1 Purpose

The purpose of this policy is to establish procedures for incorporating decontamination activities into the overall project plan. Decontamination of workers and equipment as part of hazardous waste activities at (Insert Company Name) requires consideration of worker health and safety, generation of additional waste and periodic equipment replacement. This procedure has been developed to minimize contamination, to prevent its spread and to decontaminate workers and equipment when they exit contamination areas.

2 Responsibilities

It is the responsibility of the (insert title) to ensure that decontamination procedures are incorporated into the Site Safety and Health Plan.

It is the responsibility of the (insert title) to ensure that decontamination of people, equipment and personal protective equipment is carried out in a manner to prevent the decontamination of clean areas.

It is the responsibility of the Site Safety and Health Officer to assist in the implementation of this procedure.

3 Policy Content

3.1 DECONTAMINATION PLAN

Contamination control and decontamination procedures depend on the:

- type and source of contaminants
- level of contamination
- severity of the hazards posed
- evaluation of worksite hazards
- job tasks to be performed

Contamination control and decontamination are crucial for protecting worker health and safety, the public and the environment during (Insert Company Name) hazardous waste activities. The specific processes must be outlined in the Site Specific Health and Safety Plan. The processes must be continually evaluated for effectiveness and modified to correct deficiencies and address changing conditions and activities at the worksite.

The decontamination plan outlined in the Site Specific Health and Safety Plan should contain the following:

- the number and layout of decontamination stations
- decontamination equipment needed
- appropriate decontamination methods
- procedures to prevent contamination of clean areas
- methods and procedures to minimize worker contact with contaminants during removal of PPE
- methods for disposing of clothing and equipment that are not completely decontaminated
- incompatible wastes requiring separate decontamination stations
- target level of decontamination

3.2 DECONTAMINATION METHODS

Selecting a Decontamination Method

(Insert Company Name) jobsites may contain radiological, as well as mixed and traditional chemical or biological wastes or both. To prevent the further generation of mixed wastes, decontamination methods must be carefully chosen and implemented. Consideration must be given to the following when selecting a decontamination method:

- ***Contact Time***: The longer a contaminant is in contact with an object, the greater the probability and extent of permeation. Minimizing contact time is one of the most important objectives of decontamination.
- ***Concentration***: As concentrations of contaminants increase, the potential for permeation of PPE increases.
- ***Temperature***: Temperature increases generally increase the contaminant permeation rate.
- ***Chemical Characteristics***: Permeation rates are dependent on the molecular or particulate size of the contaminant and on the pore space of the protective material. Chemical characteristics (e.g.,polarity, vapor pressure, pH) of both the contaminant and the protective material determine permeability.
- ***Physical state of contaminants***: Gases, vapors and low viscosity liquids tend to permeate more readily than high-viscosity liquids or solids.

Decontamination by Physical Means

Some contaminants that are encountered can be removed by physical means, such as:

- washing
- brushing
- scraping
- using sticky tape
- rinsing
- heating

These methods work by dislodging or displacing the contaminant. Caution should be used when using high pressure or heat because these methods can product aerosols or cause burns. Weather conditions should be considered when choosing physical decontamination methods.

Contaminants that can be physically removed fall into four major categories:

Loose Contaminants: Dusts and aerosols that cling to equipment and workers or become trapped in small openings can be removed with sticky tape, water or a liquid rinse. Coating clothing or equipment with antistatic solutions enhances removal of electrostatically attached material. Chemicals can be complexed and removed using specially designed vacuums equipped with high-efficiency particulate air (HEPA) filters and other system controls. Asbestos fibers can be removed using similar devices. In some cases, elemental mercury can be removed using special mercury vacuums.

Adhering Contaminants: Removal of these materials can be enhanced using solidification, freezing (ice or dry ice), adsorption or absorption (kitty litter or powdered lime) or melting with a low-energy heat source (hair dryer or heat lamp).

Adsorbed or Permeated Contaminants: In some cases, contaminant removal is not possible and the PPE, tools, instruments or other equipment has to be discarded as hazardous waste. Care in selecting PPE and in applying contamination prevention and control measures, along with timely and appropriate decontamination measures, often prevents this situation.

Volatile Liquids: Volatile liquid contaminants can be removed from protective clothing or equipment by evaporation followed by a water rinse. Using steam jets can enhance evaporation of volatile liquids. With any evaporation or vaporization process, care must be taken to prevent worker inhalation of vaporized chemicals.

A water washing and rinse should always follow physical decontamination.

Decontamination Using Solutions, Chemicals and Other Materials

For equipment, steam or hot water with detergent is the recommended method of decontamination. In some cases, a special solution or combination of solutions to decontaminate thoroughly may be needed. The Site Safety and Health Officer, in consultation with other professionals, should determine the safe and most effective means of decontamination solutions for special contaminants.

Cleaning solutions usually use one of the following methods:

Dissolving contaminants: Chemical removal of surface contaminants can be accomplishing by dissolving them in a solvent, such as, alcohol, ethers, ketones, aromatic, straight-chain alkanes and common petroleum products. Halogenated solvents should not be used as they are generally incompatible with PPE and are toxic. Care must be taken in selecting the solvent as some may be incompatible and damage the PPE or are flammable or potentially toxic.

Surfactants: Household detergents are the most common surfactants. Surfactants work by reducing the adhesion forces between the surface and the contaminant and prevent them from redepositing.

Solidification: Solidifying liquid or gel contaminants can enhance their physical removal. The mechanisms of solidification include:

- moisture removal through the use of adsorbents such as ground clay or powdered lime
- chemical reactions via polymerization catalysts and chemical reagents
- freezing using ice water

Rinsing: Rinsing removes contaminants through dilution, physical attraction and solubilization. Multiple rinses with clean solutions will remove more contaminants than a single rinse. Continuous rinses with large volumes of clean solutions should be used to effectively remove contaminants.

***Disinfection/Sterilization*:** Chemical disinfectants are a practical means of inactivating infectious agents. Standard sterilization techniques are not a practical means of disinfecting large equipment and for PPE. Therefore, disposable PPE is recommended for use with infectious agents.

3.3 EQUIPMENT AND PPE DECONTAMINATION

Physical and chemical decontamination methods may themselves be hazardous. Methods that permeate, degrade, damage or reduce PPE effectiveness are to be avoided. PPE, sampling instruments, tools and other equipment should be decontaminated by scrubbing with solutions of detergent and water, using soft-bristle brushes, followed by rinsing with water. This process may not remove all contaminants but it is safer then using harsh chemicals. The decontamination method that is the simplest method likely to be effective should be chosen first.

Contaminated equipment must be properly decontaminated before being removed from the site or, in the case of drilling tools, must be cleaned before the next use. Particular care should be given to tracks, tires, shovels, grapples, and scoops that come into direct contact with contaminants.

A thorough inspection of the equipment, supplemented by frisking or a wipe test should be conducted before beginning the cleaning process. Air filters are to be considered highly contaminated, removed and replaced before the equipment leaves the worksite. Porous items (e.g. wooden truck beds, cloth hoses, wooden handle) usually cannot be thoroughly cleaned and must be discarded.

Disposable plastic tarpaulins can be used to minimize the need for subsequent cleaning.

Decontamination of vehicles and large pieces of equipment (pumps) should be conducted on a wash-pad constructed in a manner to recycle or collect for later disposal all cleaning solutions and wash water.

Equipment being dry-brushed or vacuumed with specially filtered vacuums should be placed on a nonporous pad to facilitate containment and waste collection.

Steam cleaning and pressure spraying using water mixed with a general purpose, low sudsing soap or detergent to improve wetting is the preferred method for wet decontamination. Scrubbing with disposable or easily decontaminated brushes may be necessary to loosen materials. In most instances, hot water is more effective then cold.

Flushing should be done under high pressure, taking care not to damage dials, gauges, wires or hoses. Power spraying is often more effective for shovels, loader and scoops. Dry removal of contaminants can be accomplished through brushing, vacuum cleaning, vacuum blasting and sandblasting. To best control fugitive emissions, a vacuum cleaner with high-efficiency filtered units mounted over 55 gallon recovery drums should be used.

3.4 TESTING FOR DECONTAMINATION EFFECTIVENESS

The effectiveness of any decontamination method must be assessed at the beginning of a project and periodically throughout the conduct of the project. If contaminants are not being removed or are penetrating protective clothing, the decontamination program must be revised. The following methods should be used in assessing the effectiveness of decontamination:

Visual Observation

Visual observation involves use of natural light and ultraviolet light. In natural light, discoloration's, stains, corrosive effects, visible dirt, or alterations in clothing fabric may indicate that contaminants have not been removed.

In ultraviolet light, certain contaminants (e.g., polycyclic aromatic hydrocarbons, which are commonly found in refined oils and solvent wastes) fluoresce and can be detected visually. UV light can be used to observe contamination on skin, clothing and equipment. A qualified health professional must be consulted prior to using this technique because of the natural fluorescence of certain body parts can introduce uncertainty in to the test. The use of UV light poses an increased risk of skin cancer and eye damage.

Wipe Sampling

Wipe sampling involves swiping a dry or wet cloth, glass fiber filter paper or swab over the surface of a potentially contaminated object and performing a laboratory analysis. Both the inner and outer surfaces of protective clothing should be tested to check for permeation. Skin can also be tested using this method.

Cleaning Solution Analysis

Analysis of contaminants left in cleaning (or final rinse) solutions may indicate that additional cleaning and rinsing are necessary.

Permeation Testing

Testing for the presence of permeated chemical contaminants requires that pieces of the protective garments be sent out to a laboratory for analysis.

3.5 LOCATION AND CONFIGURATION OF DECONTAMINATION AREA

Decontamination for hazardous waste activities is conducted in a contamination reduction corridor (CRC) within a well-defined contamination reduction zone (CRZ). Decontamination equipment, processes and procedures will vary, depending on the presence of specific hazards and the size and complexity of the worksite and project. Modifications to the location and configuration of the decontamination area may be required to accommodate changing conditions (e.g. wind) at the jobsite.

The location and size of the Contamination Reduction Zone/Corridor (CRZ/C) for most (Insert Company Name) hazardous waste activities depends on the amount of space available at the worksite, the use of large equipment, the number of stations necessary for the decontamination procedure and the overall dimensions of the work zones. For some activities, wind direction is an important consideration in selecting the best location and layout for the CRZ/C, as you want to stay upwind of the contaminated areas of the worksite.

The following process should be followed in establishing the configuration of the CRZ/C:

1) Outer, more heavily contaminated items (e.g., outer boots and gloves) should be decontaminated first, followed by decontamination and removal of inner, less contaminated items (e.g. jackets and pant).

2) Each procedure should be performed at a separate station to prevent cross contamination.

3) Stations should be physically separate and should be arranged in order of decreasing contamination, preferably in a straight line.

4) Separate flow patterns and stations should be provided to isolate workers from different contamination zones containing incompatible wastes.

5) Dressing stations for entry to the CRZ should be separate from redressing areas for exit from the CRZ.

6) Workers should always pass through doffing stations for respiratory protective equipment only after their garments are removed to maximize respiratory protection while decontaminating.

3.6 EMERGENCY DECONTAMINATION PROCEDURES

The following emergency decontamination procedures have been established to ensure that the decontamination process does not cause serious health effects or aggravate an existing illness or injury. When protective clothing is grossly contaminated, it is possible that contaminants can be transferred to either emergency medical personnel or the wearer. Unless severe medical problems have occurred simultaneously with gross contamination events, PPE should be quickly washed off and carefully removed.

Immediate medical attention must be instituted without consideration for decontamination when an individual is experiencing difficulty in breathing, cardiac arrest, arrhythmia's, heatstroke and severe bleeding. The following procedures should be followed for decontaminating individuals who are experiencing medical problems or injuries.

1. Outer garments and PPE may be removed depending on the injury, weather conditions, delays, interference with treatment or aggravation of the problem. Respirators and backpack assemblies should be removed. Fully encapsulating suits or chemical resistant clothing should be cut away.

2. If removal of contaminated garments will cause further injury, the individual should be wrapped in plastic, rubber or blankets to prevent contamination of medical personnel and equipment. Contaminated garments should be removed at a medical facility and carefully handled and contained to prevent or minimize cross-contamination.

3. Do not wash or rinse the victim at the worksite unless the individual is contaminated with an extremely toxic or corrosive material that could cause further severe injury or loss of life.

4. For minor medical problems or injuries, normal decontamination procedures should be followed.

4 References

OSHA 1910.120 Hazardous Waste Operations and Emergency Response.

5 Appendices

None