amount of arc flash energy available at the point of fault depends on several factors. Primarily, the energy is related to the available short-circuit current and the amount of time until the protective device interrupts the fault.

8.2.1 Short-Circuit Current

This is the maximum current supplied to the equipment under a fault condition. It is limited only by upstream system characteristics and is normally measured in thousands of amperes.

8.2.2 Arc Clearing Time

This is the total time from sensing the overcurrent to extinguishing the arc. Protective devices typically rely on an inverse-time sensing of current. This means that if the current is low enough, it will take longer to trip, and in some cases, the total released arc flash energy will be greater.

Where arc flash detectors are installed, this is the total time from sensing the arc to extinguishing the arc. The trip is instantaneous and does not have an inverse-time characteristic. The time to extinguish the arc is determined only by the reaction time of relays and the mechanical characteristic of the breakers.

In a low-voltage arcing fault, the arc impedance also limits the short-circuit current. The current may be low enough to delay the tripping of protective devices, resulting in a more severe arc flash. This can also happen at the far end of a wind farm, where long feeder lines contribute a significant amount of line resistance.

Changing the model or setting of an overcurrent protective device will have a direct effect on arc flash energies.

8.2.3 Expectation of an Arc Flash Hazard

a) Voltage Level

Arc flash energy is only partly dependent on system voltage. However, arc flash hazards are not expected on systems whose rated voltage is 240 VAC or less and that are supplied from a transformer rated at less than 125 KVA.

b) DC Circuits

Although DC circuits can be very energetic and sustain powerful arcs, current standards cannot calculate the arc flash energy related to DC faults. In wind turbines, DC circuits less than 110 VDC are not considered an arc flash hazard. Inverter system DC buses are accounted for in c) .

c) Inverter Systems

Turbine rotor current control systems contain power electronic circuits that operate at variable frequencies, currents and voltages that fall outside of the normal parameters *where arc flash calculations are useful.*

All power electronics cabinets used for rotor current control shall be marked for Class 2 arc flash PPE.

8.3 Requirements

8.3.1 Customer Responsibility

The AFHA must take into account the entire contribution from the collection grid. For this reason, the AFHA will be performed by the customer or the customer's preferred electrical engineering contractor. The AFHA report must be reviewed and approved by a licensed professional engineer with significant experience in electric power engineering.

8.3.2 VAME Engineering Responsibility

VAME shall provide an Arc Flash Information Packet (AFIP) to the customer in order to accurately model the turbine for the AFHA. The AFIP shall be prepared by the VAME Electrical Engineering department.

8.4 Review and Approval

8.4.1 Once the AFHA is complete, the customer shall submit a report to the VAME Electrical Engineering group. The VAME Electrical Safety Engineer will review the report and interact as necessary with the author of the report to resolve any issues.

8.4.2 The Electrical Safety Engineer cannot approve the report as he or she does not have the required site information. However, the Electrical Safety Engineer shall verify that the results are consistent with expectations and that anomalies are corrected or satisfactorily explained.

8.4.3 Once the AFHA has been reviewed and determined satisfactory, the Electrical Safety Engineer shall:

a) Keep a copy of the original AFHA for record keeping.

b) Transfer the cabinet PPE information to a master record of arc flash energies for each site.

c) Instruct the Technical Support department that a new AFHA has been documented.

8.4.4 The Technical Support department shall:

a) Use the data in the master record to print out arc flash labels for all cabinets and turbines at the site.

b) Create the necessary Work Order(s) in SAP to affix the arc flash labels on all the turbines at the site.

c) Communicate the results of the AFHA to the Site Manager and Energy Control Coordinator, or to the Project Manager for new construction sites.

8.4.5 **Arc Flash Energy Greater Than 40 Cal/cm^2**

a) Incident energies greater than 40 cal/cm^2 are classified "Dangerous". NFPA 70E has no clothing class for energies greater than 40 cal/cm^2. Any task on the electrical equipment is prohibited. In cases like this, it is recommended that the upstream electrical equipment be turned off before servicing the electrical equipment or modify the electric equipment in order to reduce the incident range so that the equipment can be safely serviced.

b) If the AFHA shows that any turbine cabinet has an arc flash energy greater than 40 cal/cm^2, VAME shall contact the customer and determine a course of action. The site manager shall be notified and no electrical work shall be performed on that equipment. Procedures shall be developed to safely work around the issue in the short term. In the long term, VAME shall work with the customer to reduce the arc flash energy to below 40 cal/cm^2.

8.5 Labeling

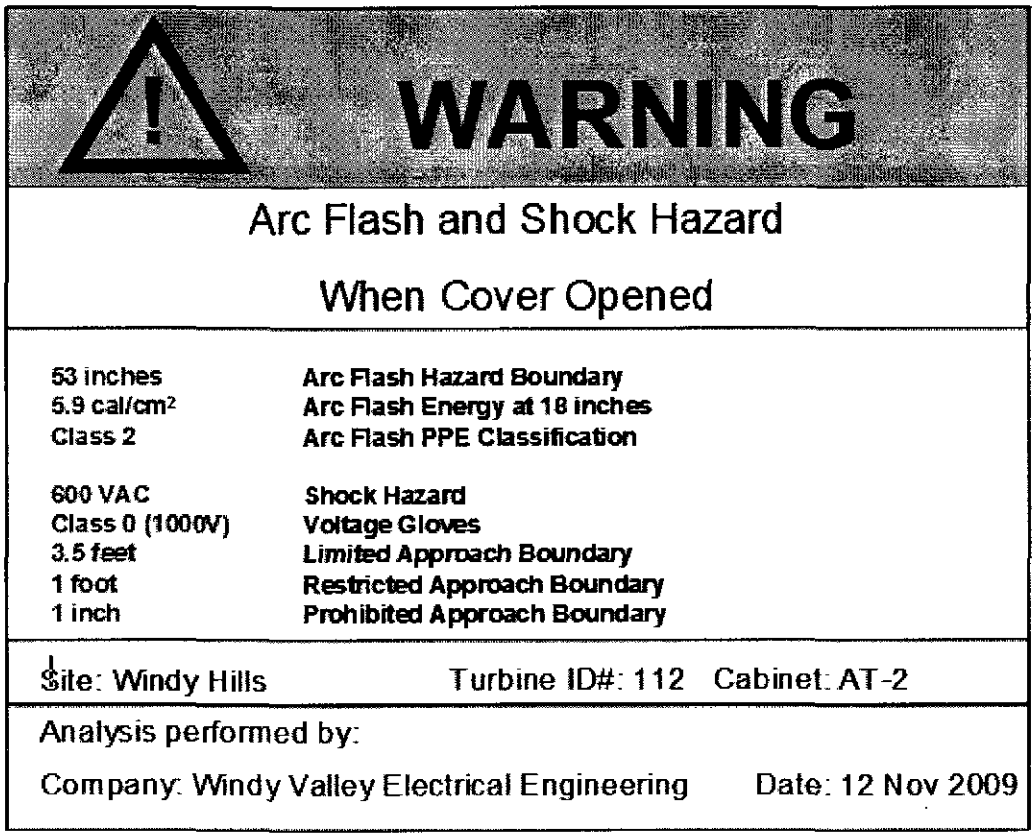
There are two Flash Hazard Labels used at VAME. The first is a Flash Hazard Label with a heading of "WARNING" (Figure 7.1) and the second is a Flash Hazard Label with a heading of "DANGER" (Figure 7.2).

8.5.1 **WARNING - Flash Hazard Label**

Employees or contractors shall follow the instructions and requirements on the Flash Hazard Label to protect themselves from electrical hazards.

Figure 8.5.1

Example of a Flash Hazard WARNING Label

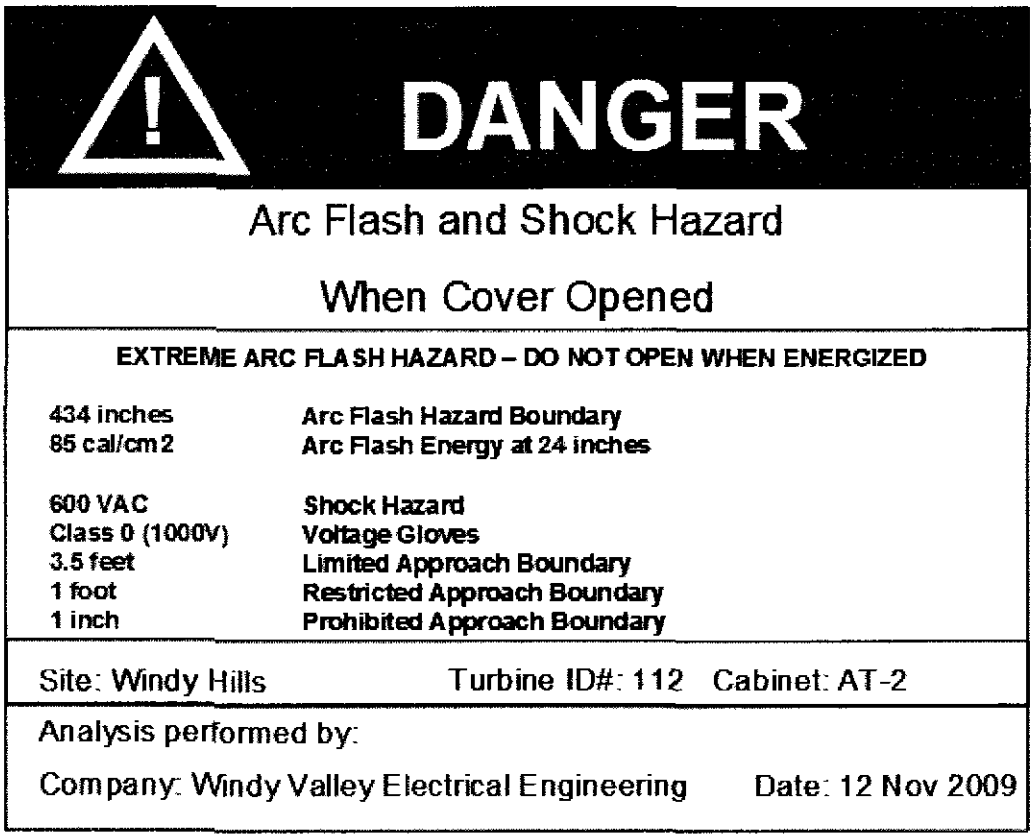


8.5.2 DANGER - Flash Hazard Label

Employees or contractors shall NOT perform any task on these pieces of equipment due to fact that the arc flash energy level exceeds 40 cal/cm^2.

Figure 8.5.2

Example of a Flash Hazard DANGER Label



8.6 Periodicity

8.6.1 The AFHA shall be renewed every five years to account for changes in the grid configuration and advances in standards.

8.6.2 Additionally, the AFHA shall be renewed every time the basic assumptions for the study are modified, including:

a) Phased expansion to the wind farm

b) Wind turbine generator replacement with different generator parameters

c) Change to overcurrent protective device settings

d) Transformer replacement with different impedance or power rating

e) Any other change in the collection grid which may impact the results of the arc flash study.

9. Tools

9.1 Test Instruments

9.1.1 General

a) Test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors shall be visually inspected before each use for external defects and damage.

b) If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service, and no employee may use it until necessary repairs and tests to render the equipment safe have been completed.

c) Test instruments and equipment and their accessories shall be rated for the circuits and equipment to which they will be connected.

9.1.2 Voltage Meters

a) A voltage meter is a device which physically contacts the circuit to measure voltage. This is also called a contact voltage meter.

b) Voltage meters shall be voltage-rated for the circuits and equipment to which they will be connected.

c) The minimum IEC 61010-1 Measurement Category for all voltage meters is Category III at 1000V, Category IV at 600V.

d) Voltage meters shall be listed with UL and CSA.

e) Voltage meters shall be calibrated biannually by a certified independent laboratory.

f) All voltage measuring tools will be visually inspected daily before use for the following:

- Valid calibration dates
- Integrity of test leads, cables, probes, and connectors, external defects/damage

If the voltage measuring tool shows defects or damage it shall be removed from service and no employee shall use it until repairs and tests necessary to render the equipment safe have been made.

9.1.3 Contact Voltage Detector

a) A contact voltage detector is a device which physically contacts the circuit to detect voltage. It does not provide a precise measurement of voltage, although in some cases it may indicate the nominal voltage level.

b) A contact voltage detector does not require periodic recalibration.

c) Contact voltage detectors shall be voltage-rated for the circuits and equipment to which they will be connected.

d) The minimum IEC 61010-1 Measurement Category for all contact voltage detectors is Category III at 1000V, Category IV at 600V.

e) Voltage detectors shall be listed with UL and CSA.

f) All contact voltage detectors will be visually inspected daily before use for the integrity of test leads, cables, probes, connectors, and external defects or damage. If the contact vol-

tage detector shows defects or damage it shall be removed from service and no employee shall use it until repairs and tests necessary to render the equipment safe have been made.

9.1.4 **Non-Contact Voltage Detector**

a) A non-contact voltage detector is a device which does not physically contact the circuit to measure voltage. Instead it detects the induced field in the proximity of an energized conductor.

b) Non-contact voltage detectors are required for use on high voltage circuits.

c) Non-contact voltage detectors are permitted to be used on low voltage circuits, but shall not be the means to verify deenergization for LOTO.

d) Non-contact high voltage detectors shall only be used by attaching the detector to a live line tool, so that the technician does not penetrate the Restricted Approach Boundary.

e) A non-contact voltage detector does not require periodic recalibration.

9.2 Live-line tool (Hot-stick/Shotgun)

9.2.1 A live-line tool is required for entering the Restricted Approach Boundary of any system rated above 1000V.

9.2.2 Live line tools shall be only used with rubber insulating gloves that are rated for the system voltage.

9.2.3 The clamp-type hot stick, also called a shotgun, shall be used to apply temporary personal protective grounds. Proper use of the shotgun requires practice.

9.2.4 Live line tools shall be inspected prior to use.

9.2.5 Live line tools shall be tested every two years unless an inspection determines a need.

9.3 Temporary Static Grounds

9.3.1 Purpose

The installation of Static Grounds at the work location protects employees from the following hazards:

a) Electrostatic Induction

A deenergized line may pick up a static charge from parallel energized circuits in the area. The amount of charge depends on such things as the length of the parallel, the distance between the lines, atmospheric condition, etc., and can reach values that are hazardous to employees.

b) Electromagnetic Induction

When a deenergized line parallels a line carrying either load or fault current, the deenergized line may have a voltage induced on it in the same manner as the secondary of a transformer.

9.3.2 Temporary Static Grounds shall not be used where Temporary Personal Protective Grounds are required.

9.3.3 Rating of Temporary Static Grounds

a) Temporary Static Grounds do not need to be sized to carry the maximum fault current that could appear at the point of grounding for the time necessary to clear the fault. However, static grounds must meet all other requirements of personal protective grounds.

b) Temporary Static grounds shall be constructed of #6 stranded copper insulated cable, colored green and yellow, with booted clamp connections. They shall be permanently marked with "Temporary Static Ground" on the ground lead.

9.4 Temporary Personal Protective Grounds

9.4.1 Purpose

The installation of Temporary Personal Protective Grounds at the work location protects employees from the following hazards:

a) Accidental closing

Although all potential feeds for a deenergized circuit are required to be visibly open and tagged out prior to the commencement of work, the possibility of someone inadvertently energizing the circuit still remains.

b) Accidental Contact

A deenergized circuit could come in contact with another energized circuit or the deenergized circuit could be energized through human error.

c) Equipment Failure

The insulation of the switching devices opened to de-energize the circuit could either break down or track over, and energize the line on which work is being done.

d) Backfeed

In addition to the primary sources, there are several secondary sources that can cause current to flow in a deenergized circuit. Some examples of these sources include parallel transformers, instrument transformers, metering installations and auxiliary generators.

9.4.2 **Requirements of Temporary Personal Protective Grounds**

When a worker comes into contact with a grounded line, the worker is in parallel with the protective grounds. The voltage the worker would be exposed to should the line/equipment become energized would depend on the resistance of the protective grounds and the distance between the grounds and the worker. For proper protection, protective grounds must fulfill the following requirements:

a) Low Resistance

Personal Protective Grounds must conduct virtually all fault current and provide low enough resistance to cause all protective devices to operate in a timely manner. In order to facilitate this, protective grounds need:

- Clean connections
- Tight connections
- Adequate capacity to clear the fault current in the circuit

b) Inspection and Testing

Protective grounds and grounding equipment shall be inspected and tested at least annually. In addition, protective grounds shall be given a visual inspection before each use.

c) Connection at Proper Points

The resistance of the conductors and the earth between the work location and the grounds are part of the total resistance of the protective grounding circuit. For this reason, grounds should be placed at the work location, if possible. This is known as "single point grounding" and this method is the most effective method of protective grounding. When a grounded neutral conductor is available, it should be connected to the protective grounding circuit.

9.4.3 Movement of Personal Protective Grounds

The electric fields produced when large currents flow through grounding cables will cause the cables to whip violently. For this reason, grounding cables should be kept as short as possible and placed such that workers are not injured should whipping of cables occur.

9.4.4 Applying Personal Protective Grounds

a) All grounding clamps shall be placed on conductors rated 1000V or less with approved rubber insulating gloves.

b) All grounding clamps shall be placed on primary conductors rated over 1000V with approved rubber insulating gloves and approved company standard live-line tool.

c) Only approved grounding cables and clamps shall be used for personal protective grounding.

d) Before applying grounds to any conductor, the conductor must be tested for the absence of voltage with an approved tester, to verify the conductor is in fact deenergized. The function of the tester should also be verified before and after each voltage test for circuit voltages greater than 1000 volts.

e) The surfaces of all grounding connections must be cleaned at the point where ground clamps are to be applied.

f) For most locations, a ball type connection with a protective rubber boot has been installed at the line and ground point.

g) On structures, special grounding clamps that can be attached to angle iron are required.

h) Some structures are equipped with grounding pads. In these cases, the normal grounding clamp must be removed and the cable attached to the via a bolted connection.

i) Grounding clamps shall not be installed over cable termination paddles.

j) When applying Personal Protective Grounds to deenergized equipment, the grounding cables shall be connected to the ground before being brought near the conductor that is to be grounded.

k) All grounding connections should be made so they do not interfere with the work.

l) Personal Protective Grounds should be carefully laid out, and if necessary, tied securely so as not to present a hazard to the workers.

m) Workers should avoid standing near earth grounds, to which protective grounding systems are attached.

n) Personal Protective Grounds shall never be installed in series with a fuse or switch.

o) When removing grounds, the grounding cable to each conductor shall be first removed before the ground connection point is removed.

9.4.5 Rating of Personal Protective Grounds

a) Personal Protective Grounds shall be rated in accordance with ASTM F 855-09 or EN/IEC 61230:2008.

b) Personal Protective Grounds shall be of sufficient size to carry the maximum fault current that could appear at the point of grounding for the time necessary to clear the fault.

9.5 Voltage-Rated Hand Tools

When working within the Restricted Approach Boundary of exposed energized conductors or electrical parts, workers shall only use voltage-rated hand tools.

9.5.1 General

a) The term "voltage-rated hand tools" refers to both insulated and insulating hand tools.

b) Insulated hand tools are constructed from conductive material or components and have electrical insulation applied on the exterior surface.

c) Insulating hand tools are constructed from nonconductive material. Insulating hand tools might have metal or other conductive inserts for reinforcement but, essentially, the tool must be constructed of nonconductive material.

d) Voltage-rated hand tools are not intended to serve as primary protection from shock or electrocution. Although insulated hand tools might provide adequate shock protection for circuits below 1000 VAC, workers must select and wear PPE that provides protection from shock and arc flash without considering the hand tool rating. Although insulated and insulating hand tools include insulation from electrical sources of up to 1000 VAC, the primary function of the insulation is to reduce the risk of initiating an arcing fault.

e) The insulating coating of insulated hand tools may consist of a single layer, but normally it consists of two layers of contrasting colors. The interior layer provides 100 percent protection from shock to the full rating of the tool. The contrasting color of the exterior layer provides a method for inspecting the tool for damage.

9.5.2 Requirements

a) Any cut or abrasion that exposes any of the inner layers constitutes significant damage and suggests that the tool shall not be used. The damaged tool should be replaced with a new tool.

b) Workers shall visually inspect each voltage-rated tool before each use. If the interior layer is visible, the tool shall be discarded.

c) The manufacturer must mark voltage-rated hand tools as follows:

- Manufacturer's name or trademark
- Type or product reference
- Double triangle symbol (International 1000 V symbol)
- The marking "1000 V"

- Year of manufacture

d) Only hand tools that meet the requirements of ASTM F1505 shall be purchased. A storage toolbox shall be purchased with the tools. The tools shall be kept in the storage toolbox when not in use. The toolbox, with the tools, shall be stored in a location that is clean and dry.

9.6 Portable power tools

9.6.1 Portable power tools shall be properly stored when not in use.

9.6.2 Power tools shall never be suspended by the cord.

9.6.3 Electrical power tools shall be visually inspected before each day's use for external defects, such as deformed or missing pins or insulation damage, and for indications of possible internal damage.

9.6.4 Ground prongs shall not be removed. Power tools whose ground prong is found to have been removed shall not be used.

9.6.5 Tools found damaged or defective, shall be tagged "out-of-service," by the user and not used until repaired and tested in accordance with the manufactures recommendations.

9.6.6 Electrical portable power tools (except for battery-powered or double-insulated types) shall be grounded by a grounding conductor, which is contained within the same cable or cord as the circuit conductors.

9.6.7 When used outside or in wet and damp location, or when the user is well grounded, portable electric power tools shall be connected to ground-fault circuit interrupters (GFCI's).

9.6.8 Tools shall be cleaned and maintained in accordance with the manufacturer's instructions.

9.6.9 **Equipment Assured Grounding Program**

All grounded portable electrical power tools shall be:

a) Tested in accordance with manufacturers recommendation before initial use after purchase and annually thereafter.

b) Tested before being returned to service following any repairs.

c) Tested before being returned to service after any incident that can reasonably be suspected to have caused damage.

d) Have a label placed on the male end to identify the test date and name of the technician performing the test.

e) The following tests shall be performed on all grounded portable electric power tools:

- All grounded conductors shall be tested for continuity.
- Insulation resistance test on all conductors, minimum 1.0 megaohms.

9.7 Extension Cords

Extension Cords shall be inspected before each day's use by the employee utilizing the extension cord. This inspection will include the jacket and the ground pin.

9.7.1 **All extension cords shall be:**

a) Tested before being returned to service following any manufacturer recommended repairs.

b) Tested before being returned to service after any incident that can reasonably be suspected to have caused damage.

9.7.2 **The following tests shall be performed on all extension cords:**

a) All grounded conductors shall be tested for continuity.

b) Insulation resistance test on all conductors, minimum 1.0 megohms.

c) Both tests shall be performed using an approved multimeter. The insulation resistance test shall not exceed the voltage rating of the wires in the cord.

9.7.3 Extension Cords shall not to be used in wet locations unless designed for the purpose or GFCI protected.

9.7.4 Ground prongs shall not be removed. Extension cords whose ground prong is found to have been removed shall not be used.

9.7.5 Extension Cords connected to equipment may not be used for raising or lowering the equipment.

9.7.6 Extension Cords may not be fastened with staples or otherwise hung in such a fashion that could damage the outer jacket or insulation.

9.7.7 Adapters that interrupt the continuity of the equipment grounding connection may not be used.

9.7.8 Employees' hands must not be wet when plugging and unplugging extension cords and cord-and-plug connected equipment if energized equipment is involved.

9.8 Fiberglass Ladders

9.8.1 Only fiberglass portable ladders shall be used in wind turbines.

9.8.2 Fiberglass ladders shall be duty rated to at least Type 1 (250 pounds) according to the ANSI A14.5-2000 standard for fiberglass ladders. Where the combined weight of the person using the ladder and tools or equipment exceeds 250 pounds a higher duty rating shall be used (Type 1A – 300 pounds or Type 1AA – 375 pounds).

9.8.3 Fiberglass ladders shall be inspected before each day's use by the employee utilizing the ladder.

9.8.4 Fiberglass ladders found damaged or defective, shall be tagged "out-of-service," reported to the immediate manager and not used until repaired.

10. Appendix A – VAME Energized Electrical Work Permit

Site Location/Name: _____ Turbine/Pad Location: _____

PART 1: TO BE COMPLETED BY THE REQUESTER

(1) **Description of Circuit /Equipment/Job Location:**

_____

(2) **Description of work to be done:**

_____

(3) **Justification for why the work must be performed in an energized condition:**

_____

_____

_____ _____

Requester/Title Date

PART 2: TO BE COMPLETED BY ELECTRICALLY QUALIFIED PERSON DOING THE WORK

(4) **Detailed job procedure to be used in performing the above work:**

_____

_____

(5) Results of the Shock Hazard Analysis:

a. Highest voltage to be tested de-energized: _____
b. Highest voltage to be worked on energized: _____
c. Other voltages within workspace: _____
d. Explain why this job has to be completed on energized equipment.

_____

_____

(6) Determination of Shock Protection Boundaries:

a. Prohibited Approach Boundary: ____ feet ____ inches
b. Restricted Approach Boundary: ____ feet ____ inches
c. Limited Approach Boundary: ____ feet ____ inches

(7) Results of Flash Hazard Analysis:

a. Maximum exposure level: ____ cal/cm^2 at ____ inches
b. Arc Flash Boundary (> 1.2 cal/cm^2): ____ feet ____ inches

VAME Energized Electrical Work Permit

(8) Necessary PPE to safely perform the task: (check all that apply)

☐	Voltage gloves, Class 0, w/leather outers	☐	Voltage gloves, Class 4, w/leather outers
☐	Safety Glasses	☐	FR Clothing, Class 0
☐	FR Clothing, Class 2	☐	FR Clothing, Class 4
☐	Arc-rated flash hood, Class 2	☐	Arc-rated flash hood, Class 4
☐	Class E Hard Hat	☐	Leather Safety Shoes
☐	Voltage-rated tools	☐	Hearing protection
☐	Voltage-rated blanket	☐	Barricade

(9) Means employed to restrict the access of unqualified persons from the work area:

a. Caution Tape Barricade ☐
   Minimum boundary distance: ____ feet ____ inches
b. Standby Person(s) Name: _____ ☐
c. Standby Person(s) Qual level: _____ ☐
d. Standby Person briefed on job tasks and Emergency Response Plan ☐
e. JSA/PTP complete ☐

Qualified Workers	Date	Qualified Workers	Date
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Standby Person: I have been briefed on the work tasks for this Energized Electrical Work Permit and I fully understand my role as the Standby Person.

_____ _____
Standby Person Date

PART 3: TO BE COMPLETED BY ENERGY CONTROL COORDINATOR

☐ JSA has been verified and completed ☐ PTP has been verified and completed

_____
Energy Control Coordinator ☐ Check if per phone conversation Date: _____

_____
Vestas Offsite Manager ☐ Check if per phone conversation Date: _____

*Completed form must be placed in turbine during work

*Form shall be retained by Energy Control Coordinator following job completion

11. Appendix B – VAME Electrical Safe Work Procedure Audit

VAME Electrical Safe Work Procedure Audit

Level * Qualification

Name of Auditor: _____ Date of Audit: _____

Name of worker to be audited: _____ Site Name: _____

Description of work task: _____

_____

Safe Work Procedure Questions:	Yes	No
1) Does this work require an Energized Work Permit?	☐	☐
1.a) If yes, was it completed correctly?	☐	☐
2) Is the worker qualified to perform this task?	☐	☐
3) Is the JSA filled out accurately and completely?	☐	☐
4) Have the hazards been identified correctly?	☐	☐
5) Is the worker wearing any prohibited articles or clothing?	☐	☐
6) Is the worker's PPE in satisfactory condition?	☐	☐
7) Have the worker's gloves been tested in the last 6 months?	☐	☐
8) Is the worker's equipment in satisfactory condition?	☐	☐
9) Has the worker's Voltage Tester been calibrated within the last year?	☐	☐
10) Has the proper PPE been selected?	☐	☐
11) Is the worker using the 3 point test method?	☐	☐
12) Has the equipment been locked out in accordance with VAME ESP?	☐	☐
13) Is there a written procedure for this task?	☐	☐
13.a) If yes, is the worker following the written procedure?	☐	☐

Qualification Questions:

1)

2)

3)

4)

5)

Comments: _____

_____

Signature of Auditor _____ DATE: _____

12. Appendix C - Training Level Matrix

This Training Level Matrix summarizes the levels outlined in both the VAME LOTO Program and the VAME Electrical Safety Manual.

Training Level	Persons	LOTO Program	Electrical Safety Program
Electrically Unqualified Workers			
Level 0	Escorted visitors	Affected Person Not authorized to perform lockout unless under direct supervision of an escort	General site orientation Not authorized to perform electrical work, or to enter within the Limited Approach Boundary or Arc Flash Boundary of any electrical system.
Level 1	Vestas personnel that are not technicians Approved contractors	Authorized Person Authorized to apply personal lockout locks to a system that has been locked out by a Qualified Person	Basic Safety / Electrical Safety for Non-Electrical Workers Not authorized to perform electrical work, or to enter within the Limited Approach Boundary or Arc Flash Boundary of any electrical system.
Electrically Qualified Workers			
Level 2	Vestas Technicians Approved electrical contractors	Qualified Person Authorized to place turbine equipment in a safe working condition, establishing a lockout, in accordance with a LOTO Procedure	Fundamentals / Electrical Safety for Qualified Workers Authorized to perform electrical work and to enter within the Limited Approach Boundary or Arc Flash Boundary of any electrical system for which they have been trained.
Level 3	Senior Vestas Technicians	LOTO Specialist Authorized to design equipment LOTO Procedures	Turbine Theory / Electrical Safety for Qualified Workers Authorized to perform complex electrical troubleshooting, interlock bypassing, and permit-required energized electrical work.

13. History of this Document

Rev. no.:	Date:	Description of changes
00	2009-Oct-22	New document (for reference only)
01	2009-Dec-22	Initial release
02	2010-May-07	Addition of Warning to Section 2.2
03	2010-Oct-01	Link updates in Sections 2.4 and 2.6

Vestas

Vestas Americas Fire Protection and Prevention

Contents

1. Purpose

To ensure that Vestas Americas maintains an Occupational Safety, Health and Environmental program that creates a safe work environment for Vestas Americas employees and others on Vestas Americas worksites, meets the needs of the communities in which we do business and is compliant with all applicable governmental regulations.

2. Scope

Vestas Americas – All locations

3. References

- OSHA 29 CFR Parts 1910 and 1926 (United States)
- Occupational Health and Safety Act, Regulation and Code (Canada)
- OHSAS 18001 Clause 4.2 Occupational Health & Safety Policy

4. General Requirements

4.1 The work environment must be assessed prior to beginning any work, noting the possibility of a fire occurring, the proximity of fire fighting equipment and safe escape routes in the event of fire.

4.2 The persons on the site must be instructed in fire procedures.

4.3 All fire-fighting equipment must be located so that it is easy to spot and easy to access. The equipment must be checked and maintained at scheduled intervals. The persons on the site must know the location of fire extinguishers.

4.4 An alarm system, e.g. the telephone (landline or mobile), radio calls, sirens, etc. must be established for alerting all employees on-site and the nearest local emergency services in the event of an emergency. Telephone numbers and reporting instructions must be conspicuously posted at phones and employee entrances and outlined by the respective site's Emergency Response Plan (DMS 0008-7901).

4.5 Occurrence of fires on the site must be prevented. The risk of fire can be limited when the guidelines listed below are followed.

- Compliance with the site-specific smoking rules.
- Oily rags should be stored in waste containers labeled for hazardous waste. Oily rags should not be discarded in ordinary rubbish bins or buckets.
- Minimize the use of flammable liquids.
- Internal combustion engine powered equipment (e.g. portable generators) must be placed in such a way that the exhaust is clear of any combustible materials.

5. Hot Work

5.1 Welding and torching is not allowed until approved by a regional safety specialist.

5.2 Before starting up hot works, the condition of the equipment must be inspected.

5.3 The proper personal protective equipment (PPE) for welding work must be worn.

5.4 The welding area must be well-ventilated and mechanical ventilation may be required.

5.5 A welding screen must be used when welding in the vicinity of any other person(s).

5.6 A fire watch must be employed if welding, burning, use of open flame torches or grinding is performed in an area where combustibles or flammables are present. The fire watch must be equipped with proper fire extinguishing equipment. Combustibles should be moved or carefully protected from sparks.

5.7 When welding outside, it is important to be especially aware of the wind, dry weeds, fuel tanks, etc.

6. Flammable Liquids

6.1 If flammable liquids are stored on-site, they must be stored in a secure area in approved packaging and be provided with a spill tray.

6.2 No other flammable liquid storage facilities (either mobile or stationary) may be installed at the site without prior approval from the site manager.

6.3 Access to mobile tankers on the site will only be given to vehicles that have been fitted with a suitably sized chemical spill kit.

6.4 In case of a flammable liquid spill or leakage, the spill must be contained immediately and the contaminated material disposed of in approved packaging and to an approved recipient. The defective tank(s) or container(s) must be flushed out and packaging must be safely disposed of.

7. Fire Protection and Prevention

7.1 Prior to beginning any work, assess your work environment, noting the possibility of a fire occurring, the proximity of firefighting equipment, and a safe escape route in the event of a fire.

7.2 All firefighting equipment shall be conspicuously located, shall be easily accessible, and will be inspected and maintained on a regularly scheduled basis.

7.3 Internal combustion engine powered equipment (e.g.: portable generators), shall be so situated that the exhausts are clear of any combustible materials.

7.4 Smoking is prohibited on site except in designated areas. Smoking is forbidden in any turbine.

7.5 Gasoline or other flammable liquids should never be used for cleaning. Use approved cleaning agents only.

7.6 Oily rags should be stored in an appropriate receptacle labeled for them. Do not discard OILY rags in regular rubbish bins.

7.7 A fire extinguisher rated 2A or better shall be provided for each 3,000 square feet of protected building area or major fraction thereof.

7.8 Travel distance from any point of the building to the nearest fire extinguisher shall not exceed 50 feet.

7.9 Fire extinguishers are to be inspected by a competent person monthly and annually by a certified inspector.

7.10 Fire extinguishers are to be unobstructed and readily accessible.

7.11 A fire extinguisher, rated not less than 10B, shall be provided within 50 feet of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used on the site (this requirement does not apply to motor vehicle fuel tanks). Fire extinguishers are also required to be up tower when working.

8. History of this Document

Rev. no.:	Date:	Description of changes
00	01-Jan-2010	New document

Vestas®

First Aid/CPR Procedures
Medical Emergencies

Contents

1. Purpose

Vestas Americas requires a First Aid procedure that is both site specific and general to address Vestas Americas emergency response procedures.

2. Scope

Vestas Americas – All locations

3. Definitions

Word	Definition
Blood	Human blood, saliva components, and products made from human blood, feces, and urine.
Blood-borne Pathogens	Pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, Hepatitis B Virus (HBV), Hepatitis C (HBC) and Human Immunodeficiency Virus (HIV).
Air-borne Pathogens	Infection causing micro organisms spread by droplets expelled into the air by coughing or sneezing. These pathogens include but are not limited to Tuberculosis (TB), German Measles (Rubella) and Influenza.
Contaminated	The presence of, or, the reasonably anticipated presence of, blood or other potentially infectious materials on an item or surface.
Decontamination	Use of physical or chemical means to remove, inactivate, or destroy blood-borne pathogens on a surface or item to a point where they are no longer capable of transmitting infectious particles. The surface or item is rendered safe for handling, use or disposal.
Universal Protections	The practice of specific methods of hygiene and control methods (such as the use of gloves, masks and other devices) to prevent the unintentional contact with the blood or bodily fluids of another person.

4. Regulatory References

4.1 OSHA 29 CFR 1910.1030

5. Appendices

5.1 A - First Aid Incident Log

6. General Requirements

6.1 Localization

6.1.1 In some cases, Vestas Americas has implemented a requirement that may exceed a state or provincial requirement. The higher level requirement in the Safety Manual will prevail.

6.1.2 In the event that a state or provincial requirement exceeds a Safety Manual procedure, the higher level requirement will prevail.

6.1.3 Complete the information on the First Aid Incident Log, Appendix A.

6.2 Emergency Response

6.2.1 Vestas Americas worksites shall implement the Emergency Response Plan (DMS# 0008-7901) that is both specific to the site and general to address Vestas emergency response procedures. It describes in general terms the major categories of an emergency, which are:

- Accidents, including automobile accidents that result in or could result in a serious injury or loss of life
- Major fire, or incidents where damage has occurred or threatens Company and / or public property
- Spill of chemicals

6.2.2 The Emergency Response Plan contains telephone numbers of appropriate state or provincial regulatory agencies for Vestas Americas personnel to contact in times of emergency.

6.2.3 This Safety Manual contains some general rules when dealing with emergencies; however, no list of rules can possibly cover every contingency. Use your training and refer to the Vestas Emergency Response Plan when dealing with any emergency for further assistance and direction.

6.2.4 Do not risk your safety or the safety of others at any time.

6.3 First Aid Kits and Supplies

6.3.1 Vestas shall provide first aid supplies and facilities as required under the various state and provincial Workers' Compensation Acts and OH&S Acts and Regulations.

6.3.2 The first aid kit requirements vary depending on the size and type of job and the number of workers.

6.3.3 Detailed requirements, including the contents of kits, are available in the various provincial Workplace Health and Safety legislation. A copy of these regulations and codes will be available at the field office for immediate and unrestricted access by workers.

6.3.4 First aid kits will be available at all work locations. For remote locations, additional kits may be stored in operators' vehicles. First aid kits in remote locations will be upgraded to recognize the severity of potential injuries on the worksite and the possibility of delay in arrival of medical assistance or transport.

6.3.5 First Aid kits should not contain any prescription or non-prescription drugs. The inclusion of symptom-relief medication(s) is beyond the scope of the state and provincial legislation. The routine inclusion of over-the-counter medication(s) in first aid kits is not recommended as there is no established benefit and there is a potential for problems. If an employer determines that it is necessary to provide over-the-counter medication(s) in a first aid kit, a physician should be asked to prepare a policy and procedure to cover their use.

6.3.6 Eyewash stations shall be available at all locations where chemicals and other controlled products are handled, stored, or transported. They will be checked at least monthly and their condition documented. If necessary, portable eyewash stations may be transported in workers' trucks to remote locations.

6.4 First Aid and CPR Training Requirements

6.4.1 All Vestas Americas field personnel are to maintain current certification in Standard First Aid and basic CPR. This will provide sufficient understanding to treat most minor injuries.

6.4.2 Contractors working for Vestas Americas should have a significant percentage of their personnel trained in Standard First Aid and CPR. The required number of trained first aid responders and related equipment on a project site is determined prior to job commencement.

6.5 Blood-Borne/Air-borne Pathogens Exposure

6.5.1 This exposure plan is established to protect occupationally exposed employees from hazards of blood-borne/air-borne pathogens, in particular Hepatitis B, Hepatitis C Virus, HIV, and TB.

6.5.2 The Health and Safety representative shall be responsible for the establishment, implementation, and maintenance of all aspects of this procedure. These procedures will be reviewed and updated in accordance with the regulations.

6.5.3 All Vestas Americas field personnel are provided with training in Universal Protections and Blood Borne Pathogens. This training may be included in the First Aid and CPR training or it may be completed as a separate topic.

6.5.4 Any employee who is exposed to the blood of an injured worker will:

- Immediately notify their supervisor of the exposure
- Thoroughly wash the affected area
- Request a Hepatitis shot from a local medical provider. An employee is not required (may refuse) to receive the Hepatitis shot. If the shot is provided, the cost is covered by Vestas Americas.

The exposure will be noted on the Incident Report Form (DMS# 0008-7917) and forwarded to the Safety Department (per the Incident Reporting Procedure (DMS# 0008-7912)).

7. Responsibilities

7.1 Vestas Americas Site Supervisor or Construction Manager

7.1.1 It is the responsibility of the Vestas supervisor in charge to ensure that:

- First aid requirements are determined
- First aid personnel, equipment and transportation are provided
- First aid personnel are suitably trained and experienced
- Injured Worker Transportation Plan is completed and reviewed with all affected workers and is available in all required locations
- For remote locations: Prior arrangements have been made with the providers of air evacuation services (helicopter or fixed wing), and
- Air evacuation providers are aware of the specific work locations or designated transfer points.

7.2 Subcontractors: US

7.2.1 The Subcontractor will designate in writing the name of at least one employee (for every ten employees).

7.2.2 Currently trained and certified in CPR/First Aid, through an approved program.

7.2.3 Training will be conducted and certified through EMP America, American Red Cross, or other recognized programs.

7.2.4 Proof of current training will be provided to Vestas – AWT.

7.2.5 For each additional ten employees, another employee will be designated in writing.

7.2.6 Refer to American Subcontractor Requirements (DMS 0008-6835).

7.3 Subcontractors: Canada

7.3.1 All subcontractors will designate in writing the names of employees currently trained and certified in CPR/First Aid, through an approved program.

7.3.2 Training will be conducted and certified through an accredited training provider which meets provincial requirements.

7.3.3 Proof of current training will be provided to Vestas – CWT.

7.3.4 The number of trained personnel must meet applicable provincial requirements.

7.3.5 Refer to Canadian Subcontractor Requirements (DMS 0008-7999).

8. Instructions

8.1 Aiding an injured worker

8.1.1 Immediately request assistance from the site office and/or the nearest co-worker.

8.1.2 Your job is to administer first aid and keep your patient as comfortable as possible while waiting for further help and transportation to a medical treatment facility.

8.1.3 If the patient is able to safely move with your assistance (without causing themselves additional injury) to a location where they can be attended by medical personnel, use your best judgement in doing so.

8.1.4 If this is not possible, have the patient stay where they are. Provide comfort and first aid until additional help arrives.

8.1.5 Unconscious patients: Unless the patient is in danger of sustaining additional injury, do not move them. Assess their condition and provide first aid and/or CPR as needed based on whether or not they are breathing.

8.1.6 If you discover an injured person who will likely die without your assistance, you are duty bound to assist to the best of your ability.

8.2 Contacting Emergency Assistance (911 or other emergency number from your Emergency Response Plan)

8.2.1 When contacting the hospital, medical aid station, or other medical provider, they will want the following information. The order in which you provide the information is important. By providing your name and contact number first, they can get back to you if contact is lost, or additional information is required:

- Contact name;
- Contact number, alternate number and/or radio frequency;
- Location, physical description, longitude/latitude, directions to location;
- Number of patients requiring transport;
- Age of patient(s);
- Condition and types of injury;
- Treatment already provided;
- Type of first aid/medical aid available on site;
- Type of transport requested; and
- Location of transfer point.

8.3 Transportation of an injured worker

8.3.1 A Vestas supervisor has the authority to make any arrangements necessary regarding treatment and transportation to sustain life in extenuating circumstances.

8.3.2 Unless the injury is very minor, it is recommended that injured employee be transported by medical transport.

8.3.3 In no case should employees drive themselves to a medical facility – they must be accompanied (driven) by another employee.

8.3.4 Certain jurisdictions, British Columbia being one, leave the decision as to when and how to transport in the hands of the first aid attendant who administers treatment. The attendant's, or more senior medical practitioner's, decision to transport takes precedence over any decision to the contrary by non-medical personnel.

8.3.5 The mode of transportation will be by ambulance in most emergency situations. However, in some circumstances, it may be necessary to transport the victim to the nearest medical aid facility by air.

8.3.6 In either event, call the nearest medical aid station and provide all of the necessary details. If the medical aid facility has access to the air ambulance services for both fixed wing and rotary aircraft, advise them according to your needs.

8.4 After the injured worker has been transported

8.4.1 Complete the Incident Report Form (DMS# 0008-7917), including all information related to the incident (per the Incident Reporting Procedure (DMS# 0008-7912)).

8.4.2 Notify all contacts on the on the Emergency Response Plan, based on the nature of the incident.

Appendix A

In Case of Accident, Injury, or Illness

NOTIFY YOUR SUPERVISOR IMMEDIATELY

SUPERVISOR WILL PERFORM THE FOLLOWING:

Determine the severity of injury or illness and the appropriate response.

Major medical issues (such as altered level of consciousness, severe bleeding, chest pains, seizures, and loss of breathing) require immediate medical intervention.
- **Call 9-911 for paramedics and ambulance**
- **Send someone to direct emergency response personnel to the appropriate area.**

Minor medical issues (such as sprains, strains, and minor cuts with controllable bleeding) require timely transport to a medical facility.
- **Notify medical facility and authorize treatment (see facilities below).**
- **Arrange for non-ambulance transport to the appropriate treatment facility.**

First Aid issues (such as paper cuts, splinters, and minor burns) require a qualified First Aid Provider (see below). The First Aid Provider treats the injury and completes First Aid Log below.

Monday – Friday, 7:00 am to 7:00 pm (Occupational Clinic) **Address & Phone:**	**All Other Times (Emergency Room)** **Address & Phone:**

Emergency First Aid Providers

Responder	Location/Shift	Extension	Direct Dial	Cell

First Aid Treatment Log

Name of Injured	Date	Type of Injury	1st Aid Provider	Supplies Used