GENERIC HEALTH AND SAFETY PLAN

STANDBY ENGINEERING SERVICES
CONTRACT NO: D009812

Prepared for:

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, New York 12233

Prepared by:
TRC Engineers, Inc.
1430 Broadway
New York, New York 10018

APRIL 2020

RECORD OF REVISIONS

Revision No.	Revision Date	Summary of Revision	Modified by
0	4/1/2020	New document	J. King

TABLE OF CONTENTS

SECTION PAGE

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

This Generic Health and Safety Plan (HASP) has been developed for use on work assignments issued to TRC Engineers, Inc. (TRC) under New York State Department of Environmental Conservation (NYSDEC), Division of Environmental Remediation (DER), Standby Engineering Services Contract No. D009812. Compliance with this Generic HASP, and associated documents, is required for all TRC personnel entering NYSDEC project sites and/or conducting NYSDEC project field work. This Generic HASP has been prepared to meet the requirements specified in the following regulations, standards, guidance, policies, etc.:

- 29 Code of Federal Regulations (CFR), Chapter XVII Occupational Safety and Health Administration (OSHA), Part 1910 Occupational Safety and Health Standards, Section 1910.120 Hazardous Waste Operations and Emergency Response (HAZWOPER)
- 29 CFR Part 1926 – OSHA Safety and Health Regulations for Construction
- National Institute for Occupational Safety and Health (NIOSH) 85-115 – Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities
- NYSDEC, DER Standby Engineering Services Contract No. D009812
- United States Environmental Protection Agency (USEPA) Standard Operating Safety Guides
- USEPA Superfund Amendments and Reauthorization Act (SARA) Title 1 Section 126 – Health and Safety Audit Guidelines
- TRC Health and Safety Management System

To ensure the safety of its employees, TRC maintains a Health and Safety Management System (HSMS), which consists of procedures and programs detailing employee responsibilities and safe work practices. TRC HSMS procedures and programs applicable to NYSDEC Standby Engineering Services Contract D009812 have been included in this Generic HASP as **Appendix A**. These procedures and programs will be followed by TRC personnel during field activities. A listing of the procedures and programs within **Appendix A** is presented in **Table 1** below:

Table 1: TRC HSMS Procedures and Programs within Appendix A

TRC Procedure / Program No.	Procedure / Program Title
Engineer Roles and Responsibilities	
PR02	Hazard Identification, Risk Assessment, and Determining Controls Procedure
PR05	Roles and Responsibilities Procedure
PR06	Competence, Training, and Awareness Procedure

Table 1: TRC HSMS Procedures and Programs within Appendix A

TRC Procedure / Program No.	Procedure / Program Title
CP001	Hazard Communication Program
Applicable Safety Practices	
CP004	Electrical Safety Program
CP008	Confined Space Entry Program
CP011	Heat Stress Prevention Program
CP012	Cold Stress / Cold Weather Safety Program
CP014	Radiation Safety Program
CP024	Excavation and Trench
CP030	Signs, Signals, and Barricades Compliance Program
CP052	Pandemic Preparedness Program
Decontamination Procedures	
ECR010	Equipment Decontamination
Personal Protective Equipment Programs	
CP003	Personal Protective Equipment Program
CP007	Respiratory Protection Program
CP013	Hearing Conservation Program
Employee Training and Medical Surveillance Procedures	
CP009	Health and Safety Training Program
CP015	Behavior-Based Safety Program
CP027	Fitness for Duty Program
Accident Prevention and Contingency Plans	
PR011	Incident Investigation, Nonconformance, and Corrective and Preventative Action Procedure
CP010	First Aid / CPR / AED Bloodborne Pathogens Exposure Control Plan
CP019	TRC Incident Response and Lessons Learned Program
CP046	Spill Prevention/Response Program

1.1 Objective and Scope of the Generic HASP

This Generic HASP, and associated documents, establish the on-site health and safety procedures and programs that are necessary to ensure the health and safety of TRC personnel entering NYSDEC project sites and/or conducting NYSDEC project field work. Specifically, this Generic HASP addresses the following general health and safety items specified in Standby Engineering Services Contract No. D009812:

- Responsibilities of Consultant (Appendix A, PR05 and PR06)
- Risk Analysis (Section 2.0)
- Safety Practices (Appendix A)
- Personal Protective Equipment (Appendix A, CP003)
- Site Control Procedures (Appendix A, CP030)
- Work Zones (Section 3.0)
- Decontamination Procedures (Appendix A, ECR 010)
- Site Monitoring Procedures (Section 4.0)
- Employee Training Procedures (Appendix A, CP009 and CP015)
- Medical Surveillance Procedures (Appendix A, CP027)
- Accident Prevention and Contingency Plans (Appendix A, PR011, CP019, and CP046)
- Additional information required to comply with Federal, State, and local codes, rules, and regulations (Generic HASP and associated documents)

Due to the variety of project sites and work activities associated with the contract, site-specific information (i.e., unique health and safety hazards, job safety analyses, project-specific precautions and protocols, etc.) will be included in a site-specific HASP developed for each work assignment issuance under the contract. The Generic and site-specific HASPs will establish the requirements for health and safety training, supervision, air monitoring, medical monitoring, personal protective equipment (PPE), site controls, safe work practices and proper decontamination at each site, as needed. The Generic and site-specific HASPs will be adhered to by all TRC personnel entering NYSDEC project sites and/or conducting NYSDEC project field work.

1.2 Generic HASP Review and Amendments

This Generic HASP will be reviewed periodically for compliance with applicable laws, rules, regulations, etc. and applicability to project sites, field activities, and work assignment issuances under the contract. The individual responsible for reviewing the Generic HASP will be the TRC Health and Safety Officer (HSO) who is a qualified and experienced health and safety professional, knowledgeable of environmental issues and has the authority to commit resources and implement revisions/changes to the Generic HASP, where necessary. The following components will be reviewed periodically:

- Generic HASP language
- Applicable regulations, standards, guidance, policies, etc.
- TRC HSMS Procedures and Programs
- Site-specific HASP template

The Generic HASP will undergo a complete review (and/or amendment, as appropriate) at the following frequencies:

- Annually
- Change in Federal, State, or local regulations which effect the health and safety and/or work practices of TRC personnel
- Following any OSHA recordable injury or illness as defined by 29 CFR Part 1904
- Following any incident resulting in property damage or loss and/or an environmental release
- Upon NYSDEC request

Generic HASP modifications (as appropriate) will be made within 60 calendar days after discovery, observation, or event requiring the review. If revisions and/or changes are made to the Generic HASP, they will be described in the Record of Revisions (page i of this Generic HASP) and provided to the NYSDEC for review and approval. Implementation of the new or modified health and safety procedures will be initiated immediately upon NYSDEC approval.

To ensure that appropriate activities are taken in response to the review process, each Generic HASP review will be logged and tracked on the form included in **Appendix B**.

2.0 RISK ANALYSIS AND SITE-SPECIFIC HASPS

At the onset of each work assignment, field work involving TRC employees will be evaluated by the assigned TRC Project Manager and HSO to identify and assess any potential site-specific hazards.

The risk analysis process will begin by collecting and reviewing all available site-specific information, including but not limited to the following:

- Information provided by NYSDEC regarding physical site characteristics and the known or suspected use, storage, and/or disposal of hazardous substances at the site and adjacent properties.
- Information obtained from NYSDEC's Environmental Remediation and Spill Incidents Databases and DECinfo Locator Map.
- Safety data sheets (SDSs) and other technical information regarding chemical substances, either known or suspected, to be present at the project site.
- Maps, sketches, drawings, or photographs of site conditions.
- Available historical data collected by TRC, the NYSDEC, the potential responsible party (PRP), and/or other organizations during prior site work.
- The type of work planned for TRC personnel and the associated potential hazards.
- Historical incidents associated with the project site or similar types of field work.
- Applicable Federal, State, and local health and safety regulatory requirements.

Due to the nature of work and types of project sites under this contract, it is anticipated that all on-site work will require development of a site-specific HASP. The site-specific HASP template is provided in **Appendix C**. The site-specific HASP will be prepared by TRC prior to commencement of field activities and a copy of the document will be provided to the NYSDEC Project Manager upon completion.

It is anticipated that the standard operating procedures (SOPs) detailed in TRC's Generic Field Activities Plan (FAP) will be utilized for all work practices. If site-specific activities require additional or alternate procedures, TRC will assess the task hazards and controls using job safety analyses (JSAs). The individual JSAs will be maintained within the site-specific HASP.

The site-specific HASP and all related and/or relevant documentation will be maintained at the project site by TRC personnel and available for the duration of field activities.

3.0 WORK ZONES

Field activities may be subject to work zone partitioning. The Restricted Zone (RZ) will be identified as the area within which all project operations take place and only authorized personnel are allowed. The RZ will be divided into three work areas: the Exclusion Zone (EZ), the Contaminant Reduction Zone (CRZ), and the Support Zone (SZ). Typically, a 5-foot wide (or other distance as determined by the HSO) strip of land bordering the EZ is considered the CRZ. Additionally, a specially demarcated area that connects the decontamination area to the CRZ is treated as an extension of the CRZ. All other areas inside the RZ that are not an active EZs or CRZs are treated as EZs.

3.1 Exclusion Zone

The EZ includes the intrusive activities area, isolates the potential contaminant generation area, and restricts (to the extent possible) the spread of contamination from active work zones to support zones and off-site locations. The EZ will be demarcated by the "Hot Line" (e.g., tape, rope, physical barriers, etc.). Personnel entering the EZ must:

- Enter through a controlled access point (the CRZ)
- Wear the prescribed level of PPE
- Be authorized to enter the EZ

Personnel, equipment, and materials exiting the EZ will be subject to decontamination in the CRZ. Equipment and materials will be decontaminated at temporarily constructed decontamination areas.

No personnel will be positioned downwind of the EZ during intrusive activities and sampling, if possible.

3.2 Contaminant Reduction Zone

The extent and configuration of the CRZ will be at the discretion of the HSO and/or on-site TRC field representative. Certain safety equipment (e.g., emergency eye wash, fire extinguisher, and first aid kit) will be located near the sampling location.

The PPE level to be used for decontamination will typically be Level D. If more protective PPE levels are warranted, the TRC Project Manager and HSO will conduct a hazard analysis to make the determination based on air monitoring readings and visual inspection of personnel and equipment operations in the EZ. Equipment operators (e.g., truck drivers) physically performing tasks outside of the EZ may be exempt from this requirement as approved by the TRC HSO. Personnel will remove all PPE in the CRZ.

3.3 Support Zone

Equipment and materials, paperwork, SDSs, and emergency and communications equipment, will be stored in the SZ.

4.0 SITE MONITORING PROCEDURES

In order to protect site workers from harmful exposures to site-related contaminants, airborne toxic materials, potentially explosive gases, excessively cold conditions, etc., regular environmental and worker monitoring will be performed. Additionally, community monitoring will also be performed to protect third parties and the general public from harmful exposures to site-related contaminants and/or dust resulting from site activities.

4.1 Air Monitoring

Particular work phases will require the use of specific air monitoring equipment to detect relative contaminant levels or identify unknown environments.

All air monitoring will be conducted by the TRC site personnel for the express purpose of safeguarding the health and welfare of site workers and the general public.

4.1.1 Air Monitoring Instrumentation

Specific to each work assignment, on-site air monitoring will be performed using one or more of the following direct reading instruments:

- Portable photoionization detector (PID) or flame ionization detector (FID) to determine the presence of organic volatile vapors.
- Portable multi-gas monitor (4-gas meter) for lower explosive limit (LEL), hydrogen sulfide (H_2S), carbon monoxide (CO), and oxygen (O^2) for the determination of hazardous conditions. Under no circumstances will confined spaces be entered unless discussed with a TRC confined space subject matter expert. The site-specific HASP will incorporate any additional safety requirements and document that all personnel are trained appropriately to enter confined spaces.
- Colorimetric detector tubes for detecting specific contaminants.
- Respirable dust monitor(s) to monitor airborne particulate emissions.
- Radiation detector for detecting radiological contamination (if appropriate).

All monitoring and surveillance equipment will be operated, maintained, and calibrated each working day in accordance with the manufacturer's instructions and quality assurance procedures. Continuous or periodic monitoring will be conducted by trained TRC personnel depending on the field activities and potential hazards. Should monitoring indicate a high hazard potential, the TRC HSO or on-site personnel will review the results and halt work, if appropriate.

Daily air monitoring forms, daily log book entries and instrument data collection applications will be used to record monitoring data. Instrument calibration forms will be used to document any calibrations performed. These forms are provided in and will be maintained within the site-specific HASP (**Appendix C**) for the project's duration.

Monitoring and surveillance equipment can be impacted by cold or wet weather, communication transmissions, and possibly high voltage electrical transmission wires and other interferences. Any unusual meter responses will be noted on the air monitoring forms and daily log book entries and a diagnosis of the potential influencing factors made to determine and eliminate the cause.

4.1.2 Community Air Monitoring Plan

During ground intrusive activities, air monitoring for volatile organic compounds (VOCs) and particulate matter will be accomplished at the upwind and downwind EZ perimeter to document real time contaminant and dust levels potentially migrating away from the work area. All Community Air Monitoring Plan (CAMP) activities, response levels, and actions will be in accordance with requirements of NYSDEC DER-10, Appendices 1A and 1B, New York State Department of Health (NYSDOH) Generic CAMP and Fugitive Dust and Particulate Monitoring, respectively. Copies of NYSDEC DER-10 Appendices 1A and 1B are provided in **Appendix D**.

The following will be used as a general guide for the number of CAMP stations to be used at a project site based on the type and extent of ground intrusive activities:

- Drilling/Direct Push Activities – 1 upwind and 1 downwind
- Test Pits/Small Exploratory Excavations – 1 upwind and 2 downwind
- Site Clearing/Remedial Excavations/Treatment Activities – 1 upwind and 3 downwind
- Additional configurations of upwind and downwind stations as needed based upon field activities, potential hazards, site conditions/setting and/or NYSDEC/NYSDOH request

In addition to continuous monitoring during ground intrusive activities, periodic monitoring for VOCs will also be conducted during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from monitoring wells.

4.2 Off-Site Migration Procedures

Procedures and protocols practiced by on-site workers will aid in preventing any potential adverse conditions with respect to areas adjacent to the site. Pre-planning with first responders and emergency services will be completed, as needed, prior to the start of work to ensure a coordinated, rapid and safe response in the unlikely event of a major release. The following notifications and procedures will assist in eliminating or minimizing the potential for off-site migration of contaminated media:

1. Notifications to first responders and emergency services advising them of the planned remedial investigation/cleanup activities and schedule of on-site events, including a site visit (as necessary) to discuss site conditions, contaminants of concern, potential site hazards, and emergency response procedures.
2. Immediate notification of the NYSDEC, NYSDOH, local officials, and emergency services in the event of a threatening hazardous condition that may affect the health and safety of on-site workers and the surrounding community.
3. Decontamination procedures for equipment to prevent off-site migration of contaminants.
4. Use of CAMP air monitoring equipment to monitor for potential off-site contaminant migration.
5. Implementation of dust control measures, such as wetting down the ground surface or using clean cover material to suppress dust in the event that work area dust levels are exceeded.
6. Use of liquid absorbents, pads, booms, berms, etc. to prevent and contain the flow of liquids.
7. Implementation of soil erosion and sediment control practices/measures.

General visual observations will be made during ground intrusive activities to identify the potential for airborne releases (e.g., vapors, aerosols, etc.), including but not limited to color changes in excavated material/drill cuttings, evidence of grossly-impacted material, presence of buried drums/tanks/containers, changes to the surface appearance of contact equipment, etc. Should such conditions be noticed or encountered, work will be halted, and the area evacuated until such time that the appropriate personnel can be contacted and specific procedures for characterizing and handling the hazard can be developed.

Appendix A

TRC Health and Safety Management System Procedures and Programs

1. PURPOSE

The purpose of this procedure is to establish the process and responsibilities related to identifying hazards, analyzing the risk(s), and ensuring effective controls are implemented to minimize the risk of injury or illness to people.

2. SCOPE

This procedure applies to all field work (i.e., project sites) and office locations.

3. DEFINITIONS

Hazard: A source, situation or act that has the potential to cause harm to a person.

Incident: A work-related event in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred.

Inherent Risk: The level of risk taking into account existing control measures (i.e., prior to any additional control measures being implemented).

Residual Risk: A level of risk remaining after additional control measures have been implemented.

Risk: The combination of the likelihood of an occurrence of a hazardous event or exposure(s), and the severity of injury or ill health that can be caused by the event or exposure(s).

Risk Assessment: The process of evaluating the risk(s) arising from a hazard, taking into account the adequacy of any existing controls, and deciding whether or not the risk is acceptable.

Significant Incident: Any injury defined by Occupational Safety and Health Administration (OSHA) as "recordable", or any significant near miss that could have resulted a recordable injury.

Significant Hazards: Hazards that without consideration of controls, have the greatest potential to cause serious injury to persons or regulatory violations.

4. RESPONSIBILITIES

4.1 The National Safety Director is responsible for the following:

- Developing and communicating the process for identifying and controlling hazards for TRC's field work and office locations to Project Managers and Supervisors.
- Providing training to affected personnel on this procedure.

4.2 Project Managers are responsible for understanding and following the hazard identification process for field work and implementing safety precautions necessary for adequately controlling workplace hazards.

4.3 Office Safety Coordinators are responsible for facilitating the Office Safety Inspection Program for their assigned offices.

4.4 Employees are responsible for participating in the hazard identification process associated with their field work and/or office location.

5. PROCEDURE

5.1 TRC employees perform work at various office locations and client sites that involve a wide range of hazards. Because of this diversity, TRC maintains two separate programs for identifying and controlling workplace hazards:

- For field work, TRC utilizes the Risk Analysis/Site-Specific Health and Safety Plan (HASP) Program (CP002) to identify and control hazards.
- For office locations, TRC utilizes the Office Safety Inspection Program (CP020).

5.2 The Site-Specific HASP includes a process for identifying and controlling hazards that could be encountered during field work. The Site-Specific HASP is required for all field work that is has medium or high inherent risk. Field work that is considered low risk (i.e., working inside an office building, touring a client's manufacturing facility, etc.) will not require a Site-Specific HASP.

5.3 Hazards associated with office work will be primarily identified and controlled using the Office Safety Inspection program.

5.4 Both hazard assessment processes must consider normal and abnormal operating conditions, including start-up, shut-down, maintenance, and potential emergency situations.

5.5 Every health and safety hazard has an inherent risk and residual risk. The inherent risk (without considering controls), and the residual risk (considering existing controls) will be evaluated by assessing the frequency of exposure, the consequence of the outcome, and the likelihood of the consequence occurring, with regard to harming people.

5.6 Project Managers are responsible for ensuring that adequate controls are implemented to reduce the risk of injury or illness to an acceptable level.

5.7 Hazards will be reassessed when work conditions change significantly from plan, in the event of an incident (i.e., near miss or injury), or based on concern of an employee, contractor, or client.

6. RECORDS

Completed project Site-Specific HASPs

Completed Office Safety Inspection Checklists

7. REFERENCES/RELATED DOCUMENTATION

PR08 – Operational Control Procedure

CP002 – Risk Analysis/Site-Specific Health and Safety Plan Program

CP020 – TRC Office Safety Program

1. PURPOSE

The purpose of this procedure is to outline the roles and responsibilities for all personnel within the scope of TRC's Health and Safety Management System.

2. SCOPE

This procedure applies to all TRC employees and TRC managed project sites.

3. DEFINITIONS

Hazard: A source, situation or act that has the potential to cause harm to a person.

Incident: A work-related event in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred.

Interested Party: A person or group, inside or outside the workplace concerned with or affected by the Health and Safety performance of the company.

Legal and Other Requirements: Laws, acts, legislation, regulation (local, state, federal, region), codes, standards, and other requirements such as client requirements, Company policies, and voluntary commitments made by TRC.

Health and Safety Network: TRC staff who are assigned full-time or part-time safety roles as listed in the TRC Safety Organization Chart.

4. RESPONSIBILITIES

4.1 The Chief Risk Officer is responsible for:

- Communicating matters of risk associated with Health and Safety to TRC Executives and Managers to promote a culture of risk awareness.
- Actively participating on the Executive Safety Council.

4.2 The National Safety Director is responsible for the following:

- Defining, documenting and communicating roles and responsibilities associated with the Health and Safety Management System to affected personnel.
- Ensuring that a current copy of the Health and Safety Management System procedures and associated documents are maintained on TRC's network.
- Promoting safety awareness by routinely communicating health and safety information to the organization. Relevant topics include recent safety incidents, new or revised safety procedures or programs, status of TRC's safety performance, etc.
- Facilitating the Executive Safety Council and maintaining records of the meetings.
- Maintaining TRC's Health and Safety Management System and making it accessible to TRC employees and other interested parties.

4.3 The Executive Safety Council is responsible for the following:

- Meeting routinely to discuss current topics related to TRC's health and safety performance. Topics could include the following:
  - Recent incidents, root causes and corrective actions involving TRC personnel or projects;
  - Status of health and safety improvement programs; new or proposed legal and other requirements that could apply to TRC;
  - Methods of continually improving TRC's safety performance;
  - Best industry practices.
- Working with the National Safety Director to develop TRC's Health and Safety objectives and targets, and developing the associated Safety improvement programs.

4.4 The Senior Management Team is responsible for:

- Providing the resources necessary for implementing and maintaining TRC's Health and Safety Management System.

4.5 The Corporate Safety Compliance Manager is responsible for the following:

- Providing health and safety technical advice to the National Safety Director on health and safety regulations (i.e., interpretation, recordkeeping requirements, applicability, etc.).
- Reviewing incident reports with the National Safety Director to determine if the injuries or illnesses meet OSHA's recordkeeping criteria.
- Assisting Project Managers and members of TRC's Health and Safety Network with identifying applicable health and safety standards and evaluating compliance with the standards.

4.6 The Corporate Safety Manager is responsible for the following:

- Oversight and management of the TRC Safety Service Desk;
- Assisting the National Safety Director in the management of TRC's Subcontractor Management Program;
- Managing TRC's safety performance tracking system including, entering incident and near miss data, compiling company Safety information and developing metrics reports to review with the National Safety Director;
- Updating internet-based contractor management programs (e.g., PICS, ISNetworld, etc.) and communicating client-specific health and safety requirements to the appropriate Project Managers;
- Assisting Office Safety Coordinators in the development of Site-Specific Health and Safety Plans (HASPs).

4.7 TRC's Legal Department is responsible for facilitating the response to regulatory agencies on legal matters related to Health and Safety.

4.8 Sector Safety Leaders are responsible for the following:

- Providing safety guidance and assistance to the Practices within their respective Sector.
- Communicating with Practice Leaders regarding:
  - The investigation of work-related incidents and the development of corrective actions;
  - Initiatives of the Executive Safety Council;
  - Changes to TRC's Health and Safety Management System.

4.9 Project Managers are responsible for the following:

- Managing projects in accordance with TRC's Health and Safety Management System.
- Consulting with a member of TRC's Health and Safety Network on Safety issues such as Health and Safety training requirements and determining which OSHA standards are applicable to the project.
- Communicating TRC and Client requirements to project employees and Subcontractors.

4.10 Office Safety Coordinators are responsible for:

- Periodically reviewing the Emergency Action Plans for their assigned offices;
- Conducting and documenting Office Safety Inspections and forwarding results to the National Safety Director;
- Ordering necessary Personal Protective Equipment (PPE) for office personnel;
- Communicating relevant safety information to office personnel during meetings, conference calls, and e-mails;
- Assisting Project Managers with developing Site-Specific HASPs;
- Performing safety observations and providing feedback to employees and management;
- Providing safety on-boarding (safety orientation) to new employees.

4.11 Supervisors:

- Communicating roles and responsibilities related to TRC's Health and Safety Management System to supervised employees and personnel working on behalf of TRC.
- Actively participating in incident investigations and implementing associated corrective actions.
- Promoting a proactive safety culture by including health and safety topics in meetings and encouraging employees to report near misses.

4.12 TRC employees are responsible for the following:

- Stopping work upon noticing unsafe acts and conditions, and reporting these conditions to Supervision immediately.
- Understanding and complying with TRC's health and safety procedures and compliance programs.
- Completing required training in accordance with TRC's Health and Safety Management System.
- Complying with the health and safety compliance requirements identified in the Health and Safety Management System.

5. PROCEDURE

5.1 The National Safety Director, in consultation with the Executive Safety Council, will define and document roles and responsibilities associated with TRC's Health and Safety Management System:

- Health and safety roles and responsibilities will be communicated to employees through various methods which could include: roles descriptions, established safety programs and procedures, project HASPs, and e-mail communications.

5.2 Project Managers will communicate roles and responsibilities associated with field work, including client-specific requirements, to project personnel throughout the duration of the project.

5.3 Supervisors will consider roles and responsibilities related to health and safety in employees' annual performance reviews.

6. REFERENCES/RELATED DOCUMENTATION

PR06 Competence, Training and Awareness

1. PURPOSE

The purpose of this procedure is to outline the responsibilities and the process for educating TRC personnel in the relevant Health and Safety topics to reduce the risk of work-related injuries, illnesses and incidents.

This procedure also establishes the process for confirming that Subcontractors working on TRC-managed projects have been provided the applicable Health and Safety training.

2. SCOPE

This procedure applies to all TRC employees and subcontractors working on behalf of TRC.

3. DEFINITIONS

OSHA: Occupational Safety and Health Administration

Hazard: A source, situation or act that has the potential to cause harm to a person.

Incident: A work-related event in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred.

4. RESPONSIBILITIES

4.1 The National Safety Director is responsible for the following:

- Identifying mandatory health and safety training courses for TRC personnel based on regulatory requirements and roles.
- Working with the Training and Development Coordinator to make health and safety training materials and courses available to TRC personnel.

4.2 The Training and Development Coordinator is responsible for the following:

- Maintaining the health and safety training courses on the TRC Safety Academy and other training programs utilized by TRC.
- Identifying training resources for health and safety topics that are not available on TRC Safety Academy.

4.3 The Corporate Safety Compliance Manager is responsible for the following:

- Providing technical advice to the National Safety Director and the Training and Development Coordinator on health and safety training requirements (i.e., identifying regulatory required training, evaluating content to meet compliance requirements, etc.).

4.4 The Executive Safety Council is responsible for the following:

- Evaluating the effectiveness of this procedure based on reported incidents, client and employee feedback, compliance evaluations, and field observations.

4.5 The Corporate Safety Manager is responsible for the following:

- Communicating TRC's health and safety training requirements to Subcontractors through Internet-based contractor management programs (e.g., PICS, ISNetworld, etc.).
- Providing health and safety training information (i.e., training records, training course titles, frequency of training, etc.) related to TRC employees to clients as requested.

4.6 Project Managers are responsible for the following:

- Identifying the health and safety training based on employee roles and responsibilities, legal and other requirements, and TRC's Health and Safety Management System.
- Confirming that employees participating in field work are current with health and safety training that is applicable to their field work.
- Evaluating the competency of TRC employees and Subcontractors performing field work through discussion and field observations.
- Communicating the need for additional training or remedial training to the appropriate TRC Supervisors and Subcontractor representatives, based on field observations and reports of incidents.

4.7 Supervisors are responsible for the following:

- Communicating with the National Safety Director and the Training and Development Coordinator to identify the required health and safety training for employees under their supervision.
- Evaluating the competency of TRC employees and Subcontractors performing field work through discussion and field observations.
- Assigning additional training or remedial training to employees based on job performance, employee concerns, and incident reports.

4.8 Office Safety Coordinators are responsible for the following:

- Facilitating the new hire safety orientation training for new hire employees.
- Assisting Supervisors in communicating health and safety training requirements to employees.

4.9 Employees are responsible for the following:

- Assisting their direct Supervisor and Project Managers in identifying applicable health and safety training based on job duties and regulatory requirements.
- Completing all assigned health and safety training.
- Communicating the need for additional safety training based on new types of field work, changes in role, or unclear expectations.

5. PROCEDURE

5.1 Health and Safety Training Plan:

- Supervisors will identify initial health and safety training requirements for new employees under their direct supervision, based on job expectations, legal and other requirements, and client requirements:
  - Health and safety training needs will be documented for each TRC employee in the Health and Safety Training Checklist (CP009.1).
  - The Health and Safety Training Map (CP009.2) will be used as a reference document to identify training topics, applicability to the employees' job functions and frequency of training.
- Completed Health and Safety Training Profiles will be forwarded to the Training and Development Coordinator by the employee's Supervisor, and will be used to assign required training courses in the TRC Safety Academy.
- Health and safety training profiles will be reviewed and updated by Supervisors on an annual basis for all employees as well as whenever employees' job assignments are reassigned.

5.2 Training Methods:

- Health and safety courses will be evaluated by the National Safety Director and the Corporate Safety Compliance Manager to confirm the material meets TRC's expectations and confirms to legal and other requirements.
- TRC provides both classroom training, on-line training, and on-the-job training. Classroom training and certification is conducted by designated TRC trainers or outsourced certified safety training companies.
- Health and safety training can be delivered to employees by a variety of methods including computer-based, instructor led, and on-the-job meetings (e.g., tailboard meetings).

5.3 Training Frequency:

- TRC employees will be provided new hire safety orientation within the first week of employment:
  - New hire safety orientation must include the following topics, at a minimum:
    - TRC's Environmental, Health and Safety Policy.
    - Hazard Communication.
    - Emergency Action Plan.
    - Procedure for reporting hazards and work related injuries.
    - Overview of TRC's Health and Safety Management System.
- Prior to performing tasks, employees must successfully complete all required health and safety training as defined on the CP009.1 Health and Safety Training Plan.

5.4 Documentation:

- Documentation for all required training will be forwarded to the Training and Development Coordinator who will retain the records.
  - Training records must include the following criteria, at a minimum:
    - Training date.
    - Instructor and Student(s) names.
    - Training course title.
    - Key training topics.

6. RECORDS

Employee Training Records (TRC Safety Academy)

7. REFERENCES/ RELATED DOCUMENTATION

CP009.1 – Health and Safety Training Checklist

CP009.2 – Health and Safety Training Map

1. PURPOSE

The purpose of the Hazard Communication Program is to ensure that the hazards associated with hazardous chemicals used or stored at TRC's office locations and project sites are classified and the information concerning the chemical hazards is communicated to employees so adequate precautions can be taken. This program outlines the responsibilities and procedures for managing the Hazard Communication Program at TRC office locations and project sites.

2. SCOPE

This procedure applies to all offices and project sites where hazardous chemicals are used or stored.

3. DEFINITIONS

Hazardous chemical: means any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified.

Label: means an appropriate group of written, printed or graphic information elements concerning a hazardous chemical that is affixed to, printed on, or attached, to the immediate container of a hazardous chemical, or to the outside packaging.

Substance: means chemical elements and their compounds in the natural state or obtained by any production process, including any additive necessary to preserve the stability of the product and any impurities deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition.

4. RESPONSIBILITIES

4.1 The National Safety Director is responsible for the following:

- Implement this compliance program throughout TRC.
- Make hazard communication training programs available to all TRC employees.

4.2 Office Safety Coordinators are responsible for the following:

- Communicate the requirements of this program to office personnel.
- Maintain a current inventory of hazardous substances for each office location and the corresponding Safety Data Sheets (SDSs) (see Form CP001.1- Hazardous Substance Inventory).
- Periodically inspect the workplace to confirm chemical containers are properly labeled.

4.3 Project Managers are responsible for the following:

- Communicate the requirements of this program (i.e., container labeling, SDS access, and training) to TRC field personnel and affected subcontractors.

4.4 Employees are responsible for the following:

- Complete the training required by this program.
- Review SDSs for hazardous substances associated with their work.
- Following the safety precautions listed in SDSs, TRC's safety programs, sites-specific Health and Safety Plans (HASPs), and training material.

5. PROCEDURES

5.1 Hazardous Substance Inventory:

- An inventory of all hazardous substances stored or used in the workplace shall be maintained by the Office Safety Coordinator (OSC) at each office location. See Form CP001.1 for a Hazardous Substance Inventory.
- An inventory of hazardous substances used or stored at project sites will be listed in the site-specific HASP. This inventory and associated SDSs will be offered to affected contractors working on the project site.

5.2 Container Labeling:

5.2.1 Labels on shipped containers (i.e., receiving new product) should contain the following criteria (**note:** this is a requirement after Dec 1, 2015):

- Product identifier.
- Signal word.
- Hazard statement.
- Pictogram.
- Precautionary statement.
- Name, address, and telephone number of the chemical manufacturer.

5.2.2 Labels on shipped containers shall not be removed or defaced unless the identical information is reinstalled on the container.

5.2.3 Containers in the workplace (i.e., secondary containers, portable and stationary tanks, etc.) shall be labeled with the criteria listed in Section 5.2.1, or the product identifier and words, pictures, symbols, or combination thereof, which provide at least general information regarding the physical hazards of the chemical.

5.2.4 Damaged labels or labels with incomplete information shall be reported immediately.

5.2.5 Workplace labels or other forms of warning will be legible, in English and prominently displayed on the container or readily available in the work area throughout each work shift. If employees speak languages other than English, the information in the other language(s) may be added to the material presented as long as the information is presented in English as well.

5.3 SDSs:

5.3.1 SDSs must be received with the initial order of the hazardous substance and shall be forwarded to the OSC for office locations, or the appropriate Project Manager for field work.

5.3.2 The OSC shall maintain a current file of SDSs for their respective office locations.

5.3.3 Project Managers shall maintain a current file of SDSs for their respective projects:

- Project Managers shall offer SDSs to affected contractors, clients, and other personnel who could be exposed to chemicals used by TRC on project sites.

5.3.4 Outside contractors shall be informed by the OSC of the materials to which they may be exposed at TRC office locations. Copies of the SDSs for substances in use while the contractor is on the premises shall be supplied by the contractor upon request.

5.3.5 All SDSs will be accessible to all TRC personnel electronically via TRCNET, or paper copy maintained by the OSC or Project Manager. TRC employees will be provided SDSs promptly upon request.

5.4 Multi-Employer Job Sites and/or Multi Work Site:

Chemical information is provided to employees on multiple worksites or multiple employer worksites. The following specific methods for providing other employer information concerning hazardous chemicals at job sites, methods of providing SDS sheets, methods of precautionary measures to be taken and methods of providing information on labeling systems:

- Multi-Work Sites:

  Where employees must travel between work places during a work shift (multi job sites), the written program may be kept at a primary job site. If there is no primary, then the program should be sent with employees.

- Multi-Employer Job Sites:

  A pre-job briefing shall be conducted with the contractor prior to the initiation of work on the site.

  - During this pre-job briefing, contractors shall notify TRC and present current copies of Safety Data Sheets and label information for every hazardous chemical brought on-site.
  - All contractors shall notify and provide required SDS and label information for all hazardous chemicals the contractor may encounter on the job.
  - The facilities labeling system and any precautionary measures to be taken by contractor during normal conditions and emergencies shall be addressed.
  - By providing such information to other employers, TRC does not assume any obligations that other employers have for the safety of their employees.

5.5 Training:

5.5.1 All TRC employees shall receive Hazard Communication training upon being hired. At a minimum, the training shall include:

- Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area.
- General physical and health hazards associated with chemicals and the precautions necessary to prevent injury/illness.
- Requirements of the OSHA Hazard Communication Standard.
- TRC's written Hazard Communication Program.
- How to access SDSs during their Health and Safety orientation. Container labeling requirements including new Globally Harmonized System (GHS) labeling elements and SDS format. (See Figures 1 and 2).
- Instructions on how to read and understand information contained in an SDS and where the SDS can be found.
- Operations where hazardous chemicals may be present, and potential health hazards to which the employee(s) may be exposed.
- Methods for detecting the presence of a hazardous chemical release.

5.5.2 Employees who may be exposed to hazardous substances while performing their job shall receive specific training on the chemical hazards and precautions necessary to prevent injury/illness.

5.5.3 If a new hazard is introduced into the workplace, affected employees shall receive training addressing the new hazard.

5.5.4 Employees that perform non-routine tasks will be trained on the hazards of the non-routine task prior to the work beginning.

5.6 Annual Review:

5.6.1 The Hazard Communication Program shall be reviewed by the TRC National Safety Director or designee on an annual basis (see Figure 3) to ensure it remains effective.

5.7 Records:

5.7.1 SDSs associated with employee exposures shall be retained for 30 years after the date of the last exposure.

6. REFERENCES/RELATED DOCUMENTATION

CP003 Personal Protective Equipment

29 CFR 1910.1200 Hazard Communication

Hazard Communication Training (TRC Safety Academy)

GHS Compliance Training (TRC Safety Academy) Form

CP001.1 Hazardous Substance Inventory

Form CP001.1
Hazardous Substance Inventory

OFFICE LOCATION	HAZARDOUS Substance	CHEMICAL LOCATION / AREA USED (OPTIONAL)	SDSs ON FILE (X)

Figure 1
Example GHS Label

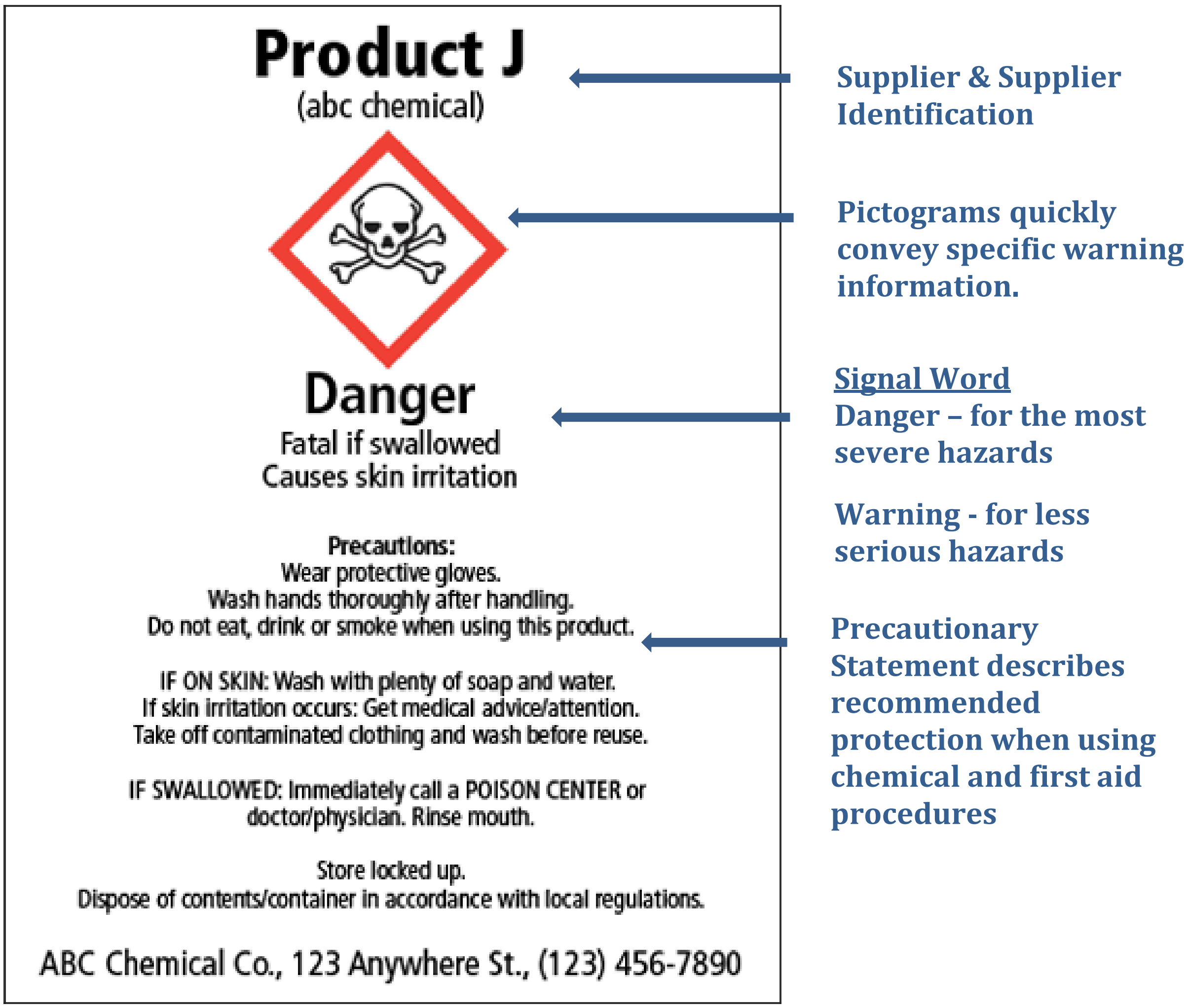


Figure 2
GHS Pictogram

HC

Health Hazard

- Carcinogen
- Mutagenicity
- Reproductive Toxicity
- Respiratory Sensitizer
- Target Organ Toxicity
- Aspiration Toxicity

Flame

- Flammables
- Pyrophorics
- Self-Heating
- Emits Flammable Gas
- Self-Reactives
- Organic Peroxides

Exclamation Mark

- Irritant (skin and eye)
- Skin Sensitizer
- Acute Toxicity
- Narcotic Effects
- Respiratory Tract Irritant
- Hazardous to Ozone Layer (Non-Mandatory)

Gas Cylinder

- Gases Under Pressure

Corrosion

- Skin Corrosion/Burns
- Eye Damage
- Corrosive to Metals

Exploding Bomb

- Explosives
- Self-Reactives
- Organic Peroxides

Flame Over Circle

- Oxidizers

Environment

(Non-Mandatory)

- Aquatic Toxicity

Skull and Crossbones

- Acute Toxicity (fatal or toxic)

Figure 3
Annual Review Checklist

		ACTIONS REQUIRED	DATE FOR ACTION TO BE COMPLETED
1.	Review of written compliance program		
2.	Hazardous materials inventory		
3.	SDS file update		
4.	Review of training program		
5.	Office review (attach list)		

Reviewer's Signature: ______________________ Date Completed: __________

1. PURPOSE

TRC's Electrical Safety Program has been developed based on the Occupational Safety and Health Administration (OSHA) standards for the construction industry (29 CFR 1926, Subpart K – Electrical) and general industry (29 CFR 1910, Subpart S – Electrical) to protect employees from hazards in the electrical industry.

2. SCOPE

This Compliance Program covers the construction and maintenance of electric power equipment. As used in this Compliance Program, the term "construction" includes the installation of new electric equipment, and the alteration, conversion, and improvement of existing electric equipment. This Compliance Program does not apply to electrical safety-related work practices for unqualified employees. These guidelines apply to all Operating Unit facilities and project sites.

3. DEFINITIONS

<u>Acceptable</u>: An installation or equipment is acceptable to the Assistant Secretary of Labor, and approved within the meaning of this Subpart K:

- If it is accepted, or certified, or listed, or labeled, or otherwise determined to be safe by a qualified testing laboratory capable of determining the suitability of materials and equipment for installation and use in accordance with this standard;
- With respect to an installation or equipment of a kind which no qualified testing laboratory accepts, certifies, lists, labels, or determines to be safe, if it is inspected or tested by another Federal agency, or by a State, municipal, or other local authority responsible for enforcing occupational safety provisions of the National Electrical Code, and found in compliance with those provisions; or
- With respect to custom-made equipment or related installations which are designed, fabricated for, and intended for use by a particular customer, if it is determined to be safe for its intended use by its manufacturer on the basis of test data which TRC keeps and makes available for inspection to the Assistant Secretary and his authorized representatives.

<u>Accepted</u>: An installation is "accepted" if it has been inspected and found to be safe by a qualified testing laboratory.

<u>Accessible</u>: (As applied to wiring methods.) Capable of being removed or exposed without damaging the building structure or finish, or not permanently closed in by the structure or finish of the building. (See "concealed" and "exposed.")

<u>Accessible</u>: (As applied to equipment.) Admitting close approach; not guarded by locked doors, elevation, or other effective means. (See "Readily accessible.")

Ampacity: The current in amperes a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

Appliances: Utilization equipment, generally other than industrial, normally built in standardized sizes or types, which is installed or connected as a unit to perform one or more functions.

Approved: Acceptable to the authority enforcing this Subpart. The authority enforcing this Subpart is the Assistant Secretary of Labor for Occupational Safety and Health. The definition of "acceptable" indicates what is acceptable to the Assistant Secretary of Labor, and therefore approved within the meaning of this Subpart.

Askarel**:** A generic term for a group of nonflammable synthetic chlorinated hydrocarbons used as electrical insulating media. Askarels of various compositional types are used. Under arcing conditions the gases produced, while consisting predominantly of noncombustible hydrogen chloride, can include varying amounts of combustible gases depending upon the askarel type.

Attachment plug (Plug cap or Cap): A device which, by insertion in a receptacle, establishes connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle.

Automatic: Self-acting, operating by its own mechanism when actuated by some impersonal influence, as for example, a change in current strength, pressure, temperature, or mechanical configuration.

Bare conductor**:** See "Conductor."

Bonding: The permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed.

Bonding jumper: A reliable conductor to assure the required electrical conductivity between metal parts required to be electrically connected.

Branch circuit: The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).

Building**:** A structure which stands alone or which is cut off from adjoining structures by fire walls with all openings therein protected by approved fire doors.

Cabinet**:** An enclosure designed either for surface or flush mounting, and provided with a frame, mat, or trim in which a swinging door or doors are or may be hung.

Certified: Equipment is "certified" if it:

- Has been tested and found by a qualified testing laboratory to meet applicable test standards or to be safe for use in a specified manner; and
- Is of a kind whose production is periodically inspected by a qualified testing laboratory. Certified equipment must bear a label, tag, or other record of certification.

Circuit breaker:

- (600 volts nominal, or less.) A device designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined overcurrent without injury to itself when properly applied within its rating.
- (Over 600 volts, nominal.) A switching device capable of making, carrying, and breaking currents under normal circuit conditions, and also making, carrying for a specified time, and breaking currents under specified abnormal circuit conditions, such as those of short circuit.

Class I locations**:** Class I locations are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. Class I locations include the following:

- A Class I, Division 1 location is a location:
    - In which ignitable concentrations of flammable gases or vapors may exist under normal operating conditions; or
    - In which ignitable concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or
    - In which breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases or vapors, and might also cause simultaneous failure of electric equipment.

  NOTE: This classification usually includes locations where volatile flammable liquids or liquefied flammable gases are transferred from one container to another; interiors of spray booths and areas in the vicinity of spraying and painting operations where volatile flammable solvents are used; locations containing open tanks or vats of volatile flammable liquids; drying rooms or compartments for the evaporation of flammable solvents; inadequately ventilated pump rooms for flammable gas or for volatile flammable liquids; and all other locations where ignitable concentrations of flammable vapors or gases are likely to occur in the course of normal operations.

- A Class I, Division 2 location is a location:
  - In which volatile flammable liquids or flammable gases are handled, processed, or used, but in which the hazardous liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in case of abnormal operation of equipment;
  - In which ignitable concentrations of gases or vapors are normally prevented by positive mechanical ventilation, and which might become hazardous through failure or abnormal operations of the ventilating equipment; or
  - That is adjacent to a Class I, Division 1 location, and to which ignitable concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

  NOTE: This classification usually includes locations where volatile flammable liquids or flammable gases or vapors are used, but which would become hazardous only in case of an accident or some unusual operating condition. The quantity of flammable material that might escape in case of accident, the adequacy of ventilating equipment, the total area involved, and the record of the industry or business with respect to explosions or fires are all factors that merit consideration in determining the classification and extent of each location.

  Piping without valves, checks, meters, and similar devices would not ordinarily introduce a hazardous condition even though used for flammable liquids or gases. Locations used for the storage of flammable liquids or liquefied or compressed gases in sealed containers would not normally be considered hazardous unless also subject to other hazardous conditions.

  Electrical conduits and their associated enclosures separated from process fluids by a single seal or barrier are classed as a Division 2 location if the outside of the conduit and enclosures is a nonhazardous location.

<u>Class II locations</u>: Class II locations are those that are hazardous because of the presence of combustible dust. Class II locations include the following:

- Class II, Division 1: A Class II, Division 1 location is a location:
  - In which combustible dust is or may be in suspension in the air under normal operating conditions, in quantities sufficient to produce explosive or ignitable mixtures;
  - Where mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignitable mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electric equipment, operation of protection devices, or from other causes; or

- In which combustible dusts of an electrically conductive nature may be present.

NOTE: Combustible dusts which are electrically nonconductive include dusts produced in the handling and processing of grain and grain products, pulverized sugar and cocoa, dried egg and milk powders, pulverized spices, starch and pastes, potato and woodflour, oil meal from beans and seed, dried hay, and other organic materials which may produce combustible dusts when processed or handled. Dusts containing magnesium or aluminum are particularly hazardous and the use of extreme caution is necessary to avoid ignition and explosion.

- Class II, Division 2: A Class II, Division 2 location is a location in which:
  - Combustible dust will not normally be in suspension in the air in quantities sufficient to produce explosive or ignitable mixtures, and dust accumulations are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus; or
  - Dust may be in suspension in the air as a result of infrequent malfunctioning of handling or processing equipment, and dust accumulations resulting therefrom may be ignitable by abnormal operation or failure of electrical equipment or other apparatus.

  NOTE: This classification includes locations where dangerous concentrations of suspended dust would not be likely but where dust accumulations might form on or in the vicinity of electric equipment. These areas may contain equipment from which appreciable quantities of dust would escape under abnormal operating conditions or be adjacent to a Class II Division 1 location, as described above, into which an explosive or ignitable concentration of dust may be put into suspension under abnormal operating conditions.

Class III locations: Class III locations are those that are hazardous because of the presence of easily ignitable fibers or filings, but in which such fibers or filings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures. Class III locations include the following:

- Class III, Division 1: A Class III, Division 1 location is a location in which easily ignitable fibers or materials producing combustible filings are handled, manufactured, or used.

NOTE: Easily ignitable fibers and filings include rayon, cotton (including cotton linters and cotton waste), sisal or henequen, istle, jute, hemp, tow, cocoa fiber, oakum, baled waste kapok, Spanish moss, excelsior, sawdust, woodchips, and other material of similar nature.

- Class III, Division 2: A Class III, Division 2 location is a location in which easily ignitable fibers are stored or handled, except in process of manufacture.

Collector Ring: A collector ring is an assembly of slip rings for transferring electrical energy from a stationary to a rotating member.

Concealed: Rendered inaccessible by the structure or finish of the building. Wires in concealed raceways are considered concealed, even though they may become accessible by withdrawing them. (See "Accessible. [As applied to wiring methods.]")

Conductor:

- Bare: A conductor having no covering or electrical insulation whatsoever.
- Covered: A conductor encased within material of composition or thickness that is not recognized as electrical insulation.
- Insulated: A conductor encased within material of composition and thickness that is recognized as electrical insulation.

Controller: A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

Covered conductor**:** See "Conductor."

Cutout**:** (Over 600 volts, nominal.) An assembly of a fuse support with either a fuseholder, fuse carrier, or disconnecting blade. The fuseholder or fuse carrier may include a conducting element (fuse link), or may act as the disconnecting blade by the inclusion of a nonfusible member.

Cutout box**:** An enclosure designed for surface mounting and having swinging doors or covers secured directly to and telescoping with the walls of the box proper. (See "Cabinet.")

Damp location: See "Location."

Dead front**:** Without live parts exposed to a person on the operating side of the equipment.

Device**:** A unit of an electrical system which is intended to carry but not utilize electric energy.

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

Disconnecting (or Isolating) switch (Over 600 volts, nominal): A mechanical switching device used for isolating a circuit or equipment from a source of power.

Dry location**:** See "Location."

Enclosed**:** Surrounded by a case, housing, fence or walls which will prevent persons from accidentally contacting energized parts.

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

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

Equipment grounding conductor: See "Grounding conductor, equipment."

Explosion-proof apparatus: Apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor which may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and which operates at such an external temperature that it will not ignite a surrounding flammable atmosphere.

Exposed:

- As applied to live parts: Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts not suitably guarded, isolated, or insulated. (See "Accessible" and "Concealed.")
- As applied to wiring methods: On or attached to the surface or behind panels designed to allow access. (See "Accessible. [As applied to wiring methods.]")
- For the purposes of § 1926.408(d), Communications systems: Where the circuit is in such a position that in case of failure of supports or insulation, contact with another circuit may result.

Externally operable: Capable of being operated without exposing the operator to contact with live parts.

Feeder: All circuit conductors between the service equipment, or the generator switchboard of an isolated plant, and the final branch-circuit overcurrent device.

Festoon lighting: A string of outdoor lights suspended between two points more than 15 feet (4.57 m) apart.

Fitting: An accessory such as a locknut, bushing, or other part of a wiring system that is intended primarily to perform a mechanical rather than an electrical function.

Fuse (Over 600 volts, nominal): An overcurrent protective device with a circuit opening fusible part that is heated and severed by the passage of overcurrent through it. A fuse comprises all the parts that form a unit capable of performing the prescribed functions. It may or may not be the complete device necessary to connect it into an electrical circuit.

Ground: A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

Grounded**:** Connected to earth or to some conducting body that serves in place of the earth.

Grounded, effectively (Over 600 volts, nominal): Permanently connected to earth through a ground connection of sufficiently low impedance and having sufficient ampacity that ground fault current which may occur cannot build up to voltages dangerous to personnel.

Grounded conductor: A system or circuit conductor that is intentionally grounded.

Grounding conductor: A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes.

Grounding conductor, equipment**:** The conductor used to connect the noncurrent-carrying metal parts of equipment, raceways, and other enclosures to the system grounded conductor and/or the grounding electrode conductor at the service equipment or at the source of a separately derived system.

Grounding electrode conductor: The conductor used to connect the grounding electrode to the equipment grounding conductor and/or to the grounded conductor of the circuit at the service equipment or at the source of a separately derived system.

Ground-fault circuit interrupter: A device for the protection of personnel that functions to deenergize a circuit or portion thereof within an established period of time when a current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit.

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

Hoistway**:** Any shaftway, hatchway, well hole, or other vertical opening or space in which an elevator or dumbwaiter is designed to operate.

Identified (conductors or terminals): Identified, as used in reference to a conductor or its terminal, means that such conductor or terminal can be recognized as grounded.

Identified (for the use): Recognized as suitable for the specific purpose, function, use, environment, application, etc. where described as a requirement in this standard. Suitability of equipment for a specific purpose, environment, or application is determined by a qualified testing laboratory where such identification includes labeling or listing.

Insulated conductor: See "Conductor."

Interrupter switch (Over 600 volts, nominal): A switch capable of making, carrying, and interrupting specified currents.

Intrinsically safe equipment and associated wiring: Equipment and associated wiring in which any spark or thermal effect, produced either normally or in specified fault conditions, is incapable, under certain prescribed test conditions, of causing ignition of a mixture of flammable or combustible material in air in its most easily ignitable concentration.

Isolated: Not readily accessible to persons unless special means for access are used.

Isolated power system: A system comprising an isolating transformer or its equivalent, a line isolation monitor, and its ungrounded circuit conductors.

Labeled: Equipment or materials to which has been attached a label, symbol or other identifying mark of a qualified testing laboratory which indicates compliance with appropriate standards or performance in a specified manner.

Lighting outlet: An outlet intended for the direct connection of a lampholder, a lighting fixture, or a pendant cord terminating in a lampholder.

Listed: Equipment or materials included in a list published by a qualified testing laboratory whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

Location:

- Damp location: Partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements.
- Dry location: A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.
- Wet location: Installations underground or in concrete slabs or masonry in direct contact with the earth, and locations subject to saturation with water or other liquids, such as locations exposed to weather and unprotected.

Mobile X-ray: X-ray equipment mounted on a permanent base with wheels and/or casters for moving while completely assembled.

Motor control center: An assembly of one or more enclosed sections having a common power bus and principally containing motor control units.

Outlet: A point on the wiring system at which current is taken to supply utilization equipment.

Overcurrent**:** Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload (see definition), short circuit, or ground fault. A current in excess of rating may be accommodated by certain equipment and conductors for a given set of conditions. Hence the rules for overcurrent protection are specific for particular situations.

Overload: Operation of equipment in excess of normal, full load rating, or of a conductor in excess of rated ampacity which, when it persists for a sufficient length of time, would cause damage or dangerous overheating. A fault, such as a short circuit or ground fault, is not an overload. (See "Overcurrent.")

Panelboard: A single panel or group of panel units designed for assembly in the form of a single panel; including buses, automatic overcurrent devices, and with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front. (See "Switchboard.")

Portable X-ray**:** X-ray equipment designed to be hand-carried.

Power fuse (Over 600 volts, nominal): See "Fuse."

Power outlet**:** An enclosed assembly which may include receptacles, circuit breakers, fuseholders, fused switches, buses and watt-hour meter mounting means; intended to serve as a means for distributing power required to operate mobile or temporarily installed equipment.

Premises wiring system**:** That interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all of its associated hardware, fittings, and wiring devices, both permanently and temporarily installed, which extends from the load end of the service drop, or load end of the service lateral conductors to the outlet(s). Such wiring does not include wiring internal to appliances, fixtures, motors, controllers, motor control centers, and similar equipment.

Qualified person**:** One familiar with the construction and operation of the equipment and the hazards involved.

Qualified testing laboratory**:** A properly equipped and staffed testing laboratory which has capabilities for and which provides the following services:

- Experimental testing for safety of specified items of equipment and materials referred to in this standard to determine compliance with appropriate test standards or performance in a specified manner;
- Inspecting the run of such items of equipment and materials at factories for product evaluation to assure compliance with the test standards;
- Service-value determinations through field inspections to monitor the proper use of labels on products and with authority for recall of the label in the event a hazardous product is installed;

- Employing a controlled procedure for identifying the listed and/or labeled equipment or materials tested; and
- Rendering creditable reports or findings that are objective and without bias of the tests and test methods employed.

Raceway**:** A channel designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this subpart. Raceways may be of metal or insulating material, and the term includes rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible metal conduit, flexible metallic tubing, flexible metal conduit, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, wireways, and busways.

Readily accessible**:** Capable of being reached quickly for operation, renewal, or inspections, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs, etc. (See "Accessible.")

Receptacle**:** A receptacle is a contact device installed at the outlet for the connection of a single attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is a single device containing two or more receptacles.

Receptacle outlet: An outlet where one or more receptacles are installed.

Remote-control circuit: Any electric circuit that controls any other circuit through a relay or an equivalent device.

Sealable equipment**:** Equipment enclosed in a case or cabinet that is provided with a means of sealing or locking so that live parts cannot be made accessible without opening the enclosure. The equipment may or may not be operable without opening the enclosure.

Separately derived system**:** A premises wiring system whose power is derived from generator, transformer, or converter windings and has no direct electrical connection, including a solidly connected grounded circuit conductor, to supply conductors originating in another system.

Service: The conductors and equipment for delivering energy from the electricity supply system to the wiring system of the premises served.

Service conductors**:** The supply conductors that extend from the street main or from transformers to the service equipment of the premises supplied.

Service drop**:** The overhead service conductors from the last pole or other aerial support to and including the splices, if any, connecting to the service-entrance conductors at the building or other structure.

Service-entrance conductors, overhead system**:** The service conductors between the terminals of the service equipment and a point usually outside the building, clear of building walls, where joined by tap or splice to the service drop.

Service-entrance conductors, underground system**:** The service conductors between the terminals of the service equipment and the point of connection to the service lateral. Where service equipment is located outside the building walls, there may be no service-entrance conductors, or they may be entirely outside the building.

Service equipment: The necessary equipment, usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of supply conductors to a building or other structure, or an otherwise defined area, and intended to constitute the main control and means of cutoff of the supply.

Service raceway: The raceway that encloses the service-entrance conductors.

Signaling circuit**:** Any electric circuit that energizes signaling equipment.

Switchboard**:** A large single panel, frame, or assembly of panels which have switches, buses, instruments, overcurrent and other protective devices mounted on the face or back or both. Switchboards are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets (See "Panelboard").

Switches:

- General-use switch: A switch intended for use in general distribution and branch circuits. It is rated in amperes, and it is capable of interrupting its rated current at its rated voltage.
- General-use snap switch: A form of general-use switch so constructed that it can be installed in flush device boxes or on outlet box covers, or otherwise used in conjunction with wiring systems recognized by this subpart.
- Isolating switch: A switch intended for isolating an electric circuit from the source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means.
- Motor-circuit switch: A switch, rated in horsepower, capable of interrupting the maximum operating overload current of a motor of the same horsepower rating as the switch at the rated voltage.

Switching devices (Over 600 volts, nominal): Devices designed to close and/or open one or more electric circuits. Included in this category are circuit breakers, cutouts, disconnecting (or isolating) switches, disconnecting means, and interrupter switches.

Transportable X-ray: X-ray equipment installed in a vehicle or that may readily be disassembled for transport in a vehicle.

Utilization equipment: Utilization equipment means equipment which utilizes electric energy for mechanical, chemical, heating, lighting, or similar useful purpose.

Utilization system: A utilization system is a system which provides electric power and light for employee workplaces, and includes the premises wiring system and utilization equipment.

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

Volatile flammable liquid: A flammable liquid having a flash point below 38 degrees C (100 degrees F) or whose temperature is above its flash point, or a Class II combustible liquid having a vapor pressure not exceeding 40 psi (276 kPa) at 38 deg. C (100 deg. F) whose temperature is above its flash point.

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

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

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

Watertight: So constructed that moisture will not enter the enclosure.

Weatherproof: So constructed or protected that exposure to the weather will not interfere with successful operation. Rainproof, rain tight, or watertight equipment can fulfill the requirements for weatherproof where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.

Wet location: See "Location."

4. RESPONSIBILITIES

4.1 The National Safety Director is responsible for establishing the Electrical Safety Program requirements and providing/communicating them to employees. The National Safety Director will coordinate with the Project Manager and the TRC Contracts Department to review contract documents to identify project- and client-specific requirements, as necessary.

4.2 The Health and Safety Network is responsible for Electrical Safety Program implementation including, but not limited to provide PPE for electrical work which meets the established American National Standards Institute (ANSI) and the American Society for Testing and Materials (ASTM) standards.

- Train new and existing TRC site employees (CP009 Health and Safety Training compliance program).
- Communicate and coordinate TRC's Electrical Safety Program requirements with all TRC subcontractors.
- Ensure that all TRC and contracted employees are aware of electrical hazards on site and that contracted workers are properly qualified to work on or around electrical equipment.
- Review and approve of all TRC and subcontractor daily Job Safety Analysis (JSA) forms and equipment inspections.
- Perform program audits and inspections in conjunction with on-site TRC subcontractor, and site Health and Safety representatives or their designees.
- Maintaining electrical safety records for Health and Safety activities on-site including equipment inspections and procedural audits of site employee work practice implementation (see Sections 13 and 14, Audits and Inspections, and Documentation).

The Health and Safety Network will be determined prior to the mobilization of any TRC employees or contractors.

4.3 The HASP includes Safety and Incident Response guidelines and procedures, nearby medical facility information, safety personnel contact information, and specific JSA for each major task. The JSAs should identify basic job steps, potential hazards, and recommended safety procedures. JSAs are included for the tasks identified in the project plan as well as site mobility, driving, and other areas of hazard and risk.

4.4 A detailed Job Safety Analysis (JSA) for the intended work tasks should be developed in conjunction with the identified hazards. The JSA shall break down the work process into individual tasks and identify the hazards associated with those tasks. All identified hazards shall have corresponding corrective steps identified for mitigation. See TRC's JSA Program.

4.5 The Construction Manager is responsible to review, manage and coordinate all on-site activities, and include Safety programs of Subcontractors, Vendors or Suppliers. Prior to any work being performed by the Subcontractor personnel, Project Safety documentation and plans need to be submitted and approved by the Construction Manager. During the course of the work, the Construction Manager is responsible to assure that the Subcontractor's program is being enforced and adhered to. Each and every Subcontractor is responsible for maintaining their programs in a satisfactory and effective manner including assigning Competent Persons as required by OSHA and APPA. The Construction Manager shall audit the Subcontractor's program documentation at any time to assure the program is effective, and in compliance. The Construction Manager holds the ultimate power to issue stop work orders to Subcontractors if there is concern about the effectiveness or accuracy/completeness of the program and/or program documentation.

4.6 A Competent Person shall be assigned to develop plans, and monitor the overall effectiveness of those plans and provide corrective actions if required, as defined by OSHA 1926 and the APPA manual for work being performed by TRC employees. The Competent Person can be any employee assigned to the work and defined as competent. In some projects, the Lead Commissioning Engineer (LCE) is designated as the Construction Manager and Competent Person.

4.7 The Project Manager is responsible for assisting the Health and Safety Network in the implementation of the Electrical Safety Program. Project Managers must hold all site employees and subcontractors accountable for safe work and maintaining a safe work environment.

4.8 Lead Commissioning Engineer:

4.8.1 The Lead Commissioning Engineer is responsible for the following:

- Take a leadership role in the planning and execution of the entire commissioning process in accordance with the guidelines and procedures established by TRC.
- Ensure the safety of his/her staff and the Craft workers who may be assisting or could accidentally come in contact with equipment that is energized and under test. The Commissioning Engineering Team shall conduct Tailboard Meetings and use temporary signage, barrier tape and flagging as necessary to ensure that all site personnel respect established test boundaries, and are prevented from entering energized test work areas.
- Ensure safety and integrity of all equipment under test and verifying that all components and systems are tested consistent with the manufacturer's stated recommendations.
- Another important aspect of safety concerns the protection and integrity of existing in-service equipment and systems located adjacent to or sometimes even within the same control cabinet where construction activities are planned. It is vitally important that every member of the Commissioning Engineering Team is familiar with and has assessed and discussed all site risks as well as the daily commissioning work plan.

These processes detail the precautions that must be taken to minimize the potential for unintended operation and/or injury to personnel.

4.8.2 The Lead Commissioning Engineer's Specific Safety Responsibilities:

In many cases, the Lead Commissioning Engineer is the TRC person on-site responsible for all work activities during the commissioning phase of the project. It is imperative that the Lead Commissioning Engineer be very familiar with all aspects of safe work practices. The Lead Commissioning Engineer must be familiar with both the TRC Safety Manual and the customer's safety policies.

Usually the commissioning activities begin before the construction phase of the project is complete. It is important that the Lead Commissioning Engineer be aware of ongoing constructions activities to safely perform commissioning tests.

The Lead Commissioning Engineer needs to provide guidance to the electricians and/or technicians working on or around live equipment and systems. The Lead Commissioning Engineer shall use temporary labels or tags to highlight equipment and/or circuits that require extra caution while working on or around them, and make certain only qualified personnel work on or around live equipment and circuits. The Lead Commissioning Engineer shall make certain they are completely aware of what they are doing and emphasize that everyone should stop and discuss the situation if they have any questions. Safety first is always the top priority.

The Lead Commissioning Engineer needs to be aware of the safety aspects in regards to the equipment as well as the personnel. The Lead Commissioning Engineer shall not perform any test that presents undue risk of damage or destruction to new or existing equipment, or creates an undue risk of causing an inadvertent outage, or one that creates an unacceptable safety hazard to the employees conducting the test, or those in the proximity of the equipment under test. Any unusual tests being considered require careful planning and a thorough review to insure both personnel and equipment will be safe.

4.8.3 Lead Commissioning Engineer's Responsibility to Perform Tailboard Meetings and Safety Briefings:

At the beginning of commissioning activities, the Lead Commissioning Engineer shall hold a general Tailboard Meeting with all personnel who will be working on that phase of the project, as well as those who may be working in the area. The Tailboard Meeting shall cover topics of Safety while working on or around energized equipment or circuits, appropriate tools and test equipment to be used, working with the drawings, switching and tagging procedures, work being performed by others that they need to be aware of, and any special circumstances specific to that project.

At the start of each work day and anytime the work scope or environment changes, the Lead Commissioning Engineer shall conduct a brief Tailboard Meeting to discuss the work taking place that day, and any specific considerations (energizing new equipment or systems, switching, testing, etc.).

When any new personnel arrive to perform commissioning work, the Lead Commissioning Engineer needs to make certain they are thoroughly briefed on all aspects of the work practices for that location, similar to the initial Tailboard Meeting described above.

TRC Tailboard Sheets are provided in Appendix B of the TRC Power Delivery Engineering Commissioning Procedures.

4.8.4 The Lead Commissioning Engineer's Responsibility to Perform a Risk Assessment and Safety Review:

Following mobilization and prior to beginning any work, a Site Risk Assessment is performed. A thorough risk assessment creates awareness of the site, system, and safety risks. The Lead Commissioning Engineer discusses identified risks with the project team and takes the necessary measures to mitigate the risks. Several items are considered when performing a risk assessment:

- Personnel Safety – This is reviewed in conjunction with the HASP and associated JSAs. Review any additional safety risks not initially identified in the HASP or JSAs. Review zones of clearance, minimum approach distances, PPE requirements, lock-out-tag-out procedures and tag holders.
- Site Team - Review the experience of and qualifications of each member to perform their duties as assigned. Review the confidence levels of the personnel; overconfidence can be more dangerous than lack of confidence.
- Site Status.

- Construction Drawing Packages.
- Existing Station Drawings.
- Instruction Manuals.
- Project Documents and Plans.
- Test Equipment and Proper Tools.
- System Risks.
- Schedule.

4.9 All Site Employees involved with electrical work shall be held accountable for performing work in a safe manner according to the requirements of this program. All employees will be required to participate in JSA training, and to participate in the daily development and review of work-specific JSAs.

All site employees, when they observe a hazard condition of any type, shall report it to the proper individual.

5. PROCEDURE

5.1 Wiring Design and Protection

5.1.1 Use and identification of grounded and grounding conductors:

- Identification of conductors: A conductor used as a grounded conductor shall be identifiable and distinguishable from all other conductors. A conductor used as an equipment grounding conductor shall be identifiable and distinguishable from all other conductors.
- Polarity of connections: No grounded conductor shall be attached to any terminal or lead so as to reverse designated polarity.
- Use of grounding terminals and devices: A grounding terminal or grounding-type device on a receptacle, cord connector, or attachment plug shall not be used for purposes other than grounding.

5.1.2 Branch circuits:

- General: TRC shall use either ground fault circuit interrupters or an assured equipment grounding conductor program to protect employees on construction sites. These requirements are in addition to any other requirements for equipment grounding conductors.

- Ground-fault circuit interrupters: 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, shall have approved ground-fault circuit interrupters for personnel protection. Receptacles on a two-wire, single-phase portable or vehicle-mounted generator rated not more than 5kW, where the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces, need not be protected with ground-fault circuit interrupters.
- Assured equipment grounding conductor program: TRC shall establish and implement an assured equipment grounding conductor program on construction sites covering all cord sets, receptacles which are not a part of the building or structure, and equipment connected by cord and plug which are available for use or used by employees. This program shall comply with the following minimum requirements:
  - A written description of the program, including the specific procedures adopted by TRC, shall be available at the jobsite for inspection and copying by the Assistant Secretary and any affected employee.
  - TRC shall designate one or more competent persons to implement the program.
  - Each cord set, attachment cap, plug and receptacle of cord sets, and any equipment connected by cord and plug, except cord sets and receptacles which are fixed and not exposed to damage, shall be visually inspected before each day's use for external defects, such as deformed or missing pins or insulation damage, and for indications of possible internal damage. Equipment found damaged or defective shall not be used until repaired.
  - The following tests shall be performed on all cord sets, receptacles which are not a part of the permanent wiring of the building or structure, and cord- and plug-connected equipment required to be grounded:
    - All equipment grounding conductors shall be tested for continuity and shall be electrically continuous.
    - Each receptacle and attachment cap or plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.
  - All required tests shall be performed:
    - Before first use;
    - Before equipment is returned to service following any repairs;

        - Before equipment is used after any incident which can be reasonably suspected to have caused damage (for example, when a cord set is run over); and
        - At intervals not to exceed 3 months, except that cord sets and receptacles which are fixed and not exposed to damage shall be tested at intervals not exceeding 6 months.
    - TRC shall not make available or permit the use by employees of any equipment which has not met the requirements of this section.
    - Tests performed as required in this paragraph shall be recorded. This test record shall identify each receptacle, cord set, and cord- and plug-connected equipment that passed the test and shall indicate the last date it was tested or the interval for which it was tested. This record shall be kept by means of logs, color coding, or other effective means and shall be maintained until replaced by a more current record. The record shall be made available on the jobsite for inspection by the Assistant Secretary and any affected employee.
- Outlet devices. Outlet devices shall have an ampere rating not less than the load to be served and shall comply with the following:
    - Single receptacles. A single receptacle installed on an individual branch circuit shall have an ampere rating of not less than that of the branch circuit.
    - Two or more receptacles. Where connected to a branch circuit supplying two or more receptacles or outlets, receptacle ratings shall conform to the values listed in Table K-4.
    - Receptacles used for the connection of motors. The rating of an attachment plug or receptacle used for cord- and plug-connection of a motor to a branch circuit shall not exceed 15 amperes at 125 volts or 10 amperes at 250 volts if individual overload protection is omitted.

TABLE K-4 - Receptacle Ratings for Various Size Circuits

Circuit rating amperes	Receptacle rating amperes
15	Not over 15.
20	15 or 20.
30	30.
40	40 or 50.
50	50.

5.1.3 Outside conductors and lamps (600 volts, nominal, or less):
This section applies to branch circuit, feeder, and service conductors rated 600 volts, nominal, or less and run outdoors as open conductors.

- Conductors on poles. Conductors supported on poles shall provide a horizontal climbing space not less than the following:
  - Power conductors below communication conductors-30 inches (762 mm).
  - Power conductors alone or above communication conductors: 300 volts or less-24 inches (610 mm); more than 300 volts-30 inches (762 mm).
  - Communication conductors below power conductors: with power conductors 300 volts or less-24 inches (610 mm); more than 300 volts-30 inches (762 mm).
- Clearance from ground: Open conductors shall conform to the following minimum clearances:
  - 10 feet (3.05 m)-above finished grade, sidewalks, or from any platform or projection from which they might be reached.
  - 12 feet (3.66 m)-over areas subject to vehicular traffic other than truck traffic.
  - 15 feet (4.57 m)-over areas other than those specified in this section that are subject to truck traffic.
  - 18 feet (5.49 m)-over public streets, alleys, roads, and driveways.
- Clearance from building openings: Conductors shall have a clearance of at least 3 feet (914 mm) from windows, doors, fire escapes, or similar locations. Conductors run above the top level of a window are considered to be out of reach from that window and, therefore, do not have to be 3 feet (914 mm) away.

- Clearance over roofs: Conductors above roof space accessible to employees on foot shall have a clearance from the highest point of the roof surface of not less than 8 feet (2.44 m) vertical clearance for insulated conductors, not less than 10 feet (3.05 m) vertical or diagonal clearance for covered conductors, and not less than 15 feet (4.57 m) for bare conductors, except that:
  - Where the roof space is also accessible to vehicular traffic, the vertical clearance shall not be less than 18 feet (5.49 m);
  - Where the roof space is not normally accessible to employees on foot, fully insulated conductors shall have a vertical or diagonal clearance of not less than 3 feet (914 mm);
  - Where the voltage between conductors is 300 volts or less and the roof has a slope of not less than 4 inches (102 mm) in 12 inches (305 mm), the clearance from roofs shall be at least 3 feet (914 mm); or
  - Where the voltage between conductors is 300 volts or less and the conductors do not pass over more than 4 feet (1.22 m) of the overhang portion of the roof and they are terminated at a through-the-roof raceway or support, the clearance from roofs shall be at least 18 inches (457 mm).
- Location of outdoor lamps: Lamps for outdoor lighting shall be located below all live conductors, transformers, or other electric equipment, unless such equipment is controlled by a disconnecting means that can be locked in the open position or unless adequate clearances or other safeguards are provided for relamping operations.

5.1.4 Services (Disconnecting):

- General: Means shall be provided to disconnect all conductors in a building or other structure from the service-entrance conductors. The disconnecting means shall plainly indicate whether it is in the open or closed position and shall be installed at a readily accessible location nearest the point of entrance of the service-entrance conductors.
- Simultaneous opening of poles: Each service disconnecting means shall simultaneously disconnect all ungrounded conductors.
- Services over 600 volts, nominal: The following additional requirements apply to services over 600 volts, nominal.
- Guarding: Service-entrance conductors installed as open wires shall be guarded to make them accessible only to qualified persons.

- Warning signs: Signs warning of high voltage shall be posted where unauthorized employees might come in contact with live parts.

5.1.5 Overcurrent protection (600 volts, nominal, or less):
The following requirements apply to overcurrent protection of circuits rated 600 volts nominal or less.

- Protection of conductors and equipment: Conductors and equipment shall be protected from overcurrent in accordance with their ability to safely conduct current. Conductors shall have sufficient ampacity to carry the load.
- Grounded conductors: Except for motor-running overload protection, overcurrent devices shall not interrupt the continuity of the grounded conductor unless all conductors of the circuit are opened simultaneously.
- Disconnection of fuses and thermal cutouts: Except for devices provided for current-limiting on the supply side of the service disconnecting means, all cartridge fuses which are accessible to other than qualified persons and all fuses and thermal cutouts on circuits over 150 volts to ground shall be provided with disconnecting means. This disconnecting means shall be installed so that the fuse or thermal cutout can be disconnected from its supply without disrupting service to equipment and circuits unrelated to those protected by the overcurrent device.
- Location in or on premises: Overcurrent devices shall be readily accessible. Overcurrent devices shall not be located where they could create an employee safety hazard by being exposed to physical damage or located in the vicinity of easily ignitable material.
- Arcing or suddenly moving parts: Fuses and circuit breakers shall be so located or shielded that employees will not be burned or otherwise injured by their operation.
- Circuit breakers shall clearly indicate whether they are in the open (off) or closed (on) position.
- Where circuit breaker handles on switchboards are operated vertically rather than horizontally or rotationally, the up position of the handle shall be the closed (on) position.
- If used as switches in 120-volt, fluorescent lighting circuits, circuit breakers shall be marked "SWD."
- Over 600 volts nominal: Feeders and branch circuits over 600 volts, nominal, shall have short-circuit protection.

5.1.6 Grounding:

- Systems to be grounded: The following systems which supply premises wiring shall be grounded:
    - Three-wire DC systems. All 3-wire DC systems shall have their neutral conductor grounded.
    - Two-wire DC systems. Two-wire DC systems operating at over 50 volts through 300 volts between conductors shall be grounded unless they are rectifier-derived from an AC system.
    - AC circuits, less than 50 volts. AC circuits of less than 50 volts shall be grounded if they are installed as overhead conductors outside of buildings or if they are supplied by transformers and the transformer primary supply system is ungrounded or exceeds 150 volts to ground.
    - AC systems, 50 volts to 1000 volts. AC systems of 50 volts to 1000 volts shall be grounded under any of the following conditions:
        - If the system can be so grounded that the maximum voltage to ground on the ungrounded conductors does not exceed 150 volts;
        - If the system is nominally rated 480Y/277 volt, 3-phase, 4-wire in which the neutral is used as a circuit conductor;
        - If the system is nominally rated 240/120 volt, 3-phase, 4-wire in which the midpoint of one phase is used as a circuit conductor; or
        - If a service conductor is uninsulated.
    - Unless exempted by the following:
        - Exceptions. AC systems of 50 volts to 1000 volts are not required to be grounded if the system is separately derived and is supplied by a transformer that has a primary voltage rating less than 1000 volts, provided all of the following conditions are met:
            - The system is used exclusively for control circuits,
            - The conditions of maintenance and supervision assure that only qualified persons will service the installation,
            - Continuity of control power is required, and
            - Ground detectors are installed on the control system.

- Portable generators: Under the following conditions, the frame of a portable generator need not be grounded and may serve as the grounding electrode for a system supplied by the generator:

    - The generator supplies only equipment mounted on the generator and/or cord- and plug-connected equipment through receptacles mounted on the generator, and
    - The noncurrent-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are bonded to the generator frame.
- Vehicle-mounted generators: Under the following conditions the frame of a vehicle may serve as the grounding electrode for a system supplied by a generator located on the vehicle:
    - The frame of the generator is bonded to the vehicle frame;
    - The generator supplies only equipment located on the vehicle and/or cord- and plug-connected equipment through receptacles mounted on the vehicle or on the generator;
    - The noncurrent-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are bonded to the generator frame; and
    - The system complies with all other provisions of this section.
- Neutral conductor bonding: A neutral conductor shall be bonded to the generator frame if the generator is a component of a separately derived system. No other conductor need be bonded to the generator frame.
- Conductors to be grounded: For AC premises wiring systems the identified conductor shall be grounded.
- Grounded system: For a grounded system, a grounding electrode conductor shall be used to connect both the equipment grounding conductor and the grounded circuit conductor to the grounding electrode. Both the equipment grounding conductor and the grounding electrode conductor shall be connected to the grounded circuit conductor on the supply side of the service disconnecting means, or on the supply side of the system disconnecting means or overcurrent devices if the system is separately derived.
- Ungrounded systems: For an ungrounded service-supplied system, the equipment grounding conductor shall be connected to the grounding electrode conductor at the service equipment. For an ungrounded separately derived system, the equipment grounding conductor shall be connected to the grounding electrode conductor at, or ahead of, the system disconnecting means or overcurrent devices.
- Grounding path: The path to ground from circuits, equipment, and enclosures shall be permanent and continuous.

- Supports and enclosures for conductors: Metal cable trays, metal raceways, and metal enclosures for conductors shall be grounded, except that:
    - Metal enclosures such as sleeves that are used to protect cable assemblies from physical damage need not be grounded.
    - Metal enclosures for conductors added to existing installations of open wire, knob-and-tube wiring, and nonmetallic-sheathed cable need not be grounded if all of the following conditions are met:
        - Runs are less than 25 feet (7.62 m);
        - Enclosures are free from probable contact with ground, grounded metal, metal laths, or other conductive materials; and
        - Enclosures are guarded against employee contact.
- Service equipment enclosures: Metal enclosures for service equipment shall be grounded.
- Fixed equipment: Exposed noncurrent-carrying metal parts of fixed equipment which may become energized shall be grounded under any of the following conditions:
    - If within 8 feet (2.44 m) vertically or 5 feet (1.52 m) horizontally of ground or grounded metal objects and subject to employee contact.
    - If located in a wet or damp location and subject to employee contact.
    - If in electrical contact with metal.
    - If in a hazardous (classified) location.
    - If supplied by a metal-clad, metal-sheathed, or grounded metal raceway wiring method.
    - If equipment operates with any terminal at over 150 volts to ground; however, the following need not be grounded:
        - Enclosures for switches or circuit breakers used for other than service equipment and accessible to qualified persons only;
        - Metal frames of electrically heated appliances which are permanently and effectively insulated from ground; and
        - The cases of distribution apparatus such as transformers and capacitors mounted on wooden poles at a height exceeding 8 feet (2.44 m) above ground or grade level.

- Equipment connected by cord and plug: Under any of the conditions described in this section, exposed noncurrent-carrying metal parts of cord- and plug-connected equipment which may become energized shall be grounded:
  - If in a hazardous (classified) location.
  - If operated at over 150 volts to ground, except for guarded motors and metal frames of electrically heated appliances if the appliance frames are permanently and effectively insulated from ground.
  - If the equipment is one of the types listed:
    - Hand held motor-operated tools;
    - Cord- and plug-connected equipment used in damp or wet locations or by employees standing on the ground or on metal floors or working inside of metal tanks or boilers;
    - Portable and mobile X-ray and associated equipment;
    - Tools likely to be used in wet and/or conductive locations;
    - Portable hand lamps.
  - However, even though the equipment may be one of these types, it need not be grounded if it is exempted by the following:
    - Tools likely to be used in wet and/or conductive locations need not be grounded if supplied through an isolating transformer with an ungrounded secondary of not over 50 volts. Listed or labeled portable tools and appliances protected by a system of double insulation, or its equivalent, need not be grounded. If such a system is employed, the equipment shall be distinctively marked to indicate that the tool or appliance utilizes a system of double insulation.
- Nonelectrical equipment: The metal parts of the following nonelectrical equipment shall be grounded: Frames and tracks of electrically operated cranes; frames of nonelectrically driven elevator cars to which electric conductors are attached; hand-operated metal shifting ropes or cables of electric elevators, and metal partitions, grill work, and similar metal enclosures around equipment of over 1 kV between conductors.
- With circuit conductors: Noncurrent-carrying metal parts of fixed equipment, if required to be grounded by this subpart, shall be grounded by an equipment grounding conductor which is contained within the same raceway, cable, or cord, or runs with or encloses the circuit conductors. For DC circuits only, the equipment grounding conductor may be run separately from the circuit conductors.

- Grounding conductor: A conductor used for grounding fixed or movable equipment shall have capacity to conduct safely any fault current which may be imposed on it.
- Equipment considered effectively grounded: Electric equipment is considered to be effectively grounded if it is secured to, and in electrical contact with, a metal rack or structure that is provided for its support and the metal rack or structure is grounded by the method specified for the noncurrent-carrying metal parts of fixed equipment in paragraph (f)(8)(i) of this section. Metal car frames supported by metal hoisting cables attached to or running over metal sheaves or drums of grounded elevator machines are also considered to be effectively grounded.
- Bonding: If bonding conductors are used to assure electrical continuity, they shall have the capacity to conduct any fault current which may be imposed.
- Made electrodes: If made electrodes are used, they shall be free from nonconductive coatings, such as paint or enamel; and, if practicable, they shall be embedded below permanent moisture level. A single electrode consisting of a rod, pipe or plate which has a resistance to ground greater than 25 ohms shall be augmented by one additional electrode installed no closer than 6 feet (1.83 m) to the first electrode.
- Grounding of systems and circuits of 1000 volts and over (high voltage).
  - Grounding of systems supplying portable or mobile equipment: Systems supplying portable or mobile high voltage equipment, other than substations installed on a temporary basis, shall comply with the following:
    - Portable and mobile high voltage equipment shall be supplied from a system having its neutral grounded through an impedance. If a delta-connected high voltage system is used to supply the equipment, a system neutral shall be derived.
    - Exposed noncurrent-carrying metal parts of portable and mobile equipment shall be connected by an equipment grounding conductor to the point at which the system neutral impedance is grounded.
    - Ground-fault detection and relaying shall be provided to automatically de-energize any high voltage system component which has developed a ground fault. The continuity of the equipment grounding conductor shall be continuously monitored so as to de-energize automatically the high voltage feeder to the portable equipment upon loss of continuity of the equipment grounding conductor.

- The grounding electrode to which the portable or mobile equipment system neutral impedance is connected shall be isolated from and separated in the ground by at least 20 feet (6.1 m) from any other system or equipment grounding electrode, and there shall be no direct connection between the grounding electrodes, such as buried pipe, fence or like objects.

- Grounding of equipment: All noncurrent-carrying metal parts of portable equipment and fixed equipment including their associated fences, housings, enclosures, and supporting structures shall be grounded. However, equipment which is guarded by location and isolated from ground need not be grounded. Additionally, pole-mounted distribution apparatus at a height exceeding 8 feet (2.44 m) above ground or grade level need not be grounded.

5.2 Wiring methods, components, and equipment for general use:

Wiring methods: The provisions of this paragraph do not apply to conductors which form an integral part of equipment such as motors, controllers, and motor control centers and like equipment.

5.2.1 General requirements:

- Electrical continuity of metal raceways and enclosures: Metal raceways, cable armor, and other metal enclosures for conductors shall be metallically joined together into a continuous electric conductor and shall be so connected to all boxes, fittings, and cabinets as to provide effective electrical continuity.
- Wiring in ducts: No wiring systems of any type shall be installed in ducts used to transport dust, loose stock or flammable vapors. No wiring system of any type shall be installed in any duct used for vapor removal or in any shaft containing only such ducts.
- Feeders shall originate in a distribution center. The conductors shall be run as multi-conductor cord or cable assemblies or within raceways; or, where not subject to physical damage, they may be run as open conductors on insulators not more than 10 feet (3.05 m) apart.
- Branch circuits shall originate in a power outlet or panelboard. Conductors shall be run as multi-conductor cord or cable assemblies or open conductors, or shall be run in raceways. All conductors shall be protected by overcurrent devices at their ampacity. Runs of open conductors shall be located where the conductors will not be subject to physical damage, and the conductors shall be fastened at intervals not exceeding 10 feet (3.05 m). No branch-circuit conductors shall be laid on the floor. Each branch circuit that supplies receptacles or fixed equipment shall

contain a separate equipment grounding conductor if the branch circuit is run as open conductors.

- Receptacles shall be of the grounding type unless installed in a complete metallic raceway, each branch circuit shall contain a separate equipment grounding conductor, and all receptacles shall be electrically connected to the grounding conductor. Receptacles for uses other than temporary lighting shall not be installed on branch circuits which supply temporary lighting. Receptacles shall not be connected to the same ungrounded conductor of multi-wire circuits which supply temporary lighting.
- Disconnecting switches or plug connectors shall be installed to permit the disconnection of all ungrounded conductors of each temporary circuit.
- All lamps for general illumination shall be protected from accidental contact or breakage. Metal-case sockets shall be grounded.
- Temporary lights shall not be suspended by their electric cords unless cords and lights are designed for this means of suspension.
- Portable electric lighting used in wet and/or other conductive locations, as for example, drums, tanks, and vessels, shall be operated at 12 volts or less. However, 120-volt lights may be used if protected by a ground-fault circuit interrupter.
- A box shall be used wherever a change is made to a raceway system or a cable system which is metal clad or metal sheathed.
- Flexible cords and cables shall be protected from damage. Sharp corners and projections shall be avoided. Flexible cords and cables may pass through doorways or other pinch points, if protection is provided to avoid damage.
- Extension cord sets used with portable electric tools and appliances shall be of three-wire type and shall be designed for hard or extra-hard usage. Flexible cords used with temporary and portable lights shall be designed for hard or extra-hard usage.
- Guarding: For temporary wiring over 600 volts, nominal, fencing, barriers, or other effective means shall be provided to prevent access of other than authorized and qualified personnel

5.2.2 Cabinets, boxes, and fittings:

- Conductors entering boxes, cabinets, or fittings: Conductors entering boxes, cabinets, or fittings shall be protected from abrasion, and openings through which conductors enter shall be effectively closed. Unused openings in cabinets, boxes, and fittings shall also be effectively closed.

- Covers and canopies: All pull boxes, junction boxes, and fittings shall be provided with covers. If metal covers are used, they shall be grounded. In energized installations each outlet box shall have a cover, faceplate, or fixture canopy. Covers of outlet boxes having holes through which flexible cord pendants pass shall be provided with bushings designed for the purpose or shall have smooth, well-rounded surfaces on which the cords may bear.
- Pull and junction boxes for systems over 600 volts, nominal. In addition to other requirements in this section for pull and junction boxes, the following shall apply to these boxes for systems over 600 volts, nominal:
  - Complete enclosure: Boxes shall provide a complete enclosure for the contained conductors or cables.
  - Covers: Boxes shall be closed by covers securely fastened in place. Underground box covers that weigh over 100 pounds (43.6 kg) meet this requirement. Covers for boxes shall be permanently marked "HIGH VOLTAGE." The marking shall be on the outside of the box cover and shall be readily visible and legible.

5.2.3 Knife switches:

Single-throw knife switches shall be so connected that the blades are dead when the switch is in the open position. Single-throw knife switches shall be so placed that gravity will not tend to close them. Single-throw knife switches approved for use in the inverted position shall be provided with a locking device that will ensure that the blades remain in the open position when so set. Double-throw knife switches may be mounted so that the throw will be either vertical or horizontal. However, if the throw is vertical, a locking device shall be provided to ensure that the blades remain in the open position when so set.

5.2.4 Switchboards and panelboards:

Switchboards that have any exposed live parts shall be located in permanently dry locations and accessible only to qualified persons. Panelboards shall be mounted in cabinets, cutout boxes, or enclosures designed for the purpose and shall be dead front. However, panelboards other than the dead front externally-operable type are permitted where accessible only to qualified persons. Exposed blades of knife switches shall be dead when open.

5.2.5 Enclosures for damp or wet locations:

- Cabinets, fittings, and boxes: Cabinets, cutout boxes, fittings, boxes, and panelboard enclosures in damp or wet locations shall be installed so as to prevent moisture or water from entering and accumulating within the enclosures. In wet locations the enclosures shall be weatherproof.

- Switches and circuit breakers: Switches, circuit breakers, and switchboards installed in wet locations shall be enclosed in weatherproof enclosures.

5.2.6 Conductors for general wiring:

All conductors used for general wiring shall be insulated unless otherwise permitted in this Subpart. The conductor insulation shall be of a type that is suitable for the voltage, operating temperature, and location of use. Insulated conductors shall be distinguishable by appropriate color or other means as being grounded conductors, ungrounded conductors, or equipment grounding conductors.

5.2.7 Use of flexible cords and cables:

- Permitted uses:
  - Flexible cords and cables shall be suitable for conditions of use and location. Flexible cords and cables shall be used only for:
    - Pendants;
    - Wiring of fixtures;
    - Connection of portable lamps or appliances;
    - Elevator cables;
    - Wiring of cranes and hoists;
    - Connection of stationary equipment to facilitate their frequent interchange;
    - Prevention of the transmission of noise or vibration; or
    - Appliances where the fastening means and mechanical connections are designed to permit removal for maintenance and repair.
- Attachment plugs for cords: If use, the flexible cord shall be equipped with an attachment plug and shall be energized from a receptacle outlet.
- Prohibited uses:
  - Flexible cords and cables shall not be used:
    - As a substitute for the fixed wiring of a structure;
    - Where run through holes in walls, ceilings, or floors;
    - Where run through doorways, windows, or similar openings;

    - Where attached to building surfaces; or
    - Where concealed behind building walls, ceilings, or floors.

- Identification: A conductor of a flexible cord or cable that is used as a grounded conductor or an equipment grounding conductor shall be distinguishable from other conductors.
- Marking: Type SJ, SJO, SJT, SJTO, S, SO, ST, and STO cords shall not be used unless durably marked on the surface with the type designation, size, and number of conductors.
- Splices: Flexible cords shall be used only in continuous lengths without splice or tap. Hard service flexible cords No. 12 or larger may be repaired if spliced so that the splice retains the insulation, outer sheath properties, and usage characteristics of the cord being spliced.
- Strain relief: Flexible cords shall be connected to devices and fittings so that strain relief is provided which will prevent pull from being directly transmitted to joints or terminal screws.
- Cords passing through holes: Flexible cords and cables shall be protected by bushings or fittings where passing through holes in covers, outlet boxes, or similar enclosures.

5.2.8 Portable cables over 600 volts nominal:

Multi-conductor portable cable for use in supplying power to portable or mobile equipment at over 600 volts, nominal, shall consist of No. 8 or larger conductors employing flexible stranding. Cables operated at over 2000 volts shall be shielded for the purpose of confining the voltage stresses to the insulation. Grounding conductors shall be provided. Connectors for these cables shall be of a locking type with provisions to prevent their opening or closing while energized. Strain relief shall be provided at connections and terminations. Portable cables shall not be operated with splices unless the splices are of the permanent molded, vulcanized, or other equivalent type. Termination enclosures shall be marked with a high voltage hazard warning, and terminations shall be accessible only to authorized and qualified personnel.

5.2.9 Fixture wires:

- General: Fixture wires shall be suitable for the voltage, temperature, and location of use. A fixture wire which is used as a grounded conductor shall be identified.
- Uses permitted:
    - Fixture wires may be used:

- For installation in lighting, fixtures and in similar equipment where enclosed or protected and not subject to bending or twisting in use; or
- For connecting lighting fixtures to the branch-circuit conductors supplying the fixtures.

- Uses not permitted: Fixture wires shall not be used as branch-circuit conductors except as permitted for Class 1 power-limited circuits.

5.2.10 Equipment for general use:

Lighting fixtures, lampholders, lamps, and receptacles:

- Live parts: Fixtures, lampholders, lamps, rosettes, and receptacles shall have no live parts normally exposed to employee contact. However, rosettes and cleat-type lampholders and receptacles located at least 8 feet (2.44 m) above the floor may have exposed parts.
- Support: Fixtures, lampholders, rosettes, and receptacles shall be securely supported. A fixture that weighs more than 6 pounds (2.72 kg) or exceeds 16 inches (406 mm) in any dimension shall not be supported by the screw shell of a lampholder.
- Portable lamps: Portable lamps shall be wired with flexible cord and an attachment plug of the polarized or grounding type. If the portable lamp uses an Edison-based lampholder, the grounded conductor shall be identified and attached to the screw shell and the identified blade of the attachment plug. In addition, portable handlamps shall comply with the following:
  - Metal shell, paperlined lampholders shall not be used;
  - Handlamps shall be equipped with a handle of molded composition or other insulating material;
  - Handlamps shall be equipped with a substantial guard attached to the lampholder or handle; and
  - Metallic guards shall be grounded by the means of an equipment grounding conductor run within the power supply cord.
- Lampholders: Lampholders of the screw-shell type shall be installed for use as lampholders only. Lampholders installed in wet or damp locations shall be of the weatherproof type.
- Fixtures: Fixtures installed in wet or damp locations shall be identified for the purpose and shall be installed so that water cannot enter or accumulate in wireways, lampholders, or other electrical parts.

5.2.11 Receptacles, cord connectors, and attachment plugs (caps):

- Configuration. Receptacles, cord connectors, and attachment plugs shall be constructed so that no receptacle or cord connector will accept an attachment plug with a different voltage or current rating than that for which the device is intended. However, a 20-ampere T-slot receptacle or cord connector may accept a 15-ampere attachment plug of the same voltage rating. Receptacles connected to circuits having different voltages, frequencies, or types of current (ac or dc) on the same premises shall be of such design that the attachment plugs used on these circuits are not interchangeable.
- Damp and wet locations. A receptacle installed in a wet or damp location shall be designed for the location.

5.2.12 Appliances:

- Live parts: Appliances, other than those in which the current-carrying parts at high temperatures are necessarily exposed, shall have no live parts normally exposed to employee contact.
- Disconnecting means: A means shall be provided to disconnect each appliance.
- Rating: Each appliance shall be marked with its rating in volts and amperes or volts and watts.

5.2.13 Motors:

Motors, motor circuits, and controllers:

- In sight from: If specified that one piece of equipment shall be "in sight from" another piece of equipment, one shall be visible and not more than 50 feet (15.2 m.) from the other.
- A disconnecting means shall be located in sight from the controller location. The controller disconnecting means for motor branch circuits over 600 volts, nominal, may be out of sight of the controller, if the controller is marked with a warning label giving the location and identification of the disconnecting means which is to be locked in the open position.
- The disconnecting means shall disconnect the motor and the controller from all ungrounded supply conductors and shall be so designed that no pole can be operated independently.
- If a motor and the driven machinery are not in sight from the controller location, the installation shall comply with one of the following conditions:

  - The controller disconnecting means shall be capable of being locked in the open position.
  - A manually operable switch that will disconnect the motor from its source of supply shall be placed in sight from the motor location.
- The disconnecting means shall plainly indicate whether it is in the open (off) or closed (on) position.
- The disconnecting means shall be readily accessible. If more than one disconnect is provided for the same equipment, only one need be readily accessible.
- An individual disconnecting means shall be provided for each motor, but a single disconnecting means may be used for a group of motors under any one of the following conditions:
  - If a number of motors drive special parts of a single machine or piece of apparatus, such as a metal or woodworking machine, crane, or hoist;
  - If a group of motors is under the protection of one set of branch-circuit protective devices; or
  - If a group of motors is in a single room in sight from the location of the disconnecting means.
- Motor overload, short-circuit, and ground-fault protection: Motors, motor-control apparatus, and motor branch-circuit conductors shall be protected against overheating due to motor overloads or failure to start, and against short-circuits or ground faults. These provisions do not require overload protection that will stop a motor where a shutdown is likely to introduce additional or increased hazards, as in the case of fire pumps, or where continued operation of a motor is necessary for a safe shutdown of equipment or process and motor overload sensing devices are connected to a supervised alarm.
- Stationary motors having commutators, collectors, and brush rigging located inside of motor end brackets and not conductively connected to supply circuits operating at more than 150 volts to ground need not have such parts guarded. Exposed live parts of motors and controllers operating at 50 volts or more between terminals shall be guarded against accidental contact by any of the following:
  - By installation in a room or enclosure that is accessible only to qualified persons;
  - By installation on a balcony, gallery, or platform, so elevated and arranged as to exclude unqualified persons; or
  - By elevation 8 feet (2.44 m) or more above the floor.

- Where live parts of motors or controllers operating at over 150 volts to ground are guarded against accidental contact only by location, and where adjustment or other attendance may be necessary during the operation of the apparatus, insulating mats or platforms shall be provided so that the attendant cannot readily touch live parts unless standing on the mats or platforms.

5.2.14 Transformers:

- The following covers the installation of all transformers, except:
    - Current transformers;
    - Dry-type transformers installed as a component part of other apparatus;
    - Transformers which are an integral part of an X-ray, high frequency, or electrostatic-coating apparatus; and
    - Transformers used with Class 2 and Class 3 circuits, sign and outline lighting, electric discharge lighting, and power-limited fire-protective signaling circuits.
- Operating voltage: The operating voltage of exposed live parts of transformer installations shall be indicated by warning signs or visible markings on the equipment or structure.
- Transformers over 35 kV: Dry-type, high fire point liquid-insulated, and askarel-insulated transformers installed indoors and rated over 35 kV shall be in a vault.
- Oil-insulated transformers: If they present a fire hazard to employees, oil-insulated transformers installed indoors shall be in a vault.
- Fire protection: Combustible material, combustible buildings and parts of buildings, fire escapes, and door and window openings shall be safeguarded from fires which may originate in oil-insulated transformers attached to or adjacent to a building or combustible material.
- Transformer vaults: Transformer vaults shall be constructed so as to contain fire and combustible liquids within the vault and to prevent unauthorized access. Locks and latches shall be so arranged that a vault door can be readily opened from the inside.
- Pipes and ducts: Any pipe or duct system foreign to the vault installation shall not enter or pass through a transformer vault.
- Material storage: Materials shall not be stored in transformer vaults.

5.2.15 Capacitors:

- Drainage of stored charge: All capacitors, except surge capacitors or capacitors included as a component part of other apparatus, shall be provided with an automatic means of draining the stored charge and maintaining the discharged state after the capacitor is disconnected from its source of supply.
- Over 600 volts: Capacitors rated over 600 volts, nominal, shall comply with the following additional requirements:
  - Isolating or disconnecting switches (with no interrupting rating) shall be interlocked with the load interrupting device or shall be provided with prominently displayed caution signs to prevent switching load current.
  - For series capacitors the proper switching shall be assured by use of at least one of the following:
    - Mechanically sequenced isolating and bypass switches,
    - Interlocks, or
    - Switching procedure prominently displayed at the switching location.

5.3 Specific purpose equipment and installations:

5.3.1 Cranes and hoists:

This section applies to the installation of electric equipment and wiring used in connection with cranes, monorail hoists, hoists, and all runways.

- Runway conductor disconnecting is a readily accessible disconnector which shall be provided between the runway contact conductors and the power supply.
- Disconnecting means for cranes and monorail hoists: A disconnecting means, capable of being locked in the open position, shall be provided in the leads from the runway contact conductors or other power supply on any crane or monorail hoist.
- If this additional disconnecting means is not readily accessible from the crane or monorail hoist operating station, means shall be provided at the operating station to open the power circuit to all motors of the crane or monorail hoist.
- The additional disconnect may be omitted if a monorail hoist or hand-propelled crane bridge installation meets all of the following:
  - The unit is floor controlled;
  - The unit is within view of the power supply disconnecting means; and

- No fixed work platform has been provided for servicing the unit.

5.3.2 Control: A limit switch or other device shall be provided to prevent the load block from passing the safe upper limit of travel of any hoisting mechanism.

5.3.3 Clearance: The dimension of the working space in the direction of access to live parts which may require examination, adjustment, servicing, or maintenance while alive shall be a minimum of 2 feet 6 inches (762 mm). Where controls are enclosed in cabinets, the door(s) shall open at least 90 degrees or be removable, or the installation shall provide equivalent access.

5.3.4 Grounding: All exposed metal parts of cranes, monorail hoists, hoists and accessories including pendant controls shall be metallically joined together into a continuous electrical conductor so that the entire crane or hoist will be grounded. Moving parts, other than removable accessories or attachments, having metal-to-metal bearing surfaces shall be considered to be electrically connected to each other through the bearing surfaces for grounding purposes. The trolley frame and bridge frame shall be considered as electrically grounded through the bridge and trolley wheels and its respective tracks unless conditions such as paint or other insulating materials prevent reliable metal-to-metal contact. In this case a separate bonding conductor shall be provided.

5.3.5 Elevators, escalators, and moving walks:

- Disconnecting: Elevators, escalators, and moving walks shall have a single means for disconnecting all ungrounded main power supply conductors for each unit.
- Control panels: If control panels are not located in the same space as the drive machine, they shall be located in cabinets with doors or panels capable of being locked closed.

5.3.6 X-Ray equipment (Disconnecting):

- General: A disconnecting means shall be provided in the supply circuit. The disconnecting means shall be operable from a location readily accessible from the X-ray control. For equipment connected to a 120-volt branch circuit of 30 amperes or less, a grounding-type attachment plug cap and receptacle of proper rating may serve as a disconnecting means.
- More than one piece of equipment: If more than one piece of equipment is operated from the same high-voltage circuit, each piece or each group of equipment as a unit shall be provided with a high-voltage switch or equivalent disconnecting means. This disconnecting means shall be constructed, enclosed, or

located so as to avoid contact by employees with its live parts.

- Control-Radiographic and fluoroscopic types: Radiographic and fluoroscopic-type equipment shall be effectively enclosed or shall have interlocks that deenergize the equipment automatically to prevent ready access to live current-carrying parts.

5.4 Hazardous (classified) locations:

This section sets forth requirements for electric equipment and wiring in locations which are classified depending on the properties of the flammable vapors, liquids or gases, or combustible dusts or fibers which may be present therein and the likelihood that a flammable or combustible concentration or quantity is present. Each room, section or area shall be considered individually in determining its classification. These hazardous (classified) locations are assigned six designations as follows: Class I, Division 1 Class I, Division 2 Class II, Division 1 Class II, Division 2 Class III, Division 1 Class III, Division 2.

5.4.1 Electrical installations:

Equipment, wiring methods, and installations of equipment in hazardous (classified) locations shall be approved as intrinsically safe or approved for the hazardous (classified) location or safe for the hazardous (classified) location. Requirements for each of these options are as follows:

- Intrinsically safe. Equipment and associated wiring approved as intrinsically safe is permitted in any hazardous (classified) location included in its listing or labeling.

5.4.2 Approved for the hazardous (classified) location:

- General: Equipment shall be approved not only for the class of location but also for the ignitable or combustible properties of the specific gas, vapor, dust, or fiber that will be present.
- Marking: Equipment shall not be used unless it is marked to show the class, group, and operating temperature or temperature range, based on operation in a 40-degree C ambient, for which it is approved. The temperature marking shall not exceed the ignition temperature of the specific gas, vapor, or dust to be encountered. However, the following provisions modify this marking requirement for specific equipment:
    - Equipment of the non-heat-producing type (such as junction boxes, conduit, and fitting) and equipment of the heat-producing type having a maximum temperature of not more than 100 degrees C (212 degrees F) need not have a marked operating temperature or temperature range.

- Fixed lighting fixtures marked for use only in Class I, Division 2 locations need not be marked to indicate the group.
- Fixed general-purpose equipment in Class I locations, other than lighting fixtures, which is acceptable for use in Class I, Division 2 locations need not be marked with the class, group, division, or operating temperature.
- Fixed dust-tight equipment, other than lighting fixtures, which is acceptable for use in Class II, Division 2 and Class III locations need not be marked with the class, group, division, or operating temperature.

5.4.3 Safe for the hazardous (classified) location. Equipment which is safe for the location shall be of a type and design which TRC demonstrates will provide protection from the hazards arising from the combustibility and flammability of vapors, liquids, gases, dusts, or fibers.

- Conduits: All conduits shall be threaded and shall be made wrench-tight. Where it is impractical to make a threaded joint tight, a bonding jumper shall be utilized.

5.5 Special systems (Systems over 600 volts, nominal):

5.5.1 Wiring methods for fixed installations:

- Above ground: Above-ground conductors shall be installed in rigid metal conduit, in intermediate metal conduit, in cable trays, in cablebus, in other suitable raceways, or as open runs of metal-clad cable designed for the use and purpose. However, open runs of non-metallic-sheathed cable or of bare conductors or busbars may be installed in locations which are accessible only to qualified persons. Metallic shielding components, such as tapes, wires, or braids for conductors, shall be grounded. Open runs of insulated wires and cables having a bare lead sheath or a braided outer covering shall be supported in a manner designed to prevent physical damage to the braid or sheath.
- Installations emerging from the ground: Conductors emerging from the ground shall be enclosed in raceways. Raceways installed on poles shall be of rigid metal conduit, intermediate metal conduit, PVC schedule 80 or equivalent extending from the ground line up to a point 8 feet (2.44 m) above finished grade. Conductors entering a building shall be protected by an enclosure from the ground line to the point of entrance. Metallic enclosures shall be grounded.

5.5.2 Interrupting and isolating devices:

- Circuit breakers: Circuit breakers located indoors shall consist of metal-enclosed or fire-resistant, cell-mounted units. In locations accessible only to qualified personnel, open mounting of circuit breakers is permitted. A means of indicating the open and closed position of circuit breakers shall be provided.

- Fused cutouts: Fused cutouts installed in buildings or transformer vaults shall be of a type identified for the purpose. They shall be readily accessible for fuse replacement.
- Equipment isolating means: A means shall be provided to completely isolate equipment for inspection and repairs. Isolating means which are not designed to interrupt the load current of the circuit shall be either interlocked with a circuit interrupter or provided with a sign warning against opening them under load.

5.5.3 Mobile and portable equipment:

- Power cable connections to mobile machines. A metallic enclosure shall be provided on the mobile machine for enclosing the terminals of the power cable. The enclosure shall include provisions for a solid connection for the ground wire(s) terminal to ground effectively the machine frame. The method of cable termination used shall prevent any strain or pull on the cable from stressing the electrical connections. The enclosure shall have provision for locking so only authorized qualified persons may open it and shall be marked with a sign warning of the presence of energized parts.
- Guarding live parts: All energized switching and control parts shall be enclosed in effectively grounded metal cabinets or enclosures. Circuit breakers and protective equipment shall have the operating means projecting through the metal cabinet or enclosure so these units can be reset without locked doors being opened. Enclosures and metal cabinets shall be locked so that only authorized qualified persons have access and shall be marked with a sign warning of the presence of energized parts. Collector ring assemblies on revolving-type machines (shovels, draglines, etc.) shall be guarded.

5.5.4 Tunnel installations:

- Application: The provisions of this section apply to installation and use of high-voltage power distribution and utilization equipment which is associated with tunnels and which is portable and/or mobile, such as substations, trailers, cars, mobile shovels, draglines, hoists, drills, dredges, compressors, pumps, conveyors, and underground excavators.
- Conductors: Conductors in tunnels shall be installed in one or more of the following:
  - Metal conduit or other metal raceway;

  - Type MC cable; or
  - Other suitable multi-conductor cable.

- Conductors shall also be so located or guarded as to protect them from physical damage. Multi-conductor portable cable may supply mobile equipment. An equipment grounding conductor shall be run with circuit conductors inside the metal raceway or inside the multi-conductor cable jacket. The equipment grounding conductor may be insulated or bare.
- Guarding live parts. Bare terminals of transformers, switches, motor controllers, and other equipment shall be enclosed to prevent accidental contact with energized parts. Enclosures for use in tunnels shall be drip-proof, weatherproof, or submersible as required by the environmental conditions.
- Disconnecting means. A disconnecting means that simultaneously opens all ungrounded conductors shall be installed at each transformer or motor location.
- Grounding and bonding. All nonenergized metal parts of electric equipment and metal raceways and cable sheaths shall be grounded and bonded to all metal pipes and rails at the portal and at intervals not exceeding 1000 feet (305 m) throughout the tunnel.

5.5.5 Class 1, Class 2, and Class 3 remote control, signaling, and power-limited circuits:

- Classification: Class 1, Class 2, or Class 3 remote control, signaling, or power-limited circuits are characterized by their usage and electrical power limitation which differentiates them from light and power circuits. These circuits are classified in accordance with their respective voltage and power limitations.
- Class 1 circuits:
  - A Class 1 power-limited circuit is supplied from a source having a rated output of not more than 30 volts and 1000 volt-amperes.
  - A Class 1 remote control circuit or a Class 1 signaling circuit has a voltage which does not exceed 600 volts; however, the power output of the source need not be limited.
- Class 2 and Class 3 circuits:
  - Power for Class 2 and Class 3 circuits is limited either inherently (in which no overcurrent protection is required) or by a combination of a power source and overcurrent protection.

- The maximum circuit voltage is 150 volts AC or DC for a Class 2 inherently limited power source, and 100 volts AC or DC for a Class 3 inherently limited power source.
- The maximum circuit voltage is 30 volts AC and 60 volts DC for a Class 2 power source limited by overcurrent protection, and 150 volts AC or DC for a Class 3 power source limited by overcurrent protection.

- Application: The maximum circuit voltages of this section apply to sinusoidal AC or continuous DC power sources, and where wet contact occurrence is not likely.
- Marking: A Class 2 or Class 3 power supply unit shall not be used unless it is durably marked where plainly visible to indicate the class of supply and its electrical rating.

5.5.6 Communications systems:

These provisions for communication systems apply to such systems as central-station-connected and non-central-station-connected telephone circuits, radio receiving and transmitting equipment, and outside wiring for fire and burglar alarm, and similar central station systems.

5.5.7 Protective devices:

- Circuits exposed to power conductors: Communication circuits so located as to be exposed to accidental contact with light or power conductors operating at over 300 volts shall have each circuit so exposed provided with an approved protector.
- Antenna lead-ins: Each conductor of a lead-in from an outdoor antenna shall be provided with an antenna discharge unit or other means that will drain static charges from the antenna system.

5.5.8 Conductor location:

- Outside of buildings receiving distribution lead-in or aerial-drop cables attached to buildings and lead-in conductors to radio transmitters shall be so installed as to avoid the possibility of accidental contact with electric light or power conductors.
- The clearance between lead-in conductors and any lightning protection conductors shall not be less than 6 feet (1.83 m).
- On poles: Where practicable, communication conductors on poles shall be located below the light or power conductors. Communications conductors shall not be attached to a crossarm that carries light or power conductors.

- Inside of buildings: Indoor antennas, lead-ins, and other communication conductors attached as open conductors to the inside of buildings shall be located at least 2 inches (50.8 mm) from conductors of any light or power or Class 1 circuits unless a special and equally protective method of conductor separation is employed.

5.5.9 Equipment location:

Outdoor metal structures supporting antennas, as well as self-supporting antennas such as vertical rods or dipole structures, shall be located as far away from overhead conductors of electric light and power circuits of over 150 volts to ground as necessary to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

5.5.10 Grounding:

- Lead-in conductors: If exposed to contact with electric light or power conductors, the metal sheath of aerial cables entering buildings shall be grounded or shall be interrupted close to the entrance to the building by an insulating joint or equivalent device. Where protective devices are used, they shall be grounded.
- Antenna structures: Masts and metal structures supporting antennas shall be permanently and effectively grounded without splice or connection in the grounding conductor.
- Equipment enclosures: Transmitters shall be enclosed in a metal frame or grill or separated from the operating space by a barrier, all metallic parts of which are effectively connected to ground. All external metal handles and controls accessible to the operating personnel shall be effectively grounded. Unpowered equipment and enclosures shall be considered grounded where connected to an attached coaxial cable with an effectively grounded metallic shield.

5.6 Protection of employees:

5.6.1 All PPE used must meet requirements found in applicable laws and regulations. These PPE requirements apply to many different kinds of PPE: arc rated apparel, insulating aprons, general eye and face protection, arc rated face protection, fall protection, testing methods and specifications for footwear, glove and sleeve testing and care, hard hats, arc rated rainwear, visual inspections of rubber protective products and sleeves.

5.6.2 TRC does not permit an employee to work in such proximity to any part of an electric power circuit that the employee could contact the electric power circuit in the course of work, unless the employee is protected against electric shock by deenergizing the circuit and grounding it or by guarding it effectively by insulation or other means.

5.6.3 In work areas where the exact location of underground electric powerlines is unknown, employees using jack-hammers, bars, or other hand tools which may contact a line shall be provided with insulated protective gloves.

5.6.4 Before work is begun TRC shall ascertain by inquiry or direct observation, or by instruments, whether any part of an energized electric power circuit, exposed or concealed, is so located that the performance of the work may bring any person, tool, or machine into physical or electrical contact with the electric power circuit. TRC will post and maintain proper warning signs where such a circuit exists. TRC will advise employees of the location of such lines, the hazards involved, and the protective measures to be taken.

5.6.5 Passageways and open spaces:

- Barriers or other means of guarding shall be provided to ensure that workspace for electrical equipment will not be used as a passageway during periods when energized parts of electrical equipment are exposed.
- Working spaces, walkways, and similar locations shall be kept clear of cords so as not to create a hazard to employees.

5.6.6 Load ratings: In existing installations, no changes in circuit protection shall be made to increase the load in excess of the load rating of the circuit wiring.

5.6.7 Fuses: When fuses are installed or removed with one or both terminals energized, special tools insulated for the voltage shall be used.

5.6.8 Cords and cables:

- Worn or frayed electric cords or cables shall not be used.
- Extension cords shall not be fastened with staples, hung from nails, or suspended by wire.

5.7 Lockout and tagging of circuits:

5.7.1 Controls: Controls that are to be deactivated during the course of work on energized or de-energized equipment or circuits shall be tagged.

5.7.2 Equipment and circuits: Equipment or circuits that are de-energized shall be rendered inoperative and shall have tags attached at all points where such equipment or circuits can be energized.

5.7.3 Tags shall be placed to identify plainly the equipment or circuits being worked on.

- Maintenance of equipment: TRC shall ensure that all wiring components and utilization equipment in hazardous locations are maintained in a dust-tight, dust-ignition-proof, or explosion-proof condition, as appropriate. There shall be no loose or missing screws, gaskets, threaded connections, seals, or other impairments to a tight condition.

5.8 Environmental deterioration of equipment

5.8.1 Deteriorating agents:

Unless identified for use in the operating environment, no conductors or equipment shall be located:

- In damp or wet locations;
- Where exposed to gases, fumes, vapors, liquids, or other agents having a deteriorating effect on the conductors or equipment; or
- Where exposed to excessive temperatures.

5.8.2 Control equipment, utilization equipment, and busways approved for use in dry locations only shall be protected against damage from the weather during building construction.

5.8.3 Protection against corrosion: Metal raceways, cable armor, boxes, cable sheathing, cabinets, elbows, couplings, fittings, supports, and support hardware shall be of materials appropriate for the environment in which they are to be installed.

5.8.4 Batteries of the unsealed type shall be located in enclosures with outside vents or in well ventilated rooms and shall be arranged so as to prevent the escape of fumes, gases, or electrolyte spray into other areas.

5.8.5 Ventilation shall be provided to ensure diffusion of the gases from the battery and to prevent the accumulation of an explosive mixture.

5.8.6 Racks and trays shall be substantial and shall be treated to make them resistant to the electrolyte.

5.8.7 Floors shall be of acid resistant construction unless protected from acid accumulations.

5.8.8 Face shields, aprons, and rubber gloves shall be provided for workers handling acids or batteries.

5.8.9 Facilities for quick drenching of the eyes and body shall be provided within 25 feet (7.62 m) of battery handling areas.

5.8.10 Facilities shall be provided for flushing and neutralizing spilled electrolyte and for fire protection.

6. **REFERENCES / RELATED DOCUMENTS:**

American Public Power Association (APPA) Safety Manual, Safety Manual for an Electric Utility
NFPA 70E – Electrical Safety in the Workplace
29 CFR 1910 Subpart S – Electrical
29 CFR 1926 Subpart K – Electrical
ANSI Z89.1 - Requirements for Protective Headwear for Industrial Workers
ANSI Z41 - Standard for Personnel Protection - Protective Footwear
ANSI/ASSE Z87.1 - Practice for Occupational and Educational Eye and Face Protection
ASTM D120 - Standard Specification for Rubber Insulating Gloves
ASTM D1051 - Standard Specification for Rubber Insulating Sleeves
ASTM F496 - Standard Specification for In-Service Care of Insulating Gloves and Sleeves
ASTM F696 - Standard Specification for Leather Protectors for Rubber Insulating Gloves and Mittens
ASTM F1117 - Standard Specification for Dielectric Overshoe Footwear
ASTM F1236 - Standard Guide for Visual Inspection of Electrical Protective Rubber Products
ASTM F1506 - Standard Performance Specification for Flame Resistant Textile Materials for Wearing Apparel for Use by Electrical Workers When Exposed to Momentary Electric Arc and Related Thermal Hazards
National Electric Code (NEC)
National Electrical Safety Code (NESC)

TRC Programs

CP002 – Risk Analysis/Site-Specific Health and Safety Plan
CP003 – Personal Protective Equipment Program
CP004 – Electrical Safety Program
CP005 – Lockout/Tagout Program

CP009 – Health and Safety Training Program

CP019 – TRC Incident Response and Lessons Learned Program

TRC Forms

JSA Forms

LOTO Permit

Site Audit Evaluation Report

Weekly Site Inspection Form

TRC Pre-Job Safety Briefing Form

TRC Daily Work Plan

TRC Weekly Work Plan

1. PURPOSE

The purpose of the Confined Space Entry Program is to set procedures that will ensure workers safe entry into confined spaces and permit-required confined spaces. Employee participation on the development and implementation of all aspects of the permit required confined space entry program is crucial for the success of this program. This procedure is designed to provide the minimum safety requirements in accordance with the Occupational Safety and Health Administration's (OSHA) Confined Space Standards 29 CFR, 1910.146 and 29 CFR 1926 Subpart AA.

2. SCOPE

This program has been developed to protect TRC employees and contractors entering and working in confined spaces by defining mandatory minimum safety requirements for confined space work. This compliance program does not apply to construction in excavations, underground construction, caissons, or cofferdams.

3. DEFINITIONS

Acceptable Entry Conditions**:** The conditions that must exist in a space to allow entry and to ensure that the employees involved with a confined space entry can safely enter into and work within the space.

Attendant: An individual stationed outside one or more spaces who monitors the authorized entrants and who performs all attendant's duties assigned in the confined space entry program.

Authorized Entrant**:** An employee who is authorized by the employer to enter a confined space.

Barrier: A physical obstruction that blocks or limits access.

Blanking or Blinding: The absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

Competent Person: A person who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them. Note: This person can act as the Entry Supervisor.

Confined Space: Is defined as a space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry); and
- Is not designed for continuous employee occupancy.

Controlling Contractor: means the employer that has overall responsibility for construction at the worksite.

Double Block and Bleed: The closure of a line, duct, or pipe by closing and locking or tagging two inline valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

Emergency: Any occurrence (including any failure of hazard control or monitoring equipment) or event(s) internal or external to the confined space, which could endanger entrants.

Engulfment: The surrounding and effective capture of a person by a liquid or finely divided solid (flowable) substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

Entry: The act by which a person intentionally passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Entry Employer: Means the employer who decides that an employee it directs will enter a permit space.

Entry Permit: The written or printed document provided by the employer to allow and control entry into a permit space and contains the information specified in section (f) of the Permit-Required Confined Space standard.

- Defines the conditions under which the permit space may be entered.
- States the reason(s) for entering the space.
- Lists the anticipated hazards of the entry.
- Lists the eligible attendants, entrants, and the individuals who may be in charge of the entry.
- Establishes the length of time for which the permit may remain valid.
- Establishes special procedures, hot work permits etc., that are required to ensure safe entry and work operations.

Entry Supervisor: The person responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry. Note: An entry supervisor may also serve as an attendant or as an entrant, as long as that person is trained and equipped as required by this program 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.

Hazardous Atmosphere: An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to escape unaided from a permit 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 Flammable Limit (LFL).
- Airborne combustible dust at a concentration that meets or exceeds its LFL.
- Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent.
- Atmospheric concentration of any substance in excess of its dose or permissible exposure limit.
- Any other atmospheric condition that is immediately dangerous to life or health.

Note: For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Safety Data Sheets (SDSs), information published by government agencies (i.e., NIOSH, ACGIH, etc.) can provide guidance in establishing acceptable atmospheric conditions.

Host Employer: The employer that owns or manages the property where the construction work is taking place. Note: If the owner of the property on which the construction activity occurs has contracted with an entity for the general management of that property, and has transferred to that entity the information specified in 1926.1203(h)(1), the contracted management entity will be treated as the host employer for as long as that entity manages the property. Otherwise, the owner of the property will be treated as the host employer. In no case will there be more than one host employer.

Immediately Dangerous to Life or Health (IDLH): Any condition, which poses an immediate threat of loss of life, may result in irreversible or immediate severe health effects, may result in eye damage, irritation or other conditions which could impair escape from the permit space.

Inerting: The displacement of the atmosphere in a permit-required space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible. It is a process of rendering the atmosphere of a permit-required space non-flammable, non-explosive, or otherwise chemically non-reactive by such means as displacing or diluting the original atmosphere with steam or a gas that is non-reactive with respect to that space. Note**:** This procedure produces an IDLH oxygen-deficient atmosphere.

Isolation: The process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tag-out of all sources of energy or mechanical linkages.

Non-Permitted Confined Space: A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or egregious physical harm. A location that is governed by specific regulations may require special procedures to ensure all hazards are controlled before entry (i.e., telecommunications manholes or high voltage manholes).

OSC: Office Safety Coordinator.

Oxygen Deficient Atmosphere: An atmosphere containing less than 19.5 percent oxygen by volume.

Oxygen Enriched Atmosphere: An atmosphere containing more than 23.5 percent oxygen by volume.

Permit-Required Confined Space: A confined space that has one or more of the following characteristics:

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

Permit-Required Confined Space Entry Program: The employer's overall program for controlling, and where appropriate, for protecting employees from permit space hazards and for regulating employee entry into permit spaces.

Permit System: The employer's written procedures for preparing and issuing permits for entry and for returning the permit space to service following termination of entry. Reference CP008.1.

Prohibited Condition: Any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

Rescue Service: The personnel designated to rescue employees from confined spaces.

Retrieval System: The equipment (including a retrieval line, chest or full-body harness, wrist-lets, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

Testing: The process by which the atmospheric hazards that may confront entrants of a space are identified and evaluated. Testing includes specifying the tests that are to be performed in the space. *Note*: Testing enables employers both to devise and implement adequate control measures for the protection of authorized entrants and to determine if acceptable entry conditions are present immediately prior to and during entry.

Ventilate or Ventilation: Controlling a hazardous atmosphere using continuous forced-air mechanical systems that meet the requirements of 29 CFR 1926.57 – Ventilation.

4. RESPONSIBILITIES

4.1 The National Safety Director is responsible for establishing Confined Space Entry Program requirements and communicating them to the Health and Safety Network. The National Safety Director will also review the Confined Space Entry Program annually to ensure it remains effective at managing risks associated with entering confined spaces.

4.2 The TRC Health and Safety Network is responsible for Confined Space Entry Program implementation including, but not limited to:

- Serving as a Competent Person for confined space entry as needed when TRC employees are entering permit spaces.
- Assisting TRC with the identifying confined spaces at the job site.
- Providing and coordinating the required level of training for TRC employees.
- Communicating and coordinating TRC's confined space entry requirements with the applicable Host Employer(s) and Controlling Contractors.
- Procuring health and safety equipment (i.e., monitoring equipment, ventilation, hard hats, safety glasses, safety warning vests, barricade tape, harnesses, lanyards, etc.) necessary for TRC employees to safely entering permit spaces.
- Working in concert with identified Competent Person(s) to provide on-site direction on confined space entry issues.
- Performing confined space permit review in conjunction with identified Competent Person(s) and other on-site TRC subcontractor health and safety representatives.
- Maintaining records for health and safety activities on-site including confined space permits and procedural audits of employee Confined Space Entry Program implementation.

- Completing site-specific emergency contact list in the event of an incident.
- Providing assistance during emergency situations; may serve in any of the assistance roles associated with confined space entry.
- Identifying rescue services that are capable of performing confined space rescue.
- Evaluating the potential rescue team/service. **Note:** Appendix F of the OSHA 29 CFR 1910.146 Standard contains examples of criteria for evaluating the capabilities of emergency responders.

4.3 The Competent Person will work in concert with the Health and Safety Network to successfully implement the requirements of this program including the requirements listed below:

- Evaluating worksites to identify and classify permit required confined spaces.
- Approve confined space entries using the Permit to Work form CP008.1.
- Make a determination if a permit required confined space can be reclassified as a non-permit confined space. The basis for this determination must be documented on form CP008.2.
- Provide guidance for confined space entry questions.
- Observe the implementation of confined space entry and perform monthly audits regarding Confined Space Entry Program implementation.
- Be trained on the atmospheric testing equipment being used and perform testing of confined spaces.

4.4 The Project Manager is responsible for assisting the Health and Safety Network in the implementation of the Confined Space Entry Program. Project Managers must hold all site employees and subcontractors accountable for safe work practices and maintaining a safe work environment.

4.5 The Host Employer is responsible providing information regarding the permit spaces to the controlling contractor,

4.6 The Controlling Contractor is responsible for obtaining information regarding permit spaces from the Host Employer and pass it to the employer of person(s) who will be entering the permit spaces.

4.7 The Controlling Contractor is also responsible for verifying that other affected employees and employers at the worksite know not to create hazards that could create hazards to confined space entrants or hinder the rescue process.

4.8 The Entry Employer is responsible for communicating its entry program information (i.e., entry procedures, methods of controlling hazards, rescue procedures, hazards encountered that were not identified by the host employer or controlling contractor, etc.).

4.9 Entry Employers are responsible for providing the Controlling Contractor the information about their entry program and hazards they encounter in the space, and the controlling contractor passes that information on to other entry employers and back to the host. As mentioned above, the controlling contractor is also responsible for making sure employers outside a space know not to create hazards in the space, and that entry employers working in a space at the same time do not create hazards for one another's workers.

5. PROCEDURE

5.1 Identification of Confined Spaces:

- Permit-required and non-permit confined spaces shall be identified and classified during project start-up and evaluated periodically by the Health and Safety Network or other designated Competent Person.

- All employees and subcontractors shall be made aware of these confined spaces through training or instruction.

- All permit required confined space hazards will be identified with the following: "DANGER: PERMIT-REQUIRED CONFINED SPACE, UNAUTHORIZED ENTRY PROHIBITED".

5.2 Reclassification of a Permit-Required Confined Space to a Non-Permit-Required Confined Space:

- A permit-required confined space may be reclassified as a non-permit confined space if the permit space contains no actual or potential atmospheric hazard, and all other non-atmospherics hazards within the space can be eliminated without entry into the space.

- The permit-required confined space must be evaluated by the Competent Person (this person can act as the Entry Supervisor) to determine if the space meets the criteria for safe reclassification. If the space can safely be reclassified, the decision must be documented using the Confined Space Reclassification Form. Completed forms must be retained with the project file for a minimum of one year.

- The Competent Person must continuously monitor the space for new hazards. Should new hazards arise within the non-permit confined space, each employee in the confined space will immediately exit the space. The Competent Person will then reevaluate the confined space and determine whether it must be reclassified as a permit confined space.

6. MONITORING ATMOSPHERIC REQUIREMENTS PRIOR TO ENTRY

6.1. Before entering a confined space, the following atmospheric conditions must be met as TRC does not allow any employee to work where IDLH conditions are present:

- The oxygen level is between 19.5 percent and 23.5 percent.
- The concentrations of flammable gas, vapors, or mists are below 10 percent of their Lower Explosive Limits (LEL).
- The concentration of airborne combustible dust must not exceed 10 percent of the LFL.

  Note: An indication of this condition is if the dust obscures vision at a distance of 5 feet.
- The monitoring device shall be equipped with an audible and visible warning device that warns the entrant and/or attendant of the hazardous atmosphere in the permit space.
- Air monitoring devices shall be calibrated relative to the oxygen content of the ambient air at the time of sampling. Calibration of the monitoring device relative to the oxygen content shall be performed where the 20.9 percent natural content of oxygen in the air is most likely to occur.
- Calibration of a sampling device shall be conducted as often as recommended by the manufacturer, but at least once every year.
- Non-sparking Equipment: When sampling the atmosphere of a confined space, the monitoring device shall have an attached non-sparking probe.
- Intrinsically Safe: When the confined space to be entered is expected to have combustible vapors present, employees shall be required to use an approved explosion-proof or intrinsically safe monitoring device.
- The atmosphere in the confined space within the entrant's immediate area shall be continuously monitored for oxygen and other atmospheric contaminants which are believed to be present in the confined space. Atmospheric monitoring must be conducted by a person trained on the proper use, calibration and limitations of the atmospheric monitoring equipment.
- When monitoring for entries involving a descent or ascent into atmospheres that may be stratified, the atmospheric envelope should be tested at a distance of approximately four feet in the direction of travel and to each side.
- Stratified testing should be performed prior to entering the space and continuously while performing work due to atmospheres in the confined space that could change due to different specific gravities of the gases/vapors.

- Prior to entering the space, tests should be performed at the top, middle, and bottom sections of entry space. If a sampling probe is used, the monitoring device's rate of progress should be slowed to accommodate the sampling speed and detector response.

6.2. Achieving Safe Atmospheres:

- In order to achieve and maintain a safe atmosphere, one or more actions may have to be taken to render the space safe for human occupancy. This could include:
  - Isolation—precautions taken to prevent release of material and/or energy into the space. This can be achieved through blinding, blanking, disconnecting, lockout/tagout (LOTO), or removal of incoming pipes or related energy sources.
  - Separation—where there is a possibility of external hazards, the space may require barricades to protect the entrants from falling objects or from unauthorized entry.
  - Depending on the confined space, there may be residual hazards that could present a hazard to the entrant. These residuals hazards should be characterized and safely removed from the space prior to entry. Contact a person that has knowledge of the confined space and its contents, refer to the safety data sheet and tank/pipe labels to identify the potential residual hazards. Examples of residual hazards include chemical residue, solid deposits, and hot/cold surfaces.

6.3. Ventilation:

- If a confined space being entered is found to contain a hazardous atmosphere, forced air ventilation may be provided for a period of time in order to bring the air quality within the acceptable limits. Once the determined ventilation period expires, employees shall monitor the confined space prior to entry. If the sampling shows that a hazard still exists, then additional ventilation and sampling may be required.

- Control of atmospheric hazards through forced air ventilation does not constitute elimination of hazards.

- If the hazard still exists after repeated ventilation steps, the confined space shall then be considered a permit-required confined space and the Confined Space Entry Team (entrant, attendant, and Confined Space Entry Supervisor) must follow the proper procedures for permit-required confined space entry.

- Forced air ventilation should be so directed as to ventilate the immediate areas where an employee is or will be present within the space and shall continue until all employees exit the space.

6.4. Whenever ventilation is used, employees shall:

- Keep the blower controls at least 10 feet from the confined space, and out of the wind or downwind from the entrance to the confined space.
- Use a ventilation blower that is designed to be intrinsically safe if the possibility of an explosive atmosphere could exit.
- Ensure that the exhaust systems are designed and placed so that they protect employees in the surrounding area from being contaminated.
- Ensure that the ventilation system is fully operational and air is supplied from a clean source.
- Ensure that contaminated air is not recirculated back into the confined space.
- Purge the ventilation hose outlet for at least one minute (at street level if possible) before inserting the hose into the confined space.
- Maintain continuous local ventilation when toxic atmospheres are being produced as part of a work procedure (i.e., welding, painting or cleaning operations).

6.5. Inert Gases:

- Inert gases, such as nitrogen, argon, and helium, are non-toxic, odorless, and tasteless gases that do not support human breathing and react scarcely or not at all with other substances. Inert gases are difficult to detect and can displace oxygen inside a confined space, therefore making the atmosphere inside the space hazardous. It is therefore absolutely essential to draw the attention of employees and contractors to the hazards of inert gases and oxygen depletion.

6.6. Extreme Temperatures:

- Prolonged exposure to extreme temperatures (hot or cold) can be dangerous. The effects of exposure to extreme temperatures can be increased by several factors including the amount of work (e.g., calorie expenditure) a person is performing, additional clothing (e.g., welding jacket, gloves, etc.), and personal protective equipment (PPE) (e.g., respirator).
- Hazards associated with extreme temperatures and the symptoms (e.g., heat stroke, hypothermia, etc.) must be understood by all employees that are involved with the confined space entry. It is also important to understand that every person has a unique tolerance to temperate extremes. Refer to TRC's Health Illness Prevention Program CP011.

7. PERMIT-REQUIRED CONFINED SPACE ENTRY

7.1 All employees required to enter into a confined or enclosed space shall be informed of the hazards involved, the necessary precautions to be taken, and in the use of PPE and emergency equipment required through tailgate meetings and danger signs posted at the job location.

7.2 Authorized Entrants:

- Authorized Entrants must know how to:
  - Use required equipment to ensure safe entry.
  - Maintain constant communication with attendants.
  - Alert attendants when warning signs or other hazardous conditions exist; and
    - Exit as quickly as possible whenever ordered or alerted (by alarm, warning sign or prohibited condition) to do so.
  - Understand the hazards they may face, be trained to recognize signs or symptoms of exposure, and understand the consequence of exposure to hazards.
  - Continuously monitor for atmospheric hazards and engulfment hazards while inside the space and evacuate the space immediately if hazards arise.

7.2.1 Attendant:

- Attendant(s) may only be assigned to a single designated confined space. The attendant shall not monitor more than one space at a time.
- Attendant(s) may not perform any duty that will interfere with their primary duties, which include, but are not limited to:
  - Check permits of authorized entrants.
  - Prevent unauthorized entry in permit-required confined spaces.
  - Maintain a continuous count of those in a confined space, by utilizing a sign-in and sign-out form.
  - Monitor activity in the confined space and continuously monitor for engulfment hazards as possible from outside the space.
  - Perform intermittent or continuous air monitoring.
  - Remain outside the confined space until relieved.
  - Trained and certified in Cardiopulmonary Resuscitation (CPR)/First Aid.
  - Understand the hazards of a confined space and being aware of potential exposures.
  - If necessary; ordering all employees to exit a confined space.
  - Contact rescue team.
  - Perform non-entry rescue.

7.2.2 Entry Supervisor:

- Entry supervisors must know the hazards of confined spaces and must verify that all tests have been conducted and all procedures and equipment are in place before endorsing a permit. The Entry Supervisor must also verify that a rescue plan is in place and the designated rescue team has been notified prior to the entry.
- Entry Supervisors are also responsible for the following:
  - Participate in and verify that a risk assessment has been conducted for the task prior to approving entry.
  - Communicate the hazards and safety precautions associated with the confined space.
  - Ensure that all equipment that is necessary for the safe entry and exit of permit-required confined space is available and maintained in good working condition.
  - Identify and evaluate potential confined space hazards.
  - Verify emergency response plans prior to allowing entry.
  - Approve and cancel entry permits; and review canceled permits to ensure the permit was effective.
  - Authorize entry into confined space.
  - Terminate or suspend the confined space entry and permit when the work covered by the confined space permit has been completed or when a hazardous condition arises in or near the confined space.
  - Remove the entry permit from the confined space for proper record retention after the permit has been terminated.
  - Confirm all personnel are accounted for upon termination of the entry permit.
  - Ensure entry operations are consistent with entry permit.
  - Revalidate and resign the entry permit when there is a change in roles.
  - Prevent unauthorized entry in to permit-required confined spaces.
  - Ensure the rescue service has been notified of the intended entry and is committed to providing rescue services when summoned.
  - Debrief the host employer or the controlling contractor about any hazards or deficiencies that developed during the entry.

8. CONFINED SPACE EQUIPMENT

8.1 In order to perform safe entry, exit, and non-entry rescue of permit-required confined spaces, the site must maintain the following equipment:

- Direct read atmospheric testing equipment;
- Ventilating equipment, if necessary;

- Communications equipment (e.g., two-way radio);
- PPE which has been identified as necessary for both entry and rescue;
- Lighting equipment that is designed for confined spaces, allowing for both safe work, exit and rescue if necessary;
- Barriers or other devices necessary for protecting workers from external hazards;
- Equipment necessary for safe entry and exit (e.g., ladders); and
- Non-entry rescue and emergency equipment including first aid supplies.

9. EMERGENCY RESCUE

- Only non-entry rescues will be permitted by TRC personnel. Only trained emergency responders are permitted to enter confined spaces to perform rescue duties.

- Rescue services must be identified, evaluated and available for all permit-required confined space entries, except for vertical entries where non-entry rescue offers the safest approach. Rescue teams can be comprised of on-site or outside personnel; however, they must be able to meet and comply with the requirements of this program and must be able to perform rescue within four minutes of being summoned for rescue.

- If local rescue services, such as the fire department, are identified as the rescue team, an evaluation must be made to verify the rescue service is available and capable of performing the rescue. This evaluation should be documented. In addition, the local rescue service must be informed of the entry schedule prior to employees entering the permit space.

- Rescue teams must be made aware of the nature and type of hazards within permit spaces and must be provided access to the permit spaces prior to work being performed in order to develop rescue plans and practice rescues. The Health and Safety Network or designated Competent Person(s) must contact rescue teams prior to permitting entry into a permit-required confined space. Rescue services will be called in the event of any emergency involving confined space, and must have training equivalent to the potential situations in which they may be required to assist. The entry supervisor will be responsible for contacting the rescue team. If outside services are used as primary or secondary rescue, the entry supervisor shall communicate with the rescue team, prior to entry, to ensure that they are aware of the intended entry and are available to perform rescue. These steps shall be documented on the Confined Space Entry Permit.

- The minimum requirements for rescue teams are as follows:
  - Rescuers are to be qualified as authorized entrants for the confined space in which work is being performed.
  - Rescue personnel will practice making permit space rescues at least once every 12 months, by means of simulated rescue operations from the actual permit spaces or from representative permit spaces. Representative permit spaces must simulate the actual permit space being entered, with respect to opening size, configuration, and accessibility.
  - Rescue personnel will be trained and certified in First Aid/CPR.
  - Rescue personnel are to be equipped with, and trained to use, PPE and rescue equipment necessary to enable them to enter and perform rescue operations in the permit-required confined space.

- For non-entry rescue, the authorized entrants must:
  - The entrant(s) shall don a full body harness with a retrieval line attached at the center of back, near the shoulder level or above the entrant's head.
  - Attach the other end of the retrieval line to a mechanical device of fixed point outside the confined space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary.
  - Set up a mechanical device and make it ready to retrieve personnel from vertical type confined spaces more than 5 feet deep.

10. ENTRY PERMITS

- Before entry into a permit required confined space is authorized, a permit to work (CP008.1) shall be prepared in order to document the completion of safety measures required. The completed permit shall be made available to all authorized entrants at the time of entry by posting the permit at the entry portal or by other equally effective means.

- The Entry Supervisor shall ensure that the permit has been satisfactorily completed, including the procedure for contacting rescue services.

- A fully completed entry permit shall be signed by the Entry Supervisor to authorize entry into a permit-required confined space.

- Conditions that prohibit entry to a confined space will be evaluated and listed on the entry permit.

- The permit shall be dated and carry an expiration time limiting the work to one shift. The permit must be revalidated and resigned if a role change occurs.

- The duration of the permit may not exceed the time required to complete the assigned task or job identified on the permit.

- The permit must be posted at the entrance to the confined space.

- The Entry Supervisor shall terminate the work in the confined space if an unsafe condition develops which exceeds the conditions authorized on the permit or when the entry has been completed.

- The entry permit status shall be updated to reflect the cancelled status and also the summary of the unsafe condition.

- Cancelled entry permits will be reviewed for effectiveness, and retained in the TRC project file for at least one year.

- A review of entry operations and procedures will occur any time there is reason to believe employees are not adequately protected under this program. Revisions to this program will be made prior to subsequent entries if deficiencies are found to exist.

11. TRAINING

- All project employees will receive documented training during site-specific orientation regarding TRC's requirements involving work with confined space entry hazards.

- Additional training for employees who will perform confined space entry procedures will be provided during site-specific Health and Safety Training, or prior to starting the project. Refresher training is necessary when duties change, hazards change, or evaluation determines inadequacies in an employee's knowledge.

- Training on TRC's LOTO Program and PPE Program is also required for employees involved with confined space entry where these hazards are present.

- The entry supervisor will ensure that all persons involved with the confined space entry will be trained and tested as necessary. He/She is to give training that ensures understanding, knowledge, and skills necessary for the safe performance of their assigned duties.

- Training will be given at the following times:
  - Prior to any new employee being assigned confined space duties;
  - Before there is a change in assigned duties; and
  - Whenever the entry supervisor has reason to believe that there are deviations from the permit space entry procedures or that there are inadequacies in the employee's knowledge or use of these procedures.

- The training requirements for entrants/attendants/ and entry supervisor will include:
  - Hazard recognition,
  - Symptoms of overexposure,
  - PPE,
  - External hazards,
  - Review of the confined space permit,
  - Air monitoring equipment and procedures,
  - Non-entry rescue equipment and procedures, and
  - Contacts to be made in event of an emergency.

12. REFERENCES/RELATED DOCUMENTATION

29 CFR 1910.146 – Permit Required Confined Spaces

29 CFR 1910.147 – The Control of Hazardous Energy

29 CFR 1926 Subpart AA - Confined Spaces in Construction

CP002 – Risk Analysis/Site-Specific Health and Safety Program

CP003 – Personal Protective Equipment Program

CP005 – Lockout/Tagout Program

CP008.1 Permit to Work

CP008.2 Confined Space Reclassification Form

CP0011 Health Illness Prevention Program

13. RECORDS

Completed Permit to Work forms

Completed Confined Space Reclassification forms

Project Name: ______________________ Project No. __________

Location: ______________________ Date: __________

Company: ______________________

Submitted By: ______________________

☐ Hot Work	☐ LOTO	☐ Confined Space	☐ Excavation	Equipment Used	Hot Work
Task/Job to be Performed/Reason for Entry (Describe in Detail)					☐ Welder
					☐ Torch
					☐ Grinder
					☐ Abrasive Saw
					☐ Open Flame

Start Date: __________ End Date: __________ Time From: __________ Time To: __________

Other Approvals: ☐ Fibers Assessment ☐ Lead Survey ☐ Critical Lift ☐ Live Electrical ☐ Hot Tap ☐ Crane Basket

ISOLATION – LOTO

Type of Energy: ☐ Electrical ☐ Mechanical ☐ Pressurized Gas/Liquid ☐ Gravity ☐ Radiation ☐ Other:

Is Equipment Isolated? ☐ Yes ☐ No ☐ N/A If yes, how? _____

Is Equipment: ☐ Depressurized ☐ Neutralized ☐ Opened ☐ Cleaned ☐ Drained ☐ Purged ☐ Other:

Equipment Previously Contained:

Equipment Still Contains Residual:

Area Isolation: ☐ Equipment in Service ☐ Barricades ☐ Signs ☐ N/A ☐ Other:

HOT WORK

Is equipment isolated and internal atmosphere tested 10% LEL or less? ☐ Yes ☐ No = Deny permit ☐ N/A

Atmosphere tests performed at fire work site and surrounding area indicate10% LEL or less? ☐ Yes ☐ No = DENY PERMIT

Is surrounding area free of material / residue that may be ignited by fire work (20 feet)? ☐ Yes ☐ No

Controls: _____

Is a fire watch needed? ☐ Yes ☐ No If yes how many? Location:

Is a fire extinguisher needed? ☐ Yes ☐ No If yes how many? Location:

CONFINED SPACE

Type: ☐ **Permit Required Confined Space** (Contains hazardous atmosphere, potential engulfment, trapping internal configuration, or any serious safety or health hazards.)

☐ **Reclassified Confined Space** (Complete Reclassification form CP008.2)

Date/Time Safety notified of Permit Required Confined Space entry: _____ ☐ N/A

Ventilation method: ☐ Forced ☐ Local Exhaust ☐ Natural Draft ☐ N/A

Communication Method: ☐ Voice Contact ☐ Hand Signal ☐ Two-Way Radio Channel: _____ ☐ Air-Horn ☐ Other

Is retrieval equipment required? ☐ Yes ☐ No Type: _____

Continuous air monitoring required? ☐ Yes ☐ No Periodic air monitoring required? ☐ Yes ☐ No

Special Lighting required? ☐ Yes ☐ No Type: _____

Emergency Rescue Service: _____

Attendant Signature: Entry Supervisor: Competent Person:

ATMOSPHERE	Time	Location	Oxygen 19.5-23.5%	Flammability < 10% LEL	H2S < 10 ppm	CO < 35 ppm	Other (Specify)	Initials

EXCAVATIONS

Competent Person: Location:

Size of Trench: Length _____ Width _____ Depth _____ Sketch or Drawing Attached: ☐ Yes ☐ No

Existing Utilities: ☐ Electrical ☐ Telephone ☐ Water ☐ Sewer ☐ Steam ☐ Alarm ☐ Drain ☐ Process ☐ Other

Other Known Obstructions: ☐ Footings ☐ Pilings ☐ Concrete Encasements ☐ Other

Contact Local Authorities? ☐ Yes ☐ No If yes, who and when? _____

Extra Precautions: ☐ De-energize Lines ☐ Ground Equipment ☐ Insolate Operator ☐ Hand Excavate ☐ Other

Soil Classification: ☐ Type A ☐ Type B ☐ Type C ☐ Solid Rock Test Used:

Protective System: ☐ Sloping _____ vertical (ft.) _____ horizontal (ft.) ☐ Benching _____ vertical cut (ft.) _____ horizontal cut (ft.) ☐ Shoring Type: _____ ☐ Shield Type:	Drawing Number(s) Referenced:

The above data has been checked with blueprints on file. When close clearances are indicated, hand excavation must be used to determine the exact location. Existing lines and interference's, in the vicinity of work, must be marked by stakes indicating location and depth prior to excavating.

Other

Additional Safety Precautions/Hazards:

Signatures

Permit Issued By:	Phone #:	Time Issued:
Permit Issued To:	Phone #:	Time Received:
Extended By:	Phone #:	Extended To:

Work Completed: ☐ Yes ☐ No Supervisor Signature:

Persons Covered by this Permit	Covered by Group LOTO? (Initials)	Group LOTO Complete (Initials)	Confined Space Entrant	Time of Entry/Exit							
				In	Out	In	Out	In	Out	In	Out
			☐								
			☐								
			☐								
			☐								
			☐								
			☐								
			☐								
			☐								
			☐								

Confined Space Reclassification Form CP008.2

Location of Confined Space (be specific): ____

Description of work activity: ____

____

Answer the following questions to determine if the permit-required confined space can be reclassified as a "non-permit space" considered for reclassification to a non-permit confined space. If any of the questions below are answered YES, the space cannot be reclassified.

NOTE: The hazards must be eliminated without entry to be considered a non-permit confined space.

1) Atmospheric conditions: (Circle One)

- Is there a potential for an oxygen deficient or oxygen enriched atmosphere caused by oxidation, bacterial action, combustion, use of inert gases, leaking, pipes? YES NO
- Is there a potential for harmful air contaminants to be present? YES NO
- Is there a potential for an explosive or flammable atmosphere (residues, bacterial action, leaking pipes, hoses, reactions with acids or metals, painting and cleaning, residual dusts)? YES NO
- Will work performed in or around the space create a hazardous atmosphere? YES NO
- Will hazardous materials be brought into the confined space? YES NO
- Will residue from the hazardous material remain in the space? YES NO
- Will additional measures, other than mechanical ventilation, be needed to control the hazardous atmosphere? YES NO

2) Are there any other safety hazards that cannot be eliminated without entry into the space? Examples of potential hazards include: YES NO

- Electrical, unsecured objects, mechanical, biological, gases or fluids under pressure.

3) Atmospheric testing

Record all atmospheric testing data on below:

TEST	LIMITS	TIME	ACTUAL READING
Oxygen	19.5% to 23.5%		
Lower Flammable Limit (LFL)	Under 10%		
Carbon Monoxide (CO)	Less than 35 ppm		
Hydrogen Sulfide	Under 7 ppm		
Other:			

I certify that all known or potential hazards have been appropriately eliminated prior to entry into the above confined space, thereby allowing for the reclassification of the space as a Non-Permit Confined Space:

Reclassification Authorized By (Competent Person): ____

Date: ____

Reclassification status may be maintained only for the duration of the ENTRY, as long as the hazards remain eliminated.

1. PURPOSE

This Heat Stress Program has been developed to reduce the risk of heat related illness to TRC employees while working outdoors or in buildings without climate control. This program outlines the responsibilities and process for preventing heat-related illnesses and intervening if a person develops symptoms of heat stress. This program is available to all employees through TRCNET.

2. SCOPE

The program applies to all part- and full-time TRC employees.

3. DEFINITIONS

Acclimatization: Means temporary adaptation of the body to work in the heat that occurs gradually when a person is exposed to it. Acclimatization peaks in most people within four to fourteen days of regular work for at least two hours per day in the heat.

Heat Stress: A physiological condition induced when high temperatures and humidity compromise the body's ability to cool itself, resulting in heat-related illnesses ranging in severity from mild (including heat cramps and heat rash), to moderate (heat syncope and heat exhaustion), to life threatening (heat stroke).

Heat Rash: A mild form of heat rash characterized by red papules usually appearing where clothing is restrictive.

Heat Cramps: Painful muscle contractions caused by consuming insufficient liquid when working in hot environments.

Heat Syncope: Fainting caused by standing in one position for a prolonged period of time in hot environments.

Heat Exhaustion: Heat stress characterized by headache, vertigo, weakness, thirst, and giddiness. Heat exhaustion, if left untreated, can progress rapidly to heat stroke.

Heat Stroke: A life-threatening form of heat stress characterized by a high body temperature (over 104° F), hot, dry skin, rapid heart rate, dizziness, shivering, nausea, irritability, mental confusion, convulsions, unconsciousness, and perhaps death.

High Risk Environments: Work environments where workers are routinely exposed to temperatures above 80 degrees Fahrenheit and often humid working conditions, putting them at increased risk for heat stress disorders.

Potable Water: Water that is fresh, pure, suitably cool, and provided to employees free of charge. One quart per employee per hour, for the entire shift, should be available.

Severe Risk (high-heat) Environments: Work environments where workers are routinely exposed to temperatures above 95 degrees Fahrenheit and often humid working conditions, putting them at risk for heat stress disorders.

4. RESPONSIBILITIES

4.1. The National Safety Director administers the Heat Stress Program for TRC.

4.2. TRC's Safety Network is responsible for providing guidance to Project Managers and Superiors on selecting appropriate safety precautions based on the project-specific risk factors.

4.3. Project Managers are responsible for the following:

- Assessing the heat related risks associated with a project during the planning phase. The risk factors listed in this program shall be considered when performing the risk assessment.
- Confirming that sufficient potable water is available at project sites, most importantly at sites where employee will be working in high risk environments.
- Confirming that employees who are working on project sites in high-risk environments have access to shade.

4.4. Office Safety Coordinators are responsible for assisting the project manager in developing the site-specific Health and Safety Plan (HASP), and assuring that appropriate Personal Protective Equipment (PPE) is available for employees.

4.5. A TRC Industrial Hygienist may be asked to evaluate specific tasks/environments and take measurements to determine the level of risk for a given area.

4.6. TRC Employees are responsible for the following:

- Informing TRC Project Managers and Supervisors of personal risk factors that may increase their risk to heat related disorders.
- Following safety precautions that have been determine appropriate for the project.
- Communicating early symptoms of heat stress to a coworker or project managers as soon as the symptoms are recognized.

5. PROCEDURE

5.1. Hazard Assessment

Project Managers and Supervisors shall assess project work during the planning phase for risk factors that can cause heat stress to TRC employees. There are four key risk factors that can affect the heat stress in the workplace, which are listed below. These risk factors will be managed to reduce the heat stress to employees working in high risk and severe risk environments.

5.1.1.Environmental conditions

- Temperature;
- Humidity; and
- Air movement.

5.1.2.Hot surfaces (machines, ovens, engines, etc.).

5.1.3.Physical activity (i.e., metabolic rate)

- Rest - Sitting
- Light - Sitting with light manual work with hands or hands and arms, and driving. Standing with some light arm work and occasional walking.
- Moderate - Sustained moderate hand and arm work, moderate arm and leg work, moderate arm and trunk work, or light pushing and pulling. Normal walking.
- Heavy - Intense arm and trunk work, carrying, shoveling, manual sawing; pushing and pulling heavy loads; walking and fast pace.
- Very Heavy - Very heavy activity at fast to maximum pace.

5.1.4.Clothing/PPE (e.g., Tyvek suit, flame resistant clothing, gloves, respirator, etc.)

5.1.5.Personal factors

- ability to acclimatize to hot environments;
- medical conditions;
- increasing age;
- overall level of fitness;
- presence of other metabolically stressful illnesses;
- use of certain medications;
- dehydration; and
- alcohol intake.

5.2. Based on this assessment, appropriate safety precautions shall be identified and implemented to minimize the risk of heat stress. When employees are exposed to multiple risk factors, the safety precautions should be increased. When there is uncertainty of the potential risk of heat stress, a quantitative exposure assessment can be performed by an industrial hygienist.

5.3. There are two primary methods for measuring and characterizing heat index levels in the workplace. One method compares the Wet Bulb Globe Temperature to the Threshold Limit Values (TLVs) for Heat Stress and Heat Strain published by the American Conference of Governmental Industrial Hygienists (ACGIH). The second method compares the temperature and humidity to the National Oceanographic and Atmospheric Administration (NOAA) Heat Index values.

5.4. The hazard assessment and safety precautions should be listed in the site-specific health and safety plan and communicated to the affected employees.

5.5. Project Managers and Supervisors shall consider one or more of the following safety precautions as necessary to minimize the risk of heat stress to employees. Personal risk factors should also be considered when selecting and implementing safety precautions.

5.6. Safety Precautions

The following safety precautions that can be used to reduce the risk of heat stress to workers. The extent and number of safety precautions shall be proportionate to the heat index in the working environment.

5.6.1. <u>Ventilation</u> – Where available, general ventilation (fans) can be provided. This should result in increased cooling of the body by increasing the convective heat loss and the sweat evaporation heat loss.

5.6.2. <u>Air Conditioning</u> – Vehicles and buildings are often equipped with air conditioning. When possible employees should be provided rest periods in air conditioning to reduce the risk of heat stress.

5.6.3. <u>Acclimatization</u> – An employee can best adapt to heat by being in the hot environment initially for very short periods, then longer periods. Acclimatization may take several days or longer, depending upon all the factors listed above. Acclimatization must be repeated if the employee is off work for an extended period or has been ill.

5.6.4. <u>Hydration</u> – Employees shall have access to potable water, starting at the beginning of the workday. Employees may begin the shift with smaller quantities of water if effective procedures for replenishment of water during the shift have been implemented to provide employees one quart or more per hour. Employees must also have multiple opportunities to consume the liquids throughout the workday.

5.6.5. <u>Shade</u> – Shade that is either open to the air or provided with ventilation shall be available as close to workers as practical whenever there is a risk of heat stress, or the temperature reaches 80 degrees Fahrenheit. Employees who need a cool-down period to avoid developing heat stress symptoms shall be provided access to shade. Shade areas must be able to comfortably accommodate all TRC employees who desire a cool-down period, and also the maximum number of TRC employees taking a meal break simultaneously.

Shade can include trees, buildings, canopies, lean-tos, or other partial and/or temporary structures that are either ventilated or open to air movement. The interior of cars or trucks are not considered shade unless the vehicles are air conditioned or kept from heating up in the sun by another method.

5.6.6. Communication and Observation – Employees working in severe risk (high-heat) work environments must maintain continual communication with coworkers. This can be accomplished verbally of via cellular telephones.

5.6.7. Limiting exposure time – Work schedules should be designed to limit the employees' time spent in high risk and severe risk environments (for example, scheduling outdoor work during the cooler hours of the day).Work breaks must provide employees with an opportunity to move to a cooler environment.

5.6.8. Appropriate clothing – Whenever possible, clothing provided to workers in hot environments should be permeable to air and loose fitting. Less clothing is not necessarily a viable option due to possibility of radiant heat burns or sunburn or work hazards (i.e., flammable/combustible liquids, electrical hazards, etc.).

5.6.9. Auxiliary Body Cooling – For employees who must work in areas at high risk for causing heat stress, commercially available cooling vests and other personal protective equipment are available and should be considered.

5.7. For work environments that have severe risk (above 95 degrees F), the following safety precautions must be implemented:

5.7.1. Communication and Observation – Employees working in severe risk (high-heat) work environments must maintain continual communication with coworkers. This can be accomplished verbally of via cellular telephones.

5.7.2. Emergency Coordinator – One or more employees and the worksite shall be designated as the emergency coordinator. The coordinator will be provided a cellular phone and authorized to call for emergency medical services (following the Site-specific Health and Safety Plan) if an employee experiences significant heat stress symptoms.

5.7.3. Hydration Reminders – The Project Manager or Site Supervisor shall periodically remind employees of the importance to consume water, even if they're not thirsty.

5.7.4. Tailgate meetings – During the pre-shift meeting, employees shall be reminded of the symptoms associated with heat stress, the importance to stay hydrated, and the requirement to follow safety precautions identified by the Project Manager and/or Site Supervisor.

5.8. Heat Stress Disorders/Symptoms and First Aid Measures

5.8.1. Employees and Project Managers shall be knowledge on the following heat disorders, the associated symptoms and the appropriate first aid / medical attention.

5.8.2. If an employee exhibits symptoms of heat stress, or if symptoms are observed by a coworker, the appropriate first aid/ medical attention listed in the following tables should be provided.

Heat Disorder	Symptoms	First Aid / Medical Attention
Heat Stroke Heat stroke occurs when the body becomes unable to control its temperature and the body's temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down. Heat stroke can cause death or permanent disability if emergency treatment is not given.	▪ Hot, dry skin or profuse sweating ▪ Hallucinations ▪ Chills ▪ Throbbing headache ▪ High body temperature ▪ Confusion/dizziness ▪ Slurred speech	▪ Call 911. ▪ Move the person to a cool shaded area. ▪ Cool the person using methods such as: — Soaking their clothes with water. — Spraying, sponging, or showering them with water. — Fanning their body.
Heat Exhaustion Heat exhaustion is the body's response to an excessive loss of water and salt, usually through excessive sweating.	▪ Heavy sweating ▪ Extreme weakness or fatigue ▪ Dizziness, confusion ▪ Nausea ▪ Clammy, moist skin ▪ Pale or flushed complexion ▪ Muscle cramps ▪ Slightly elevated body temperature ▪ Fast and shallow breathing	▪ Have person rest in a cool, shaded or air-conditioned area. ▪ Have them drink plenty of water. ▪ Have them take a cool shower. ▪ Medical approval required to return to work.

Heat Disorder	Symptoms	First Aid / Medical Attention
Heat Syncope Heat syncope is a fainting (syncope) episode or dizziness that usually occurs with prolonged standing or sudden rising from a sitting or lying position. Factors that may contribute to heat syncope include dehydration and lack of acclimatization.	▪ Light-headedness ▪ Dizziness ▪ Fainting	▪ Sit or lie down in a cool place when they begin to feel symptoms. ▪ Slowly drink water, clear juice, or a sports beverage. ▪ Obtain medical approval to needed to return to work.
Heat Cramps Heat cramps usually affect workers who sweat a lot during strenuous activity. This sweating depletes the body's salt and moisture levels. Low salt levels in muscles causes painful cramps. Heat cramps may also be a symptom of heat exhaustion.	▪ Muscle pain or spasms usually in the abdomen, arms, or legs.	▪ Stop all activity, and sit in a cool place. ▪ Drink clear juice or a sports beverage. ▪ Do not return to strenuous work for a few hours after the cramps subside because further exertion may lead to heat exhaustion or heat stroke. ▪ Seek medical attention if any of the following apply: — The worker has heart problems. — The worker is on a low-sodium diet. — The cramps do not subside within one hour.

Heat Disorder	Symptoms	First Aid / Medical Attention
Heat Rash Heat rash is a skin irritation caused by excessive sweating during hot, humid weather.	▪ Heat rash looks like a red cluster of pimples or small blisters. ▪ It is more likely to occur on the neck and upper chest, in the groin, under the breasts, and in elbow creases.	▪ Try to work in a cooler, less humid environment when possible. ▪ Keep the affected area dry. ▪ Dusting powder may be used to increase comfort.

Source: Center for Disease Control and Prevention (CDC)

5.9. Training:

Training is a critical element of heat stress prevention. All supervisors and employees must be trained in 1) the recognition of the signs and symptoms of impending heat illness, 2) the heat stress prevention methods that can reduce the risk of heat disorders, and 3) the basic First Aid procedures for heat stress symptoms. Supervisors will receive this training prior to supervision of employees.

At a minimum, heat stress prevention training will include the following topics:

- Health hazards related to heat stress.
- TRC's procedures for identifying, evaluating and controlling exposures to the environmental and personal risk factors for heat illness.
- Recognition of predisposing factors, danger signs, and symptoms.
- The importance of immediately reporting symptoms or signs of heat illness in themselves to the Project Manager, the Site Employee(s) or Work Care.
- Procedures for responding to symptoms of possible heat illness, including how emergency medical services will be provided should they become necessary.

6. REFERENCES/RELATED DOCUMENTATION

NIOSH Research Report, Relationships Between Several Prominent Heat Stress Indices, 1976 Jensen & Heins.

Occupational Exposures to Hot Environments, NIOSH Revised Criteria, 1986.

ACGIH TLV & Biological Exposure Indices for 2007, ACGIH.

Beshir, M.Y., A Comprehensive Comparison Between WBGT and Botsball, American Industrial Hygiene Association Journal, February 1981.

OSHA Technical Manual: Heat Stress (Directive Number: TED 01-00-015), 1999

Memorandum: Extreme Heat-Related Outdoor Inspections, OSHA Memo, July 2012

7. APPENDICES

Appendix A: Heat Index Table

APPENDIX A

Having awareness of heat illness symptoms can save your life or the life of a co-worker. The following table provides valuable information concerning heat-related illnesses and the level of safety precautions that should be implemented.

HEAT INDEX TABLE

NOAA's National Weather Service

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Index	Risk Level	Protective Measures
Less than 91°F	Lower (Caution)	Basic heat safety and planning
91°F to 103°F	Moderate	Implement safety precautions and heighten awareness
103°F to 115°F	High	Additional safety precautions to protect workers
Greater than 115°F	Very High to Extreme	Triggers even more aggressive safety precautions

1. PURPOSE

This Cold Stress Program has been developed to proactively prevent TRC employees from developing cold-related illness and injury.

The Cold Stress Program is designed to:

- Inform employees about potential hazards associated with working in a cold environment.
- Provide guidelines for recognizing symptoms of cold-related illnesses ranging from hypothermia to frostbite.
- Prevent employee injuries and illnesses caused by cold stress.
- Comply with all applicable federal and state regulations.

2. SCOPE

The program applies to all part- and full-time TRC employees, and will help to identify Primary Factors or Environmental Factors:

- Certain medications may prevent the body from generating heat normally. These medications include antidepressants, sedatives, tranquilizers, and heart medications.
- Medical conditions can also increase the risk of cold stress. These include heart disease, asthma/bronchitis, diabetes, and vibration/white finger disease.
- Low temperatures.
- Cool high wind.
- Dampness.
- Cold water.

3. DEFINITIONS

Frostbite: The freezing or the local effect of partial freezing of some part of the body. High surface-area-to-volume ratios such as the fingers, toes, ears, nose, and cheeks are most susceptible to frostbite.

Hypothermia: A severe drop in core body temperature due to overexposure to low temperatures.

Trench Foot: Caused by having feet exposed to wed cold environments or immersed in cold water for long periods of time. Victims will generally complain of tingling, itching or burning sensations and blisters may form in affected areas.

Wind Chill: A measure of the rate of heat loss from exposed skin caused by the combined effects of high winds and low temperatures. The wind chill temperature is what the temperature “feels like” during cold weather as a result of the wind. As the wind increases, it draws heat from the body temperature.

4. RESPONSIBILITIES

4.1. The National Safety Director administers the Cold Stress Program for TRC.

4.2. The Project Manager will be provided a copy of this program and is responsible for assessing the risks of a project including identification of when cold stress prevention measures may be required.

4.3. Office Safety Coordinators are responsible for assisting the Project Manager in developing the Site-Specific Health and Safety Plan (HASP), and assuring that appropriate Personal Protective Equipment (PPE) is available for employees.

4.4. A TRC Industrial Hygienist may be asked to evaluate specific tasks/environments and take measurements to determine the level of risk for a given area.

4.5. TRC Employees are responsible for reviewing and complying with the program.

5. PROCEDURE

When working in cold environments, most of the body's energy is used to maintain the internal body temperature. This is done by reducing heat loss and increasing heat production. Under cold conditions, blood vessels in skin, arms and legs constrict, decreasing blood flow. Over time, the body will shift blood flow from the extremities and skin to the core. This allows exposed skin and extremities to cool rapidly and increases the risk of frostbite and hypothermia. Trench foot or immersion foot occurs when feet are cold and damp while wearing constricting footwear. Unlike frostbite, immersion foot does not require freezing temperatures and can occur in temperatures up to 60° F. The condition can occur with as little as eleven hours of exposure.

The following table identifies each condition, the signs and symptoms, and recommended First Aid:

Cold Stress Disorders

Condition	Signs and Symptoms	First Aid
Mild Hypothermia Usually occurs when the core body temperature drops between 98 - 90°F.	• Shivering; • Lack of coordination, stumbling, fumbling hands; • Slurred Speech; • Memory Loss; and/or • Pale, cold skin.	• Move to warm area; • Stay active; • Remove wet clothes and replace with dry clothes or blankets and cover head; and/or • Drink a warm (not hot) sugary drink.
Moderate Hypothermia Usually occurs when the core body temperature drops between 90 - 86°F.	• Shivering stops; • Unable to walk, to stand; and • Confused and irrational.	• All of the above plus: • Call 911 for an ambulance; • Cover all extremities; completely; and • Place very warm objects, such as hot packs or water bottles on the victim's head, neck, check and groin.
Severe Hypothermia Usually occurs when the core body temperature drops between 86 - 78°F.	• Severe muscle stiffness; • Very sleepy or unconscious; • Ice cold skin; and • Death.	• Call 911 for an ambulance; • Treat the victim very gently; and • Do not attempt to re-warm. The victim should receive treatment in a hospital.
Frostbite Usually occurs when the skin actually freezes and loses water. Frostbite usually occurs when temperatures are below 30° F. Wind chill factors can allow frostbite to occur in above freezing temperatures.	• Cold, tingling, stinging or aching feeling in the frostbitten area. This is followed by numbness; • Skin color turns red, then purple, then white or very pale. The skin is cold to the touch; and • Blistering in severe cases.	• Call 911 for an ambulance; • Do not rub the area; • Wrap frostbitten area with a soft cloth; • If help is delayed, immerse in warm, not hot, water. Do not pour water on affected area; and • Apply sterile dressings to blisters to prevent breaking.
Trench Foot Usually occurs by having feet immersed in cold water for long periods of time. Similar to frostbite, but less severe.	• Tingling, itching or burning sensation; and • Blisters may also be present.	• Soak feet in warm, not hot, water; • Wrap with a dry soft cloth or bandage; and • Drink a warm, sugary drink.

5.1 Cold Stress Prevention:

5.1.1 Clothing:

- Protective clothing is the most important way to avoid cold stress. The type of fabric also makes a difference. Cotton loses its insulation value when it becomes wet. Wools retains its insulation value even when wet. The following are recommendations for working in cold environments:
  - Wear at least three layers of clothing:
    - An outer layer to break the wind and allow some ventilations (Gortex or nylon);
    - A middle layer of down or wool to absorb sweat and provide insulation even when wet;
    - An inner layer of cotton or synthetic weave to allow for ventilation.
  - Wear a hat. Up to 40% of body heat can be lost when the head is left exposed.
  - Wear insulated boots or other footwear. Tight-fitting footwear restricts blood flow. Footwear should be large enough to allow wearing of either one thick or two thin pairs of socks.
  - Keep a change of dry clothing available in case worn clothes become wet.
  - Regularly inspect cold weather supplies and restock when necessary.
  - Do not wear tight clothing. Loose clothing allows for better ventilation.
  - Cover your mouth to protect your lungs, avoid taking deep breaths, and minimize talking.
  - Employees who get hot while working should open their jackets, but keep hats and gloves on.

5.1.2 Food and Hydration:

- Caffeine is discouraged because it increases the water loss and blood flow to the extremities.
- Employees should drink warm sweet drinks and soups to maintain caloric intake and fluid volume.

5.1.3 Buddy System:

Employees working in cold environments, or who are not acclimated to cold environments should not work alone. In situations, employees should be assigned a “buddy” to provide constant verbal or visual communication. The employees should be aware of symptoms related to cold stress.

5.1.4 Work Schedule:

If possible, heavy work should be scheduled for the warmer parts of the day. Workers should take frequent breaks out of the cold and eat warm, high-calorie food. Try to work in pairs so workers can keep an eye on each other and watch for signs of cold stress. Avoid fatigue since energy is needed to keep muscles warm.

5.1.5 Wind-Chill Index:

Wind-chill index involves the combined effect of air temperature and air movement. Wind-chill cooling rate is defined as heat loss (expressed in watts per meter squared) resulting from the effects of air temperature and wind velocity upon exposed skin. The higher the wind speed and the lower the temperature in the work environment, the great the insulation value of the protective clothing required. The chart below illustrates the wind chill temperature and the levels at which frostbite can occur in 15 minutes or less.

Wind Chill Chart

	Temperature (Fahrenheit)																		
Wind (miles per hour)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
	15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
	40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
	45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
	50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
	55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
	60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times **30 minutes** **10 minutes** **5 minutes**

5.2 Facilities

- Regularly used walkways and travel ways shall be sanded, salted or cleared of snow and ice as soon as practicable.
- Employees will be informed of the dangers associated with working around unstable snow and ice build-ups. All employees will be informed of the dangers and destructive potential caused by unstable snow build-up, sharp icicles, ice dams and know how to prevent incidents caused by them.

- When dangerous overhead build-ups of snow or ice are present barricades will be used to prevent staff from walking or driving into potential fall zones.

5.3 Training:

Training is a critical element of cold stress prevention. All supervisors and employees must receive initial and annual training in 1) the recognition of the signs and symptoms of impending cold illness, 2) the cold stress prevention methods that can reduce the risk of cold illness disorders, and 3) the basic First Aid procedures for cold stress symptoms.

At a minimum, cold stress prevention training will include the following topics:

- Knowledge of the hazards of cold stress;
- TRC's procedures for identifying, evaluating and controlling exposures to the environmental and personal risk factors for cold illness;
- The importance of drinking warm sweet drinks and soups to maintain caloric intake and fluid volume;
- Recognition of predisposing factors, danger signs, and symptoms;
- The importance of immediately reporting symptoms or signs of cold illness in themselves, or in co-workers to the Project Manager or Work Care;
- TRC's procedures for responding to symptoms of possible cold illness, including how emergency medical services will be provided should they become necessary;
- Procedures for contacting emergency medical services, and if necessary, for transporting employees to a point where they can be reached by an emergency medical service provider;
- Awareness of First Aid procedures for, and the potential health effects of, hypothermia;
- The Site Employee(s) responsibilities in avoiding cold stress; and
- Dangers of using antidepressants, sedatives, tranquilizers, and heart medications.

6. REFERENCES/RELATED DOCUMENTATION

CP002 – Risk Analysis/Site-Specific Health and Safety Program

Centers for Disease Control and Prevention, Cold Stress, http://www.cdc.gov/niosh/topics/coldstress

1. PURPOSE

This program outlines the responsibilities and procedures required to support the safe and effective use of radioactive materials and radiation-producing machines used at TRC facilities. The program will provide TRC employees with information and instructions to ensure the safe and proper handling, transportation and control of radioactive equipment; and state how TRC will fulfill its requirements to operate all Portable Nuclear Gauges in conformance with all State and Federal regulations.

2. SCOPE

The regulations and guidelines outlined in this program apply to all persons who actively work with radioactive material as employees of TRC. It is the intent of this program to provide and ensure that all employees involved with radioactive material are aware of the TRC Material License, the obligations of the license, and basic safety practices associated with operating nuclear equipment. This program does not address all situations and field conditions but gives the reader the basic concepts for nuclear safety and operation procedures. Common sense, sound judgment, and adherence to federal regulations should always be exercised by all personnel involved in this area of work.

3. DEFINITIONS

ALARA (As low as is reasonably achievable): Making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.

Background radiation: Radiation from cosmic sources; naturally-occurring radioactive material, including radon (except as a decay product of source or special nuclear material); radiation not under the control of the licensee. *Background radiation* does not include radiation from source, byproduct, or special nuclear materials.

Curie: The measure of the rate at which radioactive atoms decay. The decay rate of one gram of radium is a Curie. Millicurie = one/thousandth of a Curie.

Dose: The quantity of ionizing radiation absorbed, per unit of mass, by the body or by any portion of the body. When the provisions in this section specify a dose during a period of time, the dose is the total quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body during such period of time. Several different units of dose are in current use.

Occupational Radiation Dose: The dose of radiation received as a result of working with radioactive materials. It may not exceed 3 rem to the whole body in a calendar quarter or 5 rem to the whole body in a single year.

Rad: A measure of the dose of any ionizing radiation to body tissues in terms of the energy absorbed per unit of mass of the tissue. One rad is the dose corresponding to the absorption of 100 ergs per gram of tissue (1 millirad (mrad) = 0.001 rad).

Radiation: Alpha rays, beta rays, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other atomic particles; but such term does not include sound or radio waves, or visible light, or infrared or ultraviolet light.

Radiation area: An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

Radioactive material: Any material which emits, by spontaneous nuclear disintegration, corpuscular or electromagnetic emanations.

Rem: A measure of the dose of any ionizing radiation to body tissue in terms of its estimated biological effect relative to a dose of 1 roentgen (r) of X-rays (1 millirem [mrem] = 0.001 rem). The relation of the rem to other dose units depends upon the biological effect under consideration and upon the conditions for irradiation.

Restricted area: Any accessible area which is controlled by TRC for purposes of protection of individuals from exposure to radiation or radioactive materials.

Source: Any substance that emits nuclear radiation; usually refers to a quantity of radioactive material conveniently packaged for scientific or industrial use.

Unrestricted area: Any accessible area which is not controlled by TRC for purposes of protection of individuals from exposure to radiation or radioactive materials.

X-ray: Electromagnetic radiation that is similar to gamma except in its origin. X-rays come from the inner orbits of electrons spinning about the nucleus.

4. RESPONSIBILITIES

4.1 The designated Radiation Safety Officer and is responsible for ensuring compliance with radiation safety regulations and the provisions of this program. These responsibilities include the following:

- Ensuring all radioactive material and machines (i.e., X-Ray) are registered with the State in accordance with applicable regulations.
- Ensuring the inventory or radioactive materials and radiation machines are current (see CP014.1).
- Identifying the State radiation safety regulations that apply to the operation. (Refer to Appendix A for a list of State Radiation Agencies for Agreement States.)
- Overseeing operating safety, emergency, and ALARA procedures, and to review them at least annually to ensure that the procedures are current and conform to all State and Federal Regulations.
- Participating in the approval or disapproval for procurement, storage, use, monitoring, disposal, maintaining of necessary records, licenses, and payment of fees.

- Ensuring that required radiation surveys and leak tests are performed and documented in accordance with applicable regulations, including corrective measures when levels of radiation exceed permissible limits.
- Performing leak tests on sealed sources as required.
- Performing special surveys, including wipe tests of sources when received.
- Ensuring that personnel monitoring is used properly by occupationally-exposed personnel, that records are kept of the monitoring results, and that timely notifications are made if required.
- Maintaining documentation of test and survey results.
- Ensuring the proper storing, labeling, transporting, and use of sources of radiation, storage, and/or transport containers.
- Having the responsibility and authority during a suspected or confirmed emergency to take prompt remedial action without prior approval.
- Completing the necessary radiation safety training necessary to implement and maintain the provisions of an effective radiation safety program.

4.2 TRC employees are responsible for the following:

- Understanding and following the radiation safety precautions for specific work areas. This includes procedures for safe use of radioactive materials and correct operating procedures for radiation-producing equipment;
- Participating in radiation safety training as required by this program;
- Participating in radiation exposure monitoring;
- Reporting concerns of unsafe conditions (i.e., potential overexposure to radiation, defective radiation machine, etc.) to the Radiation Safety Officer immediately.

5. PROCEDURE

5.1 Purchase of Radioactive Material:

5.1.1 To maintain an accurate inventory of radioactive sources, the Radiation Safety Officer must be informed prior to the purchases of radioactive material.

5.1.2 These communications will cover sealed sources, unsealed sources, service irradiations, or radiation producing equipment.

5.1.3 Certain radioactive materials and machines must be registered with the State. This typically includes Class 3b and Class 4 lasers and x-ray equipment. The Radiation Safety Officer will evaluate such requests for radioactive materials and obtain the required license and registration authorization prior to receiving the radioactive materials or machines.

5.1.4 The Radiation Safety Officer will retain purchase information to document the historical inventory of radioactive sources and machines.

5.2 Receipt of Radioactive Materials:

5.2.1 All sources shipped to the facility will be directed to the Radiation Safety Officer. The Radiation Safety Officer will receive verification of proper license authorization for the sources. The Radiation Safety Officer will then survey the sources for shipping damage and/or acceptable radiation levels at container surfaces. Storage will be provided as necessary.

5.2.2 If packages bearing radiation labels arrive at the facility, they will be inspected by the Radiation Safety Officer for proper labeling and possible leakage.

5.2.3 Initial removal and handling of sources from shipping containers shall be coordinated by the Radiation Safety Officer. Written evidence of a leak test within a six-month period prior to shipping must be confirmed or a leak test performed, and the results obtained prior to installation. Evidence of a leaking source prior to installation will be referred to the source vendor, and shall be their responsibility.

5.2.4 Prior to the installation of radioactive sources, the Radiation Safety Officer will coordinate an area survey to establish background radiation levels at the source and vessel surfaces. All survey results will be recorded and maintained by the Radiation Safety Officer.

5.3 Transfer of Radioactive Material:

5.3.1 To maintain an accurate inventory of sources, the Radiation Safety Officer must handle all transfer and disposal of radioactive materials and will prepare license and registration amendments when transfers and disposal are planned.

5.3.2 Transfer of radioactive materials must be preceded by exchange of license information and amendments of both parties' licenses.

5.3.3 Incoming and outgoing shipments will be managed by the Radiation Safety Officer.

5.3.4 The Radiation Safety Officer will package and ship or receive the materials. Transportation offsite must meet Department of Transit (DOT) regulations which include specific rules on packaging, labeling and physical transport.

5.3.5 The Radiation Safety Officer must arrange for all sealed sources to be returned to the manufacturer when they have reached the end of their useful life.

5.3.6 The return of radiation sources to the manufacturer requires that the Radiation Safety Officer be notified and a revised inventory be submitted to the State. Under no circumstances are radioactive materials to be discarded with ordinary wastes. The manufacturer must submit a return letter confirming that they have received the source and have assumed control/responsibility for it.

5.4 Inventory:

5.4.1 The Radiation Safety Officer maintains an inventory of all radioactive materials and machines. (See example in Appendix B.)

5.5 Area Posting and Equipment Labeling:

5.5.1 The Radiation Safety Officer will provide appropriate caution signs for doors and walls of rooms in which radioactive materials are stored or used. Signs can be removed only by the Radiation Safety Officer. Contact the Radiation Safety Officer if caution signs need to be replaced or removed.

5.5.2 The posting of radiation caution signs and labels is required in all areas where radiation equipment or sources are being used or stored. All signs must use the conventional radiation caution colors of magenta or purple on a yellow background and the conventional three-bladed design.

5.5.3 The radiation symbol with appropriate wording must be conspicuously posted in the area where radiation is in use and/or on the radiation device. A typical radiation warning sign for area posting is shown in Figure 17-III. A typical label for devices containing radioactive materials is shown in Figure 17A-III.

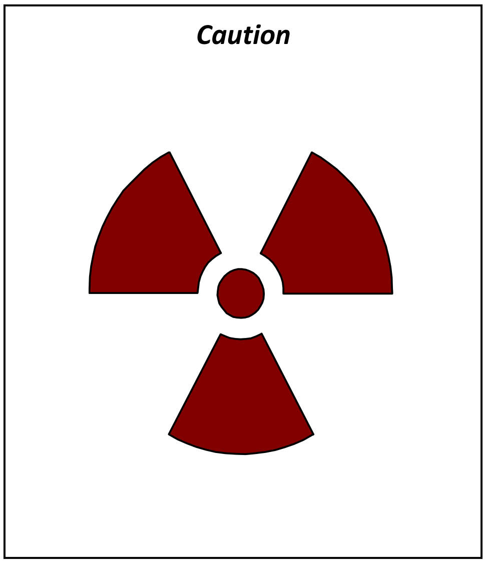


Figure 17-III

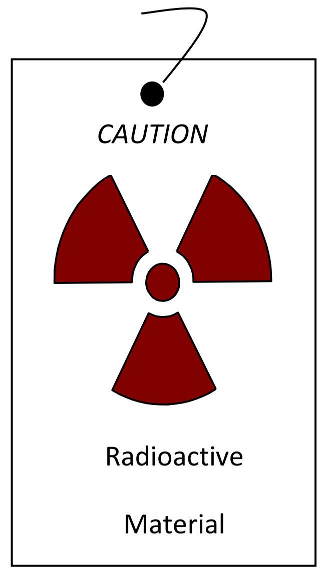


Figure 17A-III

5.5.4 Each radiation area must be conspicuously posted with a sign or signs bearing the radiation caution symbol and reading “Caution Radiation Area”. The specific requirements for area posting and container labeling are covered in Section 20.1902 and 20.1904 of 10 CFR 20 and similar agreement state regulations.

Note: A room or area is not required to be posted with a caution sign because of the presence of a sealed source, provided the radiation level is 12 inches from the surface of the source container or housing, and does not exceed 5 millirems per hour (mrem/hr).

5.5.5 The following information will be posted and/or provided to employees who work in or frequent radiation areas:

- Information regarding location of radioactive materials or areas.
- Safety hazards associated with exposure to such materials or radiation.
- Precautions or devices to minimize exposure.
- Information regarding access to radiation exposure reports.

5.6 Permissible Exposure Limits:

5.6.1 In accordance with 29 CFR 1910.1096, employee exposure levels to ionizing radiation must be limited to the following:

- During any calendar quarter, the dose to the whole body must not exceed 3 rems;

- The dose to the whole body, when added to the accumulated occupational dose to the whole body, must not exceed 5(N-18) rems, where N is the individual's age in years at the last; and
- Any employee who is under 18 years of age to receive in any period of one calendar quarter a dose in excess of 10% of the specified limits in Table 1 below.
- Furthermore, employees allowed to work in a restricted area must not receive in any period of one calendar quarter, a dose in excess of the limits listed in the following Table 1 below.

Table 1
Limits of Exposure to Ionizing Radiation

Area of Exposure	Rems per calendar quarter
Whole body: Head and trunk; active blood-forming organs; lens of eyes; or gonads	1-1/4
Hands and forearms; feet and ankles	18-3/4
Skin of whole body	7-1/2

Source: 29 CFR 1910.1096(b)(1) Table G-18

5.7 Exposure Control Methods:

5.7.1 Time—Decreasing exposure time reduces personnel dose linearly. There is a straight line relationship between total radiation exposure and the time of exposure. Employees should be advised not to stay around radiation sources any longer than necessary. The effect of time on radiation is shown in the Figure below.

100 mR per Hour

1 Hour	**100 mR**
2 Hour	200 mR
4 Hour	400 mR
8 Hour	800 mR

5.7.2 Distance—Increasing the distance between personnel and the radiation source is an effective means of reducing the dose. Notice that this effect follows the inverse square law. That is, at double the distance, the exposure rate is reduced to one-fourth, at three times the distance, the exposure rate is reduced to one-ninth, and at four times the distance, the exposure rate is reduced to one-sixteenth. It is possible to reduce radiation exposure considerably by moving farther from the source of radiation. The effect of distance on radiation exposure is shown in the figure below.

1 Foot	100 mR
2 Feet	1/4 * 100 = 25 mR
3 Feet	1/9 * 100 = 11 mR
4 Feet	1/16 * 100 = 6.25 mR
5 Feet	1/25 * 100 = 4 mR
6 Feet	1/36 * 100 = 2.8 mR
7 Feet	1/49 * 100 = 2 mR
8 Feet	1/64 * 100 = 1.5 mR
9 Feet	1/81 * 100 = 1.2 mR
10 Feet	1/100 * 100 = 1 mR

5.7.3 Shielding—Shielding a source of radiation generally reduces the radiation levels around the radioactive source. The effect of shielding is shown in the figure below. For this illustration, a shielding thickness of one-half value layer was chosen. This means that this particular thickness will reduce the intensity of radiation by one-half. The half-value layer is different for different sources. Higher energy radiation requires larger half value layers than low energy radiation. See shielding example below:

Unshielded Source	100 mR/Hr
1 half-value layer	50 mR/Hr
2 half-value layer	25 mR/Hr
3 half-value layer	12.5 mR/Hr

6. SAFE OPERATING PROCEDURES

6.1 Sufficient shielding must be installed for radiation machines to ensure radiation levels in employees' work areas are ALARA.

6.2 Suitable barriers, warning devices and interlocking systems must be used as required to prevent unauthorized personnel from gaining access to high radiation areas in the vicinity of radiation machinery. Devices to be utilized may include:

- Dead-man foot switch at the operator station.
- Heavy duty radiation switch on the door to the x-ray room.
- Visual/audible alarm inside the x-ray room.
- Emergency stop switch inside the x-ray room.

- Alarm outside the x-ray room prior to x-ray production.

6.3 Workers involved in the operation and maintenance of x-ray units must be trained in the hazards of x-rays.

6.4 Workers involved in the operation of x-ray units must wear a personal monitoring device that is changed on a monthly basis.

6.5 Workers must be provided a copy of their exposure results at least annually.

6.6 Any disassembly, reassembly, maintenance, or when personnel exposures appear abnormal, requires Radiation Safety Officer's inspection and radiation survey.

6.7 TRC employees are strictly prohibited from making adjustments to radiation-producing machines. Shielding should be verified prior to each use. Maintenance on radiation-producing machines must be performed by the equipment manufacturer's authorized representative.

6.8 Using the exposure control methods described in Section 5.7, the sites will prepare written radiation safety operating procedures for all registered radiation source materials and machines. Standard Operating Procedures (SOPs) will specify both the routine and emergency procedures to be followed.

GUIDANCE NOTE: Radiation Safety Procedures may be included in the operating manual that accompanies a radiation unit. If safety procedures are not included in the manual, they must be developed. These safety procedures must be posted on the machine or where the operator can observe them while using the machine.

6.9 Personal Dosimetry:

6.9.1 In addition to the area survey, it is recommended that a film badge survey be included. To accomplish this, suitable badges supplied by the Radiation Safety Officer are posted at several locations near a radiation installation. The survey should run from 1 to 4 weeks to obtain a good measure of the long-term radiation conditions. Surveys conducted with instruments can miss small leaks, and there is potential for radiation pattern changes with equipment operation.

6.9.2 Film badges will be worn by employees working in a designated Radiation Area.

6.9.3 Film badges may be required if employees are potentially exposed to 50% (25% for people under 18 and pregnant women) of the permissible dose. Wear film badges as specified by the Radiation Safety Officer whenever exposure to radiation may occur.

6.9.4 When film badges are not in use, badges will be stored such that they receive minimal radiation exposure.

6.9.5 Laboratory area surveys must be conducted at scheduled intervals. The surveys must consist of area radiation measurements as well as wipe tests conducted primarily in areas where sources have been used or stored. Complete records of all surveys must be maintained.

6.9.6 A very thorough radiation survey must be conducted when a new installation is being placed in service. It is preferable to conduct the survey as early as possible to avoid start-up delays if the installation needs modifications. Radiation surveys must be repeated whenever the installation is changed in any way that might affect the radiation pattern or the shielding.

6.9.7 Periodic routine checks are recommended. These need not be full-scale surveys; a spot check at a few points of interest is sufficient. At the very minimum, a visual inspection must be made for all radiation equipment whenever leak tests are being conducted. Results should be recorded and maintained.

6.10 Leak Tests:

6.10.1 The wipe testing may be contracted out or performed by the Radiation Safety Officer. The field test is conducted by wiping the device in which the source is installed with a small cotton swab. The wipe is then transferred to a vial while being careful not to touch it with bare hands. The vial is marked to identify the source wiped. The wipes are then checked with an extremely sensitive counting device, and a final report is issued stating the results and the measurement sensitivity.

6.10.2 Sealed sources must be leak tested every six months when in use or as required. A record of the test results must be maintained.

6.10.3 Sealed beta and/or gamma sources (except for gases) containing material other than tritium, with half-life greater than 30 days, will be tested for leakage prior to initial use and every 6 months thereafter. These sources need not be leak tested if they are in storage, but must be tested when removed from storage before use or transfer.

Exception: Sealed sources containing 100 µCi or less of beta and/or gamma-emitting material or 10 µCi or less of alpha-emitting material are exempt from the leak test requirements.

6.10.4 Leak tests will be performed by the Radiation Safety Officer and records of the test results will be maintained. Leaking sealed sources cannot be used; they will be taken out of service.

6.10.5 Sealed source installation must be designed to operate within the radiation levels specified for unrestricted areas. The Nuclear Regulatory Commission (NRC) considers an unrestricted area to be an area where access or entry is not restricted or controlled. In unrestricted areas, federal and state laws require that the radiation level in work areas be less than 2 mrem/hr on a continuous basis or less than 100 mrem/week on an intermittent basis. In any case, non-radiation workers must not be allowed to receive more than 100 mrem in a calendar year.

6.10.6 If a leak test shows 0.005 microcuries or more of removable contamination, the source must be removed from service. However, any source that shows any detectable contamination should be removed from service, repaired, and decontaminated before being used again in a laboratory or field service.

6.11 Pregnant Workers:

6.11.1 Workers who have declared their pregnancy will be issued an extra dosimeter for fetal monitoring.

6.11.2 Under some state provisions, pregnant workers may request reassignment if their appropriate health care provider deems it necessary.

6.12 Calibration:

6.12.1 All radiation monitoring equipment must be calibrated periodically on a schedule established by the Radiation Safety Officer. The calibration records must be maintained for all monitoring equipment in the laboratory. Methods of conducting personnel and area monitoring are listed in Appendix C.

7. EMPLOYEE TRAINING

7.1 TRC employees will receive proper radiation safety training, which is at least commensurate with the degree of potential hazards to be encountered. Appendix D contains radiation safety information which can be used for awareness training.

7.2 All associates who in the course of employment are likely to receive in a year an occupational dose in excess of 100 mrem (1 mSv) will be trained on the following:

- The storage, transfer or use of sources of radiation (i.e., where sources are located).
- The health risks associated with exposure to sources of radiation, the precautions to minimize radiation exposure, and the purposes and functions of protective devices employed.
- The key regulations.
- Operating and emergency procedures applicable to radiation sources.
- Their responsibility to any unsafe condition.

- The right to receive radiation exposure reports.

7.3 To qualify for work with radioactive materials, laboratory personnel must have training in the following areas:

- The Nature of Radiation.
- The Detection of Radiation.
- Radiation Units.
- Permissible Exposure Levels.
- Biological Effects of Radiation.
- Monitoring Techniques.
- Emergency Procedures.

8. EMERGENCY SITUATIONS

8.1 The Radiation Safety Officer must be notified of known or suspect radiation exposures that could exceed the permissible exposure limit; if exposure by inhalation, ingestion, or injection has occurred; or if radiation machines have been damaged.

8.2 The first step following an accident involving radioactive source material or machine is to notify the designated occupational medical staff (internal or external). The Radiation Safety Officer will determine if the State or Federal Agency must be notified. In determining the extent of damage to the radiation installation, the following steps are necessary:

8.2.1 If necessary, find the source holder by surveying with an appropriate meter.

8.2.2 Inspect the source holder and shutter for physical damage (from a safe distance).

8.2.3 Close the shutter, if possible and safe to do so.

8.2.4 Rope off the area around the source to prevent personnel overexposure. The rope should represent the 2 mrem/hr isodose line.

8.2.5 If area contamination is suspected, the general area should be isolated and personnel should be monitored before leaving the area. Equipment and vehicles leaving the area should also be checked. If it is suspected that injured personnel may be contaminated, the local hospital will be advised so that appropriate action can be taken.

8.2.6 The Assistant Secretary of Labor or the Assistant's duly authorized representative will be notified immediately by telephone of any incident involving radiation that may have caused or threatens to cause any of the following:

- The exposure of the whole body of any individual to 25 rems or more of radiation;
- The exposure of the skin of the whole body of any individual to 150 rems or more of radiation;
- The exposure of the feet, ankles, hands, or forearms of any individual to 375 rems or more of radiation; or
- The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limit specified for such materials in 10 CFR 20, Appendix B, Table 2.

8.3 The Assistant Secretary of Labor or the Assistant's duly authorized representative will be notified within 24 hours by telephone of any incident involving radiation that may have caused or threatens to cause any of the following:

8.3.1 The exposure of the whole body of any individual to 5 rems or more of radiation;

8.3.2 The exposure of the skin of the whole body of any individual to 30 rems or more of radiation;

8.3.3 The exposure of the feet, ankles, hands, or forearms of any individual to 75 rems or more of radiation.

9. RECORDKEEPING

9.1 Records associated with this program will be maintained by the Radiation Safety Officer as indicated by federal and state requirements.

Record	Period of Time
License applications, evaluations, and authorizations.	3 years
Radiation Safety Training certificates for radiation workers	3 years
Area Monitoring	2 years
Inventory of Radiation Material and Machines	2 years (after material has been removed from site)
Instrument Calibration Records	4 years
Employee exposure monitoring Records	30 years (after last date of employment)

10. FEDERAL AND STATE REGULATIONS

10.1 Federal Regulations:

10.1.1 Employers regulated by the NRC are governed by 10 CFR 20 standards. Employers in an NRC-agreement state (such states are listed in 29 CFR 1910.1096[p][3]) are governed by the requirements of the laws and regulations of that state.

10.1.2 The regulations developed by the Nuclear Regulatory Commission are presented in The Code of Federal Regulations. The code is identified as CFR, Title 10 - Energy. A copy of Title 10 is available from the Supt. of Documents, US Gov. Printing Office, Washington, DC 20402. At the present time, they are the basis of federal control over radiation in several states.

10.1.3 The only states not having federal control over radioisotopes are those having agreements providing for state control. In these Agreement States (see Appendix A), the state regulations on radiation control are compatible with the NRC regulations.

10.2 DOT Regulations:

10.2.1 The DOT has developed the following regulations governing interstate transportation of radioactive materials. The code is identified as CFR, Title 49 - Hazardous Materials Regulations:

- CFR, Title 49 - Part 173 Regulations Applying to Shippers.
- CFR, Title 49 - Part 177 Regulations Applying to Shipments made by way of Common, Contract, or Carriers by Public Highway.
- CFR, Title 49 - Part 178 Shipping Container Regulations.

10.3 State Regulations:

10.3.1 State radiation safety regulations can vary significantly; therefore, each TRC facility should identify the specific State regulations applicable to their operation. Appendix B contains an example inventory of State radiation safety regulations.

10.3.2 The facility Radiation Safety Officer should identify which Federal and State regulations apply to the facility.

11. REFERENCES/RELATED DOCUMENTATION

Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.)

10 CFR 20 Appendix B Table 2 – Annual Intake Limits

10 CFR 20.1904 – Labeling Requirements

10 CFR 20.1902 – Posting Requirements

29 CFR 1910.1096 – Ionizing Radiation Standard

Appendix A –Agreement States Directory

Appendix B – Register of Legal Requirements

Appendix C – The Detection of Radiation

Appendix D – Radiation Safety Information

Appendix E – Example Annual Radioactive Audit

CP014.1 – Inventory of Radioactive Materials and Devices Sample Tracking Form

APPENDIX A

AGREEMENT STATES DIRECTORY

APPENDIX A

AGREEMENT STATES DIRECTORY

Any employer who possesses or uses source material, or uses radiation sources other than source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and has either registered such sources with, or is operating under a license issued by, a State which has an agreement in effect with the Nuclear Regulatory Commission pursuant to section 274(b) (42 U.S.C. 2021[b]) of the Atomic Energy Act of 1954, as amended, and in accordance with the requirements of that State's laws and regulations shall be deemed to be in compliance with the radiation requirements of this section, insofar as his possession and use of such material is concerned, unless the Secretary of Labor, after conference with the Nuclear Regulatory Commission, shall determine that the State's program for control of these radiation sources is incompatible with the requirements of 29 CFR 1910.1096.

An Agreement State is one that has signed an agreement with the Nuclear Regulatory Commission under which the state regulates the use of by-product, source and small quantities of special nuclear material within that state. At the time of this program revision, the following are Agreement States as listed in 29 CFR 1910.1096(p)(3)(i):

State	Radiation Safety Agency
Alabama	Division of Radiation Control State Department of Public Health State Office Building 572 East Patton Avenue Montgomery, AL 36130-1701 (205) 242-5315
Arizona	Arizona Radiation Regulatory Agency 4814 South 40th Street Phoenix, AZ 85040 (602) 255-4845
Arkansas	Division of Radiation Control and Emergency Management Department of Health 4815 West Markham Street, Slot 30 Little Rock, AR 72205-3876 (501) 661-2301

State	Radiation Safety Agency
California	Radiologic Health Branch Environmental Health Division State Department of Health Services 714/744 P Street P.O. Box 942732 Sacramento, CA 94234-7320 (916) 322-3482
Colorado	Radiation Control Division (RCD-DO, B1) Colorado Department of Health 4300 Cherry Creek Drive South Denver, CO 80222-1530 (303) 692-3030
Florida	Office of Radiation Control Department of Health and Rehabilitative Services 1317 Winewood Boulevard Tallahassee, FL 32399-0700 (904) 487-1004
Georgia	Radioactive Materials Program Department of Natural Resources 4244 International Parkway, Suite 114 Atlanta, GA 30354 (404) 362-2675
Kansas	X-Ray and Radioactive Materials Control Section Department of Health and Environment Bureau of Air and Radiation 109 S.W. 9th Street Topeka, KS 66612 (913) 296-1562
Kentucky	Radiation Control Branch Cabinet for Human Resources 275 East Main Street Frankfort, KY 40621-1000 (502) 564-3700

State	Radiation Safety Agency
Louisiana	Radiation Protection Division Office of Air Quality and Radiation Protection 7290 Bluebonnet Road P.O. Box 82135 Baton Rouge, LA 70884-2135 (504) 765-0112
Maryland	Radiological Health Program Air and Radiation Management Administration Department of the Environment 2500 Broening Highway Baltimore, MD 21224 (410) 631-3300
Mississippi	Division of Radiological Health State Department of Health 3150 Lawson Street P.O. Box 1700 Jackson, MS 39215-1700 (601) 354-6657
Nebraska	Division of Radiological Health Department of Health 301 Centennial Mall South P.O. Box 95007 Lincoln, NE 68509 (402) 471-2168
New Hampshire	Radiological Health Bureau Division of Public Health Services Health and Welfare Building 6 Hazen Drive Concord, NH 03301-6527 (603) 271-4588
New York	Division of Policy Analysis and Planning 2 Rockefeller Plaza Albany, NY 12223 (518) 473-0048

State	Radiation Safety Agency
North Carolina	Division of Radiation Protection Department of Environment, Health and Natural Resources 3825 Barrett Drive P.O. Box 27687 Raleigh, NC 27611-7687 (919) 571-4141
North Dakota	Division of Environmental Engineering Department of Health 1200 Missouri Avenue, Room 304 P.O. Box 5520 Bismarck, ND 58502-5520 (701) 221-5188
Oregon	Radiation Control Section State Health Division Department of Human Resources 800 N. E. Oregon Street #21 P.O. Box 14450 Portland, OR 97214-0450 (503) 731-4014
South Carolina	Bureau of Radiological Health Department of Health and Environmental Control 2600 Bull Street Columbia, SC 29201 (803) 734-4700
Tennessee	Division of Radiological Health L and C Annex, Third Floor 401 Church Street Nashville, TN 37243-1532 (615) 532-0364
Texas	Bureau of Radiation Control Texas Department of Health 1100 West 49th Street Austin, TX 78756-3189 (512) 834-6688

State	Radiation Safety Agency
Washington	Division of Radiation Protection Department of Health, LE-13 Airdustrial Center Building #5 P.O. Box 47827 Olympia, WA 98504-7827 (206) 586-8949

APPENDIX B

REGISTER OF LEGAL REQUIREMENTS – STATE OF TENNESSEE EXAMPLE

APPENDIX B

REGISTER OF LEGAL REQUIREMENTS – STATE OF TENNESSEE EXAMPLE

Regulatory Topic	Requirements	State Regulation
License and Registration	Unless exempt, a specific or general license must be issued to any person who possesses, uses, transfers, owns, or acquires radioactive material.	1200-02-10-.09
	An annual registration fee must be submitted by the first working day following January 1st of each year.	1200-02-10-.24
	Radiation devices can only be transferred in accordance with all requirements listed in State rule 1200-02-10, which includes notification to the State.	1200-02-10
Training	Individuals who in the course of employment are likely to receive in a year an occupational dose in excess of 100 mrem (1 mSv) must be trained on the topics listed in TN Rule 1200-02-04-.12, which includes the location of radiation sources, health effects of radiation, and the precautions required to minimize exposure to radiation.	1200-02-04-.12
Radiation Safety Program	Periodically (at least annually) review the radiation protection program content and implementation, and keep records of the review for 3 years.	1200-02-05-.40; 1200-02-05-.131
Radiation Dose Exposure	Limit the occupational dose to individual adults to the following annual dose limits: An annual limit that is the lesser of: ▪ A total effective dose equivalent of 5 rems (0.05 Sv) or ▪ The sum of the deep–dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye equal to 50 rems (0.5 Sv).	1200-02-05-.50
	The annual limits to the lens of the eye, to the skin of the whole body and to the skin of the extremities are: ▪ A lens–dose equivalent to 15 rems (0.15 Sv), and ▪ A shallow–dose equivalent of 50 rems (0.50 Sv) to the skin of the whole body or to the skin of any extremity.	1200-02-05-.50

Regulatory Topic	Requirements	State Regulation
	The licensee shall reduce the dose that an individual may be allowed to receive in the current year by the amount of occupational dose received while employed by any other person (i.e., previous employer).	1200-02-05-.50
	The annual occupational dose limits for minors (less than 18 years of age) are 10 percent of the annual dose limits specified for adults.	1200-02-05-.50
	Dose equivalent to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, must not exceed 0.5 rem (5 mSv).	1200-02-05-.56
General Survey & Monitoring Requirements	Radiation surveys shall be made as necessary to ensure compliance with State regulations. Instruments used to perform radiation surveys shall be calibrated as necessary.	1200-02-05-.70
Individual Monitoring	Each licensee and registrant shall monitor occupational exposure to, and shall supply and require the use of individual monitoring devices by: 1. Adults likely to receive, in one (1) year from sources external to the body, a dose in excess of 10 percent of the limits in 1200-02-05-.50; 2. Minors likely to receive, in one (1) year from radiation sources external to the body, a deep dose equivalent in excess of 0.1 rem (1 mSv), a lens dose equivalent in excess of 0.15 rem (1.5 mSv), or a shallow dose equivalent to the skin or to the extremities in excess of 0.5 rem (5 mSv); 3. Declared pregnant women likely to receive during the entire pregnancy, from radiation sources external to the body, a deep dose equivalent in excess of 0.1 rem (1 mSv) 2; and 4. Individuals entering a high[(1)] or very high radiation area.	1200-02-05-.71
	Records of individual exposure monitoring must contain the requirements listed in 1200-02-05-.135, and must be recorded on the TN form RHS 8-2C or equivalent form.	1200-02-05-.135.

Regulatory Topic	Requirements	State Regulation
Posting	Each radiation area (where radiation levels exist which could expose a major portion of the body to a dose in excess of 5 millirems in one hour and/or 150 millirems in five consecutive days) shall be conspicuously posted with a sign stating "CAUTION RADIATION AREA". A room or area containing a sealed device is not required to be posted with a caution sign, provided the radiation level at 30 centimeters from the surface of the source container or housing does not exceed 0.005 rem (0.05 mSv) per hour.	1200-02-05-.111
	Current copies of the following documents, or a notice which contains the location of these documents, must be posted: ▪ "State Regulations for Protection Against Radiation;" ▪ Radioactive material license and amendments; ▪ Certified registration and amendments; ▪ Form RHS 8-3 (Notice to Associates) – required to be posted when employees are working in or frequenting any portion of a restricted area.	1200-02-04-.11
Device Labeling	Assure that all labels affixed to the device at the time of receipt and bearing the statement that removal of the label is prohibited, are maintained.	1200-02-10-.09
Inspection	Inspections of radiation machines are to be conducted by the Tennessee Department of environment and Conservation (TDEC) or persons (s) who are registered with the TDEC's Division of Radiological Health.	1200-02-10-.27
Leak Test	Persons who possess radioactive material in a device pursuant to the general license shall assure that the device is tested for leakage of radioactive material and proper operation of the on-off mechanism and indicator, if any, at no longer than six-month intervals or at such other intervals as are specified in the label. **Note: Devices containing only krypton need not be tested for leakage of radioactive material.**	1200-02-10-.09
Notification of Incidents	The Tennessee Division of Radiological Health must be notified as soon as possible (in some cases within 4 hours), if incidents and exposures involving radiation occur.	1200-02-05-.141 - 145

Regulatory Topic	Requirements	State Regulation
Recordkeeping	The licensee shall retain each record of receipt of radioactive material as long as the material is possessed and for three years following transfer or disposal of the material.	1200-02-10-.26
	The licensee who transferred the material shall retain each record of transfer for three years after each transfer.	1200-02-10-.26
	The licensee shall retain records of leak tests and the operation of the on-off mechanism and indicator for 3 years.	1200-02-10-.26

APPENDIX C

THE DETECTION OF RADIATION

APPENDIX C

THE DETECTION OF RADIATION

Film Badges

The film badge, worn on the outer clothing, is the most common personnel radiation monitor. Radiation interacts with the silver atoms in a photographic film to affect the film the same as electromagnetic light rays do. It then is a simple matter to measure the amount of darkening of a film, compare it to a control film that was not exposed to radiation, and determine the amount of radiation exposure. The film badge holder has open window areas and filter areas that allow the type and quantity of radiation to be determined. The following film badge precautions should be observed:

- Store film supplies in a cool dry place to avoid premature fogging of the film. Monitoring film, like all other photographic film, deteriorates with age, heat and humidity.
- Handle film badges carefully to avoid physical damage. If it is absolutely necessary to write on films, do not press too hard with the pen or pencil.
- When sending badges in to be developed and read, do not use paper clips or tape on the badges.
- When wearing the badge, be sure the number is visible in the open window. The number imprinted on the badge should be up and facing outward from the wearer's body.

Pocket Dosimeters

The pocket dosimeter is a direct reading portable unit that looks like a pencil. It is generally used to measure X and gamma radiation but some units are also available for neutron monitoring. They are generally worn in pairs to minimize the possibility of false readings. The instrument consists basically of a quartz fiber, a scale, a lens to observe the movement of the fiber across the scale, and an ionization chamber. The fiber is charged until it reaches zero on the scale. Then as it is exposed to radiation, some of the air atoms in the chamber become ionized. This allows charge to leak from the quartz fiber in direct relationship to the amount of radiation present. As the charge leaks from the fiber, it deflects to some new position on the scale indicating the amount of radiation exposure. Since the pocket dosimeter is a somewhat delicate device which can be accidentally discharged if dropped or used in high humidity areas, its use should be limited to monitoring jobs where meaningful readings can be obtained. Of course, the main advantage of the pocket dosimeter is that it allows the individual to read his radiation dose while he is working with radiation rather than waiting a week or more for a film badge report. Generally, pocket dosimeters are used in laboratory work where the radiation problem is not always easy to evaluate. For use in industrial radiation installation work, the pocket dosimeter must be applied with caution.

Ionization Chambers

Ionization chambers contain two electrodes with a suitable DC voltage applied. Then as radiation creates ion pairs in the chamber, the ions are collected and an ion current flows in an external circuit producing a voltage across a suitable resistor. However, because the currents are extremely small, very large resistors must be used in order to develop a usable voltage. Even then this voltage must be amplified in order to operate meters and other indicating devices. The high resistance circuits are difficult to maintain and the DC amplifiers tend to drift. As a result, when instruments of this type are suitably compensated to minimize these problems, the circuits become rather complicated. However, since the ionization chamber measures ionization directly and is energy independent, it is a very useful and popular tool for both radiation safety and gauging work.

Proportional Counters

Proportional counter construction is similar to the ionization chamber, but they are operated differently. The two electrodes in the proportional counter are operated at a higher DC voltage than the ionization chamber. In this way, the ions that have been formed in the chamber are not merely collected. The higher electrode voltages actually attract the ions with a stronger force causing them to move toward the electrodes much faster. Then when the ions get near the electrodes, they are moving fast enough to cause other gas atoms to ionize. This additional or secondary ionization progresses until an avalanche or breakdown of the gas atoms occurs at the electrodes. This action results in a voltage pulse whose size is proportional to the energy of the radiation. This accounts for the name of this detector.

Geiger-Mueller Counters

The Geiger counter, as it is commonly called, has a detection element constructed similarly to the ion chamber and proportional counter. That is, it is a gas-filled chamber containing two electrodes. The other stainless steel cylinder is one electrode and the central wire is the other electrode. The two electrodes are insulated from each other by special glass to metal seals at each end of the cylinder. This construction provides an extremely rugged detector where rough usage is expected. The Geiger counter generally contains a highly pressurized special gas and the electrodes are operated at a higher voltage than ion chambers or proportional chambers. The incoming radiation begins ionizing the gas and the ions produced are accelerated so rapidly by the higher potential between the electrodes that secondary ionization occurs, resulting in a very large avalanche effect filling the tube volume with ion pairs. One disadvantage is that all output pulses are of the same magnitude no matter how much energy the incoming radiation has. In a thin wall, Geiger tube, alpha, beta and gamma radiation will produce essentially the same size output pulse. Geiger tubes are used with special shields to distinguish between the types of radiation. They are also available because the tremendous avalanche effect makes them sensitive and very small dose rates can be measured.

Scintillation Counters

The family of detectors known as scintillation instruments employs a different means of detecting radiation than the detectors previously mentioned. The word “scintillate” means to emit flashes of light. A scintillating crystal or any other scintillating material, emits tiny flashes of light after being excited to a higher energy level by absorbing the entering radiation. These light flashes are collected by a light sensitive tube known as a photomultiplier tube. This tube converts the light flashes into pulses of electrons which are amplified and collected at a readout point. Scintillators are high efficiency counters for two reasons. First, the output pulses of the scintillator last for a very short duration so that pulses can be counted at a considerably higher rate than with other detectors. Secondly, crystal scintillators will absorb or interact with more incoming radiation than air- or gas-filled tubes because scintillators are much denser (more atoms per volume in the detector).

Instrument Calibration

Radiation measuring instruments like other electronic devices depend on accuracy of reading to be useful. Thus, a calibration check is a necessary part of the general maintenance program. Calibration checks require a source of radiation of known intensity. A low strength source for operational check purposes is attached to the side of those instruments used in plant radiation safety program. For detailed calibration procedures, the instrument’s instruction manual must be consulted. Instruments should be returned to the designated location for any repair or recalibration required.

APPENDIX D

RADIATION SAFETY INFORMATION

APPENDIX D

RADIATION SAFETY INFORMATION

X-rays vs. Gamma Rays

From the foregoing discussions, we can see that X-rays and gamma rays appear to be similar since they occupy a common range in the electromagnetic spectrum. The two difference names are used merely to indicate the origin of the radiation. For example, X-radiation is produced in the orbiting electron portion of the atom (see Figure 2-IIIA) while gamma radiation is produced in the nucleus (see Figure 2-IIIB). Historically, X-rays were discovered first, and generally are machine produced while gamma rays were discovered more recently, and are spontaneously emitted from radioactive materials.

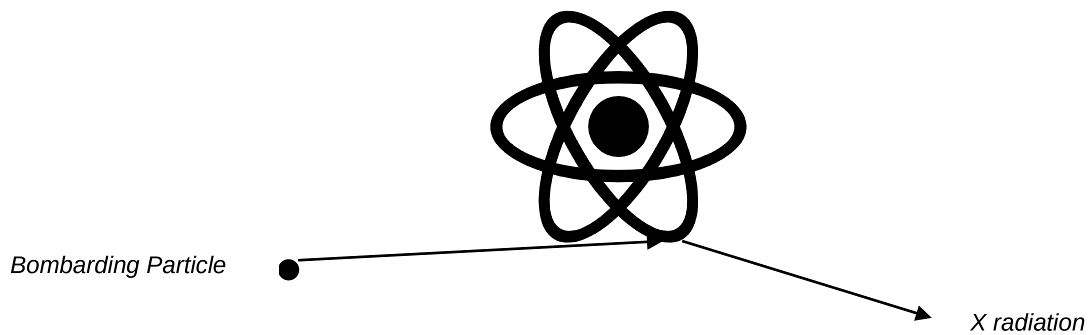


Figure 2-IIIA

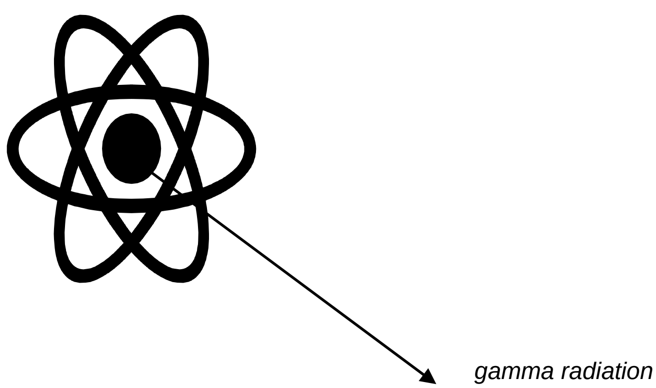
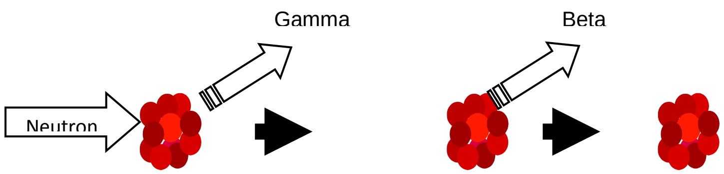


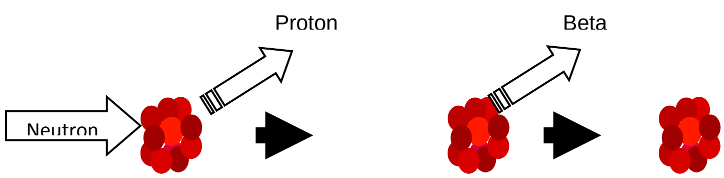
Figure 2-IIIB

Nuclear Radiation

The term nuclear radiation describes all forms of radiation energy that originate in the nucleus of a radioactive atom. In addition to the gamma rays or electromagnetic waves just described, fast moving particles may also be emitted from radioactive atoms. But before we discuss these particles, let's first see how atoms become radioactive. Some materials are naturally radioactive but the process of making a material radioactive might be compared to heating an object in an oven to some temperature above normal. Upon removal from the oven, the object is in an excited state and radiates energy in the form of heat until it returns to a stable state at room temperature. Similarly, radioactive atoms may be produced by "heating" stable, non-radioactive atoms in a "nuclear furnace". The "nuclear furnace" is a reactor or accelerator, and the "heat" is actually in the form of nuclear particles such as neutrons. Some of the non-radioactive atoms are converted to radioactive atoms when an extra neutron is captured by a nucleus. This process is illustrated in Figure 3-III. The radioactive atom is unstable because of the extra energy and the extra particle added to the nucleus. The excited or radioactive atoms get rid of their excess energy and return to a stable state by radiating gamma rays (electromagnetic waves) or nuclear particles from the nucleus. The most important particles are alpha particles (a), beta particles (B), and neutrons (n).



B31	P 32	S 32
Stable Phosphorus PHOSPHORUS	RADIOACTIVE	STABLE SULFUR



S32	P32	S32
Stable Sulfur	Radioactive Phosphorus	Stable Sulfur

Figure 3-III

Alpha Particles

An alpha particle is comparatively heavy and positively charged. It is usually emitted from the radioactive nuclei of heavy elements such as uranium, thorium, and radium. Alphas can travel only about an inch in air and are easily stopped by a thin sheet of paper or the outer layers of the skin.

Beta Particles

A beta particle is a high speed electron. It is much lighter than an alpha and it is negatively charged. Beta particles are emitted by radioactive materials such as carbon 14 or strontium 90. They can travel a maximum of a few feet in air and can penetrate to 1/3 of an inch of body tissue. They can be easily stopped by a thin sheet of aluminum or an inch of wood.

Neutrons

Neutrons are electrically neutral particles which weigh about one-fourth as much as an alpha particle. They can travel long distances through the air and are highly penetrating. They can be stopped by several feet of water or special concrete. Generally, conventional shielding material such as lead and iron are not effective for neutron shielding. Special precautions are required.

Figure 4-III illustrates the relative shielding required to stop the most common types of nuclear radiation.

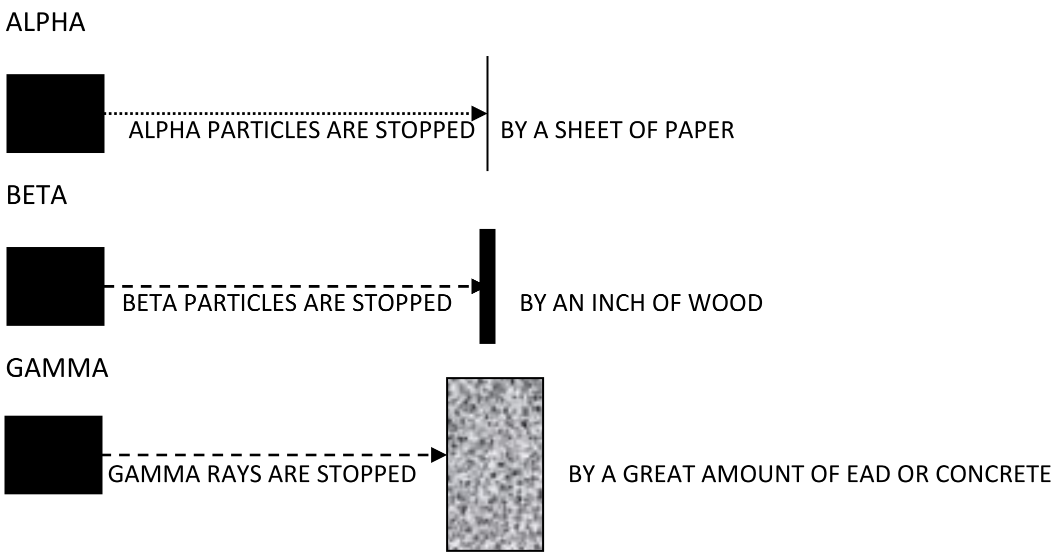


Figure 4-III — Shielding Against Nuclear Radiation

Biological Effects of Radiation

Radiation and the Body

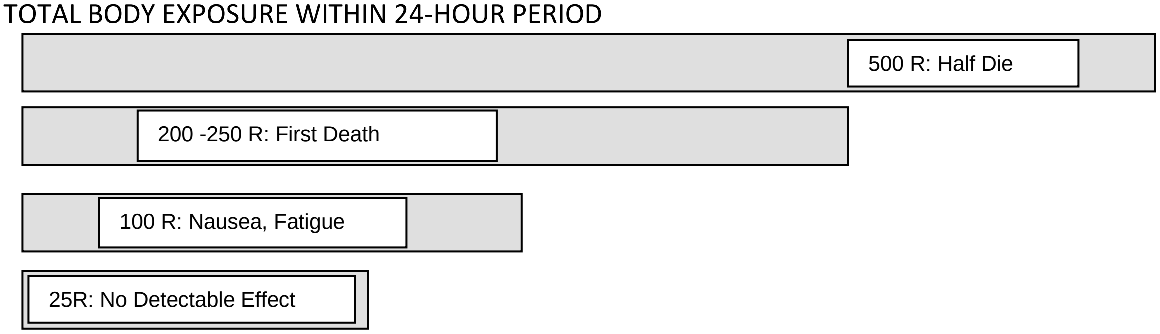
Radiation interacts with the atoms in the body in the same way that it does with all other matter. That is, by ionization. Furthermore, it is clear that when an atom has been ionized (lost an electron), it is changed and will not act like a normal atom. It should be remembered that the human body is a complex chemical machine which is constantly producing new cells to replace those that have died or been damaged. In fact, the body has a tremendous capability for repairing cell damage. Therefore, in order to survive, one must keep cell damage within the body's repair capabilities. Perhaps one of the most common examples of radiation damage is sunburn. Sunlight is electromagnetic radiation similar to X-rays and gamma rays. But since the infrared and ultraviolet rays in sunlight are relatively low energy radiations, they do not penetrate very deeply and damage is limited to the outer layers of skin. As the damaged skin cells die, the red turns to tan and eventually the outer layers peel off. Overexposures have been known to result in first degree burns and even death. This is an example of severe body damage beyond the repair capability. The more energetic electromagnetic radiations (X-rays and gamma rays) can penetrate deeper into the body, or even pass completely through, ionizing the atoms of certain cells in their path. This spreads the damage over a much larger volume, avoiding the localized surface damage observed with lower energy radiation. The real problem with the more penetrating radiation results from their ability to damage cells of the blood forming, and reproductive organs.

Radiation Damage

Now that we know how radiation damages tissue and about the establishment of safe radiation levels, let's examine a chart of effects. Figure 16-III shows the effects of various amounts of radiation administered over a relatively short period of time. It should be noted that there is a very large safety factor between the allowable radiation dose and the point where serious physical damage occurs. Another safety factor is present that is not quite so obvious. This is the time effect. For example, a person can accumulate a good looking suntan over the summer, but he would probably be in serious trouble if he tried to get the same exposure in a single day. It is, therefore, best to spread a given exposure out over a long period of time to give the body time to make necessary repairs. Even through there are very substantial safety factors between the allowable radiation and physical damage, radiation exposures should be minimized as much as possible. This is in line with the minimum possible exposure theory and all good common sense safety theory that says, "DON'T EXPOSE YOURSELF TO ANY HAZARD UNNECESSARILY."

Figure 16-III – Biological Effects of External Radiation

TOTAL BODY EXPOSURE WITHIN 24-HOUR PERIOD



NOTE: The allowable yearly dose by NRC Standards is 5 REM.

APPENDIX E

EXAMPLE ANNUAL RADIOACTIVE AUDIT

APPENDIX E

EXAMPLE ANNUAL RADIOACTIVE AUDIT

(NOTE: All areas indicated in audit notes may not be applicable to every license and may not need to be addressed during each audit.)

Licensee's Name:__xxxxxxx ___________NRC License No.__xx-xxxxx-xx________

PA DEP License No.__PA-xxx________

NY DOH License No._DH xx-xxxx

NJ DEP License No._RADxxxxx-xxxxxx

Auditor: _________________ Date of Audit ________ Telephone:_________________

No.___16___________________

____
(Signature)

1. **AUDIT HISTORY**
   a. Last audit of this location conducted on (date).
   b. Were previous audits conducted yearly? *[10 CFR 20.1101]*
   c. Were records of previous audits maintained? *[10 CFR 20.2102]*
   d. Were any deficiencies identified during last two audits or two years, whichever is longer?
   e. Were corrective actions taken? (Look for repeated deficiencies.)

2. ORGANIZATION AND SCOPE OF PROGRAM
   a. If the mailing address or places of use changed, was the license amended?
   b. If ownership changed or bankruptcy filed, was *NRC* prior consent obtained or was *NRC* notified?
   c. If the *RSO* was changed, was license amended? Does new RSO meet *NRC* training requirements?
   d. If the designated contact person for *NRC* changed, was *NRC* notified?
   e. Does the license authorize all of the *NRC*-regulated radionuclides contained in gauges possessed?
   f. Are the gauges as described in the Sealed Source and Device *(SSD)* Registration Certificate or Sheet? Have copies of (or access to) *SSD* Certificates? Have manufacturers' manuals for operation and maintenance? *[10 CFR 32.210]*
   g. Are the actual uses of gauges consistent with the authorized uses listed on the license?

h. Is *RSO* fulfilling his/her duties?

3. TRAINING AND INSTRUCTIONS TO WORKERS

a. Were all workers who are likely to exceed 100 mrem/yr instructed per [10 CFR 19.12]? Refresher training provided, as needed [10 CFR 19.12]?

b. Did each gauge operator attend an approved course prior to using gauges?

c. Are training records maintained for each gauge operator?

d. Did interviews with operators reveal that they know the emergency procedures?

e. Did this audit include observations of operators using the gauge in a field situation?

f. Operating gauge? Performing routine cleaning and lubrication? Transporting gauge? Storing gauge?

g. Did the operator demonstrate safe handling and security during transportation, use and storage?

h. HAZMAT training provided as required? [49 CFR 172.700, 49 CFR 172.701,CFR 172.702, 49 CFR *172.703, 49 CFR 172.704]*

4. RADIATION SURVEY INSTRUMENTS

a. If the licensee possesses its own survey meter, does it meet the NRC's criteria?

b. If the licensee does not possess a survey meter, are specific plans made to have one available?

c. Is the survey meter needed for non-routine maintenance calibrated as required [10 CFR 20.1501]?

d. Are calibration records maintained [10 CFR 20.2103(a)]?

5. GAUGE INVENTORY

a. Is a record kept showing the receipt of each gauge? [10 CFR 30.51(a)(1)]

b. Are all gauges received physically inventoried every six months?

c. Are records of inventory results with appropriate information maintained?

6. PERSONNEL RADIATION PROTECTION

a. Are ALARA considerations incorporated into the radiation protection program? [10 CFR 20.1101(b)]

b. Is documentation kept showing that unmonitored users receive <10% of limit?

c. Did unmonitored users' activities change during the year which could put them over 10% of limit?

d. If no to c. above, was a new evaluation performed?

e. Is external dosimetry required (user receiving >10% of limit)? And is dosimetry provided to users?

f. Is the dosimetry supplier *NVLAP* approved? *[10 CFR 20.1501(c)]*

g. Are the dosimeters exchanged monthly for film badges and at industry recommended frequency for TLDs?

h. Are dosimetry reports reviewed by the RSO when they are received?

i. Are the records NRC Forms or equivalent? [10 CFR 20.2104(d), 10 CFR 20.2106(c)]

j. NRC-4 "Cumulative Occupational Exposure History" completed?

k. NRC-5 "Occupational Exposure Record for a Monitoring Period" completed?

l. If a worker declared her pregnancy, did licensee comply with [10 CFR 20.1208[?

m. Were records kept of embryo/fetus dose per 10 CFR 20.2106(e)?

n. Are records of exposures, surveys, monitoring, and evaluations maintained? [10 CFR 20.2102, 10 CFR 20.2103, 10 CFR 20.2106]

7. PUBLIC DOSE

a. Are gauges stored in a manner to keep doses below 100 mrem in a year? [10 CFR 20.1301(a)(1)]

b. Has a survey or evaluation been performed per *10 CFR 20.1501(a)*? Have there been any additions or changes to the storage, security, or use of surrounding areas that would necessitate a new survey or evaluation?

c. Do unrestricted area radiation levels exceed 2 mrem in any one hour? *[10 CFR 20.1301(a)(2)]*

d. Are gauges being stored in a manner that would prevent unauthorized use or removal? *[10 CFR 20.1801]*

e. Are records maintained? *[10 CFR 20.2103, 10 CFR 20.2107]*

8. OPERATING AND EMERGENCY PROCEDURES

a. Have operating and emergency procedures been developed?

b. Do they contain the required elements?

c. Does each operator have a current copy (telephone numbers) of the operating and emergency procedures?

9. LEAK TESTS

a. Was each sealed source leak tested every 6 months or at other prescribed intervals?

b. Was the leak test performed as described in correspondence with NRC and according to the license?

c. Are records of results retained with the appropriate information included?

d. Were any sources found leaking, and if yes, was NRC notified?

10. MAINTENANCE OF GAUGES

a. Are manufacturer's procedures followed for routine cleaning and lubrication of gauge?

b. Does the source or source rod remain attached to the gauge during cleaning?

c. Is non-routine maintenance performed where the source or source rod is detached from the gauge? If yes, was it performed according to license requirements (e.g., extent of work, individuals performing the work, procedures, dosimetry, survey instrument, compliance with 10 CFR 20.1301 limits)?

11. TRANSPORTATION

a. Are DOT-7A or other authorized packages used? [49 CFR 173.415, 49 CFR 173.416(b)]

b. Are package performance test records on file?

c. Are special form sources documentation? [49 CFR 173.476(a)]

d. Does package have 2 labels (ex. Yellow-II) with TI, Nuclide, Activity, and Hazard Class? [49 CFR 172.403, 49 CFR 173.441]

e. Is package properly marked? [49 CFR 172.301, 49 CFR 172.304, 49 CFR 172.310, 49 CFR 172.324]

f. Is package closed and sealed during transport? [49 CFR 173.475(f)]

g. Are shipping papers prepared and used? [49 CFR 172.200(a)]

h. Do shipping papers contain proper entries? {Shipping name, Hazard Class, Identification Number (UN Number), Total Quantity, Package Type, Nuclide, RQ, Radioactive Material, Physical and Chemical Form, Activity, category of label, TI, Shipper's Name, Certification and Signature, Emergency Response Phone Number, Cargo Aircraft Only (if applicable)} [49 CFR 172.200, 49 CFR 172.201, 49 CFR 172.202, 49 CFR 172.203, 49 CFR 172.204, 49 CFR 172.604]

i. Are shipping papers within driver's reach, and readily accessible during transport? [49 CFR 177. 817(e)]

j. Are they secured against movement? [49 CFR 177. 834]

k. Are they placarded on vehicle, if needed? [49 CFR 172.504]

l. Are there proper overpacks, if used? [49 CFR 173.25]

m. Are there any incidents reported to DOT? [49 CFR 171.15, 16]

12. AUDITOR'S INDEPENDENT SURVEY MEASUREMENTS (IF MADE)

Describe the type, location, and results of measurements. Does any radiation level exceed regulatory limits?

13. NOTIFICATION AND REPORTS

a. Was any radioactive material lost or stolen? Were reports made? [10 CFR 20.2201, 10 CFR 30.50]

b. Did any reportable incidents occur? Were reports made? [10 CFR 20.2202, 10 CFR 30.50]

c. Did any overexposures and high radiation levels occur? Were they reported? [10 CFR 20.2203, 10 CFR 30.50]

d. If any events (as described in items a through c above) did occur, what was the root cause? Were corrective actions appropriate?

e. Is the licensee aware of telephone number for NRC Emergency Operations Center? [(301) 816-5100

14. RECORD KEEPING FOR DECOMMISSIONING

a. Are records kept of information important to decommissioning? [10 CFR 30.35(g)]

b. Do records include all information outlined? [10 CFR 30.35(g)]

15. BULLETINS AND INFORMATION NOTICES

a. Have any NRC Bulletins, NRC Information notices, NMSS Newsletters been received?

b. Has appropriate training and action been taken in response?

16. SPECIAL LICENSE CONDITIONS OR ISSUES

a. Did auditor review special license conditions or other issues (e.g., non-routine maintenance)?

17. DEFICIENCIES IDENTIFIED IN AUDIT; CORRECTIVE ACTIONS

a. Summarize problems/deficiencies identified during audit.

b. If problems/deficiencies identified in this audit, describe corrective actions planned or taken. Are corrective actions planned or taken at ALL licensed locations (or just location audited)?

c. Provide any other recommendations for improvement.

18. EVALUATION OF OTHER FACTORS

a. Is senior licensee management appropriately involved with the radiation protection program and/or Radiation Safety Officer (RSO) oversight?

b. Does RSO have sufficient time to perform his/her radiation safety duties?

c. Does Licensee have sufficient staff to support the radiation protection program?

CP014.1

INVENTORY OF RADIOACTIVE MATERIALS AND DEVICES
SAMPLE TRACKING FORM

Description of Device/Material	Serial Number	Office Location	License/Permit No.

1. PURPOSE

TRC's Trench and Excavation Compliance Program has been developed based on the Occupational Safety and Health Administration (OSHA) standards for the construction industry (29 CFR 1926, Subpart P – Excavations).

2. SCOPE

This Compliance Program applies to all open excavations made in the earth's surface. Excavations are defined to include trenches. These guidelines apply to all Operating Unit facilities and project sites.

3. DEFINITIONS

Accepted engineering practices: Those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring: A pre-engineered shoring system comprised of aluminum hydraulic cylinders (cross braces) used in conjunction with vertical rails (uprights) or horizontal rails (wales). Such system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole: A type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system): A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in: The separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent person: One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross braces: The horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation: Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or Sides: The vertical or inclined earth surfaces formed as a result of excavation work.

Failure: The breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere: An atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kick-out: The accidental release or failure of a cross brace.

Protective system: A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp: An inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer: A person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Sheeting: The members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system): A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring system): A structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation, and which is designed to prevent cave-ins.

Sloping (Sloping system): A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock: Natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp: A ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system: A structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data: Tables and charts approved by a registered professional engineer, and used to design and construct a protective system.

Trench (Trench excavation): A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box: See Shield.

Trench shield: See Shield.

Type A soil: Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (tsf) or greater. Examples of cohesive soils are clay, silty clay, sandy clay, clay loam, and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hard pan are also considered Type A. However, no soil is Type A if:

- The soil is fissured.
- The soil is subject to vibration from heavy traffic, pile driving, or similar effects.
- The soil has been previously disturbed.
- The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater.
- The material is subject to other factors that would require it to be classified as a less stable material.

Type B soil**:** Cohesive soil with an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf; granular cohesion less soils including angular gravel (similar to crushed rock), silt, silt loam, sandy loam, and in some cases, silty clay loam and sandy clay loam; previously disturbed soils except those that would otherwise be classed as Type C soil; soil that meets the unconfined compressive strength or cementation requirements for Type A but is fissured or subject to vibration; dry rock that is not stable; material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C soil: Cohesive soil with an unconfined compressive strength of 0.5 tsf or less; granular soils, including gravel, sand, and loamy sand; submerged soils, including soil from which water is freely seeping; submerged rock that is not stable; material in a sloped, layered system where the layers dip into the excavation at a slope of four horizontal to one vertical (4H:1V) or steeper.

Uprights**:** The vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

Wales: Horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

4. RESPONSIBILITIES

4.1 TRC's National Safety Director is responsible for establishing the Trench and Excavation Program requirements and providing/communicating them to the Health and Safety Network. The National Safety Director will review contract documents as required that include project and Client-Specific Requirements.

4.2 The Health and Safety Network is responsible for the Trench and Excavation Program implementation including, but not limited to:

- Qualifying or identifying Competent Person(s) for trench and excavation safety.
- Training new and existing TRC employees.
- Communicating and coordinating TRC's Trench and Excavation Program requirements with all TRC subcontractors, including identification of Subcontractor(s) Competent Person(s).
- Procuring TRC health and safety equipment (harnesses, lanyards, vertical and horizontal lifeline and other materials).
- Working in conjunction with identified Competent Person(s) to provide on-site direction on Trench and Excavation issues.
- Leading all investigations along with the Competent Person, Project Manager, Field Team Leader, and subcontractor health and safety representative or their designees, if a Trench and Excavation Program violation occurs on-site.
- Assisting in Trench and Excavation Program audits in conjunction with on-site TRC subcontractor, and the health and safety representatives or their designees.
- Maintaining records for health and safety activities on-site including equipment inspections and procedural audits of employee Trench and Excavation Program implementation.
- Coordinating assistance during emergency situations.

4.3 OSHA defines a Competent Person as one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, who has authorization to take prompt corrective measures to eliminate them (29 CFR 1926.32[f]). By way of training and/or experience, a Competent Person is knowledgeable of applicable standards, and is capable of identifying workplace hazards related to the specific operation. Under TRC's Trench and Excavation Program the Competent Person will:

- Perform all duties as specified in the Trench and Excavation Program.

- Review and approve all Health and Safety Plans (HASPs) and Job Safety Analyses (JSAs) that include work in and around trenches and excavations.
- In the event of simultaneous operations, cooperate fully with the Subcontractor's Person in Charge.
- Communicate with performing authorities (i.e., employees working in or around trenches or excavations) regarding the presence of other operations on-site.
- Work with Project Manager and/or Field Team Leader to identify and manage the risks associated with the project site.
- Assist in the training of employees who will be performing tasks in and around a trench or excavation.
- Ensure that a rescue plan is established by working with the Project Manager and/or facility safety personnel prior to any employees entering or working around a trench or excavation.
- Provide guidance as required for Trench and Excavation Program issues and questions.
- Coordinate with Project Managers and Health and Safety Network on trench and excavation audits.
- Observe the implementation of Trench and Excavation Program and conduct audits as required or directed.

4.4 The Project Manager is responsible for assisting the Health and Safety Network in the implementation of the Trench and Excavation Program. Project Managers must hold all TRC and other project employees working on-site accountable (zero tolerance policy) for maintaining a safe work environment.

4.5 Project Managers and site employees shall be held accountable for performing work in a safe manner according to the requirements of the Trench and Excavation Program.

4.5.1 The Field Team Leader shall:

- Participate in Trench and Excavation Awareness training.
- Confirm that Competent Personnel prepared and/or reviewed the Site-Specific Rescue Plan if required.
- When required, confirm that everyone working under a specific permit adheres to the permit's documented conditions.

5. PROCEDURE

5.1 General Requirements Permit labor

The following guidelines establish the minimum requirements of the applicable state and federal safety regulations for all work in excavations and trenches that might expose employees to the hazards of moving ground:

- All surface encumbrances adjacent to an excavation that might create a hazard to employees must be removed, secured, or supported as necessary to protect employees.
- The estimated location of underground installations, such as sewer, telephone, electric, water, or other underground utilities must be identified before opening an excavation. Utility companies, owners, and local One Call locator services must be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations before the work begins.
- When excavations approach the estimated location of underground installations, the exact location is determined by probing or hand digging, as necessary, to prevent accidental contact with the underground installations. While the excavation is open, underground installations that create a hazard to employees will be supported, protected, or removed as necessary to protect employees.

5.1.1 Access and Egress - Structural ramps.

- Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.
- Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.
- Structural members used for ramps and runways shall be of uniform thickness.
- Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.
- Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments o the top surface to prevent slipping.
- Appropriate access and egress in the form of a stairway, ladder, or ramp must be provided in all excavations deeper than 4 feet (1.23 m). In trenches, the stairway, ladder, or ramp must be installed so that a worker does not have to travel farther than 25 feet (7.62 m) in any direction to exit.

- Employees exposed to vehicular traffic must wear safety vests or other equivalent apparel marked with or made of reflectorized or high-visibility material.
- No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with 1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.
- A warning system must be provided when mobile equipment is operated adjacent to an excavation and the operator does not have a clear and direct view of the edge of the excavation. The warning system may include barricades, signals, stop logs, or other authorized methods. If possible, the grade should be away from the excavation.
- When deemed necessary by a competent person, excavations where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.
- When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.
- Emergency rescue equipment, such as rescue breathing apparatus, a safety harness and line, or a basket stretcher must be available where a hazardous atmosphere exists or could be expected to develop in an excavation.
- Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a lifeline securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.
- Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

- If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.
- Inspection of an excavation shall be made by a competent person when accumulation of water is present.
- If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person.
- The stability of adjacent structures, such as buildings, walls, and sidewalks must be maintained using a support system as necessary to protect employees.
- Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:
    - A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or
    - The excavation is in stable rock; or
    - A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or
    - A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.
- Sidewalks, pavements and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.
- Employees must be protected from loose rock or soil that could fall or roll into the excavation by placing and keeping such material at least 2 feet (0.61 m) from the edge of the excavation.
- A competent person must make daily inspections of excavations to identify and eliminate conditions that could result in cave-ins, failure of support systems, hazardous atmospheres, or other unsafe conditions. Inspections must be conducted before the start of work each day and after every rainstorm or other occurrence that might increase the hazard of moving ground. If problems are found, provisions should be made for immediate removal of personnel.

- Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.
- Where employees or equipment are allowed or required to cross over excavations that are 6 feet
- (1.83 m) or greater in depth, appropriate fall protection in the form of walkways or bridges with standard guardrails must be provided.
- An open excavation or trench that is left open overnight must be barricaded, covered, and secured in a manner that prevents anyone from entering the excavation intentionally or accidentally.

5.2 Protective Systems

Sloping, shoring, or shielding will be provided in excavations, except where the excavation is made in stable rock or the excavation is less than 5 feet (1.52 m) deep and an examination by a competent person does not indicate a potential for cave-in.

5.3 Sloping

When sloping or benching is chosen as the method to protect employees in an excavation, one of the following optional designs of sloping and benching systems must be used:

- Option 1 – Slope the excavation at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal).
- Option 2 – Perform a soil classification and determine the acceptable slopes required.
- Option 3 – Use a project-specific design prepared by a registered professional engineer.

  Engineered designs must be in writing, be rubber stamped, and must include the name and registration number of the engineer, detailed plans, the calculations used in the design, the magnitude of slopes, and the configurations determined to be safe. A copy of the design will be maintained at the jobsite during the use of the engineered system.

5.4 Shoring or Shielding

Only the following methods for support systems, shield systems, and other protective systems can be used at a TRC jobsite:

- Option 1 – Perform a soil classification and determine the appropriate support, shield or other protective system configuration using the shoring manufacturer's tabulated data.

When using the manufacturer's tabulated data, the shoring system must be installed in accordance with all the specifications, recommendations, limitations, or approvals to deviate issued by the manufacturer. The manufacturer's tabulated data, specifications, recommendations, limitations, and any approval to deviate must be in writing, and maintained at the jobsite during the use of the shoring system.

- Option 2 – Use a project-specific design prepared by a registered professional engineer.

  Engineered designs must be in writing, be rubber stamped, and include the name and registration number of the engineer, detailed plans, the calculations used in the design, and the sizes, types, and configurations of materials to be used in the support system. A copy of the design must be maintained at the jobsite during the use of the engineered system.

5.5 General Guidelines

The materials and equipment used for protective systems must be free of damage or defects that might impair their proper functions. Manufactured materials and equipment must be used and maintained in accordance with the recommendations of the manufacturer. If material or equipment used in a protective system is damaged, it must be inspected by a competent person before being reused.

The installation and removal of protective systems must be performed in accordance with all of the following guidelines:

- Members of support systems must be securely fastened together to prevent sliding, falling, kick-outs, or other predictable failures.
- Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or being struck by members of the support system.
- Individual members of support systems must not exceed their design capacities.
- Before individual members can be removed, additional precautions must be taken to protect employees, including installing other structural members to support any additional load imposed on the support system.
- Removal begins at, and progresses from, the bottom of the excavation. Members must be released slowly to reduce the likelihood of failure of the remaining members or a cave-in.
- Backfilling must progress with the removal of support systems.
- Support systems must be coordinated with the excavation of trenches and must extend to within 2 feet (0.61 m) of the bottom of the trench, but only if the system is designed to resist the forces calculated for the full depth of trench, and there is no indication of a loss of soil from behind or below the bottom of the support system.

- Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.
- Shield systems must not be subjected to loads exceeding their design capacities. Shields must be installed in a manner that restricts lateral or hazardous movement in the event that a lateral load is applied suddenly. Employees must be protected when entering or exiting the areas protected by a shield. Employees are not allowed within the shield during installation, removal, or vertical movement.
- When shield systems are used in trenches, excavation of material may proceed 2 feet (0.61 m) below the bottom of the shield only if the shield is designed to resist the forces calculated for the full depth of trench and there is no indication of a loss of soil from behind or below the bottom of the shield.

5.6 Soil Classification

This section describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits.

- Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C, in accordance with the definitions set forth in this compliance program.
- Soil and rock deposits are classified based on the results of at least one visual and one manual analysis. These analyses must be conducted by a competent person using the tests described in this chapter or other approved methods of soil classification, such as those adopted by the American Society for Testing Materials (ASTM) or the United States Department of Agriculture (USDA).
- The methods used for visual and manual analyses must provide quantitative and qualitative information sufficient to identify the properties, factors, and conditions of the deposits.
- A layered system must be classified based on the weakest layer. However, each layer may be classified individually when a more stable layer lies below a less stable layer.
- If, after classifying a deposit, the properties, factors, or conditions change in any way, the changes must be evaluated by a competent person. The deposit must be reclassified as necessary to reflect the new circumstances.

5.7 Visual Analysis

The visual analysis is conducted to collect qualitative information about the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the excavation, and soil samples taken from the excavated material. The visual analysis includes:

- Observing samples of the soil that are excavated and soil in the sides of the excavation to estimate the range of particle sizes and the relative amounts of particle sizes. Fine-grained material is cohesive.
- Observing the soil as it is excavated to determine if it stays in clumps. Soil that breaks up easily and does not stay in clumps is granular.
- Observing sides of the opened excavation and the surface area adjacent to the excavation to identify tension cracks or fissured material.
- Observing the area adjacent to the excavation and the excavation itself to identify existing underground utilities, structures, or previously disturbed soils.
- Observing the opened sides of the excavation to identify layered systems. Examine layered systems to determine if the layers slope toward the excavation, and to estimate the degree of slope in the layers.
- Observing the area adjacent to the excavation and the areas within the excavation to identify potential sources of vibration that might affect the stability of the excavation.
- Observing the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the water table.

5.8 Manual Analysis

Manual analysis is conducted to collect quantitative and qualitative information about the properties of the soil, and to provide more information to properly classify the soil. The manual analysis includes some or all of the following methods:

- Evaluating the plasticity of the soil by molding a moist or wet sample of soil into a ball and attempting to roll it into threads as thin as 1/8 inch (0.32 cm) in diameter. Cohesive material can be rolled into a thread at least 2 inches (5.08 cm) long without crumbling or breaking.
- Evaluating the cohesiveness of the soil. If the soil is dry and crumbles into individual grains or fine powder with little or moderate pressure, it is granular. If the soil is dry and falls into clumps that break into smaller clumps but the smaller clumps can only be broken up with difficulty, it might be clay in combination with gravel, sand, or silt. If the dry soil breaks into small clumps that can only be broken with difficulty and there is no visual indication the soil is fissured, the soil may be considered unfissured.

- Applying the thumb penetration test to estimate the unconfined compressive strength of cohesive soils. Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb and can be molded by light finger pressure.
- The thumb test should be conducted on an undisturbed soil sample, such as a large clump of soil, as soon as possible after excavation to minimize the effects of drying. If the excavation is later exposed to rain, flooding, or other moisture, the classification of the soil must be changed accordingly.
- Estimating the unconfined compressive strength of soils by using a pocket penetrometer or a hand-operated shear vane in accordance with the manufacturer's recommendations.
- Performing a drying test to differentiate among cohesive material with fissures, unfissured cohesive material, and granular material. After thoroughly drying a sample of soil that is approximately 1 inch (2.54 cm) thick and 6 inches (15.24 cm) in diameter, evaluate the results as follows:
    - If the sample develops cracks as it dries, significant fissures are indicated.
    - If the sample dries without cracking and can be broken by hand, then the material is either unfissured cohesive or fissured cohesive.
    - If considerable force is necessary to break the sample, the soil has significant cohesive material content. The soil can be classified as unfissured cohesive material, and the unconfined compressive strength should be determined.
    - If the sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

5.9 Sloping and Benching Specifications

This section contains the specifications for using sloping and benching to protect employees working in excavations.

- These slope and bench specifications only apply if a soil classification has been conducted and the excavation will be 20 feet (6.10 m) deep or less.
- Determine the maximum allowable slope and configuration based on the soil classification by using the information in table(s) 1, 2 and 3.

Table 1 Maximum Allowable Slope Based on Soil Classification

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V)(1) FOR EXCAVATIONS LESS THAN 20 FEET DEEP(3)
STABLE ROCK	VERTICAL (90º)
TYPE A(2)	3/4:1 (53º)
TYPE B	1:1 (45º)
TYPE C	1½:1 (34º)

1. The numbers shown in parentheses next to the maximum allowable slopes are angles expressed in degrees from the horizontal. The angles have been rounded off.
2. A short-term, maximum slope of 1/2:1 (63 degrees) is allowable in excavations in Type A soil less than 12 feet (3.66 m) deep. The short-term maximum allowable slopes for excavations deeper than 12 feet (3.66 m) is 3/4 (53 degrees).
3. Sloping or benching for excavations deeper than 20 feet (6.10 m) must be designed by a registered professional engineer.

Table 2 Excavations in Type A, B, and C Soils

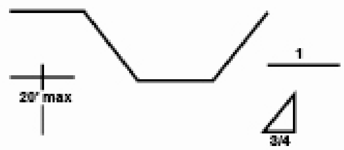
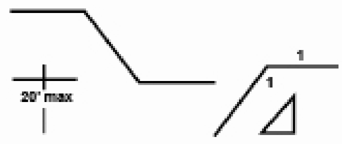
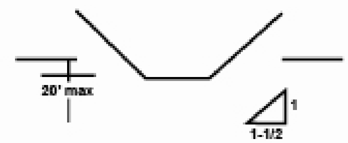
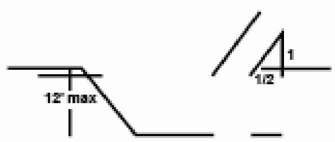
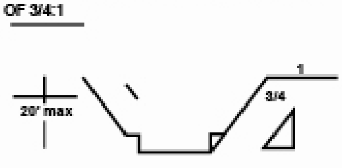
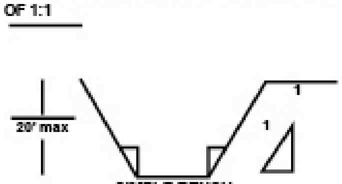
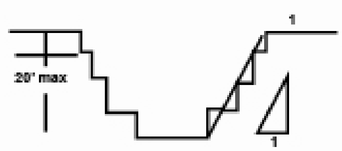
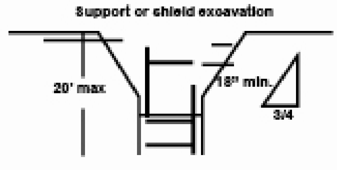
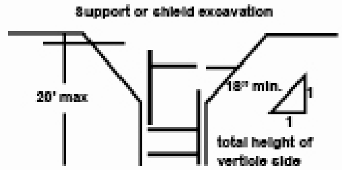
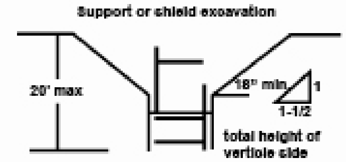
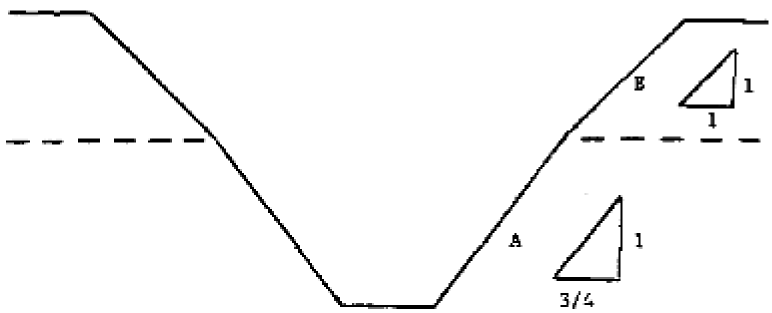
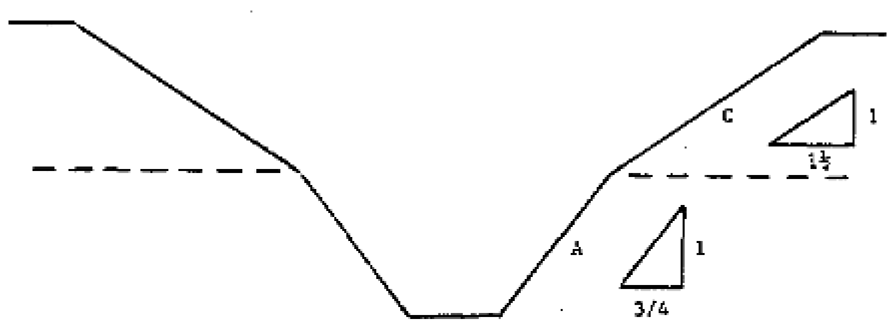
EXCAVATIONS IN TYPE A SOIL	EXCAVATIONS IN TYPE B SOIL	EXCAVATIONS IN TYPE C SOIL
SIMPLE SLOPES LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 3/4:1  SIMPLE SLOPE	SIMPLE SLOPES LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 1:1  SIMPLE SLOPE	SIMPLE SLOPES LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 1-1/2:1  SIMPLE SLOPE
EXCEPTION: SHORT-TERM SIMPLE SLOPES LESS THAN 12 FEET DEEP HAVE A MAXIMUM SLOPE OF 1/2:1  SIMPLE SLOPE SHORT-TERM		
BENCHED EXCAVATIONS LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 3/4:1  SIMPLE BENCH	BENCHED EXCAVATIONS LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 1:1  SIMPLE BENCH	BENCHED EXCAVATIONS ARE NOT ALLOWED
 MULTIPLE BENCH	 MULTIPLE BENCH	BENCHED EXCAVATIONS ARE NOT ALLOWED
SUPPORTED OR SHIELDED EXCAVATIONS LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 3/4:1. Support or shield excavation  SUPPORTED LOWER PORTION	SUPPORTED OR SHIELDED EXCAVATIONS LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 1:1. Support or shield excavation  SUPPORTED LOWER PORTION	SUPPORTED OR SHIELDED EXCAVATIONS LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 1-1/2:1. Support or shield excavation  SUPPORTED LOWER PORTION
THE SUPPORT OR SHIELD MUST EXTEND AT LEAST 18 INCHES ABOVE THE VERTICAL SIDE.	THE SUPPORT OR SHIELD MUST EXTEND AT LEAST 18 INCHES ABOVE THE VERTICAL SIDE.	THE SUPPORT OR SHIELD MUST EXTEND AT LEAST 18 INCHES ABOVE THE VERTICAL SIDE.

Table 3 Excavations Made in Layered Soils

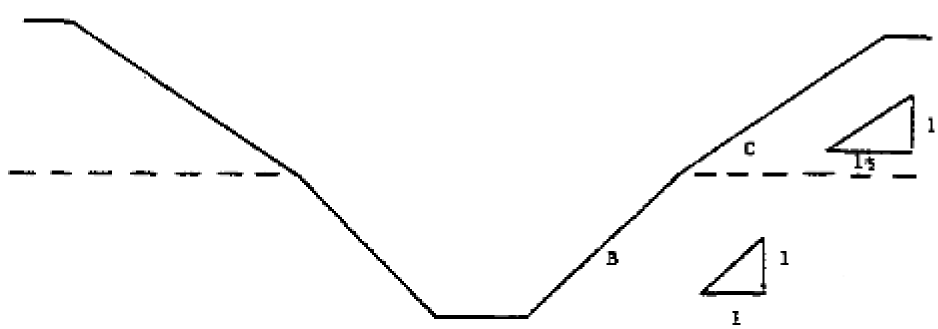
1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.



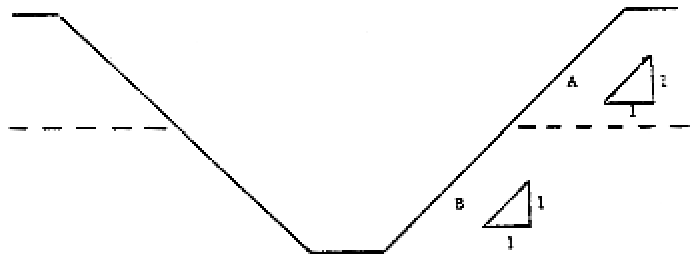
B OVER A



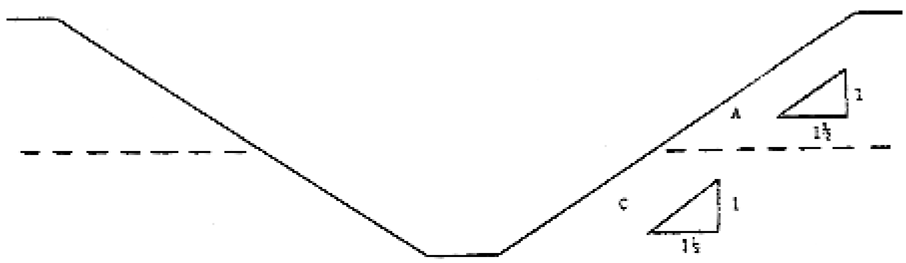
C OVER A



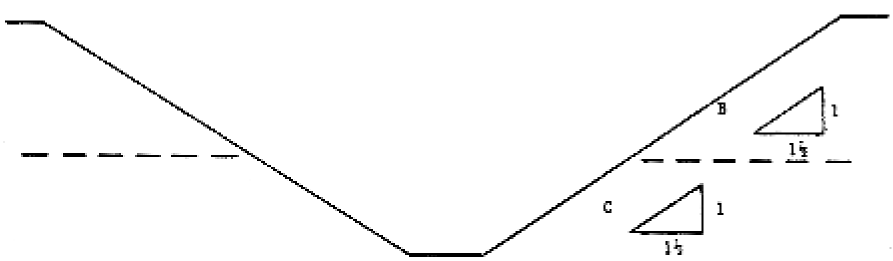
C OVER B



A OVER B



A OVER C



B OVER C

2. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

6. REFERENCES / RELATED DOCUMENTS:

29 CFR 1926 Subpart P, Excavations

CP002 – Risk Analysis Site Specific Health and Safety Program

CP003 – Personal Protective Equipment Program

CP008 – Confined Space Entry Program

CP009 – Health and Safety Training Program

7. APPENDICES

Forms

A. TRC Site-Specific Excavation Plan
B. TRC Pre-Excavation Checklist
C. TRC Excavation Inspection Form
D. TRC Protective Systems Selection Flow Chart

FORMS

A. **TRC SITE-SPECIFIC EXCAVATION PLAN**
B. **TRC PRE-EXCAVATION CHECKLIST**
C. **TRC EXCAVATION INSPECTION FORM**
D. **TRC PROTECTIVE SYSTEMS SELECTION FLOW CHART**

Site Specific Excavation Plan

Project Name: **Project #:**

Location: **Date:**

Company:

Submitted By:

Surface Encumbrances

Have Surface encumbrances that may create a hazard been removed or supported?

☐ Yes

☐ N/A

Underground Installations

Have Utility companies or owners been contacted? ☐ Yes ☐ N/A

By whom: Work Order #: Date:

When excavation operations approach the estimated location of underground installations, how will the exact location of the installations shall be determined?

☐ Probing ☐ Hand digging ☐ Detecting equipment ☐ Other

How will underground installations be protected?

☐ Support ☐ Removal ☐ Other

Access and Egress

Will structural ramps be used? ☐ Yes ☐ N/A

Designed by a competent person? ☐ Yes ☐ N/A

Will excavations be 4 feet in depth or more? ☐ Yes ☐ N/A

Means of egress (requiring no more than 25 feet of lateral travel) ☐ Yes ☐ N/A

☐ Stairway(s) ☐ Ramp(s) ☐ Ladder(s) ☐ Other

Exposure to vehicular Traffic? ☐ Yes ☐ N/A (If yes workers shall wear warning vests or other suitable garments.)

Exposure to falling loads? ☐ Yes ☐ N/A

☐ No workers permitted underneath loads

☐ Workers shall be required to stand away from any vehicle being loaded or unloaded. (Operators may remain in cabs)

Warning System for Mobile Equipment

Will mobile equipment operated adjacent to, or approaching the edge of, excavations have a clear and direct view of the edge of the excavation?

☐ Yes ☐ N/A If yes what warning system will be utilized?

☐ Barricade(s) ☐ Hand Signals ☐ Stop logs ☐ Other

Hazardous Atmospheres

Can oxygen deficiency or a hazardous atmosphere reasonably be expected to exist? ☐ Yes ☐ N/A

If yes, how will atmospheres in excavations greater than 4 feet in depth be tested?

If atmospheres contain less than 19.5% oxygen or other hazardous substance how will it be remediated?

When controls are intended to reduce the level of contaminants to acceptable levels, testing shall be conducted:

☐ Continuously ☐ Periodically

Will emergency rescue equipment be utilized? ☐ Yes ☐ N/A If yes what type?

☐ SCBA ☐ Harness and line ☐ Basket stretcher ☐ Other

Site Specific Excavation Plan

Water Accumulation

Will workers work in excavations in which there is accumulated water? ☐ Yes ☐ N/A

If yes is water controlled or prevented from accumulating by water removal equipment? ☐ Yes ☐ N/A

Equipment type: Competent Person:

Does excavation work interrupt the natural drainage of surface water (such as streams)? ☐ Yes ☐ N/A

Method used to divert water:

Stability of Adjacent Structures

Will the stability of adjacent structures be endangered by excavation operations? ☐ Yes ☐ N/A

If yes, what type of support structure will be used?

☐ Shoring ☐ Bracing ☐ Underpinning ☐ Other

If yes, but support structures will not be used, one of the following must apply:

☐ The excavation is in stable rock

☐ A registered professional engineer has determined that such work will not pose a hazard.

Name of registered professional engineer:

Protection from Loose Rock or Soil

How will workers be protected from materials or equipment that could fall or roll into excavations?

☐ Material placed > 2 feet from edge Retaining devices

Inspections

☐ Inspections of all excavations, adjacent areas and protective systems shall be made by a competent person.

☐ Inspections shall be conducted by the competent person daily, prior to the start of work and as needed throughout the shift. Inspections shall be documented on a Daily Excavation Inspection Form.

☐ Inspections shall be made after every rainfall or other hazard increasing occurrence.

☐ Where the competent person finds evidence of hazardous conditions, workers shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

Fall Protection

Will excavations be 6 feet or greater in depth? ☐ Yes ☐ N/A

If yes, fall protection will consist of:

☐ Barricades ☐ Fall restraint ☐ Harness ☐ Other

Will workers be required or permitted to cross over excavations? ☐ Yes ☐ N/A

If yes, guardrails shall be provided.

SIGNATURES

Supervisor	General Supervisor
Project/Construction Manager	Safety Representative

Pre-Excavation Checklist

Know what's below. Call before you dig.

Project Name: **Project #:**
Location: **Date:**
Company: **One Call #**
Submitted By:

The following procedures are mandatory. Failure to complete this check list could result in disciplinary action or termination:

Complete a pre-excavation walk-out of the entire job site. Your objective is to visually inspect the dig area to ensure all utilities are marked. Look for obvious signs of utilities in the immediate work area that may not be marked such as, above-ground pedestals, gas meters, man-hole covers, drains, or utility poles with cable risers. If you find these indicators and suspect that there is an unmarked utility DO NOT PROCEED**. Call your General Foreman or Locate Ticket Coordinator immediately.**

When you have completed your walk-out, complete the following check list:

1. Verify that the One-Call ticket covers the 'Scope of work' and 'Work to begin' date:
   I have verified the One-Call ticket covers the 'Scope of work' &'Work to begin' date ☐
2. What marked utilities did you observe?
   ☐Gas (Yellow) ☐Electric (Red) ☐Telephone (Orange) ☐Cable TV (Orange) ☐Water (Blue) ☐Sewer (Green)
3. Based on visual observation, did you see any obvious signs of unmarked utilities in the immediate work area?
   ☐Yes ☐No If Yes, please identify?
   ☐Gas (Yellow) ☐Electric (Red) ☐Telephone (Orange) ☐Cable TV (Orange) ☐Water (Blue) ☐Sewer (Green)
4. I have notified my Supervisor and Locate Ticket Coordinator ☐
5. Photograph the entire proposed work area including all locate marks.
   I have photographed the entire site including existing locate/markings prior to excavation ☐
6. Advise your crew members of the following: If they have to cross a marked Utility they must HAND DIG ONLY within 18" of the locate marks. For gas lines add half the diameter of the buried facility to the 18''. If necessary, dig a test-hole (pothole) using hand tools to determine the location of the facility.
   I have advised my crew of this rule ☐
7. When possible, all directional boring / drilling routes must be potholed every 50-80 feet prior to drilling.
   I have advised my crew accordingly and test-holes (potholes) have been dug ☐

~~~~~~~~~~~~~~~~~~~~~~~~~~~ RESPECT THE MARKS! ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

IN THE EVENT OF DAMAGE

- Notify your Supervisor and Locate Ticket Coordinator
- Complete the TRC Incident Notification Form
- Photograph entire area and damage location

PHOTOGRAPHY TIPS

- Make sure the correct date & time stamp is active on your camera
- Photograph the excavation itself (damage location) and cable depth (include tape measure in hole)
- Take photos from multiple vantage points and of surrounding area (360 degrees)
- If the utility was miss-marked, photograph the locate marks/flags (include tape measure in photo)
- If the utility was not marked, photograph the entire area and approaches to the cut site
- Show a quantifiable location/address (street sign, house number, mail box number etc.)
~~~~~~~~~~~~~~~~~~~~~~~~~~~

Excavation Flow Diagram

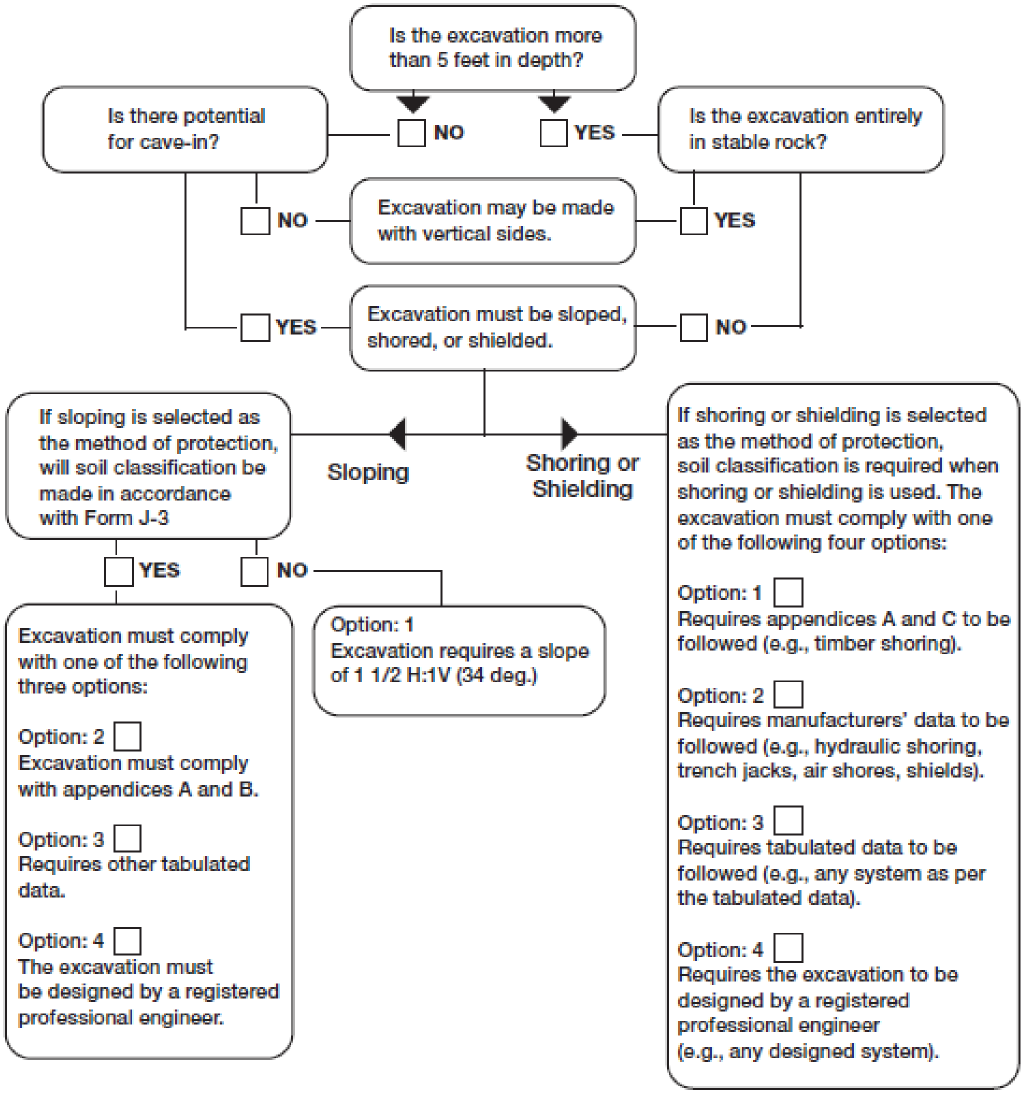
Project Name: **Project #:**

Location: **Date:**

Company:

Submitted By:

The following is a graphic summary of the requirements for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer.



Excavation Daily Inspection

Project Name: **Project #:**
Location: **Date:**
Company:
Submitted By:

Depth: ______________________ **Width:** ______________________ **Date Opened:** ____________________

Soil classification: ☐ A ☐ B ☐ C

Indicate how the classification was made:

Manual test(s)

a) plasticity	________	________	________
b) dry strength	________	________	________
c) thumb penetration	________	________	________
d) pocket penetrometer	________	________	________
e) other	________	________	________

Visual test(s) **Do as many as possible**	**Cohesive Soil**	**Granular Soil**
a) Spoil pile	☐ **Remains in clumps**	☐ **Breaks up easily**
b) Trench Side	☐ **Stands vertical >2 hours**	☐ **Sloughs into trench**

The excavation is properly (circle one):

Shored/Shielded	**(indicate type of shoring)**	☐ **closed**	☐ **open**	☐ **wood**	☐ **metal**	☐ **shield**
Sloped/benched	**(indicate the slope)**	☐ **vertical sides**	☐ **3/4:1**	☐ **1:1**	☐ **1 1/2: 1**	☐ **2:1**

Excavation Checklist:	Morning	Mid-Day	Afternoon
Time:	________	________	________
Weather:	________	________	________
Was atmospheric testing required?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Was atmospheric testing done?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Is the spoil pile back 2' from the edge?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Have surface encumbrances been removed?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Are there any signs of sloughing or cave-in?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Is there water accumulation in the bottom?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Are there vibration sources near the excavation?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Is there adequate access/egress (ladder, ramp, etc.)	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Has the soil been disturbed previously?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Sides	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Top	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
If the excavation is > 20 feet deep, have engineering designs been documented and complied with?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**

SIGNATURES

Supervisor General Supervisor

Project/Construction Manager Safety Representative

1. PURPOSE

This compliance program establishes the requirement of various types, setup, maintenance, and uses of signs, signals, and barricades mandated by the Occupational Safety and Health Administration (OSHA) standards for the construction industry (29 CFR 1926, Subpart G- Signs, Signals, and Barricades).

2. SCOPE

Signs and symbols required by this subpart shall be visible at all times when work is being performed, and must be removed or covered immediately when the hazards are no longer present at the jobsite.

3. DEFINITIONS

Barricade: means an obstruction to deter the passage of persons or vehicles.

Signs: are the warnings of hazard, temporarily or permanently affixed or placed, at locations where hazards exist.

Signals: are moving signs, provided by workers, such as flaggers, or by devices, such as flashing lights, to warn of possible or existing hazards.

Tags: are temporary signs, usually attached to a piece of equipment or part of a structure, to warn of existing or immediate hazards.

4. RESPONSIBILITIES

4.1 The National Safety Director is responsible for administering this compliance program for TRC and evaluating the effectiveness of this program at least annually to verify the program remains effective.

4.2 The Corporate Safety Manager, in consultation with TRC's Training Administrator, is responsible for making signs, signals, and barricades training available to employees.

4.3 Office Safety Coordinators are responsible for assisting Project Managers with implementing this compliance program and develop site-specific Health and Safety Plans (HASPs) when required.

4.4 The Project Manager, in consultation with TRC's Safety Network, is responsible for assessing the risks of a project including identification selecting the proper control methods when employees will be performing tasks that require the use of signs, signals, and/or barricade.

4.5 Employees are responsible for completing training required by this program and implementing the control methods identified by the site-specific HASP, or this compliance program.

5. PROCEDURE

5.1 Accident Prevention Signs and Tags

- Danger signs:
    - Shall be used only where an immediate hazard exists, and shall follow the specifications illustrated in Figure 1 below.

Figure 1

    - Shall have red as the predominating color for the upper panel, black outline on the borders, and a white lower panel for additional sign wording.
- Caution signs:
    - Shall be used only to warn against potential hazards or to caution against unsafe practices, and shall follow the specifications illustrated in Figure 2.

Figure 2

    - Shall have yellow as the predominating color, black upper panel and boarders: yellow lettering of "caution" on the black panel, and the lower yellow panel for additional sign wording. Black lettering shall be used for additional wording.
    - The standard color of the background shall be yellow, and the panel black with yellow letters. Any letters used against the yellow back ground shall be black. The colors shall be those of opaque glossy.

- Exit signs:
    - When required, shall be lettered in legible red letters, not less than 6 inches high, on a white field and the principal stroke of the letters shall be at least three-fourths inch in width (Figure 3).

Figure 3

- Safety instruction signs:
    - When used, shall be white with green upper panel with white letters to convey the principal message. Any additional wording on the sign shall be black letters on the white background (Figure 4).

Figure 4

- Directional signs:
    - Other than automotive traffic signs specified in the Traffic signs section, shall be white with a black panel and a white directional symbol. Any additional wording on the sign shall be black letters on the white background (Figure5).

Figure 5

- Traffic signs:
  - Construction areas shall be posted with legible traffic signs at points of hazard.
  - All traffic control signs or devices used for protection of construction workers shall conform to Part VI of the MUTCD, 1988 Edition, Revision 3, or Part VI of the MUTCD, Millennium Edition.
- Accident prevention tags:
  - Accident prevention tags shall be used as a temporary means of warning employees of an existing hazard, such as defective tools, equipment, etc. They shall not be used in place of, or as a substitute for, accident prevention signs (Figure 6).

Figure 6

5.2 Signaling

- Flaggers: Signaling by flaggers and the use of flaggers, including warning garments worn by flaggers, shall conform to Part VI of the Manual on Uniform Traffic Control Devices (1988 Edition, Revision 3, or the Millennium Edition).
- Crane and hoist signals: Regulations for crane and hoist signaling can be found in applicable American National Standards Institute standards.

5.3 Barricades

Barricades are required around excavations (refer to CP024 Excavation and Trench Program); openings in floors, walls, or roof areas; edges of platforms; and certain types of overhead work.

- Warning barricades:

  Warning barricades offer no physical protection, but serve to alert personnel in the area that a hazard is present.

  - Warning barricades must be set back 6 feet (1.8 meters) minimum from the hazard.

- If 6 feet (1.8 meters) is not feasible, a protective barricade should be used.
- If the hazard is a potential fall of 6 feet (1.8 meters) or more, the warning barricade must be set back at least 6 feet (1.8 meters), preferably 15 feet (4.6 meters).

- Protective Barricades:

  Protective barricades not only warn of a hazard, but provide physical isolation or protection from the hazard. Examples include guardrails or cables set at the proper height around an opening or edge. Another example is anchored railroad ties to prevent driving into a culvert. Protective barricades must be designed to meet their intended purpose. Presented below are two examples.

  - Example 1: If the barricade is to prevent personnel from walking into a floor hole, it must meet all requirements for a guardrail (top and mid rails and toe board designed to resist a 200-pound (85 kilogram) force.
  - Example 2: If the barricade is to stop equipment from running into a ditch, it must be the equivalent of railroad ties or 6-inch (15.2 centimeters) ID concrete-filled pipe posts, set 3 feet (0.9 meter) deep in concrete, spaced 3 feet (0.9 meter) apart.

- Barricade Tape:

  Barricade tape will be of a color or combination of colors that convey the appropriate level of hazard. Tape will be erected in a secure and neat manner that will maintain a height of between 40 and 45 inches (101.6 and 114.3 centimeters) from the floor or ground surface.

  - Yellow/Black Barricade Tape: This type of barricade tape serves as a caution to indicate to employees that a potential hazard exists. Employees may enter without permission from erector of this tape. This barricade tape is used for, but not limited to, the following:
    - Excavation 1 to 4 feet (0.3 to 1.2 meters) in depth;
    - Identification of trip hazards and low hanging objects; or
    - Material storage on the site.
  - Red Barricade Tape: This type of barricade tape indicates DANGER and that a potential serious hazard may be present. No employee, other than those assigned to work inside a RED barricade, may enter without first obtaining permission from the erector of the tape. This barricade tape is used for, but is not limited to, the following:
    - Excavations 4 feet (1.2 meters) or more in depth;
    - Overhead work;
    - Live electrical components;
    - Scaffold under construction; or

  - Around swing radius of equipment with a rotating superstructure.

- Magenta (Purple)/Yellow Tape: This barricade tape is used to indicate DANGER—RADIATION and that possible exposure may be present. This barricade tape is considered an equal to red, in that no employees can enter this area without first obtaining permission from the erector of the tape. This color is representative of x ray work being performed. Signs must also be posted to protect areas where radiation operations are in progress.

5.4 Floor Hole Covers

A floor hole cover conforming to the following is required:

- If one dimension of the opening is 18 inches (45.7 centimeters) or less, use plywood at least3/4 inch (1.9 centimeters) thick.
- If both dimensions of the opening exceed 18 inches (45.7 centimeters), use two layers of 3/4-inch (1.9 centimeter) plywood or material at least 2 inches (5.1 centimeters) thick.

Covers over large floor openings must be constructed to the same loading specification as scaffold decking. Floor hole covers must be secured (cleat, wire, or nail) to prevent displacement. Floor hole covers must be clearly marked with a “Danger – Hole Cover – Do Not Remove” sign.

6. REFERENCES/RELATED DOCUMENTATION

CP002 – Risk Analysis/Site-Specific Health and Safety Program

CP024 – Excavation and Trench Program

29 CFR 1926. Respirable Crystalline Silica

1. PURPOSE

The purpose of this Pandemic Preparedness Program (Program) is to protect our employees' health, improve preparedness and response, and minimize the negative impact on TRC's ability to service clients during a pandemic disease event. This Program will be managed in conjunction with TRC's Business Continuity Plan (BCP) and Crisis Management Committee program.

2. SCOPE

This procedure applies to TRC employees.

3. DEFINITIONS

Pandemic: Refers to an epidemic that has spread over several countries or continents, usually impacting a large number of people. A pandemic includes:

- Healthcare services not being available (they are already full at present with the usual ailments).
- Schools, churches and other public places not being open.
- Borders are partially or fully closed, especially airports, leaving people (our families, employees, business partners, customers and suppliers) "stranded".
- Essential materials and supplies may be limited due to distribution chains that are affected by the travel restrictions or absentee workers supporting those transportation means.
- Essential services around utilities, food distribution/access and banking systems may not be at "normal levels"; access to cash flow could be tight.
- People may not be willing to or able to come to work.

Avian influenza: A virus that infects birds especially poultry and variations have been known to be transmitted to humans. One strain, H5N1 is highly pathogenic to humans and limited vaccine is available.

COVID-19: Commonly referred to as the "coronavirus". COVID-19 is a new coronavirus not previously seen in humans that can cause upper respiratory illness with fever, cough, and difficulty breathing.

Influenza pandemic: Occurs when a new influenza virus emerges and spreads around the world as most people do not have immunity.

H1N1: Commonly referred to as the "swine flu" because it has been found in farm animals and can be transmitted to humans.

Seasonal influenza: Regional common influenza that is routine and vaccines are readily available.

Vaccine: Pre-emptive treatment in the form of a shot or nasal mist specific to a viral strain that increases a person's immunity and ability to resist infection.

US Department of State Travel Advisory Levels: Levels and definitions issued in 2018 by the US Department of State include the following:

- **Level 1 – Exercise Normal Precautions:** This is the lowest advisory level for safety and security risk. There is some risk in any international travel. Conditions in other countries may differ from those in the United States and may change at any time.
- **Level 2 – Exercise Increased Caution:** Be aware of heightened risks to safety and security. The Department of State provides additional advice for travelers in these areas in the Travel Advisory. Conditions in any country may change at any time.
- **Level 3 – Reconsider Travel:** Avoid travel due to serious risks to safety and security. The Department of State provides additional advice for travelers in these areas in the Travel Advisory. Conditions in any country may change at any time.
- **Level 4 – Do Not Travel:** This is the highest advisory level due to greater likelihood of life-threatening risks. During an emergency, the U.S. government may have very limited ability to provide assistance. The Department of State advises that U.S. citizens not travel to the country or leave as soon as it is safe to do so. The Department of State provides additional advice for travelers in these areas in the Travel Advisory. Conditions in any country may change at any time.

4. RESPONSIBILITIES

4.1 The SVP, Director EHS and Quality and the Director, Corporate Safety and Compliance is responsible for the following:

- Implement this Program throughout TRC.
- Define roles and responsibilities necessary to effectively implement this Program.
- Facilitate communications to employees and management during pandemic events.
- Periodically review the effectiveness of this Program and modify as necessary to ensure it remains current and effective.

4.2 Office Safety Coordinators are responsible for the following:

- Communicate the requirements of this Program to office personnel.
- Work with Office Managers to verify hand-hygiene products are available in the office and appropriate office sanitizing methods are practiced.

4.3 Project Managers and Supervisors are responsible for the following:

- Consult with the SVP, Director EHS and Quality and Director, Corporate Safety and Compliance, and monitor travel advisories for the geographic areas where employees are either working at or will be traveling to soon.
- Assist with implementing the health and travel precautions recommended by the respective authorities and TRC.
- Notify clients of project delays due to travel restrictions.
- Communicate and support mitigation strategies to employees.

4.4 Employees are responsible for the following:

- Follow health and travel precautions in accordance with this Program and guidance provided by TRC leadership.
- Review health and travel advisories issued by the government and health organizations prior to travelling outside the United States or to locations within the United States that may be considered at risk.
- Provide feedback on the effectiveness of this Program to Project Managers/Supervisors and Office Safety Coordinators to improve the effectiveness of this Program.

5. PROCEDURES

5.1 Risk Assessment

- A pandemic disease presents a serious health risk and could prevent TRC from serving clients. The risk to employee health and the business will vary based on the geographic area of the pandemic and the potential severity of the disease.
- The SVP, Director EHS and Quality and/or the Director of Corporate Safety and Compliance will facilitate the risk assessment in consultation with members of the executive team and the Crisis Management Committee to assess the potential impact of a pandemic on domestic and international business and associated travel (e.g. quarantines, border closures, etc.).
- The risk assessment will consider governmental agencies, including the Center for Disease Control (CDC), World Health Organization (WHO), and the US Department of State, for up-to-date pandemic information. Community public health, emergency management, and other sources will also be monitored.
- Additionally, the risk assessment will need to identify the essential/critical components of our business operation that need to be conducted during the pandemic.
- Based on this evaluation, mitigation strategies outlined in this Program will be implemented to protect employees and minimize interruption to TRC's business.

5.2 Communication

- Provide Periodic updates through internal & external communications when a pandemic is imminent:
  - Notification to employees of operational changes.
  - Provide frequent updates about the pandemic status.
  - Provide advisories and alerts as conditions change.
  - Monitor local, state, and federal pandemic updates.
- Internal Communication
  - Internal communication will be provided to employees to educate them about pandemic diseases and measures they can take to be prepared.
  - Health and travel information will be closely monitored by the Crisis Management Committee. Necessary mitigation strategies and pandemic status will be routinely provided to employees through regular business communications which may include e-mail, Safety Alerts, electronic mass communication systems (i.e., Honeywell/Everbridge), telephone, etc.
- External Communication
  - Project Managers will keep clients informed of project schedules and potential delays due to travel advisories and impacts to supply chains.

5.3 Pandemic Response by Pandemic Phase

- Currently the World Health Organization (WHO) has created various phases for a pandemic.
  - **Phase 1:** No viruses circulating among animals have been reported to cause infections in humans.
  - **Phase 2:** An animal influenza virus circulating among domesticated or wild animals is known to have caused infection in humans and is therefore considered a potential pandemic threat.
  - **Phase 3:** An animal or human-animal influenza reassortment virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks. Limited human-to-human transmission may occur under some circumstances, for example, when there is close contact between an infected person and an unprotected caregiver. However, limited transmission under such restricted circumstances does not indicate that the virus has gained the level of transmissibility among humans necessary to cause a pandemic.

- **Phase 4:** Characterized by verified human-to-human transmission of an animal or human-animal influenza reassortment virus able to cause "community-level outbreaks." The ability to cause sustained disease outbreaks in a community marks a significant upwards shift in the risk for a pandemic. Any country that suspects or has verified such an event should urgently consult with WHO so that the situation can be jointly assessed, and a decision made by the affected country if implementation of a rapid pandemic containment operation is warranted. Phase 4 indicates a significant increase in risk of a pandemic but does not necessarily mean that a pandemic is a forgone conclusion.
- **Phase 5:** Characterized by human-to-human spread of the virus into at least two countries in one WHO region. While most countries will not be affected at this stage, the declaration of Phase 5 is a strong signal that a pandemic is imminent and that the time to finalize the organization, communication, and implementation of the planned mitigation measures is short.
- **Phase 6:** This pandemic phase, is characterized by community level outbreaks in at least one other country in a different WHO region in addition to the criteria defined in Phase 5. Designation of this phase will indicate that a global pandemic is under way.
- During the post-peak period, pandemic disease levels in most countries with adequate surveillance will have dropped below peak observed levels. The post-peak period signifies that pandemic activity appears to be decreasing; however, it is uncertain if additional waves will occur and countries will need to be prepared for a second wave.
- In the post-pandemic period, influenza disease activity will have returned to levels normally seen for seasonal influenza. It is expected that the pandemic virus will behave as a seasonal influenza virus. At this stage, it is important to maintain surveillance and update pandemic preparedness and response plans accordingly. An intensive phase of recovery and evaluation may be required.

5.4 Mitigation Strategies

TRC will follow health and travel precautions issued by the respective authorities. One or more of the following precautions may be implemented based on business condition and guidance from authorities.

5.4.1 Telecommute:

- Many TRC employees have the ability to telecommute. Employees are encouraged to stay at home when ill, when having to care for ill family members, or when caring for children due to school closure. TRC also offers Personal Time Off (PTO) as an option for employees.
- Employees should stay at home when sick or otherwise experience symptoms that are consistent with the pandemic disease.

5.4.2 Infection Control Measures:

Infection control is an essential component of pandemic management and a component of public health measures. Essential measures include:

- Practice frequent hand washing. According to the CDC, washing hands with soap and water is the best way to get rid of germs in most situations. If soap and water are not readily available, you can use an alcohol-based hand sanitizer that contains at least 60% alcohol. You can tell if the sanitizer contains at least 60% alcohol by looking at the product label.
- Obtain immunizations recommended by healthcare providers to help avoid disease.
- Practice social distancing to increase the space between employee work areas and decreasing the possibility of contact by limiting large or close contact gatherings and avoid shaking hands.
- Frequently disinfect all areas that are likely to have frequent hand contact (like doorknobs, faucets, handrails).

5.5 Travel

Prior to traveling outside the United States, employees and project managers should review the current travel advisory levels that are posted on the United States Department of State. These advisories provide safety and security information intended for US travelers who are intending to travel outside the United Sates. The travel advisory system includes the following levels:

- **Level 1 – Exercise Normal Precautions**
- **Level 2 – Exercise Increased Caution**
- **Level 3 – Reconsider Travel**
- **Level 4 – Do Not Travel**

TRC's Crisis Management Committee will periodically monitor travel advisory levels and will provide company guidance on business travel to areas with active travel advisories.

6. TRAINING

TRC has a Pandemic Flu Preparedness course available to employees through the TRC Academy. Employees may complete this course if they want further information on illness prevention and avoiding the spread of disease. This course discusses disease containment strategies and disease prevention.

7. EVALUATION

The plan and emergency communication strategies will be periodically reviewed to ensure it remains current and effective. Performance of this plan during actual events will be considered for continual improvement.

8. REFERENCES/RELATED DOCUMENTATION

CP048 TRC Business Continuity Plan

CP053 Crisis Management Committee Program

9. APPENDICIES

A CP052.1 Field Guidelines COVID-19

10. REVISION HISTORY

Revision Number	Revision Date	Summary of Revision	Modified by
0	5/3/10	New Document	Gary Ritter
1	6/23/15	Minor Revisions to previous program	Mike Glenn
2	3/3/20	Updated to reflect COVID-19 and included as part of the HSMS	Mike Glenn and Todd Woletz
3	3/17/20	Added COVID-19 Field Guidelines	Tim Johnson

Attachment A
CP052.1 Field Guidelines COVID-19

STEPS TO FOLLOW IF YOU DEVELOP SYMPTOMS

Symptoms and Warning Signs	Take the following steps
If you experience the following **symptoms**, which may appear **2-14 days after exposure.** • **Fever** • **Cough** • **Shortness of breath**	1. Notify your field and direct supervisor that you feel ill. 2. Immediately isolate yourself and return to your place of lodging (return home if nearby). 3. Contact your personal healthcare provider asap (consider using the Cigna app) for evaluation and follow their instructions. 4. Update your field and direct supervisor of your health and work status (e.g., when do you expect to return to work). 5. If you're diagnosed with COVID-19 notify Mike Glenn (949-697-7418) and your HR Business Partner immediately. This communication will be treated as confidential.
If you develop any of the following **emergency warning signs:** • Difficulty breathing or shortness of breath, • Persistent pain or pressure in the chest, • New confusion or inability to arouse, • Bluish lips or face This list is not all inclusive so please consult with your medical provider for further guidance.	1. Get medical attention immediately. 2. If you're diagnosed with COVID-19, notify Mike Glenn (949-697-7418) and your HR Business Partner immediately. This communication will be treated as confidential.

Source: CDC COVID-19 Symptoms https://www.cdc.gov/coronavirus/2019-ncov/about/symptoms.html

PRECAUTIONS

1. Practice Social Distancing

   Avoid "close contact" which is either 1) a "prolonged period of time" spent "within approximately 6 feet or within the room or care area" of an individual who has been positively diagnosed with the virus or 2) "direct contact with infectious secretions."
   Do not share eating or drinking utensils, avoid close conversation, and other direct physical contact like hand shaking. "Close contact" does not include activities such as walking by a person or briefly sitting across an office.

2. Hand Hygiene

   According to the CDC, washing hands with soap and water is the best way to get rid of germs in most situations. If soap and water are not readily available, you can use an alcohol-based hand sanitizer that contains at least 60% alcohol. You can tell if the sanitizer contains at least 60% alcohol by looking at the product label.

3. Practice good respiratory hygiene – covering mouth and nose when coughing or sneezing, using tissues and disposing of them correctly.
4. Obtain immunizations recommended by healthcare providers to help avoid disease.
5. Early self-isolation of those feeling unwell, feverish and having other symptoms of flu.
6. Avoiding touching your eyes, nose or mouth.
7. Frequently disinfect all areas that are likely to have frequent hand contact (like doorknobs, faucets, handrails).

CLIENT MEETINGS/INTERACTIONS

Be aware of any restrictions or requirements that clients have in place regarding visiting client facilities or attending meetings. Verify with supervisor/project managers prior to visiting client facilities or meetings in person.

BACKGROUND

The 2019 novel coronavirus, or COVID-19, is a new respiratory virus first identified in Wuhan, Hubei Province, China. It's called a "novel" — or new — coronavirus, because it is a coronavirus that has not been previously identified.

Both the COVID-19 and influenza (flu) are respiratory illnesses, which have similar symptoms. Both are contagious and both can be mild or severe, even fatal in rare cases. The key difference between the novel coronavirus and influenza is we know what to expect from the flu.

SYMPTOMS OF COVID-19

Initial symptoms of COVID-19 usually include fever greater than 100.4°F (38.0°C), cough, and shortness of breath. However, not all affected individuals will exhibit all symptoms. If you experience these symptoms or have been in recent close contact with someone with these symptoms, notify your doctor and stay home.

TRANSMISSION

Both COVID-19 and the flu can be spread from person to person through droplets caused by an infected person coughing, sneezing or talking. Flu can be spread by an infected person for several days before their symptoms appear, and COVID-19 is believed to be spread in the same manner, but we don't yet know for sure.

Title: **Equipment Decontamination**	Procedure Number: **ECR 010**
	Revision Number: **1**
	Effective Date: **December 2016**

Authorization Signatures

Technical Reviewer	Date	ECR Practice Quality Coordinator	Date
James Peronto	12/15/16	Elizabeth Denly	12/15/16

TABLE OF CONTENTS

Page No.

ATTACHMENTS

1.0 INTRODUCTION

1.1 Scope & Applicability

This Standard Operating Procedure (SOP) was prepared to direct TRC personnel in the procedures needed for decontamination of equipment used in the field during environmental investigations (e.g., sediment, soil, groundwater investigations). Other state or federal requirements may be above and beyond the scope of this SOP and will be followed, if applicable. In all instances, the actual procedures used should be documented and described in the field notes. Preventing or minimizing potential cross-contamination of samples is important for the collection of representative samples, avoiding the possible introduction of sampling error into sample results, and for protecting the health and safety of site personnel.

Removing or neutralizing potential contaminants that may have accumulated on equipment and vehicles ensures protection of personnel, reduces or eliminates potential transfer of contaminants to clean areas, and minimizes the likelihood of sample cross-contamination.

The use of dedicated, disposable, new sampling equipment (e.g., disposable liners, plastic spoons, plastic or aluminum bowls) should be considered as an alternative to equipment decontamination and the subsequent generation of decontamination fluids.

1.2 Summary of Method

Equipment decontamination is used to remove potential contaminants from a sampling device or piece of field equipment prior to and between the collection of samples and is also used to limit personnel exposure to residual contamination that may be present on used field equipment.

Contaminants can be physically removed from equipment or deactivated by sterilization or disinfection. Gross contamination of equipment requires physical decontamination, including abrasive and nonabrasive methods. These include the use of brushes, air and wet blasting, and high-pressure water, followed by a wash/rinse process using appropriate cleaning solutions. A solvent rinse may be required when organic contamination is present, and an acid rinse may be required when metals are parameters of interest. Equipment decontamination procedures can vary depending on the media being sampled and the type of sampling equipment being used. Disposal of decontamination fluids will be handled on a project-specific basis and will be in accordance with all applicable regulations.

1.3 Equipment

The following equipment may be utilized when decontaminating equipment. Project-specific conditions or requirements may warrant the use of additional equipment or deletion of items from this list. For specialized sampling programs involving per- and polyfluorinated alkyl substances (PFAS), refer to Attachment B for further details.

- Appropriate level of personal protective equipment (PPE) as specified in the site-specific Health and Safety Plan (HASP)

- Alconox®, Liquinox® or other nonphosphate concentrated laboratory-grade soap
- Simple Green® or other nontoxic biodegradable cleaner
- Deionized, distilled, or organic-free water, as appropriate (may be supplied by the laboratory or purchased from commercial vendors depending on project requirements)
- Pump sprayer
- Pressure sprayer
- Squeeze bottle filled with pesticide-grade hexane (option for organic analyses)
- Squeeze bottle filled with pesticide-grade methanol (option for organic analyses)
- Squeeze bottle filled with pesticide-grade isopropanol (option for organic analyses)
- Squeeze bottle filled with 10 percent nitric acid (option for metals analyses and stainless-steel equipment)
- Squeeze bottle filled with 1 percent nitric acid (option for metals analyses)
- Container (squeeze bottle to 5-gallon bucket) filled with potable water and a nonphosphate, laboratory-grade soap (approximately 1 tablespoon of soap to 5 gallons of water)
- Extra quantities of above listed liquids
- Potable water
- Containers, such as buckets or wash basins (the type and number of containers is dependent on the procedure)
- Scrub brushes
- Small wire brush
- Aluminum foil
- Polyethylene sheeting
- A container for decontamination of pumps and associated tubing.

1.4 Health & Safety Considerations

TRC personnel will be on site when implementing this SOP. Therefore, TRC personnel shall follow the site-specific HASP. TRC personnel will use the appropriate level of PPE as defined in the HASP.

Samples containing chemical contaminants may be handled during implementation of this SOP. Certain decontamination fluids, including solvents and/or acids, are considered hazardous materials, and TRC employees will appropriately handle and store them at all times. Appropriately manage chemicals that pose specific toxicity or safety concerns, and follow any other relevant requirements as appropriate. Hazardous substances may be incompatible or may react to produce heat, chemical reactions, or toxic products. Some hazardous substances may be incompatible with clothing or equipment and can permeate or degrade protective clothing or equipment. Also, hazardous substances may pose a direct health hazard to workers through inhalation or skin contact or if exposed to heat/flame and they combust. Safety data sheets for chemicals handled by TRC personnel should be maintained in a designated location at the project site.

1.5 Cautions and Potential Problems

Special care should be taken when decontaminating equipment used for sampling for PFAS. Please refer to Attachment B for details.

- The use of deionized, distilled or organic-free water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been certified by the vendor as analyte-free and/or meets the project-specific requirements.

- Alconox®, Liquinox®, or other nonphosphate, concentrated, laboratory-grade soap may contain trace quantities of perchlorate.

- Avoid using an excessive amount of soap during decontamination procedures, as this could result in difficulty rinsing the soap residue off of the equipment. Typically the soap solution is prepared using 1 tablespoon of soap to 5 gallons of water.

- Use sufficient amount of decontamination fluid (e.g., acid or solvent rinses) so that the fluid flows over the equipment and runs off. Spraying the equipment with a minimal amount of decontamination fluid that does not run off is ineffective.

- Spent decontamination solutions are considered investigation-derived waste (IDW) and must be managed as directed by the site-specific field program. Project and regulatory requirements, chemical compatibility, ambient conditions and professional judgment should be used to determine the appropriate decontamination process with respect to combining and/or segregating decontamination fluids. Section 3 of this SOP provides more guidance on the disposal procedures.

- Several procedures can be established to minimize the potential for cross-contamination or analytical interference by decontamination fluids. For example:

  - The use of methanol in the decontamination procedure may not be appropriate if methanol is a contaminant of concern.

  - Isopropanol may be used as a substitute for methanol but may not be appropriate when collecting samples for volatile organic compound (VOC) analyses. Residual isopropanol on the equipment may cause substantial interferences in subsequent VOC analyses and may result in unnecessary dilutions and/or false positive results if isopropanol is not removed in subsequent decontamination steps. It should also be noted that the application of isopropanol to hot metal surfaces (e.g., a steam-cleaned split spoon) may cause oxidation of the isopropanol to acetone.

- If hexane is used in the decontamination procedure, caution should be used to ensure that the hexane is completely volatilized and the equipment is subsequently rinsed when samples are to be analyzed for VOCs and volatile petroleum hydrocarbons (VPH). Residual hexane on equipment could interfere with the VOC and VPH analyses and may result in unnecessary dilutions and/or false positive results.

- Cover monitoring and sampling equipment with protective material (i.e., aluminum foil, polyethylene sheeting, or Ziploc® bags) to minimize potential re-contamination after decontamination.

- Use disposable sampling equipment when appropriate to minimize the need for decontamination. Although disposable sampling tools are encouraged in order to minimize the generation of decontamination fluids, it should be noted that plastic tools may not be appropriate for collection of samples to be analyzed for semivolatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls (PCBs). Potential phthalate contamination may cause significant interferences in the subsequent analyses and may result in unnecessary dilutions and/or false positive results.

- After decontamination, equipment should be handled only by personnel wearing clean disposable powder-free nitrile gloves to prevent recontamination.
- If equipment decontamination is performed in the field, the equipment should be moved away (preferably upwind) from the decontamination area to prevent recontamination.
- Equipment that is not decontaminated properly may result in potentially high biased results in field samples. **Note:** Equipment blank collection may be appropriate after decontamination of equipment used to collect highly contaminated samples.

1.6 Personnel Qualifications

Since this SOP will be implemented at sites or in work areas that entail potential exposure to toxic chemicals or hazardous environments, all TRC personnel must be adequately trained. Project and client-specific training requirements for samplers and other personnel on site should be developed in project planning documents, such as the sampling plan or project work plan. These requirements may include:

- Occupational Safety and Health Administration (OSHA) 40-hour Health and Safety Training for Hazardous Waste Operations and Emergency Response (HAZWOPER) workers
- 8-hour annual HAZWOPER refresher training.

2.0 PROCEDURES

Refer to the site-specific sampling plan and/or Quality Assurance Project Plan (QAPP), if applicable, for site-specific procedures. Other state or federal requirements may be above and beyond the scope of this SOP and will be followed if applicable. In all instances, the actual procedures used should be documented and described in the field notes.

2.1 General

All personnel, sample containers, and equipment leaving the contaminated area of a site must be decontaminated. Various decontamination methods will either physically remove contaminants by abrasive and/or washing actions, inactivate contaminants by disinfection or sterilization, or both. Decontamination procedures should be documented in the field book.

2.2 Physical Decontamination Procedures

In many cases, gross contamination can be removed by physical means. The physical decontamination techniques appropriate for equipment decontamination can be grouped into two categories: abrasive methods and nonabrasive methods. In general, heavy equipment decontamination is conducted by drilling and construction subcontractors and not by TRC personnel. However, TRC personnel will typically need to document such decontamination efforts as part of project work.

ABRASIVE CLEANING METHODS APPROPRIATE FOR DRILLING EQUIPMENT (DRILLING RIGS, ETC.)

Abrasive cleaning methods involve rubbing and wearing away the top layer of the surface containing the contaminant. The following abrasive methods are available but are not commonly used:

- *Mechanical:* Mechanical cleaning methods use brushes of metal or nylon. The amount and type of contaminants removed will vary with the hardness of bristles, length of brushing time, and degree of brush contact.

- *Air Blasting:* Air blasting is used for cleaning large equipment, such as bulldozers, drilling rigs, or auger bits. The equipment used in air blasting employs compressed air to force abrasive material through a nozzle at high velocities. The distance between the nozzle and the surface cleaned, as well as the pressure of air, the time of application, and the angle at which the abrasive material strikes the surface, determines cleaning efficiency. Air blasting has several disadvantages, including it is unable to control the amount of materials removed, it can aerate contaminants, and it generates large amounts of waste.

- *Wet Blasting:* Wet blasting, also used to clean large equipment, involves use of a suspended fine abrasive delivered by compressed air to the contaminated area. The amount of materials removed can be carefully controlled by using very fine abrasives. One disadvantage of this method is the generation of a large amount of waste.

NONABRASIVE CLEANING METHODS APPROPRIATE FOR FIELD EQUIPMENT (DRILLING AUGERS AND RIGS, ETC.)

Nonabrasive cleaning methods involve forcing the contaminant off of a surface with pressure. In general, less of the equipment surface is removed using nonabrasive methods. Special care should be taken during decontamination procedures following sampling for PFAS. Please refer to Attachment B for details. The following non-abrasive methods are available:

- *High-pressure Potable Water:* This method consists of a high-pressure pump, an operator-controlled directional nozzle, and a high-pressure hose. Flow rates typically range from 20 to 140 liters per minute.

  This procedure is used the majority of the time and is more appropriate for equipment with painted surfaces.

- *Ultrahigh-Pressure Potable Water:* This system produces a pressurized water jet. The ultrahigh-pressure spray removes tightly adhered surface film. The water velocity ranges from 500 meters per second (m/sec) to 900 m/sec. Additives can enhance the method. This method is not applicable for hand-held sampling equipment.

  This procedure is not commonly used but would be appropriate for carbon steel drilling rods and augers.

2.3 Procedure for Sampling Equipment

Sampling equipment, such as split-spoon samplers, shovels, hand augers, trowels, spoons, spatulas, bailers, tethers, dippers, and pumps, will be cleaned using the following procedure. Special care should be taken during decontamination procedures following sampling for PFAS. Please refer to Attachment B for details. **Note:** The overall number of containers needed for collection of decontamination fluids may vary depending on chemical compatibilities, project and regulatory requirements, and ultimate disposal methods for these fluids.

1. Lay out sufficient polyethylene sheeting on the ground or floor to allow placement of the necessary number of containers (e.g., plastic wash basins or buckets) and an air drying area. The number of decontamination steps and designated containers should be determined prior to field sampling based on the site-specific sampling plan. At a minimum, one container should be designated for the detergent wash. A second container should be designated for water rinsing. A third container may be designated for nonwater rinsing. If more than one, the nonwater rinsate fluids may need to be separated. Nonwater rinsate fluids should not be combined with the detergent wash during decontamination. Place the containers on the polyethylene sheeting. The decontamination line should progress from “dirty” to “clean”.

   Note: In instances where acid or solvent rinses are required, additional containers may be needed to manage collection and subsequent disposal of the spent decontamination fluids.

2. Fill the first container with potable water. Add sufficient nonphosphate concentrated laboratory-grade soap to cause suds to form in the container. Do not use an excessive amount of the soap (approximately 1 tablespoon of soap to 5 gallons of water), or rinsing the soap residue off of the equipment will be difficult.

3. Brush any visible dirt off of the sampling equipment into a designated area before getting equipment wet.

4. Using a clean, coarse scrub brush, submerge and wash the sampling equipment in the soap solution in the first container, removing all dirt or visible hydrocarbons. Allow excess soap to drain off the equipment into the container when finished. If cleaning a pump that is not completely disassembled, run the submerged pump in the container long enough to allow sufficient contact time with the internal components of the pump.

5. Rinse the equipment with potable water over an appropriate container, using a coarse scrub brush or pressure sprayer to aid in the rinse if necessary. If an additional acid or solvent rinse is not required, proceed to Step 8.

6. ******If sampling for metals and if required by the project, rinse the equipment with nitric acid over an appropriate container. Consider using a container dedicated to acidic solutions to minimize the volume of liquid that needs to be neutralized later. A 10 percent nitric acid solution is used on stainless steel equipment. A 1 percent nitric acid solution is used on all other equipment. If not required, this step may be omitted.

   Rinse the equipment over an appropriate container using deionized, distilled or organic-free water. If cleaning a pump that is not completely disassembled, run the submerged pump in the container long enough to allow sufficient contact time with the internal components of the pump.

7. ******If sampling for organic parameters and if required by the project, rinse the equipment over an appropriate container using pesticide-grade methanol or isopropanol (see Cautions and Potential Problems). If oily, a pesticide-grade hexane rinse should follow the methanol/isopropanol rinse, or as an alternative, Simple Green® can be used if approved by the Project Manager. Consider using an appropriate container dedicated to volatile solvents to minimize the volume of liquid that subsequently needs to be managed as IDW. If not required, this step may be omitted.

   Allow the equipment to completely air dry prior to proceeding to the next step.

   **** Steps 6 and 7 are optional and may be used on a site-specific basis. The site-specific sampling plan or QAPP, if available, should be consulted. In the absence of a sampling plan or QAPP, the Project Manager will decide upon the necessity of these steps.**

8. Rinse the equipment over an appropriate container using deionized, distilled or organic-free water. If cleaning a pump that is not completely disassembled, run the submerged pump in the container long enough to allow sufficient contact time with the internal components of the pump.

9. Allow the equipment to completely air dry on a clean surface (e.g., polyethylene sheeting or a clean container) (See*NOTE).

   ***NOTE** that if temperature or humidity conditions preclude air drying equipment, sufficient spares, if possible, should be available so that no item of sampling equipment need be used more than once. If an ample amount of spare equipment is not available and the equipment will not completely air dry, additional rinses with deionized, distilled or organic-free water should be used. The inability of equipment to air dry and the usage of additional rinses should be recorded in the field book or on the appropriate form.

10. Reassemble equipment, if necessary, and wrap completely in clean, unused, protective material. Reuse of equipment on the same day without wrapping in protective material is acceptable.

11. Spent decontamination fluids are considered IDW and must be managed as directed by the site-specific field program.

12. Record the decontamination procedure in the field book or on the appropriate form.

2.4 Procedure for Measuring Equipment

Measuring equipment, such as pressure transducers, water level indicators, oil/water interface probes, and soil moisture/pH meters will be cleaned using the following procedure, unless it conflicts with the manufacturer's recommendations. Special care should be taken during decontamination procedures following sampling for PFAS. Please refer to Attachment B for details.

1. Fill two clean containers (e.g., plastic wash basins or buckets) with potable water.

2. Add sufficient nonphosphate concentrated laboratory-grade soap to one container to form a thin layer of soap suds. If oily residues are apparent, the use of Simple Green® may be required.

3. Brush any visible dirt off of the measuring equipment before getting the equipment wet.

4. Either spray rinse the device with the soap solution over the first container, or for heavily soiled equipment, immerse the device in the container containing soap and gently agitate. Scrub device if it is soiled. Do not submerse any electrical controls or take-up reels. Submerse only that portion of the device that came in contact with potential contaminants.

5. Immerse the device in the container containing the potable water and gently agitate. Do not submerse any electrical connectors or take-up reels. Submerse only that portion of the device that came in contact with potential contaminants.

6. Spray rinse equipment with deionized, distilled, or organic-free water over the last container used.

7. Allow the equipment to air dry if time allows.

8. Record the decontamination procedure in the field book or on the appropriate form.

3.0 INVESTIGATION-DERIVED WASTE DISPOSAL

Field personnel should discuss specific documentation and containerization requirements for IDW disposal with the Project Manager.

Each project must consider IDW disposal methods and have a plan in place prior to performing the field work. Provisions must be in place regarding what will be done with IDW. If IDW cannot be returned to the site, consider material containment, such as a composite drum, proper labeling, on-site storage by the client, testing for disposal approval of the materials, and ultimately the pickup and disposal of the materials by appropriately licensed vendors.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

One type of quality control sample specific to the field decontamination process is the equipment blank. The equipment blank provides information about the effectiveness of the decontamination process employed in the field. An equipment blank can detect contamination that may arise from potentially contaminated equipment or equipment that has not been decontaminated effectively.

Equipment blanks consist of a sample of analyte-free (i.e., deionized, distilled, organic-free) water that is poured over and through a decontaminated sampling device and placed in a clean sample container. Ideally, the reagent water should come from the laboratory and be certified as clean. If the blank water is not certified as clean and/or not supplied by the laboratory performing the analyses, a separate water blank that has not run through the sampling equipment should also be sent to the laboratory for analysis.

Equipment blanks are typically collected for all parameters of interest at a minimum rate of 1 per 20 samples for each parameter. The frequency of equipment blank collection will vary from project to project, depending upon the data quality objectives, and will be specified in either the site-specific sampling plan or QAPP. Equipment blanks are typically not required if dedicated sampling equipment is used.

5.0 DATA MANAGEMENT AND RECORDS MANAGEMENT

All reagents used must be documented in the field book or on the appropriate form. Any deviations from the decontamination procedures specified in the sampling plan or QAPP must be approved by the Quality Assurance (QA) Officer and Project Manager and documented in the field book. The lot number and vendor of each reagent used should be documented in the field book. Refer to RMD SOP 001 for field documentation procedures.

6.0 REFERENCES

USEPA. December 1987. *A Compendium of Superfund Field Operations Methods*. EPA/540/P-87/001.

USEPA. January 1991. *Compendium of ERT Groundwater Sampling Procedures*. OSWER Directive 9360.4-06. PB91-9211275.

USEPA. November 1992. *RCRA Ground-Water Monitoring: Draft Technical Guidance*. EPA/530-R-93-001. USEPA Office of Solid Waste.

USEPA. January 1999. *Compendium of ERT Groundwater Sampling Procedures*. EPA/540/P-91/007. OSWER Directive 9360.4-06. PB91-921275.

USEPA. December 20, 2011. *Field Equipment Cleaning and Decontamination*. SESDPROC-205-R2. Region 4. Science and Ecosystems Support Division. Athens, Georgia.

7.0 SOP REVISION HISTORY

REVISION NUMBER	REVISION DATE	REASON FOR REVISION
1	DECEMBER 2016	ADDED ATTACHMENT B TO ACCOMMODATE SOP MODIFICATIONS REQUIRED WHEN SAMPLING FOR PFAS; CHANGED NAMING CONVENTION FOR SOP FROM RMD TO ECR.

Attachment A: SOP Fact Sheet

EQUIPMENT DECONTAMINATION

PURPOSE AND OBJECTIVE

Removing or neutralizing potential contaminants that may have accumulated on equipment and vehicles ensures protection of personnel, reduces or eliminates potential transfer of contaminants to clean areas, and minimizes the likelihood of sample cross-contamination. Preventing or minimizing potential cross-contamination of samples is important for the collection of representative samples, avoiding the possible introduction of sampling error into sample results, and for protecting the health and safety of site personnel.

WHAT TO BRING

- Field book
- Appropriate PPE
- Site-specific HASP
- Alconox®, Liquinox® or other nonphosphate concentrated laboratory-grade soap
- Simple Green® or other nontoxic biodegradable cleaner
- Deionized, distilled, or organic-free water, as appropriate
- Potable water (or water containers if potable water source on site or nearby)
- Pump or pressure sprayer
- Squeeze bottles filled with appropriate decontamination chemicals (e.g., organic solvents, nitric acid)
- Containers, such as buckets or wash basins (type and number is dependent on the procedure)
- Scrub brushes
- Aluminum foil
- Polyethylene sheeting

OFFICE

- Prepare/update the site-specific HASP; make sure the field team is familiar with the latest version.
- Review site-specific sampling plan/QAPP for decontamination procedures and procedures for management of investigation-derived waste (IDW) (e.g., used decontamination solutions).
- Confirm all required decontamination supplies are in stock or order as needed.

ON-SITE

- Verify project HASP including safety data sheets for decontamination chemicals used on site.
- Conduct daily Health & Safety tailgate meetings, as appropriate.
- Establish a designated equipment and personnel decontamination area.
- Provide for the proper collection and management of all IDW.
- Verify that appropriate PPE is worn by all site personnel (including subcontractors) and the work area is safe.

SAMPLING EQUIPMENT DECONTAMINATION - PROCEDURES

Sampling equipment, such as split-spoon samplers, shovels, hand augers, trowels, spoons, spatulas, bailers, tethers, dippers, and pumps, will be cleaned using the following procedure. **A more simplified procedure for decontamination of measuring equipment is presented in the SOP.** Note: The overall number of containers needed for collection of decontamination fluids may vary depending on chemical compatibilities, project and regulatory requirements, and ultimate disposal methods for these fluids.

1. Lay out sufficient polyethylene sheeting on the ground or floor and the necessary number of containers (e.g., plastic wash basins or buckets) and an air drying area. At a minimum, one container should be designated for the detergent wash. A second container should be designated for water rinsing. A third container may be designated for nonwater rinsing. Nonwater rinsate fluids should not be combined with the detergent wash during decontamination. The decontamination line should progress from "dirty" to "clean".
   Note: In instances where acid or solvent rinses are required, additional containers may be needed to manage collection and subsequent disposal of the spent decontamination fluids.
2. Fill the first container with potable water. Add sufficient nonphosphate concentrated laboratory-grade soap to cause suds to form in the container.
3. Brush any visible dirt off of the sampling equipment before getting equipment wet.
4. Using a clean, coarse scrub brush, submerge and wash the sampling equipment in the soap solution in the first container.

EQUIPMENT DECONTAMINATION

5. Rinse the equipment with potable water over an appropriate container. If an additional acid or solvent rinse is not required, proceed to Step 8.
6. **If sampling for metals and if required by the project, rinse the equipment with nitric acid over an appropriate container. Consider using a container dedicated to acidic solutions to minimize the volume of liquid that needs to be neutralized later. A 10 percent nitric acid solution is used on stainless steel equipment. A 1 percent nitric acid solution is used on all other equipment. If not required, this step may be omitted.
7. **If sampling for organic parameters and if required by the project, rinse the equipment over an appropriate container using pesticide-grade methanol or isopropanol (see Caution and Potential Problems). If oily, a pesticide-grade hexane rinse should follow the methanol/isopropanol rinse, or as an alternative, Simple Green® can be used if approved by the Project Manager. Consider using an appropriate container dedicated to volatile solvents to minimize the volume of liquid that subsequently needs to be managed as IDW. If not required, this step may be omitted.
   Allow the equipment to completely air dry prior to proceeding to the next step.
   ** Steps 6 and 7 are optional and may be used on a site-specific basis. The site-specific sampling plan or QAPP, if available, should be consulted. In the absence of a sampling plan or QAPP, the Project Manager will decide upon the necessity of these steps.
8. Rinse the equipment over an appropriate container using deionized, distilled or organic-free water.
9. Allow the equipment to completely air dry on a clean surface (e.g., polyethylene sheeting or a clean container).
   *NOTE that if temperature or humidity conditions preclude air drying equipment, sufficient spares, if possible, should be available so that no item of sampling equipment need be used more than once. If an ample amount of spare equipment is not available and the equipment will not completely air dry, additional rinses with deionized, distilled or organic-free water should be used. The inability of equipment to air dry and the usage of additional rinses should be recorded in the field logbook or on the appropriate form.
10. Reassemble equipment, if necessary, and wrap completely in clean, unused, protective material. Reuse of equipment on the same day without wrapping in protective material is acceptable.
11. Spent decontamination fluids are considered IDW and must be managed as directed by the site-specific field program.

INVESTIGATION DERIVED WASTE (IDW) DISPOSAL

Field personnel should review the project work plan and ensure project-specific IDW management documentation and containerization requirements are specified or discussed with the Project Manager before going to the project site.

DATA MANAGEMENT AND RECORDS MANAGEMENT

All reagents used must be documented in the field book or an appropriate field form. Any deviations from the decontamination procedures specified in the work plan, sampling plan or QAPP must be approved by the Quality Assurance (QA) Officer and Project Manager and documented in the field book. The lot number and vendor of each reagent used should be documented in the field logbook. Refer to RMD SOP 001 for field documentation procedures.

DOs AND DO NOTs OF EQUIPMENT DECONTAMINATION

DOs:

- DO call the Project Manager or field team leader if unexpected conditions are encountered or at least daily to update them on site work.
- DO manage and collect IDW in accordance with project requirements.
- DO use deionized, distilled or analyte free water that is provided by the laboratory, is certified analyte-free, and/or meets project requirements.
- DO use sufficient amount of decontamination fluids so that the fluid flows over the equipment and runs off.
- DO use new wrapped disposable dedicated sampling equipment when appropriate to minimize the need for decontamination.

DO NOTs:

- DO NOT use an excessive amount of soap during decontamination.
- DO NOT sign anything in the field unless authorized in writing by client. This includes waste disposal documentation, statements, etc.; call PM if this issue arises.

Attachment B: SOP Modifications for PFAS

Due to the pervasive nature of PFAS in various substances routinely used during sampling and the need to mitigate potential cross-contamination or sampling bias to ensure representative data are collected, special care should be taken when sampling for PFAS. The following table highlights the required modifications to this SOP when sampling for PFAS.

PFAS Equipment Decontamination Protocols	
SOP Section Number	**Modifications to SOP**
1.3	• Use only Alconox® or Liquinox® soap; do not use Decon 90. • Use new plastic buckets for wash and rinse water. • Ensure that PFAS-free water is used during the decontamination procedure. • Do not use aluminum foil.
1.5	Always consult the Site-specific Health and Safety Plan prior to conducting field work. The following considerations should be made with regards to decontamination procedures: • Tyvek® suits should not be worn. Cotton coveralls may be worn. • Boots and other field clothing containing Gore-Tex™ or other waterproof/resistant material should not be worn. This includes rain gear. Boots made with polyurethane and polyvinyl chloride (PVC) are acceptable. • Food and drink should not be allowed within the decontamination area. Bottled water and hydration drinks (e.g., Gatorade®) may be consumed in the staging area only. • Personnel involved with decontamination should wear a new pair of nitrile gloves after each decontamination procedure when handling equipment to avoid re-contamination. Avoid handling unnecessary items with nitrile gloves. • Do not store on or cover equipment with aluminum foil after decontamination. Use of polyethylene sheeting is acceptable. • Avoid wearing clothing laundered with fabric softeners. • Avoid wearing new clothing (recommended six washings since purchase). Clothing made of cotton is preferred. • Avoid using cosmetics, moisturizers, hand creams, or other related products as part of cleaning/showering the morning of sampling and decontamination field work.
2.2	• New nylon or metal bristle brushes should be used for mechanical cleaning methods. • If high-pressure water is used, it must be tested prior to use for presence of PFAS.
2.3	• Ensure that PFAS-free water is used during the decontamination procedure.
2.4	• Ensure that PFAS-free water is used during the decontamination procedure.

1. PURPOSE

The purpose of this Personal Protective Equipment (PPE) Program is to explain the responsibilities and procedures for identifying and providing the proper PPE to protect employees from known or potential workplace hazards.

2. SCOPE

This program applies to all TRC employees who are exposed to physical or health hazards.

3. DEFINITIONS

ANSI: American National Standards Institute

Face Shield: Face Protection that meets ANSI Z87.1-1989 requirements. They provide a physical barrier around the face/neck area and are worn in addition to safety glasses or safety goggles depending on the task.

Hard Hats: Head coverings which meet ANSI Z89.1-2009 requirements.

Personal Protective Equipment (PPE): Includes all clothing and other work accessories designed to create a barrier against workplace hazards. Examples include safety goggles, hard hats, hearing protectors, gloves, respirators, aprons, and work boots.

Safety Glasses: Eye glasses that meet ANSI Z87.1-1989 requirements which details minimal eye protection against foreign bodies entering the eye. Safety glasses have impact and heat resistance lenses and permanently affixed side shields.

Safety Goggles: Eye encapsulating goggles which meet ANSI Z87.1-1989 requirements. Safety goggles provide a tightly sealed physical barrier around the entire eye area.

Safety Shoes: Shoes which meet American Society for Testing and Materials (ASTM) standard F2413-05.

4. RESPONSIBILITIES

4.1 The National Safety Director is responsible for overall implementation and maintenance of this program.

4.2 The Health and Safety Network is responsible for program implementation including, but not limited to:

- Develop the standard for PPE that will be used on-site through the site-specific Health and Safety Program.
- Potentially serve as the Competent Person for implementation of the PPE Program.
- Train new and existing TRC project employees (see CP009 – Health and Safety Training Program).
- Communicate and coordinate TRC's PPE requirements with all TRC subcontractors.

- Oversee and coordinate TRC and other project employees with implementing site-specific Task Safety and Environmental Assessments to identify the hazards and control measures (including PPE) associated with work scheduled for that day. (See *Job Safety Analysis (JSA) Program*).
- Review and approve all TRC and subcontractor PPE utilization.
- Perform program audits and inspections in conjunction with on-site TRC subcontractor, and site Health and Safety representatives or their designees.
- The Health and Safety Network will provide non-prescription safety eyewear when deemed necessary.
- Maintain records for Health and Safety activities on-site including equipment inspections and procedural audits of employee PPE implementation (see Audits and Inspections and Documentation).

4.3 The Health and Safety Network is responsible for establishing appropriate PPE levels and providing PPE to TRC employees. Subcontractors will determine who will serve as their Competent Person and provide the required level of PPE for their employees. The Competent Person will also:

- Assist the Health and Safety Network in reviewing and approving all TRC and Subcontractor PPE utilization developed for the site (see CP002 - Risk Analysis/Site-Specific Health and Safety Program).
- Perform program audits and inspections in conjunction with on-site TRC subcontractor, and on-site Health and Safety representatives or their designees.

4.4 Site employees are accountable for performing work in a safe manner according to the requirements of the PPE Program. All TRC and other project employees working on-site will be required to participate in training and daily development and review of work-specific JSAs to identify the hazards and control measures (including PPE) associated with work scheduled for that day. Employees found in willful violation of safety policies will risk disciplinary action up to and including termination as outlined in Employee Handbook. Site employees are also responsible for the selection and use of their PPE and for wearing and utilizing the assigned PPE, in a proper manner.

4.5 Project Managers are responsible for assisting the Health and Safety Network in the implementation of the PPE Program. Project Managers hold all TRC and other project employees working on-site accountable for maintaining a safe work environment.

4.6 Contractors are required to follow the provisions of this program by participating in the work risk assessment which defines the risks and the associated PPE for mitigation.

5. PROCEDURES

5.1 General Requirements:

5.1.1 PPE includes different types of protective equipment and clothing, such as gloves, safety glasses/goggles, safety shoes and boots, shoe/boot covers, hardhats, coveralls, and respirators.

5.1.2 In general, the following PPE is the minimum required on all TRC project sites:

- ANSI-rated hardhats (may require chin straps when climbing structures).
- ANSI-rated safety glasses with side shields.
- ANSI-rated steel- or safety-toed boots which, at a minimum, cover the ankle.
- ANSI-rated, high-visibility reflective vest or outerwear.

5.1.3 PPE will be provided, used, and maintained in a sanitary and reliable condition. At no time will defective or damaged PPE be used by TRC employees. TRC will provide initial and replacement PPE to its affected employees at no cost to the employee.

5.2 Hazard Assessment and Risk Management:

5.2.1 TRC's Risk Analysis/Site-Specific Health and Safety Program is used as a method for selecting the appropriate PPE for known and potential hazards. The JSA is developed from identified Health and Safety hazards in the hazard assessment for the site, and risk analysis at the job level.

5.3 Basic PPE Requirements:

5.3.1 Hardhats – Required by all employees working at project sites that have overhead hazards (including contact with electrical equipment), except when inside administrative office areas. Hardhats subjected to an impact due to a falling object must be inspected for damage prior to re-use. Damaged hardhats will be taken out of service and a replacement provided by the Health and Safety Network.

5.3.2 Safety Glasses/Goggles/Face Shield – Safety glasses are required by employees working at sites that have potential eye hazards such as flying particles, chemical splash, or compressed air. Face shields provide additional protection for the eyes and face when used with safety glasses or goggles; however, face shields may not be used in lieu of safety glasses. Face shields are required for grindings operations.

- Goggles, or a face shield over side shield safety glasses are required to be worn whenever working in operations or areas that present increased risk of eye injury or face injury such as: handling corrosive or irritating chemicals or grinding.
- During hot work operations, employees shall wear safety glasses with No. 5 or darker lens and a face shield.

5.3.3 Protective Footwear - Employees are required to wear steel- or safety-toe, cut and slip resistant boots with a defined, notched heel (not greater than 2") which extends high enough to cover the employee's ankle.

5.3.4 Hearing protection - Ear muffs and/or ear plugs shall be worn by employees who are exposed to noise levels that exceed an 8-hour time weighted average of 85 dBA or higher.

Noise Reduction Rating (NRR) Derating – Manufacturers offer the NRR as tested for their PPE. This number is not "as used" NRR, meaning it is not tested in actual work conditions. Therefore, the National Institute of Safety and Health (NIOSH) recommends that the labeled NRRS be derated as follows:

- For example, measure noise exposure levels in dBA with a sound level meter or noise dosimeter, the effective A-weighted Exposed Noise Level (ENL) is :

ENL = dBA – (derated NRR-7).

5.3.5 Gloves - Gloves protect hands from injury due to abrasive surfaces, heat, or contact with chemical substances that can cause chemical burns or skin absorption. The selection and use of gloves for protection against physical, chemical, and/or biological hazards are based on the following criteria:

- Laceration – Employees involved in tasks that could potentially expose them to laceration hazards should wear cut resistant gloves.
- Chemical – Employees involved in tasks that have been identified as chemical hazards shall be protected through the use of chemical-resistant gloves.
- Biological – Employees involved in tasks that have been identified as having microorganism hazards shall be protected through the use of latex gloves. Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens final rule mandates wearing gloves in specified circumstances to reduce the risk of exposure to bloodborne pathogens. In addition, the following procedures from the Centers for Disease Control and Prevention (CDC) shall be utilized:
    - Wash hands thoroughly and promptly after contact with blood, body fluids, secretions, excretions, equipment, and potentially contaminated articles. Wearing gloves does not replace the need for hand washing. Gloves may have small, non-apparent defects or may be torn during use, and hands can become contaminated during removal of gloves. Gloves must be changed between contacts, and hands should be washed after gloves are removed.

5.3.6 Respirators – Respirators are to be selected, used and maintained in accordance with TRC's Respiratory Protection Program.

5.3.7 Fall Protection Equipment – Personal fall arrest devices must be worn by employees who are exposed to fall hazards greater than 4 feet, and also when standing inside elevating work platforms (i.e., articulating boom lit). Refer to TRC's Fall Protection Program for details pertaining to types of equipment and situations for their use.

5.3.8 Flame Resistant Clothing (FRC) – FRC shall be provided and worn when required by site owner or when the work risk assessment process determines the need for additional protection due to exposure to hazards such as flammable/combustible liquids, arc flash, or molten metal. FRC should be worn as the outer-most garment. FRC garments shall comply with the following requirements:

- Fabric Weight – FRC materials shall not weigh less than 4 oz/yd2 (150 g/m2).
- FRC materials shall comply with National Fire protection Association (NFPS) 2112 Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire and tested to ASTM F1930, standard Test Method for Evaluation of Flame Resistant Clothing for Protection Against Flash Fire Simulation Using an Instrumented Manikin.
- Optional reflective stripes shall conform to the International Safety Equipment Association (ISEA) 107, Level 2, American National Standard for High Visibility Safety Products and Headwear.

5.3.9 PFDs – Personal floatation devices are to be used when working over or near water. They should be US Coast Guard approved Type I, II, III or V PFDs. They should be fitted with a safety of Life At Sea convention compliant whistle or noise-making device. When worn at night, PFDs should have Safety of Life at Sea rated reflective tape or materials affixed to the PFD.

5.4 Training:

5.4.1 All TRC and other project employees will receive training during Site-Specific Orientation regarding TRC's requirements involving the hazards associated with all work. In addition, all employees will be trained regarding how PPE usage correlates with their work duties.

5.4.2 Before performing work requiring the use of selected PPE, each affected TRC employee will be trained to understand at a minimum the following:

- When PPE is necessary.
- What PPE is necessary.
- How to properly don, doff, adjust, and wear PPE.
- The limitations of the PPE.
- The proper care, maintenance, useful life, and disposal of the PPE.

5.4.3 Retraining of an employee is required when changes make previous training obsolete; changes in types of PPE occur; or when the employee demonstrates lack of use, improper use, or insufficient skill or understanding of PPE.

5.4.4 Employees who are required to wear fall protection or respiratory protection shall receive site-specific training above and beyond the general site-specific orientation. This training will be provided or coordinated by the Health and Safety Network.

5.5 Audits and Inspections:

5.5.1 Inspections/audits of PPE utilization, and compliance with established guideline can be conducted by the Health and Safety Network, listed Competent Person(s), or the client's representative. Inspections/audits shall be documented in the project files and deficiencies shall have timely corrective action measures defined. The auditor will be responsible for ensuring that corrective measures are met within the established timeframe, and must report any non-compliance to the Project Manager for immediate follow up.

5.5.2 All PPE shall be visually inspected daily by the user prior to use. This inspection is not required to be documented; however, potential defects in PPE shall be brought to the Competent Person's attention, and the equipment shall be removed from service until it can be determined if it is safe to use. Unsafe equipment will be removed from service, destroyed, and replacement equipment will be provided to the employee.

5.6 Documentation:

5.6.1 Records of training, audits, and inspections associated with project work shall be maintained by the Health and Safety Network in the project file on-site throughout the life of the contract, and transmitted to the project files for storage when the work has been completed.

5.6.2 Training records for non-project work will be maintained by the Office Safety Coordinators and TRC's Training Coordinator.

5.6.3 Records of non-compliance (personal and company) shall be maintained in the associated employee's or Subcontractor's files for the duration of the project.

6. REFERENCES/RELATED DOCUMENTATION

29 CFR 1910.132 – OSHA PPE Standard

CP002 – Risk Analysis/Site-Specific Health and Safety Program

1. PURPOSE

TRC provides appropriate respirators to employees when necessary to protect them from over-exposure to airborne contaminants. When effective engineering controls are not feasible to prevent over exposure to harmful air contaminants, respirators shall be used in accordance with this program. This Respiratory Protection Program establishes procedures for respirator selection, use, care, maintenance, and storage.

2. SCOPE

This procedure applies to all TRC employees required to wear a respirator.

3. DEFINITIONS

Air-Purifying Respirator: a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

Atmosphere-Supplying Respirator: a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes Supplied-Air Respirators (SARs) and Self-Contained Breathing Apparatus (SCBA) units.

Canister or Cartridge: a container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.

Demand Respirator: an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

End-of-Service-Life Indicator (ESLI): a system that warns the respirator user of the approach of the end of adequate respiratory protection (for example, that the sorbent is approaching saturation or is no longer effective).

Fit Factor: a quantitative estimate of the fit of a particular respirator to a specific individual; typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

Fit Test: the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.

HASP: Health and Safety Plan.

High Efficiency Particulate Air (HEPA) Filter: a filter that is at least 99.97 percent efficient in removing monodisperse particles of 0.3 micrometers in diameter.

Immediately Dangerous to Life or Health (IDLH): an atmosphere that poses an immediate threat to life and/or has the potential to cause irreversible adverse health effects or impair an individual's ability to escape from a dangerous atmosphere.

Negative Pressure Respirator (tight-fitting): a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

OSC: Office Safety Coordinator.

Positive Pressure Respirator: a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Powered Air-Purifying Respirator: an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Qualitative Fit Test (QLFT): a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

Quantitative Fit Test (QNFT): an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Service Life: the period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

4. RESPONSIBILITIES

4.1 The National Safety Director administers the respiratory program for TRC.

4.2 The evaluation of the overall Respiratory Protection Program is the responsibility of the National Safety Director.

4.3 The Project Manager, with support from the Safety Department, is responsible for assessing the risks of a project including identification of when respiratory protection may be required.

4.4 The Human Resources Department is responsible for coordinating medical evaluations for employees who are assigned respirators.

4.5 Office Safety Coordinators are responsible for coordinating annual respirator training for all employees who are required to wear a respirator.

4.6 Office Safety Coordinators are also required to develop a cartridge/canister change schedule based on available data for each job where employees wear respirators:

- If the nature of the work changes, including temperature, humidity, air flow through the filter, work rate, or the presence of other potential interfering chemicals, the cartridge/canister change schedule should be reviewed and amended as necessary.

5. PROCEDURE

5.1 Respirator Selection:

5.1.1 Respirators are selected on the basis of the potential hazards to which employees are likely to be exposed using the criteria specified in 29 CFR 1910.134(d). The following factors are addressed:

- The specific contaminants known or suspected to be present.

- The concentrations of contaminants known or expected.
- Skin absorption potential of the contaminants.
- Adequate warning properties for each contaminant so that respirator cartridge break-through can be detected.
- Noticeable warning properties that signal respiratory failure.
- Whether the expected contaminant is an eye irritant, a toxic dust, or a skin irritant.
- Whether there is an adequate supply of oxygen in the contaminated atmosphere.
- Whether an IDLH atmosphere exists.

5.1.2 The Selecting Respiratory Protective Devices figure provides guidance on respirator selection, and assists in identifying the type of respirator appropriate for a given application.

5.1.3 The Respirator Selection Form is used when complex mixtures of chemicals require a detailed analysis of data for respirator selection.

5.1.4 Respiratory protection used for a specific activity at a specific site is selected based on the criteria previously outlined within this program and specified in the Site-Specific HASP. The type of respirator selected should be reviewed and approved by the Office Safety Coordinator prior to use.

5.1.5 National Institute for Occupational Safety and Health (NIOSH) approved respirators will be selected and used on the basis of type and expected concentration of specific contaminant(s) known or suspected of being present.

5.1.6 Purchases of respirators and respirator parts should be approved by the Office Safety Coordinator. Where appropriate, employees will be assigned respirators for their exclusive use (i.e., when respirator use is required for extended periods of time).

5.2 Respirator Systems:

5.2.1 Respirator systems are described as follows:

- Air Purifying Respirator – A personal protective device worn, at a minimum, over the nose and mouth, with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.
- Negative Pressure Respirator - A respirator in which the air pressure inside the face piece is negative during inhalation with respect to the ambient air pressure outside the respirator.
- NIOSH – National Institute of Occupational Safety and Health.

- Permissible Exposure Limit (PEL) - Enforceable, regulatory limits set by Occupational Safety and Health Administration (OSHA) on the amount or concentration of certain chemicals in air without presenting a health hazard.
- Powered Air Purifying Respirator (PAPR) - An air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.
- Positive Pressure Respirator – A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.
- QLFT - A pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's sensory response to the test agent.
- QNFT – An assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.
- SCBA – An atmosphere supplying respirator which supplies the user with breathing air from a source independent of the ambient atmosphere.

5.3 Respirator Canister/Cartridge Change-out Schedule:

5.3.1 For protection against gases and vapors, canisters/cartridges shall be changed in accordance with the change-out schedule established within the TRC Site-Specific HASP.

5.3.2 When available, the ESLI shall be utilized to determine when canisters/cartridges shall be changed.

5.3.3 For contaminants consisting primarily of particles with Mass Median Aerodynamic Diameters (MMAD) of at least 2 micrometers, any filter certified for particulates by NIOSH shall be used.

5.3.4 **Note:** Change-out schedules for most common contaminates at listed concentrations are provided through individual cartridge manufacturers [https://www.osha.gov/SLTC/etools/respiratory/change_schedule.html].

5.4 Respirator Cleaning and Disinfecting:

5.4.1 Respirators will be cleaned and disinfected regularly. Respirators issued for an employees exclusive use will be cleaned after each day's use, or more often if necessary.

5.4.2 Respirators used by more than one employee will be cleaned and disinfected after each use. The following procedures will be used for washing and disinfecting respirators.

- Remove filters, cartridges, or canisters. Disassemble face pieces by removing speaking diaphragms, demand and pressure-demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.

- Wash components in warm water with a mild detergent. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.
- Rinse components thoroughly in clean, warm water.

5.4.3 When the cleaner or detergent used does not contain a disinfecting agent, respirator components should be immersed for 2 minutes in one of the following:

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

5.4.4 Rinse components thoroughly in clean, warm water. The importance of thorough rinsing cannot be over-emphasized. Detergents or disinfectants that dry on face pieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

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

5.4.6 Reassemble face-piece, replacing filters, cartridges, and canisters, where necessary.

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

5.5 Respirator Storage and Maintenance:

5.5.1 When not in use, respirators will be stored to protect against dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals.

5.5.2 Clean resealable plastic bags or other equivalent containers will be used to store respirators after each day’s use or for prolonged periods of time.

5.5.3 Major maintenance or repairs will be done with parts specifically designated for the respirator, and only by qualified and experienced persons.

5.5.4 Respirators requiring repair or major maintenance will be sent to the manufacturer or manufacturer-approved repair shop if a qualified repair person is not available.

5.6 Respirator Inspection:

5.6.1 Prior to each day’s use, respirators will be inspected, at a minimum, for the following:

- Cracks, tears, decomposition, face piece distortion.
- Holes, cracks, or tears in the exhalation or inhalation valve.
- Worn or stretched headbands.
- Cracked valve covers.
- Worn or loose head strap and snap fasteners.
- Missing or deteriorated gaskets.

5.6.2 For respirators maintained for emergency use, inspections shall be monthly at a minimum, and shall be certified by documenting the date the inspection was performed, the name of the person who made the inspection, and any remedial action that might be necessary.

5.7 Industrial Hygiene Surveillance:

5.7.1 TRC conducts appropriate work area surveillance to determine the need and adequacy of respiratory protection when necessary.

5.7.2 The nature and extent of industrial hygiene surveillance is identified during each site hazard assessment, and are specified in the Site-Specific HASP.

5.7.3 Levels of protection and the concentration limits for upgrading or downgrading respiratory protection are specified in the Site-Specific HASP.

6. MEDICAL EVALUATION

6.1 TRC employees will not be assigned to tasks requiring respirators until a medical evaluation questionnaire has been completed using the criteria specified in 29 CFR 1910.134, and a physician has determined that the employees are physically able to perform the work using required Personal Protective Equipment (PPE).

6.1.1 The medical evaluation questionnaire is developed and maintained by the servicing occupational health clinic in accordance with 29 CFR 1910.134.

6.2 The respirator user's medical status is reviewed annually at a minimum, or more frequently at the discretion of the examining physician.

7. EMPLOYEE TRAINING

7.1 Respirator inspection, use, storage, and limitation training is provided to all respirator users. Respirator training will be conducted annually and more often if necessary.

7.2 Respirator training program topics will include the following:

- Respiratory protection needs.
- Respirator parts and functions.
- Respirator fit.
- Respirator limitations.
- Common contaminants found on a job.
- Face-to-face piece seal.
- Fit-testing purpose.
- Positive and negative pressure tests.
- Qualitative and quantitative fit testing.
- Respirator cleaning and disinfecting.
- Medical evaluation.
- Respirator maintenance.
- Respirator types and capabilities.
- Respirator storage.
- User’s responsibility for respirator inspection prior to each use.

8. SCBA AND AIR-LINE RESPIRATORS

8.1 An SCBA or an air-line respirator is required for Level B protection. An SCBA or air-line respirator provides breathing air to the user in hazardous atmospheres. Breathing air shall meet or exceed the requirements of the specifications for Grade D breathing air described in the American National Standards Institute (ANSI)/Compressed Gas Association Commodity Specification G-7.1, 1989. Compressed oxygen will not be used in SCBA or air-line respirators. Breathing air may be supplied to respirators from cylinders or air compressors. The compressor for supplying air must be equipped with the necessary safety and standby devices as defined in OSHA Standard 29 CFR 1910.134(i).

8.2 Air-line respirators used in IDLH atmospheres will have an egress unit (minimum 5-minute breathing air supply) for emergency use. The SCBA will have an alarm indicating a low air level in the cylinder.

8.3 Breathing air containers must be marked in accordance with ANSI’s Method of Marking Portable Compressed Gas Containers.

8.4 The buddy system will be used whenever an SCBA or air-line respirator is used. Communications (visual, vocal, or signal) will be maintained between individuals. When an SCBA or air-line respirator is used in IDLH atmospheres, a standby person will be present with suitable rescue equipment.

8.5 Special training is required for users of air-supplying respirators (SCBA or air-line). Training provides persons with an opportunity to handle the respirator, test its face-to-face piece seal, and wear it for a familiarity period. Specific training is required for the specific model of air-supplying respirator used. Employees using an air-supplying respirator will receive refresher training in the use of such a respirator prior to each job on which it must be used.

8.6 Air-supplying respirators will be inspected before and after each use and monthly at a minimum to determine proper functioning of the regulator and warning devices.

9. RESPIRATOR FIT TESTING

9.1 Individuals using respirators are fit-tested in a test atmosphere in accordance with the criteria specified in 29 CFR 1910.134 (Appendix A) to determine the respirator make, model, and size that provides a proper fit.

9.2 QLFT is performed with the stannic chloride smoke tubes testing protocol when a protection factor of 10X or less is required for negative pressure respirator, or any positive pressure respirator up to the Applied Protection Factor (APF) unless other test methods are required by applicable OSHA standards.

9.3 QTFT will be performed using a TSI Portacount when a protection factor of greater than 10X is required. The results of the fit testing for each individual are documented on a Respirator Fit Test Certification Form (see the QLFT Form and the QTFT Form) and are filed for future reference.

9.4 Employees are provided the make, model, and size of respirator that provided the optimum fit during the most recent fit test.

9.5 Respirator fit tests will be conducted annually unless they are specified more often (i.e., asbestos and lead exposure fit tests are conducted every six months).

9.6 Respirators cannot be worn when conditions such as the presence of facial hair prevent a good face-to-face piece seal.

9.7 The user must check the facepiece fit using the positive and negative pressure tests each time the respirator is worn.

9.8 If any of the following danger signals are experienced using a respirator, personnel will immediately evacuate the respirator area and will inform the site Health and Safety representative.

- Chemical smell or taste.
- Eye, nose, or throat irritation.
- Breathing difficulty.
- Chest pain.
- Nausea, dizziness, or loss of equilibrium.

10. REFERENCES/RELATED DOCUMENTATION

CP002 – Risk Analysis/Site-Specific Health and Safety Program

29 CFR 1910.134 Respiratory Protection

Qualitative Fit Testing Form

Quantitative Fit Testing Form

Selecting Respiratory Protective Devices Figure

Respirator Selection Form

1. PURPOSE

The Hearing Conservation Program has been established to help ensure that TRC employees do not suffer health effects from exposure to excessive noise while at work.

2. SCOPE

The program applies to all part- and full-time TRC employees.

3. DEFINITIONS

Action Level: An 8-hour Time-Weighted Average (TWA) of 85 decibels measured on the A-weighted scale, slow response, or equivalently a dose of 50%. This is the level of sound exposure at which employee participation in the Hearing Conservation Program is mandatory.

A-Weighted Sound Level (dBA): The weighting of sound levels that represents the function of the human ear.

Audiometric Testing Program: The portion of the Hearing Conservation Program that consists of measuring an employee's hearing threshold to establish a baseline and for subsequent comparisons.

Decibel (dB): Unit of measurement of sound level.

Dose: A ratio of noise exposure relative to the noise criterion level of 90 decibels, expressed as a percentage. Ninety decibels represents a dose of 100% over an 8-hour work shift. Eighty-five decibels represents a dose of 50% over an 8-hour work shift. Dose is based on the Occupational Safety and Health Administration (OSHA) 5 dB exchange rate. Dose may be determined from the equation given in Table 1 (See Appendix A) for non-continuous noise or estimated from Table 2 (see Appendix B) based on the TWA.

Hearing Conservation Program: A written program that establishes procedures to ensure the protection of employees from high noise areas or operations in compliance with the OSHA Occupational Noise Regulation 29 CFR 1910.95.

Hearing Protection Attenuation: The estimated reduction in the noise level at the eardrum as a result of the use of hearing protection. Estimated using the formula: Attenuated TWA, dBA = TWA - (Noise Reduction Rating, (NRR), – 7) for A–scale weighted sound levels. Attenuated TWA, dBC = TWA – NRR for C-scale weighted sound levels.

Noise Induced Hearing Loss (NIHL): The OSHA recordable occupationally related hearing loss, as defined by 29 CFR 1904.10 and 29 CFR 1904.5, and includes a Standard Threshold Shift (STS) of 10 db, with age correction, averaged over the 2K, 3K, and 4K frequencies from baseline in either ear and a 25 db shift from audiometric zero, in the same ear as the 10 dB STS at the same frequencies.

Noise Reduction Rating (NRR): The theoretical maximum amount of noise reduction that can be achieved using a hearing protection device. This is a manufacturer's calculated value and must be displayed with the hearing protection device.

Monitoring: The sampling of noise levels using a sound level meter, octave band analyzer, or personal noise dosimeter.

Permissible Noise Exposure: The maximum daily noise exposure which may be experienced by employees not using hearing protectors from a continuous 8-hour exposure to a sound level of 90 dBA or equivalent dose of 100%.

Standard Threshold Shift (STS): A change in hearing threshold, relative to the most recent audiogram for that employee, of an average of 10 decibels (dB) or more at 2000, 3000, and 4000 hertz in one or both ears and substantiated within 30 days with a follow-up audiogram.

Time-Weighted Average (TWA): The [equivalent] noise level, in dB, based on an 8-hour exposure timeframe. If the noise is not constant over an 8-hour exposure, then a calculated 8-hour TWA must be made using the equation in Table 1 (see Appendix A). The TWA may also be estimated from the dose or percent noise exposure, based on noise exposure continuous over 8 hours, as given in Table 2 (see Appendix B).

4. RESPONSIBILITIES

4.1. The National Safety Director and Corporate Safety Manager are responsible for establishing the Hearing Conservation Program requirements, and providing/communicating to TRC employees.

4.2. The Human Resources Department will coordinate baseline audiometric testing for new hire employees in the Hearing Conservation Program.

4.3. The Project Managers will assist with identifying areas and tasks that may cause employees to exceed OSHA's hearing conservation level of 85 dBA TWA. They will also ensure that employees required to participate in the Hearing Conservation Program complete their annual audiometric testing.

4.4. Office Safety Coordinators are responsible for assisting Project Managers in identifying tasks/areas that may require hearing protection and list this information in the HASP.

4.5. An Industrial Hygienist may be asked to perform noise monitoring to characterize employee exposure levels to noise.

4.6. Employees are responsible for reviewing and complying with the program. Employees will also assist the Project Managers in identifying potentially hazardous noise locations or operations that have noise levels above 85 dBA.

5. PROCEDURE

5.1. Monitoring:

5.1.1 When information indicates that employees' exposure may equal or exceed the action level of 85 dBA for an 8-Hour TWA assessment, personal noise monitoring shall be conducted. Affected employees shall be notified of the results of the monitoring where levels at or above the action level are identified. Monitoring activities may consist of:

- Sound level measurements for locations where the noise level is stationary and expected to be continuous. Monitoring will be documented using the Area Noise Survey Data Form (see Appendix C); or
- Personal noise dosimeter for work operations which are highly mobile or random in noise level. Monitoring will be documented.
- Re-monitoring, if a change in equipment, process or controls increases the noise level to the extent that:
  - Additional employees may be exposed at or above the action level or;
  - The attenuation provided by the hearing protectors used by the employee(s) does not reduce the noise exposure level to 90 dBA for an 8-hour TWA or 85 dBA for an 8-hour TWA for employee(s) that have experienced a standard threshold shift.
  - An STS has occurred, and follow-up monitoring is required.
- The opportunity for affected employees to observe the noise measurements during the collection.

5.2. Audiometric Testing and Training Program:

5.2.1. All employees exposed to noise at or above the OSHA's hearing conservation action level are required to participate in the Hearing Conservation Program. This program consists of:

- A baseline test to be completed within 6 months of the employee's first exposure above the action level. This test must be preceded by at least 14 hours without exposure to workplace noise at or above 85 dBA or hearing protection devices must be used prior to testing.
- Annual testing thereafter provided that exposure at or above the action level is expected.
- If a standard threshold shift has occurred, employees will be notified in writing within 21 days of the determination. The engineering controls and hearting protectors will be re-evaluated and/or refitted.
- A follow-up audiogram will be provided within 30 days of a standard threshold shift.

- Training of affected employees regarding the hazards of noise exposure, and where necessary the fitting of employees with appropriate hearing protection devices and training about their use, care and limitations.
  - Training will occur before initial assignment, on at least an annual basis, and will be updated to be consistent with changes in PPE and work processes.

5.3. Noise Control:

5.3.1. Where noise levels are non-mobile sources found to be in excess of 90 dBA or above the Permissible Noise Exposure as listed in Table 1 (see Appendix A) on a continuous basis and employees are required to work in such area, the following measure shall be taken:

- Engineering controls will be evaluated for feasibility in noise reduction. Until they are implemented or if adequate controls are not feasible then;
- Hearing protection devices shall be worn by employees whose exposure is at or above 90 dBA as an 8-hour TWA. Hearing protection attenuation shall reduce the exposure below 90 dBA as an 8-hour TWA using the NRR of the rated device.
- For employees exposed to noise levels at or above 85 dBA, but below 90 dBA as an 8-hour TWA, the use of hearing protection devices shall be strongly encouraged and provided at no cost to the employee. The employee will also be given an opportunity to select their own hearing protection based on TRC's selection.

5.4. Recordkeeping:

5.4.1. Audiometric test results will be maintained by a third party vendor, on behalf of TRC. Noise monitoring records will be maintained on the project site and with the Project Manager for at least two years. Employees will receive copies of personal sampling data and will be provided access to all records upon request.

6. REFERENCES

29 CFR 1910.95 Occupational Noise Exposure

7. APPENDICES

Appendix A: Table 1

Appendix B: Table 2

Appendix C: Area Noise Survey Data Form

Appendix D: Noise Dosimetry Data Sheet

APPENDIX A

TABLE 1

TABLE 1: 8- HOUR TWA SOUND LEVELS & ALLOWABLE EXPOSURE TIMES

Sound Level (dBA) (loudness)	**Allowable Exposure Duration** (Hours)
80	32
85	16
90	8
95	4
100	2
105	1
110	0.5
115	0.25
120	0.125
125	0.063
130	0.031

For brevity, only dBA values that are multiples of 5 are shown. Shaded areas represent OSHA-defined exchange rate. The complete table G-16A at 29 CFR 1910.95 App A will be used. Allowable exposure duration is time in hours at a dBA level, which constitutes an exposure equivalent in energy and sound dose to 90 dBA for 8 hours.

Calculations/Definitions:
Allowable exposure time may be calculated using the following equation for sound levels not specified in this table:

$T = 8/2^{(L-90)/5}$

Where T = Allowable Exposure Duration and
L = measured A-weighted sound level.

Example: measured sound level = 75 dBA

$T = 8/2^{(75-90)/5}$ = 64 hours Allowable Exposure Duration

Sound levels below 80 dBA are not included in exposure calculations. A dose of 50% or more, or an 8-hour TWA of 85 dBA or higher, triggers the Action Level requirements and mandates an employee's participation in the Hearing Conservation Program.

APPENDIX B

TABLE 2

TABLE 2: PERCENT NOISE EXPOSURE (DOSE) AND EQUIVALENT 8-HOUR TWA

Dose (%)	8-Hour TWA
10	73.4
20	78.4
30	81.3
40	83.4
50	85.0
60	86.3
70	87.9
80	88.4
90	89.2
100	90.0
120	91.3
140	92.4
160	93.6
180	94.2
200	95.0
240	96.3
280	97.9
300	97.9
400	100.0
500	101.6

For brevity, a shortened selection of dose values are shown. The complete list is given in Table A-1 of 29 CFR 1910.95, Appendix A.

The dose may be calculated using the following formula:
Dose = 100 x $\{(C_{Level1})/(T_{Level1})+(C_{Level2})/(T_{Level2})+(C_{Level\ n})/(T_{Level\ n})\}$
Where C = time of exposure at any noise level and
T = allowable exposure time, in hours given by Table 1.

<u>Example</u>: 100 dBA for 1 hour, 95 dBA for half hour, and 80 dBA for 4h
Dose = 100x{1/2 + 0.5/4 + 4/32} = 100x(0.5 + 0.125 + 0.125} = 75% For a dose greater than or less than the values printed in the chart use the following equation to calculate the TWA:
8h-TWA = 16.61 log(10) (D/100) + 90
Where D = accumulated dose in percent exposure. <u>Example</u>: Dose = 75%
8h-TWA = 16.61 log(.75) + 90 = 16.61(-.1249) + 90 = -2.07 + 90 =
87.93 dBA

APPENDIX C

AREA NOISE SURVEY DATA FORM

AREA NOISE SURVEY DATA FORM

Sound Level/Octave Band Data

Name: ______________________ Date: ______________________

Location: ______________________ Noise Source: ______________________

Manufacturer: Model/Serial #:

Threshold: 80 dB Exchange Rate: 5 dB

Are Hearing Protectors used? ☐ Yes ☐ No If yes, what percentage? 5%

Monitoring Conducted by:

Calibration Checks

Date/Time	Frequency	Initial Setting	Date/Time	Frequency	Final Setting
	125 Hz	dB		125 Hz	dB
	250 Hz	dB		250 Hz	dB
	500 Hz	dB		500 Hz	dB
	1000 Hz	dB		1000 Hz	dB
	2000 Hz	dB		2000 Hz	dB
Calibrator:			Serial #:		

Testing Results

Sample Location	Result	Sample Location	Result
	dBA		dBA
	dBA		dBA
	dBA		dBA
	dBA		dBA
	dBA		dBA
	dBA		dBA
	dBA		dBA
	dBA		dBA
	dBA		dBA
	dBA		dBA
	dBA		dBA
	dBA		dBA
	dBA		dBA
	dBA		dBA
	dBA		dBA

Comments:

APPENDIX D

NOISE DOSIMETRY DATA SHEET

NOISE DOSIMETRY DATA SHEET

Name: ______________________ Date: ______________________

Job Title: ______________________

Dosimeter Manufacturer: ______________________ Model & Serial #: ______________________

Work Location Description: ______________________

Threshold: 80 dBA Criterion Level: 90 dBA Exchange Rate: 5 dBA

Microphone Location: ______________________

Monitoring Conducted: ☐ Personal ☐ Area

Are Hearing Protectors Used? ☐ Yes ☐ No

If yes, what percent of the workday? 5%

Exposure Description

Calibration Check

Date	Initial Reading	Time	Final Reading	Time

Dosimetry Data

Date	115 dBA Exceeded	Start Time	Stop Time	Display Reading %	L eq(t)

1. PURPOSE

The purpose of the this Health and Safety Training Program is to provide the method identifying health and safety training requirements for employees based on their job assessments and legal requirements.

2. SCOPE

The plan applies to all full-time and part-time employees.

3. RESPONSIBILITIES

3.1 TRC's National Safety Director, or designee, is responsible for determining which training topics are required for employees based on legal requirements and company policy.

3.2 Supervisors are responsible for identifying health and safety training requirements for their employees, based on information in this plan and guidance from TRC's Safety Department and TRC's Training Coordinator.

3.3 TRC's Training Coordinator is responsible for assigning employees training topics in the TRC Safety Academy.

3.4 Employees are responsible for participating in completion of the Health and Safety Training Maps based on their job assignments. Employees are also responsible for completing assigned training topics.

4. PROCEDURE

The Health and Safety Training Checklist (CP009.1) shall be completed by the Employee's Supervisor with input from the employee and a member of TRC's Health and Safety Network as necessary. The Health and Safety Training Checklist should be completed during new hire orientation, reviewed during new job assignments, and at least annually thereafter.

The Checklist is completed electronically and provided to TRC's Training Coordinator. The affected employee and the Supervisor can review the updated Plan through the TRC Safety Academy. The employee should be instructed by his/her Office Safety Coordinator (OSC) on the training courses selected for review.

The Health and Safety Training Map (CP009.2) contains information on each training topic that can be used to identify training courses. This information is also embedded within the form. When using the Checklist, the applicability of the information in the Training Map will guide you to the appropriate yes/no box.

Health and Safety Training Checklist

Instructions: If training is required, click on the "Y" box. It will be assumed that all empty boxes are not required. All TRC employees must have a Plan completed with their Supervisor.

Employee Name: ____________________

Office Location: ____________________

Office Location: ____________________

Employee Number: ____________________ **Date of Last Review:** ____________________

Indicate One: ☐ New Plan ☐ Update to Existing Plan (update applicable fields only)

Company-wide Required Training:

Y

☒ TRC H&S Orientation (required for all employees)

Job-specific Required Training:

Y	**N**	
☐	☒	Annual Physical Examination (1 Year)
☐	☒	Biennial Physical Examination (2 Year)
☐	☒	Baseline Physical Examination
☐	☒	Respiratory Protection Program
☐	☒	Exit Physical Examination
☐	☒	40-hour HAZWOPER
☐	☒	3-day HAZWOPER Supervised On Site
☐	☒	8-hour HAZWOPER Refresher
☐	☒	8-hour Supervisor HAZWOPER
☐	☒	OSHA 10-hour Construction
☐	☒	Confined Space Training
☐	☒	First Aid/CPR
☐	☒	MSHA (Mine Safety)
☐	☒	Troxler Radiation Safety
☐	☒	NITON Radiation Safety
☐	☒	Lockout/Tagout
☐	☒	Asbestos Exposure
☐	☒	Lead Exposure
☐	☒	Benzene Exposure
☐	☒	Construction
☐	☒	Construction & Heavy Equipment
☐	☒	Field Safety Training
☐	☒	PPE (Personal Protective Equipment)

Health and Safety Training Checklist

Y	N	
☐	☒	Laboratory Chemical Hygiene Plan
☐	☒	H2S (Hydrogen Sulfide)
☐	☒	Bloodborne Pathogens
☐	☒	H&S Driver & Vehicle Safety Management Manual
☐	☒	DOT Driver (DL4 or DL5)
☐	☒	DOT Drug & Alcohol Reasonable Suspicion for Supervisors
☐	☒	DOT HazMat Transportation
☐	☒	IATA Hazmat Air Transport Dangerous Goods
☐	☒	Electrical Safety – Qualified Person
☐	☒	Office Safety
☐	☒	Office Ergonomics
☐	☒	Fire Safety: Extinguishing Risk
☐	☒	Practice-Specific - RMD
☐	☒	Practice-Specific - PDE
☐	☒	Practice-Specific - TRD
☐	☒	Practice-Specific - GDR
☐	☒	Practice-Specific - PPL
☐	☒	Client-Specific Training
☐	☒	APPA (American Public Power Association)
☐	☒	Storm / Disaster Recovery Task Team Training

Signatures

Office Safety Coordinator: ____

Employee: ____

Supervisor: ____

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
TRC H&S Orientation	Required for all employees.	Initial only	Training is conducted by an Office Safety Coordinator (OSC), and follows the training agenda outlined on the TRC H&S Intranet site directory.
First Aid/CPR	Required for all TRC personnel who will be regularly working on remote field projects that do not have medical services readily available. For this application, "regularly working" shall be defined as 30 days or more per year.	Depends on service provider: • *American Red Cross* requires an update training every year for CPR and every 3 years for First Aid. • *American Heart Association* requires an update training every 2 years for both CPR and First Aid.	For employees who, due to their job function, are required to have First Aid and CPR, the training will be offered during normal business hours. For employees who wish to receive this training but are not required to have it, TRC will furnish the training to those employees at no cost after normal business hours.
40-hour HAZWOPER	Required for employees who either will work on project sites where hazardous substance removal/ remediation could potentially expose them to health hazards associated with this work, or for those employees who serve as project managers for these projects.	Initial only unless >36 months since last 8-hour refresher.	Training will be provided by an outside resource that has established a program that complies with the training requirements of 29 CFR 1910.120.

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
8-hour HAZWOPER Refresher	Required for employees who, because of their job function, were required to complete 40-hour HAZWOPER training and will be involved in hazardous waste/material remediation, cleanup, and/or other activities that will expose the employee to uncontrolled hazardous substances.	Annual refresher	The OSC may choose to conduct the annual refresher training in-house using local resources as long as the employees who conduct the training are competent in the subject matter. Offices that do not have in-house resources available, may utilize online training resources that comply with the training requirements of 29 CFR 1910.120.
8-hour Supervisor HAZWOPER	Required for employees who, because of their job function, were required to complete 40-hour HAZWOPER training. Required for those individuals who are responsible for or who supervise employees engaged in hazardous waste operations.	Initial – One time only. Followed by annual 8-hour HAZWOPER Refreshers.	The OSC may choose to conduct the annual refresher training in-house using local resources as long as the employees who conduct the training are competent in the subject matter. Offices that do not have in-house resources available may utilize online training resources that comply with the training requirements of 29 CFR 1910.120. In general, this would be all TRC personnel who are involved in HAZWOPER work, as most projects use subcontract resources with TRC on-site management.

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
3-day HAZWOPER Supervised On Site	Required for employees who are required to have 40-hour HAZWOPER training and will be involved in on-site hazardous waste/materials remediation or cleanup.	Initial	Required for all employees after completion of 40-hour HAZWOPER training, once the employee physically enters the project site. Three-day time period may be spread over more than one site if time at project location does not exceed 3 days. For an employee to skip this requirement, he or she must be able to provide documentation of completion.
Confined Space Training	Required for employees who will be involved with on-site confined space without regards to the nature of the confined space being permitted or non-permitted.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements. The Confined Space Program material can be obtained from the TRC Intranet H&S site directory.
OSHA 10 -hour Construction	Required for all construction management personnel and other employees who will be monitoring or overseeing construction activities (i.e., excavations, scaffolding, fall protection).	Every 5 Years	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
Baseline Physical Exam	Required for all new employees who will perform field work on HAZWOPER projects regardless of duration.	Initial at employment	A baseline physical will be conducted initially for all employees involved in TRC's ***Medical Surveillance Program***. Employees who will be on HAZWOPER sites less than 30 days per year will not be required to have an annual or biennial examination.
Annual Physical Exam	Required for employees working on HAZWOPER projects who will wear a respirator 30 days or more per year.	Baseline physical at employment followed by an annual exam.	The determination of 30 days of respirator use is as follows: if a respirator is used, either we know the levels to be at or above the PEL, and engineering controls are not an option, or we do not have monitoring data, and therefore, must protect to the highest level.
Biennial Physical Exam	Required for employees who will be exposed to fieldwork on HAZWOPER sites 30 days or more per year.	Baseline physical at employment followed by a biennial exam.	Biennial physicals will make up the majority of TRC personnel involvement in the ***Medical Surveillance Program***. These are employees who are working on HAZWOPER sites 30 days or more per year but are not required to wear respirators for protection because exposure levels are known to be below the PEL during the particular field operation being performed.

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
Respiratory Protection Program	Required for all employees who will wear a respirator or who work on sites where there is potential for exposure to hazardous substances above the PEL.	• Training - Initial • Fit testing - Annual Review Respiratory Protection Program for guidelines on which fit testing procedure is required. Level A = Quantitative Level B = Qualitative • Physical – Initial, with follow-up physical biennially.	In most cases this will be HAZWOPER-trained employees who will be engaged in hazardous waste remediation/cleanup. Managers who are required to have HAZWOPER training because they manage those types of projects, but will not be involved in the ongoing work at the project, can be excluded. The Respirator Protection Program can be found on the TRC Intranet H&S site directory. This training may be covered during the annual 8-hour HAZWOPER Refresher course to meet the initial training requirements.
Exit Physical Exam	Required for all employees who received a baseline physical at employment, or who have participated in TRC's ***Medical Surveillance Program***.	Prior to last day of employment.	An employee's exit physical should be conducted prior to the employee's last day of employment with TRC. If an employee refuses to have the exit physical, ensure that this is documented in writing and signed by the employee and OSC. Ensure that the exit exam refusal documentation is forwarded to Human Resources and to the National Safety Director for filing.
Troxler Radiation Safety	Required for employees who will be using a Troxler nuclear gauge.	Initial 8-hour through manufacturer, and 1 hour in-house with the RSO.	Some states require an annual training update after completion of the initial 8-hour training. Contact Mario Marra, TRC Radiation Safety Officer (RSO).

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
NITON Radiation Safety	Required for employees who will be using a NITON XRF gauge.	Initial 8-hour through manufacturer and 1-hour in-house with the RSO.	Some states require an annual training update after completion of the initial 8-hour training. Contact Mario Marra, TRC Radiation Safety Officer (RSO).
(MSHA) Mine Safety	Required for employees who will be exposed to active parts of cement plants, quarries, or mines more than 6 days in any given month.	Annual	Training will be provided by an outside resource that has established a program that complies with the governing Mine Safety and Health Act (MSHA) regulations, or by the Office Safety Coordinator (OSC) following TRC's MSHA training program.
Lockout/Tagout	Required for all employees who will be involved with on-site project work that would give exposure to accidental hazardous releases of energy (i.e., groundwater recovery systems, breaker panel upstream from equipment repair).	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. The TRC Lockout/Tagout Program is located on the TRC Intranet H&S site directory.
Asbestos Exposure	Required for all employees who have potential exposure to asbestos.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
Lead Exposure	Required for all employees who have potential exposure to lead.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
Construction	Required for all field construction employees.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
Construction & Heavy Equipment	Required for all field construction employees who work with heavy equipment.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
Field Safety Training	Required for all field service employees.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
PPE (Personal Protective Equipment)	Required for all employees who will be conducting on-site project work, including, but not limited to: Head Protection, Eye & Face Protection, Hand and Arm Protection, Body Protection, Foot Protection, Hearing Conservation, and Respiratory Protection.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
Laboratory Chemical Hygiene Plan	Required for laboratory workers.	Initial only unless new hazards are introduced and the plan is changed.	Training will be given by the laboratory supervisor or other employees recognized to be competent in the program requirements according to the program outline. TRC's Laboratory Safety Program is located on the TRC Intranet H&S site directory.
H2S (Hydrogen Sulfide)	Required for all employees working in an area where concentrations of H2S may exceed 10 parts per million (PPM).	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
Benzene Awareness	Required for all employees who have potential exposure to Benzene	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
Bloodborne Pathogens	Required for employees who are exposed to Bloodborne pathogens as a result of their job duties.	Initial - Some instances may require annual renewal.	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Note: The student must be able to ask the instructor questions during the training session.
DOT HazMat Transportation (Hazardous Materials Shipping)	Required for employees who will transport, ship, or receive hazardous materials.	Initial at employment and then every 3 years. Note frequency changes with some state plans.	The DOT Hazardous Training Materials Program can be found on TRC on-line H&S site directory under H&S programs. This material can be covered during the 8-hour HAZWOPER Annual Refresher to meet the frequency requirements or covered in a stand-alone training session.
IATA HazMat Air Transport Dangerous Goods	Required for employees who will transport hazardous materials by air. A prerequisite is the DOT Hazardous Materials Shipping course.	Initial at employment and then every 2 years (If applicable).	The DOT Hazardous Training Materials Program can be found on TRC on-line H&S site directory under H&S programs. This course requires a prerequisite course - ***DOT HazMat Transportation***.
Electrical Safety – Qualified Person	Required for all employees working on or near potentially energized electrical equipment over 50 volts.	Initial training that is appropriate to the type of work and level of potential hazards the employee will be exposed to.	Training can be performed through a combination of formal classroom and on-the-job instruction.

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
H&S Driver & Vehicle Safety Management Manual	Required for all employees for general vehicle safety.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
DOT Drivers	Required for TRC DOT DL 4s and DL 5s who drive a fleet vehicle that weighs 10-26k or 26k, respectively.	Annual	Training can be performed through online resources.
DOT Drug & Alcohol Reasonable Suspicion for Supervisors	Required for all supervisors that need to make a reasonable suspicion determination.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements of 49 CFR Part 40.
Fire Safety: Extinguishing Risk	Required for all employees who are expected to use a portable fire extinguisher as part of their job assignment.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
Office Safety	Required for all employees working in an office environment.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
Office Ergonomics	Required for all employees working in an office environment.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
Practice-Specific - RMD	Required training for all RMD employees.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
Practice-Specific - PDE	Required training for all PDE employees.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
Practice-Specific - TRD	Required training for all TRD employees.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
Practice-Specific - GDR	Required training for all GDR employees.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
Practice-Specific - PPL	Required training for all PPL employees.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
Client-Specific Training	Required client-specific training for all employees allocated for those sites.	Initial – Can be annual or biennial based on client request.	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.

Health and Safety Training Checklist

Health and Safety Training Map

H&S Training Criteria

TRAINING TOPIC	APPLICABILITY	FREQUENCY	GENERAL INFORMATION
APPA (American Public Power Association)	Required for all employees working at a publicly-owned electric utility.	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.
Storm/Disaster Recovery Task Team Training	Required for all employees participating in the Disaster Recovery Task Team Program. Includes: Wires Down & EHA (Electrical Hazard Awareness)	Initial	Training can be conducted in-house or by using outside resources pending the experience and competency of the in-house trainer. Offices that do not have in-house resources may utilize the online training resources that comply with the training requirements.

1. PURPOSE

The Behavior-Based Safety (BBS) Program has been developed for TRC, and can be defined as the process of increasing the frequency of performing safe work habits through observation and feedback. As the term implies, safe work habits are those behaviors (or employee actions) that are routine or performed as a reflex, without much thought. The performance of safe work habits is a learned behavior, and is improved by observing others' work activities and providing instructional feedback on how the work was performed.

When at-risk behaviors are identified and reduced and communication improves, the safety culture of the project improves; all leading to less injuries and a safer work environment.

The purpose of this BBS Program is to re-enforce safe work habits and identify and discuss at-risk behaviors that may lead to workplace injuries.

2. SCOPE

This program applies to all TRC employees performing work outside of their home office location.

3. DEFINITIONS

Observation: A planned site visit conducted by a trained employee who will observe a given task.

Incident: A work-related event in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred.

4. RESPONSIBILITIES

4.1 National Safety Director:

4.1.1 The National Safety Director is responsible for establishing BBS Program requirements and providing/communicating to TRC employees. The National Safety Director will also review BBS observation findings on a monthly basis, and encourage participation in the BBS Program. The National Safety Director also executes observations on a routine basis.

4.2 Corporate Safety Manager:

4.2.1 The Corporate Safety Manager will review the BBS observation findings on a monthly basis and assist the National Safety Director in establishing the BBS Program. The Corporate Safety Manager will conduct observations on a quarterly basis at a minimum.

4.3 Health and Safety Network:

4.3.1 The Health and Safety Network is responsible for BBS Program implementation including, but not limited to:

- Training new and existing TRC site employees on BBS observation procedures (see Section 5.2 Training).
- Executing BBS observations.
- Assisting with the collection of BBS observation data.
- Communicating and coordinating TRC's BBS requirements with all TRC Subcontractors including identification of Subcontractors' Competent Person(s).
- Working in concert with identified observers to provide on-site direction on BBS implementation issues.
- Providing timely feedback to the project team on the BBS findings.
- Maintaining records for Health and Safety activities on-site including procedural audits of employee BBS Program implementation (see Sections 5.3 and 5.4 on Audits and Inspections, and Documentation).

4.4 Project Manager:

4.4.1 The Project Manager is responsible for assisting the Health and Safety Network in the implementation of the BBS Program. Project Managers should be able to support the Health and Safety Network for BBS observations and program audits. The Project Manager shall also review the BBS findings with the project team and Subcontractors and actively participate in the BBS Program.

4.4.2 The Project Manager will participate in feedback sessions with employees in relation to observations conducted on their project sites.

4.5 Site Employee:

4.5.1 Site employees are responsible for understanding the BBS Program elements and requirements and actively participate in the program. Employees are encouraged to recommend improvements to the BBS Program to help its functionality and effectiveness.

5. PROCEDURE

5.1. General Requirements:

5.1.1 Identification of At-Risk Behaviors:

- At-risk behaviors are precursors to injuries. Respected safety authorities report that 80-95 percent of all injuries are the result of at-risk behaviors. If these behaviors are eliminated and safe work habits are developed, the number of injuries decreases.
- The potential at-risk behaviors are listed on page 1 of the Safety Observation Form (SOF) (see Appendix A). Root cause(s) and solution(s) to prevent the potential incident from occurring again are then identified for each at-risk behavior. A responsible person is assigned to complete the implementation of the solution and a due date is assigned. A follow-up observation is then performed for the same task to verify that the at-risk behaviors have been corrected and validate the solution(s). The SOF may undergo periodic revisions as the site work progresses to reflect current activities and operations or to refocus attention on those at-risk behaviors which have not been changed into safe work habits.

5.1.2 Observations of Work Practices:

- Trained observers will perform observations of employee work practices to determine how safely work is being performed and to track the frequency of safe and at-risk behaviors. Announced observations will be performed as work progresses and can occur whenever work is being performed. Individuals charged with performing observations will receive additional training including the observation and feedback process to ensure that they fully understand how the BBS Program will be implemented.
- Supervisors and others trained in the observation process will use the SOFs to document safe and at-risk behaviors and to provide coaching to encourage safe behaviors.

5.1.3 Feedback:

- Feedback is the verbal interaction by the observer with the employee being observed to discuss the results of the observation. This coaching process is intended to accomplish one of the following:
  - Provide positive reinforcement, if safe behaviors are observed.
  - Provide constructive feedback, if at-risk behaviors are observed.
- Positive reinforcement confirms to the employee being observed that the work practice was performed safely. Positive reinforcement encourages a repeat performance of the same safe behavior.

- Constructive feedback is meant to be instructional, to inform the employee observed that his/her behavior may be at-risk of an injury, and to provide alternative examples of how to perform the work safely.
- Prompt and frequent feedback is encouraged as it helps to make certain employees understand what behaviors are safe and should be performed, and which at-risk behaviors should be eliminated. The more frequent and prompt the feedback, the sooner safe work habits can be adopted.
- As indicated in the Site-Specific Orientation, a zero tolerance policy has been established for blatant, willful violations of company policies regarding certain aspects of fall protection, trenching and excavation, lockout/tagout (LOTO), confined space entry, drugs, alcohol, and workplace violence.

5.1.4 Data Collection and Tracking:

- The results of the supervisor observations will be documented on the SOFs which identify the project, date, observer's name, whether safe or at-risk behaviors were performed, and if feedback was provided.
- All SOFs are reviewed by the Health and Safety Network and Project Managers, and the observation data will be entered into a spreadsheet or database for the identification of trends and patterns regarding the number of safe versus at-risk behaviors. By collecting and analyzing the data, an overall understanding of where, when, and why at-risk behaviors are performed can be developed and actions taken to prevent their re-occurrence.
- Based on data collected and patterns identified, performance goals may be established to help improve awareness and program effectiveness. Recognition of achieving these goals may be provided as an incentive to achieve increased safety performance.

5.1.5 Communication:

- The BBS Program is based strongly on employee communication and interaction. Communication, which is essential for the sustainability and success of the program, can occur by various means including:
    - Posting program information on site including observation data analysis.
    - Providing a summary of safe and at-risk observations during daily Safety Meetings.
    - Providing feedback to employees that unsafe observations have been corrected.
    - Soliciting recommendations for program improvements with staff.
- The Health and Safety Network will be responsible for providing these means of communication.

5.2. Training:

5.2.1 TRC employees will undergo BBS orientation training as part of their employee orientation. It is anticipated that eventually all employees will participate in the BBS Program. Employees performing observations will undergo additional training regarding the observing process. This training will be offered by the Health and Safety Network, Project Manager, or other designated Health and Safety staff.

5.3. Audits and Inspections:

5.3.1 Periodic audits of BBS procedure execution will be conducted by the Health and Safety Network. These audits shall be documented in the project files and deficiencies (i.e., participation levels) shall have timely corrective action measures defined. The auditor will be responsible for ensuring that corrective measures are met within the established timeframe, and must report any non-compliance to the Project Manager for immediate follow-up including, but not limited to, disciplinary action for the affected individuals as outlined in TRC's Employee Handbook.

5.4. Documentation:

5.4.1 All SOFs, SOF Data Tracking Forms shall be maintained by the Health and Safety Network. This data will be transmitted by the Health and Safety Network to the employee(s) tasked with gathering company BBS data.

6. REFERENCES/RELATED DOCUMENTATION

TRC Forms/Procedures

Appendix A - Safety Observation Form (SOF)

CP002 – Risk Analysis/Site-Specific Health and Safety Program

APPENDIX A

SAFETY OBSERVATION FORM

TRC SAFETY OBSERVATION FORM

Revised January 2014

Location/Project Name: ______________________ **Date:** ____________

Observer Name: ______________________

Observee Name: ______________________ **Time:** ____________

Task Observed

Description of Task Observed and Background Information

Positive Comments

Conclusions / Why the Questionable Items Occurred?

Feedback Session Conducted By: ______________________ **Date:** ____________

Name of Observee's Supervisor: ______________________ **Time:** ____________

At-Risk Observations/Root Cause Analysis

Personal Factor:
(1) Lack of skill or knowledge
(2) Correct way takes more time/requires more effort
(3) Shortcutting standard procedures is rewarded or appreciated
(4) In past, did not follow procedures or acceptable practices and no incident occurred

Job Factor:
(5) Lack of or inadequate operational procedures or work standards
(6) Inadequate communication of expectations or work standards
(7) Inadequate tools or equipment

At-Risk Observation #	Root Cause Analysis #	Solution(s) To Prevent Potential Incident from Occurring	Person Responsible	Agreed Due Date	Date Completed

Results of Verification (were solutions done?) and Validation (were solutions effective?)

Reviewed by (PM/Supervisor): ______________________ **Date:** ____________

Approved by (Practice Safety Leader): ______________________ **Date:** ____________

TRC SAFETY OBSERVATION FORM

Revised January 2014

PERSONAL PROTECTIVE EQUIPMENT	Safe	At-Risk	Comments
1. Hearing Protection (e.g., Ear Plugs)			
2. Head Protection (e.g., Hard Hat)			
3. ANSI Rated Eye Protection (e.g., Safety Glasses)			
4. Hand Protection (e.g., Kevlar Gloves)			
5. Foot Protection (e.g., Safety Shoes)			
6. Respiratory Protection			
7. Fall Protection Inspected (e.g., Harness)			
8. ANSI Rated Reflective Vest/High Visibility Clothing			
9. Other (Specify)			
BODY USE AND POSITIONING	**Safe**	**At-Risk**	**Comments**
10. Correct Body Use and Positioning When Lifting/Pushing/Pulling			
11. Pinch Points/Moving Equipment - Hands/Body Clear			
12. Mounts/Dismounts Using 3-Points of Contact			
13. Other (Specify)			
WORK ENVIRONMENT	**Safe**	**At-Risk**	**Comments**
14. Work/Walk Surface Free of Obstructions (e.g., Tripping Hazards)			
15. Housekeeping/Storage			
16. Defined and Secured (e.g., warning devices, barricades, cones, flags)			
17. Suspended Load, Swing Radius & Lift Area is Barricaded			
18. Safety Shutdown Devices			
19. Proper Storage & Labeling /Disposal of Sample & Waste Materials			
20. Cylinders Stored Upright, Secured, & Caps in Place			
21. Manhole/vault Inspected for Hazards			
22. Other (Specify)			
OPERATING PROCEDURES	**Safe**	**At-Risk**	**Comments**
23. Job Planning (HASP reviewed, JSAs, etc.)			
24. Fire Extinguishers Accessible and Inspections Current			
25. Work Permit/Authorization to Work (Hot, Cold, LOTO, Confined Space)			
26. JSA Reviewed & Followed			
27. Hazard Assessment - Hazard Hunt			
28. Interfaces with Other Functions (awareness with other personnel on site)			
29. Operators Looking Behind Prior to Backing Up			
30. Operators Wearing Seat Belts While Operating Equipment			
31. Subsurface Structures Identified			
32. Proper Trench Protective Equipment in Place			
33. Adequate Egress Is Available for Excavation & Trench (within 25 ft. if depth is <4 ft.)			
34. All Materials Set Back at Least 2 Feet From Edge of Trench/Excavation			
35. Other (Specify)			
TOOLS/EQUIPMENT	**Safe**	**At-Risk**	**Comments**
36. Hand Tools (Proper Equipment Selection, Condition, and Use)			
37. Power Tools (Proper Equipment Selection, Condition, and Use)			
38. Equipment, Including Heavy (Proper Equipment Selection, Condition, and Use)			
39. Hoses Inspected			
40. Required Monitoring Equipment Calibrated & Used			
41. Ladders Set up Correctly & Inspected			
42. Right Tools for the Job are Available and in Good Condition - No Fixed Open Blade Knives (FOBKs)			
43. Other (Specify)			
Total #	0	0	

1. PURPOSE

The purpose of this compliance program is to set forth the process that must be utilized to evaluate an employee's fitness for duty when an employee is:

- Exhibiting observable behavior that impacts the effective and safe performance of his/her duties,
- Posing a serious safety and/or security threat to self or others,
- Expressing concern or requests job accommodation,
- Returning-to-work (FMLA, ADA, STD, LTD, WC injury/illness),
- Participating in a medical surveillance exam, or
- Participating in a post job offer (pre-employment) physical exam.

The application of this program is not intended as a substitute for TRC's policies or procedures related to performance or behavioral problems, or as a substitute for discipline. Supervisors should continue to address and implement appropriate corrective or disciplinary actions.

2. SCOPE

This policy applies to all TRC employees. This policy does not apply to employees with short-term, infectious/communicable diseases (e.g., flu, colds).

3. DEFINITIONS

ADA – Americans with Disabilities Act.

Coordinating Team – The appropriate parties responsible for coordinating and facilitating the fitness for duty evaluation. The Coordinating Team may include the employee's supervisor, Human Resources Representative, the Office Safety Coordinator (OSC), and others that may be necessary to determine the appropriate course of action.

Disability – Defined under the American with Disabilities Act (ADA) to include any individual who has physical or mental impairment that substantially limits or more major life activity; or has a record of such an impairment; or is regarded as having such an impairment.

Employee Assistance Program (EAP) – A program/employee benefit offered by TRC that provides comprehensive, confidential, employee assistance services (such as short term counseling, assessment, and referral services) that might adversely impact their job performance, health, and well-being to covered TRC employees and their families.

Fit for Duty (FFD) – To perform the duties of the job, in accordance with the essential functions of the job, in a safe, and productive manner.

FMLA – Family and Medical Leave Act.

LTD – Long term disability insurance.

Medical Record – Any document containing medical information about an employee is considered a medical record and is regarded as confidential.

STD – Short term disability insurance.

Substance Abuse Professional (SAP) – This is a person who evaluates employees who have violated a DOT drug and alcohol program regulation and makes recommendations concerning education, treatment, follow-up testing, and aftercare.

WC – Workers compensation insurance.

4. POLICY

4.1 TRC is committed to maintaining a safe and productive workplace, and it therefore requires that every employee report to work fit to perform their job duties in a safe, secure, productive, and effective manner, and remain able to do so throughout the entire time they are working. Employees who are not fit for duty may present a safety hazard to themselves, to other employees, or the Company. For purpose of this program, "fitness for duty" refers to the readiness of an employee to perform the essential functions of the job.

4.2 In partnership with WorkCare, Inc., Aetna Disability, Sargent and Associates, and Ceridian Lifeworks (EAP and SAP), our third party administrators (TPA), TRC provides a full range of pre-placement, annual, and exit physicals for applicable employees, in compliance with the Occupational Health and Safety Administration (OSHA) 29 CFR Part 1910.120 Hazardous Waste Operations standard, DOT physicals, in compliance with the Federal Motor Carrier Safety Administration (FMCSA) 49 CFR 391.41; and return to work evaluations, in compliance with the Americans with Disabilities Act (ADA). This program compliments other health and safety programs, such as training and/or use of personal protective equipment.

4.3 TRC's third party administrators are the central repository for all TRC's medical records and maintain them in accordance with applicable OSHA Regulations and Health Insurance Portability and Accountability Act (HIPAA). The contents of all records are kept confidential at all times. In addition to these measures, TRC's TPA's adhere to HIPAA guidelines that protect the privacy of medical records through administrative, technological and physical safeguards.

4.4 TRC is committed to equal employment opportunity, and it prohibits discrimination against qualified individuals with disabilities. This program is to be construed consistent with that commitment and in compliance with applicable law, including the Americans with Disabilities Act.

4.5 TRC will provide reasonable accommodations for otherwise qualified disabled individuals in accordance with the Americans with Disabilities Act of 1993, and as amended.

4.6 TRC will communicate this program to new employees during orientation, via email to notify them of the new program, and it will be accessible on TRC's intranet site TRCNET.

5. RESPONSIBILITIES

5.1 The National Safety Director, or his/her designee, is responsible for facilitating the return to work process for employees with work-related injuries.

5.2 Human Resources is responsible for coordinating fitness for duty examinations for employees and communicating the results to Supervisors.

5.3 Supervisors are responsibilities for the following:

- Observing the attendance, performance, and behavior of the employees they supervise;
- Determine the physical requirements for their respective areas of responsibilities, which includes both field and office work;
- Communicate the physical requirements for each job, to the employee through job descriptions and field project plans (i.e., Health and Safety Plans);
- Following this program when presented with circumstances or knowledge that indicate that an employee may be unfit for duty; and
- Maintaining confidentiality of medical records and/or knowledge of medical information.

5.4 Coordinating Team Members are responsible for the following:

- Ensuring that the appropriate departments have been consulted;
- Soliciting information from the supervisor regarding employee behaviors or performance, and from the employee regarding any relevant previous medical or psychological treatment information;
- Identifying who will conduct the fitness for duty evaluation;
- Receiving the results of the fitness for duty evaluation and ensuring that the results have been communicated to the employee;

- Implementing any recommendations proposed by the fitness for duty evaluation;
- Communicating with the employee as to their rights, responsibilities and employment status; and
- Maintain confidentiality of medical records and/or knowledge of medical information.

5.5 Employees are responsible for the following:

- Managing their health in a manner that allows them to safely perform their job responsibilities;
- Reporting to work fit for duty and perform their job responsibilities in a safe, secure, productive, and effective manner during the entire time they are working;
- Adhering to any temporary or permanent physical restrictions prescribed by a medical provider.
- Notifying their supervisors when they are not fit for duty;
- Notifying a supervisor when they observe a coworker acting in a manner that indicates the coworker may be unfit for duty. If the supervisor's behavior is the focus of concern, an employee may inform senior management, an Office Safety Coordinator (OSC), a member of Human Resources team, or call the Employee Assistance Program (EAP) for further guidance at 877-543-5153; and
- Complying with this policy and any authorized request to submit to an evaluation.

6. PROCEDURE FOR A FIT FOR DUTY EXAM OR WORKPLACE ACCOMMODATION REQUEST

6.1 Employee Self -Referral

- Upon receipt of a workplace accommodation from the employee, the HR Representative will coordinate this request with the employee's supervisor.
- The supervisor and HR Representative will make a determination on the accommodation request.
- The supervisor and HR Representative will notify the employee of the outcome.

6.2 Manager Referral

- Upon receipt of a fit for duty referral, the supervisor will meet with the Coordinating Team to gain a clear understanding of the behaviors and circumstances that have raised questions about the employee's fitness for duty.
- Documentation must be submitted to Human Resources the next business day.

- A member of the Coordinating Team shall also notify the employee of the opportunity to provide any relevant previous medical or psychological treatment information.
- The Coordinating Team shall determine the appropriateness of fitness for duty testing within a reasonable time after notification from the supervisor, usually within three business days.
- In partnership with TPA's, the Coordinating Team will determine if the employee should continue working in a non-safety sensitive role or if employment should be suspended until further notice.

6.3 Results of the Evaluation

- The results of fitness for duty evaluations performed by qualified, licensed health care professionals shall be presumed to be valid. Results of the evaluation will be received by the Coordinating Team. The employee shall be notified of the results of the fit for duty evaluation.
- A member of the Coordinating Team will communicate to the employee's supervisor whether the employee may return to work.
- After an evaluation, information given to the employee's supervisor shall be limited to whether the employee may:
- Return to full duty;
- Return to conditional limited duty;
- Not return to full duty, in which case the employee will be referred to the HR Representative for a benefits discussion.

7. RETURN TO WORK

7.1 If the employee has cooperated in the fit for duty examination and is in compliance with recommendations from medical, psychological, and/or chemical dependency treatment (including continuing care or aftercare, and random drug and alcohol testing if appropriate), the employee may be returned to the job provided appropriate discipline, if warranted, has been administered, and subject to all other Company policies. Conditions for return to work will be determined by the supervisor and the Coordinating Team in consultation with EAP, Occupational Health, and or insurance providers.

7.2 If an employee sustains a work related injury that could result in permanent or temporary physical limitations, the employee must be evaluated by a licensed health care provider to determine if the employee can safely perform their job. This process will coordinated between the employee's supervisor, the National Safety Director, Human Resources, and the health care provider, which may include TRC's contract occupational health care advisor WorkCare.

- At this time, the National Safety Director, or TRC's contract occupational health care provider will inform the injured employee and the employee's treating health care provider of TRC's desire to accommodate temporary work restrictions.
- On a case by case basis, the National Safety Director and the injured employee's supervisor will evaluate the availability of temporary modified work for employees with temporary restrictions. When possible, temporary modified work that is in accordance with the employee's physical abilities, will be offered to employees.
- TRC's Human Resources department, in consultation with the employee's supervisor, will manage work assignments and accommodations for employees who have, or develop permanent physical limitations that could affect their ability to perform their job. TRC will provide reasonable accommodations to qualified employees with disabilities in accordance with applicable law. Because each case is different, accommodations will be evaluated on a case by case basis.

7.3 Employees will not be expected to perform tasks that exceed employees' physical capabilities.

8. RECORDS

Records of fitness for duty evaluations and or medical restrictions that contain medical information will be treated as confidential medical records. This information may be shared only on a need to know basis. Employees may obtain a copy of their medical records upon written request. Incident investigation records will be maintained per CP019 Incident Investigation and Lessons Learned Program.

9. APPENDICES

A – Fitness for Duty Observation Check List

Appendix A
Fitness For Duty Checklist

(This observation checklist can be used to record demonstrated behavior).

Walking (Check One)
- ☐ **Stumbling**
- ☐ **Staggering**
- ☐ **Falling**
- ☐ **Swaying**
- ☐ **Unsteady**
- ☐ **Holding on**
- ☐ **Unable to**

Standing (Check One)
- ☐ **Swaying**
- ☐ **Unable to stand**
- ☐ **Feet wide apart**
- ☐ **Staggering**
- ☐ **Sagging at knees**

Movements (Check One)
- ☐ **Fumbling**
- ☐ **Jerky**
- ☐ **Slow**
- ☐ **Normal**
- ☐ **Nervous**
- ☐ **Hyperactive**

Speech (Check One)
- ☐ **Shouting**
- ☐ **Silent**
- ☐ **Whispering**
- ☐ **Slow**
- ☐ **Rambling**
- ☐ **Mute**
- ☐ **Slurred**
- ☐ **Slobbering**
- ☐ **Incoherent**

Demeanor (Check One)
- ☐ **Cooperative**
- ☐ **Polite**
- ☐ **Calm**
- ☐ **Crying**
- ☐ **Silent**
- ☐ **Talkative**
- ☐ **Excited**
- ☐ **Sarcastic**
- ☐ **Fighting**

Face (Check One)
- ☐ **Flushed**
- ☐ **Pale**
- ☐ **Sweaty**

Eyes (Check One)
- ☐ **Bloodshot**
- ☐ **Watery**
- ☐ **Dilated**
- ☐ **Glassy**
- ☐ **Droopy**
- ☐ **Closed**

Breath (Check One)
- ☐ **Alcoholic odor**
- ☐ **Faint alcoholic odor**
- ☐ **No alcoholic odor**

Actions (Check One)
- ☐ **Resisting communication**
- ☐ **Fighting**
- ☐ **Threating**
- ☐ **Calm**
- ☐ **Drowsy**
- ☐ **Profanity**
- ☐ **Hyperactive**
- ☐ **Hostile**
- ☐ **Erratic**

Appearance (Check One)
- ☐ **Unruly**
- ☐ **Messy**
- ☐ **Dirty**
- ☐ **Partially dressed**
- ☐ **Bodily excrement stains**

Clothing (Check One)
- ☐ **Stains on clothing**
- ☐ **Neat**
- ☐ **Having odor**

1. PURPOSE

The purpose of this procedure is to outline the requirements and process for investigating, recording and reporting work-related incidents that occur in the field or in TRC offices.

2. SCOPE

This procedure applies to field work performed or managed by TRC personnel and office work performed in locations owned or leased by TRC.

3. DEFINITIONS

Incident: A work-related event in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred.

OSHA: Occupational Safety and Health Administration.

Corrective Action: An action taken after an incident to eliminate or reduce the risk of a similar incident occurring.

4. RESPONSIBILITIES

4.1 The National Safety Director is responsible for the following:

- Maintaining TRC's incident investigation process and communicating the process to TRC personnel.
- Communicating work related incident information, including the Root Cause, Corrective Actions and Lessons Learned to TRC personnel.
- Ensuring Corrective Actions are implemented and verified.

4.2 TRC's Legal Department is responsible for facilitating the communication with regulatory agencies (i.e., Occupational Safety and Health Administration (OSHA)) for incidents that require notification.

4.3 Project Managers are responsible for the following:

- Initiating and participating in the incident investigation process for incidents occurring on project sites.
- Communicating with clients and affected Subcontractors on incidents that occur on project sites.

4.4 Supervisors are responsible for the following:

- Facilitating the incident investigation process for their direct reports.
- Assisting Project Managers with the incident investigation process as it applies to their direct reports.
- Assisting the National Safety Director with investigating incidents, determining the Root Cause and Corrective Actions.

4.5 The Executive Safety Council is responsible for evaluating incident trends to determine if improvement programs are needed.

4.6 The Corporate Safety Compliance Manager is responsible for assisting the National Safety Director with evaluating the compliance of office and field work performed or managed by TRC personnel.

4.7 Office Safety Coordinators are responsible for assisting the National Safety Director and Supervision with investigation of work related incidents.

4.8 Employees are responsible for the following:

- Reporting early signs and symptoms of work related injuries and illnesses to Supervision or a member of TRC's Health and Safety Network.
- Reporting all work related incidents, no matter how severe, to Supervision or a member of TRC's Health and Safety Network immediately.
- Participating in incident investigations to help identify the Root Cause and Corrective Action(s).

5. PROCEDURE

5.1 Providing medical attention to the injured person always takes precedent in the incident investigation process.

5.2 Upon receiving notification of a work related incident, the employee's direct Supervisor will initiate the incident investigation process in accordance with CP019 – TRC Incident Response and Lessons Learned Program.

- Project Managers will initiate the incident investigation process for incidents occurring on field work.

5.3 Project Managers and Supervisors will report work related incidents to the National Safety Director in a timely manner.

5.4 The National Safety Director will facilitate the evaluation of operational controls that were associated with the incident to determine if modifications to operational controls or the hazard identification process are necessary to prevent reoccurrence.

5.5 The National Safety Director will facilitate the development of Lessons Learned for injuries and illnesses that meet OSHA's recordkeeping criteria and serious incidents that could have resulted in an injury or illness.

6. RECORDS

Completed Project/Field Safety Audit Forms

Completed Office Safety Checklists

Complete Incident Investigation Reports

Lessons Learned Communications

7. RELATED DOCUMENTATION

CP019 – TRC Incident Response and Lessons Learned Program

1. PURPOSE

The purpose of this compliance program is to establish the responsibilities and requirements for protect employees from the transmission of human bloodborne pathogens through occupational exposure to human blood and other potentially infectious materials while providing first aid treatment to an injured coworker.

2. SCOPE

This procedure applies to TRC employees (full-time, part-time, and contracted) who work in a TRC office or field job site.

3. DEFINITIONS

Automated external defibrillator (AED): A portable device that automatically analyzes the heart rhythm and, if it detects a problem that may respond to an electrical shock, permits a shock to be delivered to restore a normal heart rhythm.

Bloodborne Pathogens: Means pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV).

Contaminated Sharps*:* means any contaminated object that can penetrate the skin including, but not limited to, needles, scalpels, broken glass, broken capillary tubes, and exposed ends of dental wires.

Occupational Exposure: means that during the course of an employee's job duties, there is the potential for contact with blood, body fluids, body tissue, etc., through their skin, eyes, mouth, or mucous membranes.

Exposure Incident: Means an incident in which a person's eye, mouth, other mucous membrane, or broken skin comes into contact with a potentially infectious material such as, blood, body fluids, body tissue, etc. This can occur through bites, cuts, abrasions, contact, etc.

Infectious Material: Means any blood, body fluid or body tissue that is infected with a bloodborne pathogen.

Regulated Waste: means liquid or semi-liquid blood or other potentially infectious materials; contaminated items (e.g., bandages or clothing) that would release blood or other potentially infectious materials in a liquid or semi-liquid state if compressed; items that are caked with dried blood or other potentially infectious materials and are capable of releasing these materials during handling; and contaminated sharps.

Universal Precautions: means the practice of considering all potentially infectious material to be infectious and taking precautions without regard to source or the results of screening tests.

- All blood and other potentially infectious materials are handled as if known to be infectious for Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and other bloodborne pathogens.
- All employees identified in the Exposure Determination must routinely use appropriate barrier precautions to prevent skin and mucous membrane exposure when contact with blood or other potentially infectious material is anticipated.

4. RESPONSIBILITIES

4.1 The National Safety Director is responsible for the following:

- Establishing this compliance program and communicating the requirements to the Office Safety Coordinators, Supervisors, and Project Managers.
- Reviewing this compliance program at least annually and revising the program as necessary to verify it remains effective.

4.2 Project Managers are responsible for the following:

- Confirming that first aid treatment is available (within a four minute response time) to field employees who could reasonably be expected to sustain a work-related injury that requires treatment. Examples such work include: working at construction or demolition sites, working over or near water (pond, river, lake, etc.), working at heights, etc.
  - The names and contact numbers of project employees working at the site who are current with first aid training shall be listed in the site-specific HASP. Additionally, directions to the nearest medical facility should be listed in the HASP.
- Confirming that at least one person trained in CPR is present when the following types of work are performed.
  - Permit Required Confined Space Entry,
  - Diving,
  - Electric Power Generation, Transmission, and Distribution
  - Construction, Power Transmission and Distribution
- Determining the proper type of first aid kit for each project, based on the guidance in Appendix A.
- Confirming that first aid kits being sent to field project sites are inspected to ensure the proper supplies are present and not expired.

- Designating a project employee to perform weekly inspections of first aid supplies at construction sites.
- Identifying the closest emergency medical provider to the project site and listing the address and phone number in the site-specific HASP.

4.3 Office Safety Coordinators are responsible for the following:

- Assist with ordering first aid supplies for offices and field projects, and periodically inspecting first aid supplies to confirm they're available and not expired.
- Coordinating AED inspections at TRC offices (where they are installed).
- Coordinating first aid training for TRC personnel desire to complete the training.

4.4 TRC employees trained in first aid are responsible for the following:

- At their discretion, act as a Good Samaritan to provide first aid employees with medical emergencies. The extent to which employees respond to an incident, shall be commensurate with their training and experience.
- Staying current with first aid training and communicating training status to Office Safety Coordinators and supervisor.
- Use universal precautions in accordance with training to prevent contact with blood or other potentially infectious material.
- Report exposure incidents involving potentially infectious material to the supervisor and the National Safety Director immediately.
- Maintaining a working cellular phone while onsite that can be used to contact the nearest emergency medical provider. The phone number for the emergency medical provider will be listed in the Site-Specific HASP.

5. PROCEDURES

5.1 First Aid

- When field work involves tasks that could reasonably result in injuries that could require first aid treatment, and the nearest emergency medical response (i.e., ambulance, fire department) is more than four minutes away, the Project Manager shall verify that at least one TRC employee is current with first aid and CPR training.
- TRC employees working at the jobsite who are current with first aid training may voluntarily provide first aid treatment, including CPR and AED to and injured employee in accordance with their training.

- Field employees should contact emergency medical services for serious injuries by using their cellular telephone.
- Should 911 not be available, the contact numbers of physicians, hospitals, or ambulances shall be researched and posted.
- All TRC employees shall also contact WorkCare (**888-449-7787**) for work-related injuries and illnesses.
- A valid certificate in first aid training must be obtained from the American Red Cross, or equivalent training must be available for review.

5.2 Exposure Determination

- The following group of employees who perform duties or tasks have been determined to have a reasonably anticipated occupational exposure to blood or other potentially infectious material. This determination has been made without regard to the use of personal protective equipment.
  - Employees perform who provide first aid treatment and perform cardiopulmonary resuscitation (CPR).

5.3 Work Practice Controls

- All potentially infectious materials, as defined in section 3.0, shall be handled as infectious, regardless of the source of the material.
- Employees who perform first aid treatment or administer CPR must wear latex or other water-resistant gloves prior to contacting blood or other potentially infectious material.
- Safety glasses with side shields must be worn during all work with potentially infectious material.
- If regulated waste is generated, the waste must be placed in a red bag labeled “biohazard.” Note: Used Band-Aids are typically not considered regulated waste.
- Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited while performing first aid or CPR.
- For emergency response, place a physical barrier between the provider and the blood or body fluids of the victim being treated. Examples of appropriate barriers include gloves, clean cloth, bandages and rescue blankets.
- For CPR or rescue breathing, use a face mask as a barrier between rescuer and victim.

- Employees shall wash their hands with soap and water immediately after providing medical emergency response activities. Handwashing facilities should be readily accessible and identified. Should handwashing facilities not be accessible, appropriate antiseptic hand cleanser in conjunction with clean cloth/paper towels or antiseptic towelettes. Hand should be washed with soap and running water as soon as feasible.

5.4 Handling Sharps

- The potential for transmission of infection is greatest when handling needles or other sharps that may be contaminated with infectious material.
- Contaminated needles and other contaminated sharps shall not be bent, recapped, or removed from syringe barrels by hand.
- Contaminated sharps shall be disposed of in rigid containers labeled as biohazard.

5.5 Housekeeping

- Any of the following disinfectants may be used to disinfect surfaces that have been exposed to potentially infectious substances:
  - A freshly made 10% solution of household bleach in water
  - Solution Amphyl (commercially available disinfectant)
  - Solution Lysol (commercially available disinfectant)
- All rags, paper towels or blood absorbing agents used to clean up blood or potentially infectious material should be placed in a leak-proof waste container or sealed bag and labeled with the appropriate biohazard labels.
- After an area has been cleaned with rags or blood absorbing agents, a bleach solution or an EPA registered germicide should be used as a final clean up.
- All contaminated work surfaces should be decontaminated as soon as feasible.
- Disposal of bio-hazardous waste will be performed in accordance with applicable regulatory requirements.

5.6 Hepatitis B Vaccination and Post-Exposure Evaluation and Follow-up

- Hepatitis-B vaccination is available to TRC employees who complete first aid/CPR training and offer to voluntarily respond to first aid injuries in the workplace. The vaccine will be offered at no cost within 10 working days of initial assignment to all employees who have occupational exposure, unless the employee has previously received the complete hepatitis-B vaccination series, or antibody testing has revealed that the employee is immune, or the vaccine is contraindicated for medical reasons, or the employee declines the vaccination.

- If an employee initially declines the hepatitis-B vaccination but at a later date decides to accept the vaccination, the vaccination will be provided.
- Employees who decline the vaccination must sign a declination statement. The signed statement will be maintained with medical records by the Human Resources Department.
- All exposures to potentially infected agents must be reported immediately to the employee's supervisor and to the National Safety Director.

  Exposures include the following:

  - Accidental puncture or cut with a contaminated syringe or other sharp object.
  - Contact between skin or mucus membranes and potentially infectious material.
- Following a report of an exposure incident, the employee is entitled to a confidential medical evaluation and follow-up.
- Exposure incidents involving potentially infectious materials shall be reported, and managed as privacy cases, according to CP019 Incident Response and Lessons Learned.
- The source individual's blood shall be tested as soon as feasible and after consent is obtained in order to determine HBV and HIV infectivity. If consent is not obtained, this will be noted in the affected employee's medical record. When law does not require the source individual's consent, the source individual's blood, if available, shall be tested and the results documented and managed as confidential.
- Results of the source individual's testing shall be made available to the exposed employee, and the employee shall be informed of applicable laws and regulations concerning disclosure of the identity and infectious status of the source individual.

5.7 First aid supplies

- Office Safety Coordinators will select appropriate first aid kits for office locations and TRC fleet vehicles.
- Emergency eyewash facilities shall be provided where employees are exposed to corrosive chemicals.
- Project Managers shall identify the number and type of first aid kits based on the guidance in Appendix A. Project Managers should consider the risks and task load of the work environment and the potential severity and likelihood of occurrence of an injury. Since each workplace is unique, additional first aid kit components should be selected in addition to the basic components to address these hazards.
- First aid kits should contain bloodborne pathogen related PPE and a biohazard waste bag for exposure control and will be provided at no cost to the employee. PPE includes the following:

- CPR or rescue breathing masks.
- Latex, Nitrile or vinyl disposable gloves.

5.8 Training and Recordkeeping

- Employees who elect to complete first aid training will be provided training on bloodborne pathogens and methods used to prevent exposure to potentially contaminated material. This training will be provided upon initial assignment and annually thereafter. Employees who receive the required training will have access to this compliance program through TRCNET.
- Employees who volunteer to provide first aid treatment, perform CPR or use and AED on an injured or ill person in the workplace should be current appropriate training. The frequency of this training is determined by the agency providing the training (e.g., Red Cross).
- Training records will be maintained for at least 3 years from the date on which the training occurred.
- Employee exposure and medical records shall be kept for the duration of employment plus 30 years. Exposure and medical records will associated with this program shall be kept confidential and will not be disclosed or reported to anyone within or outside of the Company without the express written consent of the employee except as required by law.
- First/CPR/AED training records shall include the certificate from the issuing agency and be available for review upon request.

6. REFERENCES/RELATED DOCUMENTATION

29 CFR 1910.151 Medical Services and First Aid

29 CFR 1910.1030 Bloodborne Pathogens

29 CFR 1926.50 Medical Services and First Aid

ANSI 308.1-2015 – Minimum Requirements for Workplace First Aid Kits

CP019 - TRC Incident Response and Lessons Learned Program

7. APPENDICES

A – Recommended Contents for First Aid Kits

Appendix A
Recommended Contents for First Aid Kits

The following table is taken from the ANSI 308.1-2015 standard and sets forth the minimally acceptable number and type of first aid supplies for First Aid kits required under this program. **Class A** kits are designed to deal with the most common types of workplace injuries. **Class B** kits are designed to deal with a broader range and quantity of supplies to deal with injuries in more complex or high-risk environments.

ANSI Z308.1–2015, TABLE 1: CLASSES OF FIRST AID KITS & REQUIRED SUPPLIES				
First Aid Supply	Minimum Quantity		Minimum Size or Volume	
	Class A Kits	Class B Kits	(U.S.)	(Metric)
Adhesive Bandage	16	50	1 x 3 in.	2.5 x 7.5cm
Adhesive Tape	1	2	2.5 yd. (total)	2.3m
Antibiotic Application	10	25	1/57 oz.	0.5g
Antiseptic	10	50	1/57 oz	0.5g
Breathing Barrier	1	1		
Burn Dressing (Gel Soaked)	1	2	4 x 4 in.	10 x 10cm
Burn Treatment	10	25	1/32 oz.	0.9g
Cold Pack	1	2	4 x 5 in.	10 x 12.5cm
Eye Covering (with Means of Attachment)	2	2	2.9 sq. in.	19 sq. cm
Eye/Skin Wash	1 fl. oz. total			29.6mL
		4 fl. oz. total		118.3mL
First Aid Guide	1	1	N/A	N/A
Hand Sanitizer	6	10	1/32 oz.	0.9g
Medical Exam Gloves	2 pair	4 pair	N/A	N/A
Roller Bandage (2 inch)	1	2	2 in. x 4 yd.	5cm x 3.66m
Roller Bandage (4 inch)	0	1	4 in. x 4 yd.	10cm x 3.66m
Scissors	1	1	N/A	N/A
Splint	0	1	4.0 x 24 in.	10.2 x 61cm
Sterile Pad	2	4	3 x 3 in.	7.5 x 7.5cm
Tourniquet	0	1	1 in. (width)	2.5cm (width)
Trauma Pad	2	4	5 x 9 in.	12.7 x 22.9cm
Triangular Bandage	1	2	40 x 40 x 56 in.	101 x 101 x 142cm

First aid kit containers are classified by portability, the ability to be mounted, resistance to water, and corrosion and impact resistance.

Type I: Intended for use in stationary, indoor applications where kit contents have minimal potential for damage. These kits are not intended to be portable and should have a means for mounting in a fixed position. Some applications for Type I first aid kits are general indoor use, office use or use in a light manufacturing facility. First aid cabinets would fall in this classification.

Type II: Intended for portable use in indoor applications where the potential for damage to kit supplies due to environmental factors and rough handling is minimal. Some applications for Type II first aid kits are general indoor use, or use in office or manufacturing environments.

Type III: Intended for portable use in mobile indoor and/or outdoor settings where the potential for damage of kit supplies due to environment is not probable. These kits should have the means to be mounted in a fixed position and have a water-resistant seal. Typical applications are general indoor use and sheltered outdoor use.

Type IV: Intended for portable use in mobile industries and/or outdoor settings where the potential for damage to kit supplies due to environmental factors and rough handling is significant. These kits must have a means to be mounted in a fixed position and must be corrosion, moisture and impact resistant (meet the performance requirements of ANSI/ISA Z308.1-2015 Section 5.2.5). Typical applications for Type IV first aid kits include the transportation, utility and construction industries, and the armed forces.

1 PURPOSE

This compliance program outlines the responsibilities and process for investigating work-related incidents, developing corrective actions, and communicating lessons learned throughout the organization. In conjunction to what is written in this compliance program, TRC will follow the regulations of 29CFR 1904.39: Recording and Reporting Occupational Injuries and Illness.

2 SCOPE

This program applies to all TRC personnel.

3 DEFINITIONS

Environmental Incident: An unplanned event that caused, or could likely have caused, a negative impact on the environment.

Illness: Unhealthy condition; poor health; indisposition; sickness.

Injury: Wound or trauma; damage inflicted on the body by an external force.

Near Miss: A situation or condition that has a potential for an incident to occur. No property was damaged and no injury or illness was sustained, but where given a change in time or position, an environmental incident, property damage or personal injury could have occurred.

Nonconformance: A deviation from applicable legal and other requirements, which include TRC's Health and Safety Management System and client expectations.

Safe Catch: A near miss or incident that has not resulted in any personal injury. Unsafe working conditions, unsafe employee behaviors, improper use of equipment or use of malfunctioning equipment have the potential to cause work related injuries.

Safety Incident: A work-related event in which an injury or illness occurred or could have likely occurred. Subcategories of incidents include near misses and safe catches.

Severe Injury: the inpatient hospitalization of one or more employees, an amputation, or loss of an eye.

4 ROLES AND RESPONSIBILITIES

4.1 The National Safety Director is responsible for the following:

- Communicate this program and the requirements to the entire company.

- Lead or facilitate investigations for incidents and safety related non-conformances.
- Facilitate the corrective action process with the affected employees.
- Assist with developing and communicating the Lessons Learned Report to the entire company.
- Coordinate audits of field work in accordance with TRC's Health and Safety Management System to confirm that the corrective actions were implemented and are effectively controlling the hazard(s).

4.2 The Corporate Safety Manager is responsible for the following:

- Assisting with incident investigations to identify corrective actions.
- Assist members of TRC's Health and Safety Network with the development of Lessons Learned Report.

4.3 Health and Safety Network is responsible for the following:

- Assisting in incident investigations.
- Development of Lessons Learned Reports.
- Communicating the Lessons Learned Report in safety meetings.

4.4 Project Managers are responsible for the following:

- Communicate with National Safety Director and Corporate Safety Managers when an incident occurs.
- Initiating and assisting with investigating incidents and non-conformances.
- Assisting with developing corrective actions.
- Assist the Health and Safety Network with the dissemination of the Lessons Learned Report.

4.5 Employees are responsible for the following:

- Participating in incident investigation and development of corrective actions.
- Reviewing lessons learned and supporting corrective actions.

5 INCIDENT RESPONSE PROCESS

TRC employees must report all incidents and potential injuries to their supervisor immediately.

5.1 Emergency Procedures:

In the event of an emergency:

- Stop work and REMAIN CALM.
- Move personnel to a safe location.
- For life threatening injuries and medical emergencies call 911 or go to the closest emergency room.
- If serious injury or life-threatening condition exists, call 911. Clearly describe the location, injury and conditions to the dispatcher. Designate a person to direct emergency equipment to the injured person.
- Address medical emergencies and apply first aid, if necessary. Contact WorkCare for all injuries, even when symptoms are minor.
- Contain physical hazards.
  - Act only if hazard is minimal and you are trained to deal with the situation. Otherwise evacuate and wait for emergency services to arrive.
- Do not resume work until Project Manager/Supervisor has determined it safe to do so and appropriate corrective actions have been implemented to prevent the incident from occurring again.

5.2 Non-Emergency Procedures:

In the event of a non-emergency injury or incident:

- Employees:
  - Stop work immediately;
  - Contact Project Manager/Supervisor; and
  - Contact WorkCare for all injuries, even when symptoms are minor.
- Project Manager/Supervisor:
  - Immediately notify the TRC National Safety Director and to the injured employee's direct supervisor.

- Work with employee(s) to mitigate hazard(s) which caused incident and institute corrective actions.

5.3 Incident Reporting to OSHA

- Fatality
  - The Occupational Safety and Health Administration (OSHA) is to be contacted within eight hours after the fatality of any employee because of a work-related incident.
- Severe Injury
  - OSHA is to be contacted within 24 hours after a severe injury to any employee because of a work-related incident.
- Methods of Contacting OSHA
  - By telephone or in person to the OSHA Area Office that is nearest to the site of the incident.
  - By telephone to the OSHA toll free central telephone number, 1-800-321-OSHA (6742).
  - By electronic submission using the reporting application located on OSHA's public website at www.osha.gov.

6 INCIDENT INVESTIGATION

All work-related incidents shall be investigated in a timely manner. Incidents that resulted in injury or illness, including first aid and early stage symptoms (i.e., sore muscle, rash, etc.) must be documented.

The affected Supervisor is required to complete the TRC Incident Report Form within 24 hours of the reported accident and forward to the National Safety Director.

As part of the incident investigation, it will be necessary to interview the injured or affected employee along with any other employees who may have been involved or who witnessed the incident. Remember that you are working to know the facts of the situation; "fault" is not a concern. Below are some guidelines to assist in conducting the interview:

1. Conduct interview(s) as soon as possible after the incident.
2. Focus on interviewing person(s) most directly involved with the incident.
3. Be respectful of the interviewee's physical and emotional state; be sympathetic if the person has suffered an injury.

6.1 Initiating an Interview:

- Introduce yourself and ask the person if they can help you determine what happened.

- If possible, conduct the interview in a private location.
- Put the interviewee at ease by:
  - Explaining that getting the facts may help prevent a recurrence;
  - Explaining that information will be shared only on a need-to-know basis;
  - Explaining that the employee will remain anonymous on any communications of lessons learned; and
  - Remaining cordial and professional even if the interviewee is not cooperative.

6.2 Developing the Narrative:

- Collect the facts and ask the interviewee to relate the events of the incident in his or her own words. Allow the person to complete each statement and do not fill silences with leading questions.
- Construct a timeline. Pay close attention to the sequence of events in order to establish a timeline, and identify critical elements for future clarification or expansion.
- Take photos of the area and equipment involved. Avoid taking photos of people.
- Clarify critical elements:
  - Based on the interviewee’s statements, prompt him/her to elaborate on critical information.
  - Ask open-ended questions to help clarify important information.
  - Avoid using emotive or judgmental language.
  - Do not prompt interviewee to speculate. Record only what the interviewee considers factual.
- Ask control questions. Ask questions for which you already know the answer, to give you a basis for evaluating the current reliability of the interviewee’s statements.
- Confirm accuracy. Periodically summarize events for the interviewee to confirm the information has been accurately recorded.

6.3 Collecting Additional Information:

- Once the narrative has been developed, ask the interviewee how the incident could have been prevented.
- Thank the interviewee for cooperating with the investigation.

- Exchange contact information so that both parties can follow up; the interviewer may have additional questions, and the interviewee may remember additional details after the interview has been concluded.

6.4 Causal Factor Analysis:

- After the incident investigation has been completed, the information gathered should allow for the development of the causal factors. Below is a summary of the causal factor analysis process:
  - Identifying the causal factors will help determine the appropriate corrective actions.
  - In many cases more than one causal factor is identified.
  - Focus on the causal factors that are most applicable to the incident.

6.5 Identifying the Causal Factors:

It is important to identify the causal factor(s) related to the incident. Using this tool will allow for you to better determine the cause of the incident, and help to focus on the appropriate corrective actions. The National Safety Director will help in determining applicable causal factors. Please see below the casual factor categories and potential selections.

Communication	**Behavior**	**Equipment/Tools**
• Management Risk Acceptance; • Poor Pre-Job Briefing; • Poor Work Planning; • Responsibilities Not Identified; and • Unclear Work Assignments.	• Disregard for Rules; • Inexperienced; • Mental State/Medication; • Physical Capability; • Poor Judgement; • Predisposition to Injury; and • Risk Taking.	• Defective or damaged; • Excessive Wear; • Improper Use; • Inadequate Maintenance; • New or Modified Equipment; • Not Readily Available; • Poor Design; and • Not Used.
Human Factors	**Management Systems**	**Personal Protective Equipment**
• Controls; • Displays; • Inadequate Material Handling Devices; • Labels; • Lifting more than 50 lbs.; • Position of People/Equipment; • Pushing/Pulling in excessive force; or • Repetitive Motion.	• Lack of Hazard Recognition and risk mitigation; • Poor Engineering/Design; or • Unclear Accountability.	• Improper Use; • Inadequate; • In Poor Condition; • Not Readily Available; and • Not Used.

Training	**Procedures**	**Working Environment**
• Incomplete Training; • Ineffective Training; • None Developed; • Lack of Competence; • Not Followed; and	• Ambiguous Instruction; • Error in Procedure; • Improper Procedure Used; • Infrequent Procedure; • No Pre- Start Check Off; • No Procedure; • Pre-Start Check Off Not Used; • Procedure Inconvenient; • Procedure Not Required, Should Be; and • Process Change	• Arrangement/Placement; • Chemicals/Dust; • Climate/Weather; • Congestion; • Cramped Quarters; • Fall Hazards; • Housekeeping; • Illumination; • Noise; • Obstructions; • Slip/Trip Hazards; and • Ventilation

7 CORRECTIVE ACTIONS, VERIFICATION AND VALIDATION, AND LESSONS LEARNED REPORT

The next step in the process is to develop and implement the corrective actions, verify and validate that the corrective actions were successful, and disseminate the lessons learned report to TRC employees.

7.1 Development of Corrective Actions:

- Hazard mitigation methods generally fall into four categories:
  - Engineering or mechanical controls or job redesign—This is the preferred method since it eliminates or reduces the hazard and is a permanent solution. We will use this solution when possible.
  - Administrative Control—May include modifying a standard work practice and/or procedure or operational/systemic practice. An example is to limit the amount of time an employee is exposed to a repetitive operation, or exposed to a noisy environment.
  - Training—Once a safe job procedure has been established, employees can be trained in the proper (safe) method to do the job. While training is always desirable (and is required by law), a challenge with this solution is that it requires constant supervision to ensure employees continue to do the job in the manner in which they were trained.
  - Personal Protective Equipment (PPE)—It is necessary to use hearing protection for noisy areas, proper gloves for material handling or exposure to chemicals or other material, steel-toe boots and hard hats for protection against physical injury, and respirators to guard against exposure to air contaminants. This solution requires an evaluation of the proper PPE, additional training if necessary, and supervision and periodic inspection to ensure the equipment is used properly.

The corrective actions will be developed by a team of individuals consisting of the employee(s) that were onsite, the Project Manager/Supervisor, the National Safety Director and the Office Safety Coordinator. Other people may be involved depending on the severity of the incident or the complexity in developing corrective actions. Investigation findings will be tracked on the TRC Incident Investigation form.

7.2 Verification and Validation of Corrective Actions:

The corrective actions that are formulated and implemented must be verified and validated to ensure that employees are using the new safety controls and that the controls established are serving the purpose in eliminating the hazardous condition(s). Sometimes corrective actions may introduce additional safety hazards that may not be apparent until they are applied in the field. In addition, the verification and validation process allows for opportunities to photograph the corrective action while in process, which can be used in the Lessons Learned Report to follow. To identify that the safety controls are implemented and working, an observation must be planned.

7.3 Dissemination of Lessons Learned Report:

- The communication of the Lessons Learned Report is the final step. The report is designed to provide each employee with a quick summary of the incident, causal factor(s), and short- and/or long-term corrective actions. A sample of the Lessons Learned Report is provided Appendix B.
    - Sources of these lessons include incidents, First Aid cases, near misses, safe catches and observation findings from projects and offices throughout TRC. The program is designed to help TRC employees understand how to respond to safety incidents, and prevent recurrences by raising awareness of the risks associated with key incidents, and communicating practical solutions to improve behavior and mitigate safety hazards.
- Where appropriate (typically only for very high-risk occasions or where similar reportable incidents are repeated) the National Safety Director may send a formal notice to staff and Subcontractors requiring a change of work practice(s) and request an acknowledgement signature from employees and Subcontractors associated with the Project Team.
- It is the expectation that this program will provide employees and Subcontractors with a clear understanding of how to respond to safety incidents, conduct investigations, determine causal factors and corrective actions, and disseminate lessons learned to employees.

8 COMPLETE TRC INCIDENT REPORT FORM

8.1 The employee(s) and their direct supervisor shall use the information gathered through the investigation process to complete CP019 TRC Incident Investigation Report.

8.2 The report should be submitted to TRC's National Safety Director as soon as it's completed.

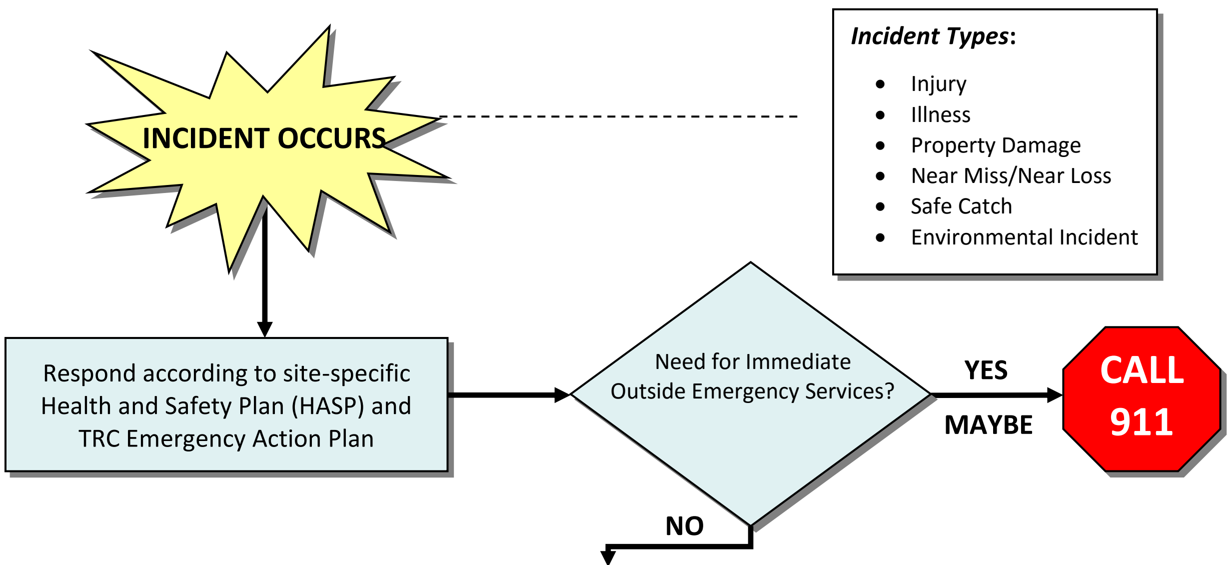
9 REFERENCES/RELATED DOCUMENTS

29CFR1904.39
Appendix A – Incident Response Flowchart
Appendix B – Example Lessons Learned Report
Appendix C – Incident Notification Report
Appendix D – Auto Incident Report
Appendix E – Safe Catch Report

APPENDIX A
INCIDENT RESPONSE FLOWCHART

INCIDENT RESPONSE AND REPORTING FLOWCHART

INCIDENT RESPONSE



TRC Employee

- Determine immediate response actions
- Administer First Aid/CPR to level of competency
- Control/contain incident, if safe to do so
- Call Project Manager/Supervisor to report incident
- Call **WORKCARE** at **(888) 449-7787**
- Gather incident information (take notes, photos, witness info, drawings, etc.)

Project Manager/Supervisor

- Notify a member of the Corporate Health and Safety Team and your manager (in that order)
- Assist with developing immediate response actions, evaluate need for additional TRC support to scene for assistance, and deploy as needed
- Gather incident information from on-site employee
- Visit site to assess scene, as required

TRC Safety Director

Mike Glenn (949) 727-7347 or (949) 697-7418 - cell

APPENDIX B
EXAMPLE LESSONS LEARNED REPORT

August 2016

LESSONS LEARNED REPORT

HEAT-RELATED ILLNESS!

HIGH TEMP + HIGH HUMIDITY = HEAT STRESS

INCIDENT SUMMARY

A TRC employee, began to feel the effects of heat stress as a result of the environmental conditions. As the summer temperature increased to 88 degrees Fahrenheit, the employee became saturated with sweat, nauseous, hands began to tremble, and fell short of breath. The employee notified the crew supervisor on-site of his condition. The employee was immediately given water to rehydrate and rest in an air-conditioned vehicle. WorkCare was called and based on the employee's symptoms, medical attention was recommended. The field supervisor located the nearest medical facility listed on the project-specific Health and Safety Plan and transported the employee to be evaluated. The employee was diagnosed with heat exhaustion and intravenous fluids were administered. Thankfully, the employee was cleared for discharge shortly thereafter and was able to return to regular work duty the following day.

CONTRIBUTING CAUSES/FACTORS

- **Extreme Heat**
  - Ambient air temperature exceeds **85 degrees** with relative humidity greater than **50 percent**. Temperature on this particular day was **88 degrees** with a relative humidity of **68 percent**.

- **Modified Work/Rest Schedule**
  - Additional rest breaks should have been introduced based on the extreme temperatures associated with the work day.
- **Acclimated to the Task**
  - The employee had not worked regularly in the field in recent months so was not acclimated to the environmental conditions.
- **Maintain Body Fluids**
  - A total of 1 to 1.5 gallons of water per individual per day are recommended for fluid replacement under heat stress conditions. The employee was not drinking enough fluids for the environmental conditions.

CORRECTIVE ACTIONS

- **Stopped Work –** Administered fluids and removed the employee from the environmental conditions.
- **WorkCare –** Notified the incident intervention service of the situation.
- **Medical Attention –** Evaluation and corrective measures.
- **Modified Work Schedule –** Work schedule has been adjusted to 30-minutes on/30-minutes off during extreme heat days.
- **Fluid Intake –** Project staff will consume 32 ounces of water per working hour to ensure proper hydration. A water supply will be readily available on-site, in coolers with ice, no more than 100 meters from staff at all times.
- **WBGT Thermometer –** A Wet-Bulb Globe Temperature (WBGT) thermometer will stay on-site at all times to accurately measure the ambient air temperature and relative humidity.
- **Staff Messaging –** Safety Reminder circulated to staff. TRC's Heat Stress Prevention Program reviewed with project team.

LESSONS LEARNED

- **Monitor Physical Conditions –** Field staff should have had increased awareness of their physical condition and their fellow co-worker's condition for signs or symptoms of heat illnesses. **The Buddy System—**staff should be asking each other: How are you feeling? Nauseous? Shaky? Need a break? How much fluid have you had this hour?
- **Environmental Conditions Responsiveness –** Field staff should have avoided heavy exertion, extreme heat, sun exposure, and high humidity when possible. Work schedule should have been adjusted to accommodate more frequent rest periods and an altered work start time to conduct field tasks during the cooler portions of the day.
- **Safety Communication –** Incident review interviews determined that heat-stress was a topic of discussion at the Daily Pre-Task Safety Briefing. Continued heat discussions will take part of all Safety Briefings to highlight the importance of environmental conditions awareness and management.

Contact: If you have any questions about this report or would like additional information please contact Curt Biondich, PPL Safety Coordinator at cbiondich@trcsolutions.com or Mike Glenn, TRC Safety Director at mglenn@trcsolutions.com.

APPENDIX C
INCIDENT NOTIFICATION REPORT

TRC Results you can rely on

INCIDENT NOTIFICATION REPORT

(To be completed immediately after an Injury, Illness, Incident or Significant Near Miss by Employee's Supervisor and Employee involved)

Incident Category

☐ Injury/Illness ☐ Near Miss/Loss ☐ Property Damage ☐ Other

1 Incident Location: ____________________
2 Project #: ____________________
3 Client: ____________________
4 Date Incident Occurred: ____________________ Time: __________
5 Date Incident Reported: ____________________ Time: __________

TRC Employee Information

6 Name: ____________________ Phone: __________
7 Office: ____________________ Address: __________
8 Supervisor Name: ____________________ Phone: __________
9 Title or Occupation: ____________________
10 Sector/Practice: ____________________

Incident Description

11 Task Performed/Description of Incident:

12 Conditions at the Time of Incident (weather, lighting, etc.):

13 Description of Property Damage:

Employee Injury or Illness Description

14 Describe the Injury or Illness:

15 First Aid/Medical Treatment Administered:

16 Was WorkCare Contacted? ☐ Yes ☐ No
17 Name of Doctor's Office, Clinic or Hospital: ____________________
18 Address: ____________________ Phone: __________

INCIDENT NOTIFICATION REPORT

(To be completed immediately after an Injury, Illness, Incident or Significant Near Miss by Employee's Supervisor and Employee involved)

Subcontractor Involvement

19 Was a subcontractor involved? ☐ Yes ☐ No

20 Name of Company: __________

21 Address: __________

22 Contact Name: __________ Phone: __________

23 Description of the Incident:

Witness Information

24 Were there witnesses to the incident? ☐ Yes ☐ No

25 Name(s) Address(es) Number(s)

____

____

Immediate Corrective Actions

26 Describe the Immediate Corrective Actions Taken:

Client Notification

27 Is there a client incident notification requirement? ☐ Yes ☐ No

28 Contact Name __________

29 Date of Notification: __________ Time: __________

30 Notification Method:

Supervisor: __________ Signature: __________ Date: __________

Employee: Signature: Date:

APPENDIX D
AUTO INCIDENT NOTIFICATION REPORT

TRC Results you can rely on

AUTO INCIDENT REPORT

EMPLOYEE INFORMATION (V-1):

Name: ______________________ Phone: ( ) ______________________

Sector/Practice: ______________________ Office Location: ______________________

Supervisor's Name: ______________________ Supervisor's Phone: ( ) ______________________

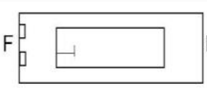
Project #: ______________________ Client's Name: ______________________

Driver's License #: ______________________ State: ______________________

VEHICLE INFORMATION (V-1):

Year/Make/Model of Vehicle: ______________________

License Plate #: ______________________ Vehicle ID # (VIN): ______________________

Circle Point of Contact: F  R

Was Vehicle Drivable? ☐ Yes ☐ No

Personal: ☐ Yes Rental: ☐ Yes Fleet: ☐ Yes

Rental Company

INCIDENT INFORMATION:

Date of Incident: __________ Time of Incident: ________ A.M. ________ P.M. Photos Taken: ☐ Yes ☐ No

Location of Incident: ______________________ City/State: ______________________

Were The Authorities Contacted? Police: ☐ Yes ☐ No Ambulance: ☐ Yes ☐ No Fire: ☐ Yes ☐ No

Name of Police Dept: ______________ Case #: ______________ Officer Name: ______________

Were Citations Issued? ☐ Yes ☐ No If Yes, To Whom? ______________________

Citation Number: ______________________

Were There Any Witnesses? ☐ Yes ☐ No If Yes, Please Provide Name, Address and Phone Below:

Witness Name: ______________________ Witness Phone: ( ) ______________________

Witness Address: ______________________

Traffic Conditions (i.e., heavy, light): ______________ Weather Conditions (i.e., dry, wet, ice, fog): ______________

WorkCare Contacted? ☐ Yes ☐ No

TRC Driver Injured? ☐ Yes ☐ No Medical Treatment Received? ☐ Yes ☐ No

Front Seat Passenger Injured? ☐ Yes ☐ No Medical Treatment Received? ☐ Yes ☐ No

Rear Driver Side Passenger Injured? ☐ Yes ☐ No Medical Treatment Received? ☐ Yes ☐ No

Rear Passenger Side Passenger Injured? ☐ Yes ☐ No Medical Treatment Received? ☐ Yes ☐ No

Describe Injuries:

____

Describe Damage to Property Other Than Motor Vehicles (i.e., guardrails, mailboxes, etc.):

____

AUTO INCIDENT REPORT

OTHER DRIVER & VEHICLE INFORMATION (V-2):

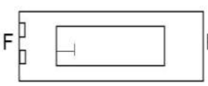
Driver's Name: ______________________ Driver's Phone: ( ) ______________

Driver's Address: ____

Owner's Name (If different than driver): ______________ Owner's Phone: ( ) ______________

Owner's Address: ____

Year/Make/Model of Vehicle: ______________ License Plate #: __________ State: ______

Circle Point of Contact: F  R

Was Vehicle Drivable? ☐ Yes ☐ No

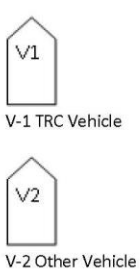
Insurance Company Name: ______________________ Policy Number: ______________________

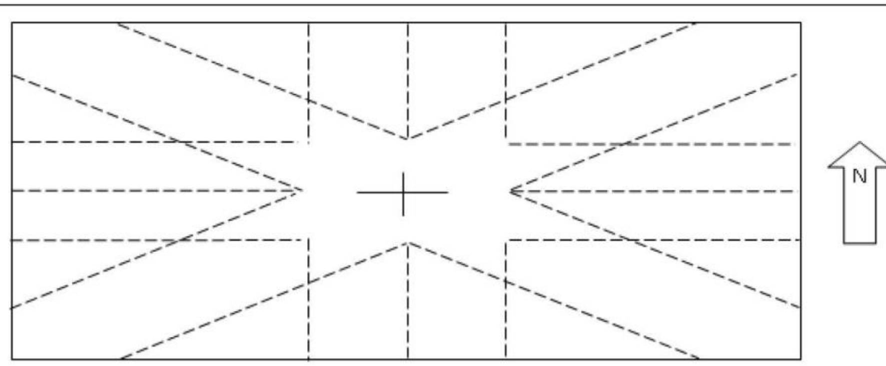
Insurance Company Phone: ( ) ______________ Number of Passengers in Vehicle: __________

List Persons Injured: ____

Were Any Other Vehicles Involved in Incident? ☐ Yes ☐ No If yes, provide details below:

PLEASE DESCRIBE THE INCIDENT AND COMPLETE THE DIAGRAM BELOW. Be sure to indicate as many details as possible (i.e., How many lanes in each direction; Were there any turn lanes; What kind of traffic controls were there – light, stop sign, yield sign, Positions of vehicles on impact).





Completed By: ______________________ Signature: ______________________

APPENDIX E
SAFE CATCH REPORT

"Safe Catch" Report

A "Safe Catch" is a potential hazard or incident that has not resulted in any personal injury. Unsafe working conditions, unsafe employee behaviors, improper use of equipment or use of malfunctioning equipment have the potential to cause work related injuries. It is everyone's responsibility to report and/or correct these potential incidents immediately. Please complete this form as a means to report these "Good Catch" situations and submit to your local OSC Representative and Mike Glenn, National Safety Director.

Complete ALL field entries:

Employee Name:		Date:	
Location:		Office:	
Project Number:		Practice:	
Conditions			
Please check all appropriate conditions:			
☐ Unsafe Act	☐ Unsafe Condition	☐ Unsafe Equipment	☐ Unsafe Use of Equipment
Description of Incident or Potential Hazard:			
Task Performed at Time of Incident:			
Causes (Primary and Contributing):			
Corrective Action(s) Taken (remove the hazard, replace, repair, or retrain):			
Employee Signature:		Date Completed:	

Our Mission: To reduce the frequency of incidents by applying local lessons learned globally.

If you have any questions about this report or would like additional information, please reference Compliance Program CP019—TRC Incident Response and Lessons Learned Program, located on TRCNET or contact Mike Glenn, National Safety Director at mglenn@trcsolutions.com.

1. PURPOSE

The purpose of this plan is to document spill prevention and response requirements. If required, a properly trained TRC employee will develop a spill prevention and response plan based on the requirements and template provided or similar (Appendix A).

2. SCOPE

This procedure applies to all TRC operations. When work is performed on a non-owned or operated site, the operator's program shall take precedence, however, this document covers TRC employees and contractors and shall be used on owned premises, or when an operator's program doesn't exist or is less stringent.

3. RESPONSIBILITIES

3.1 Supervisors:

- Supervisors should ensure that employees are familiar with these procedures and receive necessary training.

3.2 Employees:

- Responsible for following this program and for reporting all spills to their supervisor.

4. PROCEDURE

4.1 General Requirements:

Each work site spill prevention and response plan shall contain the following requirements.

- Chemical substances should be stored in proper containers to minimize the potential for a spill. Whenever possible, chemicals should be kept in closed containers and stored so they are not exposed to storm water.
- The program must identify chemicals used that may be potentially spilled or released. This will include both liquid chemicals used at our facilities or brought on to owner client sites.

- Spill kits must be adequate for any anticipated spills. A proper spill kit must contain the appropriate supplies for materials that may be spilled. Supplies must be easily accessible when required, and considerations must be made for both the type and quantity of materials. The contents of spill response kits shall be periodically assessed to ensure the availability of adequate spill response supplies and adjust inventory as necessary.
- TRC employees and contractors shall ensure the availability of adequate spill response supplies by periodic inspection to assess their availability and adjust the inventory as necessary.
- Areas where chemicals may be used or stored must be maintained using good housekeeping best management practices. This includes, but is not limited to clean and organized storage, labeling and secondary containment where necessary.
- Proper communication measures for employees to initiate in the event of a spill will be created on a site by site basis. Communication procedures will be based on type and quantity of materials spilled.
- Environmental spills shall be reported to environmental authorities when required. Reporting procedures will be based on type and quantity of materials spilled.

5. TRAINING REQUIREMENTS

- Employees must be instructed on spill prevention and the proper response procedures for spilled materials. The training should include materials available for use, proper waste disposal and communication procedures.

6. REFERENCES/RELATED DOCUMENTATION

CP002 – Risk Analysis/Site-Specific Health and Safety Program

7. APPENDICES

A – Spill Prevention and Response Plan Template

Appendix A

<u>Copies of this plan are located at the facility and are available to all employees.</u>

Location(s) of plan(s): ____

<u>Facility Information</u>

Facility Name: ______________________________

Mailing Address: ________________________________

____

Physical address if different: ________________________________

____

____

Owner Name: ________________________________

Owner Address: ________________________________

____

Primary Contact Name: ________________________________

Work Phone Number: ________________________________

Home Phone Number: ________________________________

Mobile Phone Number: ________________________________

Secondary Contact Name: ________________________________

Work Phone Number: ________________________________

Home Phone Number: ________________________________

Mobile Phone Number: ________________________________

Date of Initial Operation: ________________________________

<u>Site Assessment</u>

Location - Describe where facility is located.

____

____

____

Facility Description

Facilities and Equipment (*examples are shown but complete per site description*):

____ Garage for vehicle processing
____ Parts storage
____ Manufacturing Building
____ Spill kit/emergency equipment
____ Refrigerant (Freon) extractor
____ Parts washer

Please list: ______________________________
____
____
____
____

Services:

____ Dismantler/Recycler
____ Equipment Repair
____ Moving Equipment
____ Painting/Sandblasting
____ Manufacturing

Please list: ______________________________
____
____
____

Fixed Storage - List capacity and contents of each storage container. For example, "One 6,000 gallon above ground tank containing diesel fuel." Be sure to include diesel, gasoline, waste oil, heating oil, kerosene, paint thinner and other solvents. Also describe the construction of the containers, secondary containment for each, liquid level indicators, alarms and method of corrosion protection for each container.____
____
____
____
____
____
____

Non-Fixed Storage - List capacity and contents of each storage container. For example, "One 55 gallon drum for recycled oil." Be sure to indicate what each container is used for, its condition and construction and how secondary containment is provided. ____________________________________
____
____
____

Total quantity of stored materials: - The combined quantity of the materials listed above: _________ gallons

Oil spill history

Place an X on the appropriate line and proceed accordingly.

____ There has never been a significant spill at the above named facility.

____ There have been one or more significant spills at the above named facility. Details of such spill(s) are described below. For each spill that occurred, supply the following information:Type and amount of oil spilled

- Location, date and time of spill(s)
- Watercourse affected
- Description of physical damage
- Cost of damage
- Cost of clean-up
- Cause of spill
- Action taken to prevent recurrence

____

____

____

____

Potential Spill Volumes and Rates

Fill in all applicable blanks.

Potential Event	Volume Released	Spill Rate
Complete failure of a full tank*	____ gallons	instantaneous
Partial failure of a full tank*	1 to ____ gallons	gradual to instantaneous
Tank overflow**	1 to ____ gallons	up to ____ gallons per minute
Leaking during unloading***	up to ____ gallons	up to ____ gallons per minute
Pipe failure****	up to ____ gallons	up to ____ gallons per minute
Leaking pipe or valve****	several ounces to gallons	up to ____ gallons per minute
Fueling operations****	several ounces to gallons	up to ____ gallons per minute
Oil and grease	several ounces to quarts	spotting

* Volume of largest tank

** Calculate using the rate at which fuel is dispensed from the delivery truck into your tank(s).

*** Calculate using the rate at which petroleum would be withdrawn from the tank if it should have to be emptied (*e.g.,* if it was being taken out of service).

**** Calculate based on the specifications of your equipment.

Spill Prevention and Control

Spill Prevention - Provide specific descriptions of containment facilities and practices. Include description of items such as double-walled tanks, containment berms, emergency shut-offs, drip pans, fueling procedures and spill response kits. Also, describe how and when employees are trained in proper handling procedures and spill prevention and response procedures.

Spill discharge and flow - For each potential spill source; describe where petroleum would flow in the event of a spill. For example, "The 6,000 gallon diesel tank has a pre-manufactured secondary containment system capable of holding 110 percent of the total volume of the tank" and, "A spill from engine repair would be contained inside the shop building and quickly cleaned up with oil absorbents." Incorporate site map by reference (see instructions under *Appendices*).

Spill response - Identify what equipment would be deployed by whom and in what situation. Also, include phone numbers for response agencies, *e.g.,* U.S. Coast Guard, fire department, spill response contractors, etc. A copy of your spill response plan may be attached as an appendix to this plan in lieu of completing this section.

Security - Provide a description of how all containers are protected when the facility is not in operation or unattended. Include a description of fencing, access control, gates, locks, etc. that prevent access by unauthorized individuals.

Facility Inspections

Routine Inspections - Name facilities and the frequency with which they are inspected. For example, "The fuel pumps are inspected daily. The materials storage area is inspected monthly." Describe all facility containers, piping, etc. that is to be inspected. Name the person who has responsibility to implement preventative maintenance programs, oversee on-site inspections, coordinate employee training, maintain records, update the plan as necessary, and ensure that reports are submitted to the proper authorities.

Annual Inspections - Include a description of annual comprehensive inspections. For example, "A site inspection is also conducted annually by appropriate responsible personnel to verify that the description of potential pollutant sources are accurate, that the map reflects current site conditions, and that the controls to reduce the pollutants identified in this plan are being implemented and are adequate. This annual inspection will be conducted above and beyond the routine inspections done focusing on designated equipment and areas where potential sources are located."

Record Keeping

Describe record keeping procedures. For example, "Record keeping procedures consist of maintaining all records a minimum of three years. The following items will be kept on file: current plan, internal site reviews, training records, and documentation of any spills or maintenance conducted in regards to these sites." *Maintenance Inspection, Employee Training,* and *Record Keeping* logs are included in this template for your use.

Maintenance Inspections

Maintenance Coordinator Name:

Maintenance Coordinator responsibilities include implementation of preventative maintenance programs and oversight of on-site inspections.

Use this table to record inspections:

Facility Inspected	Date of Inspection	Name of Inspector	Result Pass/Fail	Comments

Employee Training

Employee Training Coordinator Name: ____________________

Use this table to record spill prevention and response training.

Name of Employee	Date of Training	Type of Training/Topics Addressed

Record Keeping of Incidental Spills

Record Keeper Name:

Record Keeper responsibilities include maintaining records of incidents, updating the plan as necessary and ensuring reports are submitted to the proper authorities when necessary.

Incident No.	Type of Incident	Date of Occurrence	How it was Cleaned Up

Appendices

Site map - Attach a site map as Appendix A to this plan. You may attach an existing site map or create your own. If you use an existing map, be sure that the items listed below are included. If you need to create a site map, use a large enough piece of paper so all site plan elements may be seen and try to keep the map to a scale (e.g. 1” = 20’ The following instructions should guide you step-by-step. Please use a straight edge (ruler) while creating the sketch.

- The sketch should be oriented as if you were in a plane looking down on your property (an aerial view), with North at the top (draw an arrow indicating north).Draw and label all roadways surrounding the work site.
- Draw and label all facilities within the work site as close proportionately as possible.
- Draw an arrow(s) pointing in the direction of downhill flow of water when it rains.
- Draw the location and general layout of all vehicles associated with the work site.
- Label any rivers or waterways surrounding the work site.
- Draw and label all methods of entry to the work site.
- Draw and label the location of all fuel containment facilities.
- Draw and label the location of all in-place spill prevention, control and countermeasure devices.

Other attachments - List any additional information to be attached as Appendix B, C, D, etc. Label and staple the attachments to the end of this plan.

Appendix A: Site Map
Appendix B: Emergency Response Posting Locations
Appendix C: ____________________________
Appendix D: ____________________________

Management Approval

I certify that I have personally examined and am familiar with the information submitted in this document and that, based on my inquiry of those individuals responsible for obtaining this information, the information submitted is true, accurate and complete.

________________________________ _______________________

Signature *Title*

________________________________ _______________________

Printed name *Date*

Appendix B
Generic Health and Safety Plan Review Log

GENERIC HASP REVIEW LOG

Date	Reason for Review/Revision	Reviewed By	Summary of Review/Revision

Appendix C
Site-Specific Health and Safety Plan Template

SITE-SPECIFIC HEALTH AND SAFETY PLAN

[SITE NAME]
[CITY/TOWN NAME], NEW YORK [ZIP CODE]
NYSDEC Site No. [######]
Work Assignment No. D009812-[##]

Prepared for:
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, NY 12233

Prepared by:
TRC Engineers, Inc.
1430 Broadway
New York, New York 10018

TRC Project No.: [######].0000.0000

[Month and Year]

Table of Contents

List of Tables

List of Appendices

1. Site/Project Contact Information

Table 1 – Site/Project Contact Information			
Site Information			
Site Name	**Site No.**	**Address**	
[Specify]	[Specify]	[Specify]	
Client Contact			
Name	**Organization**	**Title**	**Primary Phone No.**
[Specify]	[Specify]	[Specify]	[Specify]
[Specify]	[Specify]	[Specify]	[Specify]
TRC Personnel and Project Role			
Name	**Role**	**Email**	**Primary Phone No.**
Michael Glenn	Health and Safety Officer (HSO)	mglenn@trccompanies.com	(949) 697-7418 (cell)
David Sullivan	Assistant HSO	dsullivan@trccompanies.com	(978) 758-2809 (cell)
James Magda	Contract Manager	jmagda@trccompanies.com	(315) 415-4315 (cell)
[Specify]	Project Manager	[Specify]	[Specify]
[Specify]	Office Safety Coordinator (OSC)	[Specify]	[Specify]
[Specify]	On-Site HSO	[Specify]	[Specify]
[Specify]	Field Staff	[Specify]	[Specify]
[Specify]	Field Staff	[Specify]	[Specify]
Subcontractor Information			
Company Name	**Service**	**Primary Contact**	**Primary Phone No.**
[Specify]	[Specify]	[Specify]	[Specify]
[Specify]	[Specify]	[Specify]	[Specify]
Emergency Assistance			
Service	**Name**	**Emergency No.**	**Primary Phone No**
Ambulance	[Specify]	[Specify]	[Specify]
Early Incident Intervention	WorkCare	1-888-449-7787	Not applicable
Fire	[Specify]	[Specify]	[Specify]
Hospital	[Specify]	[Specify]	[Specify]
Police	[Specify]	[Specify]	[Specify]
Poison Control Center	[Specify]	[Specify]	[Specify]
Spill	CHEMTREC	Not applicable	1-800-424-9300 (TRC No. CCN 671126)
Spill (Federal)	National Response Center	1-800-424-8802	Not applicable
Spill (State)	New York State Spill Hotline	1-800-457-7362	Not applicable

2. Medical Facility Identification and Directions

Nearest Hospital: [Specify]

Hospital Address: [Specify]

Hospital Telephone Number: [Specify]

Directions to Hospital (see attached Map):

[Insert turn by turn directions to the hospital from the site.]

Map to Hospital:

[Insert a map to the hospital from the site.]

3. Utility Clearance

Dig Safely New York and non-member utilities will be notified at least 72 hours prior to commencing any ground intrusive work. Prior to the start of work, confirmation receipts will be reviewed, and utility mark-outs will be verified.

[Add/delete/modify the following text as needed based on site conditions/scope of work - A private utility survey will be required to survey the proposed soil boring, monitoring well and test pit locations using at a minimum Ground Penetrating Radar (GPR) and Electro-Magnetic/Radio Frequency (EM/RF) Pipe, Cable and Box locator. The survey shall encompass an area extending in all directions at least 10 feet beyond each of the locations.]

[Add/delete/modify the following text as needed based on site conditions/scope of work - Any structure detected in the subsurface within 10 feet of the proposed soil boring, monitoring well and test pit locations will be identified on the ground surface with spray paint. Results of the utility survey will be reviewed in the field between TRC and the utility surveyor the same day the service is provided. Results will also be summarized in a brief utility survey report which shall be prepared by the utility surveyor and submitted to TRC. Additionally, all proposed locations will be hand-cleared prior to commencement of intrusive activities to confirm absence of underground utilities.]

Prior to the operation of any heavy equipment, the site shall be inspected for potential overhead hazards (e.g., wires, tree branches, etc.). A minimum clearance of 10 feet must be maintained between equipment and overhead utility lines. If contact is possible (i.e., equipment, drill rig, excavator, etc.) one or more of the following will be done: 1) Power sources will be disconnected by the utility; 2) Power sources will be shielded by the utility; 3) Object will get no closer than 10 feet to prevent arcing, unless site specific conditions or weather conditions warrant greater separation per best professional judgment, or as directed by utility representatives; and, 3) Evaluate the need for shielding and coordinate with local utility representatives.

4. Scope of Work Summary

[Summarize the specific scope of work to be completed from the approved Work Assignment Package in paragraph and/or bulleted text. Provide enough detail so the reader is knowledgeable with the Scope of Work, project objectives, and field means/methods.]

5. Hazard Assessment

This Health and Safety Plan (HASP) assumes that an ongoing hazard assessment process with the HSO (or his/her designee), Project Manager, OSC and field staff (including the On-Site HSO) will take place regularly (via meetings/teleconferences), supplemented by as needed communication on project safety needs, to ensure the project work is conducted at a high level of technical excellence both safely and efficiently. Where the on-going hazard assessment indicates the presence of hazards, tasks, or other activities that are not adequately covered by the HASP and supporting documentation and/or staff training levels, supplemental planning will be conducted and documented in a revised or higher-level HASP document and appropriately trained personnel assigned.

5.1 Chemical Hazards

The following contaminants are known and/or suspected to be present at the site:

[Insert bulleted list of contaminants.]

TRC also anticipates the presence of the following chemicals in laboratory bottles used as sample preservatives: [specify]. In addition, TRC anticipates the use of methyl alcohol (methanol) during decontamination procedures. Safety Data Sheets (SDS) for preservatives and decontamination products are provided in **Appendix A**. Sample bottles containing hazardous preservatives will be handled with care. Sample bottles will be checked for leaks and lids tightened. Cut resistant and chemical resistant gloves and safety glasses will be worn at all times when handling sample bottles (see Section 5.2 for information concerning edges and material handling).

Isobutylene may be used for brief periods each work day to calibrate a photoionization detector (PID). One hundred parts per million (ppm) isobutylene will be primarily contained in a Tedlar® bag. Any gas that is released to the air will quickly disperse and will not pose a threat to on-site workers. No further monitoring is required for isobutylene

5.2 Physical Hazards

Physical hazards that may be encountered at the site are outlined below. If hazards are identified by the ongoing hazard assessment process, which are not address by this HASP, work shall be stopped and the HSO (or his/her designee), Project Manager, OSC or On-Site OSC, as appropriate, shall be contacted to determine if additional safety procedures and programs should be employed at the site.

[Add physical hazards to or delete physical hazards from the list below, as appropriate]

Dust – When conducting any ground disturbing activities, be cognizant that the dust has potential to contain hazardous chemicals and should not be inhaled. Whenever possible dust reduction by wetting shall be used. If dust is billowing, wetting the area, letting the dust settle, working from an upwind direction, and/or respirator with P100 cartridges (with proper fit test, training and medical monitoring) is recommended to reduce exposure.

Edges/Material Handling – Cut resistant gloves are required to be worn at all times while performing tasks that have the potential for hand injuries. A glove selection guideline is presented in **Appendix B**.

Excavations – Stay clear of excavation walls. TRC personnel will not enter an excavation, in accordance with 1926 Sub Part P. Subcontractor must provide a competent person on site, if one is required by the planned activities. Side cuts should conform to 1926 Subpart P requirements, or shoring should be used. All open excavations should be secured using traffic cones, barrier tape, or barricade signs stating "Do Not Enter Excavations", especially if left open overnight. See **Appendix C** for an Excavation Hazard Recognition Guide for Trenching and Shoring and Site Assessment Questions to facilitate your understanding of potential hazards and other guidance.

Ground Fault Circuit Interrupters (GFCI) and Electrical Cords – GFCIs will be used on all 120 volt, single phase, 15 and 20-ampere receptacle outlets when electrical equipment is used on-site. Electrical cords will be inspected for cracks, tears, or general wear to the outer protective casing. If the wiring of the cord is exposed, the cord will be repaired, if possible, or discarded. All extension cords will contain a grounding prong. If the grounding prong is missing, or if the cord was designed to contain only two prongs, the cord will not be allowed for use. These cords are dangerous and cannot be grounded through the use of a GFCI.

Hand Tools – Use only the appropriate tool for the task at hand. Use the tool(s) as designed, described, and intended by the manufacturer. Hand tools will meet the manufacturer's safety standards. Hand tools will not be altered in any way. Makeshift tools will not be used. At a minimum, hand and eye protection will be used when working with hand tools (see glove selection guide provided herein). Wrenches, including adjustable, pipe, end and socket wrenches, will not be used when jaws are sprung to the point that slippage occurs. Impact tools such as drift pins, wedges and chisels, will be kept free of mushroom heads. Wooden handles will be free of splinters or cracks and secured tightly to the tool. At all times use appropriate hand protection when utilizing hand tools.

Heavy Equipment/Drill Rigs – Use caution around drill rigs, construction equipment, and open excavations. Ensure the equipment operator is aware of the location of on-site personnel at all times to avoid potential injuries (e.g., maintain eye contact with the equipment operator). A spotter should be used to direct the movement of heavy equipment. A swing zone should be established with cones behind any excavators to prevent injury during movement of equipment. Exercise caution and wear protective equipment as noted herein around the equipment to guard against crushing and pinching hazards. On-site personnel will maintain a distance (approximately 10 feet) from mechanical hazards associated with heavy equipment. All field team members working near or with equipment with emergency shut-off switches should be aware of the locations and situations when these switches should be used.

Hostile Individual(s) – Most personnel who are encountered during work will not be hostile, however if a hostile individual is encountered you should not confront them. You should back away and go to your vehicle or other safe location where you can isolate yourself from the hostile person(s). Once safe, if you are continuing to be harassed you should contact the local police for assistance. Contact the Project Manager or OSC once the situation is safe and under control.

Hunters/Firing Range, etc. – Be aware of surrounding activities that may involve hunting, firearms, etc. that may not be in your immediate area, but could be create an unsafe work environment.

Lighting – There are areas/time within the work area(s) at the site which will potentially have little to no lighting. Lighting shall be utilized to make the work area and nearby hazards are illuminated. If gasoline powered equipment must be used to power portable lights, the generator shall be placed outside in a well ventilated area.

Manual Lifting – Improper lifting can lead to a variety of injuries including back strains, muscle pulls and joint damage. It is important for all personnel to understand proper lifting techniques and to utilize safe lifting procedures when handling materials. Generally, no one person should lift more than 50 pounds without assistance. Mechanical means should be used whenever possible.

Noise – Hearing protection must be worn when noise levels exceed 85 dBA in the work area. If you need to raise your voice to be heard at the work site, then hearing protection should be worn. Hearing protection will be worn near drill rigs.

Power Tools – All power tools will be inspected regularly (at least on a daily basis) and used in accordance with the manufacturer's instructions and its capabilities. Electrical tools will not be used in flammable areas, unless they are approved for that purpose. Portable electric tools will be used only with a GFCI. Proper hand, eye and hearing protection will be used when working with power tools and all appropriate safety guards must be in place. Personnel will be trained in the proper use of the specific tool. Any defective power tools will be immediately tagged and removed from service. Tools will be stored properly after use.

Pressurized Fluids/Gases – All compressed gases are hazardous due to the high pressures inside the cylinders. Even at a relatively low pressure, gas can flow rapidly from an open or leaking cylinder. Damaged cylinders can become projectiles resulting in severe injury and property damage. An unsecured or uncapped cylinder can become a cause of a major accident. Cylinders shall be secured when not in use, in transport, and as much as possible when in use.

Slips, Trips and Falls – Be aware of uneven ground and buried debris (e.g., metal, plastic, etc.) to avoid potential slip/trip/fall hazards, and use caution near open excavations. Maintain good housekeeping practices to minimize physical hazards.

Traffic Hazards – Driving to and from the site each day is considered a physical hazard. Directions and travel time to the site should be determined in advance (a.k.a. Journey Management Planning) and adequate time should be allocated to drive safely. The use of cellular phones is prohibited, and distracted driving should be avoided. Seatbelts shall be worn at all times while the vehicle is moving. Use caution around traffic flow. Ensure proper traffic control (e.g., signs, traffic cones, barriers, etc.) are in place prior to and throughout the work day where work takes place in or near traffic. Work personnel must wear ANSI-rated class 3 reflective traffic vests at all times. A site-specific traffic management plan describing procedures to be employed, including barriers, signage, etc., will be used for each drilling location.

Utilities – Dig Safely New York and non-member utilities must be notified at least 72 hours prior to commencing any intrusive activities. Use extreme caution when operating heavy equipment near utilities. Excavation and drilling locations will be selected that are located at safe distances from utility hazards. Prior to the operation of any heavy equipment, the site shall be inspected for potential overhead hazards (e.g., wires, tree branches, etc.). A minimum clearance of 10 feet must be maintained between equipment and overhead utility lines. If contact is possible (i.e., equipment, drill rig, excavator, etc.) one or more of the following will be done: 1) Power sources will be disconnected by the utility; 2) Power sources will be shielded by the utility; 3) Object will get no closer than 10 feet to prevent arcing, unless site specific conditions or weather conditions warrant greater separation per best professional judgment, or as directed by utility representatives; and, 3) Evaluate the need for shielding and coordinate with local utility representatives.

Weather – Heat and cold stress are a potential concern for on-site workers. Take breaks as needed to cool down, replenish fluids and/or warm up. Please refer to **Appendix D** for the signs, symptoms and precautions for cold and heat stress. Work may occur during a time of year when thunderstorms are possible/likely. If thunder or lightning is noted by onsite personnel, work will cease until the storm passes (thunder and/or lightning ceases and is not observed over at least a 30-minute period). Personnel will seek shelter in buildings or vehicles.

Working Over/Near Water – All workers working over/near water will be required to wear a Type I, II, or III Personal Floatation Device (PFD). When continuous fall protection is used (without exception) to prevent employees from falling into the water, the drowning hazard has effectively been removed. Therefore PFDs are not required when utilizing continuous fall protection.

5.3 Biological Hazards

[Add biological hazards to or delete biological hazards from the list below, as appropriate]

Biological Waste – This includes feces, urine, needles/sharps and other materials which may contain biological matter from humans or animals. This material should be avoided and not handled in any way. If biological waste impedes the planned scope of work the Project Manager or OSC should be contacted to discuss appropriate actions.

Blood-Borne Pathogens – Injuries received in the field may require assistance from a field team member with appropriate first aid/first responder training to perform first aid. Contact with blood and certain body fluids can contain pathogens that may be transmitted by contact with an open wound by the caregiver. The following precautions should be used when giving first aid:

- Use nitrile gloves to avoid contact with blood/fluids. Spent bandages and gloves used to perform first aid should be placed in a plastic bag and properly disposed.
- Blood/fluid should be cleaned from surfaces that may be contacted by other individuals.
- Use an appropriate barrier if required to perform rescue breathing.

Ticks **-** Ticks generally favor areas of high grass and dense vegetation so to the extent possible, these areas should be avoided. It is advisable when entering these areas to tuck pants into socks and to wear a light colored long sleeve shirt to help spot ticks before they bite. DEET-based insect repellents may be worn to repel ticks but hands should be washed thoroughly after use and DEET should not be sprayed directly onto the skin surface. Self-checks should be made frequently and at least at the end of the field day for ticks when working in or near vegetated areas.

If discovered, the tick should be removed with a pair of tweezers and saved in a sealed plastic bag. Sometimes, tick bites occur but the tick may not stay attached, followed by a rash developing in the area within a few days of the bite**. If bitten by a tick or a bulls-eye like rash develops, it is advisable to consult WorkCare**.

Spiders – Spiders typically seek cover in dark protected areas. Common areas where spiders may be encountered are heavy vegetation and trees. Spiders also are found in basements and enclosed spaces such as sheds, protective well covers, etc. Spider bites may cause swelling, pain and respiratory problems. Avoid dense vegetation, and use caution when sampling in dark poorly illuminated locations. If bitten, wash the area and use ice on the bite area to reduce swelling. If respiratory stress, significant pain or swelling is noted, or discoloration around the bite area occurs, seek immediate medical attention.

Stinging Insects – Like spiders, wasps and yellow jackets often nest in dense vegetation and in the ground, or in protective casings on monitoring wells and shielded gate locks. A sting from these insects can cause pain, swelling, and respiratory problems that may be life-threatening to certain individuals. If stung, remove stinger (if present) using tweezers, or similar, and wash the area and use ice on the sting area to reduce swelling. If respiratory stress, significant pain or swelling is noted, or discoloration around the sting area occurs, seek immediate medical attention.

Dogs and Wild Animals – Dogs often are not leashed and may be unfriendly. Bites from dogs and wild animals can cause infections or transmit disease. In general, it is best to not approach dogs even if they appear to be friendly, and wild animals should never be approached. If bitten, the area should be washed with soap and water. If the bite resulted in puncturing or tearing of the skin, the wound should be covered with a sterile dressing and medical attention should be sought immediately. A description of the dog should be noted and if possible, the dog's owner.

Plants – There are many types of plants which can cause irritation or allergic type reactions. Examples of some encountered on TRC sites include the following:

Poison Ivy **–** the trademarks of this plant are its solid green, pointed leaves that hang from the stem in groups of three. It grows as both a vine and a shrub. The look of poison ivy can change with the seasons. It produces yellow-green flowers in the spring and its green leaves can change to yellow and red in autumn.

***Wild Parsnip/Giant Hogweed* –** Both plants are part of the carrot family and can grow up to 15 feet tall. They look similar to giant Queen Anne's lace with bristly stalks. Contact with the sap from the plant can cause phytophotodermatits or irritation (sometimes severe) when skin is exposed to sunlight.

Pandemic Preparedness – A "pandemic" refers to an epidemic that has spread over several countries or continents, usually impacting a large number of people. A pandemic has the potential to significantly impact routine services. A pandemic disease presents a serious health risk and could prevent TRC from performing project-related tasks. The risk to employee health and the business will vary based on the geographic area of the pandemic and the potential severity of the disease. Pandemic risk assessments will be performed by the TRC Corporate Safety team who will provide direction to field personnel.

TRC will follow health and travel precautions issued by the respective authorities. Employees should stay at home when sick or otherwise experience symptoms that are consistent with the pandemic disease. When at a project site, infection control measures should be enacted, which are essential components of pandemic management and a component of public health measures. These essential measures include:

- Practice frequent hand washing. According to the CDC, washing hands with soap and water is the best way to get rid of germs in most situations. If soap and water are not readily available, you can use an alcohol-based hand sanitizer that contains at least 60 percent alcohol. You can tell if the sanitizer contains at least 60 percent alcohol by looking at the product label.
- Obtain immunizations recommended by healthcare providers to help avoid disease.
- Practice social distancing to increase the space between employee work areas and decreasing the possibility of contact by limiting large or close contact gatherings and avoid shaking hands.
- Frequently disinfect all areas that are likely to have frequent hand contact (like doorknobs, faucets, handrails, etc.).

5.4 Radiological Hazards

[Add radiological hazards to or delete radiological hazards from the list below, as appropriate]

No radiological hazards are expected at the site. If any new condition is encountered during this activity, the HASP will be adjusted accordingly.

Radiation (ionizing) – Exposure to ionizing radiation can be controlled by one of three methods. Time, distance, or shielding. Limit your time near the radioactive source. Keep your distance from the radioactive source. Shield yourself from the radioactive source with appropriate shielding material. If the radioactive source(s) are from TRC equipment, the TRC employee using the equipment needs required training to use the equipment, and must be monitored using a dosimeter badge. Update contact information for TRC subject matter expertise and regulatory authorities.

X-Ray Fluorescence Instruments (a.k.a., XRF Guns) – XRF units for field metals analysis are only to be used by trained employees with radiation safety training. Licensing requirements can vary by state. Coordinate with the TRC Corporate Safety team before utilizing in the field to set up dosimetry protocols and instrument specific safety procedures.

6. Personal Protection Monitoring

Personal Protection Monitoring Equipment and Use Recommendations: The following table outlines monitoring equipment needs and rationale. Note that an upgrade to a higher level of respiratory protection (C or higher) will warrant revision or addendum to this HASP and consultation with the TRC Corporate Safety team before work recommences.

[Add/delete/modify Instruments, Use Codes, Action Levels and Notes/Rationale, as appropriate]

Table 2: Monitoring Equipment Use Recommendations

Instrument	Use Code	Action Levels	Notes/Rationale
PID	C	5 ppmv*	Recommended for VOC screening to monitor airborne VOC concentrations in breathing zone levels. If PID readings are sustained above 5 ppmv in the breathing zone for at least 5 minutes, move to an upwind location for 15 minutes. After 15 minutes, measure again. If PID readings are still above 5 ppmv in the breathing zone, contact the Project Manager or OSC to evaluate suitable response actions. Any upgrade in respiratory protection will be coordinated with the TRC Corporate Safety team. Withdraw from area if PID readings exceed 50 ppmv.
TSI Dustrak™ (or equivalent)	C	> 150 µg/m3; 15 minute average**	Used where contaminants could adhere to fugitive dust, and where fugitive dust migration could potentially serve as a significant exposure pathway. Half-faced APR for particulates to be used intermittently/temporarily where dust control measures cannot maintain dust levels below action level. Use is optional for dust levels below the action level. Use of a half-face APR for dust does not require CIH approval where dust action level excursions are limited in duration, and where

Table 2: Monitoring Equipment Use Recommendations			
Instrument	**Use Code**	**Action Levels**	**Notes/Rationale**
			dust control measures will be implemented until below the action level. However, personnel must be medically qualified, fit tested for half-face APR use, and trained in the use of the APR.
O^2/LEL	C	19.5%	Recommended for landfill, lagoon, excavation, sewer, and anaerobic degradation site work. Required for confined space work.
H_2S Meter	C	1 ppm	Recommended for landfill, lagoon, excavation, sewer, and anaerobic degradation site work. Required for confined space work.
CO	C	25 ppm	½ of the PEL (PEL = 50 ppm)
CGI	C	10% LEL	Recommended safe level to prevent explosive conditions.
MINIRAM (or equivalent)	O		Supplement operation of Dustrak™ stations for work near sensitive receptors.
Radiation meters	N/A		Not known or anticipated to be a Contaminant of Concern.
[Specify]	[Specify]	[Specify]	Coordinate all additional instrumentation with the OSC.

Notes:
* Site/project specific action levels for VOCs may be established in consultation with the OSC.
** Above background upwind levels

PID – Photoionization detector
H_2S – Hydrogen Sulfide
CGI – Combustible Gas Indicator
APR – Air Purifying Respirator
µg/m3 – micrograms per cubic meter
LEL – Lower Explosive Limit
CO – Carbon Monoxide
VOC – Volatile organic compound
CIH – Certified Industrial Hygienist
O_2 – Oxygen
ppm – Parts per Million
ppmv – Parts per Million Volume
PEL – Permissible Exposure Limit

Use Codes: R – Required, C – Condition specific, O – Optional, N/A – Not applicable

Personal Protection Monitoring Procedures: When necessary, the OHSO will measure organic vapor concentrations in the breathing zone using a PID. Fugitive dust emissions are not anticipated to be a concern. When required, air monitoring for dust will be performed using a combination of real-time dust monitoring upwind and downwind of the work area, and at a point near the closest receptor.

Personal Protection Exposure Limits: The following table summarizes anticipated concentrations and accepted exposure limits of chemicals potentially present within the work site.

[Add/delete/modify Chemical of Concern, Detected Concentrations, OSHA PEL/ACGIH TLV, On-Site Usage and Potential Exposures and Control Methods as appropriate]

Table 3: Summary of Exposure Limits – Known or Suspected Site Impacts		
Chemical of Concern	**Detected Concentration**	**OSHA PEL/ACGIH TLV**
Volatile Organic Compounds (VOCs)	Unknown	200 ppm (OSHA PEL for PCE) 200 ppm (OSHA PEL for TCE) 200 ppm (OSHA PEL for DCE)
Semi-volatile Organic Compounds (SVOCs)	Unknown	0.2 mg/m^3 (OSHA PEL for PAHs)
Polychlorinated Biphenyls (PCBs)	Unknown	1,000 µg/m^3 (OSHA PEL for PCBs containing 42% chlorine) 500 µg/m^3 (OSHA PEL for PCBs containing 54% chlorine)
Metals	Unknown	50 µg/m^3 (OSHA PEL for lead) 10 µg/m^3 (OSHA PEL for arsenic) 0.2 mg/m^3 (OSHA PEL for cadmium) 0.5 mg/m^3 (OSHA PEL for chromium) 0.2 mg/m^3 (OSHA PEL for selenium) 0.01 mg/m^3 (OSHA PEL for silver) 0.5 mg/m^3 (OSHA PEL for barium) 1.0 mg/10m^3 (OSHA PEL for mercury)
[Specify]	[Specify]	[Specify]

Notes: Exposure and hazard data obtained from the NIOSH Pocket Guide to Chemical Hazards unless otherwise noted.

ppm – parts per million
OSHA – Occupational Safety and Health Administration
PCE – Tetrachloroethene
DCE – Dichloroethene
µg/m3 – micrograms per cubic meter
TLV – Threshold Limit Value
PEL – Permissible Exposure Limit
TCE – Trichloroethelene
PAHs – Polycyclic aromatic hydrocarbons

Table 4: Preservatives and Decontamination Products		
Chemical of Concern	**On-Site Usage and Potential Exposures**	**Control Method**
Hydrochloric Acid (HCl)	Less than 20 ml quantities used for sample preservation. Air phase exposure is expected to be minimal and incidental to sample containerization.	5 ppm (OSHA PEL)
Methyl Alcohol (methanol; MeOH)	Less than 20 ml quantities used for sample preservation. Air phase exposure is expected to be minimal and incidental to sample	200 ppm (OSHA PEL)

Table 4: Preservatives and Decontamination Products		
Chemical of Concern	**On-Site Usage and Potential Exposures**	**Control Method**
	containerization.	
Nitric Acid (HNO_3)	Less than 20 ml quantities used for sample preservation. Air phase exposure is expected to be minimal and incidental to sample containerization.	5 mg/m3 (OSHA PEL)
Isobutylene	100 ppm gas for use during calibration of PID instruments.	No specific exposure limits for isobutylene (simple asphyxiant). Maintain oxygen levels above 19.5%. Before attaching regulator to cylinder, verify that the regulator is off. Before opening regulator, make sure that tubing connecting regulator to monitoring device/ Tedlar® bag is secure. To use a Tedlar® bag, put bag control valve in an open position and close after filling. Before disconnecting gas from the instrument and/or Tedlar® bag, verify the regulator is closed. Empty bag of contents after calibration in a downwind position and/or to avoid inadvertent inhalation.

Notes:

ppm – parts per million
ml – milliliters
PID – Photoionization Detector
OSHA – Occupational Safety and Health Administration
PEL – Permissible Exposure Limit

7. Personal Protective Equipment

[Add/delete/modify Item and Notes/Rationale, as appropriate]

TRC personnel will use Level D PPE as noted/modified below:

Table 5: Level D Personal Protective Equipment

Item	Rationale/Notes
Hardhat	American National Standards Institute/International Safety Equipment Association (ANSI/ISEA) Z89.1-2009 rated hard hats will be worn by personnel at all times when overhead hazards are present, including electrical.
Hearing protection	Hearing protection will be worn by all personnel exposed to at least 85 dB of sound during the workday. A good rule of thumb to use in determining whether background noise is 85 dB or higher is if you must shout to be understood by somebody about one arm-length away, that background noise is hazardous.
Safety boots (steel or composite toe and shank)	Electrical Hazard (EH) rated safety-toe safety boots will be worn by all personnel during project work described in this HASP.
Eye protection (safety glasses)	ANSI rated eye protection (Z87 or Z87+) is required to be worn at all times when onsite or when personnel are exposed to flying debris, chemical vapors or particulates. Chemical splash goggles will be worn for protection against chemical gases, vapors or particulates. Safety glasses will be worn for protection against flying objects.
Safety vest	ANSI Class 2 safety vest is required at all times when onsite. Utilize in areas in or near vehicular traffic of any kind on or off property.
Chemical Protective Clothing (CPC) and Gloves	CPC and gloves will be inspected according to TRC's Personal Protective Equipment Program. CPC will be chosen with assistance from the OSC according to the chemical hazards present. Gloves are to be changed between samples to avoid cross-contamination.
Cut resistant work gloves	As indicated herein, use Cut and Abrasion Resistance Level 2 to Level 4 gloves when necessary for hand protection during field tasks. See **Appendix B** for a Glove Selection Guide**.** ***Leather work gloves are expressly prohibited.***
Electrical Safety	8 cal/cm^2 Flame Resistant (FR) clothing
Personal Floatation Device (PFD)	Type I, II, or III PFD is required to be worn at all times when working over/near water.

A basic first aid kit will be readily available on-site in the event of an emergency.

Fire extinguishers should be present within 50 feet of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used at the site, including operational equipment. All personnel working on or around the equipment should know the location of and how to operate the fire extinguisher. Ensure the fire extinguisher is in working order by checking the manufacture and/or most recent inspection dates.

8. Personnel and Equipment Decontamination Plan

At minimum, personnel and equipment decontamination will include the following:

Equipment Decontamination: There is a possibility that site media contacted during work activities contain compounds described in **Table 3**. All equipment that comes in contact with media needs to be decontaminated before it is removed from the job site. To properly decontaminate equipment that comes in contact with media, the following procedure should be followed:

- Brush accumulated material off equipment that has come in contact with impacted media. The material shall be returned to the location from which it came or disposed of properly;
- Wipe parts of the equipment that came in contact with the media down with cloth, rags or heavy-duty paper towel damp with non-phosphate concentrated laboratory-grade soap (i.e. Alconox© or Liquinox©);
- Follow up with a wipe from a separate cloth, rags or heavy duty paper towel damp with potable water; and
- PPE and cloth, rags or heavy duty paper towels can be disposed of in the regular waste stream.
- If equipment becomes grossly impacted with site media, equipment shall be steam cleaned over a decontamination pad.

Personnel Decontamination: In general, contamination of personnel shall be prevented through the use of PPE. At minimum, nitrile gloves shall be worn during contact with impacted material or chemical in addition to other Level D PPE.

9. Required Personnel Training

TRC field personnel will have the training outlined below before on-site work activities:

Table 6: Project Training Requirements				
(* required for all sites; but minimum recommended) Check "A" if training required for everyone, and check "T" if training required for specific task or per notations.				
A	**T**	**Subject**	**Reference**	
			29 CFR 1910	**29 CFR 1926 or Other**
☒	☐	HAZWOPER 40 hour*	1910.120	1926.65
☒	☐	3-Day HAZWOPER Supervised On-site*	1910.120	1926.65
☒	☐	8-Hour HAZWOPER Refresher*	1910.120	1926.65
☐	☒	8-Hour Supervisor HAZWOPER*	1910.120	1926.65
☐	☒	First Aid, CPR[*,1]	1910.151	1926.23,.50
☒	☐	Hazard Communication (HAZCOM)	1910.1200	1926.59
☐	☒	DOT/IATA Shipping Training	1910.1201	49 CFR 172.704
☐	☐			
☐	☐			
☐	☐			
Client-specific training:_______________ ☐ Not Applicable ☐ Specify				
Client-specific training:_______________ ☐ Not Applicable ☐ Specify				
Client-specific training:_______________ ☐ Not Applicable ☐ Specify				
Note: 1 Per the TRC Health and Safety Policy and Procedure Manual, each TRC project will have at least one certified CPR/first aid trained person on site at all times. All Project Managers and anyone acting as the on-site Health and Safety Officer must be current in First Aid/CPR.				

Project training requirements beyond those provided in the above table will require a HASP revision/upgrade or concurrence of the TRC Safety Director or ECR Safety Manager.

10. Medical Monitoring

Medical monitoring will apply routinely to all employees who are or may be exposed to hazardous substances or health hazards at or above the established permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year (40 CFR 1910.120[f][2][i]). Said TRC field personnel will have the medical surveillance outlined in the table below prior to commencing on-site work activities.

Table 7: Medical Surveillance Required			
*Baseline is minimum recommended.			
	29 CFR 1910	**29 CFR 1926 or Other**	**Notes**
☒ HAZWOPER Physical - Baseline*	1910.120	1926.65	
☒ HAZWOPER Physical – Annual	1910.120	1926.65	
☐ HAZWOPER Physical - Biennial*	1910.120	1926.65	
Client-specific drug testing[1]	☐ Not Applicable ☐ Specify		
Client-specific medical monitoring[1]	☐ Not Applicable ☐ Specify		
Site-specific medical monitoring:	☐ Not Applicable ☐ Specify		
Note: [1] Client required drug testing or medical monitoring should be coordinated through the Project Manager.			

TRC has a Drug and Alcohol-Free Workplace Policy (TRC Academy Course #900013753). TRC may require employees or subcontractors to be tested upon reasonable suspicion, following accidents or incidents during work activities, or during travel to or from a project site. Client policies may be stricter in regard to procedures following an accident. Project Managers must be aware of these and inform employees and subcontractors of any additional requirements.

11. General Safety Requirements

The general safety rules listed below apply to all TRC personnel present at the site.

- A tailgate health and safety meeting will be held with all field team members each day prior to the start of work, the start of a new shift, upon changing of work conditions or job task duties, or when new field team members arrive onsite.
- Adhere to all requirements of this HASP.
- Wear protective clothing appropriate for the designated level of protection and decontaminate before entering clean areas when applicable.
- Use safety equipment in accordance with OSHA guidance and labeling instructions.
- Maintain safety equipment in good condition and proper working order and make sure that the equipment is calibrated prior to use.
- Immediately report unsafe acts or conditions to the Project Manager and OSC.
- Eating, drinking, and smoking are prohibited on site, except in designated areas.
- Maintaining a position upwind from intrusive activities is encouraged.
- The emergency shutoff switch should be demonstrated to be working prior to initiating drilling.
- An adequately stocked first-aid kit will be maintained at the work site.

12. Tailgate Safety Meetings

- A tailgate safety meeting will be conducted daily prior to commencement of the work day, the start of a new shift, upon changing of work conditions or job task duties, or when new field team members arrive onsite (see checklist provided in **Appendix E**).

- Topics covered by the tailgate safety meeting will include, but not be limited to, scope of work and who will conduct each task, potential hazards, weather forecast, PPE, emergency procedures and the route to the medical facility, site conditions and features, and, communication guidelines related to stakeholder engagement and visitors.
- Safety meetings must also be held to address modifications to this HASP and any addenda prepared to supplement the HASP.
- Subcontractors and personnel present at the tailgate safety meeting shall be required to sign an acknowledgement form after each meeting.

13. Emergency/Contingency Plan

Before commencing any on-site operations, the TRC OHSO will advise all personnel of potential emergencies. Personnel will be advised on their roles in the event of an emergency, and the steps to take for a timely and controlled response.

Communication networks/chain of command – All on-site personnel will communicate any accident, injury or near miss to the TRC OHSO who will provide instruction on how to proceed further.

First Aid / Safety Equipment – First aid equipment should be readily available in the event of an emergency. First aid equipment should include a well-stocked first aid kit, fire extinguisher and emergency eye wash.

Evacuation Plans and Refuge Area – All personnel should safely remove themselves from danger in the event of an emergency and safely access the refuge area. The refuge area should be in an upwind location a safe distance from the work zone. The refuge area will be determined during the daily safety briefing.

Notifications of Fire, Police and Emergency Facilities – In the event of an emergency that cannot be controlled by on-site personnel, the appropriate emergency contact shall be notified. All personnel shall remove themselves from the area of danger and wait for the arrival of help in the predetermined refuge area.

Non-Emergency Medical Assistance – If an injury does occur and it is not life threatening, then the employee or employee's supervisor/project manager should contact WorkCare as soon as possible, but within the first hour after an injury. WorkCare information is proved in **Appendix F**. This information will help assist the injured employee by connecting them with instant access to a medically qualified professional in order to provide guidance on appropriate first aid measures and medications.

14. Stop Work

TRC personnel are all empowered, responsible, authorized and obliged to stop work at any time we feel that our safety or the safety of others is, or could be, compromised. When a stop work occurs the Project Manager and/or OSC should be contacted to discuss the reason for the stop work and the corrective action(s) needed to resume work safely. Work on an activity shall not continue until the unsafe condition has been corrected.

15. Safe Catches

A "Safe Catch" is a potential hazard or incident that has not resulted in any personal injury. Unsafe working conditions, unsafe employee behaviors, improper use of equipment or use of malfunctioning equipment have the potential to cause work related injuries. It is everyone's responsibility to report and/or correct these potential incidents immediately. Please complete the form provided in **Appendix G** as a means to report these "Safe Catch" situations and submit to your local OSC Representative and Mike Glenn, National Safety Director.

16. Observations

Note that the Project Manager and/or OSC may notify field staff that their site activities may be the subject of Safety Observation, an integral part of the continuous improvement safety culture promoted at TRC. If subject to an observation, please note the following:

- The Observation will tend to focus on the highest risk activity (as a general example, drilling in a public right-of-way).
- Follow-up observations may need to occur on previous observations, depending on prior data collected.
- The observer's preparation before visiting the site will be a review of the HASP, JSAs, client-specific requirements, etc., and a review of the work scope with the Project Manager to ensure the context of the work is well understood in advance.
- Review items may include PPE, body use and positioning, work environment, operating procedures, and tools and equipment.
- The observation should last between 30 and 60 minutes.

Both positive and negative observations are candidates for documentation and later discussion. The overarching goals are to identify and correct questionable practices and to identify and promote good, safe and efficient practices. It is a data gathering process that will allow TRC safety specialists to identify root causes for safety issues in both categories to better inform policy decisions.

17. Incident Reporting

In case of an incident, TRC personnel must report the incident immediately to their project manager/supervisor and/or OSC as well as the client's representative and follow the TRC Incident Response and Reporting Process (see **Appendix H -** In Case of Emergency and Incident Reporting). Required Incident Notification or Auto Incident Report forms must be completed within 24 hours following the incident. If neither is available, the incident shall be reported to the TRC Safety Director. Incident/injury/exposure information must be recorded per TRC policy and will be the basis of any incident investigations.

18. Job Safety Analysis

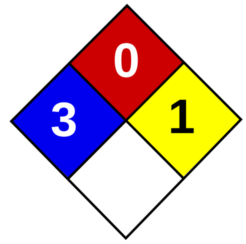
It is anticipated that the standard operating procedures (SOPs) detailed in the Generic Field Activities Plan (FAP) will be utilized for all work practices. If site specific activities require additional or alternate procedures, TRC will assess the task hazards and controls using separate job safety analysis forms (JSAs). Prior to use in the field, JSAs will be reviewed and approved by the TRC Project Manager and OSC. JSA forms can be found in **Appendix I**.

19. Acknowledgement

All TRC personnel operating under this HASP must read the HASP and sign the acknowledgment page in **Appendix J**.

Figure 1
Site Layout

Appendix A
Safety Data Sheets



Health	3
Fire	0
Reactivity	1
Personal Protection	

Material Safety Data Sheet
Hydrochloric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrochloric acid

Catalog Codes: SLH1462, SLH3154

CAS#: Mixture.

RTECS: MW4025000

TSCA: TSCA 8(b) inventory: Hydrochloric acid

CI#: Not applicable.

Synonym: Hydrochloric Acid; Muriatic Acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

Toxicological Data on Ingredients: Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth. Repeated or prolonged exposure to the substance can produce target

organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Non combustible. Calcium carbide reacts with hydrogen chloride gas with incandescence. Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine. Rubidium acetylene carbides burns with slightly warm hydrochloric acid. Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved. Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammble gas. Cesium acetylene carbide burns hydrogen chloride gas. Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute. Reacts with most metals to produce flammable Hydrodgen gas.

Special Remarks on Explosion Hazards:

Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl4 Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca3P2 Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO4 Hexalithium disilicide H2SO4 Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U3P4 , Vinyl acetate. Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
CEIL: 5 (ppm) from OSHA (PEL) [United States] CEIL: 7 (mg/m3) from OSHA (PEL) [United States] CEIL: 5 from NIOSH CEIL: 7 (mg/m3) from NIOSH TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)] TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pungent. Irritating (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point:
108.58 C @ 760 mm Hg (for 20.22% HCl in water) 83 C @ 760 mm Hg (for 31% HCl in water) 50.5 C (for 37% HCl in water)

Melting Point:
-62.25°C (-80°F) (20.69% HCl in water) -46.2 C (31.24% HCl in water) -25.4 C (39.17% HCl in water)

Critical Temperature: Not available.

Specific Gravity:
1.1- 1.19 (Water = 1) 1.10 (20%and 22% HCl solutions) 1.12 (24% HCl solution) 1.15 (29.57% HCl solution) 1.16 (32% HCl solution) 1.19 (37% and 38%HCl solutions)

Vapor Pressure: 16 kPa (@ 20°C) average

Vapor Density: 1.267 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 to 10 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water

Incompatibility with various substances:
Highly reactive with metals. Reactive with oxidizing agents, organic materials, alkalis, water.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Reacts with water especially when water is added to the product. Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C. Sodium reacts very violently with gaseous hydrogen chloride. Calcium phosphide and hydrochloric acid undergo very energetic reaction. It reacts with oxidizers releasing chlorine gas. Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates. Reacts with most metals to produce flammable Hydrogen gas. Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalies (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure) Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid. Adsorption of Hydrochloric Acid onto silicon dioxide results in exothmeric reaction. Hydrogen chloride causes aldehydes and epoxides to violently polymerize. Hydrogen chloride or Hydrochloric Acid in contact with the folloiwng can cause explosion or ignition on contact or

Special Remarks on Corrosivity:

Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinium, tantalum, silver, and certain alloys are exceptions). It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys. No corrosivity data on zinc, steel. Severe Corrosive effect on brass and bronze

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
Acute oral toxicity (LD50): 900 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse]. Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, . Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Doses (LDL/LCL) LDL [Man] -Route: Oral; 2857 ug/kg LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (fetoxicity). May affect genetic material.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Corrosive. Causes severe skin irritation and burns. Eyes: Corrosive. Causes severe eye irritation/conjuntivitis, burns, corneal necrosis. Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and larryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well has headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure, occur, particularly if exposure is prolonged. May affect the liver. Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomitting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophogeal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis). Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel. Chronic Potential Health Effects: dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hydrochloric acid, solution UNNA: 1789 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Hydrochloric acid Illinois toxic substances disclosure to employee act: Hydrochloric acid Illinois chemical safety act: Hydrochloric acid New York release reporting list: Hydrochloric acid Rhode Island RTK hazardous substances: Hydrochloric acid Pennsylvania RTK: Hydrochloric acid Minnesota: Hydrochloric acid Massachusetts RTK: Hydrochloric acid Massachusetts spill list: Hydrochloric acid New Jersey: Hydrochloric acid New Jersey spill list: Hydrochloric acid Louisiana RTK reporting list: Hydrochloric acid Louisiana spill reporting: Hydrochloric acid California Director's List of Hazardous Substances: Hydrochloric acid TSCA 8(b) inventory: Hydrochloric acid TSCA 4(a) proposed test rules: Hydrochloric acid SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid SARA 313 toxic chemical notification and release reporting: Hydrochloric acid CERCLA: Hazardous substances.: Hydrochloric acid: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):
R34- Causes burns. R37- Irritating to respiratory system. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 05:45 PM

Last Updated: 06/09/2012 12:00 PM

MATERIAL SAFETY DATA SHEET - CALIBRATION CHECK GAS

PRODUCT NAME: ISOBUTYLENE (1 PPM – 0.9%) IN AIR

MSDS NO: 248 **Version:3** **Date: August, 2010**

1. Chemical Product and Company Identification

Gasco Affiliates, LLC
320 Scarlett Blvd.
Oldsmar, FL 34677

TELEPHONE NUMBER: (800) 910-0051 **24-HOUR EMERGENCY NUMBER: 1-800-424-9300**
FAX NUMBER: (866) 755-8920
E-MAIL: info@gascogas.com

PRODUCT NAME: ISOBUTYLENE (1 PPM – 0.9%) IN AIR
CHEMICAL NAME: Isobutylene in air
COMMON NAMES/ SYNONYMS: None
TDG (Canada) CLASSIFICATION: 2.2
WHIMIS CLASSIFICATION: A

2. COMPOSITION/ INFORMATION ON INGREDIENTS

INGREDIENT	%VOLUME	PEL-OSHA	TLV-ACGIH	LD_{50} or LC_{50} Route/Species
Isobutylene FORMULA: C_4H_8	0.0001-0.9	N/A	N/A	N/A
Air FORMULA: Mixture	99.0 to 99.9999	N/A	N/A	N/A

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Release of this product may produce oxygen-deficient atmospheres (especially in confined spaces or other poorly ventilated environments); individuals in such atmospheres may be asphyxiated. Isobutylene may cause drowsiness and other central nervous system effects in high concentrations; however, due to the low concentration of this gas mixture, this is unlikely to occur.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
No	No	No	Yes	No

HEALTH EFFECTS:

Exposure Limits	Irritant	Sensitization	Reproductive Hazard	Mutagen
Yes	No	No	No	No

Carcinogenicity: --NTP: No IARC: No OSHA: No

EYE EFFECTS:
N/A.

SKIN EFFECTS:
N/A.

MATERIAL SAFETY DATA SHEET - CALIBRATION CHECK GAS

PRODUCT NAME: ISOBUTYLENE (1 PPM – 0.9%) IN AIR

INGESTION EFFECTS:
Ingestion unlikely. Gas at room temperature.

INHALATION EFFECTS:
Due to the small size of this cylinder, no unusual health effects from over-exposure are anticipated under normal routine use.

NFPA HAZARD CODES		HMIS HAZARD CODES		RATING SYSTEM
Health:	1	Health:	1	0= No Hazard
Flammability:	0	Flammability:	0	1= Slight Hazard
Reactivity:	0	Reactivity:	0	2= Moderate Hazard
				3= Serious Hazard
				4= Severe Hazard

4. FIRST AID MEASURES

EYES:
N/A

SKIN:
N/A

INGESTION:
Not required

INHALATION:
PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASED OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED THE SELF-CONTAINED BREATHING APPARATUS. Victims should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. If breathing has stopped administer artificial resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive.

5. FIRE-FIGHTING MEASURES

These containers hold gas under pressure, with no liquid phase. If involved in a major fire, they should be sprayed with water to avoid pressure increases, otherwise pressures will rise and ultimately they may distort or burst to release the contents. The gases will not add significantly to the fire, but containers or fragments may be projected considerable distances - thereby hampering fire fighting efforts.

6. ACCIDENTAL RELEASE MEASURES

In terms of weight, these containers hold very little contents, such that any accidental release by puncturing etc. will be of no practical concern.

7. HANDLING AND STORAGE

Suck back of water into the container must be prevented. Do not allow backfeed into the container. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Use only in well-ventilated areas. Do not heat cylinder by any means to increase rate of product from the cylinder. Do not allow the temperature where cylinders are stored to exceed 130^{o}F (54^{o}C).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Use adequate ventilation for extended use of gas.

GASCO

MATERIAL SAFETY DATA SHEET - CALIBRATION CHECK GAS

PRODUCT NAME: ISOBUTYLENE (1 PPM – 0.9%) IN AIR

9. PHYSICAL AND CHEMICAL PROPERTIES

PARAMETER:	**VALUE:**
Physical state	: Gas
Evaporation point	: N/A
pH	: N/A
Odor and appearance	: Colorless, odorless gas

10. STABILITY AND REACTIVITY

Stable under normal conditions. Expected shelf life 48 months.

11. TOXICOLOGICAL INFORMATION

No toxicological damage caused by this product.

12. ECOLOGICAL INFORMATION

No ecological damage caused by this product.

13. DISPOSAL INFORMATION

Do not discharge into any place where its accumulation could be dangerous. Used containers are acceptable for disposal in the normal waste stream as long as the cylinder is empty and valve removed or cylinder wall is punctured; but GASCO encourages the consumer to return cylinders.

14. TRANSPORT INFORMATION

	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Compressed Gas N.O.S. (Isobutylene in Air)	Compressed Gas N.O.S. (Isobutylene in Air)
HAZARD CLASS:	2.2	2.2
IDENTIFICATION NUMBER:	UN1956	UN1956
SHIPPING LABEL:	NONFLAMMABLE GAS	NONFLAMMABLE GAS

15. REGULATORY INFORMATION

Isobutylene is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

16. OTHER INFORMATION

This MSDS has been prepared in accordance with the Chemicals (Hazard Information and Packaging for Supply (Amendment) Regulation 1996. The information is based on the best knowledge of GASCO, and its advisors and is given in good faith, but we cannot guarantee its accuracy, reliability or completeness and therefore disclaim any liability for loss or damage arising out of use of this data. Since conditions of use are outside the control of the Company and its advisors we disclaim any liability for loss or damage when the product is used for other purposes than it is intended.

MSDS/S010/248/ August, 2010

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 10.18.2017 **Revision**: 10.18.2017

Trade Name: Alconox

1 Identification of the substance/mixture and of the supplier

1.1 Product identifier

Trade Name: Alconox

Synonyms:

Product number: 1104-1, 1104, 1125, 1150, 1101, 1103, 1112-1, 1112

1.2 Application of the substance / the mixture : Cleaning material/Detergent

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer **Supplier**

Alconox, Inc.
30 Glenn Street
White Plains, NY 10603
1-914-948-4040

Emergency telephone number:

ChemTel Inc
North America: 1-800-255-3924
International: 01-813-248-0585

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments.

Hazard-determining components of labeling:

Tetrasodium Pyrophosphate
Sodium tripolyphosphate
Sodium Alkylbenzene Sulfonate

2.2 Label elements:

Skin irritation, category 2.
Eye irritation, category 2A.

Hazard pictograms:

Signal word: Warning

Hazard statements:

H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:

P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P321 Specific treatment (see supplemental first aid instructions on this label).
P332+P313 If skin irritation occurs: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P501 Dispose of contents and container as instructed in Section 13.

Additional information: None.

Hazard description
Hazards Not Otherwise Classified (HNOC): None

Information concerning particular hazards for humans and environment:
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:
The classification is according to EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments, and extended by company and literature data. The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

3 Composition/information on ingredients

3.1 Chemical characterization : None

3.2 Description : None

3.3 Hazardous components (percentages by weight)

Identification	Chemical Name	Classification	Wt. %
CAS number: 7758-29-4	Sodium tripolyphosphate	Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	12-28
CAS number: 68081-81-2	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	8-22
CAS number: 7722-88-5	Tetrasodium Pyrophosphate	Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	2-16

3.4 Additional Information : None.

4 First aid measures

4.1 Description of first aid measures

General information: None.

After inhalation:
Maintain an unobstructed airway.
Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:
Wash affected area with soap and water.
Seek medical attention if symptoms develop or persist.

After eye contact:
Rinse/flush exposed eye(s) gently using water for 15-20 minutes.
Remove contact lens(es) if able to do so during rinsing.
Seek medical attention if irritation persists or if concerned.

After swallowing:
Rinse mouth thoroughly.
Seek medical attention if irritation, discomfort, or vomiting persists.

4.2 Most important symptoms and effects, both acute and delayed

None

4.3 Indication of any immediate medical attention and special treatment needed:

No additional information.

5 Firefighting measures

5.1 Extinguishing media

Suitable extinguishing agents:

Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition.

For safety reasons unsuitable extinguishing agents : None

5.2 Special hazards arising from the substance or mixture :

Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Protective equipment:

Wear protective eye wear, gloves and clothing.
Refer to Section 8.

5.4 Additional information :

Avoid inhaling gases, fumes, dust, mist, vapor and aerosols.
Avoid contact with skin, eyes and clothing.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures :

Ensure adequate ventilation.
Ensure air handling systems are operational.

6.2 Environmental precautions :

Should not be released into the environment.
Prevent from reaching drains, sewer or waterway.

6.3 Methods and material for containment and cleaning up :

Wear protective eye wear, gloves and clothing.

6.4 Reference to other sections : None

7 Handling and storage

7.1 Precautions for safe handling :

Avoid breathing mist or vapor.
Do not eat, drink, smoke or use personal products when handling chemical substances.

7.2 Conditions for safe storage, including any incompatibilities :

Store in a cool, well-ventilated area.

7.3 Specific end use(s):

No additional information.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 10.18.2017 **Revision**: 10.18.2017

Trade Name: Alconox

8 Exposure controls/personal protection

8.1 Control parameters :

a) 7722-88-5, Tetrasodium Pyrophosphate, OSHA TWA 5 mg/m3

b) Dusts, non-specific OEL, Irish Code of Practice

(i) Total inhalable 10 mg/m3 (8hr)

(ii) Respirible 4mg/m3 (8hr)

(iii) Tetrasodium Pyrophosphate, OSHA TWA 5 mg/m3, (8hr)

8.2 Exposure controls

Appropriate engineering controls:

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:

Not needed under normal use conditions.

Protection of skin:

Select glove material impermeable and resistant to the substance or preparation. Protective gloves recommended to comply with EN 374. Take note of break through times, permeability, and special workplace conditions, such as mechanical strain, duration of contact, etc. Protective gloves should be replaced at the first sign of wear.

Eye protection:

Safety goggles or glasses, or appropriate eye protection. Recommended to comply with ANSI Z87.1 and/or EN 166.

General hygienic measures:

Wash hands before breaks and at the end of work.
Avoid contact with skin, eyes and clothing.

9 Physical and chemical properties

Appearance (physical state, color):	White and cream colored flakes - powder	**Explosion limit lower:** **Explosion limit upper:**	Not determined or not available. Not determined or not available.
Odor:	Not determined or not available.	**Vapor pressure at 20°C:**	Not determined or not available.
Odor threshold:	Not determined or not available.	**Vapor density:**	Not determined or not available.
pH-value:	9.5 (aqueous solution)	**Relative density:**	Not determined or not available.
Melting/Freezing point:	Not determined or not available.	**Solubilities:**	Not determined or not available.
Boiling point/Boiling range:	Not determined or not available.	**Partition coefficient (n-octanol/water):**	Not determined or not available.
Flash point (closed cup):	Not determined or not available.	**Auto/Self-ignition temperature:**	Not determined or not available.
Evaporation rate:	Not determined or not available.	**Decompositio n**	Not determined or not available.

Flammability (solid, gaseous):	Not determined or not available.	**Viscosity**:	a. Kinematic: Not determined or not available. b. Dynamic: Not determined or not available.
Density at 20°C:	Not determined or not available.		

10 Stability and reactivity

10.1 Reactivity : None

10.2 Chemical stability : None

10.3 Possibility hazardous reactions : None

10.4 Conditions to avoid : None

10.5 Incompatible materials : None

10.6 Hazardous decomposition products : None

11 Toxicological information

11.1 Information on toxicological effects :

Acute Toxicity:

Oral:

: LD50 > 5000 mg/kg oral rat - Product .

Chronic Toxicity: No additional information.

Skin corrosion/irritation:

Sodium Alkylbenzene Sulfonate: Causes skin irritation. .

Serious eye damage/irritation:

Sodium Alkylbenzene Sulfonate: Causes serious eye irritation .

Tetrasodium Pyrophosphate: Rabbit - Risk of serious damage to eyes .

Respiratory or skin sensitization: No additional information.

Carcinogenicity: No additional information.

IARC (International Agency for Research on Cancer): None of the ingredients are listed.

NTP (National Toxicology Program): None of the ingredients are listed.

Germ cell mutagenicity: No additional information.

Reproductive toxicity: No additional information.

STOT-single and repeated exposure: No additional information.

Additional toxicological information: No additional information.

12 Ecological information

12.1 Toxicity:

Sodium Alkylbenzene Sulfonate: Fish, LC50 1.67 mg/l, 96 hours.
Sodium Alkylbenzene Sulfonate: Aquatic invertebrates, EC50 Daphnia 2.4 mg/l, 48 hours. Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.
Tetrasodium Pyrophosphate: Fish, LC50 - other fish - 1,380 mg/l - 96 h.
Tetrasodium Pyrophosphate: Aquatic invertebrates, EC50 - Daphnia magna (Water flea) - 391 mg/l - 48 h.

12.2 Persistence and degradability: No additional information.

12.3 Bioaccumulative potential: No additional information.

12.4 Mobility in soil: No additional information.

General notes: No additional information.

12.5 Results of PBT and vPvB assessment:

PBT: No additional information.

vPvB: No additional information.

12.6 Other adverse effects: No additional information.

13 Disposal considerations

13.1 Waste treatment methods (consult local, regional and national authorities for proper disposal)

Relevant Information:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities. (US 40CFR262.11).

14 Transport information

14.1 UN Number: ADR, ADN, DOT, IMDG, IATA	None
14.2 UN Proper shipping name: ADR, ADN, DOT, IMDG, IATA	None
14.3 Transport hazard classes: ADR, ADN, DOT, IMDG, IATA	**Class:** None **Label:** None **LTD. QTY:** None

US DOT
Limited Quantity Exception: None

Bulk:	**Non Bulk:**
RQ (if applicable): None	**RQ (if applicable):** None
Proper shipping Name: None	**Proper shipping Name:** None
Hazard Class: None	**Hazard Class:** None
Packing Group: None	**Packing Group:** None
Marine Pollutant (if applicable): No additional information.	**Marine Pollutant (if applicable):** No additional information.

Comments: None	**Comments:** None
14.4 Packing group: ADR, ADN, DOT, IMDG, IATA	None
14.5 Environmental hazards :	None
14.6 Special precautions for user:	None
Danger code (Kemler):	None
EMS number:	None
Segregation groups:	None
14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable.	
14.8 Transport/Additional information:	
Transport category:	None
Tunnel restriction code:	None
UN "Model Regulation":	None

15 Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

North American

SARA

Section 313 (specific toxic chemical listings): None of the ingredients are listed.
Section 302 (extremely hazardous substances): None of the ingredients are listed.

CERCLA (Comprehensive Environmental Response, Clean up and Liability Act) Reportable Spill Quantity: None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

Inventory: All ingredients are listed.
Rules and Orders: Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredients are listed.

Chemicals known to cause developmental toxicity: None of the ingredients are listed.

Canadian

Canadian Domestic Substances List (DSL):
All ingredients are listed.

EU

REACH Article 57 (SVHC): None of the ingredients are listed.

Germany MAK: Not classified.
EC 648/2004 – This is an industrial detergent. Contains >30% phosphate, 15-30% anionic surfactant, <5% EDTA salts
EC 551/2009 – This is not a laundry or dishwasher detergent
EC 907/2006 – Contains no enzymes, optical brighteners, perfumes, allergenic fragrances, or preservative agents

Asia Pacific

Australia

Australian Inventory of Chemical Substances (AICS): All ingredients are listed.

China

Inventory of Existing Chemical Substances in China (IECSC): All ingredients are listed.

Japan

Inventory of Existing and New Chemical Substances (ENCS): All ingredients are listed.

Korea

Existing Chemicals List (ECL): All ingredients are listed.

New Zealand

New Zealand Inventory of Chemicals (NZOIC): All ingredients are listed.

Philippines

Philippine Inventory of Chemicals and Chemical Substances (PICCS): All ingredients are listed.

Taiwan

Taiwan Chemical Substance Inventory (TSCI): All ingredients are listed.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:
H315 Causes skin irritation.
H319 Causes serious eye irritation.

NFPA: 1-0-0
HMIS: 1-0-0

Precautionary statements:
P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P321 Specific treatment (see supplemental first aid instructions on this label).
P332+P313 If skin irritation occurs: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P501 Dispose of contents and container as instructed in Section 13.

Manufacturer Statement:

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

1 Identification of the substance/mixture and of the supplier

1.1 Product identifier

Trade Name: Liquinox
Synonyms:
Product number: 1232-1, 1232, 1201-1, 1201, 1205, 1215, 1255

1.2 Application of the substance / the mixture : Cleaning material/Detergent

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer **Supplier**
Alconox, Inc.
30 Glenn Street
White Plains, NY 10603
1-914-948-4040

Emergency telephone number:
ChemTel Inc
North America: 1-800-255-3924
International: 01-813-248-0585

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments.

Hazard-determining components of labeling:
Alcohol ethoxylate
Sodium alkylbenzene sulfonate
Sodium xylenesulphonate
Lauramine oxide

2.2 Label elements:

Eye irritation, category 2A.
Skin irritation, category 2.

Hazard pictograms:

Signal word: Warning

Hazard statements:
H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:
P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P501 Dispose of contents and container as instructed in Section 13.

Additional information: None.

Hazard description

Trade Name: Liquinox

Hazards Not Otherwise Classified (HNOC): None

Information concerning particular hazards for humans and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:

The classification is according to EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments, and extended by company and literature data. The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

3 Composition/information on ingredients

3.1 Chemical characterization : None

3.2 Description : None

3.3 Hazardous components (percentages by weight)

Identification	Chemical Name	Classification	Wt. %
CAS number: 68081-81-2	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	10-25
CAS number: 1300-72-7	Sodium Xylenesulphonate	Eye Irrit. 2; H319	2.5-10
CAS number: 84133-50-6	Alcohol Ethoxylate	Skin Irrit. 2 ; H315 Eye Dam. 1; H318	2.5-10
CAS number: 1643-20-5	Lauramine oxide	Skin Irrit. 2 ; H315 Eye Dam. 1; H318	1-2

3.4 Additional Information: None.

4 First aid measures

4.1 Description of first aid measures

General information: None.

After inhalation:

Maintain an unobstructed airway.
Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:

Wash affected area with soap and water.
Seek medical attention if symptoms develop or persist.

After eye contact:

Rinse/flush exposed eye(s) gently using water for 15-20 minutes.

Remove contact lens(es) if able to do so during rinsing.
Seek medical attention if irritation persists or if concerned.

After swallowing:

Rinse mouth thoroughly.
Seek medical attention if irritation, discomfort, or vomiting persists.

4.2 Most important symptoms and effects, both acute and delayed

None

4.3 Indication of any immediate medical attention and special treatment needed:

No additional information.

5 Firefighting measures

5.1 Extinguishing media

Suitable extinguishing agents:

Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition.

For safety reasons unsuitable extinguishing agents : None

5.2 Special hazards arising from the substance or mixture :

Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Protective equipment:

Wear protective eye wear, gloves and clothing.
Refer to Section 8.

5.4 Additional information :

Avoid inhaling gases, fumes, dust, mist, vapor and aerosols.
Avoid contact with skin, eyes and clothing.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures :

Ensure adequate ventilation.
Ensure air handling systems are operational.

6.2 Environmental precautions :

Should not be released into the environment.
Prevent from reaching drains, sewer or waterway.

6.3 Methods and material for containment and cleaning up :

Wear protective eye wear, gloves and clothing.

6.4 Reference to other sections : None

7 Handling and storage

7.1 Precautions for safe handling :

Avoid breathing mist or vapor.
Do not eat, drink, smoke or use personal products when handling chemical substances.
Conditions for safe storage, including any incompatibilities:
Store closed upright and in a cool dry place, should be 15 - 30 deg C or 60 - 90 deg F.

7.2 Specific end use(s):

No additional information.

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

8 Exposure controls/personal protection

8.1 Control parameters :

No applicable occupational exposure limits

8.2 Exposure controls

Appropriate engineering controls:

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:

Not needed under normal conditions.

Protection of skin:

Select glove material impermeable and resistant to the substance.

Eye protection:

Safety goggles or glasses, or appropriate eye protection.

General hygienic measures:

Wash hands before breaks and at the end of work.
Avoid contact with skin, eyes and clothing.

9 Physical and chemical properties

Appearance (physical state, color):	Pale yellow liquid	**Explosion limit lower**: **Explosion limit upper**:	Not determined or not available. Not determined or not available.
Odor:	Not determined or not available.	**Vapor pressure at 20°C**:	Not determined or not available.
Odor threshold:	Not determined or not available.	**Vapor density**:	Not determined or not available.
pH-value:	8.5 as is	**Relative density**:	Not determined or not available.
Melting/Freezing point:	Not determined or not available.	**Solubilities**:	Not determined or not available.
Boiling point/Boiling range:	Not determined or not available.	**Partition coefficient (n-octanol/water)**:	Not determined or not available.
Flash point (closed cup):	Not determined or not available.	**Auto/Self-ignition temperature**:	Not determined or not available.
Evaporation rate:	Not determined or not available.	**Decomposition temperature**:	Not determined or not available.
Flammability (solid, gaseous):	Not determined or not available.	**Viscosity**:	a. Kinematic: Not determined or not available. b. Dynamic: Not determined or not available.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3
Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox	
Density at 20°C:	Not determined or not available.

10 Stability and reactivity

10.1 Reactivity : None

10.2 Chemical stability : None

10.3 Possibility hazardous reactions : None

10.4 Conditions to avoid : None

10.5 Incompatible materials : None

10.6 Hazardous decomposition products : None

11 Toxicological information

11.1 Information on toxicological effects :

Acute Toxicity:

Oral:

: LD50 >5000 mg per kg Rat, Oral) - product .

Chronic Toxicity: No additional information.

Skin corrosion/irritation:

Alcohol Ethoxylate: May cause mild to moderate skin irritation.
Sodium Alkylbenzene Sulfonate: Causes skin irritation.
Lauramine oxide: Causes skin irritation.

Serious eye damage/irritation:

Sodium Alkylbenzene Sulfonate: Causes serious eye irritation.
Alcohol Ethoxylate: Causes moderate to severe eye irritation and conjunctivitis.
Sodium xylenesulphonate: Rabbit: irritating to eyes.
Lauramine oxide: Causes serious eye damage.

Respiratory or skin sensitization: No additional information.

Carcinogenicity: No additional information.

IARC (International Agency for Research on Cancer): None of the ingredients are listed.

NTP (National Toxicology Program): None of the ingredients are listed.

Germ cell mutagenicity: No additional information.

Reproductive toxicity: No additional information.

STOT-single and repeated exposure: No additional information.

Additional toxicological information: No additional information.

12 Ecological information

12.1 Toxicity:

Sodium Alkylbenzene Sulfonate: Fish, LC50 1.67 mg/l, 96 hours.

Sodium Alkylbenzene Sulfonate: Aquatic invertebrates, EC50 Daphnia 2.4 mg/l, 48 hours.
Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.
Lauramine oxide: Fish, LC0 24.3 mg/l, 96h [Killifish (Cyprinodontidae)]
Lauramine oxide: Aquatic invertebrates, (LC50): 3.6 mg/l 96 hours [Daphnia (Daphnia)].
Lauramine oxide: Aquatic plants, EC50 Algae 0.31 mg/l 72 hours [Algae]
Alcohol Ethoxylate: Aquatic invertebrates, (LC50): 4.01 mg/l 48 hours [Daphnia (daphnia)].

12.2 Persistence and degradability: No additional information.

12.3 Bioaccumulative potential: No additional information.

12.4 Mobility in soil: No additional information.

General notes: No additional information.

12.5 Results of PBT and vPvB assessment:

PBT: No additional information.

vPvB: No additional information.

12.6 Other adverse effects: No additional information.

13 Disposal considerations

13.1 Waste treatment methods (consult local, regional and national authorities for proper disposal)

Relevant Information:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities. (US 40CFR262.11).

14 Transport information

14.1 UN Number: ADR, ADN, DOT, IMDG, IATA	None
14.2 UN Proper shipping name: ADR, ADN, DOT, IMDG, IATA	None
14.3 Transport hazard classes: ADR, ADN, DOT, IMDG, IATA	**Class:** None **Label:** None **LTD.QTY:** None

US DOT
Limited Quantity Exception: None

Bulk:	**Non Bulk:**
RQ (if applicable): None	**RQ (if applicable):** None
Proper shipping Name: None	**Proper shipping Name:** None
Hazard Class: None	**Hazard Class:** None
Packing Group: None	**Packing Group:** None
Marine Pollutant (if applicable): No additional information.	**Marine Pollutant (if applicable):** No additional information.
Comments: None	**Comments:** None

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

14.4 Packing group: None
ADR, ADN, DOT, IMDG, IATA

14.5 Environmental hazards : None

14.6 Special precautions for user: None

Danger code (Kemler):	None
EMS number:	None
Segregation groups:	None

14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable.

14.8 Transport/Additional information:

Transport category:	None
Tunnel restriction code:	None
UN "Model Regulation":	None

15 Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

North American

SARA

Section 313 (specific toxic chemical listings): None of the ingredients are listed.
Section 302 (extremely hazardous substances): None of the ingredients are listed.

CERCLA (Comprehensive Environmental Response, Clean up and Liability Act) Reportable Spill Quantity: None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

Inventory: All ingredients are listed.
Rules and Orders: Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredients are listed.

Chemicals known to cause developmental toxicity: None of the ingredients are listed.

Canadian

Canadian Domestic Substances List (DSL):
All ingredients are listed.

EU

REACH Article 57 (SVHC): None of the ingredients are listed.

Germany MAK: Not classified.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 05/17/2017 **Revision** : 05/17/2017

Trade Name: Liquinox

Asia Pacific

Australia

Australian Inventory of Chemical Substances (AICS): All ingredients are listed.

China

Inventory of Existing Chemical Substances in China (IECSC): All ingredients are listed.

Japan

Inventory of Existing and New Chemical Substances (ENCS): All ingredients are listed.

Korea

Existing Chemicals List (ECL): All ingredients are listed.

New Zealand

New Zealand Inventory of Chemicals (NZOIC): All ingredients are listed.

Philippines

Philippine Inventory of Chemicals and Chemical Substances (PICCS): All ingredients are listed.

Taiwan

Taiwan Chemical Substance Inventory (TSCI): All ingredients are listed.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:

H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:

P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P501 Dispose of contents and container as instructed in Section 13.

Manufacturer Statement:

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling,

use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

NFPA: 1-0-0

HMIS: 1-0-0

Appendix B
Glove Selection Guideline

APPENDIX B: GLOVE SELECTION GUIDELINE

HAZARD	EXAMPLE TASKS	ANSI CUT/ABRASION RATING*	REPRESENTATIVE GLOVE
Impact Hazards, Med/Heavy Duty Puncture Cut	Drilling/direct push activities. Construction. Heavy materials handling. Power tools. Air knifing. Excavation.	ANSI Cut and Abrasion Resistance **Level 5** **EN 388 4521**	Hexarmor®Chrome Hexarmor® GGT5 Hexarmor® L5 Hexarmor® SteelLeather III Ironclad® Kong Glove
Med/Heavy Duty Puncture Cut Oil/Solvent Resistant	Tasks where materials are treated with oil or solvents.	ANSI Cut and Abrasion Resistance **Level 3 - 4** **EN 388 4522**	Ansell Alpha-Tec ® Memphis® Ultra Tech Nitrile Cut & Splash Best® Neoprene 6780 Hexarmor™ TenX Threesixty
Medium Duty Cut/Puncture Gloves with Oily Surface Grip	Light materials handling, wet service	ANSI Cut and Abrasion Resistance **Level 3** **EN 388 44xx**	Best®Zorb-It Ultimate HV 4567 Ansell® Cut Protective Glove 97-505 Ansell HyFlex® 11-511 Ansell HyFlex® 11-624
Med/Heavy Duty Cut/Puncture	Light Materials Handling. System O&M. Use of Hand Tools. Hand Augering. Heavy Equipment Operator.	ANSI Cut and Abrasion Resistance **Level 2** **EN 388 33xx**	Perfect Fit® PF570 Hexarmor® Level Six 9010/9012 Ironclad® Cut Resistant Glove Ansell HyFlex® 11-511 Ansell HyFlex® 11-624 Ansell® Cut Protective Glove 97-505
Light Duty Cut/Puncture Abrasion Only	Handling soil and Groundwater Samples. Opening spoons. Well construction.	ANSI Cut and Abrasion Resistance **Level 2 - 4** **EN 388 21xx**	Memphis® Ninja Max N9676GL Memphis® UltraTech Dyneema 9676 Memphis® Ninja Ice (Cold Weather) Ansell HyFlex® 11-511 Ansell® Cut Protective Glove 97-505 Ansell® Powerflex 80-813 Ironclad™ Workforce
Light Duty Glove Cut/Abrasion (used under nitrile gloves)	Groundwater Sampling.	ANSI Cut and Abrasion Resistance **Level 2** **EN 388 21xx**	Ansell HyFlex® 11-500 Ansell HyFlex® 11-624 Ansell GoldKnit

* Reference to ANSI and EN 388 glove testing standards. Listed gloves meet the standards in the table, but are not the only gloves that meet the standard.

This selection chart is not intended to address all chemical hazards. Gloves used for chemical protection shall provide cut/puncture resistance, or be used in tandem with cut/puncture protection. Nitrile gloves used for environmental sampling must be used in tandem with a cut/puncture resistant glove.

Gloves available in high visibility colors have shown to be effective and are preferred.

Appendix C
Excavation Hazard Recognition Guide (Trenching/Shoring), Site Assessment Questions, and Related Guidance

1. PURPOSE

TRC's Trench and Excavation Compliance Program has been developed based on the Occupational Safety and Health Administration (OSHA) standards for the construction industry (29 CFR 1926, Subpart P – Excavations).

2. SCOPE

This Compliance Program applies to all open excavations made in the earth's surface. Excavations are defined to include trenches. These guidelines apply to all Operating Unit facilities and project sites.

3. DEFINITIONS

Accepted engineering practices: Those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring: A pre-engineered shoring system comprised of aluminum hydraulic cylinders (cross braces) used in conjunction with vertical rails (uprights) or horizontal rails (wales). Such system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole: A type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system): A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in: The separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent person: One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross braces: The horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation: Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or Sides: The vertical or inclined earth surfaces formed as a result of excavation work.

Failure: The breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere: An atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kick-out: The accidental release or failure of a cross brace.

Protective system: A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp: An inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer: A person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Sheeting: The members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system): A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring system): A structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation, and which is designed to prevent cave-ins.

Sloping (Sloping system): A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock: Natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp: A ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system: A structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data: Tables and charts approved by a registered professional engineer, and used to design and construct a protective system.

Trench (Trench excavation): A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box: See Shield.

Trench shield: See Shield.

Type A soil: Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (tsf) or greater. Examples of cohesive soils are clay, silty clay, sandy clay, clay loam, and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hard pan are also considered Type A. However, no soil is Type A if:

- The soil is fissured.
- The soil is subject to vibration from heavy traffic, pile driving, or similar effects.
- The soil has been previously disturbed.
- The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater.
- The material is subject to other factors that would require it to be classified as a less stable material.

Type B soil**:** Cohesive soil with an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf; granular cohesion less soils including angular gravel (similar to crushed rock), silt, silt loam, sandy loam, and in some cases, silty clay loam and sandy clay loam; previously disturbed soils except those that would otherwise be classed as Type C soil; soil that meets the unconfined compressive strength or cementation requirements for Type A but is fissured or subject to vibration; dry rock that is not stable; material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C soil: Cohesive soil with an unconfined compressive strength of 0.5 tsf or less; granular soils, including gravel, sand, and loamy sand; submerged soils, including soil from which water is freely seeping; submerged rock that is not stable; material in a sloped, layered system where the layers dip into the excavation at a slope of four horizontal to one vertical (4H:1V) or steeper.

Uprights**:** The vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

Wales: Horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

4. RESPONSIBILITIES

4.1 TRC's National Safety Director is responsible for establishing the Trench and Excavation Program requirements and providing/communicating them to the Health and Safety Network. The National Safety Director will review contract documents as required that include project and Client-Specific Requirements.

4.2 The Health and Safety Network is responsible for the Trench and Excavation Program implementation including, but not limited to:

- Qualifying or identifying Competent Person(s) for trench and excavation safety.
- Training new and existing TRC employees.
- Communicating and coordinating TRC's Trench and Excavation Program requirements with all TRC subcontractors, including identification of Subcontractor(s) Competent Person(s).
- Procuring TRC health and safety equipment (harnesses, lanyards, vertical and horizontal lifeline and other materials).
- Working in conjunction with identified Competent Person(s) to provide on-site direction on Trench and Excavation issues.
- Leading all investigations along with the Competent Person, Project Manager, Field Team Leader, and subcontractor health and safety representative or their designees, if a Trench and Excavation Program violation occurs on-site.
- Assisting in Trench and Excavation Program audits in conjunction with on-site TRC subcontractor, and the health and safety representatives or their designees.
- Maintaining records for health and safety activities on-site including equipment inspections and procedural audits of employee Trench and Excavation Program implementation.
- Coordinating assistance during emergency situations.

4.3 OSHA defines a Competent Person as one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, who has authorization to take prompt corrective measures to eliminate them (29 CFR 1926.32[f]). By way of training and/or experience, a Competent Person is knowledgeable of applicable standards, and is capable of identifying workplace hazards related to the specific operation. Under TRC's Trench and Excavation Program the Competent Person will:

- Perform all duties as specified in the Trench and Excavation Program.

- Review and approve all Health and Safety Plans (HASPs) and Job Safety Analyses (JSAs) that include work in and around trenches and excavations.
- In the event of simultaneous operations, cooperate fully with the Subcontractor's Person in Charge.
- Communicate with performing authorities (i.e., employees working in or around trenches or excavations) regarding the presence of other operations on-site.
- Work with Project Manager and/or Field Team Leader to identify and manage the risks associated with the project site.
- Assist in the training of employees who will be performing tasks in and around a trench or excavation.
- Ensure that a rescue plan is established by working with the Project Manager and/or facility safety personnel prior to any employees entering or working around a trench or excavation.
- Provide guidance as required for Trench and Excavation Program issues and questions.
- Coordinate with Project Managers and Health and Safety Network on trench and excavation audits.
- Observe the implementation of Trench and Excavation Program and conduct audits as required or directed.

4.4 The Project Manager is responsible for assisting the Health and Safety Network in the implementation of the Trench and Excavation Program. Project Managers must hold all TRC and other project employees working on-site accountable (zero tolerance policy) for maintaining a safe work environment.

4.5 Project Managers and site employees shall be held accountable for performing work in a safe manner according to the requirements of the Trench and Excavation Program.

4.5.1 The Field Team Leader shall:

- Participate in Trench and Excavation Awareness training.
- Confirm that Competent Personnel prepared and/or reviewed the Site-Specific Rescue Plan if required.
- When required, confirm that everyone working under a specific permit adheres to the permit's documented conditions.

5. PROCEDURE

5.1 General Requirements Permit labor

The following guidelines establish the minimum requirements of the applicable state and federal safety regulations for all work in excavations and trenches that might expose employees to the hazards of moving ground:

- All surface encumbrances adjacent to an excavation that might create a hazard to employees must be removed, secured, or supported as necessary to protect employees.
- The estimated location of underground installations, such as sewer, telephone, electric, water, or other underground utilities must be identified before opening an excavation. Utility companies, owners, and local One Call locator services must be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations before the work begins.
- When excavations approach the estimated location of underground installations, the exact location is determined by probing or hand digging, as necessary, to prevent accidental contact with the underground installations. While the excavation is open, underground installations that create a hazard to employees will be supported, protected, or removed as necessary to protect employees.

5.1.1 Access and Egress - Structural ramps.

- Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.
- Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.
- Structural members used for ramps and runways shall be of uniform thickness.
- Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.
- Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments o the top surface to prevent slipping.
- Appropriate access and egress in the form of a stairway, ladder, or ramp must be provided in all excavations deeper than 4 feet (1.23 m). In trenches, the stairway, ladder, or ramp must be installed so that a worker does not have to travel farther than 25 feet (7.62 m) in any direction to exit.

- Employees exposed to vehicular traffic must wear safety vests or other equivalent apparel marked with or made of reflectorized or high-visibility material.
- No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with 1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.
- A warning system must be provided when mobile equipment is operated adjacent to an excavation and the operator does not have a clear and direct view of the edge of the excavation. The warning system may include barricades, signals, stop logs, or other authorized methods. If possible, the grade should be away from the excavation.
- When deemed necessary by a competent person, excavations where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.
- When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.
- Emergency rescue equipment, such as rescue breathing apparatus, a safety harness and line, or a basket stretcher must be available where a hazardous atmosphere exists or could be expected to develop in an excavation.
- Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a lifeline securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.
- Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

- If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.
- Inspection of an excavation shall be made by a competent person when accumulation of water is present.
- If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person.
- The stability of adjacent structures, such as buildings, walls, and sidewalks must be maintained using a support system as necessary to protect employees.
- Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:
  - A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or
  - The excavation is in stable rock; or
  - A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or
  - A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.
- Sidewalks, pavements and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.
- Employees must be protected from loose rock or soil that could fall or roll into the excavation by placing and keeping such material at least 2 feet (0.61 m) from the edge of the excavation.
- A competent person must make daily inspections of excavations to identify and eliminate conditions that could result in cave-ins, failure of support systems, hazardous atmospheres, or other unsafe conditions. Inspections must be conducted before the start of work each day and after every rainstorm or other occurrence that might increase the hazard of moving ground. If problems are found, provisions should be made for immediate removal of personnel.

- Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.
- Where employees or equipment are allowed or required to cross over excavations that are 6 feet
- (1.83 m) or greater in depth, appropriate fall protection in the form of walkways or bridges with standard guardrails must be provided.
- An open excavation or trench that is left open overnight must be barricaded, covered, and secured in a manner that prevents anyone from entering the excavation intentionally or accidentally.

5.2 Protective Systems

Sloping, shoring, or shielding will be provided in excavations, except where the excavation is made in stable rock or the excavation is less than 5 feet (1.52 m) deep and an examination by a competent person does not indicate a potential for cave-in.

5.3 Sloping

When sloping or benching is chosen as the method to protect employees in an excavation, one of the following optional designs of sloping and benching systems must be used:

- Option 1 – Slope the excavation at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal).
- Option 2 – Perform a soil classification and determine the acceptable slopes required.
- Option 3 – Use a project-specific design prepared by a registered professional engineer.

  Engineered designs must be in writing, be rubber stamped, and must include the name and registration number of the engineer, detailed plans, the calculations used in the design, the magnitude of slopes, and the configurations determined to be safe. A copy of the design will be maintained at the jobsite during the use of the engineered system.

5.4 Shoring or Shielding

Only the following methods for support systems, shield systems, and other protective systems can be used at a TRC jobsite:

- Option 1 – Perform a soil classification and determine the appropriate support, shield or other protective system configuration using the shoring manufacturer’s tabulated data.

When using the manufacturer's tabulated data, the shoring system must be installed in accordance with all the specifications, recommendations, limitations, or approvals to deviate issued by the manufacturer. The manufacturer's tabulated data, specifications, recommendations, limitations, and any approval to deviate must be in writing, and maintained at the jobsite during the use of the shoring system.

- Option 2 – Use a project-specific design prepared by a registered professional engineer.

  Engineered designs must be in writing, be rubber stamped, and include the name and registration number of the engineer, detailed plans, the calculations used in the design, and the sizes, types, and configurations of materials to be used in the support system. A copy of the design must be maintained at the jobsite during the use of the engineered system.

5.5 General Guidelines

The materials and equipment used for protective systems must be free of damage or defects that might impair their proper functions. Manufactured materials and equipment must be used and maintained in accordance with the recommendations of the manufacturer. If material or equipment used in a protective system is damaged, it must be inspected by a competent person before being reused.

The installation and removal of protective systems must be performed in accordance with all of the following guidelines:

- Members of support systems must be securely fastened together to prevent sliding, falling, kick-outs, or other predictable failures.
- Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or being struck by members of the support system.
- Individual members of support systems must not exceed their design capacities.
- Before individual members can be removed, additional precautions must be taken to protect employees, including installing other structural members to support any additional load imposed on the support system.
- Removal begins at, and progresses from, the bottom of the excavation. Members must be released slowly to reduce the likelihood of failure of the remaining members or a cave-in.
- Backfilling must progress with the removal of support systems.
- Support systems must be coordinated with the excavation of trenches and must extend to within 2 feet (0.61 m) of the bottom of the trench, but only if the system is designed to resist the forces calculated for the full depth of trench, and there is no indication of a loss of soil from behind or below the bottom of the support system.

- Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.
- Shield systems must not be subjected to loads exceeding their design capacities. Shields must be installed in a manner that restricts lateral or hazardous movement in the event that a lateral load is applied suddenly. Employees must be protected when entering or exiting the areas protected by a shield. Employees are not allowed within the shield during installation, removal, or vertical movement.
- When shield systems are used in trenches, excavation of material may proceed 2 feet (0.61 m) below the bottom of the shield only if the shield is designed to resist the forces calculated for the full depth of trench and there is no indication of a loss of soil from behind or below the bottom of the shield.

5.6 Soil Classification

This section describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits.

- Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C, in accordance with the definitions set forth in this compliance program.
- Soil and rock deposits are classified based on the results of at least one visual and one manual analysis. These analyses must be conducted by a competent person using the tests described in this chapter or other approved methods of soil classification, such as those adopted by the American Society for Testing Materials (ASTM) or the United States Department of Agriculture (USDA).
- The methods used for visual and manual analyses must provide quantitative and qualitative information sufficient to identify the properties, factors, and conditions of the deposits.
- A layered system must be classified based on the weakest layer. However, each layer may be classified individually when a more stable layer lies below a less stable layer.
- If, after classifying a deposit, the properties, factors, or conditions change in any way, the changes must be evaluated by a competent person. The deposit must be reclassified as necessary to reflect the new circumstances.

5.7 Visual Analysis

The visual analysis is conducted to collect qualitative information about the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the excavation, and soil samples taken from the excavated material. The visual analysis includes:

- Observing samples of the soil that are excavated and soil in the sides of the excavation to estimate the range of particle sizes and the relative amounts of particle sizes. Fine-grained material is cohesive.
- Observing the soil as it is excavated to determine if it stays in clumps. Soil that breaks up easily and does not stay in clumps is granular.
- Observing sides of the opened excavation and the surface area adjacent to the excavation to identify tension cracks or fissured material.
- Observing the area adjacent to the excavation and the excavation itself to identify existing underground utilities, structures, or previously disturbed soils.
- Observing the opened sides of the excavation to identify layered systems. Examine layered systems to determine if the layers slope toward the excavation, and to estimate the degree of slope in the layers.
- Observing the area adjacent to the excavation and the areas within the excavation to identify potential sources of vibration that might affect the stability of the excavation.
- Observing the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the water table.

5.8 Manual Analysis

Manual analysis is conducted to collect quantitative and qualitative information about the properties of the soil, and to provide more information to properly classify the soil. The manual analysis includes some or all of the following methods:

- Evaluating the plasticity of the soil by molding a moist or wet sample of soil into a ball and attempting to roll it into threads as thin as 1/8 inch (0.32 cm) in diameter. Cohesive material can be rolled into a thread at least 2 inches (5.08 cm) long without crumbling or breaking.
- Evaluating the cohesiveness of the soil. If the soil is dry and crumbles into individual grains or fine powder with little or moderate pressure, it is granular. If the soil is dry and falls into clumps that break into smaller clumps but the smaller clumps can only be broken up with difficulty, it might be clay in combination with gravel, sand, or silt. If the dry soil breaks into small clumps that can only be broken with difficulty and there is no visual indication the soil is fissured, the soil may be considered unfissured.

- Applying the thumb penetration test to estimate the unconfined compressive strength of cohesive soils. Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb and can be molded by light finger pressure.
- The thumb test should be conducted on an undisturbed soil sample, such as a large clump of soil, as soon as possible after excavation to minimize the effects of drying. If the excavation is later exposed to rain, flooding, or other moisture, the classification of the soil must be changed accordingly.
- Estimating the unconfined compressive strength of soils by using a pocket penetrometer or a hand-operated shear vane in accordance with the manufacturer's recommendations.
- Performing a drying test to differentiate among cohesive material with fissures, unfissured cohesive material, and granular material. After thoroughly drying a sample of soil that is approximately 1 inch (2.54 cm) thick and 6 inches (15.24 cm) in diameter, evaluate the results as follows:
  - If the sample develops cracks as it dries, significant fissures are indicated.
  - If the sample dries without cracking and can be broken by hand, then the material is either unfissured cohesive or fissured cohesive.
  - If considerable force is necessary to break the sample, the soil has significant cohesive material content. The soil can be classified as unfissured cohesive material, and the unconfined compressive strength should be determined.
  - If the sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

5.9 Sloping and Benching Specifications

This section contains the specifications for using sloping and benching to protect employees working in excavations.

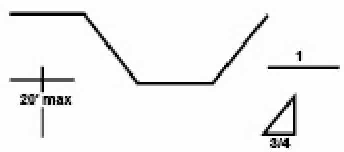
- These slope and bench specifications only apply if a soil classification has been conducted and the excavation will be 20 feet (6.10 m) deep or less.
- Determine the maximum allowable slope and configuration based on the soil classification by using the information in table(s) 1, 2 and 3.

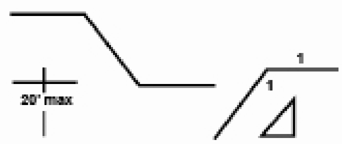
Table 1 Maximum Allowable Slope Based on Soil Classification

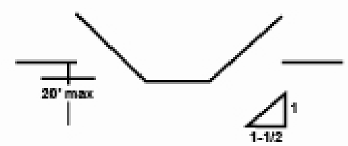
SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V)(1) FOR EXCAVATIONS LESS THAN 20 FEET DEEP(3)
STABLE ROCK	VERTICAL (90º)
TYPE A(2)	3/4:1 (53º)
TYPE B	1:1 (45º)
TYPE C	1½:1 (34º)

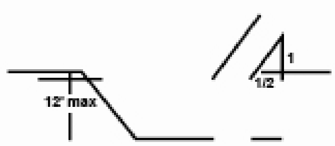
1. The numbers shown in parentheses next to the maximum allowable slopes are angles expressed in degrees from the horizontal. The angles have been rounded off.
2. A short-term, maximum slope of 1/2:1 (63 degrees) is allowable in excavations in Type A soil less than 12 feet (3.66 m) deep. The short-term maximum allowable slopes for excavations deeper than 12 feet (3.66 m) is 3/4 (53 degrees).
3. Sloping or benching for excavations deeper than 20 feet (6.10 m) must be designed by a registered professional engineer.

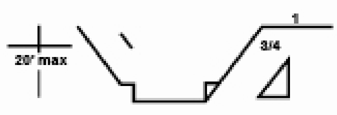
Table 2 Excavations in Type A, B, and C Soils

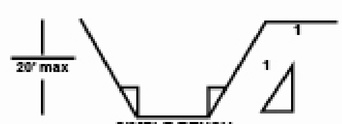
<table>
<tr><td>EXCAVATIONS IN TYPE A SOIL</td><td>EXCAVATIONS IN TYPE B SOIL</td><td>EXCAVATIONS IN TYPE C SOIL</td></tr>
<tr>
<td>SIMPLE SLOPES LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 3/4:1


SIMPLE SLOPE</td>
<td>SIMPLE SLOPES LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 1:1


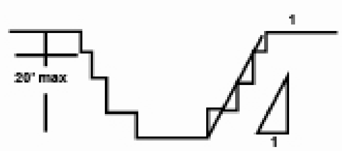
SIMPLE SLOPE</td>
<td>SIMPLE SLOPES LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 1-1/2:1


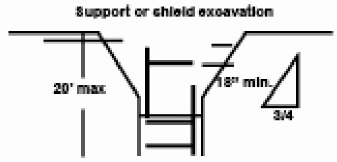
SIMPLE SLOPE</td>
</tr>
<tr>
<td>EXCEPTION: SHORT-TERM SIMPLE SLOPES LESS THAN 12 FEET DEEP HAVE A MAXIMUM SLOPE OF 1/2:1


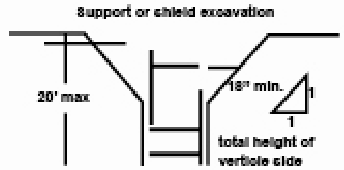
SIMPLE SLOPE SHORT-TERM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BENCHED EXCAVATIONS LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 3/4:1


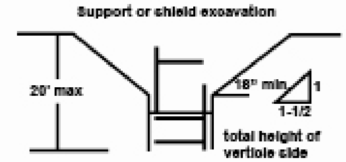
SIMPLE BENCH</td>
<td>BENCHED EXCAVATIONS LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 1:1


SIMPLE BENCH</td>
<td>BENCHED EXCAVATIONS ARE NOT ALLOWED</td>
</tr>
<tr>
<td>

MULTIPLE BENCH</td>
<td>

MULTIPLE BENCH</td>
<td>BENCHED EXCAVATIONS ARE NOT ALLOWED</td>
</tr>
<tr>
<td>SUPPORTED OR SHIELDED EXCAVATIONS LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 3/4:1.
Support or shield excavation


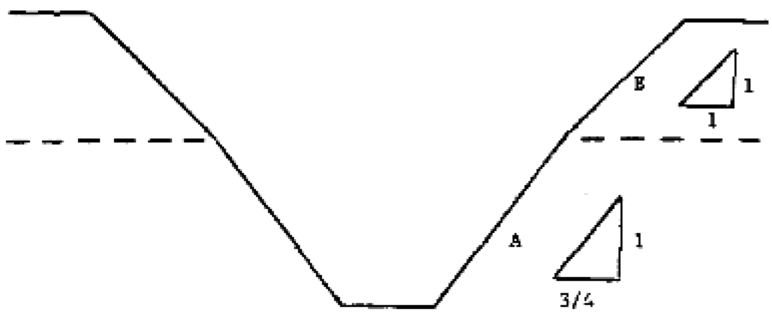
SUPPORTED LOWER PORTION</td>
<td>SUPPORTED OR SHIELDED EXCAVATIONS LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 1:1.
Support or shield excavation


SUPPORTED LOWER PORTION</td>
<td>SUPPORTED OR SHIELDED EXCAVATIONS LESS THAN 20 FEET DEEP WILL HAVE A MAXIMUM SLOPE OF 1-1/2:1.
Support or shield excavation


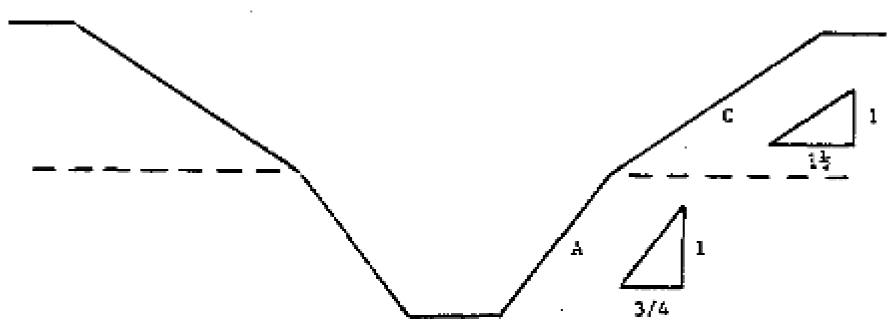
SUPPORTED LOWER PORTION</td>
</tr>
<tr>
<td>THE SUPPORT OR SHIELD MUST EXTEND AT LEAST 18 INCHES ABOVE THE VERTICAL SIDE.</td>
<td>THE SUPPORT OR SHIELD MUST EXTEND AT LEAST 18 INCHES ABOVE THE VERTICAL SIDE.</td>
<td>THE SUPPORT OR SHIELD MUST EXTEND AT LEAST 18 INCHES ABOVE THE VERTICAL SIDE.</td>
</tr>
</table>

Table 3 Excavations Made in Layered Soils

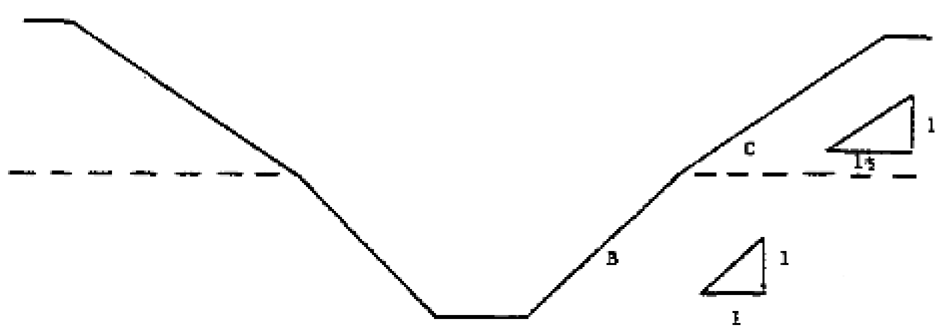
1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.



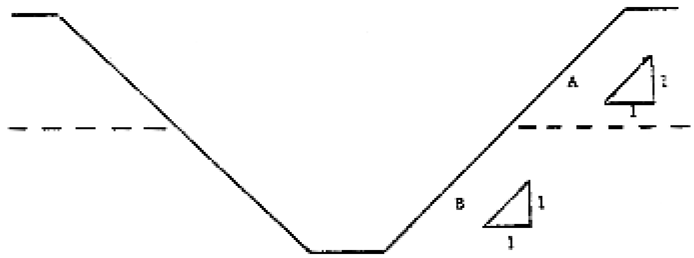
B OVER A



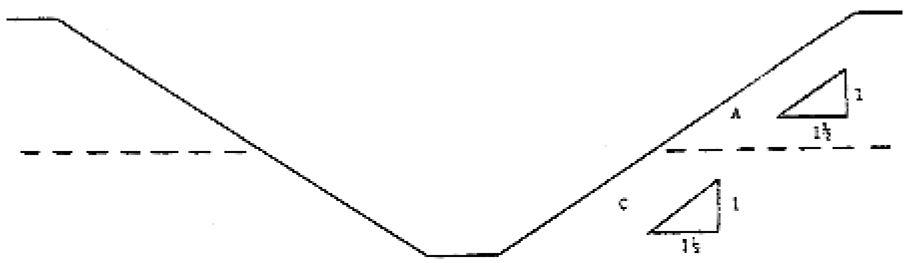
C OVER A



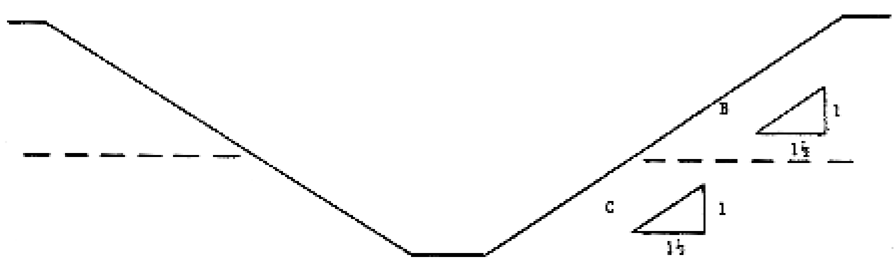
C OVER B



A OVER B



A OVER C



B OVER C

2. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

6. REFERENCES / RELATED DOCUMENTS:

29 CFR 1926 Subpart P, Excavations

CP002 – Risk Analysis Site Specific Health and Safety Program

CP003 – Personal Protective Equipment Program

CP008 – Confined Space Entry Program

CP009 – Health and Safety Training Program

7. APPENDICES

Forms

A. TRC Site-Specific Excavation Plan
B. TRC Pre-Excavation Checklist
C. TRC Excavation Inspection Form
D. TRC Protective Systems Selection Flow Chart

FORMS

A. **TRC SITE-SPECIFIC EXCAVATION PLAN**
B. **TRC PRE-EXCAVATION CHECKLIST**
C. **TRC EXCAVATION INSPECTION FORM**
D. **TRC PROTECTIVE SYSTEMS SELECTION FLOW CHART**

Site Specific Excavation Plan

Project Name: **Project #:**

Location: **Date:**

Company:

Submitted By:

Surface Encumbrances

Have Surface encumbrances that may create a hazard been removed or supported?

☐ Yes

☐ N/A

Underground Installations

Have Utility companies or owners been contacted? ☐ Yes ☐ N/A

By whom: Work Order #: Date:

When excavation operations approach the estimated location of underground installations, how will the exact location of the installations shall be determined?

☐ Probing ☐ Hand digging ☐ Detecting equipment ☐ Other

How will underground installations be protected?

☐ Support ☐ Removal ☐ Other

Access and Egress

Will structural ramps be used? ☐ Yes ☐ N/A

Designed by a competent person? ☐ Yes ☐ N/A

Will excavations be 4 feet in depth or more? ☐ Yes ☐ N/A

Means of egress (requiring no more than 25 feet of lateral travel) ☐ Yes ☐ N/A

☐ Stairway(s) ☐ Ramp(s) ☐ Ladder(s) ☐ Other

Exposure to vehicular Traffic? ☐ Yes ☐ N/A (If yes workers shall wear warning vests or other suitable garments.)

Exposure to falling loads? ☐ Yes ☐ N/A

☐ No workers permitted underneath loads

☐ Workers shall be required to stand away from any vehicle being loaded or unloaded. (Operators may remain in cabs)

Warning System for Mobile Equipment

Will mobile equipment operated adjacent to, or approaching the edge of, excavations have a clear and direct view of the edge of the excavation?

☐ Yes ☐ N/A If yes what warning system will be utilized?

☐ Barricade(s) ☐ Hand Signals ☐ Stop logs ☐ Other

Hazardous Atmospheres

Can oxygen deficiency or a hazardous atmosphere reasonably be expected to exist? ☐ Yes ☐ N/A

If yes, how will atmospheres in excavations greater than 4 feet in depth be tested?

If atmospheres contain less than 19.5% oxygen or other hazardous substance how will it be remediated?

When controls are intended to reduce the level of contaminants to acceptable levels, testing shall be conducted:

☐ Continuously ☐ Periodically

Will emergency rescue equipment be utilized? ☐ Yes ☐ N/A If yes what type?

☐ SCBA ☐ Harness and line ☐ Basket stretcher ☐ Other

Site Specific Excavation Plan

Water Accumulation

Will workers work in excavations in which there is accumulated water? ☐ Yes ☐ N/A

If yes is water controlled or prevented from accumulating by water removal equipment? ☐ Yes ☐ N/A

Equipment type: Competent Person:

Does excavation work interrupt the natural drainage of surface water (such as streams)? ☐ Yes ☐ N/A

Method used to divert water:

Stability of Adjacent Structures

Will the stability of adjacent structures be endangered by excavation operations? ☐ Yes ☐ N/A

If yes, what type of support structure will be used?

☐ Shoring ☐ Bracing ☐ Underpinning ☐ Other

If yes, but support structures will not be used, one of the following must apply:

☐ The excavation is in stable rock

☐ A registered professional engineer has determined that such work will not pose a hazard.

Name of registered professional engineer:

Protection from Loose Rock or Soil

How will workers be protected from materials or equipment that could fall or roll into excavations?

☐ Material placed > 2 feet from edge Retaining devices

Inspections

☐ Inspections of all excavations, adjacent areas and protective systems shall be made by a competent person.

☐ Inspections shall be conducted by the competent person daily, prior to the start of work and as needed throughout the shift. Inspections shall be documented on a Daily Excavation Inspection Form.

☐ Inspections shall be made after every rainfall or other hazard increasing occurrence.

☐ Where the competent person finds evidence of hazardous conditions, workers shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

Fall Protection

Will excavations be 6 feet or greater in depth? ☐ Yes ☐ N/A

If yes, fall protection will consist of:

☐ Barricades ☐ Fall restraint ☐ Harness ☐ Other

Will workers be required or permitted to cross over excavations? ☐ Yes ☐ N/A

If yes, guardrails shall be provided.

SIGNATURES

Supervisor General Supervisor

Project/Construction Manager Safety Representative

Pre-Excavation Checklist

Project Name: **Project #:**
Location: **Date:**
Company: **One Call #**
Submitted By:

The following procedures are mandatory. Failure to complete this check list could result in disciplinary action or termination:

Complete a pre-excavation walk-out of the entire job site. Your objective is to visually inspect the dig area to ensure all utilities are marked. Look for obvious signs of utilities in the immediate work area that may not be marked such as, above-ground pedestals, gas meters, man-hole covers, drains, or utility poles with cable risers. If you find these indicators and suspect that there is an unmarked utility DO NOT PROCEED**. Call your General Foreman or Locate Ticket Coordinator immediately.**

When you have completed your walk-out, complete the following check list:

1. Verify that the One-Call ticket covers the 'Scope of work' and 'Work to begin' date:

   I have verified the One-Call ticket covers the 'Scope of work' &'Work to begin' date ☐
2. What marked utilities did you observe?

   ☐Gas (Yellow) ☐Electric (Red) ☐Telephone (Orange) ☐Cable TV (Orange) ☐Water (Blue) ☐Sewer (Green)
3. Based on visual observation, did you see any obvious signs of unmarked utilities in the immediate work area?

   ☐Yes ☐No If Yes, please identify?

   ☐Gas (Yellow) ☐Electric (Red) ☐Telephone (Orange) ☐Cable TV (Orange) ☐Water (Blue) ☐Sewer (Green)
4. I have notified my Supervisor and Locate Ticket Coordinator ☐
5. Photograph the entire proposed work area including all locate marks.

   I have photographed the entire site including existing locate/markings prior to excavation ☐
6. Advise your crew members of the following: If they have to cross a marked Utility they must HAND DIG ONLY within 18" of the locate marks. For gas lines add half the diameter of the buried facility to the 18''. If necessary, dig a test-hole (pothole) using hand tools to determine the location of the facility.

   I have advised my crew of this rule ☐
7. When possible, all directional boring / drilling routes must be potholed every 50-80 feet prior to drilling.

   I have advised my crew accordingly and test-holes (potholes) have been dug ☐

~~~~~~~~~~~~~~~~~~~~~~~~~~~~ RESPECT THE MARKS! ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

IN THE EVENT OF DAMAGE

- Notify your Supervisor and Locate Ticket Coordinator
- Complete the TRC Incident Notification Form
- Photograph entire area and damage location

PHOTOGRAPHY TIPS

- Make sure the correct date & time stamp is active on your camera
- Photograph the excavation itself (damage location) and cable depth (include tape measure in hole)
- Take photos from multiple vantage points and of surrounding area (360 degrees)
- If the utility was miss-marked, photograph the locate marks/flags (include tape measure in photo)
- If the utility was not marked, photograph the entire area and approaches to the cut site
- Show a quantifiable location/address (street sign, house number, mail box number etc.)
~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Excavation Flow Diagram

Project Name:

Location:

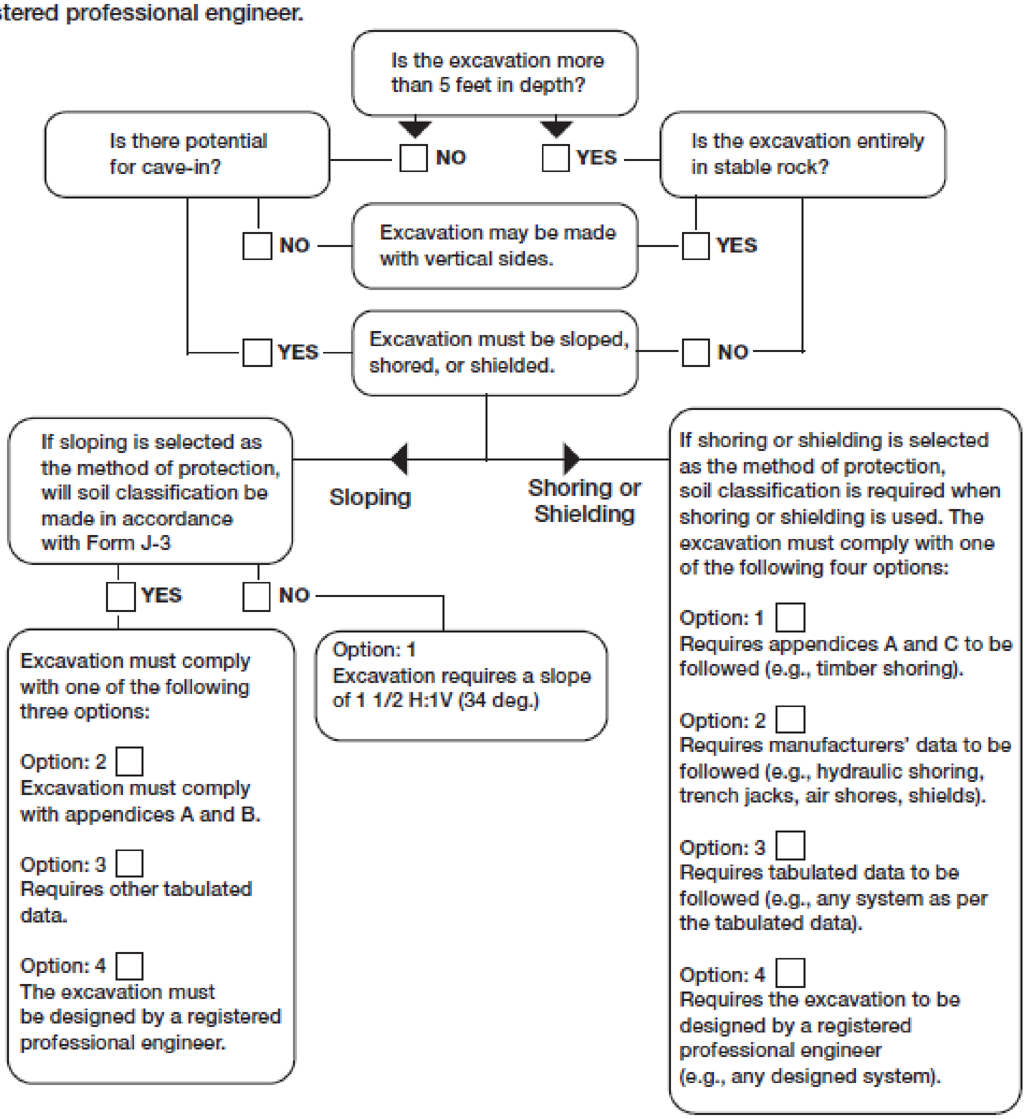
Company:

Submitted By:

Project #:

Date:

The following is a graphic summary of the requirements for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer.



Excavation Daily Inspection

Project Name: **Project #:**
Location: **Date:**
Company:
Submitted By:

Depth: ________________________ **Width:** _______________________ **Date Opened:** _____________________

Soil classification: ☐ A ☐ B ☐ C

Indicate how the classification was made:

Manual test(s)

a) plasticity	__________	__________	__________
b) dry strength	__________	__________	__________
c) thumb penetration	__________	__________	__________
d) pocket penetrometer	__________	__________	__________
e) other	__________	__________	__________

Visual test(s) **Do as many as possible**	**Cohesive Soil**	**Granular Soil**
a) Spoil pile	☐ **Remains in clumps**	☐ **Breaks up easily**
b) Trench Side	☐ **Stands vertical >2 hours**	☐ **Sloughs into trench**

The excavation is properly (circle one):

Shored/Shielded	**(indicate type of shoring)**	☐ **closed**	☐ **open**	☐ **wood**	☐ **metal**	☐ **shield**
Sloped/benched	**(indicate the slope)**	☐ **vertical sides**	☐ **3/4:1**	☐ **1:1**	☐ **1 1/2: 1**	☐ **2:1**

Excavation Checklist:	Morning	Mid-Day	Afternoon
Time:	__________	__________	__________
Weather:	__________	__________	__________
Was atmospheric testing required?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Was atmospheric testing done?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Is the spoil pile back 2' from the edge?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Have surface encumbrances been removed?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Are there any signs of sloughing or cave-in?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Is there water accumulation in the bottom?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Are there vibration sources near the excavation?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Is there adequate access/egress (ladder, ramp, etc.)	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Has the soil been disturbed previously?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Sides	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
Top	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**
If the excavation is > 20 feet deep, have engineering designs been documented and complied with?	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**	☐ **yes** ☐ **no**

SIGNATURES

Supervisor	General Supervisor
Project/Construction Manager	Safety Representative

Appendix D
Heat and Cold Stress

COLD STRESS

Ambient air temperatures during site activities may create cold stress for on-site workers. Procedures for recognizing and avoiding cold stress must be followed. Cold stress can range from frostbite to hypothermia. The signs and symptoms of cold stress are listed below.

Frostbite is defined as the actual freezing of one or more layers of skin. In severe cases, organs and structures below the skin can become frozen. Usually, body areas exposed to the most cold, and least body warmth, are affected first. These areas include fingers, toes, ears, and the tip of your nose. Frostbite is characterized by pain and loss of dexterity in the affected limb. The tissue initially appears reddened, but may progress to white, blue, or black.

> **FIRST AID:** Bring the affected employee indoors and call the local emergency clinic. Rewarming of frostbitten parts is best left to a medical doctor in a controlled setting.

Hypothermia is the condition that occurs when the body's natural warming mechanisms (muscle activity and shivering) cannot counteract the loss of body heat to the environment. The onset of hypothermia is greatly hastened by being wet. Hypothermia is marked by severe, uncontrollable shivering. The patient will show signs of excessive fatigue, drowsiness, irritability, or euphoria. As hypothermia progresses, the patient will begin to lose consciousness, blood pressure will drop, shivering will cease, and the patient may slip into a coma and possibly die.

> **FIRST AID:** If these symptoms occur, remove the patient to a warm, dry place. If clothing is wet, remove and replace with dry clothing. Keep the patient warm, but not overheated. The patient should be gradually rewarmed to prevent shock. If the patient is conscious and alert, warm liquids should be provided. Coffee and other caffeinated liquids should be avoided because of diuretic and circulatory effects. Notify the emergency clinic if conditions worsen, the patient loses consciousness, or the patient has an altered mental status. Have the patient transported to an emergency facility.

General Precautions The reduction of adverse health effects from cold exposure can be achieved by adopting the following work practices.

- Provide adequate insulating clothing to maintain core temperature at 98.6° F if work is to be performed in air temperatures below 40° F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the air temperature in the work area, the greater the insulation value of the protective clothing should be.
- If the air temperature is 32° F or less, hands should be protected by mittens/gloves.
- If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of clothing should be impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outer layer should be changed as it becomes wet. The outer garments should include provisions for easy ventilation in order to prevent wetting of the inner layer by sweat.
- If available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is available, or until weather conditions improve.
- For prolonged work, heated shelters should be available. Workers should be encouraged to use these at regular intervals, with the frequency depending on the severity of the environmental exposure. When entering the shelter, the outer layer of clothing should be removed and the remainder of the clothing

loosened to permit heat evaporation, or a change of work clothing should be provided.

- Warm, sweet drinks, such as hot cocoa or soup, should be available at the work site to provide caloric intake and fluid volume. The intake of coffee should be limited because of diuretic and circulatory effects.
- The weight and bulk of cold-weather gear should be included in estimating the required work performance and weights to be lifted in the field.

Workers should be instructed in safety and health procedures regarding cold work environments as part of the pre-work safety meeting. The training program should include instruction in preventing, recognizing, and treating cold stress conditions.

Wind Chill Chart

Wind (mph)	Temperature (°F)																	
	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	29	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

HEAT STRESS

There is a potential for heat stress from the use of protective clothing and climate conditions. One or more of the following procedures may be employed to alleviate potential heat stress problems in the event that site conditions warrant the use of personal protective equipment (PPE), or ambient temperatures exceed 85° F. Heat stress training must be emphasized during the daily safety meetings, and adequate supplies of potable water must be provided to workers each day.

General Precautions Provide plenty of liquids. To replace body fluids (water and electrolytes) lost because of sweating, use a 0.1 percent saltwater solution, more heavily salted foods, or commercial drink mixes. The commercial mixes may be preferable for those employees on a low sodium diet. Employees on low sodium diets, or other special diets, are advised to contact their personal physician for recommendations regarding appropriate electrolyte replacement fluids/beverages.

In extremely hot weather, conduct operations in early morning or evening and rotate shifts of workers wearing impervious clothing. Install mobile showers and/or hose-down facilities to reduce body temperature and cool protective clothing.

Ensure that adequate shelter is available for breaks to protect personnel against heat, which can decrease physical efficiency and increase the probability of accidents.

Acclimatization for workers not accustomed to working in elevated temperature environments will be considered and implemented as appropriate in accordance with American Conference of Governmental and Industrial Hygienists (ACGIH) Guidelines.

Heat Stress Monitoring

For monitoring the body's recuperative ability toward excess heat, one or more of the following techniques should be used as a screening mechanism. Monitoring of personnel wearing impervious clothing should commence when the ambient temperature is 70° F or above. Frequency of monitoring should increase as the ambient temperature increases or as slow recovery rates are indicated. When temperatures exceed 80° F, regardless of the use of Personal Protective Equipment (PPE), workers will be monitored for heat stress after every work period.

Good hygienic standards must be maintained by the employee to aid in the prevention of heat stress illnesses. At a minimum, frequent changes of clothing and daily showering should occur with clothing being allowed to dry during rest periods. Persons who notice skin problems should immediately inform their supervisor.

Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/minute. If the HR is higher, the next work period should be shortened by 25 percent. The HR is then measured again, once each minute for 2 minutes (a total of three measurements), after the initial rest period measurement. The HR should decrease by ten beats per minute between each measurement (a total reduction of 20 beats). If the HR does not decrease, the work period should be reduced by an additional 25 percent.

Body temperature can be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should not exceed 99°F. If it is greater than 99°F, the next work period should be shortened by 25 percent. The OT should be measured again at the end of the rest period to make sure that it has dropped below 99° F.

Effects of Heat Street

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat loading, a number of physical reactions can occur. The severity of these reactions ranges from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to severe (fatal).

Heat-related illnesses include:

Heat rash (also known as prickly heat rash) is caused by continuous exposure to heat and humid air and aggravated by chafing clothes. Heat rash decreases the ability to tolerate heat as well as being a nuisance. Signs are not limited to, but may include, a red prickly rash.

FIRST AID: Employees exhibiting signs of heat rash will be directed to shower and change into clean, dry clothing.

Heat cramps are caused by profuse perspiration with inadequate fluid intake and electrolyte replacement (especially salts). Signs are muscle spasms and pain in the extremities and abdomen, and may occur several hours after work has stopped.

FIRST AID: Employees showing signs of heat cramps will be directed to lie in a cool, shady area, and drink cool fluids. If symptoms persist or worsen, the employee will be transported to an emergency facility.

Heat exhaustion is caused by increased stress on various organs to meet increased demands to cool the body. Signs are shallow breathing; pale, cool, moist skin; profuse sweating; dizziness and lassitude.

FIRST AID: Employees with signs of heat exhaustion will be brought to a cool, shady location and given fluids. After recovering, the employee will be dismissed for the day. If employee is unconscious, or conditions persist, the employee will be transported to a hospital.

Heat stroke is the most severe form of heat stress. The body must be cooled immediately to prevent severe injury and/or death. Signs and symptoms are red, hot, dry skin; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; and/or coma.

FIRST AID: HEAT STROKE IS A MEDICAL EMERGENCY. Employees will be brought to a cool area, aggressively treated by removing constricting clothes and applying wet towels or ice packs, and transported without delay to an emergency facility.

Appendix E
Tailgate Meeting/Checklist

Daily Pre-Job Safety Briefing

Project Name: ______________________ Project Number: ______________

Work Location: ______________________ Date: ______________

Tasks Performed: ______________________ Time: __________ AM PM

Client Name: ______________________ Submitted By: ______________________

Weather: ____

Refuge Area: ____

First Aid/CPR Persons: ____

Potential Hazards: ____

For Emergencies Dial 911 **For Non-Emergencies Dial WorkCare (888) 449-7787**

Personal Protective Equipment Required

	Yes	***No***	***Specify***
Clothing	☐	☐	____________
FR, reflective vest, chemical, other (specify)			
Eye/Face	☐	☐	____________
Safety glasses, goggles, face shield, other (specify)			
Respirator	☐	☐	____________
1/2 face, full face, other (specify)			
Foot Protection	☐	☐	____________
Safety toe, EH rated, rubber boots, other (specify)			
Hand Protection	☐	☐	____________
Kevlar, chemical, EH, other (specify)			
Head Protection	☐	☐	____________
hard hat, electrical hazard, other (specify)			
Fall Protection	☐	☐	____________
body harness, lifelines, barricades, other (specify)			
Hearing Protection	☐	☐	____________
Other: ____________			

Procedures/Programs Required	***Yes***	***No***
Confined Space	☐	☐
Hot Work	☐	☐
Signs/Barricades	☐	☐
LOTO/Energy Control	☐	☐
Scaffolds/Aerial Lifts	☐	☐
____________	☐	☐
____________	☐	☐
____________	☐	☐
____________	☐	☐
Employee Certification/Training Required		
HAZWOPWER	☐	☐
Asbestos Awareness	☐	☐
Asbestos Inspector	☐	☐
XRF Trained	☐	☐
____________	☐	☐
____________	☐	☐
____________	☐	☐
____________	☐	☐

Additional Considerations

Work Procedures: ☐ Dig Safe
☐ Working clearances ☐ ____________
☐ ____________

People: ☐ Worker fatigue ☐ Other site activities
☐ Public safety ☐ Pedestrian control ☐ Experience
☐ Traffic control ☐ Other utilities
☐ ____________

Tools/Equipment: ☐ Eye wash ☐ First Aid Kit
☐ Inspection of tools/equipment
☐ Specialized tools/equipment
☐ Correct tool/equipment for the job
☐ ____________

Special Precautions: ☐ Environmental
☐ Condition of structures ☐ Weather conditions
☐ Lighting conditions ☐ Terrain ☐ Water bodies
☐ Adjacent structures
☐ ____________

If Conditions CHANGE…Stop Work, Review and Revise the Plan!!

Daily Pre-Job Safety Briefing

Hazards Associated with the Job

☐ Hazardous Chemicals	☐ Heavy Equipment	☐ Slip/Trip and Falls	☐ Work in Active Rail ROW	☐ Confined space
☐ Biological Waste	☐ Hostile Individual(s)	☐ Traffic Hazards	☐ Work in Active Substation	☐ Hot Work
☐ Asbestos	☐ Ladder	☐ Trenches Excavations	☐Animals/Insects	☐ Radioactive Materials
☐ Dust	☐ Lighting	☐ Utilities	☐Plants	☐ Boom/Scissor Lift
☐ Edges/Material Handling	☐ Manual Lifting	☐ Water/Boat Safety	☐ ____________________	☐ ____________________
☐ Electricity	☐ Pressurized Fluids/Gases	☐ Weather (hot/cold)	☐ ____________________	☐ ____________________

List all hazards associated with this task	**Signature of Crew Members Present**	
	Print Name	Sign Name
Barriers to eliminate/control above hazards?		
Supervisor Signature:		

Post Task Safety Analysis

Did any injuries or incidents occur today? If yes, explain.		
☐ Yes	☐ No	
Was the injury or incident reported the safety department?		
☐ Yes	☐ No	☐ N/A
What problems did you have with today’s work assignment?		
What can we do tomorrow to improve performance?		

Appendix F
WorkCare Program Information

WorkCare Making Health Count

FACT SHEET

EARLY INCIDENT INTERVENTION®

Immediate Access to Medical Advice for Work Related Incidents

(888) 449-7787

INTRODUCTION

WorkCare, Inc. (WorkCare) and TRC have partnered together to promote Incident Intervention®, a resource designed to support company safety goals/targets—while reducing runaway-costs associated with workplace injuries and illnesses.

PURPOSE

Early Incident Intervention provides TRC employees with **IMMEDIATE** telephonic access to WorkCare clinicians at the time of a presumed, non-emergency workplace injury or illness. Clinicians provide expert guidance on the evaluation of symptoms, appropriate first aid, and the need for additional medical evaluation or treatment.

When utilizing this service within the first hour of an incident, known as the "Golden Hour," licensed medical staff can guide the case so that medical evaluation and treatment are rendered appropriately.

"…helps the worker traverse the unpredictable terrain of work-related injuries and illness."

PRINCIPLES OF EARLY INCIDENT INTERVENTION

- Utilizes principles of the "Golden Hour."
- Provides workers immediate clinician support at the time of an incident.
- Focuses on providing the right care, at the right time in the proper setting.

BENEFITS FOR EMPLOYEES

- Instant access to a medically qualified professional for evaluation of symptoms and possible outcomes.
- Professional guidance on appropriate first aid measures and medications.
- Professional advice regarding the need for additional medical evaluation or treatment.

BENEFITS FOR TRC

- Point of contact for emergency and non-emergency medical clinicians.
- Triages the incident to determine risk and urgency, delivering interventions that are consistent with medical guidelines for the specified injury and illness.
- Maintains communication with clinicians to ensure accurate and timely reporting.

Appendix G
Safe Catch Form

Safe Catch Report

A "Safe Catch" is a potential hazard or incident that has not resulted in any personal injury. Unsafe working conditions, unsafe employee behaviors, improper use of equipment or use of malfunctioning equipment have the potential to cause work related injuries. It is everyone's responsibility to report and/or correct these potential incidents immediately. Please complete this form as a means to report these "Good Catch" situations and submit to your local OSC Representative and Mike Glenn, SVP/National Safety Director.

Complete ALL field entries:

Employee Name:		Date:	
Location:		Office:	
Project Number:		Practice:	

Conditions

Please check all appropriate conditions:

☐ Unsafe Act ☐ Unsafe Condition ☐ Unsafe Equipment ☐ Unsafe Use of Equipment

Description of Incident or Potential Hazard:

Task Performed at Time of Incident:

Causes (Primary and Contributing):

Corrective Action(s) Taken (remove the hazard, replace, repair, or retrain):

Employee Signature:		Date Completed:	

Our Mission: To reduce the frequency of incidents by applying local lessons learned globally.

If you have any questions about this report or would like additional information, please reference Compliance Program CP019 TRC Incident Response and Lessons Learned Program, located on TRCNET or contact Mike Glenn, SVP/National Safety Director at mglenn@trcsolutions.com.

Appendix H
In Case of Emergency and Incident Reporting

Incident Response Flow Chart - Employees

Incident Occurs
(Injury, Illness, Property Damage, Environmental Release, Near Miss)

Emergency?

Yes, Call 911

Contact your Supervisor as soon as possible

No, Contact your Supervisor immediately

If the incident involves an employee injury contact WorkCare

(888-449-7787)

In Case of Injury at Work

1 If emergency care **is** needed, or if you are in a motor vehicle incident, call 9-1-1.

2 If emergency care **is not** needed, notify your supervisor **prior** to the initial contact with **WorkCare (888.449.7787).**

3 Supervisor must notify a Corporate Health and Safety Team Member.

Submit the appropriate form(s): TRC Incident Notification Report or TRC Auto Incident Report **within 24 hours** to Mike Glenn, VP, National Safety Director.

TRC
Results you can rely on

Appendix I
Job Safety Analysis Forms

Job Safety Analysis Template

COMPANY/ PROJECT NAME or ID/ LOCATION (City, State) **TRC**	DATE PREPARED FOR HASP:	☐ NEW ☐ REVISED
JSA WORK ACTIVITY (Description):	List of Contractor(s) and key work activity:	

SITE SPECIFIC JSA AUTHOR	**POSITION / TITLE**	**DEPT**	**SIGNATURE**

TRC HEALTH AND SAFETY MANAGEMENT	**POSITION / TITLE**	**APPROVAL DATE**

PERSONAL PROTECTION EQUIPMENT (PPE) QUICK SUMMARY

Required PPE (indicate with "R") vs. Must Have Available On-site (indicate "A")

____ REFLECTIVE VEST ____HARD HAT _____GLOVES: **ANSI Cut Level ____ Kevlar** ____SAFETY GLASSES ______GOGGLES ______FACE SHIELD	_____ HEARING PROTECTION ____SAFETY SHOES: Protective Toe _____ 5pt.HARNESS / LANYARD PPE CLOTHING: ____Coveralls ____Tyvek Suit ____Nomex ____Other (specify):	RESPIRATORY PROTECTION: ☐ NA ____½ face Air Purifying Respirator (APR) _____Particulate Mask: ☐ PM100 ☐ PM95 _____ Cartridge: ☐ P100-Multigas ☐ ______________ _____Full face ARP; specify cartridge type: _____ Air Supplied Respirator ____SCBA _____Air-line	Additional PPE: .

Always perform a Safety Assessment (Hazard Hunt): 1) prior to starting work; 2) when changing tasks; and 3) throughout the day. Focus on each new task, procedures, and skill sets to be used.

[1] JOB TASKS	**[2] POTENTIAL HAZARDS**	**[3] HAZARD CONTROLS (beyond wearing "Required" PPE)**
1)	a.	
	b.	

Always perform a Safety Assessment (Hazard Hunt): 1) prior to starting work; 2) when changing tasks; and 3) throughout the day. Focus on each new task, procedures, and skill sets to be used.		
[1] JOB TASKS	**[2] POTENTIAL HAZARDS**	**[3] HAZARD CONTROLS (beyond wearing "Required" PPE)**
2)		
3)		

Always perform a Safety Assessment (Hazard Hunt): 1) prior to starting work; 2) when changing tasks; and 3) throughout the day.

[1] JOB TASKS	[2] POTENTIAL HAZARDS	[3] HAZARD CONTROLS (beyond wearing "Required" PPE)
3)		
4)		
	LOCATION(S) WHERE HAZARD IS TO BE EXPECTED	[3] HAZARD CONTROLS (beyond wearing "Required" PPE)
1.	a.	a.
2.	a.	a.
3.	a.	a.

Field Notes:

____

____

LIMITATION: As part of TRC's EHS Policy, a JSA is provided by TRC for its employees. The purpose of a JSA is NOT to identify all hazards associated with a task, but to identify key potential hazards to get TRC and other onsite personnel thinking about other potential safety hazards and mitigating actions for unsafe conditions and behavior during various works. TRC recognizes that JSA's may not cover every conceivable step or hazard that emerges during a job, so we've provided a "Field Change" section below to amend a JSA if required. The JSA does not supersede or replace any local, state or federal permit, regulation, statute or other entities policies and procedures but is simply a tool for enhancing the execution of safe work at a jobsite under TRC's supervision. Similarly, all subcontractors are required to provide their own JSA(s) for their specialty prior to performing any work for TRC or its customers in accordance with TRC's EHS Policy; however, any unsafe condition or hazard not covered in any JSA is ultimately the direct responsibility of the person or entity performing the work.

Appendix J
Acknowledgement

PERSONAL ACKNOWLEDGEMENT

A component of the HASP, designed to provide personnel safety during work activities described herein, requires that you receive training as described in the HASP prior to working at this site. Additionally, you are required to read and understand the HASP. When you have fulfilled these requirements, please sign and date this personal acknowledgement:

Name (Printed)	Signature	Date
Name (Printed)	Signature	Date
Name (Printed)	Signature	Date
Name (Printed)	Signature	Date
Name (Printed)	Signature	Date
Name (Printed)	Signature	Date
Name (Printed)	Signature	Date
Name (Printed)	Signature	Date
Name (Printed)	Signature	Date
Name (Printed)	Signature	Date

Appendix D

Generic Community Air Monitoring Plan and Fugitive Dust and Particulate Monitoring Program

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.