State of Delaware
Department of Natural Resources and Environmental Control
Division of Waste and Hazardous Substances

Health and Safety Manual

Revised March 2016

1-1. HEALTH AND SAFETY POLICY STATEMENT

Because the Delaware Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) highly values our employees, at WHS the prevention of job-related injuries and illnesses and the promotion of workplace safety is given precedence over other considerations at all times. WHS's policy is to provide and maintain a safe and healthful working environment and to follow practices that will safeguard all employees and result in greater efficiency.

Safety is everyone's responsibility. All levels of management of each WHS Program and Section are responsible for providing the resources necessary to maintain a safe working environment, for establishing health and safety policies, and for ensuring policy implementation. Supervisors are responsible for implementing health and safety policies and ensuring that day-to-day activities are conducted in a safe and healthy manner. Employees are responsible for adhering to established health and safety policies and for performing their tasks in a manner that does not endanger themselves, other employees, the public, or property. [1]

[1] Roles and responsibilities are further defined in Section 1-7.

1-2. REVIEW AND APPROVAL

This document was reviewed and updated by the WHS Integrated Health and Safety Workgroup (IHSW) with the assistance of TekSolv Inc. for the Delaware Department of Natural Resources and Environmental Control (DNREC), Division of Waste and Hazardous Substances (WHS) to establish a standard for WHS employee protection. TekSolv makes no warranties, expressed or implied, included or intended by this program, except that it has been prepared in accordance with the currently generally accepted practices and standards consistent with the level of care and skill exercised under similar circumstances by other professional consultants or firms performing the same or similar services. TekSolv does not assume responsibility for the discovery and elimination of hazards that could possibly cause accidents, illness, injury or damage. Compliance with this health and safety program does not assure elimination of hazards or risks associated with any tasks performed in the workplace.

The WHS IHSW is responsible for insuring that the Health & Safety Manual is reviewed biennially by DNREC staff, and to have OSHA-specific expertise evaluated every 5 years.

The DNREC WHS, Health and Safety Manual has been reviewed, updated, and approved by the following:

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1-4. ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ALARA	As low as reasonably achievable
ALI	Annual limit for intake
ANSI	American National Standards Institute
APR	Air-purifying respirator
CFR	*Code of Federal Regulations*
CGI	Combustible gas indicator
CPR	Cardiopulmonary resuscitation
CRZ	Contamination reduction zone
CSEP	Confined space entry permit
CTD	Cumulative trauma disorder
CWM	Chemical warfare material
DAC	Derived air concentration
dBA	Decibel on the A-weighted scale
DAWM	Division of Air and Waste Management
DNREC	Department of Natural Resources and Environmental Control
EPA	U.S. Environmental Protection Agency
FAA	First aid assistant
FID	Flame ionization detector
HASP	Health and safety plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HBV	Hepatitis B virus
HEPA	High-efficiency particulate air
HIV	Human immunodeficiency virus
HPS	Hantavirus pulmonary syndrome
HSCA	Hazardous Substances Control Act
IARC	International Agency for Research on Cancer
IDLH	Immediately dangerous to life or health
IHSW	Integrated Health and Safety Workgroup
kV	Kilovolt
LEL	Lower explosive limit
LUST	Leaking underground storage tank

mR/hr	Millirem per hour
MSC	Medical Surveillance Coordinator
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
NEC	National Electric Code
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NTP	National Toxicology Program
OPIM	Other potentially infectious materials
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated biphenyl
PFD	Personal floatation device
PID	Photoionization detector
PPE	Personal protective equipment
Psig	Pound per square inch gauge
RAM	Radioactive material
RCRA	Resource Conservation and Recovery Act
Rem	Roentgen equivalent in man
RPO	Radiation protection officer
SCBA	Self-contained breathing apparatus
SOP	Standard operating procedure
SSO	Site safety officer
TLD	Thermoluminescent detector
TSD	Treatment, storage and disposal
TWA	Time-weighted average
UEL	Upper explosive limit
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
UST	Underground storage tank
UXO	Unexploded ordnance

1-5. REFERENCES AND POLICIES

The references listed below are the basis of or supporting documentation for the health and safety programs developed by the Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS), and provided in this manual.

American Conference of Governmental Industrial Hygienists (ACGIH). "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices." Latest Edition

American Petroleum Institute. 1996. "Closure of Underground Petroleum Storage Tanks." Third Edition. March.

American National Standards Institute, Inc. (ANSI). 1992. "Respiratory Protection." ANSI Z88.2-1992. New York, New York.

National Fire Protection Association (NFPA). "National Electrical Code." Quincy, Massachusetts. Latest Edition.

National Institute for Occupational Safety and Health (NIOSH). 2002. "NIOSH Pocket Guide to Chemical Hazards." June.

U.S. Army Corps of Engineers. 1996. "Safety and Health Manual" Publication No. EM 385-1-1. September 3.

U.S. Department of Health, Education, and Welfare and NIOSH (USDHEW/NIOSH). 1990. "Criteria for a Recommended Standard - Working in Confined Spaces." Publication No. 80-106. Cincinnati, Ohio.

U.S. Department of Health and Human Services and NIOSH (DHHS/NIOSH). 1985. "NIOSH/OSHA/USCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities." DHHS/NIOSH Publication Number 85-115. Washington, DC.

DHHS/NIOSH. 1987. "NIOSH Respirator Decision Logic." DHHS/NIOSH Publication Number 87-108. Cincinnati, Ohio.

U.S. Environmental Protection Agency (EPA). 1992. "Standard Operating Safety Guides." Publication 9285.1-03. June.

1-6. INTRODUCTION TO THE HEALTH AND SAFETY PROGRAM

Protection of employee health and safety is a vital and integral part of the Delaware Department of Natural Resources and Environmental Control (DNREC) operations. The DNREC Division of Waste and Hazardous Substances (WHS), requires this comprehensive Health and Safety Program to provide for the health and safety of its employees. This Health and Safety Program will be implemented by all sections and branches within WHS. The Health and Safety Program and associated procedures apply to all DNREC WHS employees and set forth minimum health and safety requirements for contractors. This Health and Safety Program shall be made available to all DNREC WHS employees, employee-designated representatives, Occupational Safety and Health Administration (OSHA) personnel, and personnel of other federal, state, or local agencies with appropriate regulatory authority. The goals of the Health and Safety Program and the Health and Safety Manual are discussed below.

1-6.1. PROGRAM GOALS

The goals of the Health and Safety Program are as follows:

- Ensure the health and safety of all personnel involved in field, office, and other activities;
- Define the minimum division-wide requirements for health and safety;
- Support each WHS section and program/branch in implementing health and safety programs;
- Ensure compliance with all applicable federal, state, and local regulations regarding occupational health and safety; and
- Support Department and state level health and safety initiatives, policies and programs.

1-6.2. HEALTH AND SAFETY MANUAL

The Health & Safety Manual ("Manual") is a key component of the WHS health and safety program. The manual:

- Details WHS's commitment to health and safety;
- Sets forth the minimum health, safety, and emergency response requirements for activities that involve employee exposures or the reasonable possibility for employee exposure to safety or health hazards including physical, chemical, biological or safety hazards; and

- Meets the requirements for a written health and safety program of specific federal health and safety regulations.

This manual is divided into four sections. Section 1 includes the organizational structure of the program as well as administrative information about the program. Section 2 includes all those programs applicable to all WHS employees regardless of the nature of the work they do. Section 3 includes those programs specifically required by and applicable only to work done on uncontrolled hazardous waste sites as defined by Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.120, the Occupational Safety and Health Act (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) standard. Section 4 includes Standard Operating Procedures for ensuing safety and health during routine activities conducted by WHS employees.

1-7. PROGRAM ADMINISTRATION AND ORGANIZATIONAL STRUCTURE

The purpose of the Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances' (WHS or Division) comprehensive Health and Safety Program is to define the minimum health and safety standards required on a division-wide basis. The Health and Safety Program applies to all WHS employees, and sets forth minimum requirements for contractors working under contract to WHS. The responsibilities, organizational structure, recordkeeping requirements, and evaluation of the Division Health and Safety Program are discussed below.

1-7.1. RESPONSIBILITIES

1-7.1.1. ADMINISTRATION

The following personnel are responsible for implementing and administering the WHS Integrated Health and Safety Program and Standard Operating Procedures.[2]

- The ***Division Director*** of WHS is ultimately responsible for ensuring that all employees actively participate in the WHS Comprehensive Health and Safety Program and follow applicable standard operating procedures (SOPs). The Division Director may assign the responsibility for tracking and retaining records of employee training and medical surveillance to a *Medical Surveillance Coordinator*. The Division Director will chair the Integrated Health and Safety Workgroup and will dedicate at least one senior staff meeting per year to discussing health and safety with program/section managers.

- ***Program/Section Managers*** are delegated the authority and responsibility for implementing and enforcing the Health and Safety Program at the program/section level. This will include the responsibilities for tasks such as developing, reviewing and approving section and site-specific health and safety plans and standard operating procedures relating to health and safety; emphasizing health and safety in planning and implementing daily activities; requiring compliance with health and safety programs, plans, and policies in individual performance plans, dedicating time and section meetings to discuss health and safety topics; and complying with reporting and tracking requirements associated with section and Division health and safety programs, plans and procedures. To ensure a truly integrated and coordinated program, each program/section manager is required to assign at least one appropriately qualified person to serve

[2] These procedures identify four distinct activity categories into which employees are assigned, based upon their training certification classification (29 CFR 1910.120 and 29 CFR 1910.121) and exposure potential. The categories are defined and outlined in Section 2.0 of this section.

as liaison on the WHS *Integrated Health and Safety Workgroup*. Further, program/section managers shall identify and assign a work category for each of their assigned employees. The program/section managers will provide the assigned employee with a complete description of the WHS activity categories. Program/section managers are responsible for budgeting allocated funds for: (a) required health and safety training; and (b) purchasing, maintaining, and storage of employee safety and personal protective equipment (PPE). The program/section manager shall encourage and provide opportunities to staff for first aid and cardiopulmonary resuscitation (CPR) training, including automated external defibrillator training.

- The ***WHS Integrated Health and Safety Workgroup (IHSW)***, is responsible for coordination and maintenance of the Division Integrated Health and Safety Program and Standard Operating Procedures. The IHSW will support program/section managers and administrators with advice, technical assistance, selection of auditors, and resolution of issues relating to the implementation of the overall Division Health and Safety Program, but will not be responsible for implementing the program at the section level. Section implementation of the health and safety program will be done by program/ section managers and administrators. The IHSW shall review, advise, and coordinate changes, additions, amendments or modifications of the Division Health and Safety Program and Standard Operating Procedures. The IHSW may also request or review audits. IHSW is responsible for overseeing the WHS audit program and ensuring that corrective actions are taken to address findings identified in the safety audits. Similarly, a key role of this group is to investigate any health and safety incidents and share learned information with the WHS organization to prevent future incidents. The IHSW Section representative is the focal point for coordinating the office activities with regard to WHS worker occupational health and safety activities. Each program/ section manager/administrator will assign a representative to the WHS IHSW. The director will serve as the chair of the workgroup. Although the director is not required to attend each meeting, as the person responsible for the overall implementation of the Health and Safety Program, the director will receive recommendations and reports from the IHSW. The IHSW will conduct regularly scheduled meetings and may additionally hold ‘emergency’ meetings.

- ***Medical Surveillance Coordinator (MSC)*** is responsible for notifying employees when they are due for scheduled medical surveillance examinations. Medical monitoring shall be tracked using a database.

- ***Occupational Medical Advisor*:** DNREC WHS contracts a medical advisor, who is a physician, qualified to make clinical decisions regarding medical monitoring for personnel. All contact with the medical advisor regarding the selection of exam protocols and medical monitoring program is made through the medical monitoring coordinator.

  The medical advisor has the following responsibilities: advising DNREC on the fitness for duty of employees in the program, and recommending limitations in their duties if applicable; advising DNREC on the adequacy of the medical monitoring program; recommending additional testing for special employee needs or site-specific project needs; and providing medical consultation.

- ***Project Managers/Project Officers*** are responsible for the following on all sites:

  - Conducting all operations in accordance with applicable safety and health regulations and the DNREC WHS Health and Safety Program and standard operating procedures;
  - Ensuring that health and safety aspects of all prospective projects are reviewed and approved by qualified personnel;
  - Ensuring that necessary and appropriate protective equipment is available on site and used as required;
  - Ensuring that employees assigned to projects are trained in SOPs and adequately informed of the hazards associated with their work;
  - Informing contractors of site emergency procedures and any potential fire, explosion, health, safety, or other hazards, as necessary;
  - Ensuring that all necessary respiratory equipment and personal protective equipment (PPE) are available on site;
  - Reporting all accidents and exposures or near misses to their program/section administrator and to the appropriate IHSW representative;
  - Performing or assigning periodic on-site inspections/audits to ensure that the Heath and Safety Program is being implemented;
  - Stopping work at a project where unsafe conditions exist that can not be remedied without a work stoppage; and

- Reporting to the program/section manager any health and safety concerns associated with WHS projects, and recommending topics to be addressed in the periodic training update and/or by the IHSW or the director.

- ***Affected WHS Employees***[3] must read and fully understand the WHS Health and Safety Program and Standard Operating Procedures and must sign a statement (Role, Responsibilities and Tasks, Section 1-7A) attesting to that fact. The program/section manager provides the statement forms to each employee. Once the employee has signed the form. The form will be kept with the personnel files maintained within the Department's Human Resources office.

- ***DNREC-hired contractors*** are responsible for executing the Project Manager/Project Officer and the Site Safety Officer responsibilities at sites that are under their control in accordance with this manual. If the DNREC Project Manager/Project Officer or the Site Safety Officer is on site, the DNREC representative is responsible for ensuring compliance with this manual.

For operations that take place on uncontrolled hazardous waste sites, RCRA Treatment, Storage and Disposal Facilities (TSDFs), or above/underground tanks sites as defined by Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.120, the Occupational Safety and Health Act (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, additional responsibilities apply to on-site workers and management as described in Section 3-1 of this manual, "Hazardous Waste Operations". A site-specific health and safety plan (HASP) must be developed for these sites in accordance with the WHS "Site-Specific Health and Safety Plan Program", in Section 3-2 of this manual. The HASP will outline the specific chain-of-command for the project.

1-7.1.2. TRAINING

The development, implementation, and ongoing management of health and safety training programs is the highest WHS training priority. The Division Director of WHS bears the ultimate responsibility for ensuring that all WHS employees receive the appropriate safety equipment and training, or equivalent, in accordance with WHS Policies and Programs and 29 CFR 1910 and 1926. Although the Division Director is ultimately responsible for employee training, the task of ensuring that all employees receive the proper mandatory safety training and equipment on a day-to-day basis is borne jointly by the WHS Program/Section Managers and employees. Types and dates of training are tracked by program/section

[3] An "employee" is defined as any full, part-time, seasonal, temporary, or permanent WHS employee; a detailee or fellow to WHS from another government agency; a student assigned to WHS; an intern or fellow assigned to WHS; and any other individual who is designated on a case-by-case basis by the Division Director.

managers. The requirements for Health and Safety Training are further detailed in the "Health & Safety Training Program".

1-7.1.3. MEDICAL SURVEILLANCE

The Division Director of WHS, or designee, bears the ultimate responsibility for ensuring that all WHS employees receive the appropriate medical surveillance, in accordance with WHS Policies and Programs and 29 CFR 1910 and 1926. Although the Division Director is ultimately responsible for employee medical monitoring, the task of ensuring that all employees receive the proper medical exams and program/section managers are notified of restrictions and fit for duty is borne by the medical surveillance coordinator. The requirements for medical surveillance are further detailed in the "Medical Surveillance Program", Section 2-8 of this manual.

1-7.2. WORK CATEGORIES AND PROCEDURES

Four distinct work categories have been identified for WHS personnel. Each work category requires different levels of initial and annual training as well as medical surveillance requirements. The training and medical surveillance requirements for each work category are described in the Training and Medical Surveillance Programs (Section 2-7 and 2-8 of this manual), respectively, and are summarized below. In some cases, employees' job responsibilities may fit into more than one of the work categories; in that case, the more protective of the classifications will apply.

A program/section manager will assign personnel to the appropriate work category. The MSC will keep a record of which category applies to each employee.

A program/section manager may modify an employee's work category assignment by providing written notification placed in the employee's file. This notification must identify the changes(s) in the work category and verify that the appropriate training, equipment, and medical examination(s) have been provided to the individual.

- ***Category 1*** is established as the WHS highest risk category. This category includes all employees whose job description/critical job elements require handling of, or potential exposure to, identified or unidentified hazardous chemicals and wastes in uncontrolled environments such as employees who respond to spill or other environmental emergencies. Category 1 employees must qualify to wear all HAZWOPER Levels of PPE (i.e., Levels A, B, C, and D) which include fully-encapsulated chemical protective clothing, atmosphere supplying respirators, air purifying respirators, etc.

All Category 1 employees are required to undergo a baseline medical examination. Thereafter, the frequency of medical examinations and tests is to be annual and after potential overexposure or injury unless agreed to by the consulting physician.

All Category 1 employees must be certified in OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) at the First Responder (Emergency Response) level. Annual refresher training certification must be kept current. Further training is dependent upon job responsibilities as described in the WHS "Training Program", Section 2-7 of this manual.

- ***Category 2*** includes employees who are authorized to perform work in a hazardous atmosphere as part of a regulatory program in a non-emergency response situation. This includes those WHS personnel who enter sites where planned or ongoing remedial actions, building demolitions, or facility operations require the use of respiratory equipment. Included are project related staff in SIRS, Solid and Hazardous Waste, and Tanks staff. Other staff may be assigned to category 2 based on specific job duties.

Category 2 employees must qualify to wear HAZWOPER PPE Levels B, C and D and will be required to be in the Division's Respiratory Protection Program. Category 2 employees include those employees who may perform sampling of contaminated media (soil, ground water, surface water, air etc.) at a remedial action sites (HSCA, LUST, RCRA, etc.) or who conduct oversight of contractors at such sites. These persons may encounter, and should be able to recognize potentially hazardous atmospheres.

Category 2 employees are also required to submit to a baseline medical examination. Thereafter, the frequency of medical examinations will be annual unless agreed by the consulting physician.

- ***Category 3*** includes WHS employees who conduct field inspections and site visits and may be subject to hazards, such as confined spaces, engulfment hazards, noise, and slip, trips or falls during their work. These employees may encounter, and should be able to recognize potentially hazardous conditions that they must never voluntarily enter. Category 3 personnel require special training on the specific hazards of their jobs and on PPE used for their work. Included is staff performing site visits relating to project scoping, emissions testing, permitting, pollution prevention, and compliance inspections. Category 3 personnel will be included in the hearing protection program and have training for fall protection and the use of escape respirators. If it is determined that a category 3 employee requires respiratory protection as part of their job duties they will be reassigned to a higher work category.

A baseline medical examination will be conducted for Category 3 employees. Periodic examination will be conducted biennially or as recommended by the consulting physician.

- ***Category 4*** includes personnel who perform their job functions in a "Secure/Clean Area" or in an office environment. Category 4 employees may attend meetings in administrative or support areas at a site or be part of a facility tour. These employees can enter any clear areas of a facility or field site when they are escorted by either DNREC's Site Safety Officer and/or the Facility's Site Safety officer. There should be no significant risk of chemical exposure and/or physical hazards (such as, but not limited to, confined spaces, engulfment hazards, hazardous atmospheres, or noise above 85dBA). While performing the site visit, they must be knowledgeable of and follow procedures specified in a site-specific health and safety plan and wear appropriate personal protection equipment including hardhat and steel-toed safety shoes or hearing protection. Training will be provided to Category 4 personnel on the hazards of their jobs and the methods to control those hazards, and necessary personnel protection equipment.

A baseline medical examination will be conducted for Category 4 employees only as deemed necessary as described in the WHS Medical Surveillance Program in Section 2-8 of this manual (such as in the event of injury or accidental exposure) or on a voluntary basis.

1-7.3. RECORDKEEPING REQUIREMENTS

All sections of the DNREC WHS Health and Safety Manual (including organizational plan, policies, and procedures) will be maintained in in an electronic file entitled "DNREC WHS Health and Safety Manual." The program manual shall be kept current and in order. The existence of the program shall be communicated to all staff, and the manual shall be readily available for their reference. Recordkeeping requirements for specific policies and procedures are addressed within each Health and Safety Manual.

1-7.4. AUDIT

The director shall conduct, or shall assign qualified personnel or contractors to conduct annual evaluations of the Health and Safety Program to ensure the implementation and effectiveness of health and safety policies and procedures. Audit procedures are addressed in a separate policy entitled "Health and Safety Audit Program", Section 1-8 of this manual.

1-7A. PROGRAM ADMINISTRATION AND ORGANIZATIONAL STRUCTURE

1-7A.1. ROLES, RESPONSIBILITIES, & TASK LISTS – IHSW

RESPONSIBILITY / TASK: INTEGRATED HEALTH AND SAFETY COMMITTEE	SCHEDULE	REFERENCE
Responsible for coordination and maintenance of the Division Integrated Health and Safety Program and Standard Operating Procedures. The IHSW will support program/section managers and administrators with advice, technical assistance, selection of auditors, and resolution of issues relating to the implementation of the overall Division Health and Safety Program,	Continuous	HSM 1-7 / 1.1
The IHSW shall review, advise, and coordinate changes, additions, amendments or modifications of the Division Health and Safety Program and Standard Operating Procedures.	On occurrence	HSM 1-7 / 1.1
The IHSW may also request or review audits. IHSW is responsible for overseeing the WHS audit program and ensuring that corrective actions are taken to address findings identified in the safety audits.	Continuous	HSM 1-7 / 1.1
The IHSW is to investigate any health and safety incidents and share learned information with the WHS organization to prevent future incidents.	On occurrence	HSM 1-7 / 1.1
The IHSW will conduct regularly scheduled meetings and may additionally hold ‘emergency’ meetings.	Continuous	HSM 1-7 / 1.1
The IHSW will receive reports of all accidents and exposures or near misses from project officers	Initial +annual review	HSM 1-7 / 1.1 Pg 3
Receive audits conducted by others.	Initial	HSM 1-8 / 2.2.1
Requiring noise level monitoring for specific tasks and job duties.	On occurrence	HSM 2-2/2.0
The IHSW may give technical assistance to the Quality Manager when the Quality Manager is selecting appropriate personal protective equipment, acquiring approved equipment, maintaining availability, and establishing equipment cleaning and disposal procedures as defined in appropriate standard operating procedures (SOPs).	On occurrence	HSM 2-9/6.0
The IHSW may receive safety assessments from construction sites.	On occurrence	HSM 2-11/2.5
The IHSW shall provide technical guidance to the project manager/project officer and site safety officer (SSO) regarding site characterization requirements	On occurrence	HSM 3-3/ Intro.
The IHSW may assist the program manager with implementing the Control of Hazardous Energy Sources SOP.	On occurrence	HSM 4-7/3.0

1-7A.2. ROLES, RESPONSIBILITIES, & TASK LISTS – SAFETY OFFICER

RESPONSIBILITY / TASK: SAFETY OFFICER	SCHEDULE	REFERENCE
Responsible for escorting Category 4 level employees to clear areas of a facility or field site.	On occurrence	HSM 1-7 / 2.0
Receive a copy of any safety audits and take appropriate action as needed.	On occurrence	HSM 1-8 / 2.2.2
Sign Worksite Audit Checklist	On occurrence	HSM 1-8B/Form
Receive reports of near misses and take action as necessary.	On occurrence	HSM 1-9/4.1
The site safety officer will verify and document the proper use of respiratory PPE.	On occurrence	HSM 2-4/1.0
The site safety officer shall determine filter selection and change schedules at the time of the respiratory hazard assessment	On occurrence	HSM 2-4/2.1.3
The site safety officer shall determine the procedures and processes used to clean the inside of a confined.	On occurrence	HSM 2-5/3.2.2
Receive notification of confined space entry.	On occurrence	HSM 2-5/1st bullet.
Give training to all personnel involved in hazardous waste site field activities, including those assigned to the support zone	On occurrence	HSM 2-7/3.3
Performing the following on a HAZWOPER Site ▪ Being on site during all work activities (an alternate SSO will be designated by the project manager/project officer in the absence of the designated SSO); ▪ Ensuring health and safety issues are addressed at the HAZWOPER sites to which he or she is assigned; ▪ Communicating health and safety requirements, procedures, etc. to all on-site personnel; ▪ Verifying that on-site personnel read and sign off on HASP and have necessary training and medical clearance; ▪ Advising the project manager/project officer of any practices that are endangering the health and safety of personnel and recommending corrective action; ▪ Shutting down a project for up to 24 hours if necessary to ensure worker safety if the situation cannot be corrected immediately, during which time the project manager/project officer must arrange for corrective action or resolution of the	On occurrence	HSM 3-1/2.0

problem; ▪ Maintaining line-of-sight or communication with the work parties; ▪ Verifying the proper use, cleaning, and maintenance of protective clothing and equipment; ▪ Conducting periodic or daily health and safety briefings for site personnel and initial site training for new personnel; ▪ Overseeing control of entry and exit at site access control points and recording the names and job assignments of all personnel entering and exiting the site; ▪ Arranging for work area and personal air monitoring, as necessary, and ensuring that all monitoring equipment used on site has been properly calibrated in accordance with manufacturer's recommendations; ▪ Maintaining records of exposure and monitoring results for all on-site personnel; ▪ Determining the need for additional safety equipment (such as respirators), depending on site-specific conditions; ▪ Monitoring workers for signs of stress, such as heat stress and fatigue; ▪ Monitoring on-site hazards and conditions; ▪ Coordinating and supervising emergency response and providing emergency first aid and cardiopulmonary resuscitation (CPR) to other team members, if required; ▪ Reporting all occupational illness and injuries to the project manager/project officer; and, ▪ Assisting in the preparation of reports of illnesses, injuries, or property damage.		
The Safety Officer will be responsible for ensuring compliance of all site personnel with the HASP and shall have the authority	On occurrence	HSM 3-2/3.0

to stop operations if necessary, mandate protective equipment needs, and dismiss from the site any individual demonstrating on-site conduct that may endanger their own health and safety or the health and safety of others.		
The Safety Officer will document violations of the HASP in the safety log portion of the field logbooks maintained for the project. The offender shall be verbally notified of the violation and reminded of the conditions of the HASP compliance agreement. If the violation continues, it will be the responsibility of the SSO to protect the health and safety of site personnel by dismissing the offender from the project.	On occurrence	HSM 3-2/3.0
Conduct on site Health and Safety Meetings.	On occurrence	HSM 3-2/3.0
Distribute copies of the HASP to contractors.	On occurrence	HSM 3-2/3.0
Routinely inspect the work site for general compliance and document this in the field logbook.	On occurrence	HSM 3-2/5.0
Maintain a file on-site of significant health and safety records, such as training certificates and monitoring results	On occurrence	HSM 3-2/6.0
The Safety Officer shall implement the health and safety requirements during site characterization.	On occurrence	HSM 3-3/Intro.
Control safety, physical, and biological hazards after they are reported.	On occurrence	HSM 3-3/2.2/2.3/2.4
The Safety Officer will take all steps necessary to ensure that the air monitoring program in implemented at the site and appropriate monitoring equipment and supplies are available during hazardous materials projects.	On occurrence	HSM 3-4/Intro.
The Safety Officer will use and train others in the operation calibration, care, and limitations of Air monitoring equipment.	On occurrence	HSM 3-4/Intro.
The Safety Officer will ensure that monitoring equipment in calibrated in accordance with manufacturers' instructions.	On occurrence	HSM 3-4/3.0
Maintain certifications of analysis for calibration gas standards and span gases.	On occurrence	HSM 3-4/3.0
The Safety Officer shall conduct background air monitoring prior to commencement of site work.	On occurrence	HSM 3-4/4.0
Initiate personnel exposure monitoring when concerns are raised or the situation necessitates.	On occurrence	HSM 3-4/4.2
Establish and conduct perimeter work zone air monitoring.	On occurrence	HSM 3-4/4.3
Log and maintain all air monitoring information in a field log book. Maintain the information in a secure project file.	On occurrence	HSM 3-4/5.0
Maintain phone numbers of key project staff.	On occurrence	HSM 3-5/1.0
Maintain site access logs that show who has arrived and left the project site.	On occurrence	HSM 3-5/9.0
Implement the requirements of the decontamination program on site.	On occurrence	HSM 3-6/Intro.
Select appropriate decontamination procedures for a site.	On occurrence	HSM 3-6/Intro.
Inform any commercial laundries or cleaning establishments to	On occurrence	HSM 3-6/4.0

clean protective clothing or equipment of the potentially harmful effects of exposure to hazardous substances.		
In the event of an employee injury or illness, decide if decontamination of the victim is necessary or appropriate.	On occurrence	HSM 3-6/6.0
The safety officer should serve as an alternate to the project manager.	On occurrence	HSM 3-7/1.0
The safety officer will assist in first aid response, notifying appropriate government agencies of the need for assistance, and overseeing general emergency response operations.	On occurrence	HSM 3-7/1.0
When site conditions require the use of radio communication, the project manager/project officer and safety officer will maintain on site in working condition a minimum of two portable two-way radios for use in emergency situations or in the course of normal work activity.	On occurrence	HSM 3-7/2.2.2
For properties with the risk of fires, explosions, or significant chemical releases, the safety officer and the project manager/project officer will make arrangements to familiarize the police and fire departments and emergency response providers with the site layout, properties of hazardous wastes handled and associated hazards, places where on-site personnel would normally be working, entrances to on-site roads, and possible evacuation routes.	On occurrence	HSM 3-7/2.4
During an emergency, the safety officer must evaluate the situation on an ongoing basis and determine appropriate actions to follow.	On occurrence	HSM 3-7/3.0
Record all injuries and first aid kit usage in a field log book.	On occurrence	HSM 3-7/3.2.1
If a fire is on site, instruct fire fighters of pertinent information, including hazards, missing personnel (including their last known work location), and fire location and size.	On occurrence	HSM 3-7/3.3
If there is a fire, the project manager/project officer and safety officer will make determination about the safety of continuing work in the affected zone. If conditions are determined to be unsafe, the project manager/project officer and safety officer will develop a remediation plan to restore the work zone to a safe condition.	On occurrence	HSM 3-7/3.3
The safety officer and project manager/project officer will direct emergency activities at the spill site and ensure that all health and safety equipment and supplies needed for spill response are readily available and properly used.	On occurrence	HSM 3-7/3.4
During a hazardous material spill cleanup, the safety officer will monitor exposures to chemicals, determine the need for protective equipment and clothing, identify restricted work areas and controlled access areas, and provide cleanup guidance.	On occurrence	HSM 3-7/3.4

The safety officer and project manager/project officer will remain at the spill site during cleanup activities until the spill site is secured.	On occurrence	HSM 3-7/3.4
Make decisions to evacuate a site. If a site needs to be evacuated, authorize re-entry.	On occurrence	HSM 3-7/3.5
Notify staff of evacuation routes, establish a meeting place, get a head count.	On occurrence	HSM 3-7/3.5
Follow the procedures outlined in DNREC WHS Policy 0623 – Workers' Compensation no later than 2 days after such incident or accident has occurred. The safety officer will further investigate the incident or accident as needed and as soon as possible.	On occurrence	HSM 3-7/4.0
Update the site emergency response plan as necessary.	On occurrence	HSM 3-7/4.0
Determine when staffs working near water need lifejackets.	On occurrence	HSM 4-2/1.0
Safety Officer on a HAZWOPER site shall conduct a Pre-Job Briefing prior to personnel utilizing personal fall arrest equipment.	On occurrence	HSM 4-3/3.0
Record all instances of cold stress.	On occurrence	HSM 4-5/Page 2.
The safety officer is responsible for ensuring that work areas are evaluated for the presence of high-voltage or other hazardous electricity sources and that all electrical equipment and circuits are de-energized prior to any normal electrical maintenance work.	On occurrence	HSM 4-6/Intro.
The site safety officer will coordinate all site activities at locations where telephone, gas, water, and electric utility lines exist.	On occurrence	HSM 4-6/1.0
The safety officer hall not permit any employee to work near any part of an electric power circuit that the employee could contact in the course of work unless the employee is protected against electric shock by de-energizing the circuit and grounding it, or by guarding it effectively by insulation, barricades, or other means.	On occurrence	HSM 4-6/2.0
Before starting each job involving exposure to energized electrical equipment, the safety officer shall conduct a job briefing with the employees involved. The briefing shall cover such subjects as hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements.	On occurrence	HSM 4-6/2.0
Inform contractors of WHS lockout/tagout procedures.	On occurrence	HSM 4-7/1.0
Conduct inspections when lockout/tagout procedures are implemented.	On occurrence	HSM 4-7/4.3

Before performing a drilling activity make staff aware of the following: • Insure "Miss Utility" contact and clearance for underground utilities or other issues. • Wear a hard hat, safety glasses or goggles, steel-toed work boots, a shirt and full-length pants when working with or near the drill rig. Shirts must be tucked in at the belt. • Do not wear loose or frayed clothing, loose long hair, or loose jewelry while working with rotating equipment. • Do not eat, drink, or smoke near the drill rig. • Utility companies or a utilities locating service for the area must be notified **before drilling activities begin** to arrange for locating and protecting underground utilities. Ensure that the drill rig and any other machinery used are inspected daily by competent, qualified individuals. Test all emergency equipment (emergency stop) to ensure it is operational before actual work commences. • Drill rig operators will be instructed to report any abnormalities, such as equipment failure, oozing liquids, and unusual odors, to their supervisors or the Site Safety Officer (SSO). • Establish hand-signal communications for use when verbal communication is difficult. One person per work team will be designated to give hand signals to equipment operators.	On occurrence	HSM 4-9/Page 1
When drilling activities are occurring, receive reports of any abnormalities, such as equipment failure, oozing liquids, and unusual odors,	On occurrence	HSM 4-9/Page 1
When the drill rig is operating ensure staff: • Wear appropriate respiratory and personal protective equipment (PPE) when conditions warrant their use. Respirators will be used in accordance with WHS's Respiratory Protection Program, Section 2-4.	On occurrence	HSM 4-9/ Page 1

• Avoid direct contact with known or suspected contaminated surfaces. • Move tools, materials, cords, hoses, and debris to prevent tripping hazards and contact with moving drill rig parts. • Adequately secure tools, materials, and equipment subject to displacement or falling. • Store flammable materials away from ignition sources and in approved containers.		
The safety officer is responsible for on-site enforcement of the safe excavating SOP on uncontrolled hazardous waste sites as defined in 29 CFR 1910.120, the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard.	On occurrence	HSM 4-10/Intro
The safety officer or project manager/project officer will ensure compliance with the precautions listed in the Heavy Equipment SOP.	On occurrence	HSM 4-11/ Page 1
Enforce the SOP for drum and container handling.	On occurrence	HSM 4-15/Intro.
The safety officer is responsible for recognizing potential flammable hazards and ignition sources, conducting air monitoring, posting warning signs, and notifying on-site workers of the hazards.	On occurrence	HSM 4-15/1.0
Before field work begins that involves working near oil and fuel products, the site safety officer (SSO) will brief all field personnel, including contractor employees, on their work assignments and site safety procedures.	On occurrence	HSM 4-18/3.2

1-7A.3. ROLES, RESPONSIBILITIES, & TASK LISTS – MEDICAL SURVEILLANCE COORDINATOR

RESPONSIBILITY / TASK: MEDICAL SURVEILLANCE COORDINATOR	SCHEDULE	REFERENCE
MSC Medical Surveillance Coordinator	NA	HSM 1-4
The Division Director may assign the responsibility for tracking and retaining records of employee training and medical surveillance to a *Medical Surveillance Coordinator*.	Continuous	HSM 1-7 / 1.1
Medical Surveillance Coordinator (MSC) is responsible for notifying employees when they are due for scheduled medical surveillance examinations. Medical monitoring shall be tracked using a database.	Continuous	HSM 1-7 / 1.1
All contact with the medical advisor regarding the selection of exam protocols and medical monitoring program is made through the medical monitoring coordinator.	Continuous	HSM 1-7 / 1.1
the task of ensuring that all employees receive the proper medical exams and program/section managers are notified of restrictions and fit for duty is borne by the medical surveillance coordinator.	Continuous	HSM 1-7 / 1.3
The following records are to be kept by the Medical Surveillance Coordinator (MSC) for each employee, as required by the employee's category and status:	Continuous	HSM 1-9 / 1.0
Records and forms related to injuries and exposures are maintained by the Medical Surveillance Coordinator and at the state level.	Continuous	HSM 1-9 / 3.0
Respiratory clearances provided by the examining physician shall be provided to the medical surveillance coordinator.	Continuous	HSM 2-4 / 2.2
Copies of the completed form shall be forwarded to the Medical Surveillance Coordinator and the designated healthcare professional.	Continuous	HSM 2-12 / 7.2

1-7A.4. ROLES, RESPONSIBILITIES, & TASK LISTS – PROGRAM/SECTION MANAGER

RESPONSIBILITY / TASK: PROGRAM / SECTION MANAGER	SCHEDULE	REFERENCE
authority and responsibility for implementing and enforcing the Health and Safety Program at the program/section level	Continuous	HSM 1-7 / 1.1
developing, reviewing and approving section and site-specific health and safety plans and standard operating procedures relating to health and safety	On occurrence	HSM 1-7 / 1.1
emphasizing health and safety in planning and implementing daily activities	Continuous	HSM 1-7 / 1.1
requiring compliance with health and safety programs, plans, and policies in individual performance plans	On occurrence	HSM 1-7 / 1.1
dedicating time and section meetings to discuss health and safety topics	Continuous	HSM 1-7 / 1.1
complying with reporting and tracking requirements associated with section and Division health and safety programs, plans and procedures		HSM 1-7 / 1.1
to assign at least one appropriately qualified person to serve as liaison on the WHS *Integrated Health and Safety Workgroup*	Initial +annual review	HSM 1-7 / 1.1
identify and assign a work category for each of their assigned employees	Initial + annual review	HSM 1-7 / 1.1
provide the assigned employee with a complete description of the WHS activity categories	Initial	HSM 1-7 / 1.1
budgeting allocated funds for required health and safety training	Annual	HSM 1-7 / 1.1
purchasing, maintaining, and storage of employee safety and personal protective equipment (PPE)	Initial + annual review	HSM 1-7 / 1.1
determine at least two individuals, if adequate number of individuals are available, in his/her program to receive first aid and cardiopulmonary resuscitation (CPR) training, including automated external defibrillator training	Initial + annual review	HSM 1-7 / 1.1
ensuring the proper training of their personnel	Initial + annual review	HSM 1-7 / 1.1
Receive support from IHSW	On occurrence	HSM 1-7 / 1.1
assign a representative to the WHS IHSW	Initial	HSM 1-7 / 1.1
Receive any health and safety concerns associated with WHS projects from Project Officers	On occurrence	HSM 1-7 / 1.1
provide the SOP confirmation statement forms to each employee	Initial + Performance Review	HSM 1-7 / 1.1
ensuring that all employees receive the proper mandatory safety training and equipment	Initial + annual review	HSM 1-7 / 1.2
Track types and dates of training	Ongoing	HSM 1-7 / 1.2
notified of restrictions and fit for duty	Initial + annual review	HSM 1-7 / 1.3

assign personnel to the appropriate work category	Initial + annual review	HSM 1-7 / 2.0
modify an employee's work category assignment by providing written notification placed in the employee's file	On occurrence	HSM 1-7 / 2.0
Receive copy of report findings from H&S audits	On occurrence	HSM 1-8 / 2.1
Document on the audit action plan those actions taken to correct the deficiencies and the date the deficiencies were corrected	On occurrence	HSM 1-8 / 2.1
in the event of a fatal accident or accident resulting in the in-patient hospitalization of one or more individuals, an immediate telephone report will be made by the project manager/project officer to the program/section manager	On occurrence	HSM 1-9 / 2.0
contact the director and describe all details of the accident and determine actions to be taken		
In the event OSHA conducts an inspection of any WHS work site or project, the WHS employee initially receiving the OSHA compliance officer must immediately notify the program/section manager	On occurrence	HSM 1-9 / 5.0
support an effective hazard communication program within their office or area	Continuous	HSM 2-1 / 1.0
may elect to delegate the day-to-day administration of the hazard communication program to other qualified personnel	On occurrence	HSM 2-1 / 1.0
Communicate program requirements to employees included in the Health and Safety Program or required to implement program requirements off site	Initial + annual review	HSM 2-1 / 1.0
Provide for the necessary hazard communication training	Initial + annual review	HSM 2-1 / 1.0
Maintain chemical inventories and safety data sheet (SDS) files within their respective program offices	Continuous	HSM 2-1 / 1.0
application and oversight of the hearing conservation program	Continuous	HSM 2-2 / 0.0
Monitoring for occupational noise exposure will be conducted for each representative task or job position that… deems necessary.	On occurrence	HSM 2-2 /2.0
approving the site-specific PPE selection criteria	On occurrence	HSM 2-3 / 0.0
taking action to ensure that WHS personnel and contractors achieve compliance with the PPE program	On occurrence	HSM 2-3 / 0.0
overseeing the respiratory protection program	Continuous	HSM 2-4 / 1.0
will maintain a record for each respirator that will include date of inspection, inspector name, findings, repairs made, and a serial number or other means to identify the respirator.	On occurrence	HSM 2-4 / 2.6
ensure the communication and implementation of the confined space entry program	On occurrence	HSM 2-5 / 2.0
review canceled permits [confined space] or forms used on each project… to evaluate the effectiveness of the program.	Annual	HSM 2-5 / 4.1
responsible for implementing [vehicle safety program]	Continuous	HSM 2-6 / 0.0
Any vehicle found to have a deficiency that impacts the safe operation of the vehicle shall be removed from service and reported to the program/section manager	On occurrence	HSM 2-6 / 4.0

ensuring that all employees receive the proper mandatory safety training and equipment on a day-to-day basis	Continuous	HSM 2-7 / 1.0
ensure that all personnel receive appropriate training based on the hazards to which they are potentially exposed	Continuous	HSM 2-7 / 2.2
assign only adequately trained personnel to their projects	Continuous	HSM 2-7 / 2.2
validate employee training status	Continuous	HSM 2-7 / 5.0
Employees who have been exposed to hazardous chemicals shall have access to and be provided with the following information upon request	On occurrence	HSM 2-9 / 1.4
Questions about employee rights under the OSHA Laboratory Standard or about the contents of any part of the Chemical Hygiene Plan	On occurrence	HSM 2-9 / 1.4
review the “Employer’s Report of Occupational Injury or Disease” form for completeness and complete Section II of the “DNREC Workers Compensation Investigation Form”	On occurrence	HSM 2-9 / 5.2.3
If a spill or incident represents a hazard to other building occupants, it should be reported immediately to the program/section manager	On occurrence	HSM 2-9 / 5.2.4
be responsible for meeting all requirements of the Health and Safety Program on his or her project sites	On occurrence	HSM 2-11 / 1.0
ensure that personnel are adequately trained and experienced to work safely on construction sites before they are assigned to a construction project	On occurrence	HSM 2-11 / 1.0
Health and safety assessment documentation should be kept in the project file and copies shall be distributed to the program/section manager	On occurrence	HSM 2-11 / 2.5
responsible for implementation of this program [bloodborne pathogens]	On occurrence	HSM 2-12 / 0.0
Determining whether work on each project site in the program/branch is covered by the HAZWOPER program	On occurrence	HSM 3-1 / 2.0
Reviewing and approving site-specific health and safety plans, or designating qualified personnel to do so		
Assigning adequately trained and qualified personnel to work on HAZWOPER sites		
Requiring compliance with all the Division Health and Safety Program from all on-site personnel		
The HASP will then be reviewed and approved	On occurrence	HSM 3-2 / 2.3
At the earliest opportunity, the project manager/project officer will notify the program/section manager of activities related to the incident	On occurrence	HSM 3-7 / 3.4
Required regulatory agency notifications will be made as soon as safely possible by the project manager/project officer in conjunction with the program/section manager	On occurrence	HSM 3-7 / 3.4
Report all unsafe conditions and equipment to the program/section manager	On occurrence	HSM 4-1 / 0.0
support project managers/project officers in application of this SOP [Control of Energy, 4-7]	On occurrence	HSM 4-7 / 3.0

should contact the Integrated Health and Safety Workgroup (IHSW) for assistance with and evaluation of implementation of this SOP		
become familiar with biological hazards indigenous to the geographical area in which most of their personnel work, and assist in evaluating the risks to personnel on projects staffed from their program	On occurrence	HSM 4-13 / 0.0

1-7A.5. ROLES, RESPONSIBILITIES, & TASK LISTS – DIVISION DIRECTOR

RESPONSIBILITY / TASK: DIVISION DIRECTOR	SCHEDULE	REFERENCE
Approve Manual and Additions/Revisions	Initial and as needed	HSM 1-2
The ***Division Director*** of WHS is ultimately responsible for ensuring that all employees actively participate in the WHS Comprehensive Health and Safety Program and follow applicable standard operating procedures (SOPs).	Continuous	HSM 1-2
The Division Director may assign the responsibility for tracking and retaining records of employee training to Program/Section Managers and medical surveillance to a *Medical Surveillance Coordinator*.	Continuous	HSM 1-7 / 1.1
The Division Director will chair the Integrated Health and Safety Workgroup	On occurrence	HSM 1-7 / 1.1
and will dedicate at least one senior staff meeting per year to discussing health and safety with program/section managers.	Annually	HSM 1-7 / 1.1
Although the director is not required to attend each meeting, as the person responsible for the overall implementation of the Health and Safety Program, the director will receive recommendations and reports from the IHSW.	Continuous	HSM 1-7 / 1.1
An "employee" is defined as any full, part-time, seasonal, temporary, or permanent WHS employee; a detailee or fellow to WHS from another government agency; a student assigned to WHS; an intern or fellow assigned to WHS; and any other individual who is designated on a case-by-case basis by the Division Director.	On occurrence	HSM 1-7 / 1.1
The Division Director of WHS bears the ultimate responsibility for ensuring that all WHS employees receive the appropriate safety equipment and training, or equivalent, in accordance with WHS Policies and Programs and 29 CFR 1910 and 1926.	On occurrence	HSM 1-7 / 1.2
The Division Director of WHS, or designee, bears the ultimate responsibility for ensuring that all WHS employees receive the appropriate medical surveillance, in accordance with WHS Policies and Programs and 29 CFR 1910 and 1926.	On occurrence	HSM 1-7 / 1.2
The director shall conduct, or shall assign qualified personnel or contractors to conduct annual evaluations of the Health and Safety Program to ensure the implementation and effectiveness of health and safety policies and procedures.	Annual	HSM 1-7 / 4.0
The WHS Division Director is responsible for implementation of the audit program. Compliance audits, when conducted at any operational level, shall be led by suitably qualified individuals appointed by the Director, as recommended by the WHS Integrated Health and Safety Workgroup (IHSW). Worksite project audits may be conducted by competent staff	Annual	HSM 1-8 / 1.0

approved by the director or by a member or members of the IHSW, or by a contracted health and safety specialist. Although most audits will be preplanned, all WHS activities may periodically be subjected to unannounced inspections.		
The audit action plan will be returned to the Division Director for review and filing. DNREC WHS will maintain audit reports and completed action plans for a period of three (3) years after the audit.	Annual	HSM 1-8 / 2.1
Operations audits will be conducted on each section at least once every four years or as ordered by the WHS Director.	Annual	HSM 1-8 / 2.1
The director shall ensure compliance with the requirements identified in this hazard communication program by conducting annual audits. The director shall also act as a resource to sections and programs regarding hazard communication compliance issues	Annual	HSM 2-1 / 1.0
Oversight, evaluation, and auditing of the implementation and effectiveness of PPE programs shall be the responsibility of the division director or designee.	Annual	HSM 2-3
Evaluation of confined space entry program compliance and associated recordkeeping will be completed by formal audits conducted by the director or designee.	On occurrence	HSM 2-5
The WHS division director bears the ultimate responsibility for ensuring that all WHS employees receive the appropriate safety training in accordance with WHS Policies and Programs and 29 CFR 1910 and 1926.	On-going	HSM 2-7 / 1.0
The director will designate qualified personnel or a contractor to review and evaluate the employee training status as part of the annual internal health and safety program audit to ensure the proper implementation of this training program.	Annual	HSM 2-7 / 1.0
The director or designee will have the authority to approve equivalent training.	On occurrence	HSM 2 -7 / 3.7
The Director has ultimate responsibility for the overall effectiveness of the Chemical Hygiene Plan for the Division and shall provide endorsement and budgetary support.	On-going	HSM 2-9 / 1.5
The Division Director is responsible for overall implementation of the program (construction accident prevention	On occurrence	HSM 2-11 / 1.0

1-7A.6. ROLES, RESPONSIBILITIES, & TASK LISTS – AFFECTED EMPLOYEES

WHS H&S Manual Document / Section	Description	Designated	Acknowledged
1-6 Introduction			
1.0	Program Goals	x	
2.0	Health and Safety Manual	x	
1-7 Program Administration and Organizational Structure			
1.1	Administration	x	
1.2	Training	x	
1.3	Medical Surveillance	x	
2.0	Work Categories	x	
3.0	Recordkeeping	x	
4.0	Audit	x	
1-8 Audit Program			
1.0	Responsibilities		
2.0	Audit Program Elements		
2.1	Operations Audits		
2.2	Worksite Audits		
2.2.1	General Projects		
2.2.2	Hazwoper Projects		
1-9 Recordkeeping and Reporting			
1.0	General Requirements	x	
2.0	Hazwoper Sites		
3.0	Incidents Involving Injury or Illness	x	
4.0	OSHA Recordkeeping Requirements for Contractors		
4.1	Employee Involvement	x	
5.0	Responding to OSHA Inspections	x	
2-1 Hazcom Program			
1.0	Hazard Communication Program Responsibilities	x	
2.0	Hazard Communication Program Elements	x	
2.1	Hazard Determination	x	
2.2	Hazardous Chemical Inventory	x	
2.3	Labeling and Containers	x	
2.4	Safety Data Sheets	x	
2.5	Employee Training	x	
2.6	Contractors	x	
2-2 Hearing Conservation			
1.0	Action Levels		
2.0	Monitoring		
3.0	Employee Notification		
4.0	Audiometric Testing		

Employee Name:

WHS Section:

Role/Job:

Supervisor:

Date Reviewed:

5.0	Hearing Protection		
6.0	Warning Signs and Information		
7.0	Training		
2-3 PPE Program			
1.0	PPE Selection		
1.1	Chemical Protective Clothing		
1.2	Other PPE		
1.3	HAZWOPER Site Evaluation		
1.4	Job Hazard Analysis		
2.0	Levels of Protection for HAZWOPER Activities		
2.1	Level A Protection		
2.2	Level B Protection		
2.3	Level C Protection		
2.4	Level D Protection		
3.0	Upgrades and Downgrades		
4.0	Use and Limitations		
5.0	In-use Considerations		
6.0	Training Requirements		
6.1	Initial Training		
6.2	Refresher Training		
7.0	Inspection		
8.0	Maintenance and Storage		
9.0	Decontamination and Disposal		
2-4 Respiratory Program			
1.0	Responsibilities		
2.0	Program Elements		
2.1	Respirator Selection		
2.1.1	Determining Protection Factors and Respirator Selection		
2.1.2	Respirators for Environments that are IDLH		
2.1.3	Respirators for Environments that are not IDLH		
2.2	Medical Clearance		
2.3	Training		
2.4	Respirator Fitting		
2.5	Respirator Assignment		
2.6	Respirator Inspection		
2.7	Procedures for Routine Use of Respirators		
2.8	Gas and Vapor Respirator Cartridge Change Schedules		
2.8.1	Procedure		
2.8.2	Methods		
2.8.2.1	Manufacturer’s Objective Data		
2.8.2.2	Experimental Methods		
2.8.2.3	Mathematical Predictive Modeling		
2.8.2.4	Workplace Simulations		
2.8.2.5	Analogous Chemical Structure		
2.8.2.6	Rules of Thumb		
2.8.2.7	Mixture Assumptions		
2.8.2.8	Application of OSHA Standards		

2.9	Respirator Maintenance and Care		
2.10	Breathing Air and Supply Systems		
2-5 Confined Space Program			
1.0	Definitions		
2.0	Responsibilities		
3.0	Program Elements		
3.1	Hazard Identification		
3.2	Hazard Control		
3.2.1	Lockout and Tagout		
3.2.2	Cleaning		
3.2.3	Entry and Exit		
3.2.4	Equipment and Tools		
3.3	Permit and Certification Systems		
3.4	Employee Training		
3.4.1	Non-Permit Required Confined Space Training		
3.4.2	Permit-Required Confined Space Training		
4.0	Recordkeeping		
4.1	Permits and Forms		
4.2	Training Certificates		
2-6 Vehicle Safety			
1.0	Occupant Protection	x	
2.0	Helmet Use		
3.0	Driver Safety Awareness	x	
4.0	Inspections	x	
5.0	Accident Reporting	x	
2-7 Training Program			
1.0	Responsibilities	x	
2.0	Health and Safety Training for All WHS Personnel	x	
2.1	Category 4 Personnel		
2.2	Category 3 Personnel		
3.0	Hazwoper Training		
3.1	Initial Employee Training	x	
3.2	Supervised Field Training		
3.3	Site-Specific Training		
3.4	Daily Tailgate Safety Meetings		
3.5	Refresher Training		
3.6	Supervisor Training		
3.7	Equivalent Training		
3.8	Site Visitor Training		
3.9	Contractor’s Certification of Health and Safety Requirements		
4.0	First Aid and CPR Training	x	
5.0	Documentation of Training	x	
2-8 Medical Monitoring			
2-8	Medical Monitoring - Administrative Policy and Procedures #0615	x	

2-9 Chemical Hygiene Plan			
1.0	Introduction to the Chemical Hygiene Plan		
2.0	General Laboratory Procedures		
3.0	Chemical Procurement, Distribution, and Storage		
4.0	Hazard Identification & Monitoring		
5.0	Medical Surveillance Program		
6.0	Personal Protective Equipment		
7.0	Emergency Equipment		
8.0	Recordkeeping & Training		
9.0	Visitor and Contractor Training		
10.0	Hood Safety and Ventilation		
11.0	Hazardous Materials		
12.0	Standard Operating Procedures		
13.0	Review and Revision of the Chemical Hygiene Plan		
14.0	Definitions		
2-11 Construction Safety			
1.0	Administration		
2.1	Training		
2.2	Planning		
2.3	Risk Reduction		
2.4	Safety Meetings		
2.5	Safety Assessments		
2.6	Contractor Requirements		
3.0	Construction Site SOPs		
2-12 Bloodborne Pathogens			
1.0	Program Applicability and Exposure Determination	x	
2.0	Universal Precautions	x	
3.0	Engineering and Work Practice Controls	x	
4.0	Personal Protective Equipment	x	
5.0	Housekeeping	x	
6.0	Regulated Waste Disposal	x	
7.0	Hepatitis B Vaccination, Post-Exposure Evaluation	x	
8.0	Information and Training	x	
3-1 HAZWOPER			
1.0	Applicability	x	
2.0	Personnel Responsibilities		
3.0	Elements of the Hazwoper Program		
3-2 HASP Program			
1.0	Program Scope		
2.0	HASP Preparation		
2.1	HASP Format Selection		
2.1.1	Short Form HASP		
2.1.2	Standard HASP		
2.1.3	Custom-Prepared HASP		
2.2	Pre-Entry Evaluation		
2.3	HASP Review and Approval		
3.0	HASP Implementation		

4.0	HASP Amendment		
5.0	HASP Compliance Inspections		
6.0	Recordkeeping		
3-3 Site Characterization Program			
1.0	Procedures for Site Characterization		
1.1	Pre-Entry Evaluation		
1.2	Initial Site Entry		
1.2.1	Organic Vapor and Gas Monitoring		
1.2.2	Inorganic Vapor and Gas Monitoring		
1.2.3	Radiation Monitoring		
1.2.4	Oxygen Monitoring		
1.2.5	Combustible Gas Monitoring		
1.3	Periodic Monitoring		
2.0	Considerations for Site Characterization		
2.1	Limitations of Direct-Reading Instruments		
2.2	Safety Hazards		
2.3	Physical Hazards		
2.4	Biological Hazards		
2.5	Ordnance and Explosive Waste Hazards		
3-4 Air Monitoring			
1.0	Criteria for Selecting Air Monitoring Equipment		
2.0	Instrumentation		
3.0	Calibration		
4.0	Monitoring Implementation		
4.1	Screening and Periodic Monitoring		
4.2	Personal Exposure Monitoring		
4.3	Perimeter Monitoring		
4.4	Community Monitoring		
5.0	Air Monitoring Documentation		
3-5 Site Security and Control Program			
1.0	Site Security Measures		
2.0	Protection of Adjacent Areas		
3.0	Site Map		
4.0	Site Work Zones		
4.1	Exclusion Zone (Hot Zone)		
4.2	Contamination Reduction Zone (Warm Zone)		
4.3	Support Zone (Cold Zone)		
5.0	Buddy System		
6.0	Standard Operating Procedures		
7.0	Site Communications		
8.0	Identification of Nearest Medical Facility		
9.0	Site Access Logs		
3-6 Decontamination Program			
1.0	HASP Components		
2.0	Decontamination Facility Design		
3.0	Implementing Basic Decontamination Procedures		
4.0	Decontamination by Commercial Laundries		

5.0	Decontamination Waste Disposal Methods		
6.0	Decontamination During Medical Emergencies		
3-7 Emergency Response Planning Program			
1.0	Responsibilities		
2.0	Pre-Emergency Preparation		
2.1	Emergency Responders and Equipment		
2.2	Emergency Communication System		
2.2.1	Off-Site Communication		
2.2.2	On-Site Communication		
2.3	Site Maps		
2.4	Arrangements with Local Authorities		
3.0	Emergency Response Procedures		
3.1	Basic Response Actions		
3.2	Injuries		
3.2.1	Minor Occupational Injuries		
3.2.2	Major Serious Occupational Injuries		
3.3	Uncontrolled Fires		
3.4	Uncontrolled Releases of Hazardous Materials		
3.5	Site Evacuation		
3.6	Community Evacuation		
4.0	Post-Emergency Procedures		
5.0	Amendments to the Emergency Response Plan		
4-1 Employee Safety SOPs			
	General / Introduction	x	
	Reporting	x	
	Fire Safety	x	
	Housekeeping	x	
	Equipment Safety	x	
	Chemical Safety	x	
	Vehicle Safety	x	
4-2 Working Near Water SOP			
1.0	General Procedures		
2.0	Cold Water Procedures		
4-3 Fall Protection			
1.0	General Information		
2.0	Fall Protection Requirements		
3.0	Fall Protection Pre-Job Brief		
4.0	Personal Fall Protection Systems		
5.0	Fall Arrest Rescue		
6.0	Training		
4-4 Heat Stress			
	SOP for Preventing Heat Stress		
4-5 Cold Stress			
	SOP for Preventing Cold Stress		
4-6 Electrical Work Safety			
1.0	Power Lines		
2.0	General Safe Work Practices		

3.0	Grounding		
4.0	Training		
4-7 Control of Hazardous Energy Sources			
1.0	Applicability		
2.0	Definitions		
3.0	Responsibilities		
4.0	Procedures		
4.1	Energy Control Procedures		
4.1.1	Lockout or Tagout Sequence		
4.1.2	Restoration of Equipment to Service		
4.2	Employee Training		
4.3	Periodic Inspections		
4-8 Ladder Safety			
1.0	Ladder Safety Requirements	x	
2.0	Training	x	
4-9 Safe Drilling			
	SOP for Safe Drilling		
4-10 Excavation			
1.0	Definitions		
2.0	Procedures		
2.1	General Safety Requirements		
2.2	Protective System Requirements		
2.2.1	Sloping and Benching Requirements		
2.2.2	Shoring System Requirements		
4-11 Heavy Equipment			
	SOP for Use of Heavy Equipment		
4-12 Tank Removal			
1.0	General Safety Considerations		
2.0	Removal Activities		
2.1	Site Preparation		
2.2	Product Transfer		
2.3	Tank Purging or Inerting		
2.3.1	Tank Purging		
2.3.2	Tank Inerting		
2.4	Tank Atmosphere Testing		
2.5	UST Removal		
2.6	Tank Cleaning		
2.7	Demolition		
4-13 Biohazards			
1.0	Insects	x	
2.0	Snakes	x	
3.0	Animals	x	
4.0	Plants	x	
5.0	Waterborne Pathogens – Giardia	x	
4-14 General Safe Work Practices			
	SOP for General Safe Work Practices at HAZWOPER Sites		

4-15 Drum and Container Handling			
1.0	Inspection		
2.0	Opening		
3.0	Sampling		
4.0	Over-packing		
5.0	Staging		
4-16 Spill and Discharge Control			
1.0	General Procedures	x	
2.0	Solids	x	
3.0	Liquids	x	
4.0	Reporting	x	
4-17 Flammable Hazards and Ignition Sources			
1.0	Responsibilities		
2.0	Air Monitoring		
3.0	Elimination of Ignition Sources		
4.0	Proper Chemical Handling and Transfer		
4-18 Oil and Fuel Product Hazards			
1.0	Applicability		
2.0	Hazard Evaluation		
2.1	Flammability		
2.2	Toxicity		
2.3	Exposure Limits		
3.0	Health and Safety Requirements		
3.1	Medical Surveillance Requirements		
3.2	Training Requirements		
3.3	Personal Protective Equipment Requirements		
4.0	Air Monitoring		
5.0	Area Controls		
6.0	Decontamination		
7.0	Storage Tank Removal Procedures		
8.0	Emergency Response		
9.0	Accident Reporting		

CERTIFICATION OF HEALTH AND SAFETY MANUAL REVIEW:

I certify that I have read and understand the selected Health and Safety Manual sections that have been designated for me in the above table.

*Signature:*_____*Date:*_____

1-8. HEALTH AND SAFETY AUDIT PROGRAM

The purpose of the Department of Natural Resources and Environmental Control (DNREC) WHS Division of Waste and Hazardous Substances (WHS) audit program is to ensure compliance with the comprehensive Health and Safety Program, as well as any federal, state, or other regulations as applicable to WHS staff and contractors. The audit program includes operations audits and worksite audits. In addition, the audit program provides a mechanism for continual improvement of the health and safety program. Audit responsibilities and program elements are discussed below.

1-8.1. RESPONSIBILITIES

The WHS Division Director is responsible for implementation of the audit program. Compliance audits, when conducted at any operational level, shall be led by a team comprising of two Section staff members knowledgeable in the activities and duties performed by the audited worksite that are in a Program Manager or higher position. Worksite project audits may be conducted by competent staff approved by the director or by a member or members of the IHSW, or by a contracted health and safety specialist. Although most audits will be preplanned, all WHS activities may periodically be subjected to unannounced inspections.

It shall be the responsibility of the Section Management to ensure the completion of a minimum of two compliance audits each calendar year. Although work sites chosen to be inspection should be random, efforts to inspect varying work sites, activities, and employees should be made when practical.

1-8.2. AUDIT PROGRAM ELEMENTS

This section describes the auditing program elements and procedures, including operations audits and worksite audits.

1-8.2.1. OPERATIONS AUDITS

Division audits will be performed to ensure that each program/section is maintaining the health and safety program at the required performance level. The auditor will use the attached “Health and Safety Program Audit Checklist” (Attachment A to this section) to document audit results. The audit will cover, at a minimum, the following:

- Recordkeeping procedures.
- Division policies compliance.
- Occupational Safety and Health Administration (OSHA) compliance.

- Medical surveillance compliance.
- Health and Safety Plan (HASP) development and effectiveness, if applicable.
- Personal protective equipment (PPE) use and inventories.
- Status of employee training.

In addition, a general evaluation will be made of the overall health and safety administration within the program or section.

A report of findings from the audit will be prepared and distributed to the Director, the program/section manager, as applicable, and the project manager/project officer(s) of any audited project(s). The report will document the status of the WHS Health and Safety Program and any deficiencies found. The report will also include an audit action plan outlining actions necessary to correct the deficiencies. The program/section manager will be required to document on the audit action plan those actions taken to correct the deficiencies and the date the deficiencies were corrected. The audit action plan will be returned to the Division Director for review and filing. DNREC WHS will maintain audit reports and completed action plans for a period of three (3) years after the audit.

Operations audits will be conducted on each section at least once every four years or as ordered by the WHS Director.

1-8.2.2. WORKSITE AUDITS

1-8.2.2.1. GENERAL PROJECTS

Worksite audits are conducted to ensure that the WHS Health and Safety Program and Standard Operating Procedures are being properly implemented at the project site. Worksite audits may also be conducted of a specific WHS office or location. The nature of the audit will depend upon the type of activity taking place at the site. During the audit, activities will be directly compared to the requirements of the Health and Safety Program. To evaluate field procedures the auditor may use the “Worksite Audit Checklist” (Attachment B to this section). An audit of a project site should include, at a minimum, the following:

- Records review information (including training, safety briefing, and other information).
- Monitoring procedures and equipment if required.
- Personal protective equipment (PPE) clothing and equipment.

In addition, a general evaluation will be made of the overall implementation of the Health and Safety program at the site. Completed audit reports must be maintained with the project files. The auditor will provide a copy of the completed report, including any deficiencies, to the project manager/project officer, and the IHSW representative. The project manager/project officer will be responsible for ensuring that deficiencies are remedied in a timely manner.

- During an audit, if the auditor discovers any unsafe practices or conditions that may endanger site personnel or create an environmental risk, immediate corrective action will be taken in the field. If such action is not possible, the auditor will have the authority to shut down the operation until the unsafe situation can be corrected.

The frequency of inspections will vary with the characteristics of the project and the equipment used on site.

1-8.2.2.2. HAZWOPER PROJECTS

Worksite audits are conducted at uncontrolled hazardous waste sites as defined by the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard (29 CFR 1910.120) to ensure that the WHS Health and Safety Program and site-specific HASP are being properly implemented at the project site. To evaluate field procedures the auditor may use the "Worksite Audit Checklist" (Attachment B to this section). If this form is not used, an audit should include, at a minimum, the following:

- Records review information (including training, safety briefing, HASP sign-off, and other information).
- Work zone information.
- Monitoring procedures and equipment.
- Personal protective equipment (PPE) clothing and equipment.
- Decontamination information.
- Monitoring results.

In addition, a general evaluation will be made of the overall implementation of the HASP at the site. For example, the auditor should inspect work zones and decontamination stations, observe PPE usage and monitoring procedures, and note general site orderliness.

Completed audit checklists must be maintained with the project files. The auditor will provide a copy of the completed checklist, including any deficiencies, to the site safety officer (SSO), the project manager/project officer, and the Section Administrator. The project manager/project officer will be responsible for ensuring that deficiencies are remedied in a timely manner.

During a field audit, if the auditor discovers any unsafe practices or conditions that may endanger site personnel or create an environmental risk, immediate corrective action will be taken in the field. If such action is not possible, the auditor will have the authority to shut down the operation to prevent serious injury or exposure of site personnel.

The SSO should also conduct regular inspections of site conditions, facilities, equipment, and activities to determine whether the HASP is adequate, and if all field staff and subcontractors are abiding by the requirements of the HASP. In order to make safety inspections effective, the following guidelines should be observed:

- A checklist should be used for each inspection that lists the items that should be inspected.
- Following the inspection, the results should be reviewed with site supervisors and workers.
- Within one week, any identified problems should be re-inspected to verify that they have been corrected.
- All inspections and subsequent follow-up actions should be documented and the records retained with the project files

The frequency of inspections will vary with the characteristics of the site and the equipment used on site. Project audits will be included in the operations audit.

DNREC DIVISION OF WASTE AND HAZARDOUS SUBSTANCES

1-8A. HEALTH AND SAFETY PROGRAM COMPLIANCE CHECKLIST

Date: _____ Auditor: _____

Program/Section: _____

Program/Section Manager: _____

AUDIT AGENDA

A. Initial meeting with Program/Section Manager

1. Follow-up on past deficiencies
2. General assessment of equipment and office
3. Review Health and Safety Program compliance (see attached checklist; additional items may be added by auditor)

	Yes	No	NA
A. RECORDS AND POSTING			
1. Ensure Health and Safety Program files are up to date			
2. Check following records:			
Training records			
CPR and first aid training documentation			
Accident investigations records			
Medical surveillance records			
Fit test records			
Worker Category Risk Forms			
Personal Information Datasheets			
Comments: _____			
B. EQUIPMENT			
1. Is someone in charge of PPE maintenance & storage?			
2. Is inventory of supplies and equipment up-to-date?			
3. Are supplies replenished as needed?			
4. Storage areas clean, accessible, and labeled?			

Note: NA = Not applicable

	Yes	No	NA
5. Are records kept of respirator inspections?			
6. Are First Aid kits available, stocked, and locations marked?			
7. Are eyewash stations checked monthly?			

Comments: _____
_____

C. OFFICE INSPECTION			
1. Aisleways and doors clear			
2. Exit signs visible and lighted			
3. Emergency lighting operational			
4. All exit points unlocked and accessible			
5. Slip, trip, and fall hazards controlled			

Comments: _____
_____

D. FIRE PREVENTION			
1. Fire extinguishers in place and accessible			
2. Inspection tags current / fire extinguisher gauge OK (green)			
3. Halon units available near sensitive electronic equipment / (if applicable)			
4. Smoke detectors in place and functional			
5. Combustibles stored away from heat sources			
6. Flammable liquids stored properly			
7. Fire extinguisher training completed			

Comments: _____
_____

E. MEDICAL SURVEILLANCE			
1. All field staff up to date			
2. Proper forms used for documentation			
3. Physical exam records maintained by medical provider			

Note: NA = Not applicable

	Yes	No	NA
4. Exit physicals completed as needed			
5. Contract for medical surveillance current			
Comments: _____			
F. TRAINING			
1. Health and safety training up to date			
2. First aid and CPR training up to date (if required)			
3. Training certificates on file			
4. All eligible supervisors trained			
5. Miscellaneous records of completion maintained			
6. Documentation of course content on file			
Comments: _____			
G. ACCIDENT AND OCCUPATIONAL ILLNESS INVESTIGATION			
1. Review of reported incidents to date			
2. Review of quality of reports			
– Reports complete			
– Reports signed as required			
3. Adequacy of follow-ups to date			
- Actions identified			
- Actions implemented			
Comments: _____			
H. SITE HEALTH AND SAFETY PLANS (HASP)			
1. Compare copy of current project list to HASPs on file			
2. Review of documentation			
– Approval sheet used and filed			
– Compliance agreement sheet used and filed			

Note: NA = Not applicable

	Yes	No	NA
– Tailgate safety meeting held and documented			
3. Field auditing forms used and filed			
Comments: _____			

I. FIT TESTING			
1. Fit tests provided to Level 1 employees annually and other personnel assigned respiratory protection as needed.			
2. Respirator fit test records on file			
Comments: _____			

J. CONTRACTORS			
1. Contractor questionnaire used and filed (see HSM 1-9 Attachment A)			
Comments: _____			

Note: NA = Not applicable

	Yes	No	NA
K. PERSONAL PROTECTIVE EQUIPMENT (PPE) AND RESPIRATORY PROTECTION			
1. Hazard assessments documented			
2. Proper selection			
3. Proper storage			
4. Maintenance records / Replacement Schedules			
Comments: _____			
L. CONFINED SPACE ENTRY (CSE)			
1 CSE identification			
2. CSE permit procedures followed?			
3. CSE training			
4. CSE records kept			
Comments: _____			
M. HAZARD COMMUNICATION			
1. Are hazardous materials inventories completed?			
2. Are MSDSs available for all hazardous materials?			
3. Are employees allowed instant access to MSDSs?			
5. All hazardous materials labeled			
Comments: _____			

Note: NA = Not applicable

N. HEARING CONSERVATION –				
1.	Is a hearing conservation program established (see HSM Section 2-2)?			
2.	Has any noise monitoring been performed? (site specific)			
3.	If yes, were employees notified of results?			
4.	Is training provided annually and documented?			
5.	Have employees been provided hearing protection when necessary?			
6.	Have all employees (as applicable) been shown how to wear hearing protectors?			
Comments: _____ _____				

Note: NA = Not applicable

DNREC DIVISION OF WASTE AND HAZARDOUS SUBSTANCES

1-8B. WORKSITE AUDIT CHECKLIST

For Division Funded Projects

Project Name: _____ Project No.: _____

Field Location: _____ Auditor: _____

Project Manager/Project Officer_____ Site Safety Officer: _____

General Items		In Compliance?		
Health and Safety Plan Requirements		Yes	No	NA
1	Approved health and safety plan (HASP) on site or available			
2	Names of on-site personnel recorded in field logbook or daily log			
3	HASP compliance agreement form signed by all on-site personnel			
4	Safety Data Sheets on site or available immediately			
5	Designated site safety coordinator present			
6	Daily tailgate safety meetings conducted and documented			
7	On-site personnel meet HASP requirements for medical examinations, fit testing, and training (including contractors)			
8	Compliance with SOPs			
9	Documentation of training, medical examinations, and fit tests available			
10	Exclusion, decontamination, and support zones delineated and enforced			
11	Windsock or ribbons in place to indicate wind direction			
Emergency Planning				
12	Emergency telephone numbers posted			
13	Emergency route to hospital posted			
14	Local emergency providers notified of site activities			
15	Adequate safety equipment inventory available			
16	First aid provider and supplies available			
17	Eyewash stations in place			
Air Monitoring				
18	Monitoring equipment specified in HASP available and in working order			
19	Monitoring equipment calibrated and calibration records available			
20	Personnel know how to operate monitoring equipment and equipment manuals available on site			

DNREC DAWM

FIELD AUDIT CHECKLIST (Continued)

21	Environmental and personnel monitoring performed as specified in HASP			

Safety Items		In Compliance?		
Personal Protection		Yes	No	NA
1	Splash suit			
2	Chemical protective clothing			
3	Safety glasses or goggles			
4	Gloves			
5	Over-boots			
6	Hard hat			
7	Dust mask			
8	Hearing protection			
9	Respirator			
10	Cartridges/Air supply			
Instrumentation				
11	Combustible gas meter			
12	Oxygen meter			
13	Flame/Photo-ionization detector			
Supplies				
14	Decontamination equipment and supplies			
15	Fire extinguishers			
16	Spill cleanup supplies			
Corrective Action Taken During Audit:				
Corrective Action Still Needed:				

Note: NA = Not applicable

DNREC DAWM

FIELD AUDIT CHECKLIST (Continued)

_____	_____
Auditor's Signature	Site Safety Officer's Signature
_____	_____
Date	Date

1-9. RECORDKEEPING AND REPORTING REQUIREMENTS

This Recordkeeping and Reporting program applies to all Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) programs and branches. Health and safety recordkeeping and reporting activities occur at various levels. Recordkeeping and reporting are described in, and required by, the Health and Safety Program components specified in this manual. All recordkeeping and reporting files are subject to audits as described in the "Health and Safety Audit Program" in Section 1-8 of this manual. General recordkeeping requirements and recordkeeping and reporting for fieldwork, incidents involving personal injury or illness, Occupational Safety and Health Administration (OSHA) requirements, responding to OSHA inspections are discussed below.

1-9.1. GENERAL REQUIREMENTS

The following records are to be kept by the Medical Surveillance Coordinator (MSC) for each employee, as required by the employee's category and status:

- Physician's written opinion or clearance for the medical monitoring program;
- Certifications of employee safety-related training, such as hearing conservations training, respirator training, hazard communication training, OSHA Hazardous Waste Operations (HAZWOPER) 40-hour training, 8-hour supervisor training, 8-hour refresher training, cardiopulmonary resuscitation (CPR) and first aid training records, and others;
- Copies of training course outlines;
- Respirator Fit Test Record; and
- Documentation of Field Experience.

In accordance with 29 CFR 1910.120, all medical records, including employee exposure records, must be maintained for the duration of the employee's employment plus 30 years. The MSC, or the examining clinic or other contracted facility, will maintain all medical examination records in accordance with all applicable laws and regulations. Copies of medical monitoring results will be mailed directly to the employees. Employees may receive additional copies of their examination records by completing the form in Appendix C of WHS Policy 0615 – Medical Monitoring.

For individual projects, records to be kept in the project files may include: logbooks/field notes; records of safety meetings and/or tailgate safety briefings; noise or air-monitoring records; job hazard analyses; and/or site-specific health and safety training records.

These records must be kept with the permanent project files by the project manager/project officer.

1-9.2. HAZWOPER SITES

Operations that take place on uncontrolled hazardous waste sites, as defined by Title 29 of the *Code of Federal Regulations* (CFR), Part §1910.120, the Occupational Safety and Health Act (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, may require the completion or collection of various forms and records depending on the site and work activities. These forms and records can include the following:

- Field Logs/Logbooks;
- Health and safety plans (HASP), including the approval forms;
- HASP Compliance Agreement documenting that all employees have access to a copy of the HASP and that they have read, understood, and agreed to comply with the HASP;
- Certification of Health and Safety Requirements for Contractors; and
- Contractor health and safety documents including training certificates, incident/accident reports, HASPs, etc.

These records must be kept with the permanent project files by the project manager/project officer.

1-9.3. INCIDENTS INVOLVING PERSONAL INJURY OR ILLNESS

Certain recordkeeping and reporting requirements must be met in the event of a fatality, hospitalization, personal injury, or illness.

All incidents involving personal injury or illness must be reported immediately to the project manager/project officer and reported by the affected employee's supervisor within two (2) days after such an incident occurs as described in detail in WHS Policy 0623- "Incident Reporting". The form *State of Delaware First Report of Occupational Injury or Disease* must be used to document the incident. It is important to report all exposures and injuries even though the incident is not considered serious or adverse health effects or symptoms are not apparent at the time of occurrence.

On a contractor site, in the event of a fatal accident or accident resulting in the in-patient hospitalization of one or more individuals, an immediate telephone report will be made by the project manager/project officer to the program/section manager. The program/section manager will contact the director and describe all details of the accident and determine actions to be taken. In these events, the contractor must contact appropriate local, state, or federal health and safety agencies within a designated time period. The

WHS project manager/project officer will verify that the contractor follows this procedure. OSHA requires reporting of any fatality or in-patient hospitalization of three or more individuals to the nearest OSHA office within 8 hours as stated in Title 29 of the *Code of Federal Regulations* (CFR) §1904.39. The contractor's report shall relate the establishment name, location and circumstances of the accident, the number and names of fatalities or hospitalized employees, and the extent of any injuries. The report shall be made by telephone to the nearest OSHA area office or the OSHA toll free telephone number may be used (800)-321-OSHA. In these instances, OSHA will typically conduct an on-site investigation. Records and forms related to injuries and exposures are maintained by the Medical Surveillance Coordinator and at the state level.

1-9.4. OSHA RECORKEEPING REQUIREMENTS FOR DNREC CONTRACTORS

Regulations established by the Occupational Safety and Health Act of 1970 require non-exempt (i.e. most contractor) employers to prepare and maintain records of occupational injuries and illnesses. In addition, the Act requires the reporting of fatal or serious injuries as described in Section 3.0 above. All records must be made on forms approved by the U.S. Department of Labor or equivalent forms. The OSHA Form 300, "Log of Work-Related Injuries and Illnesses," is used to document recordable injuries and illnesses as defined by OSHA. All injuries and illnesses that require treatment beyond first aid must be recorded by the contractor on the OSHA Form 300. At the end of the calendar year, each contractor should complete an OSHA Form 300A, Summary of Work-Related Injuries and Illnesses. On February 1 of each year, Form 300A from the previous year must be posted in an area where notices to employees are customarily placed. This form shall remain posted from February through April. Copies of the OSHA Forms 300 and 300A must be maintained by each contractor for a minimum of 5 years.

Although WHS is not responsible for the recordkeeping requirements of its contractors, a WHS project manager/project officer may request copies of a contractor's health and safety records to ensure proper recording and reporting of incidents that take place on WHS work sites.

Attachment A "Contractor Health and Safety Questionnaire" should be completed through contractor / consultant qualification program or through State contract specifications.

1-9.4.1. EMPLOYEE INVOLVEMENT

In order to provide prompt medical attention, correct unsafe conditions and maintain an effective accident prevention program, all WHS employees are expected to immediately report any work-related injury or illness. The method for reporting of injuries and illnesses is included in Policy 0623 – "Incident Reporting". This policy is available on the WHS computer server and the Intranet site.

Near misses (an unsafe act or condition) that do not involve injury or property damage should be shared with the site safety officer or manager as soon as possible so that learnings can be applied across the organization.

1-9.5. RESPONDING TO OSHA INSPECTIONS

OSHA may conduct inspections of work sites on which contractors are working. OSHA conducts workplace inspections for the following reasons, in the order of priority:

- A reported or recognized situation presenting "Imminent Danger" to the safety of employees;
- Following a fatality or a catastrophic incident;
- Investigations in response to employee complaints or referrals; and
- Programmed inspection determined by OSHA criteria such as serious injury, frequency rates, and so on.

In the event OSHA conducts an inspection of any WHS work site or project, the WHS employee initially receiving the OSHA compliance officer must immediately notify the program/section Manager. The director must be notified of an OSHA inspection within eight hours. Timely notification is necessary in order to provide assistance during the inspection and guidance for any additional communications between agencies.

DNREC DIVISION OF WASTE AND HAZARDOUS SUBSTANCES

CONTRACTOR HEALTH AND SAFETY QUESTIONNAIRE

Company Name:	
Address:	
City, State, Zip:	
Contact Name:	
Telephone No.	
Fax No.	

HEALTH AND SAFETY PROGRAM

1. Does your company have a written safety program? ☐ Yes ☐ No

2. Does your company have a full-time safety director? ☐ Yes ☐ No

   If no, who is responsible for the safety program (include job title)?

3. List your firm's interstate experience modification rate for the past 3 consecutive years.
   NOTE: This information can be obtained from your worker's compensation insurance carrier.

20 _____ _____	20 _____ _____	20 _____ _____

4. Please consult your last 3 years of OSHA 200 logs to complete the table below.

		20____	20____	20____
(a)	Number of lost workday cases			
(b)	Number of lost workdays			
(c)	Number of restricted workday cases			
(d)	Total number of recordable cases as defined on OSHA 200 log			
(e)	Total employee hours worked this year			
(f)	Number of fatalities			

5. Are accident investigation reports completed for all injuries? ☐ Yes ☐ No

   Who receives the reports?

6. Do you conduct project safety inspections? ☐ Yes ☐ No

   If yes, who conducts this inspection (include job title)? _____

   How often? _____ Checklist used? ☐ Yes ☐ No

7. Do you require "tool box" or "tailgate" safety meetings? ☐ Yes ☐ No

   If yes, how often? ☐ Daily ☐ Weekly ☐ Monthly

   Are the meetings documented? ☐ Yes ☐ No

8.	Do you require safety information from your subcontractors?	☐ Yes	☐ No
9.	Indicate the written programs your organization has in place:		
	Hazard Communication (29 CFR 1910.1200)	☐ Yes	☐ No
	Hazardous Waste Operations and Emergency Response (29 CFR 1910.120)	☐ Yes	☐ No
	Respiratory Protections (29 CFR 1910.139)	☐ Yes	☐ No
	Confined Space Entry (29 CFR 1910.146)	☐ Yes	☐ No
	Lockout/Tagout (29 CFR 1910.147)	☐ Yes	☐ No
	Hearing Conservation (29 CFR 1910.95)	☐ Yes	☐ No
	Substance and Alcohol Abuse Policy	☐ Yes	☐ No
	Illness and Injury Prevention Program (California only)	☐ Yes	☐ No
TRAINING			
1.	Indicate training topics for new hires:		
	Head protection	☐ Yes	☐ No
	Eye protection	☐ Yes	☐ No
	Hearing protection	☐ Yes	☐ No
	Respiratory protection	☐ Yes	☐ No
	Safety belts and harnesses	☐ Yes	☐ No
	Scaffolding	☐ Yes	☐ No
	Fire protection and use of extinguishers	☐ Yes	☐ No
	Toxic substances	☐ Yes	☐ No
	Electrical safety	☐ Yes	☐ No
	Lockout/tagout	☐ Yes	☐ No
	Confined space entry	☐ Yes	☐ No
	Hazardous waste operation	☐ Yes	☐ No
2.	Do you provide refresher training for hazardous waste operation?	☐ Yes	☐ No
3.	Are field employees trained in first aid and cardiopulmonary resuscitation (CPR)?	☐ Yes	☐ No
4.	Do employees receive information on bloodborne pathogen control?	☐ Yes	☐ No
5.	Are any employees trained in the use of air monitoring equipment?	☐ Yes	☐ No
	If yes, which types? ☐ Combustible gas/oxygen meter ☐ Organic vapor analyzer ☐ Aerosol/dust meter ☐ Other (specify): _____		

6. Are employees trained and experienced in the use of the following levels of personal protective equipment (PPE)?

PPE Level	Trained	Field Experience
Level A		
Level B		
Level C		

7. Are respirator users fit tested annually, at a minimum? ☐ Yes ☐ No

   Are records of the testing maintained? ☐ Yes ☐ No

8. Are employees provided with suitable medical surveillance? ☐ Yes ☐ No

EQUIPMENT

1. Indicate the safety equipment available to field employees:

	Yes	No	Mandatory
Steel-toed boots			
Hard hat			
Safety glasses			
Gloves			
Coveralls			
Chemical-resistant coveralls			
Air-purifying respirator			
Air-supplied respirator (airline, SCBA)			
Ear plugs or ear muffs			

2. Are first aid kits available at all job sites? ☐ Yes ☐ No

3. Are fire extinguishers available at all job sites? ☐ Yes ☐ No

Completed by (printed name):	Title:
Signature:	Date:

1-10. ACCIDENT AND NEAR MISS INVESTIGATION (RESRVED)

(Reserved)

2-1. HAZARD COMMUNICATION PROGRAM

The hazard communication program was developed to protect the right of Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) employees and contractors to access information on the chemical and physical hazards of materials they use in their work. Specifically, this hazard communication program defines the measures to communicate these hazards and ensure that WHS employees and contractors are informed of chemical hazards in accordance with the requirements outlined in Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.1200, the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard. The OSHA standard applies to all work places where personnel are occupationally exposed to hazardous chemicals. In addition, to ensure employee rights, this hazard communication program shall be available upon request to employees and their representatives. The hazard communication program does not apply to hazardous wastes but does apply to all hazardous materials, such as acids and caustics, used in sample preparation and as cleaning solvents brought onto and used at a work site. The responsibilities and elements associated with the hazard communication program are discussed below.

2-1.1. HAZARD COMMUNICATION PROGRAM RESPONSIBILITIES

Division Director: The director shall ensure compliance with the requirements identified in this hazard communication program by conducting annual audits. The director shall also act as a resource to sections and programs regarding hazard communication compliance issues.

Program/Section Managers: All program/section managers shall support an effective hazard communication program within their office or area. Program/section managers may elect to delegate the day-to-day administration of the hazard communication program to other qualified personnel. Program/Section Managers shall perform the following duties:

- Communicate program requirements to employees included in the Health and Safety Program or required to implement program requirements off site
- Provide for the necessary hazard communication training
- Maintain chemical inventories and safety data sheet (SDS) files within their respective program offices

Project Manager/Project Officer: The project manager/project officer shall ensure that all hazard communication program requirements have been identified and addressed for their projects. This task may include, but is not limited to, the following:

- Identification of work tasks (routine and non-routine) and performance of an associated hazard analysis
- Completion of a chemical inventory for the project
- Procurement of SDSs for chemicals used for the project
- Labeling of containers used on site for hazardous materials
- Identification of any additional hazard communication training requirements

2-1.2. HAZARD COMMUNICATION PROGRAM ELEMENTS

The following program elements describe how the criteria specified by the OSHA Hazard Communication Standard shall be implemented and maintained. Program elements include the following:

- Hazard determination
- Hazardous chemical inventory
- Labeling and containers
- Safety Data Sheets
- Employee training
- Contractors

Each of these elements is described below.

2-1.2.1. HAZARD DETERMINATION

In most cases, the determination of chemical hazards will be based on information provided by the chemical's manufacturer or distributor. In situations where this is not possible, a hazard determination shall be conducted by WHS based on the criteria established in Appendices A and B of the hazard communication standard, 29 CFR, Part 1910.1200.

Additionally, the chemicals listed in the following resources are to be considered hazardous and shall fall under the scope of this hazard communication program:

- 29 CFR, Part 1910, Subpart Z, "Toxic and Hazardous Substances," OSHA
- *Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment*, American Conference of Governmental Industrial Hygienists (ACGIH), latest edition

- *Annual Report on Carcinogens*, National Toxicology Program (NTP), latest edition
- International Agency for Research on Cancer (IARC) *Monographs*, latest edition

Chemical mixtures are defined as any combination of two or more chemicals if the combination is not in whole or in part the result of a chemical reaction. If a chemical mixture has not been tested as a whole to determine whether the mixture is hazardous, then the mixture shall be assumed to present the same health hazards as each component that makes up 1 percent or greater of the mixture by weight or volume. A mixture will be considered potentially carcinogenic if it contains a carcinogenic component at a concentration of 0.1 percent or greater.

If evidence indicates that a component in a mixture at a concentration of less than 1 percent (or, in the case of carcinogens, less than 0.1 percent) could be released at a concentration that exceeds an established OSHA permissible exposure limit or ACGIH threshold limit value or that could present a health risk to employees at the released concentration, the mixture is assumed to present the same hazard as that component.

If the mixture has not been tested as a whole to determine whether the mixture presents a physical hazard (such as combustible or explosive), WHS will use whatever scientifically valid data are available to evaluate the physical hazard potential of the mixture.

2-1.2.2. HAZARDOUS CHEMICAL INVENTORY

For each field project, the project manager/project officer will develop and maintain a current list of hazardous materials (hazardous chemical inventory) brought onto the work site. The existence and location of these documents shall be communicated to all employees and contractors prior to start of project. Small quantities of hazardous chemicals may also be present at WHS offices and storage areas. For purposes of this program or as required by the OSHA Hazard Communication Standard, chemicals and consumer products not used in the same manner, duration, or frequency intended by consumers shall be included on the hazardous chemical inventory.

2-1.2.3.LABELING AND CONTAINERS

When a chemical is received from a manufacturer or distributor, the employee responsible for its receipt will verify that the container is properly labeled with the following information:

- Product identifier
- Signal word
- Hazard statement(s)

- Pictogram(s)
- Precautionary Statements
- Name, address, and phone number of the chemical manufacturer and/or distributor

All chemicals associated with a project should be stored, dispensed from, or otherwise used in their original containers. The use of secondary containers should be avoided. However, secondary containers may be used when the employee who made the transfer will immediately use the chemical. Container labeling is not required for secondary immediate uses. However, should secondary container use be necessary beyond immediate use, the employee who made the transfer will affix a label that identifies the chemical identity as well as the general and specific hazards of the chemical.

All original labels, warnings, and other printed information must be maintained intact and plainly visible at all times. Original labels shall not be defaced. Hazardous materials will not be allowed on a project site if they are not in the original or approved containers or if the containers are unlabeled or improperly labeled. When stationary process containers, such as tanks that cannot be moved, are used on a project, WHS may elect to use signs, placards, operating procedures, or other such written materials instead of affixing labels to individual stationary containers as long as the required label information is conveyed. If written materials are used, then this information shall be readily available to employees in the area.

2-1.2.4. SAFETY DATA SHEETS

All chemicals brought on or used at a work site must be accompanied by SDSs provided by the manufacturer. Chemicals will not be permitted at the work site without SDSs. Whenever a chemical is purchased, it is the responsibility of the individual in charge of the purchase to obtain a current and complete SDS as part of the order. A written request will be made for a SDS if one is not received. If a SDS is still not received after the original written request, a second request will be made in writing or by telephone. If the supplier refuses to provide a SDS, the local OSHA office will be contacted for further assistance.

Once received, the SDS shall be reviewed and evaluated by the purchaser and the SSO for completeness and to determine if the new chemical will pose any new or significant risks that require additional hazard communication training.

A copy of each SDS will be maintained in the project file and included in the site-specific HASP. Employees will have unrestricted access to the SDSs at all times.

In addition, prior to beginning work, contractors will be required to provide the project manager/project officer with a list of all chemicals that they will use and a SDS for each chemical. The SSO will evaluate the SDSs and list of chemicals to determine if the chemicals used pose any new or significant risks to WHS employees. Additional training will be provided, if required.

The format and specific information found on a SDS shall be in accordance with 29 CFR 1910.1200 Appendix D. Each SDS shall contain, at a minimum, the following information:

- Name of the product on the label
- The name, address, and telephone number of the chemical manufacturer or importer, or of someone who can provide additional information on the chemical and appropriate emergency procedures, if necessary
- Hazard identification
- Chemical and common names of each ingredient if the product is a mixture
- Emergency and first aid procedures
- Precautions for safe handling
- Exposure control measures
- OSHA permissible exposure limits, ACGIH threshold limit values, any other published exposure limit, or any other exposure guideline used or recommended by the chemical manufacturer or importer
- Physical and chemical characteristics of the chemical
- Physical hazards of the chemical
- Health hazards of the chemical
- Primary routes of exposure
- Whether the hazardous chemical is listed in the NTP *Annual Report on Carcinogens* or has been found to be a potential carcinogen in the IARC *Monographs* or by OSHA

Date of SDS preparation -or the last date of the last revision, and the name of the preparer. If no information is available for any given category on the SDS, the chemical manufacturer is required to mark the SDS to indicate that no applicable information was found. Blank sections are not allowed.

2-1.2.5. EMPLOYEE TRAINING

The project manager or designee will provide information and training to employees upon assignment to a job task involving the use of hazardous materials and whenever a new material posing new physical or health hazards is introduced.

General information and training will be provided in the initial 40-hour health and safety training class and refresher training classes as required under 29 CFR 1910.120. Employees not enrolled in the HAZWOPER Program will receive training in the provisions of this Hazard Communication Program initially and again when necessary based on the nature of their work, a change in the program, or a change in workplace chemicals used. Information conveyed to employees during training will include the following:

- Requirements of the hazard communication standard in 29 CFR 1910.1200;
- The types of operations in an employee's work that involve hazardous materials;
- The location of copies of the hazard communication program, SDSs, and the chemical inventory;
- Methods and observations that may be used to detect the presence or release of a hazardous material in the work area (such as monitoring conducted by the employer, continuous monitoring devices, or visual appearance or odor of hazardous materials being released);
- Recognition of signs and symptoms that may indicate exposure to hazards such as dizziness, nausea, skin rash, and other symptoms;
- Signs and symptoms of chemical exposure;
- Physical and health hazards associated with materials in the work area;
- Protective measures, including specific procedures such as appropriate work practices, emergency procedures, and use of personal protective equipment (PPE), that WHS has implemented to protect employees from exposure to hazardous materials ;
- Details of the hazard communication program developed by WHS, including an explanation of the labeling system and SDSs and how employees can obtain and use the appropriate hazard information;
- How to read and use SDSs; and

- When to include SDSs in site-specific HASPs.

2-1.2.6. CONTRACTORS

WHS shall provide contractors at a work site with a copy of relevant Health and Safety Programs or Standard Operating Procedures. On HAZWOPER sites, the site-specific HASP shall be provided to all contractors. The HASP shall include the following hazard communication information:

- Hazard analysis of work tasks
- Chemical hazards anticipated at the site
- Recommended PPE
- Air monitoring instruments to be used for site hazards
- Information on the major chemical hazards in the form of SDSs or a chemical hazard information table

WHS will make available to contractors copies of SDSs, for each hazardous chemical brought on site by WHS that the contractor might be exposed to while working on site. Contractors will be informed of any precautionary measures that need to be taken to protect their employees using hazardous materials brought on site by WHS during the site's normal operating conditions and during potential emergency situations.

WHS will inform contractors of the hazardous materials labeling system used on site. Each contractor will be required to have its own hazard communication program in accordance with 29 CFR 1910.1200 and applicable state and local regulations. An SDS is also required for each hazardous material a contractor brings to the site.

2-2. HEARING CONSERVATION PROGRAM

The Delaware Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) has established this hearing conservation program to protect employees from the harmful effects of noise exposure. This program is designed to comply with the Occupational Safety and Health Administration (OSHA) occupational noise exposure standard in Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.95.

Program/section managers are responsible for application and oversight of the hearing conservation program within their respective organizations. Records of all noise exposure measurements will be retained for at least two (2) years.

Project managers/project officers are responsible for ensuring compliance with hearing conservation controls and protection at their project sites. During activities in facilities not controlled by DNREC, such as in operating factories or on construction sites, personnel are responsible to know in which areas hearing protection is required. If hearing protection is not required in a noisy area, WHS personnel should ask to see the results of noise surveys for the area that indicate hearing protection is not required. WHS personnel are responsible for wearing appropriate hearing protection devices and following hearing conservation procedures in any noise control area.

The hearing conservation program elements describe how the criteria specified by the OSHA standard shall be implemented and maintained. Program elements include action levels, monitoring, employee notification, audiometric testing, hearing protection, warning signs and information, and training. This hearing conservation program shall be made available upon request to employees and their representatives.

2-2.1. ACTION LEVELS

The OSHA permissible exposure limit for noise is an 8-hour time-weighted average (TWA) of 90 decibels on the A-weighted scale (dBA) in the slow response mode. OSHA also has an action level for noise, which is 85 decibels measured on the A-weighted scale (dBA) in the slow response mode. **The WHS action level for noise is set at 85 dBA, which is more protective than the OSHA standard requires.** When WHS employees are exposed to sound levels above 85 dBA for any period of time, the hearing conservation program elements must be implemented, including the provision of appropriate hearing protective devices (i.e., ear muffs or plugs) and engineering controls, where feasible. Whenever possible, administrative or engineering controls will be used to reduce the sound level. If such controls are not feasible or fail to reduce sound levels to below 85 dBA, hearing protection will be provided to

employees to reduce sound exposures to below the 85-dBA limit. **The DNREC WHS hearing conservation program mandates the use of hearing protection for exposures of 85 dBA or greater regardless of the length of exposure.**

2-2.2. MONITORING

In most instances, high noise levels at work sites are caused by contractor equipment, such as drill rigs and backhoes, or sources associated with the work site, such as factory equipment and vehicles. Most common high-noise-level sources have been measured, and instances where hearing protection is required shall be communicated to all WHS personnel working on the site. For hazardous waste operations (HAZWOPER) sites, required hearing protection shall be indicated in the site-specific health and safety plan (HASP) for the site. When noise exposures at a work site are suspected to equal or 85 dBA resulting from noise sources not previously measured, the project manager/project officer shall conduct an evaluation to characterize the noise sources and exposure levels.

A portable sound-level meter (or equivalent technology) is recommended for surveying general work areas and for estimating noise exposure when the noise levels are relatively constant. Noise dosimeters are recommended for documenting full-shift noise exposures when noise sources fluctuate, are intermittent, or otherwise difficult to document with the sound-level meter and when employees move from place-to-place in the performance of their duties. Monitoring for occupational noise exposure will be conducted for each representative task or job position that the project manager/project officer, program/section manager, or integrated health and safety workgroup deems necessary.

All noise measurements will be taken in the hearing zone of the individual. The hearing zone is an area within a radius not to exceed 12 inches from the ear closest or in most direct proximity to the noise source.

Monitoring equipment must be in factory calibrated and will be checked in the field with an appropriate field calibration check standard (pure tone) before and after each set of measurements. Documentation of test field calibration checks will be kept with the field data collected.

In some cases, such as short-term projects, the project manager/project officer may forego actual noise level measurements and use a simple rule-of-thumb test to determine if noise levels are in excess of 85 dBA. The test requires the project manager/project officer to determine how loud he or she must speak to be heard at arm’s length from another person. If the project manager/project officer must raise his or her voice to be heard, average noise levels likely exceed 85dBA.

2-2.3. EMPLOYEE NOTIFICATION

The project manager/project officer is responsible for informing employees exposed at or above 85 dBA of the results of the monitoring. The project manager/project officer shall utilize the appropriate procedures for notifying employees as outlined in section 6.0 of this program.

2-2.4. AUDIOMETRIC TESTING

Audiometric testing is a component of the DNREC WHS medical surveillance program (Section 2-8 of this manual). The program consists of baseline audiograms, annual audiograms, and termination audiograms. Employees will be informed of the results of these tests at the time of their examination. If an employee annual audiogram shows that a Standard Threshold Shift has occurred, WHS may retest the employee within 30 days and consider the retest as the annual audiogram.

Audiometric test results will be retained by the medical clinic conducting the testing and will become a part of each employee's permanent medical record. Exposure and audiometric records will be made available to employees upon request. All medical and exposure records generated through compliance with this procedure will be maintained in accordance with 29 CFR 1910.1020 Access to Employee Exposure and Medical Records.

2-2.5. HEARING PROTECTION

WHS will provide hearing protectors to all personnel who may experience noise exposures of 85 dBA or greater regardless of length of time exposed. Hearing protectors must provide sufficient noise level reduction, or attenuation, to limit employee noise exposure to less than 85 dBA. The hearing protectors will be replaced as necessary. The project manager/project officer or designee will supervise the correct use of hearing protectors at a work site. All affected personnel will receive instruction in proper fitting during initial and annual health and safety refresher classes.

All hearing protectors shall have a Noise Reduction Rating (NRR). These ratings shall be used to determine if the hearing protectors will offer adequate protection for the environment in which the employee will be exposed. The NRR of the hearing protection must be sufficient so that the 8-hour TWA will be 85 dBA or less.

- The listed NRR is a laboratory result. The real world NRR will be significantly less because of inadequate fit and application.
- Subtract 7 dB from the NRR of the HPD to account for improper fit and application.

- Use the following formula to calculate how much noise the employee is exposed to when properly using the hearing protector:

  Noise level – [NRR of HPD – 7] = Employee noise exposure level

2-2.6. WARNING SIGNS AND INFORMATION

During long-term projects, the project manager/project officer will post "Hearing Protection Required" signs in areas where noise levels have been measured and determined to exceed the 85-dBA action level. Signs may also be posted in areas where monitoring has not been conducted but noise levels are expected to exceed 85-dBA based on similarity to past activities or on the judgment of the project manager/project officer.

For short-duration projects or where personnel exposure in the high-noise area is limited and controlled, the project manager/project officer may provide verbal notice of the need for hearing protection in place of the signs described above.

2-2.7. TRAINING

Hearing conservation training may be conducted as a stand-alone course or may be included in other health and safety training courses. Hearing conservation training will include the following:

- Effects of noise on hearing;
- The purpose of hearing protectors;
- The advantages, disadvantages, and attenuation of various types of hearing protection;
- Instruction on selection, fitting, use, and care of hearing protectors; and
- The purpose of audiometric testing and an explanation of the test procedure.

Documentation of training will be through class attendance records and course agendas. Specific components of the WHS hearing conservation program will be discussed during annual refresher training classes and documented through attendance records and course agendas.

2-3. PERSONAL PROTECTIVE EQUIPMENT PROGRAM

The Department of Natural Resources and Environmental Control (DNREC) Division of Air and Waste Management (WHS) has developed this personal protective equipment (PPE) program to protect its employees from health and safety hazards and to prevent injury to employees from malfunction, incorrect selection or incorrect use of PPE. This program covers the use of PPE by WHS employees to control contact with or exposure to hazardous chemicals, physical health and safety hazards, and any other health and safety risks exclusive of respiratory exposure. The program complies with the requirements of Title 29 of the *Code of Federal Regulations* (CFR), Parts 1910.120 (g) (5), 1910.132, 1910.133, 1910.135 through 1910.138, and 1926.28. Respiratory protection and compliance with applicable Occupational Safety and Health Administration (OSHA) standards for respirators are addressed under a separate program, the "Respiratory Protection Program" in Section 2-4 of this manual.

To the extent possible, engineering and administrative controls shall be used to eliminate or minimize health and safety hazards. When such controls are not feasible or sufficiently effective to reduce worker exposures to chemical, physical or biological hazards, appropriate PPE shall be used in accordance with this program. WHS shall provide and maintain PPE in various sizes and styles to provide a comfortable and effective fit for all wearers. Except as provided by 29 CFR 1910.132 paragraphs (h)(2) through (h)(6), PPE shall be provided by the employer at no cost to employees.

The proper use of PPE, in addition to safe work practices, site entry control, proper decontamination, and other safety considerations, reduces the potential for exposure or injury to WHS employees working at hazardous waste sites, construction sites, manufacturing facilities, and other work places where significant physical, biological or chemical hazards exist. As part of its overall Health and Safety Program, WHS will develop and implement procedures for the introduction and use of new employee protective technologies as they become available. WHS will continually evaluate and use state-of-the-art methods, materials, and equipment to enhance employee protection.

The program/section manager or designee is responsible for approving the site-specific PPE selection criteria for his or her project. A site-specific health and safety plan (HASP) must indicate PPE required for activities that take place on uncontrolled hazardous waste sites as defined by Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.120, the Occupational Safety and Health Act (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) standard. Each contractor or operating facility is responsible for PPE program compliance for its own employees and must establish appropriate administrative control of its personnel for purposes of compliance with this program. The WHS project manager/project officer is responsible for taking action to ensure that WHS personnel and contractors

achieve compliance with the PPE program. Oversight, evaluation, and auditing of the implementation and effectiveness of PPE programs shall be the responsibility of the division director or designee.

PPE selection, levels of protection, upgrades and downgrades, use and limitations, in-use considerations, training requirements, inspection, maintenance and storage, and decontamination and disposal are discussed below.

2-3.1. PPE SELECTION

Personal protective equipment used on WHS work sites must be chosen based on the hazards present as determined during a site evaluation and job hazard analysis as described below.

2-3.1.1. CHEMICAL PROTECTIVE CLOTHING

Chemical protective clothing is available in a variety of materials and configurations that offer a range of protection against chemical and physical hazards. The most widely available source of information on the features and capabilities of PPE are manufacturer and vendor catalogs. The information is often in table form and lists chemical resistance ratings. Information may be qualitative or quantitative. Qualitative ratings are generally on a scale of “Excellent” to “Poor” or “Not Recommended” and may apply to permeation or degradation resistance.

Quantitative ratings are sometimes provided for permeation rates. The rating is in the number of minutes for a chemical to permeate through a material and be detected on the other side. These tables are intended as guidelines for the selection of PPE. Besides degradation and permeation, several other factors must be considered during PPE selection, including the following:

- Durability (resistance to wear, tear, abrasions, and punctures).
- Flexibility.
- Ease of decontamination.
- Comparability with other equipment.
- User comfort in hot or cold temperatures.

The selection and evaluation of PPE should not be limited to the selection factors stated above. The correct PPE ensemble cannot be assigned without knowledge of the types and degrees of hazards that may be encountered. All potential and existing chemical, physical, and biological hazards should be considered. Assessment of each potential hazard is necessary because not every type or style of PPE may be effective for that hazard.

For HAZWOPER sites, each site-specific HASP must specify mandatory PPE requirements and indicate the level of protection for each on-site task. As necessary, criteria for upgrades and downgrades should be established.

2-3.1.2. OTHER PPE

The following PPE must be used on every WHS work site where the applicable hazards are present, according to the table below:

Type of Protection	Type of PPE	Hazard Present for Selection
Head Protection	Most current ANSI Z-89.1 or equivalent	Whenever there is a potential hazard caused by falling or overhead objects
Eye Protection	Safety Glasses, most current ANSI A87.1 or equivalent	When there is a hazard of solid material striking the eye
Eye Protection	Splash goggles	When there is a hazard of liquid splashes to the eye
Foot Protection	Most current ANSI Z-41.1 or equivalent	When there is a hazard of stepping on dangerous objects or heavy objects striking or rolling over the foot
Hearing Protection	In accordance with DNREC WHS Hearing Conservation Program.	
Respiratory Protection	In accordance with DNREC WHS Respiratory Protection Program.	

A thorough site evaluation of potential hazards must be made before commencing on-site work. At operating facilities, a record should be available of the job hazard analysis used for choosing required PPE, as required by OSHA. WHS personnel shall request a copy of the job hazard analysis when necessary to determine whether the facility's PPE requirements comply with the WHS Health and Safety Program.

The site evaluation and job hazard analysis for HAZWOPER site activities are discussed below.

2-3.1.3. HAZWOPER SITE EVALUATION

Much of the information needed for the site evaluation should be gathered during site characterization. The effort needed to complete a site evaluation will vary from project to project but should be sufficient to anticipate all potential or known health and safety hazards. Factors to consider in PPE selection include the following:

- Hazardous materials known or anticipated to exist on the site.
- Potential injury hazards.
- Site characteristics (such as topography, building locations, and weather conditions).

2-3.1.4. JOB HAZARD ANALYSIS

In addition, many hazards associated with site work are related specifically to the tasks and activities performed. Factors that should be considered in PPE selection for the job hazard analysis include the following:

- Type and duration of the project.
- Exposure or injury sources and pathways.
- Work rate and physical effort involved.
- Capacity of personnel to work in PPE.
- Daily work and rest schedule (work mission duration factors).

The job hazard analysis is performed to evaluate each hazard associated with a particular task or activity during preparation of the HASP. The hazards for each assigned job are identified, and available control methods to reduce or eliminate each hazard are listed. The analysis provides an opportunity to examine all aspects of the involved tasks to help determine PPE needs and types. To help determine what PPE is required for the task/location/area, please see Attachment B, “PPE Hazard Assessment Form”.

2-3.2. LEVELS OF PROTECTION FOR HAZWOPER ACTIVITIES

This program uses the classification system for levels of protection currently accepted by the hazardous waste industry and as defined in Appendix B of 29 CFR 1910.120, “General Description and Discussion of the Levels of Protection and Protective Gear.” This appendix describes Levels of Protection A, B, C, and D, with Level A representing the maximum protection level.

Specific PPE for each level of protection is discussed below. An asterisk (*) behind a listed item indicates that its use is optional for that level of protection.

2-3.2.1. LEVEL A PROTECTION

Level A protection should be worn when a hazardous substance has been identified that requires the highest level of protection for skin, eyes, and the respiratory system. Level A PPE includes the following:

- Positive-pressure/pressure demand, full-facepiece, self-contained breathing apparatus (SCBA) or positive-pressure/pressure demand, supplied air respirator with escape SCBA approved by the National Institute for Occupational Safety and Health (NIOSH).
- Totally-encapsulating, chemical-protective suit (i.e. gas and vapor tight).
- Coveralls*.
- Long underwear*.
- Chemical-resistant outer gloves.
- Chemical-resistant inner glove.
- Chemical-resistant boots with steel toe and shank.
- Hard hat (under suit)*.
- Disposable protective suit, gloves, and boots (depending on suit construction, may be worn over totally-encapsulating suit).
- Two-way radio (intrinsically safe, a designation used for equipment that will not produce a spark and therefore is safe to use in explosive atmospheres)*.

Level A protection should be worn when one or more of the following situations apply:

- Level A protection is worn in atmospheres with potentially immediately dangerous to life or health (IDLH) concentrations of specific substances that present severe inhalation hazards as well as a severe skin hazard
- Exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the skin is possible based on either the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates, or on site operations and work functions that involve a high potential for exposure.
- Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible.
- Operations are being conducted in confined, poorly ventilated areas, and the absence of conditions requiring Level A protection has not yet been determined.
- The atmosphere contains less than 19.5 percent oxygen.

Only Category 1 employees as described in Section 1-7 of this manual perform work at sites where Level A protection is required.

2-3.2.2. LEVEL B PROTECTION

Level B protection is worn in atmospheres with potentially IDLH concentrations of specific substances that present severe inhalation hazards and that do not represent a severe skin hazard or that do not meet the criteria for use of air-purifying respirators. Level B protection is the minimum level recommended for initial site entry until hazards have been further characterized. Level B protection includes the following PPE:

- Positive-pressure/pressure demand, full-facepiece SCBA or positive-pressure/pressure demand, supplied air respirator with escape SCBA (NIOSH-approved).
- Hooded, chemical-resistant clothing (such as one- or two-piece chemical-splash suit, or disposable chemical-resistant overalls).
- Coveralls*.
- Chemical-resistant outer gloves.
- Chemical-resistant inner gloves.
- Chemical-resistant boots with steel toe and shank.
- Chemical-resistant outer boot covers (disposable)*.
- Hard hat*.
- Face-shield*.
- Two-way radio (intrinsically safe)*.

Level B protection should be worn when one or more of the following situations apply:

- The type and atmospheric concentration of a substance has been identified and requires the highest level of respiratory protection but a lesser level of skin protection.
- The atmosphere contains less than 19.5 percent oxygen.
- The presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but the vapors and gases are not suspected of being harmful to skin or capable of being absorbed through the skin.

- Under certain circumstances fireman's turnout gear can be used as part of Level B protection when the contaminant has minimal skin hazard properties. A hazard assessment should be done to determine that the fireman's turnout gear will provide the appropriate protection from exposure to the specific chemical(s).

2-3.2.3. Level C Protection

Level C PPE includes the following:

- Full-face or half-face mask air purifying respirator (NIOSH-approved) with appropriate cartridge.
- Chemical-resistant clothing (such as two-piece chemical-splash suit or disposable chemical-resistant overalls).
- Coveralls*.
- Chemical-resistant outer gloves.
- Chemical-resistant inner gloves.
- Chemical-resistant outer boots with steel toe and shank.
- Chemical-resistant outer boot covers (disposable)*.
- Hard hat*.
- Escape mask*.
- Face-shield*.
- Two-way radio (intrinsically safe)*.

Level C protection should be worn when one or more of the following situations apply:

- The types of air contaminants have been identified, concentrations measured, and an air-purifying respirator chemical cartridge or mechanical filter is available that can remove the contaminants.
- All criteria for the use of an air-purifying respirator have been met, including sufficient oxygen level, identification and quantification of contaminants, and availability of suitable filtering media.
- Exposure will not adversely affect any exposed skin.

- Gases and vapors have adequate warning properties (odor threshold is lower than published exposure limit) in the event of chemical breakthrough of the cartridge.

2-3.2.4. LEVEL D PROTECTION

Level D protection should not be worn at any site where respiratory or skin hazards are present. Level D PPE is primarily a work uniform that provides minimal protection and includes the following:

- Coveralls.
- Gloves*.
- Boots or shoes with steel toe and shank and chemical-resistant soles.
- Chemical-resistant outer boot covers (disposable)*.
- Safety glasses or chemical splash goggles*.
- Hard hat*.
- Escape mask*.
- Face-shield*.

Level D protection should be worn when the following situations exist:

- The atmosphere contains no known skin or respiratory hazards.
- Work functions will not cause exposure to hazardous levels of any chemicals.

The use of escape masks is optional under Levels C and D protection. The SSO should determine whether they will be used on a case-by-case basis. Escape masks should be strategically located on site in areas that have a higher possibility for exposure of workers to toxic vapors, gases, or particulates. OSHA specifically requires that an escape SCBA having at least 5 minutes of air be carried by employees or kept available at their work station if a positive-pressure/pressure demand SCBA is not used as part of the entry ensemble during initial site characterization and analysis.

Combinations of PPE other than those described for Levels A, B, C, and D protection may be more appropriate and may be used to provide the proper level of protection. The site-specific HASP should specify specific PPE combinations within the framework of the Level A, B, C, and D system.

2-3.3. UPGRADES AND DOWNGRADES

The PPE used, and/or level of protection used should be re-evaluated periodically as site conditions change or as more information about the site becomes available. The type of PPE shall be re-evaluated when one or more of the following situations arise:

- A new phase of work begins.
- A work task changes.
- Significant change of weather.
- New hazards or contaminants are encountered.
- The level of contamination changes.

Each site-specific HASP should specify mandatory PPE requirements, along with specific action levels for site-specific contaminants or groups of contaminants.

2-3.4. USE AND LIMITATIONS

PPE is intended to shield or isolate individuals from health and safety hazards that may be encountered on site. However, PPE is limited in its capability to completely protect users. In addition, the use of PPE can in itself create several worker hazards, including the following:

- Impaired mobility.
- Impaired vision.
- Impaired communication.
- Increased workload and exertion.

The PPE also has the following limitations during use:

- Permeation and degradation susceptibility.
- Physical factors (limited durability, flexibility, or other factors).
- Available sizes.

A person’s medical condition can also limit the use of PPE. Some potential limiting medical conditions include the following:

- Compromised pulmonary function.

- Heart disease.
- Physical handicaps.
- Obesity.
- Physical condition and age.

Finally, heat and cold can affect both the performance of the PPE and the user in his or her ability to tolerate PPE use. Heat and cold stress are discussed in detail in the respective Standard Operating Procedures in Section 4 of this manual.

2-3.5. IN-USE CONSIDERATIONS

During equipment use, wearers should pay attention to the following factors that may affect PPE performance or indicate a health or safety concern:

- Perception of odors.
- Irritation.
- Discomfort.
- Degradation or damage to PPE.
- Fatigue or dizziness.
- Movement restrictions.
- Personal response such as rapid pulse, nausea, chest pain, or other.

If any of these factors are detected, the user should immediately move to the contaminant reduction zone with his or her buddy and explain the situation to the project manager/project officer or SSO.

2-3.6. TRAINING REQUIREMENTS

Proper PPE donning and doffing procedures will be demonstrated and practiced during both employee initial and annual health and safety training programs. Employee training in PPE use will be documented in employee's personnel file. Initial and refresher training in PPE use are discussed below.

2-3.6.1. INITIAL TRAINING

For all employees, initial PPE training will take place before the employee works in any area requiring PPE. As required by 29 CFR 1910.132 (f), training topics will include: when and what PPE is necessary;

how to don, doff, adjust and wear PPE; the limitations of PPE; the proper care, maintenance, and useful life of PPE.

WHS personnel engaged in HAZWOPER site activities will receive training in the selection, use, maintenance, and decontamination of PPE (Levels B through D) during initial 40-hour health and safety training. For site activities requiring Level A training, personnel are required to complete an additional training and field exercise in the use, maintenance, and decontamination of fully-encapsulating Level A PPE. Training may include lectures, classroom demonstrations, and videotape simulations. Employees will demonstrate their understanding of use by donning, wearing, and properly removing PPE in a minimum of a Level C ensemble and passing a written examination at the end of the training that includes questions about PPE.

In addition to basic classroom instruction, all WHS work category 1 and 2A (HAZWOPER) personnel must complete a minimum of 24 hours of supervised training in the field in each level of protection before that employee is considered competent to operate at that level of protection in the field without supervision.

2-3.6.2. REFRESHER TRAINING

Employees will be retrained in PPE selection and use when changes in the workplace, worker, or PPE occur that render refresher training necessary. During refresher training, employees will be provided with information on any new types of, or changes to, available PPE. General concepts on the proper use of PPE will also be covered and will include discussion of any instances of improper use of PPE during the previous year.

Annual HAZWOPER refresher training will include PPE training.

2-3.7. INSPECTION

PPE must be inspected before, during and after use and periodically while in storage. Attachment A, “Protective Equipment Inspection”, provides guidance for both field use inspection and for inspecting stored equipment.

2-3.8. MAINTENANCE AND STORAGE

PPE maintenance needs vary with the amount of use and complexity of the equipment. Under all circumstances, manufacturer’s recommendations and replacement parts shall be used. Taping, stapling, gluing, or other temporary measures shall not be allowed. Only trained, qualified, and/or certified

personnel shall repair equipment. Whenever possible, WHS employees shall use disposable PPE. Disposable PPE shall not be repaired or reused.

PPE must be stored to prevent damage or malfunction from exposure to dust, moisture, sunlight, chemicals, impact, and extreme temperatures. General rules to follow for proper PPE storage are listed below.

- Used and potentially contaminated PPE should be stored separately from clean PPE and street clothing.
- Potentially contaminated PPE should be stored in a well-ventilated area.
- PPE should be folded, hung, or stacked to prevent distortion or damaging creases.
- PPE of similar appearance but different functions should not be stored together. For example, black gloves made of different materials (such as nitrile, neoprene, or natural rubber) could be mistaken for each other.
- In the field, PPE should be stored in a clean location such as a vehicle or office. PPE should not be stored at work sites or any location that may allow the PPE to be exposed to dust or chemicals.
- The useful life and shelf life of PPE as recommended by manufacturer information or other guidelines will be noted for all PPE, and the 'expiration date' of the PPE will be clearly marked while the PPE is in storage.

2-3.9. DECONTAMINATION AND DISPOSAL OF CHEMICAL PROTECTIVE CLOTHING

Decontamination procedures for PPE have been established as a component of each site-specific HASP for HAZWOPER activities. The procedures outline steps for decontamination of each level of protection. A more detailed discussion of decontamination is presented in the "Decontamination Program" in Section 3-6 of this manual.

All decontamination solutions and disposable PPE must be disposed of properly. Whenever possible, this waste should be disposed in designated on-site containers. Wastes should not be returned to or stored at office locations or disposed of improperly.

DNREC DIVISION OF WASTE AND HAZARDOUS SUBSTANCES

PROTECTIVE EQUIPMENT INSPECTION

PROTECTIVE CLOTHING

Before use:

- Determine that the clothing material is correct for the specific task at hand.
- Visually inspect the equipment for
  - Imperfect seams
  - Nonuniform coatings
  - Tears
  - Malfunctioning closures
- Hold up to light and check for pinholes.
- Flex the equipment and
  - Observe for cracks
  - Observe for other signs of shelf deterioration

After use, inspect inside and out for the same signs of chemical attack.

During use, periodically inspect equipment for

- Evidence of chemical attack such as discoloration, swelling, stiffening, and softening. Keep in mind, however, that chemical permeation can occur without any visible effects.
- Closure failure
- Tears
- Punctures
- Seam discontinuities

Note: Discard any protective clothing that has any of the conditions listed above.

GLOVES

Before use:

- Visually inspect gloves for
  - Imperfect seams
  - Tears and abrasions
  - Nonuniform coatings
- Pressurize glove with air and listen for pinhole leaks.

Note: Discard any gloves that exhibit any of the conditions listed above.

DNREC DIVISION OF WASTE AND HAZARDOUS SUBSTANCES

PROTECTIVE EQUIPMENT INSPECTION (Continued)

FOOTWEAR

Before use, inspect footwear for

- Holes and cuts
- Interior wetness
- Integrity of closures
- Cracks in sole

Note: Discard any footwear that exhibits any of the conditions listed above.

EYEWEAR

Before use, inspect eyewear for

- Cracks
- Fogginess
- Scratches
- Sturdiness of frame or supports and suspension

Note: Discard any eyewear that exhibits any of the conditions listed above.

HEADGEAR

Before use, inspect headgear for

- Cracks or gouges
- Sturdiness of suspension system
- The proper gap is maintained between the suspension system and shell of the hard hat

Note: Discard any headgear that exhibits any of the conditions listed above.

PPE Hazard Assessment

Job Task:_____

Date:_____ Project Location/Area:_____

Assessed By:_____ Job Title:_____

Potential Hazards: (Check all that apply to either existing conditions or are a result of site operations)

( ) Rotating Machinery
( ) Heat Stress
( ) Cold Stress
( ) Heavy Equipment
( ) Intrusive Activity
( ) Trench/excavation collapse
( ) Other:_____
( ) Projectiles
( ) Physical Exertion
( ) Noise (>90 dBA)
( ) Vehicle Traffic
( ) Fire/Explosion
( ) Uneven Terrain
( ) Contact with contaminated soil or water
( ) Confined Space
( ) Biological
( ) Electrical (utilities)
( ) Chemical Exposure
( ) Other: Slips, trips, & falls
( ) Flammable materials

Control or Protective Measures: (Check all that apply)

( ) Tailgate Meetings
( ) Employee or Operator Training
( ) Engineering Controls:
( ) PPE
( ) Site Control
( ) Other: Install caution-tape/barriers around operation, establish sufficient work space and minimize access.
( ) Safe Work Practices
( ) Decontamination

INITIAL LEVEL OF PERSONAL PROTECTIVE EQUIPMENT FOR ASSIGNED TASK:

PPE has been assigned for this work task per the potential for exposure. PPE requirements are outlined below. PPE may be upgraded or downgraded depending on monitoring data, site conditions, or as determined by a qualified personnel.

HazMat PPE Level:
( ) Level A ( ) Level B ( ) Level C ( ) modified Level D ( ) Level D

Respirator:
( ) SCBA, Airline ( ) Full-face APR Resp. ( ) 1/2 Face APR Resp.
( ) N95 Dust Mask ( ) OV/AG/HEPA Cart. ( ) Other Cart._____

Protective clothing:
( ) Encapsulating Suit ( ) Tyvek ( ) Poly Coated Tyvek
( ) Saranex ( ) Splash Suit ( ) Other:_____

Head/eye/ear:
( ) Hard Hat ( ) Safety Glasses ( ) Goggles ( ) Welding Shield
( ) Splash Shield ( ) Ear Plugs/Muffs ( ) Other:_____

Gloves:
( ) Nitrile ( ) Neoprene ( ) PVC - Use with Petroleum Products
( ) Vinyl ( ) Leather ( ) Cotton ( ) Other_____

Footwear:
( ) Leather work boots ( ) Safety-toed Leather ( ) Chemical Over-boots
( ) Safety-toed Rubber ( ) Other: _____

Other PPE:
( ) _____
( ) _____

Certification of Hazard Assessment:

I certify that I personally performed the above PPE Hazard Assessment of the Area/Task listed.

*Signature:*_____*Date:*_____

2-4. RESPIRATORY PROTECTION PROGRAM

This program covers the use of respirators by the Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS), employees for protection from gases, vapors, dusts, mists, and other airborne contaminants. This program establishes policies and procedures for the selection, use, and care of respiratory protective equipment and was developed in accordance with the requirements of Title 29 of the *Code of Federal Regulations* (CFR), Parts 1910.120(g) and 1910.134.

Respiratory protection is of primary importance because inhalation is the major route of exposure to hazardous materials. It is WHS's intent to provide a safe and healthy work environment free of recognized hazards. Whenever possible, exposure to hazardous atmospheres will be reduced using engineering controls and appropriate work practices. When effective engineering controls are not possible or while they are being instituted, employees will wear respiratory personal protective equipment (PPE).

The effectiveness of the respiratory protection program will be evaluated during annual Health and Safety audits as detailed in Section 1-8 of this manual. Program elements will be evaluated to (1) determine the adequacy of the respirators in providing necessary protection, (2) inspect program operations, and (3) assess wearer acceptance. The auditor will document the evaluation and note corrective action plans and target dates if applicable.

The responsibilities and program elements associated with the respiratory protection program are discussed below.

2-4.1. RESPONSIBILITIES

Program/section managers shall be considered respiratory program administrators and are responsible for overseeing the respiratory protection program within their branches and programs. Project managers/project officers are responsible for ensuring that on their projects (1) respiratory PPE is used appropriately; (2) all employees potentially exposed to hazardous materials wear National Institute for Occupational Safety and Health (NIOSH)-certified respirators and follow WHS Programs and SOPs for respiratory PPE; (3) only medically cleared, fit tested, and trained employees wear respiratory PPE; and (4) the required respirator maintenance, storage, and inspection procedures are followed.

All personnel are required to use respirators provided in accordance with instruction and training received and to report any respirator malfunction or damage to the project manager/project officer. For operations that take place on uncontrolled hazardous waste sites as defined by Title 29 of the *Code of Federal*

Regulations (CFR), Part 1910.120, the Occupational Safety and Health Act (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, the site safety officer will verify and document the proper use of respiratory PPE.

2-4.2. PROGRAM ELEMENTS

This section establishes the elements of the respiratory protection program, including respirator selection, medical clearance, training, respirator fitting, respirator assignment, respirator inspection, procedures for routine use of respirators, gas and vapor cartridge change schedules, respirator maintenance and care, and breathing air and supply systems.

2-4.2.1. RESPIRATOR SELECTION

Only respirators certified by NIOSH will be used. The selection of proper respiratory protection for a given situation requires consideration of the following parameters:

- Nature of the hazardous material(s), including toxic effects, skin and eye hazards posed by the chemical, airborne concentrations, required or recommended exposure levels, the potential for immediately dangerous to life and health (IDLH) concentrations, and antagonistic or synergistic effects if two or more materials are present;
- Service life of the chemical cartridge, filter, or canister approved for use;
- Characteristics of the hazardous operation, process, or work area, including temperature extremes;
- Location of the hazardous area in relation to an area with respirable air;
- Employee conditioning and workload;
- Period of time respiratory protection may be required;
- Worker activities in the hazardous area;
- Other PPE in use;
- Physical characteristics, capabilities, and limitations of the various types of respirators; and
- Respiratory protection factors to determine the maximum use limit of a particular respirator.

DNREC WHS shall systematically identify and evaluate respiratory hazards in the workplace. Respirator selection will be based on the assessment of the nature and extent of hazardous atmospheres anticipated during field activities. This assessment shall include a reasonable estimate of employee exposure to respiratory hazards and an identification of the chemical state and physical form of contaminants potentially encountered.

For each project requiring respirator use, a respiratory hazard assessment shall be conducted. For non-emergency situations, the results of this assessment shall be documented on the Respiratory Hazard Assessment Form (Attachment A to this Respiratory Protection Program) and submitted to the project manager/project officer or designee for approval. For HAZWOPER site activities (excluding emergency response), the completed form will be included as an attachment to the site HASP. A copy of the form will be kept in the project file.

The respirator selected via Attachment A must have an assigned protection factor (APF) adequate for those identified workplace exposures. Respirators used in environments that are IDLH and environments that are not IDLH differ. Requirements for respirators used in each environment are discussed below.

2-4.2.1.1. DETERMINING PROTETION FACTORS AND RESPIRATOR SELECTION

To determine adequacy of a respirator, the air in the work area shall be sampled to determine contaminant levels. These levels will then be compared to the Maximum Use Concentrations (M.U.C.) for the respirator.

Protection Factors are used in the selection process to determine the maximum use concentration. The OSHA PEL or the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Value - Time Weighted Average (TLV-TWA) value for identified air contaminants shall be used in this determination. The more conservative exposure limit (OSHA PEL or ACGIH TLV-TWA) shall be used to multiply by the PF for the respirator to get the maximum concentration in which the respirator will provide protection. For additional information regarding respirator selection, see the NIOSH Pocket Guide to Chemical Hazards.

M.U.C. = OSHA PEL (or ACGIH TLV-TWA) X PF for type of respirator

NOTE: Know the IDLH level for the contaminant before selecting the respirator. SCBA/pressure demand respirators shall be used when the concentration of the contaminant is unknown or ≥ IDLH.

Protection Factors for Respirators

Respirator	PF
Half-face APR w/cartridges	10
Powered APR (PAPR) w/cartridges	25
Full face APR w/cartridges	50
Full-face PAPR (w/tight-fitting facepiece & cart.)	1000
Full-face Supplied Air: Airline Pressure Demand	1000*
Full-face Pressure Demand	1000*
Full-face SCBA-Pressure Demand	10,000*

*PF is 50 in Demand Mode

2-4.2.1.2. RESPIRATORS FOR ENVIRONMENTS THAT ARE IDLH

The work atmosphere shall be considered IDLH if, after an initial hazard assessment or in emergency situations, the contaminants or estimated exposure cannot be reasonably identified. Respirators used in IDLH environments must be supplied air respirators (SAR): either a full-face, pressure-demand, self-contained breathing apparatus (SCBA) with a minimum 30-minute service life; or a combination full-facepiece, pressure-demand airline system with an auxiliary self-contained 5-minute air supply.

When field personnel are wearing respiratory protection in potentially IDLH atmospheres, the following requirements apply:

- Presence of at least one additional person using the “buddy system;”
- At least one ‘stand-by’ employee must be located outside the IDLH environment and be in constant communication during the entry of an employee into the IDLH environment; and
- Development of emergency rescue procedures to include appropriate retrieval equipment and a NIOSH-certified, positive pressure/pressure demand supplied air device with a separate air source from the one used by workers in the exclusion zone (if air-line is used in the exclusion zone).

2-4.2.1.3. RESPIRATORS FOR ENVIRONMENTS THAT ARE NOT IDLH

When potential contaminants to be encountered are identifiable gases or vapors and the concentrations are known or can be reasonably estimated, respiratory protection shall include one of the following:

- A Supplied Air Respirator (either air-line or SCBA);

- An air-purifying respirator (APR) with the appropriate APF provided that it is equipped with a NIOSH-certified end of service life indicator (ESLI) for the identified contaminant. If no ESLI is available, a change schedule for cartridges and canisters must be developed based on objective data or information in accordance with 29 CFR 1910.134.

Respirator cartridge change out schedules will be determined or approved by the Project Manager / Project Officer or designee at the time of the respiratory hazard assessment. The respiratory hazard assessment form will describe the information and data used as the basis for determining the cartridge change-out schedule. Section 2.8 below discusses procedures for developing change-out schedules. For hazardous waste site activities, cartridge change-out schedules and the respiratory hazard assessment form will be included as part of the approved site-specific HASP.

For protection against particulate contaminants, approved respirators may include one of the following:

- A SAR (either air-line or SCBA);
- A respirator equipped with a filter certified by NIOSH under 30 CFR Part 11 or 42 CFR Part 84 as a high-efficiency particulate air (HEPA) filter designated by N100, R100, or P100;
- For particles with mass median aerodynamic diameter (MMAD) of at least 2 micrometers, an APR equipped with any certified NIOSH filter.

The project manager/project officer or the site safety officer shall determine filter selection and change schedules at the time of the respiratory hazard assessment. The respiratory hazard assessment form will describe respiratory requirements for the site. The respiratory hazard assessment will be included as part of the approved site-specific HASP.

2-4.2.2. MEDICAL CLEARANCE

Respirator use may place a physiological burden on an employee depending on the health status of the employee, the type of respirator being worn, and workplace conditions. All field personnel are required to have a baseline medical examination prior to fit testing and use of respirators to determine their physical ability to wear such equipment while working. These examinations will be given prior to initial assignment at a site and annually thereafter as part of the individual's annual medical examinations. As part of these examinations, personnel will be required to complete the health questionnaire presented in 29 CFR Part 1910.134, Appendix C, or an equivalent questionnaire. The following information will be provided to the physician prior to the medical evaluation:

- Type and weight of the respirator to be used;
- Duration and frequency of respirator use (including use for rescue and escape);
- Expected physical work effort;
- Protective clothing and equipment that may be worn during the course of the employees job;
- Temperature and humidity extremes that may be encountered;

Respiratory clearances provided by the examining physician shall be provided to the medical surveillance coordinator. These clearances shall state whether or not the employee is medically capable of using respiratory equipment; any limitations regarding respirator use related to the medical condition of the employee; the need, if any, for follow-up evaluations; and a statement from the physician that the employee has been provided with a copy of the examination results.

In addition to annual medical examinations, employees shall be examined if (1) the employee reports medical signs or symptoms related to the ability to wear a respirator; (2) if the supervisor, or physician determines the need for re-evaluation of the employee's ability to wear a respirator; or (3) if a change occurs in the workplace that may result in a substantial increase in the physiological burden placed on the employee.

2-4.2.3. TRAINING

All personnel required to wear respirators will receive effective respirator training prior to respirator use in the workplace. For employees who conduct hazardous waste site activities, training will be provided during the initial HAZWOPER 40-hour and 8-hour refresher health and safety training. Each employee, regardless of assignment requiring respirator use, shall be trained on and demonstrate knowledge of the following topics:

- Knowledge of potential respiratory hazards;
- Why a respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator;
- Functions, capabilities, and limitations of the various types of respirators;
- Proper selection of respirators (including consideration of respirator type, contaminant concentration, cartridge efficiency, properties of the contaminants, oxygen content, and IDLH situations);

- Proper inspection, donning, and doffing of respirators, and respirator fit testing techniques;
- Proper maintenance and storage of respirators;
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions; and
- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators.

Respirator training shall be repeated annually or whenever a change in the workplace or the type of respirator renders previous training obsolete. Training will also be conducted prior to any work where site-specific respiratory requirements were not included in the original training. Employee retraining is necessary when: changes in the workplace or the type of respirator render previous training obsolete; inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or any other situation arises in which retraining appears necessary to ensure safe respirator use.

Employees voluntarily electing to wear respiratory protection must be provided with a copy of 29 CFR Part 1910.134, Appendix D, "Information for Employees Using Respirators When Not Required Under the Standard."

2-4.2.4. RESPIRATOR FITTING

Each respirator user will be qualitatively or quantitatively fit-tested in accordance with procedures specified in 29 CFR Part 1910.134, Appendix A. Standard Operating Procedure "Respirator Qualitative Fit Testing Procedures," (Attachment B to this Respiratory Protection Program) further describes the procedures for qualitative fit-testing of employees. If quantitative fit testing is performed, WHS will use either the controlled negative pressure (CNP) fit testing protocols (OHD Quantifit/Fit Tester 3000) or Ambient aerosol condensation nuclei counter (CNC) fit testing protocols (Portacount). Fit testing of field personnel will be conducted annually or prior to work requiring respiratory protection. The Respirator Fit Test Record included in Attachment C is used to document fit testing. The records will be maintained by the Medial Monitoring Coordinator.

The requirements below apply to the qualitative fit test (QLFT) or quantitative fit test (QNFT):

- The test must be conducted on a respirator of similar make, model, size, and style of facepiece for any negative- and positive-pressure respirator an employee may be required to wear;
- The test must be conducted annually or whenever changes occur that could affect the fit of the respirator (such as scarring, weight gain or loss, facial surgery; dental work, and so on);
- A QLFT can be used only to fit negative-pressure APRs that must achieve a fit factor of 100 or less.
- A QNFT must be used for fit factors greater than 100. The QNFT is considered passed if the test result is equal to or greater than 100 for tight-fitting half-mask respirators or equal to or greater than 500 for tight-fitting full face-pieces.
- The QLFT and QNFT must be conducted in a negative-pressure mode on a tight-fitting APR or SAR.

Full-face respirators fit-tested using qualitative methods can be used only in atmospheres up to 10 times the permissible exposure limit (PEL) of any contaminant.

2-4.2.5. RESPIRATOR ASSIGNMENT

Respirators will be provided to employees requiring respiratory protection. Respirators are provided based on the successful completion of a medical evaluation and qualitative or quantitative fit test as appropriate. Respirators shall not be loaned to any other employee or individual. Only persons trained in the proper selection of respirators will be permitted to issue them to others.

2-4.2.6. RESPIRATOR INSPECTION

Respirators must be inspected before and after use and during cleaning. Respirator inspection will include the following:

- Inspecting the tightness of connections and condition of the facepiece, headbands, valves, connecting tubes, and canisters; and
- Inspecting all rubber and elastomer parts for pliability and signs of deterioration.

For in-service equipment owned and maintained by WHS, monthly inspections will be conducted on emergency use respirators and SCBAs. Inspections of emergency-use respirators and SCBAs will help

ensure that regulators and warning devices function properly. The program/section manager or designee will maintain a record for each respirator that will include date of inspection, inspector name, findings, repairs made, and a serial number or other means to identify the respirator. This information may be provided on a label or tag that is attached to the storage compartment of the respirator or may be included in field audit reports. Any discrepancy affecting the reliability of a respirator will be corrected prior to use of the unit.

2-4.2.7. PROCEDURES FOR ROUTINE USE OF RESPIRATORS

Written procedures for the use of respirators under routine and foreseeable emergency conditions are available in Standard Operating Procedure, "Safe Work Practice for Use of Air Purifying Respirators" (Attachment D to this Respiratory Protection Program). The SOP will be available on-site whenever air purifying respiratory equipment is used. This SOP shall be attached to the HASP for all HAZWOPER projects that involve the use of air purifying respiratory protection.

The project manager/project officer will monitor the use of respirators at work sites to ensure that the correct respirators and cartridges are used, are working properly, and are in good working condition. In work areas where respirator use is routine, inspections will be conducted before each use and during cleaning. For non-routine respirator use, the respirator shall be checked for proper function prior to use, after each use and at least monthly thereafter.

2-4.2.8. GAS AND VAPOR RESPIRATOR CARTRIDGE CHANGE SCHEDULES

The purpose of a cartridge change schedule is to establish the time period for replacing respirator cartridges to prevent contaminant breakthrough and subsequent potential overexposure of the employee. Because breakthrough for particulate respirators is unlikely unless physical damage has occurred to the facepiece or filter, this guideline applies only to change schedules for ***vapor and gas*** respirator cartridges. OSHA prohibits the use of warning properties as the sole basis for determining change schedules. However, if an effective change schedule is developed, air purifying vapor and gas respirators may be used for chemicals with few warning properties.

The change schedule guidelines described in this document were derived in part from Appendix A of OSHA Directive CPL 2-0.120, "Inspection Procedures for the Respiratory Protection Standard" and information contained on the OSHA webpage "Respiratory Protection Advisor" (https://www.osha.gov/SLTC/etools/respiratory/change_schedule.html). The sections below describe procedures and methods for determining cartridge change schedules.

2-4.2.8.1. PROCEDURE

Selection of the method to be used for developing a change schedule depends on several factors, including the information available regarding the chemical hazard, the task to be completed, and the brand of respirator designated for a specific task.

Change schedules must be developed on a task-by-task basis following a complete hazard assessment of the work task or tasks for which respirator use may be necessary. The hazard assessment is documented using the form "Respiratory Hazard Assessment", Attachment A to this Respiratory Protection Program. Information gathered during the hazard assessment, along with the methods described below, will be used to determine the cartridge change schedule for each task. Once the change schedule is developed, the information must be entered onto the form and the form attached to the project HASP as documentation of the respirator selection process.

2-4.2.8.2. METHODS

A brief description of allowable approaches or methods for determining cartridge change schedules is presented below. These methods are based on information such as manufacturers' objective data, experimental methods, mathematical predictive modeling, workplace simulations, analogous chemical structures, rules of thumb, mixture assumptions, and application of OSHA standards. It should be noted that mixtures, intermittent respirator use and contaminant concentrations, respirator storage practices, and other variables may require an administrative time limit, such as using a cartridge for only one (1) day even though the estimated service life is longer.

2-4.2.8.2.1. MANUFACTURER'S OBJECTIVE DATA

Respirator cartridge manufacturers have developed objective data that can be used to establish change schedules. The data is brand-specific and should not be applied to another brand because of differences in absorption capacities between brands of respirator cartridges.

Data provided by the manufacturer may be presented as tables or graphs of cartridge service life for a particular chemical at a given concentration. Following the rules of thumb described in Section 2.8.2.6 below, cartridge service life for concentrations other than the values presented in the table or graph can be estimated.

Some manufacturers have developed software programs that often can be downloaded from the Internet. These programs can calculate an estimated service life after key variables are entered such as the chemical and its concentration, the anticipated relative humidity, and the work rate of the user.

2-4.2.8.2.2. EXPERIMENTAL METHODS

This method involves development of breakthrough-time data from laboratory-based simulations of worst-case workplace conditions. This method can provide very accurate service life information. However, this method is unfeasible for most work situations.

2-4.2.8.2.3. MATHEMATICAL PREDICTIVE MODELING

This method is very complex and is more typically applied by a cartridge manufacturer because of the need for proprietary information regarding cartridge specifications. However, OSHA has developed a mathematical model called "The Advisor Genius" for calculating contaminant breakthrough times using the Wood Equation. The model will estimate the contaminant breakthrough time for an activated carbon respirator cartridge based on physical and environmental parameters specific to the contaminant and the workplace. It is only applicable to contaminants in liquid form at the workplace temperature. The model can be accessed at: https://www.osha.gov/SLTC/etools/respiratory/mathmodel_advisorgenius.html.

The OSHA model requires the following chemical contaminant information:

- Chemical name;
- Molecular weight;
- Liquid density in units of grams per cubic centimeter at the workplace temperature;
- Vapor pressure of the contaminant in units of torr at the workplace temperature; and
- Molar polarization in units of cubic centimeters per mole.

NIOSH provides a downloadable Microsoft Windows program that was developed similarly to "The Advisor Genius;" enabling qualified personnel to estimate breakthrough times and service lives of air-purifying respirator cartridges. However, NIOSH has updated this program since it was first published in 2003, in order to include new chemical compounds and provide more accurate cartridge parameters. NIOSH's "MultiVapor" program can be downloaded from:

http://www.cdc.gov/niosh/npptl/multivapor/multivapor.html.

The Handbook of Chemistry and Physics (CRC press, latest edition) contains extensive chemical data required for calculating breakthrough times.

The model will require the following information about the respirator to be used, workplace conditions, and work rate:

- Number of cartridges used by the respirator;

- Weight of sorbent in each cartridge in grams;
- Carbon micropore volume in cubic centimeters per gram(if this number cannot be obtained from the manufacturer, a standard value of 0.4 can be assumed);
- Bulk density of the packed bed in units of grams per cubic centimeter; this value can be calculated by disassembling a respirator cartridge and determining the total volume of the bed and then dividing this value into the sorbent weight;
- Maximum temperature expected in the workplace;
- Maximum humidity expected in the workplace (the model assumes a maximum humidity of less than 65 percent; for higher humidity, a safety factor must be applied to the calculated breakthrough time);
- Maximum contaminant concentration expected in the workplace in units of parts per million or milligrams per cubic meter; and
- Estimated employee work rate to determine respiration in units of liters per minute (L/min); the type of work being performed, with office work having a typical work rate of about 20 L/min and heavy work having a work rate exceeding 60 L/min.

The model has several limitations. Conservative assumptions are used to calculate the service life, and the service life estimate is therefore likely to be shorter than needed. Also, the model can be used only for single-contaminant situations. Situations involving mixtures are discussed below in Section 2.8.2.7.

2-4.2.8.2.4. WORKPLACE SIMULATIONS

This method involves testing a cartridge in the workplace under actual working conditions of use. Air is drawn through the cartridge at a rate typical of that associated with breathing at a high work rate. An analytical device on the other side of the cartridge measures the breakthrough time. Although this method provides the most accurate change schedule, it is also one of the least practical.

2-4.2.8.2.5. ANALOGOUS CHEMICAL STRUCTURE

Under certain circumstances, the service life values from other chemicals having an analogous chemical structure may be used to determine the breakthrough time and service life of the contaminant under evaluation. In certain cases, a chemical with a known migration rate may reasonably be anticipated to act as a surrogate for a similar chemical that would have a less rapid migration rate and breakthrough time. For example, it can usually be assumed that a heavier, less volatile compound than another in a similar

chemical series that has been tested for breakthrough time would have a breakthrough time no faster than the tested chemical.

This method requires a substantial amount of judgment and a good understanding of chemistry and chemical groups. Data from higher molecular weight groups should not be used to predict the behavior of analogous substances with lower molecular weight. It is appropriate to include a safety factor into the predicted breakthrough time to account for the degree of similarity of the chemicals and the level of confidence regarding variables associated with the workplace conditions. A safety factor of 1 or 2 is appropriate for chemicals with similar structure and molecular weights, and where work place conditions are the same. A safety factor of 2 to 5 is advised where molecular weights differ by more than 1 carbon or halogen and where work rates vary substantially.

2-4.2.8.2.6. RULES OF THUMB

Chapter 36 of the American Industrial Hygiene Association publication titled "The Occupational Environment: Its Evaluation and Control" presents organic vapor cartridge service life the rules of thumb summarized below.

- If a chemical's boiling point is greater than 70 °C and the concentration is less than 200 parts per million, a service life of 8 hours can be expected at a normal work rate.
- Service life is inversely proportional to work rate.
- Reducing contaminant concentrations by a factor of 10 will increase service life by 50 percent.
- Relative humidity greater than 85 percent will substantially reduce service life.

These rules of thumb should only be applied when used with other methods for predicting cartridge service life for a specific contaminant.

2-4.2.8.2.7. MIXTURE ASSUMPTIONS

Predictive mathematical models are very difficult to develop for mixtures of contaminants. Establishing change schedules for mixtures of contaminants is considerably more complex than for single contaminants and requires professional judgment to create a reasonable change schedule. The following assumptions can be applied to change schedules for mixtures:

- When the individual compounds in the mixture have similar breakthrough times (that is, within one order of magnitude), the service life of the cartridge should be established by assuming that the mixture stream behaves as a pure system of the most rapidly migrating

component or compound with the shortest breakthrough time. The concentrations of the components should be summed, and the sum should be used as the compound concentration.

- When the individual compounds in the mixture vary by two orders of magnitude or greater, the service life can be based on the contaminant with the shortest breakthrough time.

A margin of safety or safety factor must be entered into developing a change schedule for mixtures to reflect the level of confidence in the breakthrough time estimate. For example, the margin of safety should reflect the level of confidence in applying the assumptions listed above to the mixture and the quality of data regarding actual concentrations of the contaminants. Assumptions regarding change schedules for mixtures can only be applied after information on individual mixture components such as breakthrough time has been gathered.

2-4.2.8.2.8. APPLICATION OF OSHA STANDARDS

Several of OSHA's chemical specific standards already address cartridge change schedules. The table below summarizes these standards and the applicable change schedule.

Chemical and Applicable Standard	Change Schedule
Acrylonitrile, 29 CFR 1910.1045(h)(2)(ii)	Calculated end of service life or end of shift, whichever comes first
Benzene, 29 CFR 1910.1028(g)(2)(ii)	Calculated end of service life or beginning of shift, whichever comes first
Butadiene, 29 CFR 1910.1051(h)(2)(ii)	Every 1, 2, 3, or 4 hours, depending upon concentration according to Table 1 of the standard, and at beginning of each shift
Formaldehyde, 29 CFR 1910.1048(g)(2)(ii)	Every 3 hours or end of shift, whichever is sooner
Methylene chloride, 29 CFR 1910.1052(g)(2)(ii)	Cartridges can only be used for emergency escape and must be replaced after each use; APRs not allowed for routine use
Vinyl chloride, 29 CFR 1910.1017(g)(2)(ii)	Calculated end of service life or end of shift in which they are first used, whichever occurs first

2-4.2.9. RESPIRATOR MAINTENANCE AND CARE

When respirators are used on a routine basis, a cleaning and maintenance program will be established to ensure that the respirators are maintained at their original level of effectiveness. A respirator maintenance

schedule will be established in each Program/Branch where respirators are used. This schedule will be based on the specific respirators used and whether they are used routinely or non-routinely.

All personnel will receive and wear a respirator that is clean and sanitized. Respirator cleaning procedures will be conducted in accordance with 29 CFR Part 1910.134, Appendix B-2. The SOP "Respirator Cleaning Procedures" (Attachment E to this Respiratory Protection Program) has been prepared based on Appendix B-2. The respirator manufacturer will specify cleaning and sanitizing agents. During the cleaning of respirators, rubber or elastomer parts will be stretched and manipulated with a massaging action to aid in keeping the parts pliable and flexible and prevent them from becoming distorted during storage.

A qualified person will conduct respirator part replacements or repairs and with parts designed for the respirator only. No attempt shall be made to replace parts with other parts not specified by the manufacturer. Respirators that are defective shall be removed from service until repaired.

Inspected and cleaned respirators must be stored in areas protected against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. They shall be stored to prevent deformation of the facepiece and exhalation valve. All manufacturer storage instructions must be followed.

2-4.2.10. BREATHING AIR AND SUPPLY SYSTEMS

Breathing air and supply systems shall provide Type 1 Grade D breathing described in ANSI G-7.1-2011 titled "Commodity Specification for Air." If purchased cylinders of supplied breathing air are to be used on the site, the project manager shall retain a certificate of analysis from the supplier that the breathing air has been tested within the previous 6 months and meets the ANSI specifications.

The compressor for supplying breathing air shall be equipped with the necessary safety and standby devices. Compressors shall be constructed and situated to prevent entry of contaminated air into the system, and suitable in-line air purifying sorbent beds and filters must be installed to further ensure breathing air quality. The compressor shall have a tag containing information including the most recent filter and sorbent change date and signature of the person performing the service.

An escape respirator of sufficient capacity (minimum of five minute duration) to enable the respirator wearer to escape from a contaminated atmosphere in the event of compressor failure shall be provided. If an oil-lubricated compressor is used, it shall have both high-temperature and carbon monoxide alarms installed. Air-line couplings shall be incompatible with outlets for other gas systems to prevent inadvertent servicing of air-line respirators with non-respirable gases.

Breathing air supply cylinders must meet the following requirements:

- Be maintained in a fully charged state and recharged when the pressure falls below 90 percent;
- Be tested and maintained as prescribed in the shipping container specification regulations of the U.S. Department of Transportation (specified in 49 CFR Part 173);
- Have a certificate of analysis from the supplier that the air meets the requirements of Grade D breathing air; and
- Have a moisture content that does not exceed a dew point of -50 °F.

2-4A. RESPIRATORY HAZARD ASSESSMENT

Project Name:	Project No.:	
Location:	Project Manager/Project Officer:	
Type: ☐ Baseline ☐ Reassessment	Date:	Valid for _____ days
Job/Task Description:		☐ Routine ☐ Escape
Hazard Identification and Source:	Workplace Factors: Temperature: _____ Humidity: _____ Other: _____	User Factors: Work rate: _____ Protective clothing: _____ Other: _____

Chemical:					
PEL:					
ACGIH TLV:					
Form (part/gas/vapor):					
IDLH:					
Eye Irritant (Y/N):					
Skin Absorption(Y/N):					
Monitoring (Y/N) :*					
Frequency:					
Maximum Use Concentration Estimated:**					

* Monitoring Method: ☐ PID ☐ NIOSH method: _____ ☐ FID ☐ Vapor badge: _____ ☐ Detector tube: _____ ☐ Other: _____	Respirator Type: ☐ Half-face disposable Brand: _____ ☐ Half-face reusable Brand: _____ ☐ Full-face Brand: _____ ☐ Air-supplied airline Brand: _____ ☐ Air-supplied SCBA Brand: _____ ☐ PAPR Brand: _____ ☐ ESCBA Brand: _____
** If concentrations exceed the immediately dangerous to life and health (IDLH) value, use air-supplied systems.	Vapor and Gas Cartridge Exchange: ESLI: ☐ Yes ☐ No Exchange frequency: _____
Cartridge/Filter Selection ☐ N100 ☐ R100 ☐ P100 ☐ N99 ☐ R99 ☐ P99 ☐ N95 ☐ R95 ☐ P95 ☐ Organic vapor ☐ Acid gas ☐ Ammonia ☐ Mercury ☐ Formaldehyde ☐ Combo: _____ ☐ Other: _____	Basis for Exchange Frequency ☐ Manufacturer's data ☐ Workplace simulations ☐ Experimental methods ☐ AIHA "Rules of Thumb" ☐ Predictive modeling ☐ Analogous chemical structure ☐ OSHA Regulation: _____ ☐ Other: _____
_____ _____ Completed by Date	_____ _____ Reviewed by Date

RESPIRATORY HAZARD ASSESSMENT
(Continued)

DEFINITIONS AND ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ESLI	End of service life indicator
FID	Flame ionization detector
IDLH	Immediately dangerous to life and health
NIOSH	National Institute for Occupational Safety and Health
N100/99/95	Non-oil-proof particulate filter
OSHA	Occupational Safety and Health Administration
P100/99/95	Oil-proof particulate filter
PEL	Permissible exposure limit
PID	Photoionization detector
PPE	Personal protective equipment
R100/99/95	Oil-resistant particulate filter
SCBA	Self-contained breathing apparatus
TLV	Threshold limit value

Note: This form must be reviewed by the WHS project manager/project officer (or designee) and must be available on the worksite where respirators are used. A copy must also be placed in the project files.

2-4B. RESPIRATOR QUALITATIVE FIT TESTING PROCEDURES

This standard operating procedure (SOP) addresses the need for proper and thorough procedures for qualitative fit testing of respirators. The Occupational Safety and Health Administration (OSHA) regulates general industrial use of respiratory protection under Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.134. Appendix A of the standard outlines mandatory procedures to use for both qualitative fit tests (QLFT) and quantitative fit tests (QNFT). This SOP was written to meet the requirements of Appendix A for QLFTs. This SOP must be used in conjunction with the DNREC WHS, "Respiratory Protection Program", Section 2-4 of the Health and Safety Manual. Fit testing should be recorded on the WHS "Respirator Fit Test Record" found in Attachment C to the Respiratory Protection Program.

The following sections describe the SOP's applicability, qualifications of fit testers, and fit testing procedures for use during QLFTs.

2-4B.1. APPLICABILITY

This SOP applies to all DNREC WHS employees who use respirators on the job and to employees who conduct any fit testing. In addition, when WHS uses an outside service to perform fit testing, the organization conducting the fit testing shall meet the minimum requirements for QLFT and QNFT procedures specified in Appendix A of the OSHA standard.

Respirator fit testing shall be conducted at the following intervals:

- Prior to initial use of a respirator;
- Whenever a different respirator facepiece (size, style, model, or make) is used;
- At least annually thereafter for emergency response team members or prior use by all others; and
- After any reported or observed changes in an employee's physical condition that could affect respirator fit. This includes but is not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.

If an employee notices that the fit of a respirator has become unacceptable, he or she will be given an opportunity to select another respirator facepiece.

2-4B.2. QUALIFICATION OF FIT TESTERS

DNREC WHS employees who conduct QLFTs must demonstrate sufficient understanding and expertise in the required testing procedures. Fit testers shall qualify through appropriate education, experience, or both. Qualifications of fit testers shall be determined on a case-by-case basis by the program/section managers or designee based on the fit tester's demonstrated knowledge of OSHA-mandated fit test procedures and performance of a simulated fit test. The program/section manager must ensure that persons administering fit tests are able to prepare test solutions, calibrate and operate equipment, perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order. The fit tester must also demonstrate how to clean and maintain equipment to operate within the parameters for which it was designed.

2-4B.3. FIT TESTING PROCEDURES

Appendix A of 29 CFR 1910.134 provides instruction for five OSHA-accepted QLFT procedures. DNREC WHS has selected two of these procedures for its fit test program. The sections below describe general requirements that must be followed during all fit tests and for any fit test method used. Both the Bitrex™ and irritant smoke QLFT protocols are discussed below.

2-4B.3.1. GENERAL REQUIREMENTS

QLFTs must be conducted in accordance with the general requirements discussed below.

- The test subject shall be shown how to put on a respirator, position it on the face, set strap tension, and determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning the facepiece.
- The test subject must be allowed to choose from a sufficient selection of models and sizes to identify a respirator that fits correctly and is comfortable. The subject shall be informed that he or she is being asked to select the respirator that provides the most acceptable fit. The subject shall be asked to hold each chosen facepiece up to the face and eliminate those that obviously do not provide an acceptable fit.
- The subject shall don the most comfortable respirator and wear it for at least 5 minutes to assess comfort. If the subject is not familiar with a particular respirator, the subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper strap tension.

- The tester shall review the following points with the subject and allow the subject adequate time to determine the comfort of the respirator:
  - Position of the mask on the nose.
  - Room for eye protection.
  - Ability to talk.
  - Position of the mask on the face and cheeks.
- The following criteria shall be used to help determine the adequacy of the respirator fit:
  - Chin properly placed.
  - Adequate strap tension (not overly tight).
  - Fit across nose bridge.
  - Proper size to span distance from nose to chin.
  - Tendency of respirator to slip.
  - Self-observation in a mirror to evaluate fit and respirator position.
- The subject shall conduct a user seal check using the negative- and positive-pressure seal check procedures described in Section 3.4 of this SOP. Before conducting the check, the subject shall be instructed to seat the mask on the face by moving the head from side to side and up and down slowly while taking a few slow, deep breaths. If the seal checks fail, the subject shall choose another facepiece.
- Seal checks and fit testing shall not be conducted if there is any facial hair growth such as stubble beard growth, beard, mustache, or sideburns that interferes with the facepiece sealing surface. Any interfering apparel shall be altered or removed.
- If the subject experiences difficulty in breathing during testing, the testing shall stop immediately and he or she shall be referred to a company physician for assessment.
- If the subject finds the fit of the respirator unacceptable, the subject shall be given the opportunity to select a different respirator and to be retested.
- Prior to commencement of the fit test, the subject shall be given a written description of the respirator user seal check procedures and exercises to perform during the testing.

Exercises and a prepared text to be read during the test are included in Section 3.5 of this SOP.

2-4B.3.2. BITREX™ SOLUTION QUALITATIVE FIT TEST PROTOCOL

Bitrex™ solution (denatonium benzoate) is a taste aversion agent. To conduct a QLFT using Bitrex™, the test subject must first pass a taste threshold screening. The entire procedure must be explained to the test subject before the screening is conducted. The sections below describe taste threshold screening and fit test procedures. Particulate filters (cartridges) are used during this test.

2-4B.3.2.1. TASTE THRESHOLD SCREENING

The taste threshold screening is intended to determine whether the individual tested can detect the taste of Bitrex™. The procedures below shall be used for the taste screening.

- Prior to testing, the tester shall prepare a quantity of threshold check solution by adding 13.5 milligrams (mg) of Bitrex™ to 100 milliliters (mL) of 5 percent salt solution in distilled water. A nebulizer for taste screening shall be clearly marked to distinguish it from the fit test solution nebulizer. The taste screening nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every 4 hours.
- During the taste screening as well as during the fit testing, subjects shall wear an enclosure around the head and shoulders that is approximately 12 inches in diameter by 14 inches tall. The front portion of the enclosure shall be clear from the respirator and allow free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts #14 and #15 combined, is adequate.
- The test enclosure shall have a 0.75-inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.
- The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his or her slightly open mouth with tongue extended. The subject is instructed to report when he or she detects a bitter taste.
- Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely.

The bulb is then released and allowed to fully expand. Correct use of the nebulizer means that approximately 1 mL of liquid is used at a time in the nebulizer body.

- The nebulizer should be rapidly squeezed 10 times and then the test subject is asked whether the Bitrex™ solution can be tasted. If the subject reports tasting the bitter taste during the 10 squeezes, the screening test is complete. The taste threshold is noted as 10 regardless of the number of squeezes actually completed.
- If the first response is negative, the nebulizer is rapidly squeezed 10 more times and the test subject is again asked whether the Bitrex™ solution is tasted. If the test subject reports tasting the bitter taste during the second 10 squeezes, the screening test is completed. The taste threshold is noted as 20 regardless of the number of squeezes actually completed.
- If the second response is negative, the nebulizer is rapidly squeezed 10 more times and the test subject is again asked whether the Bitrex™ solution is tasted. If the test subject reports tasting the bitter taste during the third 10 squeezes, the screening test is completed. The taste threshold is noted as 30 regardless of the number of squeezes actually completed.
- If the Bitrex™ solution is not tasted after 30 squeezes, the test subject is unable to taste the Bitrex™ solution and cannot be fit tested using the Bitrex™ solution test.
- The tester will note the number of squeezes required to solicit a taste response. When a taste response has been elicited, the test subject shall be asked to note the taste for reference in the fit test.

2-4.3.2.2. BITREX™ SOLUTION FIT TEST PROCEDURES

The procedures below must be followed to conduct the actual Bitrex™ solution fit test:

- A fit test solution is prepared by adding 337.5 mg of Bitrex™ to 200 mL of a 5 percent salt solution in warm water. A second nebulizer dedicated to fit testing shall be clearly marked to distinguish it from the taste screening solution nebulizer. The nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every 4 hours.
- The test subject shall be instructed not to eat, drink, smoke, or chew gum for 15 minutes before the test.

- The person being fit tested shall don the respirator without assistance and perform the required user seal check.
- The fit test uses the same enclosure described for taste threshold screening in Section 3.2.1. The test subject shall don the enclosure while wearing the respirator selected as described in the general requirements in Section 3.1. The respirator shall be properly adjusted and equipped with particulate filter(s).
- As before, the test subject shall breathe through his or her slightly opened mouth with tongue extended, and shall be instructed to report is he or she tastes the bitter taste of Bitrex™
- The nebulizer is inserted into the hole in front of the enclosure, and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20, or 30) based on the number of squeezes required to elicit taste response noted during the screening test.
- After generating the aerosol, the test subject shall be instructed to perform the test exercises provided in Section 3.5 of this SOP.
- Every 30 seconds, the aerosol concentration shall be replenished using one half the number of squeezes used initially (such as 5, 10, or 15).
- The test subject shall indicate to the tester if at any time during the fit test the taste of Bitrex™ solution is detected. If the test subject does not report tasting the Bitrex™ solution, the test is passed.
- If the taste of Bitrex™ solution is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried, and the entire test procedure (taste threshold screening and fit test) is repeated.

2-4B.3.3. IRRITANT SMOKE (STANNIC CHLORIDE) QUALITATIVE FIT TEST PROTOCOL

This QLFT uses a person's response to irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator. To conduct this QLFT, the general requirements and precautions, a sensitivity screening check, and fit test procedures discussed below must be followed.

2-4B.3.3.1. GENERAL REQUIREMENTS AND PRECAUTIONS

General requirements and precautions related to the irritant smoke QLFT are discussed below.

- The respirator to be tested shall be equipped with high-efficiency particulate air (HEPA) or P100 series filter(s). It is recommended that the person performing the fit test also wear a full-face respirator with HEPA or P100 series filters.
- Only stannic chloride smoke tubes shall be used for this protocol.
- No test enclosure or hood for the test subject shall be used.
- The smoke can irritate the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that only the minimum amount of smoke is used necessary to elicit a response from the test subject.
- The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or buildup of irritant smoke in the general atmosphere.

2-4B.3.3.2. SENSITIVITY SCREENING CHECK

The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke as discussed below.

- The tester shall break both ends of a ventilation smoke tube containing stannic chloride and attach one end of the smoke tube to (1) a low-flow air pump set to deliver 200 mL per minute or (2) an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.
- The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his or her eyes closed while the test is performed.
- The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to

determine if he or she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine if he or she can detect it.

2-4B.3.3.3. IRRITANT SMOKE FIT TEST PROCEDURES

The procedures below must be followed to conduct the actual irritant smoke fit test.

- The person being fit tested shall don the respirator without assistance and perform the required user seal check.
- The test subject shall be instructed to keep his or her eyes closed.
- The tester shall direct the stream of irritant smoke from the smoke tube toward the face seal area of the test subject using the low-flow pump or squeeze bulb at least 12 inches from the facepiece. The tester shall move the smoke stream around the whole perimeter of the mask. The tester shall gradually make two more passes around the perimeter of the mask, moving to within 6 inches of the respirator.
- If the person being tested does not have an involuntary response or detect the irritant smoke, the test should proceed with the test exercises provided in Section 3.5 of this SOP.
- The test subject shall perform the test exercises while the respirator seal is being continually challenged by the smoke around the perimeter of the respirator at a distance of 6 inches.
- If the person being fit tested reports detecting the irritant smoke at any time, the fit test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.
- Each test subject passing the irritant smoke test without evidence of a response is required to undergo a second sensitivity screening check after the respirator has been removed using the smoke from the same smoke tube used during the fit test to determine whether he or she still reacts to the smoke. Failure to evoke a response shall render the fit test void. If the subject responds during the second sensitivity check, the fit test is passed.

2-4B.3.4. RESPIRATOR USER SEAL CHECK PROCEDURE

Individuals using tight-fitting respirators must perform a user seal check each time a respirator is put on to ensure that an adequate seal is achieved. Two methods are available for use; one is the positive- and negative-pressure check and the other is the respirator manufacturer's method. Either the positive- and negative-pressure checks described below may be used or, if a manufacturer of a particular respirator brand has developed its own recommended seal check method, that method may be used in place of the negative- and positive-pressure seal checks. User seal checks are not a substitute for qualitative or quantitative fit tests. The user check procedures described below are as described in the mandatory Appendix B-1 of Title 29 of the *Code of Federal Regulations*, Part 1910.134.

- Positive-Pressure Check

  Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators, this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replace it after the test.

- Negative-Pressure Check

  Close off the inlet opening(s) of the canister or cartridge(s) by covering the opening with the palm of the hand(s) or by replacing the filter seal(s). Inhale gently so that the facepiece collapses slightly, and hold the breath for 10 seconds. The inlet opening of some cartridges cannot be effectively covered with the palm of the hand. In this case, the test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

2-4B.3.5. RESPIRATOR FIT TEST EXERCISES

Test subjects shall perform the exercises below during fit test process. Prior to the actual fit test, the test subject shall (1) select a suitable and comfortable respirator; (2) don, adjust, and then wear the respirator for 5 minutes to assess comfort; (3) conduct a user seal check in accordance with the procedures outlined in Section 3.4 of this SOP (4) report any difficulties breathing while wearing the respirator, (5) select a different respirator if the fit and level of comfort is unacceptable, and (6) perform the fit test exercises described below in the order listed. The qualitative fit test (QLFT) shall be performed in a test environment.

Test Exercises

Each exercise below shall be conducted for 1 minute. During testing, the subject will be questioned and observed to determine if the respirator is comfortable. The respirator shall not be adjusted during the fit testing procedure. Any adjustment voids the test, and the test must be repeated from the beginning.

1. **Normal breathing.** In a normal standing position without talking, breathe normally.
2. **Deep breathing.** In a normal standing position, breathe slowly and deeply. Be careful not to hyperventilate.
3. **Turning head from side to side.** Standing in place, slowly turn the head from side to side between the extreme positions on each side. Hold the head at each extreme momentarily and inhale at each side.
4. **Moving head up and down**. Standing in place, slowly move the head up and down. Inhale in the up position (such as when looking toward the ceiling).
5. **Talking.** Talk out loud slowly and loud enough to be heard clearly by the fit tester. Read the entire "Rainbow Passage" on the next page.
6. **Bending over.** Bend at the waist as if to touch the toes.
7. **Normal breathing.** Complete the same exercise as item 1 above.

After these test exercises are completed, the tester shall ask the test subject about the comfort of the respirator. If the respirator is uncomfortable, another respirator shall be tried and the fit test, as well as user seal check and screening (taste or sensitivity) procedures, will be repeated.

RAINBOW PASSAGE

"When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow."

Source: Appendix A of Title 29 of the *Code of Federal Regulations,* Part 1910.134

2-4C. RESPIRATOR FIT TEST RECORD

Name: _____ Program or Branch: _____

Office: _____ Last Medical Examination: _____

Fit Test Date: _____ Corrective Lenses Needed: ☐ Yes ☐ No

Employee briefed on fundamental principles of respiratory protection, use, selection, inspection, cleaning, maintenance, and storage of equipment ☐ Yes ☐ No

	Respirator 1	Respirator 2	Respirator 3
Equipment Type			
Manufacturer Name			
Model			
Size			
Facepiece Composition (rubber or silicone)			

	Respirator 1		Respirator 2		Respirator 3	
Test Performed	Pass	Fail	Pass	Fail	Pass	Fail
Negative-Pressure Test						
Positive-Pressure Test						
Irritant Smoke Test						
Bitrex™						
Quantitative Fit Test (attach record)						

The individual named above has been fit-tested in accordance with procedures specified in the DNREC WHS, Health and Safety Program Manual. Fit-test protocols have been adapted from 29 CFR 1910.134, Appendix A.

_____ _____ _____
Printed Examiner's Name Examiner's Signature Date

_____ _____
Employee's Signature Date

2-4D. SAFE WORK PRACTICES FOR USE OF AIR-PURIFYING RESPIRATORS

This standard operating procedure (SOP) was developed to ensure the proper use of respirators in routine and foreseeable emergency situations. The SOP supplements the Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) "Respiratory Protection Program", Section 2-4 of the WHS Health and Safety Manual.

2-4D.1. APPLICABILITY

This SOP shall apply to any project that involves use of air purifying respirators and shall not be used for situations involving the use of supplied air systems such as self-contained breathing apparatuses and air-line apparatuses.

2-4D.2. ROUTINE RESPIRATOR USE PROCEDURES

The procedures below apply to the routine use of air purifying respirators.

- Respirators shall not be issued to or worn by individuals when conditions prevent valve function or a good facial seal. These conditions may include but are not limited to facial hair, such as the growth of beard, sideburns, or excessive mustaches, and possibly the wearing of corrective eyeglasses.
- If spectacles, goggles, face shields, or welding helmets must be worn with a facepiece, they will be worn so as not to adversely affect the seal of the facepiece to the face.
- For all tight-fitting respirators, a positive and negative pressure seal check shall be performed each time the respirator is donned. Seal checks shall be performed as follow:
  - *Negative pressure check:* Close off the inlet opening of the canister or cartridge(s) by covering it with the palm of the hand(s), inhale gently so that the facepiece collapses slightly, and hold the breath for 10 seconds. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is satisfactory.
  - *Positive pressure check*: Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. The exhalation valve cover may have to be removed to perform this procedure.

- *Manufacturer's recommended seal check*: If the respirator manufacturer recommends specific procedures for performing a user seal check, these procedures may be used instead of the negative and positive pressure checks.

- Work areas must be monitored for conditions that may adversely affect the effectiveness of respiratory protection. Employees may leave the work area where respirators are required under the following conditions:
  - To wash the face and respirator facepieces as necessary to prevent eye or skin irritation.
  - If vapor or gas breakthrough, changes in breathing resistance, or leakage of the facepiece is detected.
  - To replace the respirator or the filter, cartridge, or canister elements.
  - If established monitoring instrument action levels are exceeded.
  - For any other criteria as established in a project specific health and safety plan.

2-4D.3. RESPIRATOR USE DURING EMERGENCY SITUATIONS

Emergency situations may arise during the wearing of respiratory protection. These situations could include medical emergency, respirator failure, fire, chemical spills or leaks, and other events that pose an immediate risk. Procedures for respirator use during emergency situations are summarized below.

- When an emergency situation arises that creates or has the potential to create immediately dangerous to life and health (IDLH) conditions, the work environment shall be evacuated immediately and shall not be reentered by employees without suitable protective gear as well as following the procedures outlined Section 2-4, "Respiratory Protection Program" of the WHS Health and Safety Manual, paragraph 2.1.2.

- Only employees using the buddy system shall enter work environments with the potential for the development of atmospheres that may present IDLH conditions.

- When an emergency situation arises that includes physical hazards that may interfere with the proper use of respiratory protection, the work environment shall be evacuated.

- Under no circumstances shall respirator users remove facepieces in hazardous atmospheres. In the event of respirator malfunction, users should leave the hazardous

environment immediately and proceed to a known safe location before removal of the facepiece.

- Episodes of respirator failure shall be thoroughly investigated before work activities begin again. The investigation shall include re-evaluation of work area atmospheric conditions, review of the respirator selection criteria and service life calculations, and an evaluation of the working conditions under which respirator failure occurred.

2-4E. RESPIRATOR CLEANING PROCEDURES

This standard operating procedure (SOP) provides guidelines for proper and thorough cleaning of respiratory protection equipment. The Occupational Safety and Health Administration (OSHA) regulates the use of respiratory protection for general industry in Title 29 of the *Code of Federal Regulations* (CFR) Part 1910.134, "Respiratory Protection." Appendix B-2 of the standard outlines mandatory requirements for respirator cleaning and is used as the basis for this SOP. This SOP supplements the "Respiratory Protection Program", Section 2-4 of the WHS Health and Safety Manual. It provides specific respirator cleaning and disinfection procedures and shall be included as an attachment to the site-specific health and safety plan for projects for which respirator use is planned or is a contingency.

2-4E.1. APPLICABILITY

This SOP shall apply to any project that involves use of respirators with reusable facepieces.

Respirators shall be cleaned and disinfected as discussed below.

- Respirators issued for the exclusive use of an employee shall be cleaned and disinfected as often as necessary to be maintained in a sanitary condition.
- Respirators issued to more than one employee shall be cleaned and disinfected before being worn by different individuals.
- Respirators maintained for emergency use shall be cleaned and disinfected after each use.
- Respirators used in fit testing and training shall be cleaned and disinfected after each use.

2-4E.2. CLEANING AND DISINFECTION PROCEDURES

Mandatory respirator cleaning procedures as defined in 29 CFR Part 1910.134, Appendix B-2, are listed below. All wash and rinse water should be warm, with a maximum temperature of 110 °F (43 °C).

1. Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure-demand valve assemblies, hoses, and any other components as recommended by the manufacturer. Discard or repair any defective parts.
2. Wash components in warm water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.

3. Rinse components thoroughly in clean, warm, preferably running water. Drain all components.

4. When the cleaner does not contain a disinfecting agent, respirator components should be immersed for 2 minutes in one of the following:

   - Hypochlorite solution [50 parts per million (ppm) of chlorine] made by adding approximately one milliliter of laundry bleach to 1 liter of warm water.
   - Aqueous solution of iodine [50 ppm iodine] made by adding approximately 0.8 milliliter of tincture of iodine (6 to 8 grams ammonium and/or potassium iodide per 100 cubic centimeters of 45 percent alcohol) to 1 liter of warm water.
   - Other commercially available cleansers of equivalent disinfectant quality when used as directed if their use is recommended or approved by the respirator manufacturer.

5. Rinse components thoroughly in clean, warm, preferably running water. Drain all components. The importance of thorough rinsing cannot be over emphasized. Detergents or disinfectants that dry on facepieces may cause dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

6. Components should be air-dried or hand-dried with a clean, lint-free cloth.

7. Reassemble the facepiece. Replace filters, cartridges, and canisters prior to next use.

8. Test the respirator to ensure that all components work properly.

9. Place the respirator in a clean bag and seal for storage.

Depending on work conditions, respirator facial sealing surfaces may need periodic cleaning during the course of daily use. Cleaning of the facial sealing surface during work breaks can reduce the chance of facial irritation caused by sweat, natural skin oil, or irritating materials that may have deposited on the facepiece. Facial sealing surfaces can be cleaned using disinfectant wipes soaked in isopropyl alcohol or benzalkonium chloride. After use of the disinfectant wipe, the sealing surface should air dry or be dried thoroughly using paper towels or tissues.

2-5. CONFINED SPACE ENTRY PROGRAM

The purpose of this confined space entry program is to establish specific procedures to protect Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) and contractor employees from the hazards of entry into both non-permit and permit-required confined spaces. Procedures for confined space entry are based on the requirements of Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.146.

Although historically the Division has not needed to enter confined spaces, in the event that it is necessary, all requirements specified in this program will apply to all WHS employees and contractors working under the direct supervision of WHS. Evaluation of confined space entry program compliance and associated recordkeeping will be completed by formal audits conducted by the director or designee.

Definitions, responsibilities, program elements, and recordkeeping associated with the confined space entry program are discussed below.

2-5.1. DEFINITIONS

The following definitions apply to WHS's confined space entry program:

Attendant**:** A person stationed outside of a permit-required confined space who monitors the authorized entrants, performs no other duties for the work, and has the authority to cancel the permit or certification if necessary.

Entrant or Authorized Entrant**:** a qualified person who will enter the confined space. The entrant is trained on the procedures of the Confined Space and is authorized by WHS to enter.

Entry Supervisor**:** a qualified person, who is responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, authorizes entry, oversees entry operations, and terminates entry when required.

Confined Space**:** A space or work area containing all of the following characteristics:

- Is large enough and configured so that an employee can bodily enter the space or area and perform assigned work.
- Has limited or restricted means for entry or exit; examples are tanks, silos, vats, degreasers, sewers, tunnels, hoppers, underground utility vaults, and pipelines; low-lying outdoor areas such as ravines, ditches, pits, and trenches tend to accumulate heavier-than-air vapors and gases and may also qualify as confined spaces.

- Is not designed for continuous employee occupancy.

Non-Permit Required Confined Space**:** A confined space that does not contain, or with respect to atmospheric hazards has the potential to contain, any hazard capable of causing death or serious physical harm.

Permit-Required Confined Space (PRCS)**:** Any space or work area that has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere.
- Contains a material that has the potential for engulfing an entrant.
- Has an internal configuration that can trap or asphyxiate an entrant by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section.
- Contains any other recognized serious safety or health hazard.

Hazardous Atmosphere**:** An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (escape unaided from a space), injury, or acute illness from one or more of the following causes:

- Flammable gas, vapor, or mist in excess of 10 percent of its lower explosive limit (LEL).
- Airborne combustible dust at a concentration that meets or exceeds its LEL (this condition is met if dust obscures vision at a distance of 5 feet or less).
- Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent.
- Atmospheric concentration of any substance that could result in employee exposure in excess of the substance's permissible exposure limit.
- Any other atmospheric condition that is immediately dangerous to life or health (IDLH).

Entry**:** The action by which a person passes though an opening into a permit-required confined space; entry is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

2-5.2. RESPONSIBILITIES

The responsibilities of personnel involved in the confined space entry program or that supervise such activities are as follows:

Program/Section Manager**:** The program/section manager shall ensure the communication and implementation of the confined space entry program within his or her affected areas.

Project Manager/Project Officer**:** All project managers/project officers are responsible for implementation of the confined space entry program on their respective projects. Specifically, project managers shall ensure the following:

- Completion of a confined space entry permit (CSEP) or entry certificate, as appropriate, and that the conditions of each permit or certificate are not violated.
- Confined spaces are identified with signs and personnel are informed of the locations and nature of confined spaces on a project site.
- The availability of proper equipment necessary for safe confined space entry; equipment may include, but not be limited to, communication, rescue, testing, and ventilation equipment, and personal protective equipment (PPE).
- Individuals authorizing CSEPs are qualified and trained.
- All personnel, including subcontractors, identified as authorized entrants, attendants, or entry supervisors have been properly trained.
- All documentation of training, permits, and certificates are maintained in permanent file records.

Entry Supervisor: Responsible for the overall PRCS entry and must coordinate all entry procedures, tests, permits, equipment and other relevant activities. The following entry supervisor duties are required:

- Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms and consequences of the exposure;
- Verifies, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place;
- Endorses the entry permit when all conditions have been met that allows for safe entry into the confined space. No personnel shall enter the confined space until the Entry Supervisor has signed the entry permit;
- Terminates the entry and cancels the permit when the entry is complete and there is a need for terminating the permit;

- Verifies that the means for summoning rescue services are operable;
- Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations;
- Ensures that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained throughout the entry;
- Conducts a pre-entry briefing, as a minimum, with the Authorized Entrants and Attendants prior to the start of the job.
- Makes confined space assignments to all personnel and explains their duties and responsibilities each time they are assigned PRCS work;
- Establishes a communication network that will permit the attendant to maintain effective and continuous contact with the authorized entrant(s) in the PRCS;
- Establishes an effective communication network between the attendant and rescue personnel; and
- Ensures that work performed in confined spaces is in accordance with this procedure and, when required, meets the definition of isolation in a PRCS.
- Note: An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this section for each role he or she fills. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

Authorized Entrants: All entrants must be authorized by the entry supervisor to enter permit spaces, have received the required training, use the proper equipment and follow the entry procedures and permit. The following entrant duties are required:

- Before entry of the confined space, receive training of the hazards which they may face.
- Recognize the signs and symptoms of overexposure to a hazard.
- Review and follow the action items listed on the confined space permit.
- Ensure that qualified personnel have performed whatever tests are required to assure a safe work environment before entering the confined space, during the course of the work, and at the beginning of each shift.

- Notify the attendant and other entrants when conditions may change in the confined space.
- Maintain constant communication with the Attendant while in a PRCS.
- Notify the Attendant when they enter or exit the PRCS.
- Be aware of what personal protective equipment is required.
- Exit the confined space when the Attendant orders an evacuation, an automatic alarm is activated, or they perceive that they are in danger.
- Perform a close-out inspection when the job is complete to assure that tools and equipment have been removed.

Attendants: At least one attendant is required outside the permit space in which entry is authorized and shall remain for the duration of the entry operation. Responsibilities include:

- To remain outside the opening/entry point of the permit space during entry operations until relieved by another attendant. Once properly relieved, they may participate in other permit space activities.
- Continuously maintain an accurate count of all persons in the PRCS.
- Update the confined space permit when entrants enter and/or exit.
- Are able to recognize potential confined space hazards and possible behavioral effects of hazard exposure on entrants.
- Maintain effective and continuous contact with Authorized Entrants and, when required, alert the entrants of the need to evacuate.
- Have no other job that will take his/her attention from the person(s) in the confined space. However, they may pass tools/material or other equipment when necessary.
- Order evacuation from the PRCS when:
    - The Attendant cannot effectively and safely perform all the attendant duties,
    - The Attendant observes a condition which is not allowed on the entry permit,
    - The Attendant detects behavioral effects of hazard exposure, or

- The Attendant detects any situation outside the space which could endanger the entrants.

If evacuation of the space occurs for any of the above-listed reasons, it will be noted on the permit and the permit will be canceled. A new permit must be issued before the space can be re-entered.

- Summon rescue and other emergency services as soon as Authorized Entrants need aid to escape from the PRCS.
- Take the following actions, as necessary, when unauthorized persons approach or enter a PRCS:
  - Warn the unauthorized persons to keep away from the space,
  - Immediately request the unauthorized persons to exit if they have entered the PRCS,
  - Inform the Authorized Entrants and Entry Supervisor if unauthorized persons have entered the space.
- The Attendant shall not enter the PRCS to attempt rescue of the entrants.

2-5.3. PROGRAM ELEMENTS

WHS employees and subcontractor employees shall not enter a confined space without strict adherence to all preparation and entry procedures outlined in this program. Confined spaces that cannot be cleared of atmospheric hazards shall not be entered until all provisions and procedures for entry into permit-required confined spaces are followed. Permit-required confined space entry procedures are provided in the Standard Operating Procedure for Confined Space Entry, and the CSEP form (Attachment A).

Non-permit required confined spaces must meet the definition detailed in Section 1.0 of this program. The non-permit required confined space shall not have continuous sources of atmospheric hazards or uncontrolled physical hazards. If these conditions cannot be achieved, then the space shall be classified as a permit-required confined space. Non-permit required confined space entry procedures are provided in Attachment B.

If the project manager/project officer can demonstrate the absence of any hazardous conditions preventing safe entry through monitoring and inspection data, then entry into this confined space may follow the non-permit required entry procedures outlined in the SOP “Procedures of Entry of Confined Space”. If

initial entry is required to obtain monitoring and inspection data, then the initial entry shall be conducted in accordance with the permit-required confined space entry procedures.

Hazard identification, hazard control, permit and certification systems, and employee training under the confined space entry program are discussed below. These program elements fulfill the requirements of 29 CFR 1910.146.

2-5.3.1. HAZARD IDENTIFICATION

The project manager/project officer shall evaluate the scope of work at each job site and identify all confined space entry locations. All confined spaces shall be considered permit-required confined spaces until pre-entry procedures described in the attached SOP demonstrate otherwise.

If the site contains permit-required confined spaces, WHS shall inform exposed employees, the client, and all contractors of the existence, location, and danger posed by the permit-required confined spaces by posting signs or another equally effective means. Signage identifying each confined space shall be posted near the entrance to each space. An inventory of all confined spaces at project sites shall be included in the site HASP.

2-5.3.2. HAZARD CONTROL

Employees entering confined spaces are subject to chemical and nonchemical hazards. The nonchemical hazards include the following:

Thermal Effects**:** Workers within confined spaces are prone to heat stress. Because of the nature and design of confined spaces, moisture control and radiant heat are difficult to control. All personnel working within and around confined spaces shall be trained in the recognition of the signs and symptoms of heat stress and work and rest regimen guidelines. Special precautions must also be taken in cold environments to prevent frostbite, trench foot, and general hypothermia. See Sections 4-4 & 4-5 of WHS's Health and Safety Manual

Noise**:** Because of the nature of confined spaces, noise may be intensified and expose the employee to higher decibel levels than in an outside environment. The project manager shall evaluate noise exposures within the confined space as appropriate and comply with the WHS Hearing Conservation Program, Section 2-2 as necessary. Noise within the confined space may also interfere with communication between personnel inside and outside the space. Measures such as intrinsically safe communication devices, hand signals, or air horns shall be used if workers are unable to hear voice commands or danger signals because of excessive noise.

The hazard control measures discussed below for lockout and tagging, cleaning, entry and exit, and equipment and tools shall apply to all confined space work.

2-5.3.2.1. LOCKOUT AND TAGOUT

If activation of electrical or mechanical equipment would cause injury to confined space entrants, then the equipment shall be removed from service, and stored energy must be released to prevent inadvertent activation before workers enter the confined space. The WHS lockout and tagout SOP (Section 4-7) shall be used for equipment deactivation.

All confined spaces shall be completely isolated from other systems such as feed lines for liquids, solids, or gases, by physically disconnecting, double-blocking and bleeding, or blanking off all feed lines. In a continuous system where complete isolation is impossible, such as sewers or utility tunnels, specific procedures for isolation shall be included in the site-specific HASP for that site. Blanks used to seal off lines shall be capable of withstanding the maximum working pressure or load of the line (with a minimum safety factor of 4), have a gasket on the pressure side that can ensure a leak-proof seal, and be made of chemically nonreactive material. Shut-off valves servicing the confined space shall be locked in the closed position and tagged for identification.

2-5.3.2.2. CLEANING

Procedures and processes used to clean the inside of a confined space shall be specified in the site-specific HASP and site Work Plan then reviewed and authorized by the site safety officer (SSO) or another qualified individual. The cleaning method used will depend on the space and contents of the space. If possible, standing fluids that may produce toxic or displacing gases, vapors, or dust should be removed prior to entry. Also if possible, initial cleaning should be conducted from outside the confined space. Special procedures should be evaluated and addressed in the site-specific HASP for situations where unique hazards may be created by the cleaning process itself.

2-5.3.2.3. ENTRY AND EXIT

The extent of entry and exit precautions needed to maintain a safe confined space work area will be determined by the SSO at each confined space entry location. All necessary entry and exit equipment shall be identified on the applicable permit. The following items shall be evaluated and considered:

- Type of confined space to be entered.
- Barriers within the space.
- The occupancy load of the space.

- Time required for emergency exiting.
- Time required for emergency rescue.

At minimum, all confined spaces deeper than 4 feet or the employee's shoulder height (whichever is less) shall be required to have a ladder securely fixed within the space. This ladder shall not be removed until all employees have exited the space.

2-5.3.2.4. EQUIPMENT AND TOOLS

Confined space entry shall be allowed only when all equipment necessary for a safe entry has been assembled and shown to be in proper working order. Equipment that may be necessary includes: (1) atmospheric testing equipment, (2) PPE, (3) communication devices, and (4) entry and exit and rescue equipment. All equipment and tools to be used within a confined space shall be inspected and meet the following requirements:

- Hand tools shall be kept clean and in good repair and selected according to intended use.
- If portable electrical tools and equipment are used, they shall be equipped with a ground fault circuit interrupter and checked before use within a confined space.
- All electrical cords, tools, and equipment shall be of heavy-duty type with heavy-duty insulation and inspected for visual defects prior to use.
- All equipment that may be used in a flammable atmosphere shall be explosion-proof or intrinsically safe for the atmosphere involved.
- Lighting used within a confined space shall be of explosion-proof design and equipped with guards. Lighting must be listed by the Underwriters Laboratories for use in Division 1 atmospheres of the appropriate class and group, or be approved by the U.S. Bureau of Mines, the Mine Safety and Health Administration, or the U.S. Coast Guard.
- Lighting shall not be hung by electrical cords unless specifically designed for that purpose. The illumination of the area shall be sufficient to provide for safe work conditions.
- Cylinders of compressed gases shall never be taken into a confined space. When not in use, cylinders shall be turned off at the cylinder valve and capped. This restriction does not apply to self-contained breathing apparatuses or resuscitation equipment.

2-5.3.3. PERMIT AND CERTIFICATION SYSTEMS

Confined space entries shall be controlled through the implementation of either a permit or certification system. The appropriate permit or certificate must be completed prior to any entry of a confined space. The type of confined space to be entered will determine the need for either a permit or certification.

A permit-required confined space shall require a CSEP. Details of how the permit is completed are presented in the attached SOP. A non-permit-required confined space requires the completion of the "preparation and testing of a non-permit-required confined space form (Attachment B).

Each permit is valid for only one shift and will be "canceled" when confined space work is complete; it may not be used for any future entries. Permits shall serve as a permanent record of entry activities and shall be kept in the project file after completion of work.

2-5.3.4. EMPLOYEE TRAINING

Awareness level confined space entry training shall be provided to all WHS field employees and employees supervising contractor personnel entering confined spaces. Confined space entry training of WHS employees may be conducted as a stand-alone course or as part of the 40-hour initial health and safety training and annual refresher training classes. Project managers/project officers shall verify that all contractor personnel have received training and are proficient and certified in their duties as required by this program.

Employees actually entering confined spaces must have the additional training described below for non-permit required and permit-required confined spaces before entry and must be briefed on site-specific hazards while on site.

2-5.3.4.1. NON-PERMIT REQUIRED CONFINED SPACE TRAINING

WHS personnel performing non-permit required confined space entry must receive training in the following:

- Definition of confined spaces.
- Recognition, evaluation, and control of chemical and physical hazards within a confined space.
- Requirements of the confined space standard (29 CFR 1910.146) and the WHS confined space entry program.
- Use and limitations of atmospheric testing and PPE.

2-5.3.4.2. PERMIT-REQUIRED CONFINED SPACE TRAINING

WHS employees involved in permit-required confined space entries shall receive training to include the subjects listed in Section 2-5.3.4.1 plus additional specific training as necessary to safely perform the following assigned duties:

- Authorized entrants for permit-required confined spaces shall be trained and knowledgeable in the responsibilities listed above in Section 2-5.2. and in the following:
  - The hazards of confined space entry, including information on the mode, signs, symptoms, and consequences of the hazard exposure.
  - Communication rules.
  - Rescue procedures.
- Authorized attendants for permit-required confined space entries shall be trained and knowledgeable in the responsibilities listed above in Section 2-5.2. and in the following:
  - The hazards of confined spaces and how to monitor confined space conditions to determine if it is safe for entrants to remain in the space.
  - The mode, signs, symptoms, and possible behavioral effects of hazard exposure.
  - Authorized entry identification requirements and the maintenance of an accurate count of personnel in permit spaces.
  - Communication requirements with the entrants, including maintaining effective and continuous contact with the entrants.
  - The reasons to order an evacuation, such as (1) observing conditions not allowed on the permit; (2) observing dangerous situations outside the space; (3) observing behavioral effects in authorized entrants; and (4) if the attendant must leave the work station or cannot safely perform his or her duties.
- Individuals responsible for authorizing permits or in charge of entry into permit-required confined spaces (i.e. entry supervisors) must be trained and knowledgeable in the responsibilities listed above in Section 2-5.2. and of the following:
  - Requisite information for permits.
  - Procedures, practices, and equipment necessary for safe entry.

- Conditions under which permits should be canceled or entry terminated.
- How to deal with unauthorized personnel entry.

2-5.4. RECORDKEEPING

This section outlines recordkeeping requirements under this program for permits and training certificates.

2-5.4.1. PERMITS AND FORMS

Copies of all permits shall be kept in the permanent project file. On an annual basis, each program/section manager or assignee shall review canceled permits or forms used on each project within his or her program/branch to evaluate the effectiveness of the program. If there is reason to believe that the measures taken under this program are not protecting employees, the program will be revised to correct the deficiencies found.

2-5.4.2. TRAINING CERTIFICATES

Proof of training shall be issued to all employees successfully completing the appropriate confined space entry training. Proof shall consist of certificates of completion issued with 40-hour initial and 8-hour refresher health and other safety training courses. Certificates shall contain the employee's name, identification of the training provider, and the dates of the training. This certification shall be available for inspection by employees and their representatives.

2-5A. CONFINED SPACE ENTRY PERMIT

This permit must be posted at the job site until the job is completed.

Permit Valid from : _____ a.m./p.m. to _____ a.m./p.m. Date:

Site Information

Project Name: _____ Project No.: _____

Space Description and Field Location: _____

Description of Work Performed: _____

_____

Permit Space Hazards
(indicate specific hazards with initials)

____ Oxygen deficiency (less than 19.5%)
____ Oxygen enrichment (greater than 23.5%)
____ Flammable gases or vapors (greater than 10% of LEL)
____ Airborne combustible dust (meets or exceeds LEL)
____ Toxic gases or vapors (greater than PEL)
____ Mechanical hazard
____ Electrical shock
____ Material harmful to skin
____ Engulfment
____ Other: _____

Equipment Required for Entry and Work
(specify as required)

Protective clothing:: _____
_____
_____

Respiratory protection: _____
_____

Air monitoring: _____
_____

Communication: _____
_____

Rescue equipment: _____

Other: _____

Communication Procedures (to be used by attendants and entrants)

Authorized Entrants
(List by name, attach entry/exit roster)

_____ _____
_____ _____
_____ _____

Emergency Service

Name of Service	Telephone Number
_____	_____
_____	_____
_____	_____

Authorized Attendants
(List by name or attach roster)

_____ _____
_____ _____
_____ _____

Additional Information_____
_____
_____

Permit Authorization

I certify that all safety precautions have been taken and necessary equipment has been provided for safe entry and work in this confined space. Air monitoring results will be recorded on this permit.

Permit Authorized by (Entry Supervisor printed name): _____

Signature: _____ Time: _____ Date: _____

Preparation for Entry
(check after steps have been taken)

____ Notification of affected departments of service interruption
____ Emergency Response Team available
____ Isolation methods:
- ____ Lockout/tagout
- ____ Blank/blind
- ____ Purge/clean
- ____ Inerting
- ____ Ventilate
- ____ Atmospheric test
- ____ Barriers
- ____ Other: _____

____ Personnel awareness:
- ____ Pre-entry briefing on specific hazards and control methods
- ____ Notify contractors of permit and hazard conditions
- ____ Other: _____

____ Additional permits required and attached:
- ____ Hot work
- ____ Line breaking
- ____ Other: _____

Testing Record

	Acceptable Conditions	Result					
		_____:____ am/pm	_____:____ am/pm	_____:____ am/pm	_____:____ am/pm	_____:____ am/pm	_____:___ am/pm
Oxygen-min.	19.5%						
Oxygen-max.	23.5%						
Flammability	<10% LEL						
H_2S	<10 ppm						
Cl_2	<0.5 ppm						
CO	<35 ppm						
SO_2	<2 ppm						
Heat	°F/°C						
Toxic (specify)							
Other							
Tester Initials							

Notes:

Cl_2	=	Chlorine	PEL	=	Permissible exposure limit
CO	=	Carbon monoxide	ppm	=	Part per million
H_2S	=	Hydrogen sulfide	SO_2	=	Sulfur dioxide
LEL	=	Lower explosive limit			

Permit Authorizer's Signature: _____

Original to project file

2-5A. PERMIT-REQUIRED CONFINED SPACE ENTRY STANDARD OPERATING PROCEDURE

This standard operating procedure (SOP) presents procedures that must be followed for all permit-required confined space entries involving DNREC staff. If any of the space preparation or entry requirements described in this SOP cannot be met, entry shall not proceed until the space is evaluated by the project manager/project officer or designee. Contractors are responsible for equivalent procedures for their own employees.

This SOP supplements the DNREC WHS "Confined Space Entry Program," and provides specific procedures for permit-required confined space entry. This SOP must be included with the health and safety plan for all projects on uncontrolled hazardous waste operations (HAZWOPER) sites that include permit-required confined space entry operations.

The entry permit, hazard inspection, atmospheric testing, ventilation, respiratory protection, pre-entry briefing, communication, evacuation, and rescue provisions for permit-required confined space entry are discussed below.

2-5A.1. ENTRY PERMIT

DNREC WHS has established a confined space entry permit (CSEP) system to ensure safe entry and safe performance of work within a permit-required confined space. Before entry into a permit-required confined space can occur, a CSEP must be completed, signed, and issued by a qualified entry supervisor. The CSEP is a written authorization and approval that specifies the location of the confined space, specifies the type of work to be conducted in the space, certifies that all existing and potential hazards have been evaluated, and verifies that necessary employee protective and hazard control measures have been implemented to ensure the safety of each worker.

The CSEP is attached to this SOP and must be completed in its entirety and signed by an entry supervisor (either the project manager/project officer or qualified designee). Blank entries are not allowed, and all sections requesting a specific time or date must be completed. Additional sheets may be necessary.

The entry supervisor shall do the following:

- Determine that the entry permit contains the requisite information and that all tests specified by the permit have been conducted before endorsing the permit and allowing entry.

- Determine that the necessary procedures, practices, and equipment necessary for safe entry are in effect before allowing entry.
- Cancel entry authorization and terminate entry whenever unacceptable entry conditions are present.
- Take the necessary steps for concluding an entry operation, such as closing off a permit space and canceling the permit once the authorized work has been completed.
- Ensure that confined space entrants are properly trained and that an authorized attendant will remain outside of the confined space to monitor the entrants throughout the entire entry.

The entry supervisor must be readily available for reviewing the permit and must personally inspect the confined space before the startup of the entry task. The permit authorizer (i.e. entry supervisor) shall then sign the permit.

The completed permit shall be posted at the entry portal or displayed by any other equally effective means before entry activities begin so that authorized entrants can confirm that all pre-entry preparations have been completed. After reviewing the permit, all authorized entrants shall initial the CSEP after their name.

A copy of the CSEP shall be furnished to the project manager/project officer. The original copy of the permit shall be retained as a permanent record in the project file. The CSEP posted at the work site shall be removed upon completion of the job or the end of the shift, whichever is first.

The date and time for which the permit has been authorized shall be indicated on the permit. Permits are valid for a maximum of 8 hours. Reauthorization of the permit shall be required for each day of entry.

A CSEP becomes void under any of the following conditions:

- If work in the confined space does not start within 1 hour after atmospheric testing is performed.
- The job is interrupted for more than 60 minutes for any reason.
- Atmospheric testing of the confined space is discontinued.
- Atmospheric changes occur resulting in (1) an oxygen content below 19.5 percent or above 23.5 percent; (2) a greater than 10 percent lower explosive limit (LEL) of

combustible gases or vapors; or (3) concentration of a hazardous airborne contaminant exceeding its permissible exposure limit.

- Injury or illness of an entrant.
- A power failure affecting lighting or telephone usage.
- Severe weather.

2-5A.2. HAZARD INSPECTION

Before scheduling a confined space entry, the permit authorizer shall inspect the area around the confined space for (1) sources of combustion exhaust, (2) flammable gases, (3) sparks and fire, and (4) objects that might fall into the space.

The confined space and the scope of work to be performed within that space shall be evaluated to identify potential hazards, and identify and implement appropriate hazard controls. The permit authorizer shall ensure that appropriate hazard controls are in place prior to entry activities. Such hazard controls can include, but are not limited to, the following:

- Lockout and tagout requirements.
- Confined space-cleaning procedures.
- Equipment and tool requirements.
- Safe entry and exit procedures.
- Physical hazard controls (such as hearing protection and heat stress controls).

Each hazard control identified above is specifically detailed in the DNREC WHS “Confined Space Entry Program”.

2-5A.3. ATMOSPHERIC TESTING

Atmospheric testing shall be conducted to evaluate the potential hazards and verify that entry conditions for the space are acceptable. Atmospheric testing equipment is described in the DNREC WHS “Air Monitoring Program”. The atmosphere of a confined space should be analyzed using equipment of sufficient sensitivity and specificity to identify and evaluate any hazardous atmospheres that may exist or arise so that appropriate permit procedures can be developed to ensure safe entry.

The duration of testing for each atmospheric contaminant shall be at least the minimum response time of the test instrument as specified by the manufacturer plus an allowance for dead space in sampling lines.

Testing shall be conducted to ensure that all spaces are surveyed for hazardous conditions and shall include all sections of noncontiguous spaces and all levels of each space to account for stratification. When monitoring for entries involving descent into atmospheres that may be stratified, measurements shall be recorded at a distance of approximately 4 feet in the direction of travel and to each side. If a sampling probe is used, the entrant's rate of progress should be slowed to accommodate the sampling speed and the detector response.

Atmospheric testing shall be conducted in the following order:

- First, oxygen content must be tested since most combustible gas meters are oxygen-dependent and will not provide reliable readings in an oxygen-deficient atmosphere.
- Next, combustible gases must be tested since the threat of fire or explosion is more immediate and life threatening in most cases than exposure to toxic gases and vapors.
- Last, toxic gases and vapors must be tested for specific toxic gases and vapors (e.g., hydrogen sulfide, carbon monoxide) as necessary.

Continuous monitoring for oxygen, combustible gases, and specific hazardous contaminants is required in all permit-required confined spaces.

Equipment for continuous monitoring of gases and vapors shall be explosion-proof (intrinsically safe) and equipped with an audible alarm that will alert personnel when a hazardous condition develops. Testing equipment shall be calibrated prior to use in accordance with the manufacturer's recommendations. Calibration parameters shall be recorded in the field logbook, and each piece of equipment will be tagged with its calibration results. Calibration records should be included in the permanent project file.

Pre-entry evaluation must, at a minimum, include remote atmospheric testing before employee entry and before validation or revalidation of a CSEP to ensure the following:

- Oxygen content between 19.5 and 23.5 percent.
- Less than ten percent (10%) of LEL of combustible gas or vapor.
- The absence of other atmospheric contaminants, if the space contained toxic, corrosive, or irritant materials.

Verification testing of the atmosphere of the permit space shall be conducted for all contaminants identified during evaluation testing procedures at the time of entry in order to verify that concentrations are within the range of acceptable conditions. The ranges of acceptable conditions are contained on the

CSEP. Testing results shall be recorded on the CSEP for the space and compared to the acceptable ranges. Continuous atmospheric monitoring shall be performed for the duration of the entry; however, measurements should be recorded at a prescribed frequency (e.g., every 15 minutes). Any deviation of atmospheric concentrations above pre-entry levels or below 19.5% oxygen as noted above, shall be recorded on the permit and evaluated by the entry supervisor or attendant.

2-5A.4. VENTILATION

Natural ventilation of the confined space prior to initial entry and for the duration of the CSEP shall be provided. However, positive-pressure, forced mechanical ventilation may also be required. Before forced ventilation is initiated, information such as restricted areas within the confined space, voids, nature of contaminants present, size of the space, type of work to be performed, and the number of entrants involved should be considered. The procedures listed below also apply.

- The confined space shall be ventilated before starting work and for the duration of the time that work is to be performed in the space.
- Ventilation air should not create an additional hazard resulting from recirculation of contaminants, improper arrangement of the inlet duct, or substitution of anything other than Grade D (as defined by the Compressed Gas Association) or fresh air.
- When air-moving equipment is used to provide ventilation, the equipment shall be tested before each shift and provided with an audible alarm to signal ventilation failure.
- Chemicals shall be removed from the vicinity of the air supply to prevent their introduction into the confined space by air-moving equipment or any other means.
- Vehicles shall not be left running near confined spaces or near air-moving or air compressor equipment being used for confined space ventilation because vehicle exhaust can act as a source of carbon monoxide.

2-5A.5. RESPIRATORY PROTECTION

Respiratory protection needed for confined space entry shall be determined by a technically qualified person such as a health and safety specialist based on site conditions, air monitoring results for the confined space, and the work activity to be performed. Air-purifying respirators with appropriate cartridges can be worn only if (1) testing indicates that the atmosphere is not oxygen deficient; (2) the contaminants are at concentrations below the maximum use concentration of the respirator selected; and (3) an approved respiratory hazard assessment has been completed.

Self-contained breathing apparatuses (SCBA) or National Institute for Occupational Safety and Health-certified, positive-pressure/pressure demand, airline respirators equipped with a 5-minute emergency air supply (egress bottle) shall be used in any confined space when conditions have been determined to be immediately dangerous to life and health.

See WHS's Respiratory Protection Program for additional requirements relating to respirator usage.

2-5A.6. PRE-ENTRY BRIEFING

Immediately before entering a confined space, the authorized attendant and entrants shall again review all potential hazards and emergency procedures during a pre-entry briefing. The following topics shall be discussed:

- CSEP components.
- Work to be completed and the time period the CSEP shall remain in effect.
- Location of telephone and emergency numbers.
- Atmospheric, physical, electrical, and miscellaneous hazards expected in the space.
- Rescue provisions and procedures.
- Reasons to evacuate the confined space.

2-5A.7. COMMUNICATION

When visual monitoring of the entrants is not possible because of the layout of the confined space, the authorized attendant shall maintain voice contact as necessary to monitor entrant status and to alert entrants of the need to evacuate the space. The method of communication between the attendant and entrant will be identified on the CSEP.

Attendants shall not enter the space to communicate with entrants. Passing of the head through the plane of the opening is not allowed. The attendant shall also know emergency telephone numbers. If a mobile telephone or radio is not available, other communication procedures must be arranged.

2-5A.8. EVACUATION

Evacuation of the permit-required confined space will be initiated if any of the following conditions arise:

- Observation of a condition not allowed on the CSEP.
- Entrant exhibits signs or symptoms of hazardous exposure or heat stress.

- Situation outside the space endangers entrants.
- Uncontrolled hazard (such as fire or spill).
- Loss of power or ventilation.
- Monitoring equipment malfunctions.
- Authorized attendant must leave.

2-5A.9. RESCUE PROVISIONS

Provisions must be made for rescue equipment, personnel, and procedures for each permit-required confined space entry. If a worker becomes ill or injured, the attendant will contact the nearest emergency response technical rescue team (by dialing 911 or a site-specific emergency telephone number). The emergency number for initiating a confined space rescue will be listed on the CSEP. The attendant may then attempt to retrieve the ill or injured employee from outside of the space by utilizing a retrieval line or other non-entry rescue equipment until arrival of a rescue team. If non-DNREC personnel provide rescue operations, the rescue personnel must be informed of the hazards they may confront during rescue.

Under no circumstances shall the attendant enter the confined space to attempt rescue unless trained and equipped for rescue operations and relieved of his or her attendant duties by another qualified attendant. The attendant must have appropriate rescue respiratory protection available for rescue teams. This equipment must include a positive pressure airline (with 5-minute escape bottle) or SCBA. Anyone using emergency respiratory equipment must have received prior to its use a medical evaluation, fit testing, and training in its use.

To facilitate non-entry rescue, retrieval systems or methods shall be used when an authorized entrant enters a permit space unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. The authorized entrant shall be fitted with a chest or full-body harness with a retrieval line attached at a suitable point so that if rescued, the employee easily fits through the entrance. Wristlets can be used when the use of a chest or full-body harness would present a hazard and the use of wristlets is the safest and most effective alternative.

A mechanical retrieval device shall be available to retrieve personnel from a vertical-type permit-required space more than 5 feet deep. The line will be at least 0.5-inch in diameter and tested for 2,000 pounds. Mechanical retrieval devices are not required for spaces less than 5 feet deep or during horizontal entries. A simple retrieval line on the entrant can be tied off outside the entrance for these spaces.

2-5A.10. CONFINED SPACE ENTRY PERMIT

(Note: no CSEP attached) separate document

2-5B. PREPARATION AND TESTING OF NON-PERMIT REQUIRED CONFINED SPACE

Site Information

Project Name: _____ Date: _____

Specific Field Location: _____ Project Manager Initials: _____

Space Description: _____ Project No.: _____

Description of Work Performed

Space Preparation

Precautions taken for entrance cover opening: _____

Entrance barrier(s) used: _____

Ventilation equipment used: _____

Atmospheric Testing Record

		Result					
	Acceptable Conditions*	_____:____ am/pm	_____:____ am/pm	_____:____ am/pm	_____:____ am/pm	_____:____ am/pm	_____:___ am/pm
Oxygen-min.	>19.5%						
Oxygen-max.	<23.5%						
Flammability	<10% LEL						
H_2S	<10 ppm						
Cl_2	<0.5 ppm						
CO	<35 ppm						
SO_2	<2 ppm						
Heat	°F/°C						
Toxic (specify)							
Other							
Tester Initials							

* If acceptable conditions are not met, describe techniques used to eliminate the hazard:

Signature of Tester:

Notes:

Cl_2	=	Chlorine	LEL	=	Lower explosive limit
CO	=	Carbon monoxide	ppm	=	Part per million
H_2S	=	Hydrogen sulfide	SO_2	=	Sulfur Dioxide

If atmospheric testing indicates that the hazards are not being controlled within acceptable conditions, entrants must leave the confined space. Procedures for a permit-required confined space must then be followed.

2-5B. NON-PERMIT-REQUIRED CONFINED SPACE ENTRY STANDARD OPERATING PROCEDURES

The following standard operating procedure (SOP) applies to entry into confined spaces classified as non-permit-required. The confined space must conform to the definition of a non-permit-required confined space as discussed in the Confined Space Entry Program, Section 2-5 of the WHS Health and Safety Manual. Entry into spaces classified as non-permit-required are preferable over entry into permit-required spaces. When feasible, efforts shall be directed to prepare confined spaces so they meet the definitions of non-permit-required confined space.

Permit-required confined spaces (PRCS) can be reclassified as a non-permitted confined space if the PRCS poses no actual or potential atmospheric hazards or if all hazards within the space are eliminated without entry into the space. The PRCS may be reclassified as a Non-Permit Confined Space for as long as the non-atmospheric hazards remain eliminated.

If any of the procedures discussed in this SOP cannot be completed or an unanticipated hazard is identified, the non-permit-required status of the space will be revoked until the space is re-evaluated and re-approved as a non-permit-required space by a technically qualified individual.

Non-permit-required confined space entry procedures that need to be completed before entry into the space are listed below.

- The project manager/project officer or designee (such as site safety officer) shall be notified of the need to enter into a confined space. This notification must allow sufficient time to assemble necessary safety equipment.
- A blank “Preparation and Testing of Non-Permit Required Confined Space” form must be obtained.
- The necessary safety equipment can include, but is not limited to, atmospheric testing meters and devices, a mechanical ventilator, and a ladder for entry and exit.
- All equipment to be used during entry must be tested and inspected before use. Atmospheric testing equipment shall be calibrated prior to use in accordance with the manufacturer’s instructions to ensure proper operation. Calibration parameters shall be documented in the field logbook, and the equipment will be tagged with a label specifying these parameters.

- Hazardous conditions associated with the removal of the entrance cover shall be eliminated before opening the confined space. After removal of the entrance cover, a railing, temporary cover, or other temporary barrier to prevent employees and equipment from accidentally falling through the opening shall be promptly used to barricade the opening.
- The internal atmosphere shall be tested for the following conditions, in the order given:
  - Oxygen content (shall be between 19.5 to 23.5 percent).
  - Combustible gases (shall be less than10 percent of the lower explosive limit).
  - Potential toxic air contaminants.
- The space shall be tested at all levels (top, middle, and bottom) and in all areas where work may occur. The atmosphere within the space must not be hazardous whenever an employee is inside the space.
- If forced-air ventilation is used, the following conditions apply:
  - Ventilation shall not be used to control continuous sources of hazardous contaminants.
  - There must be a clean source of air that will not increase the hazard within the space.
- The entrant shall document on the attached form that the space is safe for entry and that pre-entry measures required by this SOP have been taken. The form shall be made available to each employee entering the space and shall be kept at the work site until completion of confined space work. The certificate will then become part of the permanent project file.

The atmosphere within the confined space must be tested periodically while entrants are within the confined space. Frequency of testing shall be every 30 minutes during the first 2 hours, and then hourly when entrants are in the confined space. If at any time during occupancy a hazardous atmosphere is detected, the entrants shall leave the space immediately. The space shall then be evaluated to determine how the hazardous atmosphere developed, and measures shall be implemented to protect employees from the hazardous atmosphere before any subsequent entry. Re-entry shall not be allowed until atmospheric testing demonstrates acceptable conditions.

When changes in the use or configuration of a non-permit-required space cannot be eliminated or controlled, the SSO shall re-evaluate the space, and if necessary, reclassify it as a PRCS.

2-6. VEHICLE SAFETY PROGRAM

The vehicle safety program was developed to provide guidelines for employee awareness and training regarding vehicle safety to Department of Natural resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) personnel. Vehicle safety is important because of the significant occupational vehicle use within the department and the risk of injury, death, and property damage associated with vehicle use.

This program applies to every employee, including administrative and support staff, operating any class of motor vehicle as part of that employee's official duties or work assignment. This program applies to rental, state-owned, contractor-owned, and personal vehicles. WHS expects all personnel operating vehicles during official duties to obey local traffic laws and practice safe driving habits at all times. Program/section Managers are responsible for implementing this program within their respective program or branch.

Occupant protection, helmet use, driver safety awareness, inspections, and accident reporting are discussed below.

2-6.1. OCCUPANT PROTECTION

WHS employees must use the available passenger restraint system (such as seat belts) in vehicles in which they drive or ride whenever the vehicle is in motion. This includes off- and on-road vehicles, and all passengers in the vehicle. The driver is responsible for ensuring that all passengers are using restraint systems before moving the vehicle.

2-6.2. HELMET USE

Employees using motorcycles during official business are required to wear approved helmets while the motorcycle is in motion. This requirement applies regardless of state law requirements. Employees using any type of unenclosed off-road or all-terrain vehicle are required to wear approved head protection any time the vehicle is in motion regardless of speed or distance traveled.

2-6.3. DRIVER SAFETY AWARENESS

Employees who routinely are expected to use motor vehicles as part of that employee's official work assignment shall receive driver safety awareness training. The training shall address the following topics:

- Vehicle familiarization and general operation
- Unsafe driving practices (such as the use of cell phones while driving)

- Defensive driving techniques
- Use of vehicle safety systems, including seat belts and air bags
- Use of helmets
- Effects of drugs, alcohol, and fatigue on driver performance

Training for staff shall be Defensive Driving as offered by recognized authorities. Co-payments are the responsibility of the recipient; other expenses (eg. Parking) will be covered by the State.

2-6.4. INSPECTIONS

Any vehicle found to have a deficiency that impacts the safe operation of the vehicle shall be removed from service and reported to the Program/section Manager or Fleet Services as appropriate. Deficiencies shall include problems with brakes, head, tail, and brake lights, turn signals, 4-way flashers, horn, wipers, mirrors, windows, tires, seat belts, engine warning lights, interior cleanliness, etc.

2-6.5. ACCIDENT REPORTING

Accidents and incidents of property damage must be reported in accordance with Fleet Services Policy. Cases of personal injury as a result of vehicle use during work-related activities must be reported as soon as possible following the incident. If the injury is the result of an on-road accident, a copy of the police report for the accident must be obtained and included with the State of Delaware First Report of Occupational Injury or Disease and Automobile Accident Report Form.

Cases of property damage must be reported within 24 hours. If the property damage is the result of an on-road accident, a copy of the police report for the accident must be obtained and included with the State of Delaware Automobile Accident Report Form.

2-7. HEALTH AND SAFETY TRAINING PROGRAM

This program has been developed to ensure that all Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) personnel involved in operations or projects where there is a potential for exposure to hazardous materials, hazardous wastes, or physical, biological or safety hazards will be trained to conduct operations in a safe manner. This program is intended to meet the requirements of Title 29 of the *Code of Federal Regulations (CFR)*, Occupational Safety and Health Administration (OSHA) standards for general industry (29 CFR 1910) and construction (29 CFR 1926) and applicable occupational health and safety guidelines. This program is also written to comply with 29 CFR 1910.120, the Occupational Safety and Health Act (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) standard for activities conducted on uncontrolled hazardous waste sites.

The health and safety training program applies to employees in Categories 1 through 4 as described below and in the Organizational Structure part of this Health and Safety Program (section 1-7 of this manual).

2-7.1. RESPONSIBILITIES

The WHS division director bears the ultimate responsibility for ensuring that all WHS employees receive the appropriate safety training in accordance with WHS Policies and Programs and 29 CFR 1910 and 1926. Although the division director is ultimately responsible for employee training, the task of ensuring that all employees receive the proper mandatory safety training and equipment on a day-to-day basis is borne jointly by the WHS program/section managers, project managers/project officers and employees.

The director will designate qualified personnel or a contractor to review and evaluate the employee training status as part of the annual internal health and safety program audit to ensure the proper implementation of this training program. In addition, all training records for each program or branch shall be subject to annual auditing.

All new employees should receive awareness training regarding the health and safety program within their program/branch. Employees shall be informed of DNREC WHS Health and Safety Program, including all relevant Standard Operating Procedures, the Organizational Structure of the program and the responsibilities of the WHS personnel with regard to health and safety in the workplace.

2-7.2. HEALTH AND SAFETY TRAINING FOR ALL WHS PERSONNEL

All DNREC WHS employees are assigned to a work category based on their job duties and the hazards likely to be encountered while performing those duties. (Employee categories are further described in Section 1-7 of this Health and Safety Manual.)

2-7.2.1. CATEGORY 4 PERSONNEL

This employee category includes personnel required to perform their job functions in an office environment or other secure/clean area. Category 4 employees may attend meetings outside the DNREC offices, but do not enter any areas with chemical hazards, or significant biological, physical, or safety hazards.

Training will be provided to Category 4 personnel on the hazards of their jobs and the methods to control those hazards. Such training might include topics such as ergonomics, safe driving, hazard communication, etc. All Category 4 personnel will receive a workplace safety orientation including information about the emergency action plan for the facility in which they work; the locations of fire alarms, fire extinguishers, and emergency exits; policies and procedures for reporting incidents and accidents; and any other relevant information regarding workplace safety and emergencies.

2-7.2.2. CATEGORY 3 PERSONNEL

WHS Work Category 3 employees are identified as those who are potentially exposed to significant hazards such as hazardous atmospheres, confined space hazards, falls from heights, excessive noise, etc, but who do not perform work on uncontrolled hazardous waste operations (HAZWOPER) sites as defined by 29 CFR 1910.120. Category 3 personnel shall receive a workplace safety orientation as described above for Category 4 personnel. In addition, Category 3 personnel are required to receive training in the specific hazards of their jobs, the identification and control of these hazards, standard operating procedures to protect against these hazards and any personal protective equipment required or supplied by DNREC. Because the hazards to which Category 3 personnel are exposed vary by work environment, training requirements will also vary. It is the responsibility of each program/section manager to ensure that all personnel receive appropriate training based on the hazards to which they are potentially exposed. In addition, project managers/project officers will assign only adequately trained personnel to their projects. Specific training requirements are detailed in each of the relevant Health and Safety Programs listed below:

Health and Safety Program Requiring Training	DNREC WHS Health and Safety Manual Section
Hazard Communication	Section 2-1
Hearing Conservation	Section 2-2
Personal Protective Equipment	Section 2-3
Respiratory Protection Program	Section 2-4
Confined Space Entry	Section 2-5
Vehicle Safety	Section 2-6
Emergency Response Planning	Section 3-7
Fall Protection	Section 4-3
Heat Stress	Section 4-4
Cold Stress	Section 4-5
Control of Energy Sources	Section 4-7
Excavation Practices	Section 4-11
Heavy Equipment	Section 4-12

2-7.3. HAZWOPER TRAINING (CATEGORIES 1 AND 2)

Employees assigned to WHS Work Categories 1 and 2 must receive training in accordance with the OSHA HAZWOPER standard. Additionally, Category 1 and Category 2 personnel must receive the appropriate training as described above for all WHS personnel.

2-7.3.1. INITIAL EMPLOYEE TRAINING

All HAZWOPER field personnel will receive a minimum of 40 hours of initial health and safety training from a qualified trainer and a minimum of three (3) days (24-hours) of field-supervised training under the direct guidance of a trained and experienced supervisor. No employee will engage in field activities until this initial training has been completed. Refresher training will ensure that employee proficiency in field health and safety procedures is maintained (see Section 3.5 below concerning refresher training).

All Category 1 and 2 personnel are required to complete an initial training course in accordance with the OSHA HAZWOPER standard before assignment to any hazardous field activities. This training will include a minimum of 40 hours of instruction. Topics covered will include, at a minimum, the following:

- Medical surveillance requirements, including recognition of symptoms and signs that might indicate exposure to hazards.
- Recognition, evaluation, and control of chemical and physical hazards.
- Personal protective equipment (PPE).
- Safe use of engineering controls and equipment.

- Environmental monitoring equipment.
- Respiratory protection and respirator fit testing.
- Practical exercise in the use of PPE and monitoring instruments.
- Standard operating procedures and safe work practices.
- Site-specific health and safety plan (HASP) development and implementation.
- Confined space entry procedures.
- Spill containment program
- Emergency response plan development.
- Decontamination procedures.

WHS work category 1 personnel include those employees who respond to emergency releases of hazardous substances and/or who may be required to wear OSHA HAZWOPER Level A personal protective equipment (i.e. fully-encapsulating suits). Category 1 personnel shall receive additional training at the hazardous materials specialist level in accordance with 29 CFR 1910.120 (q) (6). These employees must be trained and show competency in the following areas:

- Implementing local and state Emergency Response Plans
- Classifying, identifying, verifying known and unknown materials using survey instruments and equipment
- Functioning within an assigned role in the Incident Command System
- Selecting and using proper specialized chemical personal protective equipment
- In depth hazard and risk assessment techniques
- Advanced control, containment, and/or confinement operations
- Determining and implementing decontamination procedures
- Release termination procedures
- Developing site safety and control plans
- Understanding chemical, toxicological, and radiological terminology and behavior

2-7.3.2. SUPERVISED FIELD TRAINING

In addition to the initial training described above, OSHA requires that each person complete a minimum of 24 hours of supervised training in the field before the employee is considered competent to operate in the field without supervision. This training will be documented in the Department's training database

2-7.3.3. SITE-SPECIFIC TRAINING

In addition to the initial and refresher training provided to DNREC WHS employees, all personnel involved in hazardous waste site field activities, including those assigned to the support zone, must participate in site-specific training to be provided by the site safety officer (SSO). Topics to be covered shall include the following:

- Names of personnel responsible for site health and safety.
- Engineering controls and work practices by which the employee can minimize risks and hazards.
- Medical surveillance requirements, including recognition of symptoms and signs that may indicate exposure to hazards.
- Biological, chemical, radiological, and physical hazards at the site and their respective properties.
- Potential routes of exposure to chemicals, possible toxic effects, exposure limits of chemical hazards, and level of personal exposure that can be anticipated from the acute and chronic effects of toxic chemicals.
- Heat and cold stress prevention, treatment, and monitoring.
- Personal cleanliness and restrictions on eating, drinking, and smoking on the job.
- Availability of on-site potable water and toilet facilities.
- Applicable provisions of the OSHA standards (29 CFR 1910 and 1926) and the WHS Health and Safety Program.
- Confined space entry procedures.
- Spill containment program.

- Functions, capabilities, limitations, use, and maintenance of monitoring equipment (a hands-on review shall be held with persons assigned to use the equipment).
- Use and care of the specific PPE selected for the work involved (PPE shall be available for hands-on familiarity and donning and doffing practice, as needed).
- Handling of medical emergencies (the location and telephone numbers for ambulance service and hospitals shall be made known).
- Decontamination procedures established for the site activities.
- Emergency contingency plans in the site-specific HASP.
- Fire and accident response procedures (discussed prior to the start of work).
- Basic operational safety, with emphasis on hazards expected on site.

Emergency Responders shall receive HAZWOPER training that is consistent with their duties, in accordance with 29 CFR 1910.120(q)(6) including training in implementation of facility and Delaware State Emergency Response Plans, the Incident Command System, Fire School Training, Police Officer training, etc.

2-7.3.4. DAILY TAILGATE SAFETY MEETINGS

The purpose of the daily tailgate safety meeting is to briefly review planned field activities for that day, describe potential chemical and physical hazards, review PPE procedures, review decontamination procedures, make corrections to any procedures identified during the previous day's work, plan for emergencies, obtain worker feedback on conditions affecting health and safety, and answer any employee questions regarding health and safety at the site.

The daily tailgate safety meeting will be conducted prior to the start of work for that day. If more than one shift is active at a site, the tailgate safety meeting will be conducted at the start of each work shift.

2-7.3.5. REFRESHER TRAINING

Field personnel and on-site supervisors in Category 1 and Category 2 will be required to maintain proficiency in the areas covered in the initial training course by completing a minimum of 8 hours of annual refresher training in the topics listed above for initial HAZWOPER training. The annual refresher training will also include a regulatory update on relevant topics and critique of incidents that have

occurred in the past year that can serve as training examples. Emergency responders will receive annual refresher training of sufficient content and duration to maintain and demonstrate their competencies.

2-7.3.6. SUPERVISOR TRAINING

Supervisors directly responsible for field activities (other than contractor-led sites) or who directly supervise employees engaged in hazardous waste operations will receive, in addition to the required 40 hours of initial training, 8 hours of specialized training on managing field activities or equivalent experience. At a minimum, this training should include the management of hazardous waste site cleanup operations, management of site work zones, health hazard monitoring, and spill containment procedures. Supervisors must also be familiar with the requirements and procedures defined in the WHS Health and Safety Manual. Incident Commanders in Emergency Response situations must receive Incident Commander training in accordance with 29 CFR 1910.120 (q)(6)(v).

2-7.3.7. EQUIVALENT TRAINING

Employees who can show by documentation or certification that their work experience or training is equivalent to training as defined by 29 CFR 1910.120 shall be exempt from the training requirements listed in above in Section 3.2. However, these employees shall still receive any site-specific training deemed necessary and must attend the annual refresher training course.

Equivalent training includes any academic training or training that existing employees may have received from actual hazardous waste site work experience prior to the effective date (March 6, 1990) of 29 CFR 1910.120 or training not specifically intended for Hazardous Waste Operations but which meets the requirements of the standard. The director or designee will have the authority to approve equivalent training.

2-7.3.8. SITE VISITOR TRAINING

All site visitors intending to enter into the exclusion zone or decontamination area must have met the mandated OSHA training requirements for that site before entry and must provide documentation of training and proof of medical clearance to the SSO.

All site visitors will receive site-specific training from the SSO before being allowed to access any portion of the hazardous waste operation. The purpose of the training is to describe potential chemical and physical hazards at the site, delineate restricted-access areas that the visitor is not allowed to enter, and provide the visitor with information on any PPE needed to safely enter the site (such as hard hat, safety

glasses, and other equipment). The site visitor training will be documented in the site logbook or an appropriate form.

2-7.3.9. CONTRACTOR'S CERTIFICATION OF HEALTH AND SAFETY REQUIREMENTS

All WHS contractors must complete the "Contractor Health and Safety Questionnaire" (Section 1-9 to this Manual) prior to starting any work at a HAZWOPER site. The signed form is the contractor's certification that its employees have completed a health and safety program that complies with all applicable federal and state requirements for workers at HAZWOPER sites. The form must be maintained in the contract file. The project manager/project officer must inform all on-site contractors at a site of any specialized training required for work on his/her project site.

2-7.4. FIRST-AID AND CARDIOPULMONARY RESUSCITATION TRAINING

The Project Manager / Project Officer shall insure that at least one person certified in First Aid and cardiopulmonary resuscitation (CPR) and Automated External Defibrillator (AED) will be on site during all HAZWOPER site activities. All WHS employees are encouraged to obtain First Aid and CPR/AED certification. WHS shall provide training to employees as deemed appropriate by management, and will on occasion offer First Aid/CPR certification courses free of charge to those employees not required to be certified.

2-7.5. DOCUMENTATION OF TRAINING

All training and experience documentation must be carefully maintained to (1) ensure that the field staff has received the necessary initial and ongoing training required by this program, and (2) meet specific OSHA requirements and the recordkeeping and recording requirements of the Health and Safety Manual. All such documents shall be maintained in the Department's training database.

All employees who have received and successfully completed HAZWOPER training shall receive written certification. Any person who has not been certified shall be prohibited from engaging in HAZWOPER site operations.

Program/Section managers will validate employee training status. Expired certifications or other deficiencies will be highlighted.

2-8. MEDICAL SURVEILLANCE PROGRAM

Refer to the current DNREC WHS Administrative Policy and Procedures #0615-Medical Monitoring.

2-9. CHEMICAL HYGIENE PLAN

2-9.1. INTRODUCTION TO THE CHEMICAL HYGIENE PLAN

2-9.1.1. PURPOSE

The purpose of this Chemical Hygiene Plan (CHP) is to provide protocols and guidance for the protection of employees of the Division of Waste and Hazardous Substances (WHS) from health hazards associated with chemicals used in the laboratory. This Chemical Hygiene Plan meets the requirements of the Federal Occupational Safety and Health Administration (OSHA) Laboratory Standard, 29 CFR 1910.1450 and current industrial guidelines and best practices.

2-9.1.2. SCOPE

The CHP applies to all WHS laboratory employees working on laboratory scale operations involving laboratory use of hazardous chemicals, as per 29 CFR 1910.1450, the Federal Occupational Safety and Health Administration (OSHA) Laboratory Standard, and 29 CFR 1910.1200, the OSHA Hazard Communication Standard.

2-9.1.3. EMPLOYEE RIGHTS

WHS is required to advise laboratory employees of their rights regarding the Chemical Hygiene Plan. It is to your advantage to understand your rights.

2-9.1.3.1 Employees shall receive training on the hazards associated with the chemicals used at all WHS laboratories and on the measures they can take to protect themselves from those hazards.

2-9.1.3.2. Employees who may be exposed to hazardous chemicals shall have access to the following information:

2-9.1.3.2.1. Chemical exposure information,

2-9.1.3.3. Workplace chemical inventory, and

2-9.1.3.4. Safety Data Sheets (SDS).

2-9.1.3.5. The employer must provide employees with appropriate personal protective equipment free of charge.

2-9.1.4. Employees who have been exposed to hazardous chemicals shall have access to and be provided with the following information upon request through the Employees' Program/Section Manager:

2-9.1.4.1. Medical Consultation and Examinations

2-9.1.4.2. Records of their Medical Consultations and Examinations

2-9.1.4.3. Results of Environmental Monitoring

Questions about employee rights under the OSHA Laboratory Standard or about the contents of any part of the Chemical Hygiene Plan should be directed to the Program/Section Manager for clarification or more information.

2-9.1.5. RESPONSIBILITIES

Division Director–The Director has ultimate responsibility for the overall effectiveness of the Chemical Hygiene Plan for the Division and shall provide endorsement and budgetary support. Working through the Quality Manager, the Laboratory Administrator ensures that all employees are working in the safest possible environment.

Quality Manager—A quality manager shall be designated for each WHS laboratory. The quality manager is also designated as the Chemical Hygiene Officer (CHO) and the Right-to-Know Coordinator; he/she is responsible for the development and implementation of chemical hygiene policies and safe work practices in the laboratory. The purpose of the CHO in this role is to provide the direction necessary to promote and maintain a high standard of health and safety in the Division. He/she shall:

- Monitor procurement, use, and disposal of chemicals used in the lab.
- Provide oversight to audits and laboratory inspections.
- Facilitate the development of precautions and adequate facilities.
- Know the current legal requirements concerning regulated substances.
- Develop, implement, and seek ways to improve the chemical hygiene program.
- Communicate standards, changes in standard operating procedures (SOPs) and the CHP status.

Laboratory Manager/Supervisor -- The Laboratory Manager/Supervisor is responsible for the day-to-day implementation of the CHP. The chemists shall provide support for chemical hygiene through ensuring that the laboratory or fieldwork is being carried out in accordance with established safety rules and policies. Chemists shall provide chemical hygiene and housekeeping inspections annually. All

chemists shall know the current legal requirements concerning regulated substances used by them and their staff. The Laboratory Manager/Supervisor shall ensure:

- The laboratory staff has a working knowledge of this CHP and applicable laws including 29 CFR 1910.1450.
- Staff knows and follows the chemical hygiene rules and relevant SOPs.
- Appropriate personal protective equipment is available, in good working order, and used properly and when required.
- Appropriate training and facilities are provided and utilized.
- Inspections of emergency equipment, chemical hygiene, and housekeeping are recorded.
- Any deficiencies that require higher-level action are reported to the Quality Manager and Laboratory Administrator.

Staff -- Each member of the WHS laboratory staff is responsible for planning and conducting all operations in accordance with the chemical hygiene plan, developing good personal chemical hygiene habits, reporting safety deficiencies immediately to their manager/supervisor, and taking advantage of appropriate training opportunities.

Safety Team -- The Quality Manager will appoint one or more individuals to conduct annual laboratory self-inspections.

2-9.2. GENERAL LABORATORY PROCEDURES

2-9.2.1. BEHAVIOR IN THE LABORATORY

2-9.2.1.1. Employees must act in a professional manner at all times.

2-9.2.1.2. Horseplay and practical jokes are expressly forbidden.

2-9.2.1.3. Employees shall not work alone when working with chemicals of moderate or high chronic or acute toxicity.

2-9.2.1.4. Any visitor to the laboratory is to be escorted by an employee and is the responsibility of that employee. Appropriate safety rules must be observed at all times.

2-9.2.1.5. While running unattended operations, employees shall leave lights on, place appropriate signs on doors, and provide for containment of hazardous substances in the event of a utility (such as cooling water) failure, which could result in accidental spills.

2-9.2.1.6. Employees shall be aware of the location and proper operation of laboratory safety equipment.

2-9.2.2. AVOIDANCE OF ROUTINE EXPOSURES

2-9.2.2.1. Employees shall minimize all chemical exposures.

2-9.2.2.2. Employees shall work only with materials when their flammability, reactivity, corrosiveness, and toxicity are known.

2-9.2.2.3. Skin and eye contact with chemicals should be avoided. Eye protection is required at all times in the laboratory and where chemicals are stored and handled.

2-9.2.2.4. Employees shall not smell or taste chemicals.

2-9.2.2.5. Employees shall use a vacuum or pipette bulb, and shall not pipette or start a siphon by mouth.

2-9.2.2.6. For any activity that may discharge toxic or noxious chemicals, venting into a local exhaust device (e.g., a chemical fume hood) shall be conducted.

2-9.2.2.7. Flammable, corrosive, or toxic volatile materials must be trapped when they are evaporated when possible, for example with rotary evaporators or similar devices.

2-9.2.3. PERSONAL HABITS IN THE LABORATORY

2-9.2.3.1. Eating, drinking, gum chewing and cosmetic application are not permitted in the laboratory.

2-9.2.3.2. Smoking is not allowed in the building at any time.

2-9.2.3.3. Food shall not be stored in a refrigerator that has been or is being used to store chemicals.

2-9.2.3.4. Ice produced by ice machines for laboratory use shall not be used for beverages, food or food storage.

2-9.2.3.5. No glassware or utensils that are used for laboratory operations shall be used for storage, handling, or consumption of food or beverages.

2-9.2.3.6. Hands should be washed before using the restrooms and before eating or smoking.

2-9.2.3.7. Areas of exposed skin, i.e. forearms, should be washed frequently if there is potential for contact with chemicals.

2-9.2.3.8. Long hair and loose clothing shall be confined.

2-9.2.3.9. Closed-toed shoes shall be worn at all times while working in the laboratory.

2-9.2.3.10. Laboratory employees shall be alert to unsafe conditions and shall see that they are corrected when detected.

2-9.2.3.11. Any spills or accumulations of chemicals on work surfaces shall be removed as soon as possible using techniques that minimize residual surface contamination.

2-9.2.3.12. Safety glasses and/or face shields shall be worn when working with chemicals, both in the laboratory and field, as required by the WHS Personal Protective Equipment Program (Section 2-3 of the WHS Health and Safety Manual).

2-9.2.4. HOUSEKEEPING

2-9.2.4.1. Laboratory areas are to be kept clean and uncluttered. This will help prevent spillage, breakage, personal injuries and unnecessary contact with chemicals.

2-9.2.4.2. Contaminated glassware should be cleaned daily.

2-9.2.4.3. Spills shall be cleaned up immediately from work areas and floors.

2-9.2.4.4. Doorways and walkways within the laboratory shall not be blocked or used for storage.

2-9.2.4.5. Access to exits, hallways, emergency equipment, and utility controls shall never be blocked.

2-9.2.4.6. Chemical containers shall be properly emptied and rinsed prior to cleaning by laboratory services, disposal, or recycling. Glass bottles will be uncapped, washed out with an appropriate solvent, triple rinsed with water and placed in the appropriate container for disposal or recycling.

2-9.2.4.7. Equipment and instrumentation shall be cleaned to remove spillage and contamination before repair or calibration service is requested and service personnel will be informed of any hazardous contamination prior to servicing.

2-9.3. CHEMICAL PROCUREMENT, DISTRIBUTION AND STORAGE

2-9.3.1. DWHS Lab is located at the Lukens Drive office. The only hazardous chemical currently used in this lab is methanol.

2-9.3.2. PROCUREMENT

2-9.3.2.1. Before purchasing any new chemical, the following information must be considered and available:

- Hazardous properties (e.g., flammability) and toxicity,
- Proper storage and handling procedures,
- Proper disposal procedures,
- Presence of adequate facilities to handle and store the material safely, and
- Adequate training for personnel handling the material.

2-9.3.2.2. A safety data sheet (SDS) shall be requested for all hazardous chemicals if the SDS is not already on file.

2-9.3.2.3. No container should be accepted without an adequate identifying label. The label should include, at a minimum, the chemical name and appropriate hazard warning and target organ effects.

2-9.3.3. CHEMICAL LIST

Each Laboratory Manager will annually conduct a chemical inventory of SDS forms and chemicals on hand, and will forward the updated inventory to the Quality Manager. The inventory shall be in compliance with the WHS Hazard Communication Program (Section 2-1 of the WHS Health and Safety Manual). Missing SDS forms should be requested from chemical manufacturers or suppliers. Unneeded items shall be submitted for disposal in accordance with the WHS Hazardous Waste Management Manual.

2-9.3.4. STORAGE

2-9.3.4.1. Stored and working amounts of hazardous chemicals shall be kept to a minimum.

2-9.3.4.2. All chemical containers must have a legible and firmly attached label with, at a minimum, the name of the compound and appropriate hazard information. If the container is too small, the name or structure of the compound is sufficient.

2-9.3.4.3. Chemicals shall be stored in containers with which they are chemically compatible.

2-9.3.4.4. Chemicals shall not be stored on bench tops or in hoods.

2-9.3.4.5. Chemical reagents shall be kept in closed containers when not in use.

2-9.3.4.6. Stored chemicals should be examined periodically (annually) for replacement, deterioration and container integrity.

2-9.3.4.7. Flammable substances must be stored in a flammable materials cabinet or refrigerator designed for flammable liquid storage.

2-9.3.4.8. Cylinders of compressed gases should be handled as high-energy sources and therefore as potential explosives. When storing or moving a cylinder, have the cap securely in place to protect the valve stem. Compressed gas cylinders must be properly secured at all times. Cylinder caps should be in place on cylinders when not in use. Use straps, chains, or stands to support the cylinders in an upright position. Never lubricate, modify, force or tamper with a cylinder valve. Promptly remove the regulators from empty cylinders and replace the protective caps at once. Mark the cylinder “MT”.

2-9.3.4.9. Incompatible chemicals must be segregated. At a minimum, acids, bases, flammables, and oxidizers should be segregated within the laboratory. Water- reactive materials must be separated from all other chemicals.

2-9.3.4.10. Food shall not be stored in refrigerators with chemicals.

2-9.3.4.11. Refrigerators shall be appropriately labeled with respect to materials stored inside.

2-9.4. HAZARD IDENTIFICATION & MONITORING

2-9.4.1. LABELING REQUIREMENTS

2-9.4.1.1. All chemical containers must have a legible, firmly attached label showing the contents of the container.

2-9.4.1.2. Labels on incoming containers of hazardous chemicals shall not be removed or defaced.

2-9.4.1.3. Chemical substances developed in the laboratory shall be assumed to be hazardous in the absence of other information.

2-9.4.1.4. Safety data sheets (SDS) for hazardous chemicals in a given laboratory shall be available to all employees in that laboratory.

2-9.4.1.5. The Quality Manager shall ensure that Hazard Communication requirements are also met (see WHS's Health and Safety Manual Section 2-1).

2-9.4.2. SIGNAGE

2-9.4.2.1. Prominent signs should be posted for the following:

- In areas requiring the use of personal protective equipment (e.g., eye protection).
- Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory personnel,
- Location signs for safety showers, eye wash stations, other safety and first aid equipment, exits, permitted areas for food/drink storage and consumption.
- Warnings at areas or equipment where special or unusual hazards exist.

2-9.4.3. ENVIRONMENTAL MONITORING

2-9.4.3.1. The Quality Manager shall be responsible for oversight of any environmental monitoring as necessary. This may include employee exposure determinations if there is reason to believe that exposure levels for a hazardous substance routinely exceed the action level (or in the absence of an action level, the Permissible Exposure Limit (PEL)).

2-9.4.3.2. Highly toxic materials can be handled without undue hazards if the following procedures are followed:

- The ventilation system (including hood) is performing and being used properly. Laboratory ventilation shall not be less than eight air changes per hour. To ensure proper operation, laboratory ventilation hoods shall be tested in accordance with the manufacturers' guidelines. See Section 10.3 of this procedure for additional guidance on ventilation hoods.
- The proper personal protective clothing is worn to avoid skin and eye contact.

- Good hygiene and laboratory safety practices are followed (See Section 2).

2-9.4.3.3. Monitoring results for any substance regulated by an OSHA standard shall be provided to the Quality Manager and to the employee(s). Permissible Exposure Limits (PELs) for OSHA-regulated substances can be found in 29 CFR (Code of Federal Regulations) Part 1910, Subpart Z. Action levels (generally equivalent to one-half of the PEL value) for specific chemicals are listed under the individual OSHA standard (e.g. lead, cadmium, arsenic).

2-9.4.3.4. The affected employee(s) shall be notified in writing or by posting results in appropriate locations that are accessible to employees within 15 working days after receipt of any monitoring results.

2-9.5. MEDICAL SURVEILLANCE PROGRAM

2-9.5.1. GENERAL PROVISIONS

2-9.5.1.1. An opportunity for medical surveillance, including medical consultation and follow-up, shall be provided under the following circumstances:

- Where exposure monitoring is over the action level or Permissible Exposure Limit (PEL), in the absence of an action level) for an OSHA regulated substance that has medical surveillance requirements.
- Whenever a laboratory employee develops signs or symptoms that may be associated with a hazardous chemical to which the employee may have been exposed in the laboratory.
- Whenever a spill, leak, or explosion results in the likelihood of a hazardous exposure, as determined by the Laboratory or Quality Manager.
- To all employees required to wear a respirator.
- To all emergency response team members.

2-9.5.1.2. All examinations shall be provided by or under the supervision of a licensed physician, at no cost to the employee, without loss of pay, and at a reasonable time and place in accordance with the WHS Medical Surveillance Program.

2-9.5.1.3. Each laboratory organizational unit and field vehicle will contain a first aid kit. First aid kits will be maintained and checked by the Laboratory Manager/Supervisor or

designee monthly for expired or missing items. Medical assistance, if required, is available through Emergency Services (call 911).

2-9.5.1.4. Where medical consultations or examinations are provided, the examining physician shall be provided with the following information:

- The identity of the hazardous chemical(s) to which the employees may have been exposed.
- A description of the conditions under which the exposure occurred including quantitative exposure data, if available.
- A description of the signs and symptoms of exposure that the employee is experiencing, if any.

2-9.5.1.5. When medical examinations or consultations are provided to employees, a written opinion shall be obtained from the examining physician. It shall include:

- Recommendations for further medical follow-up.
- Results of the examination and associated tests.
- Any medical condition revealed that places the employee at an increased risk of exposure to a hazardous substance found in the workplace. Note that the written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.
- A statement that the employee has been informed of the results of the examination or consultation.

2-9.5.2. ACCIDENTS & SPILLS

2-9.5.2.1. Laboratory accidents that involve a personal injury shall be immediately reported to the appropriate personnel in accordance with DNREC WHS policy.

2-9.5.2.2. Personnel responding to any injury that appears to require emergency first aid shall notify the Quality Manager at the first safe opportunity.

2-9.5.2.3. Occupational Injury:

- An “Employer’s Report of Occupational Injury or Disease” form and “DNREC Workers Compensation Investigation Form”, Section I, must be completed within two days of the injury by the supervisor of the injured employee and forwarded to the

appropriate personnel for any accident involving personal injury as described in the DNREC Worker's Compensation Policy, #D0619.

- The Program/Section Manager shall review the "Employer's Report of Occupational Injury or Disease" form for completeness and complete Section II of the "DNREC Workers Compensation Investigation Form".
- A copy is made of both forms and filed in the central personnel files.
- The original forms are then forwarded to the Department of Human Resources Office for filing.

2-9.5.2.4. If a spill or incident represents a hazard to other building occupants, it should be reported immediately to the Quality Manager and the appropriate Program/Section Manager.

2-9.5.2.5. If a volatile, flammable or toxic material is spilled, immediately warn everyone to extinguish flames and turn off spark-producing equipment and vacate the room until it is decontaminated. Follow the standard operating procedure for cleanup of liquid and solid spills. Avoid skin contact and inhalation exposure through the use of appropriate personal protective equipment.

2-9.5.2.6. Most small liquid spills (less than 100 ml) can be absorbed with paper towels, sand, or an absorbent. Most solid spills can be brushed up and disposed of in solids waste containers. Use care to avoid mixtures of reactive combinations.

2-9.5.2.7. The Quality Manager shall investigate all reported accidents. Results will be documented and communicated to the Department of Human Resources Office for Worker's Compensation.

2-9.6. PERSONAL PROTECTIVE EQUIPMENT

The Quality Manager, with the technical assistance of the Program/Section Manager or the Integrated Health and Safety Work Group, will be responsible for selecting appropriate personal protective equipment, acquiring approved equipment, maintaining availability, and establishing equipment cleaning and disposal procedures as defined in appropriate standard operating procedures (SOPs). Laboratory employees should be advised on the proper selection, use, limitations, and care of personal protective equipment before they are required to use the equipment. Personal protective equipment, excluding safety glasses and shoes, will be removed before leaving work areas.

2-9.6.1. EYE PROTECTION

2-9.6.1.1. Safety glasses and/or face shields must be provided and worn in accordance with the SDS as described by the WHS Personal Protective Equipment Program (Section 2-3 of the WHS Health and Safety manual).

2-9.6.1.2. Employees wearing contact lenses must be informed of the special hazards associated with their use (e.g. ., absorption of chemicals from the air, drying out) and must inform their supervisors so that appropriate measures can be taken in an emergency.

2-9.6.1.3. Before each use, eye and face protection equipment is to be inspected for damage (i.e., cracks, severe scratches, debris). If deficiencies are noted, the equipment should be cleaned, repaired or replaced before use.

2-9.6.2. GLOVES

2-9.6.2.1. Gloves shall be selected on the basis of the material being handled, the particular hazard involved, and their suitability for the operation being conducted. In general, the following glove types are recommended for use in the laboratory:

CHEMICAL	GLOVE
Methanol	Butyl rubber
Toluene	PVA (polyvinyl alcohol)
Sample Handling	Disposable Vinyl, Nitrile or Latex Examination
Acetone, Acids (nitric, hydrochloric, sulfuric)	Butyl Rubber

2-9.6.2.2. Chemical-resistant gloves shall be worn whenever the potential for hazardous skin contact exists. The safety data sheet for the substance or glove selection charts should be referenced. Standard operating procedures should specify glove requirements, if any.

2-9.6.2.3. Contaminated gloves shall be removed before touching surfaces outside the immediate work area (i.e., doorknobs, faucet handles).

2-9.6.2.4. Before each use, gloves are to be inspected for damage and contamination (i.e., tears, punctures, and discoloration). If deficiencies are noted, the gloves should be cleaned, repaired, or replaced before use.

2-9.6.2.5. Heat-resistant gloves shall be used for handling hot objects.

2-9.6.2.6. Abrasion-resistant gloves shall be worn for handling broken glass and other similar materials, and should not be used to handle chemicals.

2-9.6.3. SHOES

2-9.6.3.1. No sandals or open-toed shoes shall be worn in the laboratory. Shoes worn should have non-skid soles to prevent accidental slips.

2-9.6.3.2. Safety shoes, toe guards or the equivalent should be worn if there is potential for injury from heavy objects as described in the WHS Personal Protective Equipment Program (Section 2-3 of the WHS Health and Safety manual). Safety shoes must meet the requirements of ANSI Z41 (Current version).

2-9.6.3.3. Before each use, shoes are to be inspected for damage, deterioration, contamination (i.e., tears, punctures, discoloration). If deficiencies are noted, the shoes should be cleaned, repaired or replaced before use.

2-9.6.4. CLOTHING

2-9.6.4.1. Laboratory employees shall wear disposable laboratory coats whenever a reasonable risk of chemical exposure to skin or street clothing exists or when specified by SOPs.

2-9.6.4.2. Before each use, laboratory coats or aprons shall be inspected for damage, deterioration, and contamination (i.e., tears, punctures, discoloration). If deficiencies are noted, the covering shall be properly disposed of.

2-9.6.4.3. Chemical protective clothing must be removed before leaving the work area.

2-9.6.5. HEARING PROTECTION

2-9.6.5.1. Hearing protection (noise-attenuating earmuffs or plugs) is required whenever employees are exposed to 85 decibels (dBA) or greater as an eight-hour time weighted average. See WHS Hearing Conservation Program (Section 2-2 of the WHS Health and Safety manual) for additional information.

2-9.6.5.2. Hearing protective devices are to be inspected before each use for tears and contamination.

2-9.6.5.3. If deficiencies are noted, the hearing protectors should be cleaned, repaired or replaced before use.

2-9.6.6. RESPIRATORS

All employees issued respirators for any reason must follow all the requirements set forth in the WHS Respiratory Protection Program (Section 2-4 of the WHS Health and Safety Manual). Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134.

2-9.7. EMERGENCY EQUIPMENT

2-9.7.1. GENERAL

Emergency equipment for the laboratories shall be indicated on a floor plan posted in each laboratory. Each laboratory employee shall be familiar with the location, application and correct use of the following equipment, where applicable:

- Fire extinguishers,
- Fire blankets,
- Fire alarms,
- Fire doors/exits,
- Smoke detectors,
- Safety showers,
- Eye wash units,
- Laboratory wash sinks,
- First aid kits,
- Spill clean-up kits

2-9.7.2. SAFETY SHOWERS, EYE WASHES AND WASH SINKS

2-9.7.2.1. Safety showers and eyewashes shall be easily accessible.

2-9.7.2.2. Splashes of the eye with alkaline (base) materials may cause severe and delayed effects. Acid splashes may also cause serious damage to the eyes. Promptly flush eyes with water for at least 15 minutes and seek medical attention. Ensure eye wash stations are located next to work areas where acid and alkaline materials are used.

2-9.7.2.3. For skin contact with hazardous chemicals, promptly flush the affected area with water and remove any contaminated clothing. If symptoms persist after washing, seek medical attention.

2-9.7.2.4. The laboratory should have a wash sink with drainage separate from sanitary drainage.

2-9.7.2.5. Inspections

- Access should be checked and must be documented monthly by laboratory personnel.
- Adequate flow should be tested and documented annually for safety showers and eyewashes by laboratory staff. Eyewash units shall be checked for adequate flow once a month by laboratory personnel who will run them until water is clear.

2-9.7.3. FIRE EXTINGUISHERS

2-9.7.3.1. Fire extinguishers should be provided within 30 feet of a work area and located along normal paths of travel.

2-9.7.3.2. Access must be maintained and the location should be conspicuously marked in an appropriate manner (e.g., signage, wall and floor markings).

2-9.7.3.3. Monthly Inspections shall include:

- The extinguisher is in its designated location.
- Access is maintained.
- The pin should be in place and attached with unbroken tamper seal.
- The indicator, if present, should be in the full range.
- No indication of physical damage.
- The inspection should be documented.

2-9.7.3.4. The landlord is responsible for conducting inspections and maintenance annually. Maintenance of extinguishers involves a complete and thorough examination, including the mechanical parts, the amount and condition of the extinguishing agent, hefting of ABC dry chemical type, and the agent's expelling device.

2-9.7.3.5. Discharged fire extinguishers must be immediately reported to the Quality Manager.

2-9.7.4. BLANKETS / FIRE BLANKETS

2-9.7.4.1. Fire blankets must be available and accessible.

2-9.7.4.2. Inspections

- Blanket should be in its designated place.
- Access should be maintained
- The location should be conspicuously marked.
- The blanket shall not be contaminated or damaged.

2-9.7.5. FIRE ALARMS

2-9.7.5.1. Fire alarms must be provided along normal paths of travel and along exit routes.

2-9.7.5.2. Inspections will be conducted periodically by fire alarm service:

- Fire alarms will be activated periodically to insure proper operation per manufacturer's instructions and/or fire insurer's instructions.
- Fire alarms are not to be tested by laboratory personnel.

2-9.7.6. SMOKE OR HEAT DETECTORS

2-9.7.6.1. Should be installed and selected for the appropriate hazards per building codes, fire codes and fire insurer's requirements.

2-9.7.6.2. Fire alarm contractor will perform inspections periodically. The detection system should be tested to assure proper working order per manufacturer's and/or fire insurer's instructions.

2-9.7.6.3. Smoke detectors are not to be tested by laboratory personnel.

2-9.7.7. FIRST AID KITS

2-9.7.7.1. First aid kits will be available and maintained for treatment of minor injuries or for short-term emergency treatment until medical assistance arrives.

2-9.7.7.2. First aid kits will be kept in an accessible and marked location in each operational unit.

2-9.7.7.3. Periodic inspections of the first aid kits shall be performed by each Laboratory Manager/Supervisor.

2-9.7.7.4. First aid kits should be kept adequately stocked and maintained.

2-9.7.8. FIRE DOORS (not applicable /reserved)

2-9.7.9. FIRE SUPPRESSION SYSTEMS

2-9.7.9.1. The fire suppression system must be selected based on the hazards.

2-9.7.9.2. Inspections--Periodically by fire alarm contractor as required per building codes, fire codes and fire insurer's requirements.

- All system components must be checked for physical condition.
- The system should be activated and checked as appropriate for the type of system.
- Fire suppression systems are not to be tested by laboratory personnel.

2-9.7.10. EMERGENCY LIGHTING

2-9.7.10.1. Emergency lighting must be adequate to provide lighting for egress during an emergency situation or power failure.

2-9.7.10.2. Inspections--Annually by the landlord

- Emergency lighting must be activated to assure it is operational.
- Inspections and findings should be documented.

2-9.7.11. WASTE SPILL AND CONTAINMENT KITS

Each area in which chemicals are used will maintain an appropriate spill control kit.

2-9.7.12. WASTE DISPOSAL PROCEDURES

Waste Disposal procedures for chemical, infectious and other wastes are contained in the DNREC Hazardous Waste Management Manual. Chemical waste shall be deposited in appropriately labeled receptacles. Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill disposal is prohibited. Hoods should not be used as a means of disposal for volatile chemicals.

2-9.7.13. EMERGENCY PROCEDURES

2-9.7.13.1. No emergency plan can include all the contingencies for every emergency situation. The most important component of emergency planning is prevention. Preventive measures range from employee training and facility inspection programs to engineering design of hazardous processes. The risks present in the laboratory include accidents or injuries, chemical releases, fires and explosions.

2-9.7.13.2. Refer to the facility Emergency Action Plan for details concerning prevention and responses to various potential emergencies such as fire, power outage, severe weather, evacuation routes and assembly points, drills, and medical emergencies.

2-9.7.13.3. All emergency contacts and telephone numbers should be posted in the laboratory, next to the telephone.

2-9.7.13.4. In an emergency, proceed to a safe location, call 911 and provide the dispatcher with the following information:

- Location
- Nature of emergency
- Names of chemicals involved
- Your name
- Phone number that you are calling from
- Number of victims and first aid being administered

2-9.7.13.5. If possible, return and pull the local fire alarm, if necessary, to evacuate the building and be prepared to meet the responding emergency personnel at the entrance to the building and provide them with appropriate information.

2-9.7.13.6. An Accident Report must be filled out and forwarded for any accident resulting in injury or capital property damage as per the DNREC Worker's Compensation Policy, #D0619.

2-9.7.13.7. All near accidents and all accidents, whether resulting in injury or damage, should be carefully analyzed with the results reported to all that might benefit.

2-9.8. RECORD KEEPING & TRAINING

2-9.8.1. RECORD RETENTION

2-9.8.1.1. Self-inspection records, such as general laboratory safety and hood function inspections, shall be forwarded to the central files and retained for five years.

2-9.8.1.2. In accordance with State of Delaware, Public Archives, General Records Retention Schedule for Personnel Records, GPR-019, Right-to-Know Hazardous Chemical Training Program records shall be retained in the WHS central files for five years and transferred to Archives for permanent preservation. (16 Del Code, Ch. 24, 29 CFR 1910)

2-9.8.1.3. In accordance with State of Delaware, Public Archives, General Records Retention Schedule for Personnel Records, GPR-017, previous Material Safety Data Sheets (MSDS) as well as Safety Data Sheets (SDS) shall be retained by WHS for five years and transferred to Archives for permanent preservation. (16 Del Code, Ch. 24, 29 CFR 1910)

2-9.8.1.4. In accordance with State of Delaware, Public Archives, General Records Retention Schedule for Personnel Records, GPR-018, Chemical Information Lists shall be retained by WHS for five years and transferred to Archives for permanent preservation. (16 Del Code, Ch. 24, 29 CFR 1910)

2-9.8.2. EMPLOYEE TRAINING

2-9.8.2.1. All laboratory employees shall be trained on the hazards of the chemicals present in their work area (16 Del Code, Ch. 24; 29 CFR 1910.1200).

2-9.8.2.2. The aim of the training program is to assure that all individuals at risk are adequately informed about the work in the laboratory, its risks, and what to do if an accident occurs.

2-9.8.2.3. This training shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present. It shall also be provided prior to assignments involving new exposure situations. The training shall be coordinated through the Laboratory Manager/Supervisor, Quality Manager, or designee, as appropriate.

2-9.8.2.4. The training should include:

- Safe handling of hazardous chemicals,
- Physical and health hazards of laboratory chemicals,
- Exposure signs and symptoms,
- Fire training--prevention and response,
- Emergency response and evacuation,
- Interpretation of SDS's,
- First aid,
- Personal hygiene/decontamination,
- Protective clothing,
- Chemical or infectious waste disposal,
- Contents and availability of the CHP,
- Review of PELs/action levels,
- Laboratory hazards specific to work area and, if necessary,
- Respirator protection and fit testing program.

2-9.8.2.5. Continuing training shall be provided on an annual basis to update training relating to the Laboratory Standard (29 CFR 1910.1450).

2-9.8.2.6. Training will be documented with the following information:

- Trainer or media used,
- Content of Training,
- Location and,
- Date of Training.

2-9.8.3. REFERENCE MATERIALS

2-9.8.3.1. Safety data sheets (SDS) shall be maintained by the Laboratory Manager/Supervisor for all hazardous chemicals used in the laboratory.

2-9.8.3.2. Laboratory workers receiving chemicals new to the laboratory should forward a copy of the SDS to the Laboratory Manager.

2-9.8.4. TRAINING RESOURCES

2-9.8.4.1. As needed, WHS shall offer the following training programs related to the Laboratory Standard:

- Laboratory Standard
- Solvent Safety
- Fume Hoods
- Compressed Gases
- Toxicology
- Chemical Management (Waste)
- Personal Protective Equipment
- Fire Extinguisher

2-9.9. VISITOR AND CONTRACTOR TRAINING

2-9.9.1. DEFINITIONS

2-9.9.1.1. Visitor - individual who is on site by invitation and who is not involved in the operations or processes of the laboratory and is not present in a contractual capacity.

2-9.9.1.2. Contractor - individual who is on site to complete a contracted responsibility and whose direct compensation is not being paid by WHS.

2-9.9.2. TRAINING

Visitor and contractor training will be the responsibility of the individual issuing the invitation. Ensure visitors are provided with appropriate eye protection before entering any work area.

2-9.10. HOOD SAFETY AND VENTILATION

2-9.10.1. GENERAL GUIDELINES

2-9.10.1.1. General laboratory ventilation shall provide airflow into the laboratory from non-laboratory areas and out to the exterior of the building.

2-9.10.1.2. Laboratory doors should remain closed, except for egress and entrance.

2-9.10.2. HOOD USE

2-9.10.2.1. All reactions that produce unpleasant and/or potentially hazardous fumes, vapors and gases must be performed within a fume hood.

2-9.10.2.2. The hood sash should remain closed when it is in use. When adjustments are needed to laboratory equipment or operations within the hood while chemical emissions are being produced, the hood sash should not be raised past the 100 linear feet per minute (lfm) indicator.

2-9.10.3. HOOD MAINTENANCE AND INSPECTIONS

2-9.10.3.1. Periodic hood function inspections by operators should be conducted.

- Visually inspect the hood area for storage of materials and other visible blockages.
- If hood function indicating devices are not a part of your hood, place a 1-inch by 6-inch piece of soft tissue paper at the hood opening and observe it for appropriate directional flow into the hood. Ventilation smoke tubes may be used in lieu of tissue paper.
- Date the inspection tag(s) provided for each hood. If the hood is not in use, indicate on the tag, "out-of-service". If the hood is not operating properly, indicate this on the tag and notify service contractor and the Quality Manager.
- The laboratory will retain fume hood inspection tags for three years.
- Replacement tags shall be are available from the Quality Manager.

2-9.10.3.2. Periodic hood function inspections of the quality and quantity of ventilation shall be evaluated upon installation, quarterly, and whenever a change in local ventilation devices is made. These evaluations are the responsibility of Supervisor/Manager of the laboratory containing the hood with copies of the inspections forwarded to the Quality Manager and the Integrated Health and Safety Workgroup.

- Capture or face velocity will be measured with a velometer or anemometer. Hoods for most common chemicals must have an average face velocity of 100 linear feet per minute at sash opening of 18 inches or higher. Face velocity readings should not vary by more than 20%. A minimum of six readings shall be used to determine average face velocity.

2-9.11. HAZARDOUS MATERIALS

2-9.11.1. SPECIAL PRECAUTIONS

The precautions and procedures listed below shall be followed if any of the substances used is known to be highly toxic according to its SDS. The toxicity of a material pertains to its ability to damage or interfere with the metabolism of living tissue. An acutely toxic substance can cause damage as the result of a single or short-duration exposure. A chronically toxic substance causes damage after repeated or long-duration exposure or that becomes evident only after a long latency period.

These procedures are a supplement to the routine safety precautions listed elsewhere in this manual. The overall objective of these precautions is to minimize exposure to the material by any potential route of entry (i.e., inhalation, dermal contact, ingestion). .

While WHS lab does not currently use chemicals of high toxicity, these procedures shall apply for all future work with chemicals of high toxicity and are in addition to all other safety protocols contained in this manual, laboratory or field standard operating procedures, or the chemical's safety data sheet. In case of conflicting protocols, the stricter or more restrictive protocol shall be followed.

2-9.11.1.1. There shall be a minimum of two people present in the immediate laboratory or field area where the work is being performed.

2-9.11.1.2. Hands and forearms shall be protected with a laboratory coat and gloves that are appropriate for the material.

2-9.11.1.3. Procedures involving volatile toxic substances and those involving solid or liquid toxic substances that may result in the generation of an aerosol shall be conducted in a laboratory hood or other suitable containment device.

2-9.11.1.4. After working with toxic materials, hands and arms shall be washed immediately.

2-9.11.1.5. Employees shall never eat, drink, smoke, chew gum, apply cosmetics, take medicine, or store food in areas where toxic substances are being used or stored.

2-9.11.1.6. All work surfaces (bench tops, hoods, floors) on which toxic materials are used shall be covered with stainless steel or plastic trays, dry absorbent plastic-backed paper or aluminum foil. The protective surfaces shall be examined for possible contamination immediately after the procedure involving the toxic material has been

completed. The contaminated surface shall be decontaminated or disposed of in accordance with Delaware Hazardous Waste Regulations.

2-9.11.2. SOLVENTS

Many of commonly used solvents are volatile and are harmful when relatively small amounts are inhaled. Many are readily absorbed through the skin. Most are flammable. A flammable liquid itself does not burn; it is the vapor from the liquid that burns.

SDSs shall be consulted for the fire and explosion hazards associated with flammable liquids. Work with solvents shall be conducted in accordance with Section 4-17 of the WHS Health and Safety Manual, "Flammable Hazards and Ignition Sources".

2-9.11.3. RADIONUCLIDES (reserved)

2-9.12. STANDARD OPERATING PROCEDURES

In addition to the following generic laboratory procedures, each laboratory should develop standard operating procedures (SOPs) specific to its operation. Safety SOPs should be included for all procedures in which sufficient protection for an employee is not provided by the general practices described in the CHP and already addressed in an existing operational procedure. Safe work practices, specific restrictions, and selection and use of personal protective equipment should be part of the procedures.

2-9.12.1. LABORATORY AND GENERIC SOPs

A specific SOP is required when the general requirements cited in the following sections of the CHP are insufficient to direct and protect a new laboratory employee in a commonly required and repeated laboratory procedure. Separate programs, procedures or policies exist for the following:

- Hazard Communication Program
- Personal Protective Equipment Program
- Respiratory Protection Program
- Medical Surveillance Program
- Bloodborne Pathogens Protection Program
- General Employee Safety SOPs
- Drum and Container Handling Practices
- Spill and Discharge Control Practices

- Flammable Hazards and Ignition Sources

2-9.13. REVIEW AND REVISION OF CHEMICAL HYGIENE PLAN

The Quality Manager and/or the Integrated Health and Safety Workgroup will review this Chemical Hygiene Plan annually. Requests for changes to the document may be made at any time during the year by the Laboratory Manager or affected personnel.

2-9.14. DEFINITIONS (AS EXCERPTED FROM 29 CFR 1910.1450)

Action Level -- a concentration designated in 29 CFR Part 1910.1450 for a specific substance, calculated as an 8-hour time weighted average (TWA), that initiates certain required activities such as exposure monitoring and medical surveillance. The Action Level is generally considered to be one half of the Permissible Exposure Limit (PEL).

Bloodborne Pathogen -- Pathogenic microorganisms that are present in human blood and other potentially infectious materials and can cause disease in humans. These pathogens include, but are not limited to, Hepatitis B Virus (HBV) and Human Immune Deficiency Virus (HIV).

Quality Manager-- An employee who is qualified by training or experience to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan (CHP).

Chemical Hygiene Plan-- A written program developed and implemented that sets forth, procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in the laboratory. This plan shall be reviewed and updated at least annually by the Safety Team.

Combustible Liquid-- A liquid that has a flash point at or above 100° F and below 200° F.

Designated Area-- An area that may be used for work with select carcinogens, reproductive toxins or substances that have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory, or a device such as a laboratory hood.

Flammable Liquid-- A material that has a flash point below 100° F and a vapor pressure not exceeding 40 pounds per square inch, absolute (psi) at 100° F.

Hazardous Chemical-- A chemical for which there is statistically significant evidence, based on at least one study conducted in accordance with established scientific principles, that acute or chronic health effects may occur in exposed employees. The term “health hazard” includes chemicals that are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers,

hepatotoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic systems and agents that damage the lungs, skin, eyes or mucous membranes.

Laboratory -- A facility where the laboratory use of hazardous chemicals occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory Scale -- Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. Also may be called Bench Scale.

Laboratory Standard -- The procedures and standards encompassed by 29 Code of Federal Regulations (CFR) 1910.1450; also known as the "Occupational Exposure to Hazardous Chemicals in Laboratories."

Laboratory Use of Hazardous Chemicals -- Handling or use of such chemicals in which all of the following conditions occur:

- Chemical manipulations are carried out on a laboratory scale.
- Multiple chemical procedures or chemicals are used.
- The procedures involved are not part of a production process nor in any way simulate a production process.
- Protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

Laboratory Employee -- An individual employed by the ELS to perform laboratory or field activities whom may be exposed to hazardous chemicals in the course of his or her assignments.

Permissible Exposure Limit (PEL) – For laboratory uses of OSHA-regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the Permissible Exposure Limits specified in 29 CFR 1910, Subpart Z

Reproductive Toxins-- Chemicals that affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogens).

Select Carcinogen -- Any substance that meets one of the following criteria:

- It is regulated by OSHA as a carcinogen; or
- It is listed under the category *Known to be Carcinogens* in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or

- It is listed under Group 1 (carcinogenic to humans) by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or
- It is listed in either Group 2A or 2B by IARC or under the category, reasonably anticipated to be carcinogens by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
  - After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime, to dosages of less then 10 mg/m^3 .
  - After repeated skin application of less than 300 mg/kg of body weight per week; or
  - After oral dosages of less that 50 mg/kg of body weight per day.

Shall / Should -- In this document, shall indicates a required condition or action; should indicates a preferred laboratory practice.

Toxicity - The toxicity of a material is due to its ability to damage or interfere with the metabolism of living tissue. An acutely toxic substance can cause damage as the result of a single or short-duration exposure. A chronically toxic substance causes damage after repeated or long-duration exposure or that becomes evident only after a long latency period.

Common Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
DOT	Department of Transportation
ELS	Environmental Laboratory Section
EPA	Environmental Protection Agency
IARC	International Agency for Research on Cancer
IUPAC	International Union of Pure and Applied Chemistry
LD50	Lethal Dose for 50% Mortality
MSDS	Material Safety Data Sheets (old terminology, see SDS)
NFPA	National Fire Protection Association

NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
SDS	Safety Data Sheet
SOP	Standard Operating Procedure
TLV	Threshold Limit Value

2-10. ERGONOMIC HAZARD GUIDELINES (RESERVED)

(Reserved)

2-11. CONSTRUCTION ACCIDENT PREVENTION PROGRAM

This program has been developed to ensure the safety of all Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) personnel involved in construction operations. This program has been developed to comply with Occupational Health and Safety Act (OSHA) construction standards (*Title 29 of the Code of Federal Regulations, Section 1926*).

This program applies to the following employees:

- All employees of WHS engaged in work requiring their presence on construction sites, in construction zones, or on any work site with increased hazards due to construction activities.
- Supervisors or managers responsible for personnel or projects where construction activities and associated hazards exist.

2-11.1. ADMINISTRATION

The construction accident prevention program is part of the overall WHS Health and Safety Program and will be carried out according to guidelines established in the WHS Health and Safety Manual. Each project manager/project officer will be responsible for meeting all requirements of the Health and Safety Program on his or her project sites. Program/section managers will ensure that personnel are adequately trained and experienced to work safely on construction sites before they are assigned to a construction project. The Division Director is responsible for overall implementation of the program. Other responsibilities for health and safety are outlined in Section 1-7 of this manual "Program Administration and Organizational Structure".

2-11.2. PROGRAM ELEMENTS

2-11.2.1. TRAINING

All WHS employees working on construction sites must be trained in the WHS Health and Safety Program, including SOPs applicable to their job responsibilities and worksites. Training shall be implemented according to the WHS Health and Safety Training Program (Section 2-7 of the WHS Health and Safety Manual).

2-11.2.2. PLANNING

A job hazard analysis shall be conducted for each construction project to determine the potential hazards and the type of protective equipment to be required on the site. The project manager/project officer or designee shall conduct a walk-through survey of the project site. The purpose of the survey is to identify

sources of hazards to WHS workers. During the survey, the project manage/project officer should observe:

- Sources of motion: where any movement of tools, machine elements, or parts could exist; or movement of personnel that could result in a collision with stationary objects (i.e. struck-by or caught in/between hazards);
- Sources of high temperatures that could result in burns, eye injury, or ignition of combustible materials;
- Sources of potential chemical exposures;
- Sources of harmful dust;
- Sources of electrical exposure
- Areas in which a fall hazard exists
- Sources of falling objects or potential for dropping objects;
- Sources of sharp objects that might pierce the feet or cut the hands;

All personnel who will work on the site will receive training on the hazards of the each site/work area and procedures implemented for worker protection.

Copies of applicable health and safety programs and SOPs will be kept on the site during all activities. In addition, emergency telephone numbers and a map indicating the route to the nearest hospital will be posted on site.

For all construction site activities on sites or at facilities considered OSHA hazardous waste operations and emergency response (HAZWOPER) sites (See Section 3-1 of this manual), site-specific health and safety plans must be prepared. Each HASP will list all on-site hazards and controls, including those related to construction. Applicable SOPS will be attached to the HASP.

2-11.2.3. RISK REDUCTION

The WHS Health and Safety Program has been developed to reduce the risk of illness or injury to employees by providing methods for identifying hazards, and SOPs to follow during routing work activities. The hazards encountered on construction sites are highly variable in type, duration, and degree of risk. The following list identifies potential construction work hazards and the corresponding WHS Health and Safety program(s) or SOP(s).

Construction Site Hazard	**DNREC WHS Health and Safety Program or Standard Operating Procedure, Health and Safety Manual Section**
Hazardous Chemicals & Fuels	Hazard Communication Program, Section 2-1 Flammable Hazards and Ignition Sources, Section 4-17 Oil and Petroleum Distillate Fuel Product Hazard Control, Section 4-18
Noise	Hearing Conservation Program, Section 2-2
Physical Hazards	Personal Protective Equipment, Section 2-3 General Employee Safety SOPs, Section 4-1
Confined Spaces	Confined Space Entry Program, Section 2-5
Hazardous Waste	HAZWOPER Health and Safety Programs, Section 3, Safety Work Practices for HAZWOPER activities, Section 4-14
Falls	SOP for Fall Protection, Section 4-3
Heat Stress	SOP for the Prevention of Heat Stress, Section 4-4
Cold Stress	SOP for the Prevention of Cold Stress, Section 4-5
Electricity/Hazardous Energy	Work with or Around Electricity, Section 4-6 Control of Hazardous Energy (Lock out/ Tag out) Section 4-7
Ladders	Portable Ladder Safety, Section 4-8
Drilling and Excavating Hazards	Safe Drilling Practices, Section 4-9 and Safe Excavation Section 4-10
Heavy Equipment	Use of Heavy Equipment, Section 4-11
Hazardous plants, animals, insects, etc.	Biohazards Safety, Section 4-13
Drums and Containers	Drum and Container Handling Practices, Section 4-15 and Spill and Discharge Control Practices, Section 4-16
Hazardous Waste Hazards	HAZWOPER Health and Safety Programs, Section III and General Safe Work Practices for HAZWOPER Activities, Section 4-14

2-11.2.4. SAFETY MEETINGS

The WHS project manager/project officer or assignee shall conduct daily safety meetings on all construction projects staffed by more than one WHS employee. The meeting topics should include current conditions and hazards, and precautions to prevent injuries and illnesses. Safety meeting should be documented in the field log and signed by all WHS personnel present on site.

2-11.2.5. SAFETY ASSESSMENTS

Construction projects should be assessed for compliance with the WHS Health and Safety Program and applicable health and safety regulations. The scope, frequency, and duration of the assessments will vary based on the nature and duration of the construction project. These assessments may be completed by the project manager/project officer, or may be audited by a qualified auditor according to the Division Health and Safety Auditing Program in Section 1-8 of the WHS Health and Safety Manual.

Health and safety assessment documentation should be kept in the project file and copies shall be distributed to the program/section manager and the IHSW representative.

2-11.2.6. CONTRACTOR REQUIREMENTS

Contractors to WHS working on construction sites are required to comply with all applicable OSHA construction and general industry standards. Contractors shall provide copies of all written health and safety programs and required records when requested by the project officer/project manager.

2-11.3. CONSTRUCTION SITE SOPS

In addition to Standard Operating Procedures for General Employee Safety (WHS Health and Safety Manual Section 4-1) and other applicable health and safety programs and standard operating procedures, the following SOPs shall be followed on construction sites:

- Safety glasses meeting the requirements of ANSI Z87.1 (or more recent) will be worn as the minimum required eye protection. Additional eye and face protection may be required for such operations as grinding, jackhammering, utilizing compressed air, handling of chemicals, etc.
- Safety shoes (ANSI Z41.1) shall be worn on all construction sites. Boots shall have rigid slip-resistant soles.
- Housekeeping shall be an integral part of every construction job.
- All scaffolding or work platforms must be in accordance with OSHA standards.
- Any floor openings shall be barricaded on all sides to ensure that employees are aware of the hazard. Floor holes shall be covered with secure cover and clearly marked.
- Warning signage shall be posted where necessary. Warning signs, barricades, and tags will be used to the fullest extent and shall be obeyed.
- “No Smoking” signs shall be posted in areas where smoking is prohibited.

- Trash and debris will be disposed of regularly.
- Sanitary facilities shall be adequate and clean.
- Passageways, driveways and walkways shall be kept clear.
- Fire extinguishers shall be in proper locations and charges. They will be checked daily.
- Tools will be inspected daily and stored properly and neatly.
- Power tools will be properly grounded.
- OSHA standard 29 CFR 1926.404(b)(1)(ii) requires **all** 120-volt, single-phase, 15- and 20-ampere receptacle outlets on construction sites, which are not a part of the permanent wiring of the building or structure and which are in use by employees, to have Ground Fault Circuit Interrupters for personnel protection. They must be used and tested as required.
- Stairs must not have broken steps or rails.
- Materials shall be stored in safe secure areas.

2-12. BLOODBORNE PATHOGENS EXPOSURE CONTROL PROGRAM

This exposure control program has been developed in accordance with Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.1030 the bloodborne pathogens standard. The purpose of this exposure control program is to minimize employee occupational exposure to blood and other infectious body fluids. This program document must be accessible to employees and shall be included or referenced in site-specific health and safety plans (HASP), as appropriate.

All medical records related to bloodborne pathogen exposure shall be maintained in accordance with 29 CFR 1910.1020. Records related to exposure incidents shall be maintained with other medical records for the employee. Training records associated with this standard shall be maintained with other health and safety training records, particularly CPR and First Aid Training records. Compliance with this standard shall be evaluated during annual Health and Safety Program audits.

Program/section managers are responsible for implementation of this program within their respective organizations.

The 29 CFR 1910.1030 bloodborne pathogens standard requires that the bloodborne pathogens exposure control program detail the methods of implementation for the various requirements of the standard. The following program elements comply with this requirement.

2-12.1. PROGRAM APPLICABILITY AND EXPOSURE DETERMINATION

This program applies to all employees who may reasonably be anticipated to have occupational exposure to blood or other potentially infectious materials (OPIM). Currently WHS staff has no assigned duties that would expose them to blood or OPIM.

Additional exposure determinations specific to field projects or programs shall be made. All identified tasks and controls specific to HAZWOPER work shall be documented and implemented within the site-specific HASP.

2-12.2. UNIVERSAL PRECAUTIONS

In 1987, the Centers for Disease Control and Prevention (CDC) published a document recommending that precautions be consistently used for all patients whenever contact with blood and body fluid is possible, regardless of their bloodborne infection status. This recommendation is referred to as universal precautions; it is an approach to infection control. Universal precautions are intended to prevent parenteral, mucous membrane, and nonintact skin exposures of healthcare providers to bloodborne pathogens. According to the concept of universal precautions, all human blood and certain body fluids

are treated as if known to be infectious for human immunodeficiency virus (HIV), Hepatitis B (HBV), and other bloodborne pathogens.

The proactive use of universal precautions shall be implemented during all first aid activities whenever contact with blood or OPIM may be reasonably anticipated. All blood or OPIM shall be considered infectious regardless of the perceived status of the source individual. Universal precautions should be attained by using engineering controls, work practice controls, and PPE.

2-12.3. ENGINEERING AND WORK PRACTICE CONTROLS

Whenever possible, engineering and work practice controls shall be implemented to eliminate or minimize employee exposures. Such controls may include, but are not limited to, the following:

- Hand-washing supplies should be available at all project sites. At a minimum, antiseptic hand cleaner with clean paper towels or antiseptic towellettes will be provided.
- Employees shall be instructed to wash hands and skin with soap and water or flush mucous membranes immediately or as soon as feasible after contact with blood or OPIM.
- No eating, drinking, smoking, cosmetics or lip balm application, or handling of contact lenses is allowed in areas with reasonable likelihood of occupational exposure to blood or OPIM.
- In rare cases where employees may come across waste items contaminated with blood or OPIM, care shall be taken to avoid potential contact.
- Any needles or sharp objects shall be placed in a puncture-resistant, labeled, leak-proof container using tongs, pliers, broom/dust pan, or other means to prevent contact with the needle or sharp object. Under no conditions shall needles or contaminated sharp objects be bent, sheared, broken, or recapped.
- All waste created during first aid administration, including PPE, shall be disposed of in a sealable waste bag for disposal. If waste is known to contain pathogens, a Delaware-permitted infectious waste transporter must be contracted.

2-12.4. PERSONAL PROTECTIVE EQUIPMENT

WHS shall provide occupationally exposed employees with appropriate PPE at no cost. PPE may include the following items: gloves; protective clothing; eye protection such as face shields or masks; and ventilation devices such as mouthpieces, resuscitation bags, or pocket masks

PPE shall be selected based on the potential exposure to blood or other OPIM. PPE is considered appropriate only if it does not permit blood or OPIM to pass through to or reach the employee's work clothes, street clothes, skin, eyes, mouth, or mucous membranes under normal conditions and for the duration of time it will be used. PPE shall be worn during any first aid response involving blood or OPIM.

Disposable gloves and pocket masks will be included in the standard first aid kit required at all field sites and offices. Gloves shall be worn whenever it is reasonably anticipated that employees will have hand contact with blood, nonintact skin, mucous membranes, or OPIM, and when handling or touching contaminated items or surfaces.

Disposable gloves and mouthpieces will not be washed or decontaminated for reuse and must be replaced when they become contaminated, torn, or punctured, or when their ability to function as a barrier is compromised.

Masks in combination with eye protection devices, such as goggles or glasses with solid side shields, or chin-length face shields, shall be worn whenever splashes, spray, spatter, or droplets of blood or other potentially infectious materials may be generated and eye, nose, or mouth contamination can be reasonably anticipated.

Appropriate protective clothing such as, but not limited to, gowns, aprons, lab coats, clinic jackets, or similar outer garments shall be worn in occupational exposure situations. The type and characteristics will depend upon the task and degree of exposure anticipated.

2-12.5. HOUSEKEEPING

In general, work areas are not expected to be contaminated with blood or OPIM unless in the event of a severe injury. In that case, all surfaces and equipment shall be cleaned and disinfected after contact with blood or OPIM as soon as possible with a diluted bleach solution (concentration ratio 1:10) or other appropriate disinfectant.

If contaminated sharp objects or broken glassware are encountered, these items shall not be picked up by hand. Mechanical means of retrieval (such as use of a broom and dust pan, tongs, or forceps) shall be used. Any reusable bin, pail, can, and similar receptacles that could become contaminated must be inspected and decontaminated with a bleach solution as soon as possible when contamination is visible. Clothing contaminated with blood or OPIM shall be bagged, labeled, and discarded as regulated waste.

2-12.6. REGULATED WASTE DISPOSAL

The handling, storage, treatment, and disposal of all regulated waste shall be conducted in accordance with all applicable federal, state, and local regulations. Proper handling of regulated waste is essential to prevent unnecessary exposure to blood and OPIM. Regulated waste includes wastes in which blood or OPIM could be released from pouring, dripping, squeezing, or flaking. Regulated waste must be placed in a red biohazard bag labeled "Biohazardous Waste" or with the international symbol and the word "Biohazard." Bags must be tied shut and placed in closable, leak-resistant and labeled containers that can prevent leakage during all handling, storage, transport, shipping, and other activities. If the outside of the container becomes contaminated, it must be placed in a secondary container meeting the same specifications.

Nonregulated waste can be disposed of along with regular waste. This waste must be placed in a leak-proof container, closed tightly, and promptly placed into a garbage receptacle.

2-12.7. HEPATITIS B VACCINATION, POST-EXPOSURE EVALUATION & FOLLOW-UP

WHS shall make available to employees the HBV vaccination series and a post-exposure evaluation and follow-up following an exposure incident. An exposure incident includes a specific eye, mouth, other mucous membrane, nonintact skin, or parenteral contact with blood or OPIM resulting from the performance of an employee's duties. The HBV vaccination and post-exposure evaluation and follow-up are discussed below.

2-12.7.1. HEPATITIS B VACCINATION

In accordance with the OSHA Directive "Change to OSHA Instruction CPL 3-2.44C" dated July 1, 1992, a pre-exposure HBV vaccination does not have to be offered to employees who are designated only as first aid providers and those whose primary job assignment is not rendering first aid but administering first aid only as a collateral duty to their routine work assignments; however, the HBV vaccination series will be made available to any unvaccinated first aid provider who has rendered assistance in any situation involving the presence of blood or OPIM, regardless of whether an actual exposure incident occurred.

If the employee initially declines the vaccination but decides later to accept, WHS will provide the vaccination series at that time. If an employee eligible for the vaccination series declines to participate, he or she must sign the "Hepatitis B Vaccine Declination" (Attachment A to this Program).

2-12.7.2. POST-EXPOSURE EVALUATION AND FOLLOW-UP

A confidential medical evaluation and follow-up shall be immediately provided to exposed employees following the report of an exposure incident. The post-exposure evaluation and follow-up shall include the following:

- Documentation of the exposure route and exposure incident circumstances
- Identification and documentation of the source individual (unless identification is not feasible or prohibited by law)
- Collection and testing of blood for HBV and HIV serological status
- Post-exposure prophylaxis, when medically indicated, as recommended by the U.S. Public Health Service
- Counseling
- Evaluation of reported illness

The source individual's blood shall be tested as soon as feasible after consent is obtained to determine and document HBV and HIV infection status. If the source individual is already known to be infected with HBV or HIV, the blood testing need not take place. The test results shall be made available to the exposed employee, and any applicable laws and regulations regarding disclosure of identity and infection status of the source individual will be complied with. Details of the exposure incident investigation shall be documented on the WHS "Post-Exposure Evaluation" (Attachment B to this Program). Copies of the completed form shall be forwarded to the Medical Surveillance Coordinator and the designated healthcare professional.

Information provided to the healthcare professional and the healthcare professional's written opinion for follow-up are discussed below.

2-12.7.3.1. INFORMATION PROVIDED TO THE HEALTHCARE PROFESSIONAL

In the event of an exposure incident, WHS shall provide the following information to the healthcare professional responsible for the employee's HBV vaccination:

- A copy of 29 CFR 1910.1030
- A description of the exposed employee's duties as they relate to the exposure incident

- Documentation of the routes of exposure and exposure incident circumstances
- Results of source individual's blood testing, if available
- All medical records relevant to the appropriate medical treatment, including vaccination status
- A copy of Form BBP-2, "Post-Exposure Evaluation"

2-12.7.3.2. HEALTHCARE PROFESSIONAL'S WRITTEN OPINION

WHS employees shall receive a copy of the evaluating healthcare professional's written opinion within 15 days of the completion of the evaluation. The opinion for HBV vaccination shall be limited to whether the vaccination is indicated and if the employee has received such vaccination. The employee will be informed of the results of the examination. During the evaluation, the employee will also be told about any medical conditions that may result from exposure to blood or OPIM and that may require further evaluation or treatment. All other findings or diagnoses shall remain confidential and shall not be included in the healthcare professional's written opinion.

2-12.8. INFORMATION AND TRAINING

All WHS employees with the potential for occupational exposure to blood and OPIM will receive training at the time of initial assignment to tasks during which occupational exposure might occur and at least annually thereafter. The training may be included with other health and safety training. Additional training will be provided when changes in tasks or procedures affect employee exposure potential. The training program shall contain or address the following elements:

- A copy of the 29 CFR 1910.1030 bloodborne pathogens standard, along with an explanation of its contents
- Epidemiology and symptoms of bloodborne diseases
- Modes of transmission of bloodborne pathogens
- Explanation of the WHS Bloodborne Pathogens Exposure Control Program and means by which the employee can obtain a copy
- Methods for recognizing tasks and other activities that may involve exposure to blood and OPIM
- Use and limitations of exposure prevention or reduction methods, including engineering controls, work practices, and PPE

- PPE types and their proper use, location, removal, handling, decontamination, disposal, and basis for selection
- HBV vaccination efficacy, safety, method of administration, benefits, and that the vaccine and vaccination will be offered free to eligible employees
- Appropriate actions in the event of an emergency involving blood or OPIM
- Procedures to follow in the event of an exposure incident, including method of reporting and medical follow-up that will be made available in accordance with Document Control No. 2-2
- Details of the post-exposure evaluation and follow-up
- Signs and labels and/or color coding regulated waste containers or other containers of blood or OPIM
- An opportunity for interactive questions and answers with the person conducting the training session.

All training conducted shall be documented and the training records kept for 3 years. An example of a suitable training record is “Bloodborne Pathogens Training” (Attachment C to this Program). Training documentation shall include the dates of the training, the contents or summary of the training session, names and qualifications of persons conducting the training, and the names of those attending.

2-12A. HEPATITIS B VACCINE DECLINATION

I understand that because of my occupational exposure to blood or other potentially infectious materials, I may be at risk of acquiring Hepatitis B virus (HBV) infection. I have been offered the HBV vaccine at no charge. However, I decline HBV vaccination at this time. I understand that by declining the vaccine, I continue to be at risk of acquiring Hepatitis B, a serious disease. I also understand that if in the future I continue to have occupational exposure to blood or other potentially infectious materials and want to be vaccinated with the HBV vaccine, I can receive the vaccination series at no charge to myself.

Employee Name (printed)	Employee Signature	Date
Supervisor Name (printed)	Supervisor Signature	Date

Note: This form has been developed to ensure compliance with Title 29 of the *Code of Federal Regulations*, Part 1910.1030, Bloodborne Pathogens, Paragraph (f), and Appendix A.

2-12B. BLOODBORNE PATHOGEN POST-EXPOSURE EVALUATION

I. Exposed Person		**II. Exposure Source** (if legally obtainable)	
Name:	Date of Birth:	Name:	Date of Birth:
Street Address:		Street Address:	
City, State, Zip Code:		City, State, Zip Code:	
Telephone No.: Work: ( ) Home: ( )		Employer:	
Employer (and office location):		Employer's Street Address:	
Personal Physician or Clinic:		City, State, Zip Code:	

III. Description of Incident Resulting in Exposure	
Date of Incident (month/day/year):	Time of Incident: ☐ a.m. ☐ p.m.
Specific Description of Incident (include estimate of volume of fluid involved):	

Type of Incident and Body Fluid Exchanged (check all that apply):

Body Fluid	Action	Route of Entry of Exposed Person
☐ Blood	☐ Needle puncture	☐ Eye
☐ Sputum or saliva	☐ Bite that breaks skin	☐ Nose
☐ Urine	☐ Impalement	☐ Mouth
☐ Feces	☐ Splash or splatter	☐ Open wound or break in skin
☐ Semen	☐ Mouth-to-mouth CPR	
☐ Vaginal secretions	☐ Cut or wound	
☐ Vomitus	☐ Other	

DNREC WHS

POST-EXPOSURE EVALUATION (Continued)

Have you been vaccinated against Hepatitis B virus? ☐ No ☐ Yes If yes, what year?		
The above information accurately describes the exposure. I request disclosure of the source person's body fluid/bloodborne pathogen(s) test results.		
Exposed Person's Signature:		Date Signed:
IV. Significant Exposure Certification by Physician		
I certify that the incident described above had the potential for the exposed person to have a significant exposure to blood or other body fluids. I have informed the exposed person about medical conditions that may require further evaluation or treatment as a result of this exposure.		
A Hepatitis B vaccination is recommended for the exposed person: ☐ Yes ☐ No		
The exposed person has received the Hepatitis B vaccination: ☐ Yes ☐ No		
Physician's Name (print):	Physician's Signature:	Date Signed:
Business Telephone No.: ( )	Physician's License No.:	
Physician's Business Address (street, city, state, zip code):		

2-12C. BLOODBORNE PATHOGENS TRAINING

Date of Training: _____ Location: _____

Trainer(s): _____

Summary of Trainer Qualifications: _____

_____

ATTENDEES

By signing below, I certify that I have received and understand the bloodborne pathogens and exposure control training offered by DNREC WHS.

Name (printed)	**Signature**	**Program or Branch**

DNREC WHS
BLOODBORNE PATHOGENS TRAINING (Continued)

Content:

1. Requirements of Title 29 of the *Code of Federal Regulations*, Part 1910.1030, "Bloodborne Pathogens"
2. Epidemiology and symptoms of bloodborne diseases
3. Modes of transmission of bloodborne pathogens
4. Methods for recognizing tasks that may involve exposure to infectious materials
5. Engineering controls, safe work practices, and personal protective equipment (PPE) that will prevent or reduce exposure
6. Selection of the correct PPE
7. Types, proper use, location, removal, handling, decontamination, and disposal of PPE
8. Hepatitis B vaccine efficacy, safety, methods of administration, benefits, and fact that vaccination is free of charge to employees
9. Appropriate actions and persons to contact in the event of an emergency involving potentially infections materials
10. Procedures to follow if an exposure incident occurs, including how to report the incident and available medical follow-up
11. Post-exposure evaluation and follow-up provided to employees following an exposure incident
12. Question-and-answer session

Training Aids and Materials Used (to be completed by trainer):

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

2-13. ASBESTOS SAFETY PROGRAM

The asbestos safety program was developed to provide guidelines for employee awareness and training regarding asbestos safety to Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) personnel. Asbestos safety is important because exposure to asbestos fibers can cause serious health risks.

This program applies to every employee, including administrative and support staff. This program is designed to provide an awareness level to the employee and is not intended to provide the required level of training to handle asbestos-containing materials (ACM) or cleanup asbestos related contamination.

2-13.1. TYPES AND USES OF ASBESTOS

Asbestos is a group of naturally occurring silicate minerals that can be found throughout the world that have a structure of thin fibrous crystals. Asbestos fibers were found to be extremely strong and flexible, have sound absorption qualities, and were resistant to heat, corrosion, chemical, and electrical damage. Since asbestos was found to have these desirable characteristics and is relatively inexpensive to mine, asbestos was and is still used in a variety of commercial applications. Some examples of the over 3,000 different manufactured products include:

- Drywall
- Joint compound
- Plasters
- Mudded or textured wall and ceiling coats
- Thermal pipe/boiler/heater insulation
- Gaskets
- Flexible duct connectors and tapes
- Electrical wiring/partitions
- Vapor barriers
- Caulks/glazes
- Laboratory tables/fume hoods
- Fire blankets
- Brake pads
- Vinyl floor tiles
- Resilient flooring
- Mastics and adhesives
- Ceiling tiles
- Roofing tars, felts, and shingles
- Fireproofing

Due to the similarities in mineral formation, products that contain vermiculite (commonly used as a building insulation or soil amendment) or talc (commonly used in cosmetics, soaps, or crayons) have also on occasion been found to be contaminated with small traces of asbestos minerals. The amount of asbestos contained within the various building materials and products can range from trace amounts to near 100%. Materials that contain greater than 1% asbestos content by weight are considered to be asbestos-containing and are a regulated material. Asbestos content and quantity can only be verified through laboratory analysis by polarized light microscopy or transmission electron microscopy analytical methods.

2-13.2. HEALTH HAZARDS

Asbestos exposure has been linked to a variety of diseases including asbestosis, lung cancer, stomach cancer, colon cancer, and mesothelioma. Unlike chemical exposures which can present symptoms of exposure in a short period of time following the initial exposure, there is typically a long latency period (greater than 10-years) between the onset of an asbestos related disease and the initial exposure. The

primary route of exposure is through respiration; however, exposure can occur through ingestion or injection of an ACM or from fiber contamination.

2-13.3. HAZARD ANALYSIS

Since asbestos was used in a variety of different materials and applications, there is good chance that an ACM is present in most buildings or industrial facilities. Although the likelihood of finding an asbestos-containing building material is higher in a building or facility constructed prior to 1980, asbestos has not been completely banned in the United States. Individuals should refer to Safety Data Sheets or other product information prior to purchasing new building materials to ensure that the material is asbestos-free.

An ACM that is considered friable has the highest potential to present a health hazard. Material that is friable is defined as having the ability to be crumbled, pulverized, or reduced to powder by hand pressure when dry. These materials have the highest potential to release fibers allowing them to become airborne. Generally these materials include pipe insulations, boiler/heater insulations, acoustical tiles or coatings, fireproofing, and paper wraps. Friable materials are easily damaged by physical forces which may allow fibers to be released and become airborne.

Non-friable materials, or those materials that cannot be crumbled, pulverized, or reduced to powder by hand pressure when dry, generally do not present an immediate health hazard in their normal condition. Non-friable materials tend to have the asbestos fibers bonded or trapped in a ridged matrix which prevents the fibers from releasing from the material. Generally these materials include cement board, tars, or vinyl flooring tiles. Non-friable materials can become friable due to damage by fire or water or rendered friable by grinding or pulverizing.

ACMs that are maintained in a good condition and are not subjected to external forces that would disturb the material have a low probability of a fiber release. Known or suspect ACMs should be inspected frequently for signs of damage including delamination, separation of layers, cracking, flacking, crumbling, blistering, scrapes, gouges, water damage, water stains, or other signs of physical damage to the material. Areas that may be impacted by vibration, wind, water, or are in high traffic areas have higher potential for damage. Early identification of damage to these materials can prevent fiber release. Failures to address continuing minor damage can lead to a major fiber release and the potential for exposure should the material suddenly break apart.

2-13.4. PROCEDURES

In order to prevent accidental exposure to asbestos fibers from building materials, the following procedures shall be completed.

- Renovation and/or demolition activities shall not be completed until suspect building materials have been tested by a certified asbestos professional to verify that they are not asbestos-containing;
- ACMs, whether it is in a good or poor condition, shall only be handled by certified professionals under controlled conditions;
- Do not disturb damaged or unknown material;
- Do not walk through piles of unknown debris;
- Do not enter spaces that are under disrepair, water/fire damaged, or in a general poor condition such as boiler rooms, pipe chases, areas of high temperature, or other spaces where the likelihood of an ACM is high, unless previously assessed by an asbestos professional;
- Materials shall be assumed to be asbestos-containing unless laboratory data, historical documentation, or product information can be provided to document whether the material is a regulated material;
- Known ACMs should be inspected by qualified individuals on a regular basis and early signs of damage reported to a supervisor or building maintenance immediately.

The Office of Management and Budget Division of Facilities Management (OMBDFM) Environmental Services' mission is to protect and promote the physical and environmental health of the citizens and state employees of Delaware in work places and State-owned buildings. OMBDFM Environmental Services shall be contacted prior to any activities that may disturb suspect ACM in a State-owned or operated buildings. Damage to known ACMs in a State-owned or operated buildings should be reported to OMBDFM Environmental Services immediately so that corrective actions can be taken to remove or control the hazard.

Employees shall follow the procedures outlined below in the event damaged ACMs have been observed.

- Do not handle or otherwise disturb suspect ACMs even if the material appears to be in a good condition;
- Never attempt to dry sweep, vacuum, or otherwise cleanup damaged suspect ACM;
- In the event suspect ACM is found to be damaged, isolate the area by closing doors and windows, turn off or isolate HVAC systems that service the area, post signs to prevent unauthorized access to the location;
- Contact your supervisor and building maintenance personnel immediately to report the incident.

In the event an individual has accidentally come in contact with damaged ACM, employees shall do the following:

- Contact your supervisor or site health and safety officer immediately should you come in contact with a suspect ACM.

- If you have handled a suspect ACM, immediately wash your hands thoroughly with soap and water;
- In the event an article of clothing has come in contact with suspect damaged or friable suspect ACM, the items should be removed and placed in a sealed leak-tight container, such as a garbage bag, and labeled.
- In the event that your entire body should become soiled with a suspect ACM, thoroughly wash your body using soap and water. Clothing or other items should be removed and placed in a leak-tight container, such as a garbage bag, and labeled.

In the event of an accidental exposure, never dismiss or ignore proper decontamination procedures. Failure to follow proper decontamination procedures may inadvertently expose yourself, coworkers, family, or others to asbestos fibers. It is important to remember that there are no safe airborne concentrations of asbestos fibers. Identifying the potential for the presence of asbestos and addressing the steps needed to manage the material properly are the important steps to preventing exposure.

2-14. OFFICE HEALTH AND SAFETY (RESERVED)

(Reserved)

3-1. HAZARDOUS WASTE SITE OPERATIONS PROGRAM

The Occupational Safety And Health Act (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) standard in *Title 29 of the Code of Federal Regulations Part 1910.120 (29 CFR 1910.120)* and Environmental Protection Agency regulations in *40 CFR 311* require that any employer whose workers engage in hazardous waste operations at uncontrolled hazardous waste sites or who perform corrective action at Resource Conservation and Recovery Act (RCRA) Treatment Storage or Disposal Facilities (TSDFs) must develop and implement a written health and safety program.

The details of the Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) HAZWOPER program are described below.

3-1.1. APPLICABILITY

HAZWOPER defines an <u>uncontrolled hazardous waste site</u> as the following: *an area identified as an uncontrolled hazardous waste site by a governmental body, whether Federal, state or local or other, where an accumulation of hazardous substances creates a threat to the health and safety of individuals or the environment or both. Some sites are found on public lands such as those created by former municipal, county or state landfills where illegal or poorly managed waste disposal has taken place. Other sites are found on private property, often belonging to generators or former generators of hazardous substance wastes. Examples of such sites include, but are not limited to, surface impoundments, landfills, dumps, and tank or drum farms. Normal operations at TSDFs are not covered by this definition.*

This Division HAZWOPER program applies to all WHS operations that take place on the following types of project sites (as required by 29 CFR 1910.120(a)(1)):

- Clean-up operations required by a government body, whether federal, state or local, involving hazardous substances that are conducted at uncontrolled hazardous waste sites (including but not limited to, U.S. Environmental Protection Agency (EPA) National Priorities List (NPL) sites, state priority list sites, sites recommended for the NPL, and initial investigations of government identified sites conducted before the presence of hazardous substances has been confirmed);
- Corrective actions involving cleanup operations at sites covered by the Resource Conservation and Recovery Act (RCRA), including known or suspected leaking underground storage tank (LUST) removals and spill cleanups; and

- Voluntary cleanup operations at sites recognized by federal, state, or local governmental bodies as uncontrolled hazardous waste sites.
- Operations involving hazardous wastes that are conducted at TSDFs; and
- Emergency response operations for releases of, or substantial threats of releases of, hazardous materials (HAZMAT) without regard to the location of the hazard.

Included in the above, are operations conducted on Federal Superfund sites, Delaware Hazardous Substances Cleanup Act (HSCA) sites; RCRA Corrective Action Sites; Leaking Underground Storage Tank (LUST) sites; Voluntary Cleanup Program (VCP) sites; Brownfields sites; and HAZMAT emergency response operations.

The following activities are exempt from the HAZWOPER program:

- Inspections of operating facilities, including TSDFs and other RCRA-permitted facilities, such as visits by compliance inspectors or permit writers, that do not involve participation in clean-up activities at those facilities;
- Work on any site or at any facility that does not include the potential for exposure to hazardous materials, hazardous substances, or hazardous wastes; and
- Activities conducted on sites that have been delisted from the NPL or other hazardous waste site lists, where there is no longer potential for exposure of employees to hazardous wastes or hazardous substances.

3-1.2. PERSONNEL RESPONSIBILITIES

For operations that take place on HAZWOPER sites as defined above, a site-specific health and safety plan (HASP) will be developed in accordance with the WHS "Site-Specific Health and Safety Plan Program", in Section 3-2 of this manual. The HASP will outline the chain of command for the project. All duties and responsibilities detailed in the "Program Administration and Organizational Structure" part of the Division Health and Safety Program (Section 1-8 of this manual) apply.

Program/Section Managers have the following additional responsibilities on HAZWOPER sites:

- Determining whether work on each project site in the program/branch is covered by the HAZWOPER program;
- Reviewing and approving site-specific health and safety plans, or designating qualified personnel to do so;

- Assigning adequately trained and qualified personnel to work on HAZWOPER sites; and
- Requiring compliance with all the Division Health and Safety Program from all on-site personnel.

Project Managers/Project Officers have the following additional responsibilities on HAZWOPER sites:

- Ensuring development and implementation of a site-specific HASP for each HAZWOPER project, including ensuring that no work begins until the site-specific HASP has been written and approved;
- Reading and signing the site-specific HASP for his or her project and ensuring that site personnel have appropriate training and medical clearance;
- Performing or assigning periodic on-site inspections to ensure that the HASP is being implemented;
- Assigning key safety duties and responsibilities to project team members, including assigning a site safety officer (SSO) to ensure implementation of the HASP during operations, and ensuring that the SSO is adequately trained to carry out his or her duties;
- Monitoring and overseeing revision of the site-specific HASP, as necessary; and
- Stopping work at a project not in compliance with the HASP or where unsafe conditions exist that cannot be immediately corrected.

The ***Site Safety Officer (SSO)*** is assigned by the project manager/project officer on a HAZWOPER site and is responsible for the following:

- Being on site during all work activities (an alternate SSO will be designated by the project manager/project officer in the absence of the designated SSO);
- Ensuring health and safety issues are addressed at the HAZWOPER sites to which he or she is assigned;
- Communicating health and safety requirements, procedures, etc. to all on-site personnel;
- Verifying that on-site personnel read and sign off on HASP and have necessary training and medical clearance;
- Advising the project manager/project officer of any practices that are endangering the health and safety of personnel and recommending corrective action;

- Shutting down a project for up to 24 hours if necessary to ensure worker safety if the situation cannot be corrected immediately, during which time the project manager/project officer must arrange for corrective action or resolution of the problem;
- Maintaining line-of-sight or communication with the work parties;
- Verifying the proper use, cleaning, and maintenance of protective clothing and equipment;
- Conducting periodic or daily health and safety briefings for site personnel and initial site training for new personnel;
- Overseeing control of entry and exit at site access control points and recording the names and job assignments of all personnel entering and exiting the site;
- Arranging for work area and personal air monitoring, as necessary, and ensuring that all monitoring equipment used on site has been properly calibrated in accordance with manufacturer's recommendations;
- Maintaining records of exposure and monitoring results for all on-site personnel;
- Determining the need for additional safety equipment (such as respirators), depending on site-specific conditions;
- Monitoring workers for signs of stress, such as heat stress and fatigue;
- Monitoring on-site hazards and conditions;
- Coordinating and supervising emergency response and providing emergency first aid and cardiopulmonary resuscitation (CPR) to other team members, if required;
- Reporting all occupational illness and injuries to the project manager/project officer; and,
- Assisting in the preparation of reports of illnesses, injuries, or property damage.

The project manager/project officer may also serve as the SSO on HAZWOPER projects. In this case, an alternate SSO will be assigned for projects where the project manager/project officer will not be present during all field activities.

3-1.3. ELEMENTS OF THE HAZWOPER PROGRAM

The HAZWOPER standard requires employers to develop and implement a written health and safety program for employees involved in HAZWOPER operations. The program must be designed to identify, evaluate, and control safety and health hazards, and provide for emergency response for hazardous waste

operations. Programs in Sections 2 and 3 of this manual and SOPs in Section 4 of this manual have been prepared by WHS to present methods and procedures that will be used to identify, evaluate, and control site hazards. Included are programs for the control of physical, biological, chemical and safety hazards.

The HAZWOPER standard also requires the employer Health and Safety Program to include certain elements at a minimum. The following table lists those required elements and the section of this Division Health and Safety Manual that is intended to meet the requirement of the HAZWOPER standard.

Health and Safety Program Element Required by the HAZWOPER standard	**DNREC WHS Health and Safety Manual Section**
Organizational Structure	Section 1-7, Section 3-1
Site-Specific Work Plans	Section 1-9 and Section 3-2
Site-Specific Health and Safety Plans	Section 3-2
Health and Safety Training Program	Section 2-7
Medical Surveillance Program	Section 2-8
Standard Operating Procedures	Section 4 (all)
Interface between general program and site-specific activities	Section 1-7, Section 3-1 and Section 3-2

3-2. SITE-SPECIFIC HEALTH AND SAFETY PLAN PROGRAM

This program has been developed by the Department of Natural Resource and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) to ensure adequate pre-entry site investigations and development of site-specific health and safety plans (HASP) for protection of WHS employees and contractors at hazardous sites. It has been developed to meet the requirements of the Occupational Health and Safety Act (OSHA) Hazardous Waste Operating and Emergency Response (HAZWOPER) Standard at Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.120(b). Contractors to WHS are required to submit their own task-specific HASP to address hazards unique to their on-site work. Contractor HASPs must be at least as stringent as the WHS HASP for the site, and must not conflict with the requirements of the WHS HASP. The WHS project manager/project officer may decide, after reviewing the contractor HASP, to have WHS employees adhere to the contractor HASP while conducting limited activities on the site, such as site reconnaissance or contractor oversight.

Site-specific HASPs shall be completed for all WHS HAZWOPER projects that involve or have the potential to involve risks to the health or safety of DNREC staff, other on-site personnel or owners, and residents of the surrounding community. These projects include, but are not limited to, work at HSCA, LUST, and RCRA corrective action sites. The HASP, whether developed by WHS or a contractor, shall be appropriate to address hazards anticipated for the project and shall apply to all personnel on-site under WHS supervision. HASPs shall be developed upon the project manager/project officer's initiation and shall be prepared in accordance with the instructions and guidelines outlined in this document. The overall effectiveness of the HASP program shall be evaluated during the health and safety program evaluation described in Section 1-8, "Health and Safety Audit Program," of this manual.

The program scope, HASP preparation, HASP implementation, HASP amendment, HASP compliance inspections, and recordkeeping under the HASP program are discussed below.

3-2.1. PROGRAM SCOPE

According to the OSHA HAZWOPER standard, a site-specific HASP must be completed for work at any of the following types of sites:

- Uncontrolled hazardous waste sites designated for cleanup action by a governmental authority, including but not limited to, U.S. Environmental Protection Agency (EPA) National Priorities List (NPL) sites, state priority list sites, sites recommended for the NPL, and initial investigations of government identified sites conducted before the presence of hazardous substances has been confirmed;

- Cleanup operations at sites covered by the Resource Conservation and Recovery Act (RCRA), including known or suspected leaking underground storage tank (UST) removals and spill cleanups; and
- Voluntary cleanup operations at sites recognized by federal, state, or local governmental bodies.

The following activities are exempt from this program:

- Reconnaissance and inspections of properties suspected of containing contaminated media only (not containerized or released hazardous wastes) where intrusive activities such as sampling will not be conducted;
- Tours of sites as part of a pre-bid or pre-work inspection where a preliminary assessment or background investigation has shown minimal risk; and
- Inspections of operating facilities that do not meet the criteria of uncontrolled hazardous waste sites as described above, such as site visits by compliance inspectors or permit writers.

3-2.2. HASP PREPARATION

The HASP is considered an integral part of the work or task plan developed for a project. The project manager/project officer shall note the need for a HASP for a project during project setup. Suitable amounts of time and resources should be allocated in the project budget for completing an appropriate HASP.

Several site and project related features must be considered when determining the type and level of HASP needed. Primary criteria are as follows:

- Potential health and safety hazards anticipated (such as airborne contaminants, skin hazards, fire potential, radioactivity, and heat or cold stress);
- Type of site (such as tank farm, gas station, landfill, industrial site, and so on);
- Duration of project;
- Work to be performed (such as drilling of borings, well installation, monitoring of tank removal, and so on);
- Level of personal protective equipment (PPE) to be used (Levels A, B, C, or D); and

- Involvement of contractors.

Based on these criteria and information available regarding the site and planned work, a HASP format shall be chosen by the project manager/project officer.

HASP preparation involves HASP format selection, a pre-entry evaluation, HASP completion, and HASP review and approval. These activities are discussed below.

3-2.2.1. HASP FORMAT SELECTION

The complexity of and the effort needed to complete the HASP format chosen will vary from project to project. All health, safety, and emergency issues must be adequately addressed. The HASP should include three primary sections: a general information section to address proposed site activities, site information, history, and characteristics; a safety plan or characterization section to cover specific safety and health related issues; and an emergency plan to describe emergency resources and plans of action in an emergency. Standard Operating Procedures (SOPs) that address specific site issues can be used as HASP attachments and are presented in Section 4 of this manual.

In accordance with 29 CFR 1910.120(b)(4), the site safety and health plan, as a minimum, shall address the following:

- A safety and health risk or hazard analysis for each site task and operation found in the work plan.
- Employee training assignments
- Personal protective equipment to be used by employees for each of the site tasks and operations being conducted
- Medical surveillance requirements
- Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used.
- Site control measures
- Decontamination procedures
- An emergency response plan for safe and effective responses to emergencies, including the necessary PPE and other equipment.

- Confined space entry procedures.
- A spill containment program

Three HASP formats are available to choose from depending on the type of site and anticipated tasks. The three options available are described below.

3-2.2.1.1. SHORT FORM HASP

Several basic short form HASPs have been developed by WHS to cover health and safety aspects of low-hazard site projects, such as those requiring only non-intrusive activities or limited surface sampling. These forms require a minimal amount of time and effort to complete and can be filled out by the project manager/project officer or assigned site staff.

Short form HASPs can be modified for various project tasks by including appropriate standard operating procedure (SOP) documents and health and safety forms as attachments. SOPs are included in Section 4 of this manual. However, several attachments and forms are mandatory for all short form HASPs, including the following:

- Map of route to hospital;
- "General Safe Work Practices for HAZWOPER activities" (SOP Section 4-15); and
- A Health and Safety Plan Compliance Agreement.

In instances where WHS (1) provides oversight of investigations or remedial activities or (2) participates in technology demonstrations on-site controlled by others, field personnel may follow the HASP for the site prepared by another organization. For these sites, WHS will review the HASP and prepare an addendum indicating acceptance of the HASP for WHS workers and including information regarding any special health and safety needs of the WHS staff.

3-2.2.1.2. STANDARD HASP

Standard HASPs also exist in several formats within WHS; these are designed in a fill-in-the-blank format to allow use on a variety of designated hazardous sites. Examples of projects that may use this HASP are remedial projects on governmental agency-recognized sites (federal Superfund, RCRA corrective action, HSCA, LUST, etc.), subsurface investigations with potential for employee exposure to or contact with contaminated media, and any project requiring up through Level C personal protection.

The form provides for the discussion of site background and hazards, safety and PPE requirements, and emergency planning. These plans can also be modified through a series of attachments to address such

issues as heat or cold stress, decontamination area setup, and excavation. The project manager/project officer, assigned field personnel, or a health and safety specialist can prepare the standard HASP.

The standard HASP, having more complex data requirements, will require greater review and input from the project manager/project officer and may require review by the integrated health and safety workgroup. Time allocation for completing this form is significantly greater and should be factored into project cost estimates.

3-2.2.1.3. CUSTOM-PREPARED HASP

A custom-prepared HASP is required for projects that, because of the project complexity or type, require a HASP that cannot be satisfactorily addressed by the standard HASP format. Examples include extended HAZWOPER projects with multiple tasks, cleanups or removals of hazardous materials at a site, and projects that involve multiple contractors. Most projects involving Level B PPE require use of a custom-prepared HASP. Custom-prepared HASPs generally do not have a standard format. The Integrated Health and Safety Workgroup may be consulted to decide the content and completion of custom-prepared HASPs. Time necessary to complete this type of HASP will vary significantly.

3-2.2.2. PRE-ENTRY EVALUATION

An evaluation of a site's characteristics is required prior to site entry in order to develop background information for completing an appropriate HASP and to determine PPE needs for site entry and activities. Procedures for completing a pre-entry evaluation are discussed in Section 3-3, "Site Characterization Program," of this manual. The following information must be collected:

- Location and approximate size of site;
- Description of activities and tasks to be performed;
- Duration of planned activities;
- Site description, including topography and accessibility;
- Expected health and safety hazards;
- Potential exposure dispersion pathways for hazardous substances;
- Emergency assistance resources available on site; and
- Summary of expected hazardous substance chemical and physical properties.

In most instances, initial investigations have been performed and the information listed above has been completed for sites where WHS may conduct work. The individual responsible for HASP preparation should have access to this information.

3-2.2.3. HASP REVIEW AND APPROVAL

Following completion of the HASP, a review is necessary to evaluate content for completeness, accuracy, and appropriateness. The reviewer should have information available to adequately assess the proposed tasks and potential health and safety risks. The review processes may vary with the type of plan prepared. Each HASP shall have a section for signatures of the preparer and reviewer. The minimum guidelines for HASP review are discussed below.

Short form HASPs are generally completed by designated field staff and should be reviewed for content and approved by the project manager/project officer or other designated approver.

Unless otherwise specified, the standard HASP shall be reviewed by the project manager/project officer and approved by another designated approver. The review process of the standard HASP varies with the project. Complex or extremely hazardous sites requiring more detailed and elaborate HASPs may require a more strict review or review by the Integrated Health and Safety Work Group.

Custom-prepared HASPs will be completed in consultation with a designated health and safety specialist. Review will vary with the nature of the project and will be determined during project setup. At a minimum, custom-prepared HASPs will be reviewed by the project manager/project officer for accuracy and completeness of task-related content. The HASP will then be reviewed and approved by the program/section manager or designee.

3-2.3. HASP IMPLEMENTATION

A copy of the approved HASP shall be maintained on site during all work periods. The HASP will be kept accessible and its location known to all on-site personnel. A copy shall also be kept in the project files. WHS staff shall enforce HASPs written and implemented by WHS staff. The WHS policy, “Program Administration and Organizational Structure,” Section 1-7 of this manual, designates a site safety officer (SSO) for administration of HASPs. The SSO may be the project manager/project officer or his or her designee and will be indicated on the HASP. The SSO will be responsible for ensuring compliance of all site personnel with the HASP and shall have the authority to stop operations if necessary, mandate protective equipment needs, and dismiss from the site any individual demonstrating on-site conduct that may endanger their own health and safety or the health and safety of others.

The SSO will document violations of the HASP in the safety log portion of the field logbooks maintained for the project. The offender shall be verbally notified of the violation and reminded of the conditions of the HASP compliance agreement. If the violation continues, it will be the responsibility of the SSO to protect the health and safety of site personnel by dismissing the offender from the project. If the need arises, the project manager/project officer should be contacted first to obtain instruction on the procedure to follow, the documentation of the violation, and cause for dismissal.

Upon the initiation of site work, a safety meeting shall be conducted involving the SSO and all contractors. The purpose of the meeting will be to discuss the location, availability, and content of the HASP developed for the site. A copy of the HASP shall be given to each contractor working under the direction, supervision, or authority of WHS. Receipt of the copy and acknowledgment of the HASP shall be documented. The signed agreement shall be maintained with the on-site copy of the HASP. Individuals refusing to sign the agreement shall be prohibited from on-site work.

3-2.4. HASP AMENDMENT

HASPs may need amendment or revision under certain circumstances. HASPs should be amended or revised when one or more of the following situations arise:

- Tasks change or are added;
- Site hazards change or new hazards are discovered; and
- Key personnel are changed.

Amendments or changes must follow the preparation, review, and approval processes similar to those for the original HASP.

3-2.5. HASP COMPLIANCE INSPECTIONS

The HAZWOPER standard specifically requires site inspections for HASP compliance. This requirement shall be met through on-site inspections conducted during regular work activities. The SSO should routinely inspect the work site for general compliance and document this in the field logbook.

More sophisticated inspections should be conducted by an independent auditor not associated with the project. Form “Field Audit Checklist,” Section 1-8, Attachment 1 is an example of a form suitable for conducting and documenting on-site inspections. Deficiencies noted during these inspections will be brought to the immediate attention of the project manager/project officer and SSO. A written report of

findings shall also be issued to the project manager/project officer. The project manager/project officer shall respond in writing to document how any deficiencies will be addressed.

The frequency of inspections will vary with the length of the project and the nature of the hazards. Long running projects or projects involving significantly hazardous materials or operations may require more frequent visits and compliance checks.

3-2.6. RECORDKEEPING

The HASP must be maintained as a project-related record. A copy shall be placed in the project file. All signed compliance agreements from individuals and contractors should also be maintained in the project files. The SSO shall keep a file on-site of significant health and safety records, such as training certificates and monitoring results.

A portion of a site field logbook may be maintained as a project safety log or the log may be a separate record. This log will be used to record the names, entry and exit dates, and times of all WHS and contractor personnel and of site visitors, safety infractions, monitoring for air quality or personnel exposure, and any other information related to safety matters. Following completion of the project, the safety log portion may be left in the field logbook if the logbook is properly identified by project number and maintained as a project record.

3-3. SITE CHARACTERIZATION PROGRAM

The purpose of the Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) site characterization program is to identify and evaluate potential health and safety hazards prior to beginning and during operations on uncontrolled hazardous waste sites. This program is an integral part of health and safety plan (HASP) development. A formal site characterization must be completed at all sites covered by the Occupational Safety and Health Administration (OSHA) standard for Hazardous Waste Operations and Emergency Response (HAZWOPER) activities in Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.120.

The integrated health and safety work group shall provide technical guidance to the project manager/project officer and site safety officer (SSO) regarding site characterization requirements, if required. The SSO shall implement the health and safety requirements during site characterization. The project manager/project officer is responsible for ensuring that health and safety requirements are implemented during site characterization. Field personnel are required to adhere to all health and safety requirements during site characterization. Procedures for site characterization are discussed below, followed by a discussion of considerations necessary for conducting site characterizations in order to prepare the site-specific HASP.

3-3.1. PROCEDURES FOR SITE CHARACTERIZATION

Pre-entry evaluation, initial site entry, periodic monitoring, and site perimeter monitoring procedures for site characterization are discussed below.

3-3.1.1. PRE-ENTRY EVALUATION

Prior to site entry, as much information as possible shall be collected concerning the types and degrees of hazard and risks that may be present. Based on available information or off-site studies, the project team can assess hazards, determine the need to go on site to gather additional information, and identify all initial safety requirements.

The following information, when available, is needed prior to site entry and can be obtained through interviews, records research, and reconnaissance and will be incorporated into the site-specific HASP:

- Site location and size;
- Job tasks to be performed;
- Duration of planned site activities;
- Past and present site operations;

- Site topography;
- Site accessibility;
- Potential hazardous substance exposure pathways;
- Status and capabilities of emergency response teams; and
- Hazardous substances and health hazards expected at the site and their chemical and physical properties.

3-3.1.2. INITIAL SITE ENTRY

Initial site entry can help personnel determine, on a preliminary basis, hazardous or potentially hazardous conditions and confirm information collected during the pre-entry evaluation. The purpose of initial site entry is to accomplish one or more of the following tasks:

- Collect supplemental information to determine safety requirements for personnel initially and subsequently entering the site;
- Characterize hazards and potential hazards that could affect public health, the environment, or response personnel; and
- Evaluate the need for prompt mitigation actions.

Suspected conditions that (1) can pose inhalation or skin absorption hazards, (2) are immediately dangerous to life or health (IDLH), or (3) can cause death or serious harm will be identified during initial site entry. Monitoring information is presented in the "Air Monitoring Program."

While on site, the initial entry team should make visual observations that could help in evaluating site hazards. These observations might include dead animals, vegetation, or fish; land features; wind direction; labels on containers indicating hazardous contents; conditions conducive to contact with unconfined liquids, sludges, or solids; and other general conditions.

Personal protective equipment (PPE) used for the initial site entry will be selected based on information obtained during the pre-entry evaluation. Level B PPE is required when the pre-entry evaluation does not provide sufficient information to identify the hazards or suspected hazards associated with the site. A 5-minute-escape self-contained breathing apparatus (SCBA) will be carried by employees or kept available at their immediate work stations if a positive-pressure/pressure demand SCBA is not used as part of the site entry ensemble.

If a poorly ventilated space must be entered, combustible vapors and gases and oxygen levels must be monitored in accordance with the "Confined Space Entry Program" in Section 2-5 of this Health and Safety Manual. Toxic gases and vapors and radiation, unless known not to be present, should be measured as the next priority.

For open, well-ventilated areas, combustible gases and oxygen deficiency are lesser hazards and require lower priority; however, areas of lower elevation, such as ditches, gullies, and downwind areas, could contain combustible gas mixtures in addition to toxic vapors or gases and lack sufficient oxygen. Entry teams should approach and monitor these areas from upwind whenever possible.

The primary concerns to initial entry personnel are conditions that could affect their immediate safety. These conditions include exposure to organic vapors and gases, inorganic vapors and gases, radiation, oxygen-deficient or oxygen-enriched atmospheres, and combustible gases. Procedures for monitoring these conditions and actions to take based on monitoring results are discussed below and summarized in Table 1.

3-3.1.2.1. ORGANIC VAPOR AND GAS MONITORING

If organic substances are known or suspected to be present at a site, air measurements for organic vapors and gases should be made with one or more properly calibrated survey instruments. When the presence or types of organic vapors or gases are unknown, instruments such as a photoionization detector (PID) or flame ionization detector (FID) should be used to measure for the gases or vapors. The readout on these instruments indicates the concentration of total airborne substances to which the instrument is responding. If individual vapor or gas constituents are identified, the instrument can be calibrated for a more specific analysis or chemical-specific colorimetric tubes could be used.

Sufficient data should be obtained during the initial site entry to map or screen the site for various levels of organic vapors. These gross measurements can be used on a preliminary basis to determine levels of personal protection, establish site work zones, and select candidate areas for more thorough qualitative and quantitative studies.

3-3.1.2.2. INORGANIC VAPOR AND GAS MONITORING

Instrumentation to detect and quantify unknown inorganic vapors and gases is limited. Presently, PIDs and FIDs have limited or no detection capability. If specific inorganic vapors or gases are known or suspected to be present on site, measurements should be made with colorimetric detector tubes or a compound-specific, direct-reading instrument.

3-3.1.2.3. RADIATION MONITORING

Although radiation monitoring is not necessary for all sites, it should be incorporated into initial surveys of sites where radioactive materials are suspected to be present. Normal background levels of gamma radiation are approximately 0.01 to 0.02 millirem per hour. Limited investigation may continue at elevated radiation exposure rates. However, if the exposure rate increases to 3 times above the gamma background level (an indication of the possible presence of radiation sources), a qualified health physicist must be consulted before work is allowed to continue.

The absence of gamma readings above background level should not be interpreted as the complete absence of radioactivity. Radioactive materials emitting low-energy gamma, alpha, or beta radiation may be present but may not cause a response on a general gamma survey instrument. Unless airborne or ingested, these radioactive materials should present a minimal health hazard but can still present a contamination hazard. More thorough surveys should be conducted as site operations continue to completely characterize the presence of any radioactive material.

TABLE 1
HAZARDOUS CONDITION MONITORING EQUIPMENT AND ACTION SUMMARY

Hazardous Condition	Monitoring Equipment	Level or Concentration	Action
Organic vapors and gases	Organic vapor analyzer: PID or FID	Depends on compound	Consult standard reference manuals for air concentration and toxicity data
Organic and inorganic vapors and gases	Colorimetric tubes or direct-reading instrument	Depends on compound	Consult standard reference manuals for air concentrations and toxicity data
Radiation	Radiation survey meter	< 0.25 millirem per hour or less than 3 times gamma background level	Continue investigation
		> 0.25 millirem per hour or more than 3 times gamma background level	Possible radiation sources present; more thorough monitoring necessary; consult health physicist
Oxygen deficient or enriched atmosphere	Oxygen meter	< 19.5% oxygen	Monitor wearing SCBA *Note:* Combustible gas readings not valid in atmospheres with less than 19.5% oxygen
		19.5% to 23.5% oxygen	Continue investigation with caution; SCBA not needed based on oxygen content only
		> 23.5% oxygen	Discontinue inspection; fire hazard potential; consult health and safety specialist
Combustible gases	Explosimeter or combustible gas indicator	<5% LEL	Continue investigation
		> 5 to 10% LEL	Continue on-site monitoring with extreme caution as higher levels are encountered
		> 10% LEL	Explosion hazard; withdraw from area immediately; investigate source

Notes:

FID Flame ionization detector
LEL Lower explosive limit
PID Photoionization detector
SCBA Self-contained breathing apparatus
> Greater than
< Less than

3-3.1.2.4. OXYGEN MONITORING

Ambient air contains approximately 21 percent oxygen by volume. At percentages lower than 19.5 percent by volume of oxygen, air-supplying respiratory equipment is mandatory. Oxygen measurements are of particular importance for work in enclosed spaces, low-lying areas, or near accidents that have produced heavier-than-air vapors that could displace ambient air. These oxygen-deficient areas are also prime locations for taking further organic vapor and combustible gas measurements because other substances have displaced the air. Oxygen-enriched atmospheres (greater than 23.5 percent) increase the potential for fires. Oxygen measurements can be made using an approved oxygen meter.

3-3.1.2.5. COMBUSTIBLE GAS MONITORING

The presence or absence of combustible vapors or gases must be determined through the use of an approved explosimeter or combustible gas indicator (CGI). If readings on the CGI approach 10 percent of the lower explosive limit (LEL), extreme caution must be used while continuing the investigation. If readings exceed 10 percent LEL, personnel should withdraw from the site immediately. Before resuming any on-site activities, project personnel must consult with experts in fire or explosion prevention to determine procedures for continuing operations.

3-3.1.3. PERIODIC MONITORING

Monitoring surveys made during the initial site entry provide for preliminary evaluation of atmospheric hazards. In some situations, the information obtained may be sufficient to preclude additional monitoring; however, some hazards detected during the initial site survey could require more comprehensive evaluation. The site-specific HASP must include provisions for monitoring, sampling, and evaluating these hazards for the duration of site operations. Because site activities and weather conditions change, monitoring may require a combination of stationary sampling equipment, personnel monitoring devices, and periodic area monitoring using direct-reading instruments.

3-3.2. CONSIDERATIONS FOR SITE CHARACTERIZATION

Factors to consider during site characterization and HASP preparation are discussed below. These factors include the limitations of direct-reading instruments, safety hazards, physical hazards, biological hazards, and ordnance and explosive waste hazards.

3-3.2.1. LIMITATIONS OF DIRECT-READING INSTRUMENTS

Direct-reading field instruments do not detect or measure all substances; therefore, negative readings should not be interpreted as the complete absence of airborne toxic substances. Negative results can only be verified by collecting air samples for laboratory analysis.

It is essential that personnel using monitoring instruments are trained in their use, limitations, operating characteristics, and constraints in the ability to detect or quantify the hazards for which they were designed. In addition, personnel should only use intrinsically safe equipment until the absence of combustible gases or vapors can be confirmed.

3-3.2.2. SAFETY HAZARDS

Numerous safety hazards potentially present at hazardous waste sites include, but not limited to, the following:

- Fire or explosion;
- Snapping cables, slings, or ropes;
- Overloaded cranes and other hoists and suspended loads;
- Speeding and improperly operated vehicles;
- Improperly operated moving equipment including struck by or caught in/between hazards;
- Slippery and unstable surfaces, steep grades, and uneven terrain;
- Precariously positioned objects that may fall; and
- Buried utility lines and energized overhead and underground power lines.

Once a specific safety hazard has been identified, appropriate hazard control procedures must be initiated by the SSO and included in the HASP.

3-3.2.3. PHYSICAL HAZARDS

Physical hazards potentially present at HAZWOPER sites and general construction-type projects include, but are not limited to, the following:

- Noise: Noise levels shall be controlled to levels below a 8-hour, time-weighted average (TWA) of 90 decibels on the A-weighted scale (dBA) or else use of hearing protection

shall be required. Whenever noise levels exceed an 8-hour, TWA of 85 dBA, the WHS Hearing Conservation Program shall be initiated.

- Heat Stress: Risk of developing heat stress is greatly increased when the employee is wearing impermeable clothing or a respirator. The effects of PPE and heat stress must be evaluated at each site. Field staff shall follow the heat stress guidelines for monitoring and work and rest schedules presented in WHS Standard Operating Procedure for Heat Stress Monitoring.
- Cold Stress: Cold stress can result in lowered core body temperature, reduced mental alertness, reduction in rational decision-making, cold injury to bodily extremities, or loss of consciousness with the threat of fatal consequences. Exposure to cold air or immersion in cold water, even at temperatures well above freezing, can lead to hypothermia. At sites where cold stress may present a hazard, field staff shall follow the WHS Cold Stress Standard Operating Procedure presented in this manual.
- Sunburn: Sunburn is caused by overexposure to ultraviolet light. The symptoms of exposure are not usually apparent until 2 to 4 hours after exposure ceases. At sites where extended exposure to sunlight may occur, precautions such as the use of sunblock and long-sleeved clothing and hats shall be required.

Once a specific physical hazard has been identified, the appropriate hazard control procedures must be initiated by the SSO and included in the HASP.

3-3.2.4. BIOLOGICAL HAZARDS

Examples of potential biological hazards that may be encountered during on-site work are listed below and discussed in Standard Operating Procedure for “Biohazards.” The project manager/project officer shall modify this list during the preparation of the HASP. Common biological hazards include but are not limited to the following:

- Animals
- Spiders
- Snakes
- Ticks
- Stinging insects

- Poison ivy
- Poison oak

Once a specific biological hazard has been identified, the appropriate hazard control procedures must be initiated by the SSO and included in the HASP.

3-3.2.5. ORDNANCE AND EXPLOSIVE WASTE HAZARDS

If explosives, chemical warfare material (CWM), or unexploded ordnance (UXO) are discovered at any time during site operations, the project manager/project officer shall be informed and work shall be stopped immediately in the affected area. The project manager/project officer shall mark the location; notify on-site personnel concerning the ordnance and explosive waste hazard and the area's restrictions. The emergency response team shall make the appropriate arrangements for evaluation and proper disposal of the devices. WHS personnel and contractors shall not drill, excavate, or otherwise physically disturb any areas where ordnance, CWM, or explosives may be reasonably suspected. If known or potential CWM, UXO, or other such items are encountered during any phase of field work, the HASP shall specifically address procedures to be followed.

3-4. HAZARDOUS WASTE SITE AIR MONITORING PROGRAM

The purpose of the Delaware Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS), air-monitoring program is to set forth the criteria necessary to conduct air monitoring as part of a comprehensive hazardous waste site evaluation that accomplishes the following:

- Identifies work areas and activities that require the use of engineering or work technique controls or require the use of personal protective equipment (PPE)
- Provides data to confirm that levels of protection afforded by the assigned PPE and engineering or work technique controls are adequate to protect workers
- Provides data to ensure that all necessary controls and precautions are being taken to protect the public and the environment
- Complies with Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.120 the Hazardous Waste Operations and Emergency Response standard (HAZWOPER) paragraph (c)(6) and (h),

The project manager/project officer shall be responsible for the air monitoring program at each site, specifically including the identification of known or potential hazards, the implementation of sound industrial hygiene monitoring practices, equipment calibration, and analytical operations, as appropriate. The site safety officer (SSO) will take all steps necessary to ensure that the air monitoring program in implemented at the site and appropriate monitoring equipment and supplies are available during hazardous materials projects. Air monitoring equipment will be used by the SSO or individuals trained in the operation, calibration, care, and limitations of the equipment.

The criteria for selecting air monitoring equipment, instrumentation, calibration, monitoring implementation, and air monitoring documentation are discussed below.

3-4.1. CRITERIA FOR SELECTING AIR MONITORING EQUIPMENT

Priorities for monitoring should be based on information gathered during initial site characterization. This information serves as the basis for selecting the appropriate monitoring equipment and PPE to use when conducting site monitoring. Depending on site conditions, activities, the length of time spent on site, and project goals, the air monitoring program can vary from simply monitoring for immediately dangerous to life or health (IDLH) conditions and other dangerous circumstances to more extensive

monitoring, such as personal exposure monitoring, perimeter monitoring, and community monitoring. Thus, not all types of monitoring described in this program will be conducted for every project.

The air monitoring requirements for a particular project must be specified in the site-specific health and safety plan (HASP). The types of field instruments to be used for a particular project shall also be discussed in the HASP. This list shall include specific equipment, models, accessories, frequency of use, procedures for calibration, and frequency of checks.

3-4.2. INSTRUMENTATION

Air monitoring equipment may include, but is not limited to the following:

- **Photoionization Detector (PID):** This instrument is generally used for the determination of trace concentrations of hydrocarbons (except methane gas) and other photoionizable organic and some inorganic contaminants in work zones and ambient air. It is a "real-time" or direct indicating instrument nonspecific in its detection capability and has a response that varies for different chemical contaminants. Readings for specific gases are obtained by multiplying the reading by a correction factor supplied by the manufacturer of the PID. For the most accurate readings on specific gases, it is necessary to individually calibrate the gas of interest. A data logging feature on some PIDs can be used when a permanent record of monitoring results is desired.

- **Flame Ionization Detector (FID):** This instrument is used for surveying work zones and ambient air for the presence of organic vapors. Organic materials in the air are burned in a hydrogen-fueled flame. It is also a real-time instrument nonspecific in its detection capability and has a response that varies for different chemical contaminants. Readings for specific gases are obtained by applying the response factor provided by the FID manufacturer for the specific gas. An audible alarm warns the user when a preset level is exceeded. Data logging is also available with some FIDs.

- **Personal Air Sampling Pumps:** These devices may be used in conjunction with ongoing, real-time monitoring. When an air sampling plan calls for exposure and ambient air concentration monitoring of contaminants for 8-hour (or another specified period), time-weighted averages (TWA), these pumps are used for sample collection onto specified sample media (such as filter cassettes, sorbent tubes, and grab sample bags). The pump typically provides air flow rates from 0.5 to 5 liters of air per minute. Samples collected on the media are analyzed in a laboratory and therefore do not provide results or

readings at the time the sample was collected. Only laboratories successfully participating in and meeting the requirements of the American Industrial Hygiene Association's Proficiency Analytical Testing or Laboratory Accreditation programs shall analyze samples.

- **Hand Pump and Colorimetric Indicator Tubes:** The hand pump draws a measured quantity of air through a colorimetric indicator tube. The chemical "bed" inside the tube undergoes a characteristic color change in the presence of specific contaminants. The degree or length of color change as measured and observed through the glass tube surrounding the chemical bed yields a semiquantitative measurement of the concentration of a given contaminant or class of contaminants. According to the National Institute of Occupational Safety and Health (NIOSH), the accuracy of detector tubes generally is considered to be +/-25% of the reading. Colorimetric indicator tubes are available for a wide variety of chemical gases or vapors.
- **Combustible Gas Indicators (CGI):** These instruments are capable of detecting the presence of flammable gases and are used to determine the potential for explosive atmospheres. Concentrations are expressed as a percent of the lower explosive limit. Nearly all CGIs are based on the catalytic combustion of gases on a filament. Flammable gases actually burn on the filament. The resulting change in temperature produces an increase in electrical current resistance and decreases current flow. This change in current is translated by the Wheatstone bridge circuit into a meter reading.
- **Oxygen Meter:** This instrument is capable of measuring the concentration of oxygen. The sensor employs an electrolyte to detect the presence and concentration of the gas.
- **Meteorological Instrumentation:** Meteorological instruments provide data on wind speed and direction, precipitation, humidity, and other environmental conditions and are used on site as an adjunct in determining perimeter and off-site monitoring or sampling locations and may be used for interpretation of air monitoring results.
- **Radiation Monitoring Instrumentation:** A radiation survey is necessary when there is reason to suspect the presence of radioactive material or contamination.

3-4.3. CALIBRATION

The SSO will ensure that monitoring equipment in calibrated in accordance with manufacturers' instructions. Frequency of calibration varies with the instrument. Some instruments require calibration

before use and after each use. Other instruments are less prone to response drift and may require less frequent checks of instrument response. The user should verify the calibration frequency before use. Factory servicing of the monitoring instruments will be conducted periodically as recommended by the manufacturers. The project manager/project officer will make provisions for replacement equipment when factory service of an instrument is needed.

Documentation of instrument calibration is required. Each calibration event should be noted in the logbook. For portable monitoring instruments such as the PID or FID, the information recorded should include the following:

- Instrument type, brand, model, and serial numbers and other information such as lamp specifications
- Date of calibration
- Time of calibration
- Concentration and source of calibration gas standard
- Instrument scale range
- Name of person calibrating instrument

For personal air sampling pumps, pump flow calibration results will be documented. A copy of the current calibration curve for the rotameter used for calibration will be filed with the pump calibration data. Documentation of any field servicing or repair of an instrument must be documented.

Any and all user comments regarding instrument operation, problems, questionable readings, misuse, or other issues will be fully documented in the field logbook. Certifications of analysis for calibration gas standards and span gases will be maintained on file by the SSO. Any and all factory or manufacturer communications regarding the instruments will be documented in the field logbook. Primary calibration documents for flow meters calibrated by the manufacturer or equipment technician will be maintained with the calibration documentation (especially the calibration curves).

3-4.4. MONITORING IMPLEMENTATION

Monitoring for airborne hazards at a HAZWOPER work site will fall into four categories: screening and periodic monitoring, personal exposure monitoring, perimeter (work zone or work site) monitoring, and community monitoring. Before commencement of site work, background air monitoring should be conducted by the SSO at locations representative of and consistent with work zones proposed in the

HASP. The pre-startup or background sampling locations will be determined by the SSO, who will consider such factors as wind direction, terrain, and building locations. The four categories of monitoring are discussed below.

3-4.4.1. SCREENING AND PERIODIC MONITORING

Site characterization is used to identify primary health and safety concerns associated with a work site. Once site work has begun, screening monitoring should be conducted to evaluate the potential threats associated with air contaminant sources identified. Screening should be performed with the instrument and detector appropriate for the contaminant to evaluate the actual sources and concentrations of contaminants released in the immediate area of site personnel. Information from the screening will help determine the need for periodic monitoring of site conditions or personal exposure monitoring.

Periodic monitoring of ambient air in the work area is necessary when screening has demonstrated an air contaminant source that may persist as a hazard to personnel. Periodic monitoring is also necessary when a new task has begun or a change in procedures has occurred. Periodic monitoring should be conducted using direct reading instrumentation to fully evaluate the work area. The HASP should provide information on which concentration, indicated as action levels, will trigger specific employee protection actions such as donning of respirators or evacuation of the work area.

3-4.4.2. PERSONAL EXPOSURE MONITORING

Personal exposure monitoring will be conducted whenever routine, real-time screening or periodic monitoring has determined that an action level requiring PPE upgrade has been reached. Personal worker exposure monitoring related to hazardous work activities will also be conducted whenever personnel voice concerns regarding hazardous substance exposure based on qualified symptoms confirmed by the SSO or documented by a physician. Additionally, personal sampling will be performed whenever required by Federal or state regulations, such as lead exposure monitoring during lead construction activities in accordance with 29 CFR 1926.62.

Personal exposure monitoring may include both worker breathing zone and ambient work zone air. The monitoring should be conducted during each hazardous, task-specific activity. Samples can be collected to determine the 8-hour TWA or short-term exposures represented by the specific task at hand. Initial samples will be collected for workers with the highest likelihood of exposure. The number of initial determination samples will be determined by the SSO based on the extent and conditions of the new task-specific activity. Sampling may include survey or real-time monitoring with the PID or FID supplemented by filter cassette (for dusts and metals), sorbent tube (organics), and badge (organics)

sampling media data. Long-term colorimetric indicator tube readings can also be used. Laboratory analysis based sampling will be conducted in accordance with validated OSHA and/or NIOSH sampling methodologies.

Specific hazard exposure will be monitored on or around personnel engaged in unique work activities (such as electric arc welding, torch cutting or welding, and plastic pipe cement use) and where there exists a concern for exposure that may exceed an Occupational Safety and Health Administration (OSHA) permissible exposure limit or action level.

3-4.4.3. PERIMETER MONITORING

Perimeter monitoring needs will be determined by the SSO based on site and contaminant characteristics. Perimeter monitoring will be conducted during all active phases of a hazardous materials operation until sufficient documentation has established that either no hazard exists or that a constant known hazard level is unlikely to change. Work zone perimeter monitoring may additionally involve any of the previously discussed passive, active, or real-time, or other specialized monitoring techniques as necessary, based on the SSO's determination.

3-4.4.4. COMMUNITY MONITORING

Monitoring of nuisance dust, metals, and organics at the site perimeter may be necessary when hazardous activities likely to be a source of fugitive emissions are in progress. These samples will be taken at the site perimeter or just outside the perimeter downwind of work in progress.

3-4.5. AIR MONITORING DOCUMENTATION

All air monitoring data should be logged daily by the SSO in a field logbook or on forms developed for the project. All other documents (such as strip chart records or printouts from data logging instruments) will be collected and maintained with the monitoring records. All calibration- and instrument-related documentation will be maintained with the monitoring records. Chain-of-custody forms will accompany all analytical samples to the laboratory.

When personal exposure monitoring has been conducted, results will be documented and provided to the employees monitored within the OSHA-required time frame (generally 5 working days). A copy of this information will also be filed in the employee's personnel file.

All monitoring documents will be kept secure by the SSO for inclusion in the project file.

3-5. SITE SECURITY AND CONTROL PROGRAM

The Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) has developed this program to minimize potential contamination of workers, protect the public from site hazards during site activities as defined by the Occupational Safety and Health Act (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) standard in Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.120.

The WHS site security and control program is intended to ensure that all HAZWOPER sites will be controlled and provided with adequate security measures to prevent unauthorized entry to a site. Site controls establish procedures for a site designed to limit spread of contamination and movement of personnel. This program was written in accordance with site control requirements defined in 29 CFR 1910.120(d).

The project manager/project officer is responsible for ensuring that procedures are in place to provide adequate site security and control. Details of these procedures shall be included in the site-specific health and safety plan (HASP) for the project. All employees will comply with all site security and control measures.

The degrees of site security and control necessary depend on site characteristics, site size, and the surrounding community. The site security and control program is established during the planning stages of a project and HASP development and is modified based on new information and site assessments.

The elements of the site security and control program include the following:

- Site security measures
- Protection of adjacent areas
- Site map
- Site work zones
- The “buddy system”
- Standard Operating Procedures (SOPs)
- Site communications, including the capability for alerting team members in emergencies and contacting off-site emergency response personnel

- Identification of the nearest medical assistance
- Site access log

Each element is discussed below.

3-5.1. SITE SECURITY MEASURES

Site security is maintained by fencing, posting signs, and limiting access control points. A system should be established to identify authorized persons and to approve site visitors. Trained site personnel will accompany visitors at all times and advise them of the appropriate protective equipment. When necessary, site security during off-duty hours will be maintained by lockable gates, site personnel, or contract security guards. The security personnel will be provided with telephone numbers for the project manager/project officer and site safety officer (SSO) and other key personnel as described in the site-specific HASP.

3-5.2. PROTECTION OF ADJACENT AREAS

All site work shall be performed without damage to or contamination of adjacent clean or uncontaminated work or areas. Efforts shall be taken to contain operations to the work area only. When adjacent areas are damaged or contaminated, the project manager and client representative shall be notified.

3-5.3. SITE MAP

The site map should show topographic features, prevailing wind direction, drainage, buildings, containers, impoundments, pits, ponds, tanks, and any other important physical structures at the site. The map, to be included in the site-specific HASP, will be prepared prior to site entry and updated throughout the course of the site operations to reflect new information, such as changes in site activities, and hazards not previously identified.

3-5.4. SITE WORK ZONES

The establishment of site work zones helps ensure that (1) personnel are properly protected against hazards, (2) work activities and contamination are confined to appropriate areas, and (3) personnel can be located and evacuated in an emergency. Hazardous waste sites can be divided into different zones, as needed to meet operational and safety objectives; however, normally three zones are established: the exclusion zone, the contamination reduction zone (CRZ), and the support zone. Delineation of these three zones should be based on sampling and monitoring results and on an evaluation of potential routes of contaminant dispersion in the event of a release. Movement of personnel and equipment across these

zones should be minimized and restricted to specific access control points to prevent cross-contamination from contaminated areas to clean areas. The three zones are discussed below.

3-5.4.1. EXCLUSION ZONE (Hot Zone)

The exclusion zone is the area of contamination and is also referred to as the "hot zone". The outer boundary of the exclusion zone, called the "hotline," should be clearly marked by lines, placards, hazard tape, physical barriers, and/or signs. Access control points are established at the periphery of the exclusion zone to regulate the flow of personnel and equipment into and out of the zone. Equipment used within the exclusion zone should be cleaned of all gross contamination prior to movement to the CRZ.

3-5.4.2. CONTAMINATION REDUCTION ZONE (Warm Zone)

The CRZ is where decontamination takes place and is also referred to as the "warm zone". The CRZ is the transition area between the contaminated area and clean areas. The degree of contamination in the CRZ decreases as one moves from the hotline to the support zone. Decontamination procedures are performed in a designated area within the CRZ called the "contamination reduction corridor." The "contamination control line" separates the CRZ from the clean support zone. The contamination reduction corridor is positioned upwind of the exclusion zone. Decontamination procedures are discussed in detail in Section 3-6 "Decontamination Program," of this manual.

3-5.4.3. SUPPORT ZONE (Cold Zone)

The support zone is the uncontaminated area where personnel are unlikely to be exposed to hazardous conditions and is also referred to as the "cold zone". Activities conducted in the support zone include supervising field operations and field teams, recordkeeping, interfacing with the community, maintaining site security, maintaining sanitary facilities, administering first aid, storing bulk supplies, resupplying equipment, personnel vehicle parking, and sample packaging and shipping. Entry onto any controlled site should be through the support zone. All site personnel are responsible for ensuring that the support zone remains clean during project operations.

3-5.5. BUDDY SYSTEM

Most activities in contaminated or otherwise hazardous areas should be conducted with a "buddy" able to provide his or her partner with assistance, observe the partner for signs of chemical or heat exposure, periodically check the integrity of the partner's protective clothing, and notify the project manager or other support zone personnel if emergency help is needed.

When field personnel wearing respiratory protection could be overcome by a toxic or oxygen-deficient atmosphere, use of the "buddy system" is mandatory. Use of the "buddy system" should be specified in the HASP.

3-5.6. STANDARD OPERATING PROCEDURES

SOPs shall be defined in the HASP and implemented by all field personnel during HAZWOPER site operations. SOPs have been developed that address a variety of hazardous site issues and are available in Section 4 of this manual. SOPs not found in this manual may be prepared as part of the site-specific HASP.

3-5.7. SITE COMMUNICATIONS

Two sets of site communication systems should be established: internal communication among personnel on site and external communication between on-site and off-site personnel. Internal communication is used to alert team members to emergencies, pass along safety information, communicate changes in the work to be accomplished, and maintain site control. Common internal communication devices are radios, noisemakers (such as bells or a megaphone), and visual signs (such as hand signals and flags). Use of both a primary and backup communications system is advised.

External communication is used to coordinate emergency response, report to management, and maintain contact with essential off-site personnel. The primary means of external communication are telephone and radio. If telephone lines are not installed at a site or cellular telephone service is not available, all team members should know the location of the nearest telephone, and the correct change and necessary telephone numbers should be readily available in the support zone.

3-5.8. IDENTIFICATION OF NEAREST MEDICAL FACILITY

The nearest medical facility must be identified in the HASP. A map showing the route to the facility is also required. This information should be posted at the site at all times and maintained in all company vehicles assigned to the project.

3-5.9. SITE ACCESS LOGS

All WHS and contractor personnel entering the CRZ and exclusion zone must (1) sign a site entry log upon each entry and exit and (2) have on file at the site documentation certifying completion of all training, respirator fit testing, and medical surveillance requirements. The log shall include the date, name, and agency or company of the visitor and entrance and exit times. Site access logs will be

maintained on site by the SSO. This information can be entered into the field logbook or on an attachment to the HASP.

3-6. DECONTAMINATION PROGRAM

Decontamination is the physical process of removing or neutralizing chemical or biological contaminants that may have accumulated on personnel protective clothing, equipment, or tools. The Department of Natural Resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) decontamination program establishes proper decontamination procedures for site work to protect field personnel from hazardous materials and to prevent the migration of chemicals from hazardous waste sites. This decontamination program is written in accordance with the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CRF 1910.120.

The levels and types of decontamination procedures required are based on site-specific factors, including the following:

- Chemical, physical, and toxicological properties of on-site wastes;
- Potential for contaminant contact based on assigned worker duties, activities, and functions;
- Potential for wastes to permeate, degrade, or penetrate materials used for personal protective equipment (PPE), clothing, vehicles, tools, and instruments;
- Presence of infectious wastes;
- Movement of personnel and equipment between different work zones;
- Emergencies;
- Methods available for protecting workers during decontamination; and
- Impact of the decontamination process and compounds on worker health and safety.

The project manager/project officer is responsible for ensuring that the prescribed decontamination procedures are implemented. The site safety officer (SSO) will implement the requirements of the decontamination program on site. Field personnel and contractors are required to adhere to the decontamination procedures specified in the site-specific health and safety plan (HASP) for the site. If necessary, the Integrated Health & Safety Workgroup will provide technical guidance to project managers/project officers and SSOs regarding the selection of appropriate decontamination procedures for a site.

HASP components related to decontamination, decontamination facility design, decontamination by commercial laundries or cleaning establishments, decontamination waste disposal methods, and decontamination during medical emergencies are discussed below.

3-6.1. HASP COMPONENTS

The decontamination plan is a critical component of a HASP and must be implemented before any personnel or equipment are permitted to enter areas where the potential for contact with hazardous substances exists. The decontamination plan should contain the following information:

- 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 personal protective equipment (PPE) and clothing;
- Methods for disposing of clothing and equipment that are not completely decontaminated; and
- Methods to assess effectiveness of decontamination efforts if equipment is intended to be re-used.

The decontamination plan should be revised as necessary to reflect changes in the type of PPE, site conditions, or site hazards.

HASPs should also include procedures to minimize contact with and contamination by hazardous materials. The procedures should address the following:

- Decontamination should be performed in areas that will minimize exposure of uncontaminated employees or equipment
- The level of protection worn by the decontamination crew in the decontamination plan
- Appropriate decontamination procedures for all personnel leaving a contaminated area
- Proper decontamination or disposal of all contaminated clothing and equipment
- Proper decontamination or disposal of all equipment and solvents used for decontamination

- Decontamination, cleaning, laundering, or replacement of protective clothing and equipment to maintain effectiveness
- Decontamination of impermeable protective clothing that has contacted or is likely to have contacted hazardous material before removal
- Immediate removal of permeable clothing that has becomes wet with hazardous substances and, if possible, showering of personnel
- Work sites requiring showers and change rooms must meet the requirements of Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.141, "Sanitation"

3-6.2. DECONTAMINATION FACILITY DESIGN

Decontamination facilities are typically located within a contamination reduction zone (CRZ), which is located directly outside and adjacent to the exclusion zone (hot zone). Specific areas within the CRZ are typically designated as decontamination areas for personnel, equipment, machinery, and vehicles. The established area must have sufficient room to provide for full decontamination. The CRZ also should have marked entry and exit points and should control access into and out of the exclusion zone.

3-6.3. IMPLEMENTING BASIC DECONTAMINATION PROCEDURES

Basic decontamination procedures are theoretical and must be altered to meet a site's specific needs or conditions, but they should be similar to:

- Establish a linear progression of stations (a step-by-step process in a straight line)
- Each station serves a function of the decontamination process
- The number of stations depends on:
    - Type of protective clothing worn
    - Work function on site
    - Chemical substances on site
    - Type of wash/rinse process needed
- Stations are placed approximately 3 feet apart
- Provide limited access between the contaminated area and decontamination area
- See Diagram 1 below for an example decontamination corridor configuration.

3-6.4. DECONTAMINATION BY COMMERCIAL LAUNDRIES

Any commercial laundries or cleaning establishments used by WHS to clean protective clothing or equipment shall be informed in writing by the SSO of the potentially harmful effects of exposure to hazardous substances.

3-6.5. DECONTAMINATION WASTE DISPOSAL METHODS

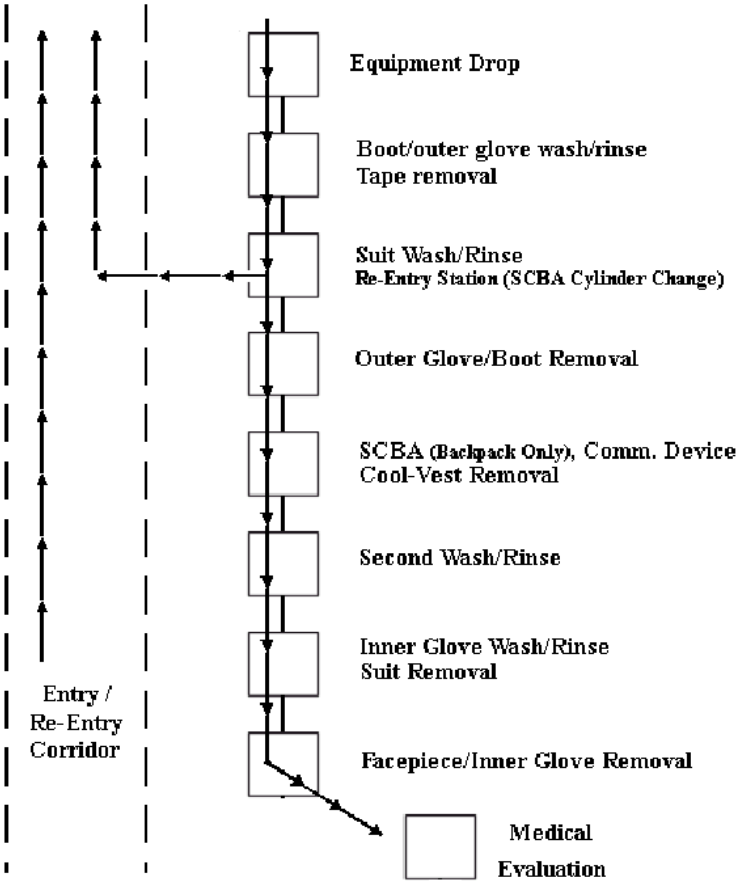
All decontamination equipment used must be decontaminated and disposed of properly. Buckets, brushes, clothing, tools, and other contaminated equipment should be collected, placed in containers, and labeled. Also, all spent solutions and wash water should be collected and disposed of properly. Clothing that is not completely decontaminated should be placed in plastic bags pending further decontamination and disposal. Collection and disposal methods should be specified in the HASP.

3-6.6. DECONTAMINATION DURING MEDICAL EMERGENCIES

In the event of an employee injury or illness, the project manager/project officer or SSO must decide if decontamination of the victim is necessary or appropriate. Situations may arise where decontamination could aggravate an injury or significantly delay the start of medical treatment for a potentially serious injury or medical condition. In circumstances where prompt medical attention is critical to recovery, the victim should not be decontaminated. If the SSO decides that decontamination will not interfere with the necessary medical treatment, then protective clothing and equipment should be washed, rinsed, and removed.

In medical emergencies when decontamination cannot be performed, provisions should be made to minimize contamination of rescue personnel (for example, by wrapping the victim in blankets or plastic sheets). All rescue or emergency service personnel should be informed of the presence of contamination and the procedures required for decontamination. A designated on-site representative should accompany the victim to the emergency facility to provide information to the attending physician (such as Safety Data Sheets from the hazardous materials present at the site and other information as appropriate).

Diagram 1
Example Decontamination Corridor Configuration



3-7. EMERGENCY RESPONSE PLANNING PROGRAM FOR HAZARDOUS WASTE SITE ACTIVITIES

The purpose of a hazardous waste site emergency response plan is to ensure decisive response actions in case of a site emergency. This document describes the Department of Natural Resources and Environmental Control (DNREC), Waste and Hazardous Substances (WHS), Emergency Response Planning requirements for establishing an emergency response plan as part of a site-specific health and safety plan (HASP) for hazardous waste site activities. This emergency response plan is applicable primarily to large remedial activities. For small sites and limited activities involving a low probability of major emergencies, a scaled-down plan is more appropriate.

Emergency response plan responsibilities are discussed below, followed by a discussion of pre-emergency preparation, on-site emergency response procedures, post-emergency procedures, and amendments to the emergency response plan.

3-7.1. RESPONSIBILITIES

The site-specific emergency response plan must include the names of all site personnel and their responsibilities in the event of an emergency response. All site personnel must be familiar with the contents of the site-specific HASP and be knowledgeable of information regarding site hazards, control methods, and the emergency response plan. Lines of authority must be clearly delineated in the plan. As a general rule, the on-site project manager/project officer should be in charge of emergency response actions. The project manager/project officer will also serve as liaison with appropriate government officials, reporters, and other parties. The project manager/project officer shall also ensure that at least one individual trained in first aid and cardiopulmonary resuscitation is on site at all times. Contractor supervisors should report directly to the project manager/project supervisor in the event of a site emergency.

The site safety officer (SSO) should serve as an alternate to the project manager. The SSO will assist in first aid response, notifying appropriate government agencies of the need for assistance, and overseeing general emergency response operations.

When emergency situations occur that are handled on site without the assistance of off-site personnel, it is the responsibility of site personnel to inform the project manager/project officer immediately of the emergency at hand, no matter how insignificant it may seem to personnel involved.

3-7.2. PRE-EMERGENCY PREPARATION

Planning for an emergency is essential for a decisive and appropriate response. The following sections describe considerations for pre-emergency preparations, including emergency responders and equipment, the emergency communication system, site maps, and arrangements with local authorities.

3-7.2.1. EMERGENCY RESPONDERS AND EQUIPMENT

An approved first aid kit must be kept on site. All contractors will provide, at a minimum, a 10-unit first aid kit for work zone personnel. First aid kits must be restocked as soon as possible after use, and must contain a face-mask barrier device for mouth to mouth resuscitation or CPR. Additional emergency medical supplies, including blankets, an American Red Cross First Aid handbook, and other equipment, as necessary, must also be provided.

When site operations may involve contact with liquid or solid chemicals, other potentially hazardous materials (such as gasoline, diesel fuel, plastic pipe cement, and wet concrete) or contaminated surface water or groundwater, eyewash facilities for flushing both of a victim's eyes should be available. The eyewash facility must be free of external contamination, and fresh potable water will be provided on a regular basis. Water will be maintained at a safe temperature.

Depending upon the project hazards, a supply of personal protective clothing and equipment may be necessary for emergency use. The specific numbers of items and types of equipment will be determined prior to mobilization to the field and listed in the site-specific HASP. Such equipment may include self-contained breathing apparatuses (SCBA), air tanks, full-body encapsulating disposable suits, gloves, tape, radio sets, shovels, emergency eyewashes, showers, and other equipment needed for emergency response. Fire extinguishers with a minimum rating of 20A12BC shall be provided where flammable or combustible materials present a fire risk.

3-7.2.2. EMERGENCY COMMUNICATION SYSTEM

Both off- and on-site communication must be addressed in the emergency response plan. This section describes requirements for off- and on-site communications.

3-7.2.2.1. Off-Site Communication

Emergency telephone numbers for the project manager/project officer, SSO, Occupational Medical Advisor, and the appropriate DNREC office will be placed in the site-specific HASP. Emergency telephone numbers for project contractor key personnel will also be included in the HASP.

In addition, a map showing the location of the closest medical facility providing emergency services will be included in the HASP.

3-7.2.2.2. On-Site Communication

Emergency alert on-site communication will consist of an audible alarm system. An air/vehicle horn is suggested for use in the event of major medical or fire emergency. The recommended alarm sequences using an air horn are as follows:

- Fire—one short blast every 5 seconds
- Medical emergency—two sequential short blasts repeated every 5 seconds
- Evacuation—one long blast repeated every 5 second
- Test—one short blast only

When site conditions require the use of radio communication, the project manager/project officer and SSO will maintain on site in working condition a minimum of two portable two-way radios for use in emergency situations or in the course of normal work activity. These radios will have transmitters with sufficient power to span the range of the project site as well as the surrounding community.

3-7.2.3. SITE MAPS

A detailed site map must be attached to the HASP. As applicable, the following information should be included on the map:

- Site layout, topography, and terrain
- Site hazard locations, especially locations immediately dangerous to life and health
- Evacuation routes
- Safe locations
- Entry points and controlled access points
- Relationship of site to nearby roads
- Prevailing wind direction

3-7.2.4. ARRANGEMENTS WITH LOCAL AUTHORITIES

For properties with the risk of fires, explosions, or significant chemical releases, the SSO and the project manager/project officer will make arrangements to familiarize the police and fire departments and

emergency response providers with the site layout, properties of hazardous wastes handled and associated hazards, places where on-site personnel would normally be working, entrances to on-site roads, and possible evacuation routes. Information regarding the properties of hazardous materials handled at the site and the types of injuries or illnesses that could result from fires, explosions, or releases should also be provided to the hospital prior to project start-up.

3-7.3. EMERGENCY RESPONSE PROCEDURES

The basic sequence of emergency response procedures to follow is listed below.

- Notify all on-site personnel of the emergency using the predetermined alarm system.
- Move to a safe area by the evacuation route.
- Contact necessary off-site emergency response services.
- Contact DNREC office managing the project to inform project personnel of the emergency situation and request any assistance.

This sequence is only a guideline. During an actual emergency, the project manager/project officer and SSO must evaluate the situation on an ongoing basis and determine appropriate actions to follow.

Basic response actions and actions to take in case of injuries, uncontrolled fires, uncontrolled releases of hazardous materials, site evacuation, and community evacuation are discussed below.

3-7.3.1. BASIC RESPONSE ACTIONS

DNREC WHS has the capacity for minimal medical or fire emergency response and will rely heavily on off-site personnel. For this reason, emergency telephone numbers should be posted by every site telephone. If a telephone is not available, it may be necessary to leave the site to obtain help. However, the project manager/project officer must consider the possibility of leaving the emergency situation, including injured personnel, to obtain help. General response procedures are as follows:

- Determine the exact nature of emergency, including what happened, injuries, chemicals involved, extent of damage, potential for danger during response action, equipment needed, and off-site emergency response needs
- Have site personnel perform emergency responses to the extent possible
- Decontaminate as necessary
- Evacuate as necessary

3-7.3.2. INJURIES

Upon being notified of an injury, the site safety officer or other trained personnel will respond under the following conditions:

- The existing environmental conditions do not threaten the responder's life (for example, an oxygen deficient atmosphere is not present) **and**
- The equipment used for response operations is intrinsically safe in a flammable or explosive environment.

Monitoring equipment to sample airborne concentrations of hazardous toxic chemicals or radioactive contaminants can be used while response operations are in progress.

The first responder to arrive at the injury location will assess the situation and direct one individual to call one or more designated emergency medical assistance numbers if necessary. The responder will provide the "messenger" with the appropriate information to give the emergency responders over the telephone.

3-7.3.2.1. MINOR OCCUPATIONAL INJURIES

Minor injuries to on-site employees can be treated by trained personnel using the first aid kits. All injuries and first aid kit usage will be reported to the SSO and documented in the field log book and as described below in Section 4.0.

3-7.3.2.2. SERIOUS OCCUPATIONAL INJURIES

Life-support techniques (such as CPR and treatment of life-threatening problems such as bleeding, airway maintenance, and shock) will be given top priority. Professional medical assistance will be obtained as soon as possible. In all cases, the protocol to follow is to perform all necessary life support actions and then take care of any decontamination procedures after the victim is stabilized.

Medical personnel on site and at the hospital should be informed of any contamination concern and be provided with the following information:

- Associated health hazards
- Concentrations believed to have been present (if known)
- Length of exposure time
- Work activity of the victim at time of accident
- Recommended decontamination methods

3-7.3.3. UNCONTROLLED FIRES

Site personnel will be instructed to attempt to extinguish small fires with the closest available portable fire extinguisher. The fire alarm signal (one short blast every 5 seconds) must be sounded as soon as possible. Fires that cannot be controlled immediately will be extinguished by the local fire department (by calling 911 or the number on the emergency telephone list). Any fire, no matter how seemingly insignificant, must be reported to the SSO and project manager/project officer.

When the fire department arrives on site, the project manager/project officer, SSO, or a designee will be required to instruct fire fighters of pertinent information, including hazards, missing personnel (including their last known work location), and fire location and size.

The project manager/project officer and SSO will make determination about the safety of continuing work in the affected zone. If conditions are determined to be unsafe, the project manager/project officer and SSO will develop a remediation plan to restore the work zone to a safe condition.

3-7.3.4. UNCONTROLLED RELEASES OF HAZARDOUS MATERIALS

Any spill of a hazardous material will be reported immediately to the project manager/project officer and SSO. The SSO and project manager/project officer will direct emergency activities at the spill site and ensure that all health and safety equipment and supplies needed for spill response are readily available and properly used. Emergency medical or fire services will be summoned immediately if the spill involves extremely toxic or flammable materials.

During a hazardous material spill cleanup, the SSO will monitor exposures to chemicals, determine the need for protective equipment and clothing, identify restricted work areas and controlled access areas, and provide cleanup guidance.

The project manager/project officer will be responsible for directing any contractor work crews. The SSO and project manager/project officer will remain at the spill site during cleanup activities until the spill site is secured. At the earliest opportunity, the project manager/project officer will notify the program/section manager of activities related to the incident. Required regulatory agency notifications will be made as soon as safely possible by the project manager/project officer in conjunction with the program/section manager.

Additional guidelines for spill control are detailed in the Standard Operating Procedure for Spill and Discharge Control in Section 4-17 of the WHS Health and Safety Manual.

3-7.3.5. SITE EVACUATION

A work location can be evacuated because of fire, chemical release, explosive or flammable atmosphere, flooding, or other abnormal conditions. The evacuation will continue until normal conditions have been restored and the project manager/project officer and SSO authorize re-entry. It is important that during evacuation, all persons remain calm and follow prescribed procedures for an orderly exit.

The SSO will inform site personnel of evacuation routes, both primary and alternate. Evacuation will be upwind or crosswind from any toxic and hazardous airborne contaminant. The SSO will determine a meeting point based on the current locations of work zones and detours. The evacuation meeting point will be discussed daily with site workers. A daily head count will be made by the SSO to determine, if evacuation becomes necessary, if all site personnel are safely evacuated.

Only trained emergency response personnel can attempt rescue following site evacuation. Workers will not re-enter an evacuated area until emergency conditions have been corrected. The project manager/project officer and SSO will determine when the area is safe for re-entry and will authorize re-entry.

3-7.3.6. COMMUNITY EVACUATION

If the project manager/project officer or SSO determines that the site has had a release, fire, or explosion that could threaten human health or the environment outside the site, he or she must report the findings as described below.

If the assessment indicates that evacuation of local areas may be advisable, the project manager/project officer must call 911 and must be available to help local and other agency officials decide whether areas should be evacuated.

3-7.4. POST-EMERGENCY PROCEDURES

All WHS employees, contractors, site visitors, and any other personnel are responsible for reporting to the project manager/project officer or SSO any accident or incident involving themselves or personnel that are working for them during the course of on-site work. Any off-site accidents or incidents that are project-related should likewise be reported.

The initial verbal notification to the project manager/project officer or SSO of an incident or accident must be followed by the procedures outlined in DNREC WHS Policy 0623 – Workers' Compensation no later than 2 days after such incident or accident has occurred. The SSO will further investigate the incident or accident as needed and as soon as possible.

3-7.5. AMENDMENTS TO THE EMERGENCY RESPONSE PLAN

The emergency response plan must be reviewed and amended under the following conditions:

- Applicable regulations are revised
- The plan fails in an emergency
- The site changes in design, construction, operations, maintenance, or other circumstances in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes the response necessary in an emergency
- The list of emergency services changes

The emergency response plan will be updated by the SSO with review as described in "Site-Specific Health and Safety Plan Program," in Section 3-2 of this manual.

4-1. STANDARD OPERATING PROCEDURES FOR EMPLOYEE SAFETY

To ensure a safe working environment, all Department of Natural Resources and Environmental Control (DNREC), Division of Waste and Hazardous Substances (WHS) employees shall comply with the standard operating procedures (SOP) discussed below, which apply to all job classifications.

- Do not leave filing cabinet drawers, kitchen cabinet doors, or office equipment cabinet doors open while the drawers or doors are unattended.
- When possible, fill filing cabinets from the bottom to the top to prevent tipping.
- Open only one drawer on a filing cabinet at a time to prevent tipping.
- Use only appropriate step stools and ladders to gain access to out-of-reach places. Chairs or tables shall not be used as a ladder or work platform.
- Never remove grounding wires from equipment and appliances.
- Do not overload electrical circuit boxes.
- Do not allow electrical cords, computer cables, and telephone wires to be tripping hazards.
- Tape down or insert into rubber protectors to all cords crossing walkways.
- Anyone known to be under the influence of drugs or intoxicating substances that impair the employee's ability to safely perform assigned duties shall not be allowed on the job while in that condition.
- Horseplay, scuffling, and other acts that tend to have an adverse influence on the safety or well-being of the employees is prohibited.
- Work shall be well planned to prevent injuries in the handling of materials and when working with equipment.
- No one shall knowingly be permitted or required to work while the employee's ability or alertness is so impaired by fatigue, illness, or other causes that might unnecessarily expose the employee or others to injury.
- Use proper lifting techniques. Heavy objects will be lifted using the large muscles of the leg instead of the smaller muscles of the back. Get assistance or use mechanical means for lifting heavy loads.
- Wear appropriate footwear.

- Cleanse thoroughly after handling hazardous substances.
- Maintain all tools and equipment in good condition. All hand and power tools shall be inspected before use.
- First aid kits shall be located in a prominent location and stocked with basic first aid supplies.

Additional SOPs, related to reporting, fire safety, housekeeping, equipment safety, chemical safety, vehicle safety, and earthquake safety, are discussed below.

Reporting

- Report all unsafe conditions and equipment to the Program/Section Manager.
- Report all accidents, injuries, and illnesses in accordance with DNREC Policy 0623, Workers Compensation.

Fire Safety

- Keep all means of egress (exits) unblocked, well lighted, and unlocked during work hours.
- Sound the alarm and evacuate in the event of fire.
- Upon hearing the fire alarm, stop work and proceed to the nearest clear exit. Gather at the designated location.
- Do not attempt to respond to a fire or other emergency unless properly trained.
- Exit doors must comply with fire safety regulations.
- Keep all stairways clear of stored materials including items that can be tripped over.
- Do not store materials and equipment against doors or exits, fire ladders, or fire extinguisher stations.

Housekeeping

- Keep aisles, walkways, exit paths, and other walking/working surfaces clear at all times.
- Maintain work areas in a neat, orderly manner. Throw trash and refuse in proper waste containers.
- all field equipment should be stored in designated storage areas and not in offices.
- Wipe up all spills promptly. Walkways shall be free from water, chemicals, or other slippery substances.

- Store files and supplies in a manner that precludes damage to the supplies or injury to personnel when they are moved. Store the heaviest items closest to the floor and lightweight items above.

Equipment Safety

- Plug all electrical equipment into appropriate wall receptacles or into only one extension cord of similar size and capacity. Unless the electrical equipment is double insulated, use three-pronged plugs to ensure ground continuity.
- Keep individual heaters in work areas clear of combustible materials such as drapes or waste from wastebaskets. Use newer heaters that are equipped with a thermostat and a cutoff switch in case the heater tips over.
- Keep appliances such as coffee pots and microwaves in working order and inspect them for signs of wear or fraying cords.
- Fans used in work areas should be guarded. Guards must not allow fingers to be inserted through the mesh. (Newer fans are equipped with proper guards.)
- Use general office equipment such as scissors, staplers, and so on for their intended purposes only and not as hammers, pry bars, screwdrivers, chisels, or other tools. Misuse can cause damage to the equipment and possible injury to the user.
- Never clean or adjust machines while they are in operation.
- Remove equipment or machines in need of repair from service immediately and do not return them to use until they have been properly repaired.
- Only qualified persons shall perform installation, repair, or maintenance of any office equipment.
- Keep the blades of hand paper cutters in the down position and locked at all times when not in use.
- Ladders or step stools of adequate design to support the employee's weight and the material to be obtained shall be provided and readily available to allow reaching high files, upper lockers, or storeroom shelves. Do not stand on a swivel or folding chair for such purposes.
- Report all hazards, such as sharp file cabinet edges or any other conditions likely to do bodily harm, damage clothing, or constitute a fire hazard.

Chemical Safety

- Store cleaning supplies away from edible items on kitchen shelves.
- Store cleaning solvents and flammable liquids in appropriate containers.
- Keep solutions that may be poisonous or not intended for consumption in well-labeled containers. Do not use food based containers to store harmful chemicals.

Vehicle Safety (including rental vehicles)

- Maintain DNREC vehicles in safe condition. This is the obligation of the employee for his or her own safety as well as to protect the division from liability to the public.
- Use defensive driving techniques at all times.

4-2. STANDARD OPERATING PROCEDURES FOR WORKING OVER OR NEAR WATER

This standard operating procedure (SOP) provides guidelines for working over or near bodies of water three (3) or more feet deep or swiftly moving water. Workers will observe the requirements of the Occupational Safety and Health Administration (OSHA) specified in Title 29 of the *Code of Federal Regulations* (CFR), Part 1926.106, "Working Over or Near Water." The following sections discuss general procedures, and cold water procedures.

4-2.1. GENERAL PROCEDURES

When working over or near water, the following precautions will be taken:

- All staff and team members who have the potential to fall into water deeper than two feet, or less if required by the site safety officer, or are in a watercraft must wear a personal flotation device (PFD). Personnel will be provided with U.S. Coast Guard (USCG)-approved life jackets or work vests. The PFD should be Class III, which will support the head of an unconscious person above water. Note: when continuous fall protection is used (without exception) to prevent employees from falling into the water and has effectively removed the drowning hazard, life jackets or buoyant work vests are not needed.
- Life jackets and work vests will be inspected before each use.
- A USCG-approved life-saving skiff will be available at locations where employees are working over or adjacent to water.
- Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations.
- Under no circumstances will team members enter water bodies without protective clothing such as rubber boots or waders.
- At least one person will remain on shore as a look-out.

If a team member falls into the water, under no circumstances should another team member enter the water to rescue the person in the water. If possible, a ring buoy, branch, paddle, pole, or similar object should be extended to the person in the water. When the person in the water grabs the extended item, they should be pulled toward the shore or boat. If the person is unconscious, the PFD, clothing, or hair should be hooked to pull the person toward the shore or boat. Once the person has been safely retrieved, qualified personnel should perform necessary emergency medical procedures. If none are necessary, the

retrieved team member should change into dry clothing as soon as possible after any necessary personal decontamination.

4-2.2. COLD WATER PROCEDURES

When the water temperature is below 45 °F, hypothermia is a serious risk. A person can lose feeling in the extremities within 5 minutes. All field staff members should be familiar with cold-water survival techniques or should receive training from an American Red Cross-certified swimming instructor in cold-water survival techniques when site conditions warrant such knowledge. If the sum of the water and air temperatures is less than 120 deg F, then an approved work/dry suit must be worn.

After a person has been rescued from cold water, he or she should change into dry clothes as soon as possible. If the person who has fallen into the water displays hypothermia symptoms, he or she should be treated immediately and taken to a medical facility. If symptoms are severe and evacuation to a medical facility cannot be quickly conducted, any wet clothing should be removed, the victim should be placed in blankets or sleeping bags in a sheltered location, and the rescuer should climb into the blankets or sleeping bag with victim to provide additional warmth. The victim should also be treated continuously for shock, elevating feet and monitoring the victim's pulse and breathing rate.

If a team member falls into cold water, he or she should not remove any clothing while in the water because clothing provides additional insulation. Although clothing creates an added drag while swimming, the insulation outweighs the disadvantage of the additional drag. Each team member should carry a wool hat to place on his or her head in case he or she falls into the water. A wool hat, even when wet, provides good insulation for the head, where a large amount of body heat is lost.

4-3. STANDARD OPERATING PROCEDURES FOR FALL PROTECTION

This standard operating procedure (SOP) presents general guidelines for basic fall protection when working in elevated areas. Continuous elevated work or elevated construction work will require detailed procedures that should be included in a site-specific health and safety plan (HASP). The SOP for "Portable Ladder Safety," in Section 4-8 of this Health and Safety Manual should also be consulted. During elevated work, the precautions below must be taken.

4-3.1. GENERAL INFORMATION

DNREC WHS Fall Protection Program's intent is to approach a fall hazard in a logical sequence that will best protect the employee from the fall hazard and enable the employee to safely perform the task at hand. There are three fundamental principles to consider when addressing a fall hazard. The first and most desirable approach to consider is elimination. The second is prevention, and the last is the controlling falls.

Elimination - This is the first and best line of defense against falls from heights. Elimination requires careful assessment of the workplace and the work itself. Pre-planning of the work and site often not only leads to eliminating the hazard altogether, but also identifies alternative approaches to the work that can measurably enhance productivity. The idea is to design safety into the work process and not simply to try to add safety as an afterthought.

Prevention - Prevention of falls is the second line of defense when fall hazards cannot be eliminated. This also requires assessment of the workplace and work process. It involves making changes to the workplace to preclude the need to rely on the worker's behavior and personal protective equipment to prevent falls. Examples include use of stairs, guardrails, barriers, restraints, and travel restriction systems to prevent the worker from direct and unprotected exposure to the fall hazard. Prevention techniques deal with preventing the fall before onset.

Control - Control of falls is the last line of defense. It should be considered only after determining "within reason" that the fall hazard cannot be eliminated or the possibility of falling prevented. This is the domain of fall protection and calls for equipment such as harnesses, lanyards, shock absorbers, fall arrests, self-retracting lifelines, and anchorage connectors. It deals with reducing the risk of injury after the onset of a fall. Fall protection also necessitates assessment and planning of the workplace and work process in order to select the proper equipment, install it, and use it correctly.

4-3.2. FALL PROTECTION REQUIREMENTS

General Industry Regulations (29 CFR 1910 Subpart D, F and R) require that fall protection must be in use/place whenever an employee is or would otherwise be exposed to a fall of 4 feet or more, less than 4 feet if over dangerous equipment.

Construction Industry Regulations (29 CFR 1926 Subpart M) require that fall protection must be in use/place whenever an employee is or would otherwise be exposed to a fall of 6 feet or more, less than 6 feet if over dangerous equipment.

A competent person shall assess the workplace for fall hazards and develop fall prevention/protection strategies to eliminate or reduce employee exposure to falls.

The following are examples of situations were fall prevention or protection would be needed. The following list is by no means comprehensive or complete. There are many other situations in the work place where a fall of 4 feet (6 feet for construction work) or more is possible.

- Wall and floor openings
- Holes
- Unprotected sides/edges
- Excavations
- Ramps, runways, and other walkways
- Hoist areas
- Roofs
- Aerial lifts

Employees shall be protected from fall exposures by selecting the appropriate fall prevention or protection system, such as guardrails, scaffolds, work stands, lifts, covers, fall restraint, safety nets, personal fall arrest systems, lifelines, or other approved means.

All fall protection systems shall be selected, installed, and utilized under the guidance of a competent person.

4-3.3. FALL PROTECTION PRE-JOB BRIEF

Appropriate fall protection shall be determined by the work environment and the task to be performed. The Project Manager/Project Officer or Site Safety Officer (SSO) on a HAZWOPER site shall conduct a

Pre-Job Briefing prior to personnel utilizing personal fall arrest equipment.

The fall protection portion of the Pre-Job Briefing shall include information and/or discussion on the following topics:

- The personal fall arrest system components and their assembly as required for the work task;
- Designation of the anchor point(s) and anchor devices to be utilized;
- Exceptional actions required for the completion of the work task, such as utilization of multiple anchor points, transference between working surfaces, or use of lifelines;
- The actions to be taken in an emergency, including the rescue plan;
- Verification of the inspection of all system components;
- Verification of affected personnel's knowledge and understanding of the requirements.

4-3.4. PERSONAL FALL PROTECTION SYSTEMS

When personnel work in elevated positions or near unprotected edges that expose them to potential falls of four (4) feet or greater (6 ft. in construction) without a compliant guardrail system, or other fall prevention system, personal fall protection systems shall be used.

The following requirements apply to personal fall arrest systems:

- To ensure recognition of a fall and to initiate prompt rescue as required by OSHA, personnel SHALL NOT utilize a fall arrest system when working in an area alone.
- If additional personnel are not in the immediate work area and capable of being immediately aware of a fall without dependence upon radio communication, personnel shall;
    - Utilize fall prevention as an alternative fall protection method, or
    - Not perform tasks requiring the use of fall protection.
- Personal fall arrest equipment shall comply with ANSI Z359.1, Safety Requirements for Personal Fall Arrest Systems, Subsystems, and Components. Note: the use of body belts for fall arrest is prohibited and a full body harness is required.

- When stopping or arresting a fall, personal fall arrest systems shall limit the maximum force on an employee to 1,800 pounds when used with a body harness. An approved deceleration device is required.
- Personal fall arrest systems shall be rigged such that an employee can neither free fall more than 6 feet nor contact any lower level or dangerous equipment.
- If vertical lifelines or drop-lines are used, not more than one employee may be attached to any one lifeline.
- Snap hooks, not specifically designed for such, may not be connected to loops made in webbing-type lanyards or to each other.

Anchorages used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds per employee attached, **or** shall be designed, installed, and used as follows:

- As part of a complete personal fall arrest system which maintains a safety factor of at least two; and
- Under the supervision of a qualified person.

  NOTE: A single fall protection anchor shall not be shared simultaneously with another person or equipment suspension system.

Where feasible, anchorages used for attachment should be main structural frames, i.e. wide flange beams or columns. Other anchorages must be approved by a qualified person.

All equipment (ex. anchor straps, lanyards, lifelines, self-retracting lanyards, body harnesses, connectors, etc.) shall be inspected in accordance with manufacturer's instructions and before each use by the user. Damaged equipment shall not be used. If inspections discover defective equipment, the equipment will be marked "DO NOT USE" and discarded.

Equipment shall be stored in a manner as to preclude damage from environmental factors such as heat, light, excessive moisture, oils, chemicals and their vapors, or other degrading elements.

Any equipment involved in a fall shall be removed from service or destroyed. In some cases the equipment (i.e. retractable lanyards) can be returned to the manufacturer for testing and certification in accordance with the manufacturer's specifications.

Where applicable, retractable lanyards shall be returned to the manufacturer for scheduled inspections,

certifications, and maintenance, as required by the manufacturer.

4-3.5. FALL ARREST RESCUE

Prolonged suspension from fall arrest systems can cause Orthostatic Intolerance (Suspension Trauma or Hanging Harness Syndrome). Venous pooling occurs in the legs due to gravity and lack of movement. Sustained hanging in an immobile position leads to unconsciousness and death in potentially less than 30 minutes. Signs and symptoms include; Faintness, nausea, dizziness, sweating, increased heart rate, "graying" or loss of vision.

Prior to an individual's use of a personal fall arrest system, prompt rescue or self-rescue shall be planned. The rescue plan shall include the following elements;

- Ensuring prompt fall recognition
- Use of self-rescue lanyards when available and/or the use of suspension relief straps
- Assessing for post-fall accessibility
- Ensuring adequate availability of rescue personnel, ladders, aerial lift/scissor lift, or other rescue equipment

Personnel shall NOT be permitted to utilize a personal fall arrest system as a means of fall protection unless the practices and/or methods necessary to ensure prompt recognition of a fall and timely rescue from the hanging position are in place for the specific application.

If outside rescue services are to be utilized, ANSI Z359.2-2007 Section 6.3 shall be complied with. Outside rescue services must be readily available and/or on stand-by when utilizing them for rescue.

If onsite rescue services/personnel are to be utilized, rescuers shall be trained in the necessary techniques to perform the required rescues and shall be furnished with all necessary equipment. Onsite rescue personnel must be notified that employees are working in fall arrest equipment and be readily available to perform a timely rescue if needed.

The following guidelines shall be utilized when providing medical care following a fall arrested with a personal fall arrest system.

- DO NOT place fall victim in a prone or supine position upon rescue;
- Provide standard trauma care;

- Monitor the worker after rescue, and ensure that the worker is evaluated by a health-care professional;
- The worker should be hospitalized, when appropriate, as possible delayed effects, such as kidney failure, which is not unusual in these cases, are difficult to assess on the scene.

4-3.6. TRAINING

All employees shall be apprised of general fall protection requirements, including the need to protect temporary openings, when fall protection systems are necessary, and the need to tie-off when working from an aerial lift.

All employees shall be trained in the proper use and application of fall protection prior to being assigned a work task requiring its use. This includes:

- The nature of fall hazards in the workplace and the recognition of the need for fall protection in the course of their work at the work site;
- Review of this Fall Protection Program;
- The proper use, care, inspection, and limitations, including proper selection of improvised anchor points and calculating fall distances;
- Rescue planning for personal fall arrest systems, implementation and post-rescue care;
- Working near floor or wall openings and how to properly protect those openings;

Refresher training shall be conducted whenever:

- There is reason to believe that the employee does not have the understanding or the skill to properly identify the need for fall protection and/or properly inspect and utilize fall protection equipment;
- Changes in the workplace render previous training obsolete;
- Changes in the types of fall protection equipment available render previous training obsolete.

Employee fall protection safety training documentation shall be maintained in the project file. Training attendance records shall contain the names of employees, the date of the training, and the name/signature of the person who conducted the training. The latest training certification shall be maintained for each trained employee.

4-4. STANDARD OPERATING PROCEDURE FOR PREVENTING HEAT STRESS

This standard operating procedure (SOP) describes situations where heat stress is likely to occur and provides procedures for the prevention and treatment of heat-related injuries and illnesses. Wearing personal protective equipment (PPE), especially during warm weather, puts employees at considerable risk of developing heat-related illness. Health effects from heat stress may range from transient heat fatigue or rashes to serious illness or death.

Many factors contribute to heat stress, including PPE, ambient temperature and humidity, workload, and the physical condition of the employee, as well as predisposing medical conditions. However, the primary factors are elevated ambient temperatures in combination with fluid loss. Because heat stress is one of the more common health concerns that may be encountered during field activities, employees must be familiar with the signs, symptoms, and various treatment methods of each form of heat stress. Heat stroke is the most serious heat-related illness—it is a threat to life and has a 20 percent mortality rate. Direct exposure to sun, poor air circulation, poor physical condition, and advanced age, directly affect the tendency to heat stroke. Table 1 lists the most serious heat conditions, their causes, signs and symptoms, and treatment.

TABLE 1
HEAT STRESS CONDITIONS

Condition	Causes	Signs and Symptoms	Treatment
Heat cramps	Fluid loss and electrolyte imbalance from dehydration	• Painful muscle cramps, especially in legs and abdomen • Faintness • Profuse perspiration	• Move affected worker to cool location • Provide sips of liquid such as Gatorade® • Stretch cramped muscles • Transport affected worker to hospital if condition worsens
Heat Exhaustion	Blood transport to skin to dissipate excessive body heat, resulting in blood pooling in the skin with inadequate return to the heart	• Weak pulse • Rapid and shallow breathing • General weakness • Pale, clammy skin • Profuse perspiration • Dizziness • Unconsciousness	• Call 911 • Move affected worker to cool area • Remove as much clothing as possible • Provide sips of cool liquid or Gatorade® (only if conscious) • Fan the person but do not overcool or chill • Treat for shock / recline and elevate legs •

Condition	Causes	Signs and Symptoms	Treatment
Heat Stroke	Life threatening condition from profound disturbance of body's heat-regulating mechanism	• Dry, hot, and flushed skin • Constricted pupils • Early loss of consciousness • Rapid pulse • Deep breathing at first, and then shallow breathing • Muscle twitching leading to convulsions • Body temperature reaching 105 or 106 °F or higher	• Call 911 • Move victim to cool area • Remove as much clothing as possible • Reduce body heat promptly by dousing with water or wrapping in wet cloth • Place ice packs under arms, around neck, at ankles, and wherever blood vessels are close to skin surface • Protect patient during convulsions

Heat Reduction. One of the best ways to reduce heat stress on workers is to minimize heat in the workplace by using engineering controls. However, there are some work environments where heat production is difficult to control, such as when furnaces or sources of steam or water are present in the work area or when the workplace itself is outdoors and exposed to varying warm weather conditions.

Acclimatization. Humans are, largely, capable of adjusting to the heat (acclimatization). This adjustment to heat, under normal circumstances, usually takes about 5 to 7 days, during which time the body will undergo a series of changes that will make continued exposure to heat more endurable. On the first day of work in a hot environment, the body temperature, pulse rate, and general discomfort will be higher. With each succeeding daily exposure, all of these responses will gradually decrease, while the sweat rate will increase. When the body becomes acclimated to the heat, the worker will find it possible to perform work with less strain and distress. Gradual exposure to heat gives the body time to become accustomed to higher environmental temperatures. Heat disorders in general are more likely to occur among workers who have not been given time to adjust to working in the heat or among workers who have been away from hot environments and who have gotten accustomed to lower temperatures. Hot weather conditions of the summer are likely to affect the worker who is not acclimatized to heat. Likewise, workers who return to work after a leisurely vacation or extended illness may be affected by the heat in the work environment. Whenever such circumstances occur, the worker should be gradually reacclimatized to the hot environment.

Drinking Fluids. In the course of a day's work in the heat, a worker may produce as much as 2 to 3 gallons of sweat. Because so many heat disorders involve excessive dehydration of the body, it is essential that water intake during the workday be about equal to the amount of sweat produced. The

worker should drink 6 to 8 ounces of fluids (water with an occasional sports drink) every 15 to 20 minutes to replenish the necessary fluids in the body. These fluids should be consumed during rest periods and/or anytime employees feel the need. *Avoid caffeine and alcoholic beverages*. These beverages make the body lose water and increase the risk for heat illness.

Training is an important component of heat stress prevention. Employees are instructed to recognize and treat heat-related illnesses during 8-hour health and safety refresher and first aid training courses. When working in hot environments, specific steps should be taken to lessen the chances of heat-related illnesses. These include the following:

- Ensuring that all employees drink plenty of fluids (water, sports drinks etc.).
- Ensuring that frequent breaks are scheduled so overheating does not occur.
- Revising work schedules, when necessary, to take advantage of the cooler parts of the day (such as working from 5:00 a.m. to 11:00 a.m. and 6:00 p.m. to nightfall).
- Implementing additional methods to reduce or eliminate heat related illnesses (fans, misters, cool vests, portable air conditioning, etc.)

When PPE must be worn (especially Levels A and B), suggested guidelines relating to ambient temperature and maximum wearing time per excursion are as shown below in Table 2.

TABLE 2
SUGGESTED GUIDELINES WHEN WEARING PPE

Ambient Temperature	Maximum PPE Wearing Time per Excursion
Above 90 °F	15 minutes
85 to 90 °F	30 minutes
80 to 85 °F	60 minutes
70 to 80 °F	90 minutes
60 to 70 °F	120 minutes
50 to 60 °F	180 minutes

Source: National Institute for Occupational Safety and Health (NIOSH). 1985. Memorandum Regarding Recommended Personal Protective Equipment Wearing Times at Different Temperatures. From Austin Henschel. To Sheldon Rabinovitz. June 20.

To monitor the level of an employee's heat stress, the following should be measured:

- Heart Rate: Count the radial (wrist) pulse during a 30-second period as early as possible in the rest period; if heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.

If the heart rate still exceeds 110 beats per minute at the next period, shorten the following work cycle by one-third.

- Oral Temperature: Use a clinical thermometer (3 minutes under the tongue) to measure the oral temperature at the end of the work period. If oral temperature exceeds 99.6 °F (37.6 °C), shorten the next work cycle by one-third without changing the rest period. If oral temperature still exceeds 99.6 °F at the beginning of the next rest period, shorten the following work cycle by one-third. Do not permit a worker to wear impermeable PPE when his or her oral temperature exceeds 100.6 °F (38.1 °C).

4-5. STANDARD OPERATING PROCEDURE FOR PREVENTING COLD STRESS

This standard operating procedure (SOP) describes situations where cold stress is likely to occur and provides safe work practices for the prevention and treatment of cold-related injuries and illnesses. Cold conditions may present health risks to employees during field activities. The two primary factors that influence the risk potential for cold stress are temperature and wind velocity. Wetness can also contribute to cold stress. Other factors that increase susceptibility to cold stress include age (very young or old), smoking, alcohol consumption, fatigue, and wet clothing. Hypothermia can occur at temperatures above freezing if the individual has on wet or damp clothing or is immersed in cold water.

The combined effect of temperature and wind can be evaluated using a wind chill index as shown in Table 1.

Bare flesh and body extremities that have high surface area-to-volume ratios such as fingers, toes, and ears are most susceptible to wind chill or extremely low ambient temperatures. Since cold stress can result in serious injury or death, employees must be familiar with the signs and symptoms and various treatments for each form of cold stress. Table 2 provides information on frostbite and hypothermia, the two most common forms of cold-related injuries.

Training is an essential component of cold stress prevention. Employees are instructed to recognize and treat cold-related injuries during first-aid and other safety and health training courses. When working in cold environments, specific steps should be taken to lessen the chances of cold-related injuries. These include the following:

- Protection of exposed skin surfaces with appropriate clothing (such as face masks, handwear, and footwear) that insulates, stays dry, and blocks wind.
- Shielding the work area with windbreaks to reduce the cooling effects of wind.
- Providing equipment for keeping workers' hands warm by including warm air jets and radiant heaters in addition to insulated gloves.
- Using adequate insulating clothing to maintain a body core temperature of above 36 °C.
- Providing extra insulating clothing on site including insulated hats or hard hat liners.
- Reducing the duration of exposure to cold
- Changing wet or damp clothing as soon as possible
- Monitoring for dehydration and assure plenty of liquids are available

During periods of extreme cold (10 °F or less) workers must use the buddy system to ensure constant protective observation.

Specific monitoring criteria are not established for cold stress. However, employees should be thoroughly cognizant of the signs and symptoms of frostbite and hypothermia (see Table 2) in themselves as well as in coworkers. Workers should be instructed to perform self-checks at designated frequencies to identify initial signs and symptoms of cold stress. All instances of cold stress should be reported to the Site Safety Officer or Supervisor. Work schedules should be adjusted and warm-up regimens (warm shelter and warm drinks) imposed as needed to deal with temperature and wind conditions.

TABLE 1

COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED AS EQUIVALENT TEMPERATURE

Estimated Wind Speed (in miles per hour - mph)	**Actual Temperature Reading (°F)**											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
CALM	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	*LITTLE DANGER* in less than 1 hour with dry skin; maximum danger from false sense of security				*INCREASING DANGER* from freezing of exposed flesh within 1 minute				*GREAT DANGER* that flesh may freeze within 30 seconds			
	Trench foot may occur at any point on this chart.											

Source: Modified from American Conference of Governmental Industrial Hygienists. 1997. "Threshold Limit Values for Chemical Substances and Physical Agents."

TABLE 2

COLD STRESS CONDITIONS

Condition	Causes	Signs and Symptoms	Treatment
Frostbite	Freezing of body tissue, usually the nose, ears, chin, cheeks, fingers, or toes	• Pain in affected area that later goes away • Area feels cold and numb • Incipient frostbite (frostnip) - skin is blanched or whitened and feels hard on the surface • Moderate frostbite - large blisters • Deep frostbite - tissues are cold, pale, and hard	Call 911 Move affected worker to a warm area Immerse affected body part in warm (100 to 105 °F) water—not hot! Handle affected area gently; do not rub After warming, bandage loosely
Hypothermia	Exposure to freezing or rapidly dropping temperatures	• Shivering, dizziness, numbness, weakness, impaired judgment, and impaired vision • Apathy, listlessness, or sleepiness • Loss of consciousness • Decreased pulse and breathing rates • Death	Call 911 Immediately move affected person to warm area Remove all wet clothing and redress with loose, dry clothes Provide warm, sweet drinks or soup (only if conscious)

4-6. STANDARD OPERATING PROCEDURES FOR WORK WITH OR AROUND ELECTRICITY

This standard operating procedure (SOP) establishes standards to prevent injuries to the Department of Natural Resources Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) employees resulting from electrical work. The site safety officer is responsible for ensuring that work areas are evaluated for the presence of high-voltage or other hazardous electricity sources and that all electrical equipment and circuits are de-energized prior to any normal electrical maintenance work. Any site-specific safe electrical work practices should be identified and detailed in the site-specific health and safety plan (HASP) for hazardous waste site activities, or in a specific written SOP for the work site. Power lines, general safe work practices, and grounding are discussed below.

4-6.1. POWER LINES

Site activities will proceed with caution in any area where historical data or instrument surveys indicate the presence of utility lines (such as gas, telephone, and other lines). The site safety officer will coordinate all site activities at these locations.

The minimum clearances summarized below will be maintained between equipment and energized overhead power lines. Additional distances may be required depending on equipment in use, wind conditions, sway distance of lines and the equipment, and other factors causing changes in the spatial relationship of the equipment and power line.

Voltage	Working Clearance	Equipment Clearance (feet)
Less than 50 kilovolts (kV)	10 feet	4
50 to less than 345 kV	10 feet, plus 4 inches per extra 10kV (50 kV or more)	10
345 to 750 kV	10 feet, plus 4 inches per extra 10kV (50 kV or more)	16

If site activities near power lines are required, necessary arrangements to turn off the power will be coordinated by the project manager.

Electrical service shall be provided by qualified and in some cases certified electricians in accordance with all applicable local and National Electric Codes (NEC) for electrical equipment or circuits operating at 50 volts or more for site or project activities. Before work begins, site safety officer shall ascertain by

inquiry, direct observation or instruments whether any part of an energized electric power circuit, exposed or concealed, is located so that the performance of work may bring any person, tool, or machine into physical or electrical contact with the electrical power circuit. The location shall be posted wherever such a circuit exists. All employees shall be advised of the location of such lines, the hazards involved, and the protective measures to be taken.

4-6.2. GENERAL SAFE WORK PRACTICES

The general procedures below shall be implemented, depending on site location, equipment, and work to be performed.

- Site team members should locate and ensure that there will be no adverse contact with overhead utilities prior to positioning or moving any elevated work platform.
- Ground fault circuit interrupters should be used in the absence of properly grounded circuitry or when portable tools must be used around wet areas.
- Hands shall not be wet when plugging and unplugging electrical equipment and extension cords.
- Electric lines, cables, and extension cords shall be guarded and maintained in good condition.
- All underground power lines should be identified and maintained before any ground-breaking work is performed.
- All power equipment should be locked out before the commencement of work by following the WHS SOP for “Control of Hazardous Energy Sources (Lockout/Tagout)” in Section 4-7 of the Division Health and Safety Manual. These procedures shall apply to all electrical circuits, electrical power equipment, steam systems, hydraulic systems, compressed air and gas systems, and any other systems that have the potential for causing injury or damage if they are improperly or accidentally energized.
- All temporary electrical equipment used on a project should conform to the NEC, the National Electrical Safety Code, and other site requirements for that specific application.
- All equipment and extension cords must be inspected visually for defects or damage prior to each use. Any equipment exhibiting evidence of damage shall be immediately removed from service, discarded, and/or tagged with “DANGER: DO NOT OPERATE”

tags until necessary repairs are completed. No damaged or defective electrical tools shall be used.

- Extension cords should be used with portable electric tools of the three-wire type, protected from damage, and not fastened with staples, hung from nails, or suspended from wires. Worn or frayed cables shall not be used.
- Portable task lights should be equipped with guards. Temporary lights should not be suspended by electric cords unless designed for suspension. Broken or burned out lamps must be replaced immediately.
- Receptacles for attachment plugs of the approved, concealed-contact type should be used. Where different voltages, frequencies, or type of current are supplied, receptacles should be of such design that attachment plugs are not interchangeable.
- Each disconnecting means for motors and appliances and each service feeder or branch circuit should be marked legibly at the point where it originates to indicate its purpose unless such devices are located and arranged so that the purpose is evident.
- Cables passing through work areas should be covered or elevated to protect them from damage. Cables and cords should be kept clear of walkways and other locations where they may be damaged or create tripping hazards.
- Boxes for disconnecting electricity should be secured, rigidly fastened, and fitted with covers.
- Appropriate warning signs should be posted in high-voltage areas, which should also be barricaded.
- Energized wiring in boxes, circuit breaker panels, and similar places should be covered at all times.
- All ladders used near energized electrical circuits shall have non-conductive side rails. No metal ladders shall be used for electrical work.
- Conductive articles of jewelry and clothing (such as watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or metal frame glasses) shall not be worn where they present an electrical contact hazard with exposed live parts.

- Under no circumstances should anyone initiate work with or on a piece of equipment until they fully understand the operation and are confident that adequate safety precautions are in place. Site safety officer shall not permit any employee to work near any part of an electric power circuit that the employee could contact in the course of work unless the employee is protected against electric shock by de-energizing the circuit and grounding it, or by guarding it effectively by insulation, barricades, or other means.
- Before starting each job involving exposure to energized electrical equipment, the site safety officer shall conduct a job briefing with the employees involved. The briefing shall cover such subjects as hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements.

4-6.3. GROUNDING

The grounding procedures below shall apply as appropriate the project site. Additional site-specific procedures shall be detailed in the site-specific HASP for hazardous waste site activities.

- All electrical tools and equipment must be approved, double-insulated, and properly grounded or used with ground-fault circuit interrupters.
- For 15- and 20-ampere receptacle outlets on single-phase, 120-volt circuits that are not part of the permanent wiring of the building or structure, either ground-fault circuit interrupters or an approved equipment grounding conductor program will be used.

An equipment grounding conductor program will include the following:

- Each cord set, attachment cap, plug, and receptacle of cord sets, and any equipment connected by a cord and plug, except cord sets and receptacles that are fixed and not exposed to damage, will be inspected before each day's use for external defects and possible internal damage.
- Tests will be performed on all cord sets, receptacles that are not part of the permanent wiring of the building or structure, and cord- and plug-connected equipment required to be grounded. Grounding conductors will be tested for continuity. Each receptacle and attachment cap or plug will be tested for correct attachment of the equipment-grounding conductor.

4-6.4. TRAINING

Employees who may reasonably be expected to face a comparable risk of injury due to electric shock (greater than 50 Volts) or other electrical hazards must be trained.

Unqualified Employees (i.e., those not permitted to work on or near exposed energized parts) shall be trained on this program and general electrical safety related work practices that pertain to their respective job assignments. Unqualified Employees shall be able to demonstrate an awareness and understanding of electrical hazards. At a minimum training shall include:

- Selection and use of work practices
- Use of applicable equipment
- Safeguards for personnel protection (including clearance distances)

Qualified Workers (i.e., those permitted to work on or near exposed energized parts) shall be, at a minimum, trained in and familiar with the following:

- The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment,
- The skills and techniques necessary to determine the nominal voltage of exposed live parts,
- The appropriate clearance distances and the corresponding voltages to which the qualified person will be exposed, and
- The proper use of procedures, PPE, testing instruments, insulating and shielding materials, and insulated tools for working on or near exposed parts of electrical equipment.
- The requirements contained in this program.

4-7. CONTROL OF HAZARDOUS ENERGY SOURCES (LOCKOUT/TAGOUT)

This standard operating procedure (SOP) establishes minimum requirements for the lockout and tagout of energy-isolating devices whenever maintenance or servicing is performed on machines or equipment. This SOP will be used to ensure that the machine or equipment is stopped, isolated from all potentially hazardous energy sources, and locked out and tagged out before Department of Natural Resources and Environmental Control (DNREC) Division Waste and Hazardous Substances (WHS) employees perform any servicing or maintenance during which the unexpected energization or startup of the machine or equipment or release of stored energy could cause injury. This document follows requirements of Title 29 of the *Code of Federal Regulations* (CFR), Part 1910.147: the "Control of Hazardous Energy (Lockout/Tagout)."

The applicability of this SOP and definitions, responsibilities, and procedures associated with lockout and tagout are discussed below.

4-7.1. APPLICABILITY

This SOP applies to all WHS employees who may perform service or maintenance activities on equipment that could result in injury from equipment startup or energization. Only trained and authorized employees are permitted to perform lockout and tagout procedures in accordance with this SOP. Upon observing a machine or piece of equipment that is locked out and tagged out to perform servicing or maintenance, an employee shall not attempt to start, energize, or use that machine or equipment.

The following situations are exempt from the requirements of this SOP:

- Cord- and plug-connected electrical equipment under sole control of the employee performing the service or maintenance
- Installation of power by a utilities service

If work is conducted at a site where a contractor or the site has an existing lockout/tagout procedure, the WHS project manager/project officer or designee (such as the site safety officer) shall inform the contractor or site personnel of WHS procedures and request access to their respective procedures.

4-7.2. DEFINITIONS

Affected Employee: An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under Lockout/Tagout or whose job requires him or her to work in an area in which such servicing or maintenance is being performed. An affected worker cannot perform work under a Lockout/Tagout.

Authorized Employee: A person who either applies the locks and tags on machines, equipment and systems or works under the protection of Lockout/Tagout in order to perform testing, servicing, or maintenance on that machine or equipment. This person has completed the mandatory training to be qualified as an Authorized Employee. Only an Authorized Employee installs and removes his or her own lock(s) and tag(s) as required by this program.

Energy-isolating device: A mechanical device that physically prevents the transmission or release of energy

Lockout: Placement of a lockout device on an energy-isolating device to ensure that the energy-isolating device and the equipment being controlled cannot be operated until the lockout device is removed

Lockout device: A device that uses a positive means, such as a key or combination lock, to hold an energy-isolating device in a safe position and prevent energizing of machine or equipment

Tagout: Placement of a tag on an energy-isolating device to indicate that the energy-isolating device and the equipment controlled must not be operated until the tag is removed

Tagout device: A prominent warning device, such as an attached tag, that can be securely fastened to an energy-isolating device to indicate that the equipment may not be operated until the tag is removed

4-7.3 RESPONSIBILITIES

Program/section managers will support project managers/project officers in application of this SOP whenever necessary. The program/section manager may choose to delegate certain responsibilities, such as training and inspection, to other qualified personnel. The program/section manager should contact the Integrated Health and Safety Workgroup (IHSW) for assistance with and evaluation of implementation of this SOP.

Project managers/project officers shall ensure and enforce necessary lockout procedures on their projects.

4-7.4. PROCEDURES

Procedures to ensure adequate energy control, employee training, and periodic inspections are discussed below.

4-7.4.1. ENERGY CONTROL PROCEDURES

This section describes basic procedures to follow for machine or equipment lockout/tagout. Whenever feasible, equipment should be locked out. Only when lockout is physically not feasible may tagout be the sole means of energy control. When a tagout system is used, it must offer full employee protection

similar to that of a lockout system. Tagout devices shall be affixed in such a manner as will clearly indicate that there should be no operation or movement of energy isolating devices from the safe or off position.

The tagout system includes all of the steps of this lockout program except the actual use of a lockout device on that particular energy isolation device. Additional means to be considered as a part of the demonstration of full employee protection shall include the implementation of additional safety measures such as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energizing.

4-7.4.1.1. LOCKOUT OR TAGOUT SEQUENCE

The following sequence of activities must be followed for proper lockout or tagout:

- All affected employees should be notified that servicing or maintenance is required on a machine or equipment and that the machine or equipment must be shut down and locked out to perform the servicing or maintenance. The notification can be provided verbally, or else a written notice of intent to lockout for service or maintenance can be posted.

  The employee conducting the servicing or maintenance shall refer to all available reference materials and information sources to identify the type and magnitude of energy that powers the machine or equipment, shall understand the hazards of the energy, and shall know methods to control the energy. Energy sources to be considered include:

  - Electrical
  - Hydraulic
  - Pneumatic
  - Steam
  - Tension
  - Gravity

- If the machine or equipment is currently operating, it must be shut down by the normal stopping procedure (such as depressing the stop button, opening the switch, closing the valve, or another method).
- The energy-isolating device(s) should be deactivated so that the machine or equipment is isolated from the energy source(s).

- The energy-isolating device(s) can then be locked out with assigned individual lock(s). Each lock must be accompanied by a "DANGER, DO NOT OPERATE" tag explaining why the equipment is locked out of service. Tags should contain complete information, such as name of servicing or maintenance employee, complete date, and reason for the tag. Tags must be written legibly. Each employee who has locked out the equipment will retain the lock key in his or her possession as long as the lock is installed. Locks and tags used for lockout/tagout must be substantial, standardized, and only be used for the purpose of lockout/tagout.

Note: Installing locks on ordinary stop-start stations is not considered a satisfactory electrical lockout. Lockout must occur at a circuit breaker, disconnect switch, block, or any similar device to block or isolate energy.

- Stored or residual energy (such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure) must be dissipated or restrained by methods such as grounding, repositioning, blocking, or bleeding down, as appropriate.

- Personnel should ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, and then by verifying the isolation of the equipment by operating the "on" switch or other normal operating control(s) or by testing to make certain that the equipment will not operate.

Caution: Operating controls should be returned to a neutral or "off" position after isolation of the equipment is verified.

- The machine or equipment is now locked out.

Each employee working on the equipment must be satisfied that it is safe for him or her to proceed with the work. Only the employee who has placed the lock can remove it, even if that person leaves the area with the lock or tag left on the equipment. Anytime an Authorized Employee leaves the site and keeps their locks/tags on equipment, the Authorized Employee is required to re-check the position of the energy isolation devices, check that their locks/tags are in-place, and conduct an energy verification check before resuming work on the equipment.

During larger projects it may be necessary to have several personnel working on one piece of equipment. In this case, it is permissible to have a group LOTO. Options would be to have all Authorized Employees apply their locks/tags to all energy isolation devices (may require the use of a multi-lock hasp at each

energy isolation point) or a group lockbox may be used (all keys to the energy isolation locks are placed in the lockbox and each authorized employee places their lock/tag on the lockbox). Group lockout shall be coordinated between all Authorized Employees.

When applicable, WHS and Contractors will inform each other of their respective Lockout/Tagout procedures. This does not equate to providing Lockout/Tagout training to an outside employer and their employees. For the protection of the WHS employees, the Contractor's LOTO program must be reviewed to ensure that WHS employees are not placed in "harm's way" as a result of allowing the Contractor's LOTO program and procedures to be implemented at the work site.

4-7.4.1.2. RESTORATION OF EQUIPMENT TO SERVICE

When the servicing or maintenance job is completed and the machine or equipment is ready to return to normal operating conditions, the following steps shall be taken:

- The machine or equipment and the area around the machine or equipment should be checked to ensure that nonessential items have been removed and that machine or equipment components are operationally intact (i.e. guards installed).
- The work area should be checked to ensure that all employees have been safely positioned or removed from the area.
- The controls should be in a neutral or "off" position.
- The lockout or tagout devices should be removed and the machine or equipment re-energized in the proper sequence.
- Affected employees should be notified that the servicing or maintenance is completed and the machine or equipment is ready for use.

Note: Some forms of blocking may require re-energization of the machine before the blocking can be safely removed.

4-7.4.2. EMPLOYEE TRAINING

Affected Employees shall be instructed in the purpose and use of WHS' Lockout/Tagout Program.

Training shall be provided to all Authorized Employees who may be required to use lockout and tagout procedures to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of the

energy controls are acquired by employees. The training shall cover the following topics as mandated in 29 CFR 1910.147:

- Types and magnitude of energy sources anticipated
- Methods of energy isolation and control
- Purpose and use of energy control procedures
- Limitations of tagout systems

Retraining will be provided any time potential energy sources change or deviations are noted in techniques and procedures used by trained employees that do not comply with previously taught methods. Retraining will also be conducted when a periodic inspection of the effectiveness of this procedure reveals inadequacies in employee knowledge or performance.

Employees must maintain training records in the Department's training database.

4-7.4.3. PERIODIC INSPECTIONS

At a minimum, inspections of compliance with this SOP by the site safety officer will be conducted as required by 29 CFR 1910.147(c)(6). Because of the low frequency of use of this SOP, compliance inspections will be conducted randomly on projects with known lockout and tagout needs.

Inspections will be documented using the "Lockout/Tagout Periodic Inspection Certificate", Attachment 1 to this SOP.

4-8. STANDARD OPERATING PROCEDURES FOR PORTABLE LADDER SAFETY

This standard operating procedure (SOP) applies to portable ladders only. Fixed ladder systems shall be used when regular access is required such as for entering storage tanks and raised work platforms. This SOP follows the regulatory requirements for ladders as found in Title 29 of the *Code of Federal Regulations* (CFR) Part 1926.1053.

4-8.1. LADDER SAFETY REQUIREMENTS

Procedures to ensure portable ladder safety are listed below.

- Ladders shall be used only for the purpose for which they were designed. A ladder shall never be used as a platform, plank, brace, hoist or scaffold. Step ladders shall not be used as straight ladders.
- Ladders must be maintained in good condition at all times. Damaged ladders shall be withdrawn from service immediately and disposed, or tagged “Broken -Do Not Use” until repairs to the ladder can be made.
- Ladders must be have a minimum Duty Rating of Type I, Heavy Duty Industrial (250 lbs).
- All markings, ratings, and labels from the manufacturer must be in-place and legible.
- Ladders must be inspected before use and removed from service and repaired or discarded if defective.
- Workers shall wear suitable work shoes and check their soles for any slippery substances before climbing a ladder. Ladder rungs must have slip-resistant surfaces and be kept free of grease and oil.
- Tops and pail shelves of portable stepladders must not be used as steps. Steps marked as do not use by the manufacturer shall not be used (i.e. second step on a 5 foot or greater step ladder).
- Rung and cleat ladders must be placed so that the horizontal distance from the top support to the foot of the ladder is one-quarter of the working length of the ladder (4:1 ratio).
- Ladder side rails shall extend at least 3 feet above the upper landing surface which the ladder is used to access.

- Ladder shall be used only on stable and level surfaces. Ladders will not be placed on slippery surfaces. An additional person may be needed to support the ladder during the initial set-up of the ladder and/or during the entire work task.
- Ladders shall not be placed in front of doorways, drives, or passageways.
- Ladders shall not be placed on boxes, barrels, or other unstable bases to add height.
- Only one person shall climb or work off a single ladder. Employees must always face the ladder during ascent or descent.
- Both hands shall be used to ascend or descend a ladder. Three points of contact must remain on the ladder at all times (ex. 2 hands and a foot or 2 feet and a hand) unless adequate fall protection or prevention is used. Ropes shall be used to raise and lower materials to the necessary elevation. Use carriers and tool belts to carry objects up a ladder.
- Fall protection or prevention shall be utilized when working off a ladder above 6 feet and there are less than 3 points of contact on the ladder. Consider the use of lifting equipment such as a scissor lift or aerial lift when having to perform tasks which otherwise would require employees to work on portable ladders at a height greater than 6 feet.
- Metal ladders shall not be used in areas with the potential for contact with electric circuits.
- When a job is completed, all ladders shall be returned to an approved storage location in good condition and ready for use.

4-8.2. TRAINING

Training shall be provided, by a qualified person, for all employees who may be required to use a ladder.

Training shall include:

- The procedures for proper selection, set-up, and use of ladders (including the awareness of improper usage of ladders).
- The maximum intended load-carrying capacities of ladders.
- The requirements for inspecting, maintaining, and storing of ladders.
- The three points of contact rule.

- Review of the WHS's Ladder Safety Program and applicable OSHA Standards.

Retraining shall be conducted when:

- Changes in the workplace or type of ladder render previous training obsolete.
- Inadequacies in employee's knowledge or use of ladder equipment indicate that the employee has not retained the required understanding or skill.

4-9. STANDARD OPERATING PROCEDURE FOR SAFE DRILLING

This document establishes standard operating procedures (SOPs) for drilling operations. This SOP is based on suggested safety procedures provided in the National Drilling Association's "Drilling Safety Guide." Procedures to follow before, during, and after drilling are listed below.

Before beginning any drilling operation, each employee must be made aware by the Site Safety Officer of the following safe work practices:

- Insure "Miss Utility" contact and clearance for underground utilities or other issues.
- Wear a hard hat, safety glasses or goggles, steel-toed work boots, a shirt and full-length pants when working with or near the drill rig. Shirts must be tucked in at the belt.
- Do not wear loose or frayed clothing, loose long hair, or loose jewelry while working with rotating equipment.
- Do not eat, drink, or smoke near the drill rig.
- Utility companies or a utilities locating service for the area must be notified **before drilling activities begin** to arrange for locating and protecting underground utilities. Ensure that the drill rig and any other machinery used are inspected daily by competent, qualified individuals. Test all emergency equipment (emergency stop) to ensure it is operational before actual work commences.
- Drill rig operators will be instructed to report any abnormalities, such as equipment failure, oozing liquids, and unusual odors, to their supervisors or the Site Safety Officer (SSO).
- Establish hand-signal communications for use when verbal communication is difficult. One person per work team will be designated to give hand signals to equipment operators.

While the drill rig is operating, employees must be aware by the Site Safety Officer of the following safe work practices:

- Wear appropriate respiratory and personal protective equipment (PPE) when conditions warrant their use. Respirators will be used in accordance with WHS's Respiratory Protection Program, Section 2-4.
- Avoid direct contact with known or suspected contaminated surfaces.
- Move tools, materials, cords, hoses, and debris to prevent tripping hazards and contact with moving drill rig parts.

- Adequately secure tools, materials, and equipment subject to displacement or falling.
- Store flammable materials away from ignition sources and in approved containers.
- Maintain adequate clearance of the drill rig and mast from overhead transmission lines. The minimum clearance is 25 feet unless the utility company grants special permission and the lines are de-energized or shielded. Call the local utility company for proper clearance.
- Only qualified and licensed personnel should operate drill rigs.
- Workers should not assume that the drill rig operator is keeping track of their exact location. Workers should never walk directly behind or beside heavy equipment without the operator's knowledge.
- Workers should maintain visual contact with drill rig operators at all times.
- When an operator must maneuver equipment in tight quarters, the presence of a second person is required to ensure adequate clearance. If much backing is required, two ground guides will be used: one in the direction the equipment is moving, and the other in the operator's normal field of vision to relay signals.
- Auger sections and other equipment are extremely heavy. All lifting precautions should be taken before moving heavy equipment. Appropriate equipment, such as chains, hoists, straps, and other equipment, should be used to safely transport heavy equipment too heavy to safely lift. Rigging equipment shall be inspected by a qualified person before use. Damaged rigging equipment shall not be used.
- Proper personal lifting techniques will be used. Workers should lift using their legs, not their backs. Get assistance or use mechanical means for loads that cannot be safely managed by one person.
- Workers will not use equipment with which they are not familiar. This precaution applies to heavy as well as light equipment.
- All personnel not essential to work activities will be kept out of the work area.
- Workers will be aware of their footing at all times.
- Workers will remain alert at all times.

After drilling operations are completed, employees shall do the following:

- Shut down machinery before repairing or lubricating parts (except parts that must be in motion for lubrication).
- Shut down mechanical equipment prior to and during fueling operations. When refueling or transferring fuel, containers and equipment must be bonded to prevent the buildup of static electricity.
- Keep drill rigs in the exclusion zone until work has been completed. Such equipment should then be decontaminated within the designated decontamination area.
- Engage parking brakes when equipment is not in use.
- Implement an ongoing maintenance program for all tools and equipment. All tools and moving equipment should be inspected regularly to ensure that parts are secured, are intact, and have no cracks or areas of weakness. The equipment must turn smoothly without wobbling and must operate in accordance with manufacturer specifications. Defective items should be promptly repaired or replaced. Maintenance and repair logs will be kept.
- Store tools in clean, secure areas to prevent damage, loss, or theft.

4-10. STANDARD OPERATING PROCEDURE FOR SAFE EXCAVATION

This standard operating procedure (SOP) outlines minimum requirements to protect employees who may be exposed to hazards during trenching and excavation activities and to provide general guidance for compliance with Title 29 of the *Code of Federal Regulations* (CFR), Part 1926, Subpart P, "Excavations."

Project managers/project officers shall ensure that all excavation, shoring, and trenching activities are conducted in accordance with the requirements outlined in this document and Subpart P of 29 CFR 1926. Project managers/project officers must also ensure that projects involving trenching and excavation are staffed by an individual capable of performing "competent person" duties as described in this procedure.

The site safety officer (SSO) is responsible for on-site enforcement of this SOP on uncontrolled hazardous waste sites as defined in 29 CFR 1910.120, the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard.

Definitions and procedures used for excavations are discussed below.

4-10.1. DEFINITIONS

The following definitions apply to this SOP:

Benching**:** Forming one or a series of horizontal levels or steps in the sides of an excavation to protect employees from cave-ins.

Competent Person**:** One capable of identifying existing or predictable hazards in the work environment that are unsanitary or dangerous to employees and who has authorization to take prompt corrective measures to eliminate the hazards. A competent person is required to:

- Have a complete understanding of the applicable safety standards and any other data provided.
- Assure the proper locations of underground installations or utilities, and that the proper utility companies have been contacted.
- Conduct soil classification tests and reclassify soil after any condition changes.
- Determine adequate protective systems (sloping, shoring, or shielding systems) for employee protection.
- Conduct all air monitoring for potential hazardous atmospheres.
- Conduct daily and periodic inspections of excavations and trenches.

- Approve design of structural ramps, if used.

Excavation**:** Any manmade cut, cavity, trench, or depression in an earth surface formed by earth removal.

Shield: A structure that is capable of withstanding the forces imposed on it by a cave-in and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. All shields must be in accordance with 29 CFR 1926.652(c)(3) or (c)(4).

Shoring**:** Metal, hydraulic, mechanical, or timber system that supports the sides of an excavation and that is designed to prevent cave-ins.

Sloping**:** Sloping the sides of an excavation at an incline away from the excavation to protect employees from cave-ins.

Trench**:** A narrow excavation (in relation to its length) that is usually deeper than it is wide but less than 15 feet wide.

4-10.2. PROCEDURES

Described below are the general safety requirements and protective system requirements for trenching and excavation activities.

4-10.2.1. GENERAL SAFETY REQUIREMENTS

General safety requirements that must be in place before work begins are as follows:

- Adequate protective systems will be utilized to protect employees. This can be accomplished through sloping, shoring, or shielding.
- Utility companies or a utilities locating service in the area must be notified **before excavation or trenching activities begin** to arrange for locating and protecting underground utilities.
- All overhead hazards (surface encumbrances) that create a hazard to employees must be removed or supported to eliminate the hazard. Employees should not work under loads of digging equipment where loads may fall.
- Access to trenching areas must be controlled and limited to authorized personnel. Prior to entering a trench or excavation, workers must notify the project manager, SSO, and nearby equipment operators whose activities could affect the trench or excavation.

- No person may enter a trench or work at the foot of the face of an excavation until a qualified, competent person has inspected the excavation and determined whether sloping or shoring is required to protect against cave-in or subsidence and the appropriate protection has subsequently been installed.
- A qualified, competent person must assess trenches and excavations even in the absence of working personnel, whenever heavy equipment will be operating nearby in order to ensure that the trench or excavation will support the weight of the equipment without subsistence or causing the accidental overturning of machinery.
- Trenches and excavations must be inspected regularly (daily at a minimum) by a competent person to ensure that changes in temperature, precipitation, shallow groundwater, overburden, nearby building weight, vibration, or nearby equipment operation have not caused weakening of the sides, faces, and floors and to ensure that personnel protection is being maintained.
- When subsidence or tension cracks are apparent anywhere in an excavation, all work should be stopped until the problem is corrected.
- The competent person must inspect trenches or excavations after any precipitation event to ensure integrity has been maintained.
- Sufficient ramps or ladders must be provided in excavations 4 or more feet deep to allow quick egress. Ramps or ladders may be placed no more than 25 feet apart, must be secured from shifting, and must extend at least 3 feet above the top of the trench or excavation. A competent person must design structural ramps. A ladder must be provided for every 10 workers who enter an excavation or trench.
- Material removed from an excavation or trench must be placed far enough from the edge (at least 2 feet) to prevent it from sliding into the excavation or trench or from stressing the trench or excavation walls. Worker protection must also be provided from loose rock or soil on the excavation faces.
- If trenches or excavations are near walkways or roadways, guards or warning barriers must be placed to alert pedestrians and drivers of the presence of the trench or excavation. If work is in or around traffic, employees must be supplied with and wear orange reflective vests.

- If possible, trenches or excavations should be covered or filled in when unattended. Otherwise, strong barriers must be placed around the trench or excavation and lighting must be provided at night if the trench or excavation is near a walkway or roadway.
- When a hazardous atmosphere could exist, the excavation must be tested for appropriate hazardous substances and oxygen level before personnel entry. Excavation where hazardous atmospheres exist must be treated as a permit-required confined space. Entry must follow procedures outlined in the DNREC WHS "Confined Spaced Entry Program" Section 2-5.
- Entry is not allowed into excavations where water has accumulated.

4-10.2.2. PROTECTIVE SYSTEM REQUIREMENTS

Protective systems protect employees from cave-ins, material that could fall in or roll off the face of the excavation, and collapse of adjacent structures. Protective systems include shoring, shielding, sloping and benching, and other systems. Sloping and benching and shoring system requirements are described below.

4-10.2.2.1. SLOPING AND BENCHING REQUIREMENTS

Sloping and benching system construction must follow the guidelines established in Appendix B to Subpart P of 29 CFR 1926. Maximum allowable slopes for excavations are summarized below. All slopes indicated are expressed as the ratio of horizontal distance (H) to vertical rise (V).

Soil or Rock Type	**Maximum Allowable Slope (H:V) for Excavations Less than 20 Feet Deep**
Stable Rock	Vertical (90°)
Type A	0.75:1 (53°)
Type B	1:1 (45°)
Type C	1.5:1 (34°)

Note: benching is not permitted in Type C soil.

Soil types are defined in Appendix A to Subpart P of 29 CFR 1926 and are summarized below.

Type A: Cohesive soils with an unconfined compression strength of 1.5 tons per square foot (ton/ft^2) or greater (such as clay, silty clay, sandy clay, or clay loam)

Type B: Cohesive soils with unconfined compression strength of greater than 0.5 but less than 1.5 ton/ft^2 (such as angular gravel, silt, silt loam, or sandy loam)

Type C: Cohesive soils with an unconfined compression strength of less than 0.5 ton/ft^2 (such as gravel, sand, loamy sand, submerged soil, or unstable submerged rock)

Sloping and benching systems for excavations five (5) to twenty (20) feet in depth must be constructed under the instruction of a designated competent person. Sloping and benching for excavations greater than 20 feet deep must be designed by a registered professional engineer.

The competent person, using at least one visual and one manual test, must determine soil types. Manual tests include plasticity, dry strength, thumb penetration, pocket penetrometer, shearvane, and drying tests.

4-10.2.2.2. SHORING SYSTEM REQUIREMENTS

Appendixes C, D, and E to Subpart P of 29 CFR 1926 outline requirements for timber shoring for trenches, aluminum hydraulic shoring for trenches, and alternatives to timber shoring, respectively. Guidelines for shoring systems are listed below.

- If it is not economically feasible or there are space restrictions to prevent cutting the trench or excavation walls back to a safe angle of repose, all trenches or excavations 5 feet deep or more must be shored.
- Shoring should be erected as trenching or excavation progresses and as closely as possible to the excavation floor.
- Shoring timber dimensions must meet the minimum timber requirements specified in Tables C1.1 through C1.3 of Appendix C to Subpart P 29 CFR 1926. Aluminum hydraulic shoring must be constructed using the guidelines and dimension requirements specified in Appendix D of the same standard.
- Trench shields may be used instead of shoring or bracing. Shields must be constructed of steel flat sides welded to a heavy framework of structural pipe. Shields should be moved along by the excavator as trenching or excavation proceeds. Shielding or trench boxes must extend 18 inches above the top of the excavation. Shields must be placed within 2 feet of the bottom of the excavation. Shielding or trench box manufacturer’s data must be available at the site.

4-11. STANDARD OPERATING PROCEDURES FOR USE OF HEAVY EQUIPMENT

Truck-mounted heavy equipment and field trucks are among the types of equipment that may be used during fieldwork. Heavy equipment can present a substantial hazard to workers. General requirements for motor vehicles and material-handling equipment are provided in the Occupational Safety and Health Administration (OSHA) Construction Industry Standards, 29 CFR 1926, Subpart O. The following precautions will be followed when heavy equipment (such as drill rigs, front-end loaders, and backhoes) is in use:

- The operator before each work shift will inspect heavy equipment. The site safety officer (SSO) or project manager/project officer will ensure compliance with these precautions.
- Equipment operators will be instructed to report any abnormalities, such as equipment failure, oozing liquids, and unusual odors, to their supervisors or the SSO. Heavy equipment shall be inspected daily before use.
- Only trained, qualified and in some cases licensed personnel will operate heavy equipment.
- Hard hats, steel-toed boots, safety glasses or goggles, and high-visibility vests will be worn at all times around heavy equipment. Other personal protective equipment (PPE) specified in the site health and safety plan (HASP) for hazardous waste sites will also be required.
- Workers will never walk directly behind or to the side of heavy equipment without the operator's knowledge.
- Workers in close proximity to heavy equipment will maintain visual contact with equipment operators at all times. Never approach a piece of heavy equipment without first getting the attention of the operator.
- When an operator must maneuver equipment in tight quarters, the presence of a second person will be required to ensure adequate clearance. If backing is required, two ground guides will be used: one in the direction the equipment is moving, and the other in the operator's normal field of vision to relay signals.
- All heavy equipment used at a contaminated work site will be kept in the exclusion zone until the work has been completed. Such equipment will then be decontaminated within the designated decontamination area.
- Hand-signal communications will be established when verbal communication is difficult. One person per work team will be designated to give hand signals to equipment operators.

- An operable horn must be present on all heavy equipment. Equipment with an obstructed rear view must have an audible alarm that sounds when the equipment is moving in reverse (unless a spotter guides the operator).
- Parking brakes will be kept engaged when equipment is not in use.
- Blades, buckets, dump bodies, and other hydraulic systems will be kept fully lowered when equipment is not in use.
- Equipment cabs will be kept free of all nonessential and loose items.
- Seat belts must be present and used in all vehicles having a rollover protective structure (ROPS).
- With certain exceptions, all material-handling equipment must be equipped with ROPS.
- Material-handling equipment that lacks a ROPS will not be operated on a grade unless the grade can safely accommodate the equipment involved.
- Drilling auger sections and other equipment are extremely heavy. All precautions must be taken before moving heavy equipment. Appropriate equipment must be used to transport heavy equipment.
- Only chains, hoists, straps, and other equipment that safely aids transport of heavy materials will be used. All rigging equipment shall be inspected by a competent person before use. Damaged rigging equipment shall not be used.
- Proper personal lifting techniques will be used. Workers will lift using their legs, not their backs. Get assistance or use mechanical means for loads that cannot be safely managed by one person.
- A safety barrier will be used to protect workers when tires are inflated, removed, or installed on split rims.
- An ongoing maintenance program for all tools and equipment must be in place. All tools and moving equipment will be inspected regularly to ensure that parts are secured, are intact, and have no cracks or areas of weakness. The equipment must turn smoothly without wobbling and must operate according to manufacturer specifications. Defective items will be promptly repaired or replaced. Maintenance and repair logs will be kept.
- Tools will be stored in clean, secure areas to prevent damage, loss, or theft.
- Workers will not use equipment with which they are not familiar. This precaution applies to heavy as well as light equipment.

- Loose-fitting clothing and loose, long hair will be prohibited around moving machinery.
- Workers will make sure that no underground or overhead power lines, sewer lines, gas lines, or telephone lines present a hazard in the work area.
- All personnel who are not essential to work activities will be kept out of the work area.
- Workers will be aware of their footing at all times.
- Workers will remain alert at all times.

4-12. STANDARD OPERATING PROCEDURES FOR UNDERGROUND/ABOVE GROUND STORAGE TANK REMOVAL

This Department of Natural resources and Environmental Control (DNREC) Division of Waste and Hazardous Substances (WHS) standard operating procedure (SOP) presents safe work practices for underground storage tank (UST) and above ground storage tank (AST) removal. The SOP also discusses hazards associated with working around a tank removal site. It is based upon procedures recommended by the American Petroleum Institute. Potential hazards associated with the excavation of USTs and ASTs include exposure to organic vapors, dermal exposure to organic contaminants, heat or cold stress, exposure to excessive noise, excavation collapse or other related ground movement, oxygen deficiency, and heavy equipment operation. Site excavations should be sloped or shored as appropriate to prevent accidental collapse and must be in accordance with Title 29 of the *Code of Federal Regulations*, Part 1926, Subpart P, and as described in SOP "Excavation Practices" in Section 4-10 of this manual. Requirements for monitoring organic vapors and gases are discussed in the DNREC WHS "Air Monitoring Program" in Section 3-3 of this manual. Additional SOPs pertaining to tank removal include "Flammable Hazards and Ignition Sources" (Section 4-17 of this manual) "Spill and Discharge Control Practices" (Section 4-16 of this manual) and "Oil and Petroleum Distillate Fuel Products Hazards" (Section 4-18 of this manual).

General tank-related safety considerations and removal activities are discussed below.

4-12.1. GENERAL SAFETY CONSIDERATIONS

The Project Manager/ Project Officer is responsible for these general safety considerations for tank removal as listed below.

- Stop logs or barricades may be used if necessary to prevent vehicles and heavy equipment from falling into excavations during UST removal. If trenches must be left open and unattended, the area surrounding the trench shall be secured by means of metal fence posts connected by cordage or wire and caution tape. The enclosed area shall be clearly posted with caution signs and signs prohibiting unauthorized personnel. Every effort shall be made to fill open excavations as soon as practical.
- Smoking in the work area is prohibited.
- Only non-sparking tools shall be used in the work area.
- Workers should minimize agitation or static-producing movement generated by moving liquids, air, or, solids. For example, static electricity results from (1) liquid flowing

through a hose when product is pumped from the tank, (2) compressed gas or air being released into the tank atmosphere, and (3) high-speed rolling of pneumatic rubber tires on pavement under dry conditions.

- A conductive path for the safe discharge of static electricity must be provided by bonding and grounding equipment and vehicles. Equipment is "bonded" by connecting it by wire to a grounded object (such as the tank if the tank is still in contact with the earth and moisture or a metal pipe driven into the ground).
- No one shall enter a tank without checking to see if a hazardous atmosphere exists.
- All tank entry work shall be considered as a *confined space* (see H&S Manual Section 2-5) entry, and shall only be performed by OSHA-trained personnel.
- All ignition sources must be removed from the area before tank work begins.

4-12.2. REMOVAL ACTIVITIES

The Project Manager/ Project Officer is responsible for removal activities, including site preparation, product transfer, tank purging or inerting, tank atmosphere testing, tank removal, tank cleaning, and tank demolition, as discussed below.

4-12.2.1. SITE PREPARATION

The activities listed below must be taken to prepare the site for tank removal.

- All on-site utility lines should be located before excavation for UST removal begins.
- Pipelines associated with the tank and other pipelines or underground structures must be located before excavation.
- The work area should be cordoned off to prevent entry by outsiders.
- If little or no breeze is blowing, vapors from tanks could accumulate at ground level. Under such conditions, workers should consider delaying the removal or take additional precautions (such as ventilating the work area with explosion-proof high-capacity fans).
- It should be determined whether purging or inerting can reduce flammable vapors that might remain in the tank after its contents have been removed. This depends on the amount of material remaining and the type of material.

- Any electrical components connected to the tank shall be de-energized and then disconnected.

4-12.2.2. PRODUCT TRANSFER

If product is found in a tank that is to be removed, the precautions and activities listed below apply.

- Employees working near the transfer operation, such as near the vacuum truck collecting product out of the tanks, should be warned in advance of the hazards of the work activities.
- Equipment (including vacuum trucks) should be bonded and grounded during any transfer operation involving flammable or combustible materials.
- When product and residues are being removed, explosion-proof or air-driven pumps should be used. Pump motors and suction hoses must be bonded to the tank or otherwise grounded to prevent electrostatic ignition hazards.
- Plastic (such as polyvinyl chloride) pickup tubes should not be used on the stripping lines of vacuum trucks. The plastic tubes are especially prone to accumulating static charges.
- If a vacuum truck is used to remove liquid or residues, the area of operation for the vacuum truck must be free of flammable vapors and the truck must be located upwind from the tank and outside the probable path of vapor dispersion. Exhaust from the vacuum pump must be discharged in accordance with local air pollution control regulations. Noise levels generated by the vacuum truck could exceed acceptable sound levels. Hearing protection should be used when working around the vacuum truck.
- Nonessential personnel should remain at a distance from the vacuum truck when it is in operation because its hoses, which are usually 4 inches in diameter, can pop off and whip around, resulting in injury. Securing means such as wires, pins, and straps shall be used when required by the hose manufacturer or type of hose connection.
- Sorbent pads should be placed under the hose connections to prevent contamination and spills.
- Operations should be observed from an upwind direction that is also perpendicular to the vacuum truck’s end.

4-12.2.3. TANK PURGING OR INERTING

After the contents of the tank have been removed, the concentration of flammable vapors in the tank may need to be reduced or eliminated by purging or inerting to reduce the potential for fires and explosions. Tank purging and inerting are discussed below.

4-12.2.3.1. TANK PURGING

Either a diffused-air blower or an eductor-type air mover should be used for purging. A diffused-air blower pumps air into the tank. Because petroleum vapors are heavier than air, air must be introduced as low into the tank as possible so that product vapors are stirred up sufficiently to be moved out of the tank. When using this purging method, the air-diffusing pipe must be properly bonded and grounded to prevent discharge of a spark. Fill (drop) tubes shall be removed to allow proper diffusion of air in the tank. The blower air supply shall be from a compressor that has been checked to ensure that Grade D air is being supplied. Air pressure in the tank must not exceed 5 pounds per square inch gauge (psig) to avoid tank failure.

An eductor-type air mover draws vapor out of the tank and fresh air into the tank. The air mover should be grounded properly to prevent the generation and discharge of static electricity. When using this method, the fill (drop) tube remains in place to ensure ventilation at the bottom of the tank. Tanks equipped with fill (drop) tubes that are not removable shall be purged using an eductor-type air mover. An eductor extension shall be used to discharge vapors a minimum of 12 feet above grade or 3 feet above rooflines within 75 feet of the excavation, whichever is greater. If this is not possible, alternate discharge methods shall be proposed and approved prior to purging operations.

Precautions and procedures for tank purging are listed below.

- Noise levels generated by the air blower or mover could exceed acceptable sound levels. Noise levels should be evaluated and appropriate hearing protection worn.
- Commercial emulsifiers and volatile fuel encapsulators that are completely miscible in water aid in the elimination of flammable vapors and are biodegradable. Regulatory requirements for treatment and disposal of the emulsifier- or encapsulator-and-water mixture shall be determined prior to use of such additives. While standing outside the tank, the worker should rinse the tank through an opening with a 3 to 6 percent solution of the emulsifier or encapsulator using a pressure sprayer. Explosive concentrations shall be measured at several levels (top, middle, and bottom) within the tank. If readings on the combustible gas indicator (CGI) are greater that 10 percent of the lower explosive

limit (LEL), the tank shall be rinsed again. When the LEL readings are acceptable, the water in the tank should be pumped out for disposal.

- Exhaust vapors from purging should be vented in accordance with local air pollution control regulations. The atmosphere at ground level and by the excavation should be tested periodically while purging is in progress to ensure the vapors are being vented effectively and are not collecting at ground level. Ground level fuel vapor can form vapor trails that can travel to a source of ignition, resulting in flashback.

CAUTION: Purging is a temporary procedure. Product trapped in the bottom sludge and wall scale of the tank can regenerate flammable vapors inside the tank. The atmosphere should be frequently tested inside the tank, in the excavation, in any other below grade areas, and at ground level, especially near the tank vent.

4-12.2.3.2. TANK INERTING

If the tank is not purged, it may need to be inerted by introducing an inert gas such as carbon dioxide (CO_2) or liquid nitrogen (N_2) to remove flammable vapors. Before inerting, all openings in the tank shall be plugged with threaded or expansion-type plugs except in the tank vent and the opening used for introducing the inert gas.

If the inerting agent is introduced into the tank as a compressed gas, the following procedures should be implemented to prevent the buildup of static electricity:

- The tank and the compressed gas supply shall be bonded together and grounded.
- The compressed gas shall be supplied only at a pressure of 5 psig or less.
- The liquid or gas shall be released at the bottom of the tank so that liquid falling to the bottom of the tank does not generate static electricity. The tank should be filled from the bottom up.
- Sufficient quantities of inert gas (either CO_2 or N_2) should be introduced into the tank to lower the oxygen content to less than 5 percent. Before proceeding with additional activities, the oxygen content of the tank should be confirmed.
- Subsequent oxygen level monitoring should be conducted at least hourly while activities involving the tank are underway but before decontamination of the tank interior or at least daily during periods in which the tank is not disturbed but prior to decontamination of the interior. If monitoring of the tank interior indicates that the oxygen level is not

remaining below 5 percent, additional inert gas should be introduced and more frequent oxygen monitoring should be initiated.

- Pressure inside the tank should not exceed 5 psig.

If dry ice is used as the inerting agent, it should be introduced as chips through the top of the tank at the rate of at least 3 pounds per 100 gallons of tank capacity. Skin contact with dry ice should be prevented by wearing heavy cloth gloves.

During all inerting procedures, an extension vent tube a minimum of 12 feet above grade or 3 feet above any roof lines within 75 feet of the excavation, whichever is greater, shall discharge tank vapors. If this is not possible, alternate methods should be proposed and approved prior to inerting procedures.

Within 30 minutes before initiating any excavation, preparation, removal, opening, demolition, transportation, or other activity involving a tank that has been inerted, the inerted atmosphere within the tank must be verified. Tank atmosphere testing is described below.

4-12.2.4. TANK ATMOSPHERE TESTING

Tank atmosphere testing procedures are listed below.

- The air within the tank should be monitored to ensure that the space is both adequately purged and safe for personnel entry or to ensure that the tank has been adequately inerted and that the oxygen content is less than 5 percent. In both instances, monitoring should be performed at the top, middle, and bottom areas of the tank to ensure that stratification of organic vapors has not occurred.
- Monitoring results should be documented in the field logbook.
- When monitoring to ensure purging or inerting, both oxygen content and LEL readings are required. Prior to obtaining LEL readings, the oxygen content of the space should be monitored to verify that the CGI is operating within the oxygen limits identified by the CGI manufacturer.
- Personnel shall not enter a space with an oxygen content of less than 19.5 percent, except in emergencies, and then only when equipped with the proper personal protective equipment (PPE) and supplied air respirators (ex. self-contained breathing apparatus [SCBA]).

- Requirements for the permit-required confined space entry must be followed for entry into any tank (see Section 2-5 if this manual, "Confined Space Entry Program").
- Before tank removal, puncturing, cleaning, or cutting, the atmosphere within the tank must be less than 5 percent of the LEL because pressure and temperature changes will affect the tank atmosphere.

CAUTION: In purged tanks, the concentration of vapors in the tank can start out in the flammable range or progress from having an atmosphere exceeding the flammable range and then into the range of a safe atmosphere. Ensure that all ignition sources have been removed from the area before this process begins.

4-12.2.5. UST REMOVAL

UST removal procedures are listed below.

- After soil has been removed to the top level of a UST, all tank cleaning, testing, and crane cable hookup activities that require personnel to physically be on the tank top surface should be performed before excavation of soil along the tank sides.
- Personnel shall use fall protection devices when work is performed on top of an UST that has been excavated around one or more sides.
- Tanks should be lifted using equipment with a rated capacity 1.5 times greater than the load to be lifted.
- Tanks should be lifted by lifting eyes or by straps under the ends of the tanks.
- Tanks should not be lifted by the manhole flange or by removing the bungs.
- Personnel should be directed to remain away from the ends of the tanks and tanks should be positioned, whenever possible, with the ends oriented away from occupied or traveled areas because of the potential for rupture.
- If the removed tank must be transported, the tank shall be secured to prevent movement.
- Personnel should never stand under or near any load, especially tanks being removed with slings. If a tank explodes, the ends usually blow off. Therefore, personnel should always be positioned perpendicular to the tank ends.

4-12.2.6. TANK CLEANING

Safety practices and procedures for tank cleaning should be conducted using only methods outlined in the approved site-specific health and safety plan (HASP). General cleaning guidelines are listed below.

- Volatile organic solvents should not be used for tank decontamination.
- Personnel should not enter any tank, except when following permit-required confined space entry procedures.
- Decontamination fluids should be collected and disposed of properly.
- Upon completion of the project, written certification should be made that tanks were properly decontaminated before leaving the site.

4-12.2.7. TANK DEMOLITION

Most tanks are demolished before leaving the site unless they are transported directly to a state-certified tank destruction facility. Tank demolition procedures are listed below.

- Demolition should not be permitted until decontamination of the interior and exterior of the UST is complete.
- Demolition should involve opening the tank sufficiently to permanently prohibit its further use as a container of liquids.
- Tanks should again be purged or inerted and tested before they are opened.
- A list of materials and supplies for safely and effectively demolishing the tank should be included in the site-specific HASP.

4-13. STANDARD OPERATING PROCEDURE FOR BIOHAZARDS SAFETY

Biological hazards, or "biohazards," include plants, animals or their products, and parasitic or infectious agents that may present potential risks to worker health. This standard operating procedure (SOP) discusses safe work practices for working with biohazards, preventive guidelines, and first-aid procedures for the most common hazards field staff are likely to encounter. This SOP does not address biohazards such as those associated with medical waste. Procedures for working with this type of biohazard should be addressed in the site-specific health and safety plan (HASP) on a case-by-case basis.

During preparation of the site-specific HASP, the preparer should consider which plants, animals, and other biological agents may be encountered; assess their potential risk to project personnel; and attach this SOP to the HASP, if necessary. Program/section managers should become familiar with biological hazards indigenous to the geographical area in which most of their personnel work, and assist in evaluating the risks to personnel on projects staffed from their program or section. SOPs for insects, snakes, animals, plants, and waterborne pathogens (giardia) are provided below.

4-13.1. INSECTS

SOPs for reducing the chance of insect bites or stings and for treating bites or stings are listed below.

- Workers should keep as much skin area covered as possible by wearing long-sleeved shirts, long pants, and a hat. Pant legs should be tucked into socks or boots and shirts into pants. In addition, workers should wear light colored clothing.
- A proven insect repellent should be used on bare skin and clothing.
- When possible, tall grasses and brush that could harbor ticks should be avoided.
- Several times during the day and at the end of the workday, each worker should perform a check for evidence of imbedded ticks or previous bites. Particular attention should be paid to the scalp, neck, ankles, back of the legs, and waist.
- When opening well covers, vaults, or other closed items, workers should watch for hornet or wasp nests and black widow or brown recluse spiders. Workers should never reach into spaces with unprotected arms.
- Workers should watch carefully for bees around open soft drinks or food.
- If a bee stings a worker, the stinger should be carefully removed, if present. The wound should be washed and a cold pack applied. Allergic reaction should be watched for and

is evidenced by extreme swelling, redness, pain, or difficulty breathing. People with an allergy to bee venom are encouraged to carry a self-injectable form of epinephrine, such as an Epi-Pen or Twin-Ject device. Seek medical attention if an employee is having signs of an allergic reaction.

- If a worker is stung or bit by a spider, medical attention should be obtained immediately.

4-13.2. SNAKES

SOPs for encounters with snakes and for treating snakebites are listed below.

- Workers should avoid walking in areas known to harbor snakes. Workers should be cautious when picking up or moving items that have been on the ground.
- Workers should wear boots made of heavy material that protect the ankles and pants. Heavy work gloves should be worn for picking up items.
- If one snake is encountered, others may be present. Workers should leave the area by retracing their steps.
- If a worker is bitten, call 911. Then the wound should be washed and the injured area immobilized and kept lower than the heart, if possible. Ice or a tourniquet should not be applied to a snake bite. The wound should not be cut.

4-13.3. ANIMALS

SOPs for encounters with animals and for treating associated wounds are listed below.

- If workers encounter an animal, the animal should be observed for unusual behavior such as a nocturnal animal out during the day, drooling, an appearance of partial paralysis, irritability, meanness, or a strangely quiet demeanor.
- Workers should never touch the body of a dead animal because fleas still on the body could carry diseases.
- Workers should avoid animal droppings (including bird droppings). Pathogens, some which can become airborne, may still be present in the droppings.
- If a worker is bitten, he or she should get away from the animal to avoid further bites. Workers should not try to stop, hold, or catch the animal.

- If the wound is minor, it should be washed with soap and water. Any bleeding should then be controlled, and an antibiotic ointment and dressing should be applied. Employee must seek medical attention. If the wound is bleeding seriously, the bleeding should be controlled but the wound should not be cleaned. Call 911.
- If a rabid animal is suspected, immediate medical attention should be summoned. If possible, workers should try to remember what the rabid animal looked like and the area in which it was last seen. The animal should be reported by calling the local emergency number (911).

4-13.4. PLANTS

SOPs for plants are as follows:

- Workers should be aware of the types and appearances of poisonous plants in the work site area. Poison ivy, oak, and sumac are the most frequently encountered plants that can cause reaction from casual contact. If a worker is extremely sensitive to these plants, he or she should avoid the area entirely because airborne drift could be sufficient to cause a reaction. Other plants, such as fireweed, can cause painful, short-term irritation and should be avoided as well. Workers should avoid touching face and eye areas after contact with any suspicious plant.
- Workers should wear proper clothing if working in or near overgrown areas. Disposable outerwear should be used, if necessary, and workers should not touch the material with bare hands during removal if the outerwear may have contacted poisonous plants.
- If contact with a poisonous plant has occurred, the affected area should be immediately washed thoroughly with soap and water. If a rash or weeping sore has already begun to develop, a paste of baking soda and water should be applied to the area several times a day to reduce discomfort. Lotions such as Calamine or Caladryl should be applied to help soothe the area. If the condition gets worse and affects large areas of the body or the face, a doctor should be consulted.
- Bushy and wooded areas should be thoroughly checked for thorn-bearing trees, brush, and bramble. In some cases, impalement can cause severe pain or infection.

4-13.5. WATERBORNE PATHOGENS-GIARDIA

Giardia is a waterborne pathogen consisting of a protoplasmic parasite of the mammalian digestive tract. Giardia is present worldwide, with the highest occurrence in areas with poor sanitation. In the United States, most reported cases are in mountainous regions where drinking water is obtained from streams and is unfiltered or untreated.

Giardia is contracted by ingesting water contaminated with giardia cysts in the dormant state. Giardia parasites can only thrive in the digestive tracts of mammals. Dormant giardia organisms enter water through the feces of infected animals or humans. Giardia symptoms include severe diarrhea and upset stomach. Some people are asymptomatic but can transmit the disease to others. Medical treatment of giardia can be difficult and unpleasant; therefore, prevention is critical. Precautions for preventing exposure to giardia are listed below.

- Workers should assume that all fresh water streams are infected with the giardia organism and not drink any <u>untreated</u> water.
- Team members collecting sediment and water samples from streams should wash their hands thoroughly with soap and water after collecting the samples.
- Giardia parasites are relatively easy to destroy or filter. Water should be treated for drinking or cooking with iodine or another recommended giardia treatment before use.

4-14. STANDARD OPERATING PROCEDURE FOR GENERAL SAFE WORK PRACTICES AT HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE (HAZWOPER) SITES

To prevent injuries and adverse health effects, the following general safe work practices are to be standard operating procedure (SOP) when conducting work involving known and unknown site hazards. This SOP establishes a pattern of general precautions and measures for reducing risks associated with HAZWOPER site operations. This list is not inclusive and may be amended as necessary.

- Do not eat, drink, chew gum or tobacco, take medication, or smoke in contaminated or potentially contaminated areas or where the possibility for the transfer of contamination exists.
- Wash hands and face thoroughly upon leaving a contaminated or suspected contaminated area. A thorough shower and washing must be conducted as soon as possible if excessive skin contamination occurs.
- Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, or other such areas. Avoid, whenever possible, kneeling on the ground or leaning or sitting on drums, equipment, or the ground. Do not place monitoring equipment on potentially contaminated surfaces.
- Remove beards or facial hair that interferes with a satisfactory qualitative respirator fit test or routine pre-entry positive and negative pressure checks.
- Be familiar with and knowledgeable of and adhere to all instructions in the site-specific health and safety plan (HASP). At a minimum, a safety meeting will be held at the start of each project to discuss the HASP. Additional meetings will be held, as necessary, to address new or continuing safety and health concerns.
- Be aware of the location of the nearest telephone and all emergency telephone numbers.
- Attend a briefing on the anticipated hazards, equipment requirements, SWPs, emergency procedures, and communication methods before going on site.
- Plan and delineate entrance, exit, and emergency escape routes.
- Rehearse unfamiliar operations prior to implementation.

- Use the "buddy system" whenever respiratory protection equipment is in use. Buddies should establish hand signals or other means of emergency communication in case radios break down or are unavailable.
- Buddies should maintain visual contact with each other and with other on-site team members by remaining in close proximity in order to assist each other in case of emergency.
- Minimize the number of personnel and equipment in contaminated areas (such as the exclusion zone). Nonessential vehicles and equipment should remain within the support zone.
- Establish appropriate support, contamination reduction, and exclusion zones.
- Establish appropriate decontamination procedures for leaving the site.
- Immediately report all injuries, illnesses, and unsafe conditions, practices, and equipment to the site safety coordinator (SSC) or supervisor.
- Maintain a portion of the site field logbook as a project safety log. The project safety log will be used to record the names, entry and exit dates, and times on site of all DNREC, contractor, and project site visitor personnel; air quality and personal exposure monitoring data; and other information related to safety matters.
- A portable eyewash station or eye wash solution should be located in the support zone if chemical splashes to eyes are possible.
- Do not bring matches and lighters in the exclusion zone or contamination reduction zone.
- Observe coworkers for signs of toxic exposure and heat or cold stress.
- Inform coworkers of nonvisual effects of illness if you experience them, such as headaches, dizziness, nausea, or blurred vision.

4-15. STANDARD OPERATING PROCEDURES FOR DRUM AND CONTAINER HANDLING

This standard operating procedure (SOP) establishes safe work practices to protect field personnel and the public from exposure to hazardous materials resulting from the handling, opening, sampling, transferring, over-packing, and shipping of drums. This SOP is applicable for all uncontrolled hazardous waste sites as defined by 29 CFR 1910.120, the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard.

Project managers/project officers are responsible for ensuring implementation of this SOP, when warranted, on their projects. Site safety officers (SSOs) are responsible for enforcement of this SOP at the work site. Field personnel are required to adhere to drum and container handling guidelines and procedures.

All drum and container handling operations must adhere to all applicable federal, state, local and contractual requirements. Preparation and shipping of containers of hazardous materials must comply with applicable U.S. Environmental Protection Agency (EPA) and U.S. Department of Transportation (DOT) regulations. All drums and containers used during hazardous waste operations must meet appropriate DOT regulations for the materials they contain.

Drum and container handling should be approached in a systematic manner, especially when the contents are unknown or containers are in poor condition. Inspection, opening, sampling, over-packing, and staging requirements for drums and containers are described below.

4-15.1. INSPECTION

When buried drums or containers are suspected, a ground-penetrating system or other type of detection system or device shall be used to estimate the location and depth. Soil or covering material shall be removed with caution to prevent drum or container rupture.

Drums or containers shall be visually inspected before any work is conducted to gain as much information as possible about their contents. Field personnel shall document in the field logbook the following information:

- Any labels or other markings indicating possible contents.
- Drum or container condition (such as rusted, leaking, dented, or evidence of shock or heat sensitive salts near seams, cracks, openings, bungs).
- Signs of pressure (such as bulging or swelling).
- Drum or container size, construction, and type.

- Configuration of drum or container head (open or closed top).

After observations are documented in the field logbook, each drum or container shall be labeled with an identification code for future tracking.

4-15.2. OPENING

For efficient and safe drum or container opening, personnel must adhere to the guidelines below.

- Drums and containers shall be opened in such a manner that excess interior pressure will be safely relieved.
- If available, remote-controlled drum or container opening equipment will be used for drums or containers of unknown or extremely dangerous contents.
- In order to protect the employee, a suitable shield shall be placed between the employee and the drum being opened.
- Only spark-proof tools should be used to open drums and containers.
- Drums or containers containing unknown materials should be opened using, at a minimum, Level B including splash protection and in some cases Level A personal protection.
- Drums or containers containing radioactive material should not be opened or handled until the appropriate personnel with expertise in this area have been consulted.
- Air monitoring equipment shall be available near the drum or container being opened, such as combination oxygen and combustible gas meters, colorimetric tubes, and photoionization detectors.
- Tools used for drum or container opening shall be decontaminated after each use to avoid mixing incompatible wastes.
- Drums or containers shall be resealed as soon as possible to minimize vapor generation.
- If possible, drums or containers exhibiting signs of pressure/bulging will not be opened.

4-15.3. SAMPLING

Drum and container sampling poses a variety of potential hazards to worker health and safety, including direct contact with hazardous materials, inhalation of hazardous vapors, and the possibility of drum or

container explosion or rupture. The guidelines below shall be used to properly sample drums and containers.

- Prior to sampling, a sample plan must be developed that includes the following information:
  - Background information on the waste.
  - Which drums or containers will be sampled.
  - Appropriate sampling devices.
  - Sample containers to be used.
- Sampling personnel shall not stand on drums or containers or lean over other drums or containers to obtain samples.
- All phases in the vertical cross section of each drum or container should be sampled.
- Disposable glass tubing or other disposable sampling devices shall be used to sample liquid.
- When sampling liquids, absorbent pads should be placed on drum tops to collect spillage that may occur while transferring samples into containers.
- Sampling personnel should document container number, any container labeling, sampling date and time, and number and color of different phases.

4-15.4. OVER-PACKING

Prior to movement of drums or containers, all employees exposed to the transfer operation shall be warned of the potential hazards associated with the contents of the drums or containers. During an emergency, drums and containers should be handled as detailed below.

- Leaks should be plugged or patched immediately if this can be done without risk.
- Damaged drums and containers should be placed in an over-pack container with absorbent pads to collect any spilled material or the contents transferred into a clean, compatible drum or container.
- Absorbent material should be used to collect any leakage that may occur during shipment.

During remedial actions, the procedures below apply to drum and container handling.

- Drums or containers should be placed in over-pack containers, and any identification number assigned to the drum or container should be placed on the outside of the over-pack container.
- If drum or container contents are to be bulked with other drum or container contents, the compatibility of the contents should be verified by a field characterization study prior to bulking.

4-15.5. STAGING

Staging refers to moving drums or containers in an organized manner to predesignated areas. Drums or containers may be staged to facilitate characterization and remedial action and also to protect drums or containers from potentially hazardous site conditions (such as high temperatures and proximity to ignition sources or heavy equipment). To ensure that staging is conducted in a safe and efficient manner, the guidelines below should be followed.

- Staging activities should be kept to a minimum to prevent hazards associated with increased handling of drums or containers.
- The staging area should be as close as possible to the site exit.
- The staging area should be level and covered with plastic sheeting or absorbent material.
- The staging area should be diked to contain possible spills.
- Drums or containers should be secured on pallets whenever possible to aid in the safe movement of drums or containers and to isolate the drums or containers from the soil surface.
- Drums or containers should not be stacked on top of each other.
- Drums or containers should be staged according to chemical composition of the contents. Drums or containers containing incompatible materials should be kept segregated.
- Drums and containers should be staged far enough apart to allow for the movement of equipment and personnel.

4-16. STANDARD OPERATING PROCEDURE FOR SPILL AND DISCHARGE CONTROL

This standard operating procedure (SOP) provides contingency measures for spills and unintentional discharges from handling and transporting hazardous materials. Spill and discharge control practices should follow specific procedures to ensure the safety of responders and bystanders and to limit environmental impacts.

4-16.1. GENERAL PROCEDURES

Immediate action should be taken to control and contain any spill following the general guidelines below:

- All but essential personnel should be kept away from the spill or discharge.
- The hazardous area should be isolated.
- If the spill or discharge creates a hazardous situation or results in injury or an environmental release, the emergency procedures of the HASP should be implemented. Emergency response telephone numbers, designated contacts, and special reporting procedures are presented in the HASP.
- Personnel should stay on the upwind side of the spill or discharge.
- Entry into a confined space or low area where liquids or vapors may accumulate should be avoided.
- Sources of ignition should be eliminated if the spill or discharge involves combustible materials.
- Drains, manholes, waterways, sewers, and the like should be identified and covered or protected.
- The spill should be controlled or absorbed using appropriate media or devices.
- When the spill or discharge is fully contained and under control, spill or discharge material should be collected.
- Following cleanup, the spill area should be evaluated by collecting soil samples and screening the area with air monitoring instruments.

4-16.2. SOLIDS

If the spill or discharge material is solid and nonreactive, the material should be scooped up and placed in a suitable and compatible container until the disposal method has been determined.

4-16.3. LIQUIDS

If liquid is discharged, the following general procedures apply:

- The point of discharge should be immediately identified and measures taken to eliminate further discharges by uprighting or patching containers, transferring contents, or other appropriate methods.
- Any discharged liquids or sludge should be removed or retrieved.
- Discharged materials should be cleaned up with absorbent materials or devices.
- Spent absorbent material should be placed into storage or disposal containers.

4-16.4. REPORTING

In some instances, a release may require reporting to government agencies. If a reportable quantity is released (this quantity is stated on the Safety Data Sheet) or human health or the environment is threatened, appropriate national, state, and local administering agency personnel should be notified. The National Response Center phone number is 1-800-424-8802, and DNREC is 1-800-662-8802. The timeframe for notification may vary from agency to agency. Notification may be required immediately or within 24 hours, depending on the type, location, and amount of released material. The appropriate agency to report spills to should be determined during HASP development.

4-17. STANDARD OPERATING PROCEDURE FOR CONTROL OF FLAMMABLE HAZARDS AND IGNITION SOURCES

This standard operating procedure (SOP) provides safe work practices for handling flammable materials and controlling ignition sources in a manner that will prevent explosions and fires that may result in injuries. The guidelines also present procedures for proper flammable liquids transfer. This SOP is applicable to any WHS site or project where flammable or combustible materials might be encountered.

4-17.1. RESPONSIBILITIES

The project manager/project officer is responsible for ensuring that the work area on any WHS project site is evaluated for the presence of flammable hazards and ignition sources and that all precautions provided in this SOP are implemented. On a Hazardous Waste Operations (HAZWOPER) site, the project manager/project officer is also responsible for ensuring that appropriate air monitoring procedures are defined in the site-specific health and safety plan (HASP); and the site safety officer (SSO) responsible for recognizing potential flammable hazards and ignition sources, conducting air monitoring, posting warning signs, and notifying on-site workers of the hazards.

All field personnel must know that explosion and fires at a work site may result from any of the following:

- Chemical reaction;
- Ignition of explosive or flammable materials;
- Agitation of shock-sensitive compounds; and
- Sudden release of materials under pressure.

Field personnel must also understand that each flammable gas and vapor has a minimum concentration in air below which propagation of flame does not occur on contact with an ignition source. This concentration is known as the lower explosive limit (LEL) and is expressed as a percent in air. Likewise, for every flammable gas and vapor, there is also a maximum concentration of gas or vapor in air above which propagation of flame does not occur. This value is known as the upper explosive limit (UEL) and is also expressed as a percent in air. The flammable range of a particular gas or vapor is the range between the LEL and UEL where the gas-air mixture will support combustion.

Proper precautions must be taken to protect against fire and ignition hazards, including air monitoring, elimination of ignition sources, and proper chemical handling and transfer. These precautions are discussed below.

4-17.2. AIR MONITORING

Monitoring for flammable or explosive atmospheres is performed using a combustible gas indicator (CGI). This instrument is designed to provide data in terms of the percent LEL. Instructions on the model use, calibration, and operating procedures shall be incorporated into the site-specific HASP as appropriate.

Because flammable gases and vapors can be heavier or lighter than air, it is important to remember that the sampling probe should be moved slowly up and down at multiple levels when monitoring for gases. Response time varies between different meters, sensor types, sample hose lengths, and accessories used. Employees performing air monitoring must be properly trained and qualified to use the specific instrument.

4-17.3. ELIMINATION OF IGNITION SOURCES

The risk of fires and explosions can be reduced using the following procedures to eliminate ignition sources:

- Ignition sources that are not required for the completion of the project should not be allowed in the exclusion zone or contamination reduction zone at hazardous waste sites or in the vicinity of work associated with flammable materials at any site.
- Warning signs should be posted and the work zone barricaded or blocked off before any work is conducted that might release flammable gases or vapors.
- All ignition sources should be eliminated from areas where flammable gases or vapors may be present or migrate to.
- If the wind direction may carry flammable gases or vapors into areas outside the work zone where ignition sources may be present, work should not be performed without careful monitoring of concentrations at the work zone boundary.
- Sparks caused by friction or electrostatic effects should be controlled using with proper grounding and bonding procedures for transfer of flammable liquids. This requires maintaining constant contact using metal between the containers and providing a metallic route to the ground to discharge electrostatic buildup.
- Non-sparking tools should be used.

4-17.4. PROPER CHEMICAL HANDLING AND TRANSFER

Precautions to reduce the risk of fire and explosion during chemical handling and transfer include the following:

- Liquids and residues should be removed from containers or tanks using explosion-proof or air-driven pumps.
- Pump motors and suction hoses should be bonded to the container or tank or otherwise grounded to prevent electrostatic ignition hazards.
- If a vacuum truck is used to remove liquids or residues, the area of operation for the vacuum truck should be vapor or gas free. The truck should be located upwind and outside of the path of probable gas or vapor travel. Vacuum pump exhaust gases should be discharged downwind of the truck through a hose of adequate size and length.
- After chemicals have been transferred, lines leading to the truck should be disconnected using non-sparking procedures and then the lines should be drained of their contents. Precautions should be taken to ensure that the contents of the lines do not spill into the environment during line disconnection.
- Only non-sparking or non-heat-producing tools should be used for opening containers and tanks. Electrical equipment shall also be explosion-proof.

4-18. STANDARD OPERATING PROCEDURE FOR OIL AND PETROLEUM DISTILLATE FUEL HAZARD CONTROL

This standard operating procedure (SOP) establishes safe work practices for protecting the Department of Natural Resources and Environmental Control (DNREC) Division of Air and Waste Management (WHS), personnel against the hazardous properties of oil and petroleum distillate fuel products during the performance of field work, including known and suspected releases of such materials. The SOP was developed to enable health and safety personnel and project managers to quickly prepare and issue site-specific health and safety plans (HASP) for investigations of such releases. A completed short form HASP and this SOP can comprise a site-specific HASP for sites where oil and petroleum distillate fuel products may be encountered. Safety procedures for drilling, trenching, and other construction operations should be attached as necessary. Anticipated physical hazards associated with site activities should be discussed in the HASP.

This SOP must not be used for confined space entry (including trench entry) or for installing or operating full-scale fuel recovery systems. The applicability of this SOP, hazard evaluation, health and safety requirements, air monitoring, area controls, decontamination, underground storage tank (UST) preparation, emergency response, and accident reporting associated with work involving oil and petroleum distillate fuel products are discussed below.

4-18.1. APPLICABILITY

This SOP is applicable to field investigations involving any of the substances listed below and involving any of the activities listed below.

SUBSTANCES

- Motor oil (used and unused)
- Leaded and unleaded gasoline
- Fuel oil No. 1 (kerosene and JP-1)
- Fuel oil No. 1-D (light diesel)
- Fuel oil No. 2 (home heating oil)
- Fuel oil No. 2-D (medium diesel)
- Fuel oil No. 4 (residual fuel oil)
- Fuel oil No. 5 (residual fuel oil)

- Fuel oil No. 6 (Bunker C fuel oil)
- JP-3, JP-4, and JP-5 (Jet fuels)
- Gasohol

ACTIVITIES

- Collection of subsurface soil samples using a truck-mounted drill rig, hand-held power auger, or hand auger
- Construction, completion, and testing of groundwater monitoring wells
- Collection of groundwater samples from new and existing wells
- Observation of removal of underground fuel pipes and USTs
- Small-scale removal of contaminated soils

4-18.2. HAZARD EVALUATION

Oil and petroleum distillate fuel products are mixtures of aliphatic and aromatic hydrocarbons. The predominant classes of compounds in motor oil, gasoline, kerosene, and jet fuels are paraffins (such as hexane and octane), naphthenes (such as cyclohexane), and aromatics (such as benzene and toluene). For example, gasoline contains about 80 percent paraffins, 6 percent naphthenes, and 14 percent aromatics. Kerosene and jet fuels contain 42 to 48 percent paraffins, 36 to 68 percent naphthenes, and 16 to 20 percent aromatics. Diesel fuels and heating oils contain 14 to 23 percent naphthenes, 68 to 78 percent nonvolatile aromatics, and less than 10 percent paraffins. Heavier fuels contain almost no volatile aromatic compounds. Chemicals may be added to automotive and aviation fuels to improve their burning properties. Examples are tetraethyl lead and ethylene dibromide. Flammability, toxicity, and exposure limits of oil and petroleum distillate fuel products are discussed below.

4-18.2.1. FLAMMABILITY

Oil and petroleum distillate fuel products possess two intrinsic hazardous properties—flammability and toxicity. The flammable property of oils and fuels presents a far greater hazard to field personnel than toxicity. Vapors of volatile components of oils and fuels can therefore also be explosive when confined.

Oil and petroleum distillate fuel products will not burn in liquid form. Only the vapors burn and then only if (1) the vapor concentration is between the compound-specific upper explosive limit (UEL) and lower explosive limit (LEL), (2) sufficient oxygen is present, and (3) an ignition source is present. Eliminating any of the three factors needed to produce combustion can minimize the probability of fire

and explosion. Two of the factors, ignition source and vapor concentration, can be controlled in many cases. The following can control ignition:

- Open fires and smoking must be prohibited on site.
- Spark arresters must be installed on drill rig engines.
- Engines must be turned off when any compound's LEL is approached.

Using fans and portable ventilation systems can reduce vapor concentrations. In fuel storage tanks, vapor concentrations in headspaces can be reduced by introducing dry ice (solid carbon dioxide) into the tank because the carbon dioxide gas displaces combustible vapors and oxygen.

The LELs (in air) of the fuels discussed in this section range from 0.6 percent for JP-5 to 1.4 percent for gasoline. Flash points range from -36 °F for gasoline to greater than 150 °F for fuel oil No. 6. JP-5 has a flashpoint of 140 °F. Although it has a lower LEL than gasoline, JP-5 is usually considered less hazardous than gasoline because its vapors must be heated to a higher temperature to ignite.

4-18.2.2. TOXICITY

Oil and petroleum distillate fuel products exhibit relatively minor acute inhalation and dermal toxicity effects. Concentrations of 160 to 270 parts per million (ppm) gasoline vapor have been reported to cause eye, nose, and throat irritation after several hours of exposure. Gasoline vapor concentrations of 500 to 900 ppm can cause irritation and dizziness in 1 hour, and levels of 2,000 ppm or above have produced mild anesthesia in 30 minutes. Most fuels, particularly gasoline, kerosene, and jet fuels, are capable of causing skin irritation after several hours of contact.

Some gasoline additives, such as ethylene dichloride, ethylene dibromide, and tetraethyl and tetramethyl lead, are highly toxic; however, the additives are present in gasoline at low concentrations and their contribution to the overall toxicity of gasoline and other fuels is therefore negligible in most cases.

4-18.2.3. EXPOSURE LIMITS

In 1989, the Occupational Safety and Health Administration (OSHA) developed a permissible exposure limit (PEL) of 300 ppm for gasoline. However, this PEL was subsequently vacated. OSHA has also established PELs for individual components, such as benzene. The American Conference of Governmental Industrial Hygienists has established a threshold limit value (TLV) of 300 ppm for gasoline. This TLV takes into consideration the average concentration of benzene in gasoline (1 percent), as well as gasoline's common additives. Oil mist has a PEL of 5 milligrams per cubic meter of air. Exposure limits have been established for some of the other petroleum constituents.

4-18.3. HEALTH AND SAFETY REQUIREMENTS

This section discusses medical surveillance, training, and personal protective equipment (PPE) requirements for personnel working at sites where oil or petroleum distillate fuel products may be encountered.

4-18.3.1. MEDICAL SURVEILLANCE REQUIREMENTS

On-site personnel must participate in a medical surveillance program and be certified by an occupational health physician as being physically fit to wear respiratory protective devices and to perform their assigned fieldwork. WHS's medical surveillance program is discussed in this Division Health and Safety Manual, Section 2-8.

4-18.3.2. TRAINING REQUIREMENTS

All WHS personnel shall be trained in the hazards of their jobs, in accordance with the WHS Health and Safety Training Program (Section 2-7 of the WHS Health and Safety Manual) and the Hazard Communication Program (Section 2-1 of the WHS Health and Safety Manual).

Before field work begins, the project manager/project officer or site safety officer (SSO) will brief all field personnel, including contractor employees, on their work assignments and site safety procedures.

4-18.3.3. PERSONAL PROTECTIVE EQUIPMENT (PPE) REQUIREMENTS

PPE for work at sites where oil or petroleum distillate fuel products may be encountered is summarized below.

- Chemical-resistant safety boots, such as neoprene or butyl boots with steel toe and shank must be worn during the performance of work where surface soil is obviously contaminated with oil or fuel, when product quantities of oil or fuel are likely to be encountered, and within 10 feet of operating heavy equipment.
- National Institute for Occupational Safety and Health-approved full- or half-face respirator with organic vapor cartridges must be worn whenever total airborne hydrocarbon levels in the breathing zone of field personnel reach or exceed a 15-minute average of 11 ppm in summer and 25 ppm in winter. If total airborne hydrocarbons in the breathing zone exceed 100 ppm, work must be suspended, personnel directed to move a safe distance from the source, and a health and safety specialist consulted.

- Chemical-resistant gloves, such as nitrile or neoprene gloves must be worn whenever soil or water known or suspected of containing oil or petroleum hydrocarbons is collected or otherwise handled.
- Chemical-resistant coveralls, such as Saranex or polyethylene-coated Tyvek coveralls, must be worn whenever product quantities of oil or fuel are actually encountered and when oil- or fuel-saturated soil is handled.
- Splash-proof safety goggles or glasses with full side shields must be worn when working within 10 feet of any operating heavy equipment (such as a drill rig or backhoe). Splash proof goggles or face shields must also be worn whenever product quantities of oil or fuel are encountered.
- Hard hats must be worn when personnel work with or in the vicinity of an operating drill rig, backhoe, or other heavy equipment.

Operators of some sites such as refineries often require all personnel working within site boundaries to wear certain specified safety equipment. WHS personnel and contractors shall strictly observe such requirements.

4-18.4. AIR MONITORING

Air monitoring shall be performed to protect field personnel and prevent fires or explosions. Individuals trained in the use and care of the monitoring equipment must perform this monitoring. Instruments used on site must be maintained and calibrated in accordance with manufacturer requirements. Instrument manuals with calibration instructions shall be transported to each site along with the instrument. The following equipment is required for monitoring for oil or petroleum distillate vapors:

- Organic vapor monitor using flame ionization or photoionization technology
- Combustible gas indicator (CGI)

During drilling operations, vapor emissions from boreholes must be measured whenever the auger is removed from the boring and whenever flights are added or removed from hollow-stem augers. This requirement does not apply to borings less than 5 feet deep and borings of any depth drilled to install monitoring wells in soil known to be uncontaminated. Measurements should first be made with an organic vapor monitor and then with a CGI if vapor levels exceed the highest concentration measurable with the organic vapor monitor. (For example, if the organic vapor monitor goes off the scale when set on the highest range.)

Initially, measurements shall be made about 12 inches from the borehole at both upwind and downwind positions. If the total hydrocarbon concentration 12 inches from the borehole exceeds the respirator use action level (11 ppm in summer and 25 ppm in winter averaged over 15 minutes), measurements must be made in the breathing zone of the individual(s) working closest to the borehole. Decisions regarding respiratory protection should be made based on vapor concentrations in the breathing zone.

If total organic vapor concentrations within 12 inches of the borehole exceed the capacity of the organic vapor monitor, a CGI must be used to determine if explosive conditions exist. If combustible gas concentrations reach 5-10 percent of the LEL, continuous monitoring is required and operations may proceed with caution. If combustible gas concentrations reach 10 percent of the LEL within a 12-inch radius of the borehole or 5 percent of the LEL at a distance greater than 24 inches from the borehole, operations must be suspended, the drill rig motor shut down, and corrective action taken. If corrective action cannot be taken, field personnel and all other individuals in the vicinity of the borehole must move to a safe area and the local fire department and project manager must be alerted.

4-18.5. AREA CONTROLS

Access to hazardous and potentially hazardous areas must be controlled to reduce the possibility of physical injury and chemical exposure to field personnel, site visitors, and the public. A hazardous or potentially hazardous area includes any area where field personnel are required to wear respirators, borings are being drilled with powered augers, or excavation with heavy equipment is being performed.

Cordons, barricades, or emergency traffic cones, depending on conditions, must identify the boundaries of hazardous and potentially hazardous areas. If such areas are left unattended, signs warning of danger and forbidding entry must be placed around the perimeter if the areas are accessible to the public. Trenches and other large holes must be guarded with wooden or metal barricades spaced no further than 20 feet apart and connected with yellow or yellow and black nylon tape not less than 0.75 inch wide. The barricades must be placed no less than 2 feet from the edge of the excavation or hole.

Entry to hazardous areas shall be limited to individuals who must work in these areas. Unofficial visitors must not be permitted to enter hazardous areas while work is in progress. Official visitors should be discouraged from entering hazardous areas but may be allowed to enter only if they agree to abide by the provisions of this document, follow orders issued by the SSO, and are informed of the potential dangers that could be encountered in these areas.

4-18.6. DECONTAMINATION

A mild detergent and hot water can be used to remove oil and petroleum distillate fuel products from skin. Liquid dishwashing detergent is more effective than hand soap, and hot water is more effective than cold. Mechanic's waterless hand cleaner is recommended for initial cleaning, followed by a detergent and water wash, for removing motor oil and heavier fuel oils (fuel oils No. 4 through 6) that are weathered to an asphaltic condition.

Detergent and hot water should also be used to clean gloves, respirators, hard hats, boots, and goggles. However, if boots do not come clean after washing with detergent and water, a strong solution of trisodium phosphate and hot water can be used. Split-spoon sampling equipment, augers, vehicle undercarriages, and tires should be steam cleaned.

4-18.7. STORAGE TANK REMOVAL PROCEDURES

Procedures used by the firm responsible for UST/AST removal and transport must agree with procedures recommended by the American Petroleum Institute (API). If the removal and transport firm's procedures, especially firms addressing the removal or inerting of flammable vapors, disagree substantially with API procedures, the WHS project manager/project officer must be notified immediately.

4-18.8. EMERGENCY RESPONSE

Standard procedures to follow in the event of an emergency involving oil and petroleum distillate fuel products are summarized below. All responses should be coordinated through the designated SSO. Trained first aid providers should administer first aid.

- In the event of a fire,
  - Stop work, shut off equipment, and evacuate to safe distance (a department vehicle should be kept at a reasonable distance from the work area to prevent fire hazards);
  - Contact the fire department and then DNREC at 1-800-662-8802;
  - Keep a safe distance away until emergency services arrive; and
  - Do not attempt to fight fires that are not incipient fires
- In the event of an injury or illness,
  - Perform first aid, if possible, and call 911;

  - Do not move the victim if broken bones are suspected unless life is endangered; and
  - If the person is safe to move (has minor cuts or burns), transport the person to the hospital, but if injuries or illness are more serious, arrange for a rescue squad or ambulance.

- In the event of overexposure,
  - Remove the employee (only if there is no danger to rescuers) from the exposure source to a location with fresh air;
  - Contact 911.
  - Do not continue work until the source of exposure is identified and controlled; and
  - Contact the employee's supervisor.
- In the event of a hazardous materials accident,
  - Stop equipment and work;
  - Relocate to a safe distance;
  - To the extent possible, determine the source of incident (such as a utility line, gas line, pipeline, or other);
  - Contact the fire department and then DNREC at 1-800-662-8802;
  - Do not attempt to back-out equipment from an underground utility strike without the guidance of the utility company.

4-18.9. ACCIDENT REPORTING

All accidents must be reported as required by DNREC WHS policy. Information on accident reporting is presented in the Health and Safety Manual Section 1-9 and in DNREC WHS Policy #0623, Workers Compensation.