Appendices for SWMU 51 Interim Measures Work Plan

Approved Draft

July 2008

Appendix A

Statement of Qualifications

STATEMENT OF QUALIFICATIONS

Mr. Bob Culbertson has over 30 years of experience as a professional in environmental remediation, construction, and mining industry operations. He has 17 years of experience managing large, multi-task programs on Hazardous, Toxic, and Radioactive Waste (HTRW) cost-reimbursable and fixed price contracts involving site characterization, Remedial Investigation/Feasibility Study (RI/FS), remedial design and engineering, and remedial construction actions. In addition, he has over 13 years of experience managing large-scale industrial projects from the conceptual evaluation and process design stage through construction, startup, and operations management. He has also managed engineering organizations responsible for new project development, providing operations support, obtaining environmental permits, and managing operations for regulatory compliance. Mr. Culbertson's program management experience has encompassed the full range of HTRW remediation services; having been responsible and accountable for Indefinite Delivery/Indefinite Quantity (ID/IQ) contracts valued in excess of $689 million on 8 programs. These programs consisted of 5 A/Es, 1 RAC, and 2 TERCs performing work for the Army, Navy, Air Force, and EPA. He has directed the activities of large field and office staffs, comprised of more than 15 project managers and up to 250 professional personnel working on more than 55 simultaneous task orders at 30 installations, including installations outside the continental United States (OCONUS).

Mr. Jeffrey Parks is a registered, professional geologist with 20 years of personnel and project management, geologic, hydrogeologic, and hazardous waste management experience. Mr. Parks' expertise is in HTRW projects, RI/FSs, RFIs, RCRA permitting and remedial actions. He is currently responsible for senior management of U.S. Army Corps of Engineers (USACE) groundwater study, remedial investigation, and remediation projects, including projects at Radford Army Ammunition Plant, VA. He has been the senior hydrogeologist and project manager for USEPA-funded investigations of uncontrolled hazardous waste sites and a technical lead for the Federal Aviation Authority-expedited response action group. Mr. Parks is also the Edgewood Office Technical Services Manager Northern Division. Responsibilities in this role include guidance for scientists in addition to project staffing, mentoring, and yearly progress evaluations.

As a Project Manager for Radford Army Ammunition Plant, Radford, VA. Mr. Parks is responsible for budgetary and technical management of a variety of tasks including RCRA Facility Investigations and Corrective Measures Studies in support of Radford's RCRA Permit, contract compliance and administration, preparation and review of daily production and usage rates, tracking and reviewing project finances, and client and regulatory interface. Also conducting Remedial Investigations/Feasibility Studies, expedited removal actions, and a facility-wide groundwater study in karst terrain.

Mr. Timothy Leahy has 13 years of experience managing environmental investigation and remediation projects. He is currently project manager for several tasks at Radford Army Ammunition Plant, including the recently completed removal action at Building 4343. His field experience includes field management of multiple crews of co-workers and subcontractors on large CERCLA field investigations. His experience also includes groundwater monitoring and extraction well design, site selection, installation, and sampling; geologic sample logging; and drilling supervision for CERCLA and RCRA sites. His experience includes project

management; technical analysis and writing; computer programming; and, design and implementation of field investigation programs.

Ms. Gretchen Tabano, P.E. has over ten years of experience as a task manager/project engineer involved in HTRW investigations and cleanup of a wide variety of DoD sites. Her experience includes the completion of site investigations, EE/CA preparation involving the removal and/or avoidance of ordnance as part of the process, the excavation and disposal of lead-contaminated range soils, pits of unknown chemical/biological wastes, and landfills including municipal, industrial, medical, and UXO wastes and RI/FS for VOC, TPH, and explosive contamination in soil and groundwater and pits of UXO/CWM. Ms. Tabano is knowledgeable in Base Realignment and Closure (BRAC) site investigation and remediation. Ms. Tabano has worked at DoD sites located in Virginia, New Jersey, New Hampshire, Colorado, Alaska, Florida, Maryland, Alabama, Tennessee, California, and Nebraska.

Mr. Joe Hoyt has been responding to emergency environmental actions, time critical remediation projects, unique demolition scenarios, RCRA landfill closures, and safety troubleshooting at hazardous remediation jobs over the course of 17 years. In the past 10 years, Mr. Hoyt has worked mainly in the DoD Program working on programs such as the LANTDIV, and the Baltimore TERC Programs and has completed with great success some of the largest and safest projects under these contracts.

Mr. Hoyt has experience in the environmental remediation and construction industry as a site safety officer. He has worked on EPA, DoD, AFCEE, USACE and multiple state governmental agencies sites. He has experience in managing a variety of cleanup scenarios including wastewater and ground water recovery and treatment, labpack operations, drum removal, large asbestos and lead projects, Superfund ERCS removal projects, RCRA closures and large soil excavation projects. He has worked with anthrax, bio-hazards, PCBs, dioxin, biomedical waste, pesticides, cyanide, flammables, radiation, lead, asbestos, unexploded ordinance, corrosives and petroleum products. Mr. Hoyt ensures that the highest safety standards are always met.

Mr. Charles Pete Hunter has successfully served the energy and environment industries for thirty years. During his career he has held responsible positions in quality management supporting the U.S. Department of Energy, as well as major architectural engineering, construction, and environmental management firms. His experience in quality systems, management of personnel, business development, and program assessment has encompassed commercial nuclear power plant construction, startup, and operations; defense reactor program support; environmental restoration; hazardous waste management and remedial construction projects. As a quality assurance professional he has extensive experience in quality programs meeting the requirements of 10CFR-830.120, DOE/RW-0333P, 10CFR-50, Appendix B, ANSI/ASME NQA-1, ANSI/ASQC-E4, ISO-9000 and other quality standards. He is a committee member of the U.S. Sub TAG to ISO/TC207 for the development of ISO 14000 Environmental Management Standards, and member of the ANSI ASQ Z1 Environmental Management Subcommittee to the U.S. Technical Advisory Group to ISO.

Mr. Steve Kritak has gained over 14 years of experience managing multi-disciplinary project personnel on both emergency response and planned remediation projects for a wide variety of government (e.g., USACE and USEPA) and commercial clients. He has managed field crews ranging in size from a few cleanup technicians to over 50 equipment operators, sample

technicians, cleanup technicians, and laborers, as well as subcontractor personnel (e.g., asbestos and lead-based paint abatement, demolition, and T&D subcontractors). Types of projects he has successfully managed include landfill capping, soil and sediment excavation, facility decontamination and demolition, stabilization/solidification, UST/AST cleaning/removal, drum handling, slurry wall construction and Transportation and disposal coordination. Mr. Kritak has worked on RFAAP previously and is well aware of the intricacies with the project.

Mr. Charles Green is a Health and Safety Coordinator. In this position he is responsible for field coordination of the project health and safety program. He plays a key role as advisor to the Project Manager, Site Superintendent, and client representative on all matters relating to project health and safety. His specific on-site duties include health and safety plan development and implementation; direct reading an integrated air monitoring; establishing site work zone and decontamination stations; conducting periodic safety inspections; establishing emergency egress points, assembly areas, and first-aid stations; implementing a site emergency warning communication system; maintaining the local medical surveillance and emergency medical treatment programs; conducting site-specific employee training and information sessions; and assigning appropriate personal protection levels.

Mr. Green has served as the Site Health and Safety Officer, Radford AAP – Building 4343 Interim Measures, Radford, Virginia. July 2006 – October 2006. As the Site Health and Safety Officer during excavation and demolition activities for the Building 4343 Interim Measures, Mr. Green has direct experience at RFAAP and is familiar with the Installation's health and safety policies and procedures.

Mr. Eric Malarek is a chemist with 19 years hands-on experience overseeing and providing broad range of environmental project consulting, quality assurance oversight and training, data validation and management, field sampling, and technical support. Overall experience with public and commercial accounts with special strengths gleaned from key project positions on large federal site/remedial investigations, feasibility studies, corrective actions, and long-term monitoring programs. Strong familiarity with relevant laboratory operations, procedures, regulatory requirements, QA/QC protocols, scheduling, data packages and other factors critical to meeting external (and internal) client needs. Practical foundation rooted in commercial and USEPA laboratory positions complimented by business, technical and project management skills enhanced in the consulting industry.

Appendix B

Standard Operating Procedures (SOPs)

Standard Operating Procedures

SOP SERIES	TITLE
10.0	**DOCUMENTATION**
10.1	Field Logbook
10.2	Surface Water, Groundwater, and Soil/Sediment Field Logbooks
10.3	Boring Logs
10.4	Chain-of-Custody Forms
30.0	**SAMPLING**
30.1	Soil Sampling
30.6	Containerized Material
30.7	Sampling Strategies
50.0	**SAMPLE MANAGEMENT**
50.1	Sample Labels
50.2	Sample Packaging
70.0	**INVESTIGATION-DERIVED MATERIAL**
70.1	Investigation-Derived Material
80.0	**DECONTAMINATION**
80.1	Decontamination

STANDARD OPERATING PROCEDURE 10.1
FIELD LOGBOOK

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for recording daily site investigation activities.

Records should contain sufficient information so that anyone can reconstruct the sampling activity without relying on the collector's memory.

2.0 MATERIALS

- Field logbook.
- Indelible ink pen.
- Clear tape.

3.0 PROCEDURE

Information pertinent to site investigations will be recorded in a bound logbook. Each page/form will be consecutively numbered, dated, and signed. All entries will be made in indelible ink, and all corrections will consist of line out deletions that are initialed and dated. If only part of a page is used, the remainder of the page should have an "X" drawn across it. At a minimum, entries in the logbook will include but not be limited to the following:

- Project name (cover).
- Name and affiliation of personnel on site.
- Weather conditions.
- General description of the field activity.
- Sample location.
- Sample identification number.
- Time and date of sample collection.
- Specific sample attributes (e.g., sample collection depth flow conditions or matrix).
- Sampling methodology (grab or composite sample).
- Sample preservation, as applicable.
- Analytical request/methods.
- Associated quality assurance/quality control (QA/QC) samples.
- Field measurements/observations, as applicable.
- Signature and date of personnel responsible for documentation.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None.

6.0 REFERENCES

USEPA. 1990. *Sampler's Guide to the Contract Laboratory Program*. EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C.

USEPA. 1991. *User's Guide to the Contract Laboratory Program*. EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response, January.

USEPA. 1998. *EPA Requirements for Quality Assurance Project Plans.* EPA/600/R-98/018, QA/R5, Final, Office of Research and Development, Washington, D.C.

STANDARD OPERATING PROCEDURE 10.2
SURFACE WATER, GROUNDWATER, AND SOIL/SEDIMENT FIELD LOGBOOKS

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for recording surface water, groundwater, and soil/sediment sampling information, as well as instrument calibration data in field logbooks.

2.0 MATERIAL

- Applicable field logbook (see attached forms).
- Indelible ink pen.

3.0 PROCEDURE

All information pertinent to surface water, groundwater, or soil/sediment sampling will be recorded in the appropriate logbook. Each page/form of the logbook will be consecutively numbered. All entries will be made with an indelible ink pen. All corrections will consist of line out deletions that are initialed and dated.

3.1 SOIL/SEDIMENT

3.1.1 Field Parameters/Logbook (Form 10.2-a)

1. HIGH CONCENTRATION EXPECTED?: Answer "Yes" or "No."
2. HIGH HAZARD?: Answer "Yes" or "No."
3. INSTALLATION/SITE: Record the complete name of the Installation or site.
4. AREA: Record the area designation of the sample site.
5. INST. NAME: Record the two-letter installation name for Radford Army Ammunition Plant – "RD."
6. SAMPLE MATRIX CODE: Record the appropriate sample matrix code. Common codes are "SD" for solid - sediment, "SI" for soil - gas, "SL for solid sludge, "SO" for surface other, "SS" for solid – soil, "SW" for surface wipe, "WD" for water – potable, "WG" for water – ground, "WS" water – surface, "WT" – water treated and "WW" water – waste.
7. SITE ID: Record a code up to 20 characters or numbers that is unique to the site.
8. ENV. FIELD SAMPLE IDENTIFIER: Record a code up to 20 characters specific for the sample.
9. DATE: Enter the date the sample was taken.
10. TIME: Enter the time (12-hour or 24-hour clock acceptable as long as internally consistent) the sample was taken.
11. AM PM: Circle "AM" or "PM" to designate morning or afternoon (12-hour clock).

12. SAMPLE PROG: Record “RFI” (RCRA Facility Investigation) or other appropriate sample program.
13. DEPTH (TOP): Record the total depth sampled.
14. DEPTH INTERVAL: Record the intervals at which the plug will be sampled.
15. UNITS: Record the units of depth (feet, meters).
16. SAMPLE MEASUREMENTS: Check the appropriate sampling method.
17. CHK: Check off each container released to a laboratory.
18. ANALYSIS: Record the type of analysis to be performed on each sample container.
19. SAMPLE CONTAINER: Record the sample container type and size.
20. NO.: Record the number of containers.
21. REMARKS: Record any remarks about the sample.
22. TOTAL NUMBER OF CONTAINERS FOR SAMPLE: Record the total number of containers.
23. SITE DESCRIPTION: Describe the location where the sample was collected.
24. SAMPLE FORM: Record the form of the sample (i.e., clay, loam, etc.) using The Unified Soil Classification System (USCS).
25. COLOR: Record the color of the sample as determined from standard Munsell Color Charts.
26. ODOR: Record the odor of the sample or “none.”
27. PID: Record the measured PID values or other similar measurement instrument value.
28. UNUSUAL FEATURES: Record anything unusual about the site or sample.
29. WEATHER/TEMPERATURE: Record the weather and temperature.
30. SAMPLER: Record your name.

3.1.2 Map File Form (refer to form 10.2-c)

- SITE ID: Record the Site ID from the field parameter form.
- POINTER: Record the field sample number for the sample being pointed to.
- DESCRIPTION/MEASUREMENTS: Describe the location where the sample was taken, along with distances to landmarks.
- SKETCH/DIMENSIONS: Diagram the surroundings and record the distances to landmarks.
- MAP REFERENCE: Record which U.S.G.S. Quad Map references the site.
- COORDINATE DEFINITION: Write the compass directions and the X- and Y-coordinates of the map run.
- COORDINATE SYSTEM: Write “UTM” (Universal Transverse Mercator).
- SOURCE: Record the 1-digit code representing the Map Reference.
- ACCURACY: Give units (e.g., write “1-M” for 1 meter).

- X-COORDINATE: Record the X-coordinate of the sample site location.
- Y-COORDINATE: Record the Y-coordinate of the sample site location.
- UNITS: Record the units used to measure the map sections.
- ELEVATION REFERENCE: Record whether topography was determined from a map or a topographical survey.
- ELEVATION SOURCE: Record the 1-digit code representing the elevation reference.
- ACCURACY: Record the accuracy of the map or survey providing the topographical information.
- ELEVATION: Record the elevation of the sampling site.
- UNITS: Write the units in which the elevation is recorded.
- SAMPLER: Write your name.

4.2 SURFACE WATER

4.2.1 Field Parameter Logbook (Forms 10.2-b and 10.2-c)

- CAL REF: Record the calibration reference for the pH meter.
- pH: Record the pH of the sample.
- TEMP: Record the temperature of the sample in degrees Celsius.
- COND: Record the conductivity of the water.
- Description of site and sample conditions (refer to 10.2-b).
- Map File Form (refer to Section 3.1.2).

4.3 GROUNDWATER (FORMS 10.2- D)

4.3.1 Field Parameter Logbook (Forms 10.2-b)

Refer to Section 3.2.1.

4.3.1 Map File and Purging Forms

- WELL NO. OR ID: Record the abbreviation appropriate for where the sample was taken. Correct abbreviations can be found on pages 18-21 of the IRDMIS User's Guide for chemical data entry.
- SAMPLE NO.: Record the reference number of the sample.
- WELL/SITE DESCRIPTION: Describe the location where the sample was taken, along with distances to landmarks.
- X-COORD AND Y-COORD: Record the survey coordinates for the sampling site.
- ELEV: Record the elevation where the sample was taken.
- UNITS: Record the units the elevation was recorded in.
- DATE: Record the date in the form MM/DD/YY.
- TIME: Record the time, including a designation of AM or PM.

- AIR TEMP.: Record the air temperature, including a designation of C or F (Celsius or Fahrenheit).
- WELL DEPTH: Record the depth of the well in feet and inches.
- CASING HEIGHT: Record the height of the casing in feet and inches.
- WATER DEPTH: Record the depth (underground) of the water in feet and inches.
- WELL DIAMETER: Record the diameter of the well in inches.
- WATER COLUMN HEIGHT: Record the height of the water column in feet and inches.
- SANDPACK DIAM.: Record the diameter of the sandpack. Generally, this will be the same as the bore diameter.
- EQUIVALENT VOLUME OF STANDING WATER: Use one of the following equations to determine one equivalent volume (EV).

  1 EV = volume in casing + volume in saturated sandpack. Or:

  $1\ EV = [\pi R_w^2 h_w + 0.30p(R_s^2 - R_w^2)h_s] * (0.0043)$

Where:

R_s = radius of sandpack in inches
R_w = radius of well casing in inches
h_s = height of sandpack in inches
h_w = water depth in inches

$0.0043 = gal/in^3$

and filter pack porosity is assumed as 30%, or

Volume in casing =
$(0.0043\ gal/in^3)(p)(12\ in/ft)(R_c^2)(W_h)$

Where:

R_c = radius of casing in inches, and
W_h = water column height in feet

Vol. in sandpack =
(0.0043 gal/in3)(p)(12 in/ft)(Rb2 - Rc2)(Wh)(0.30)

(if Wh is less than the length of the sandpack), or

Vol. in sandpack =
(0.0043 gal/in3)(p)(12 in/ft)(Rb2 - Rc2)(Sh)(0.30)

(if Wh is greater than the length of the sandpack).

Where:

Rb = radius of the borehole, and
Sh = length of the sandpack.

Show this calculation in the comments section.

- PUMP RATE: Record pump rate.
- TOTAL PUMP TIME: Record total purge time and volume.
- WELL WENT DRY? Write "YES" or "NO."
- PUMP TIME: Record pump time that made the well go dry.
- VOLUME REMOVED: Record the volume of water (gal) removed before the well went dry.
- RECOVERY TIME: Record the time required for the well to refill.
- PURGE AGAIN?: Answer "YES" or "NO."
- TOTAL VOL. REMOVED: Record the total volume of water (in gallons) removed from the well.
- CAL REF.: Record the calibration reference for the pH meter.
- TIME: Record time started (INITIAL T(0)), 2 times DURING the sampling and the time sampling ended (FINAL).
- pH: Record the pH at start of sampling (INITIAL), twice DURING the sampling, and at the end of sampling (FINAL).
- TEMP: Record the water temperature (Celsius) at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL).
- COND: Record the conductivity of the water at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL).
- D.O.: Record the dissolved oxygen level in the water at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL).
- TURBIDITY: Record the readings from the turbidity meter (nephelometer) and units at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL).
- ORD: Record the oxidation/reduction (RedOx) potential of the water sample at the start of sampling, twice DURING the sampling, and at the end of sampling (FINAL).
- HEAD SPACE: Record any positive readings from organic vapor meter reading taken in well headspace before sampling.
- NAPL: Record the presence and thickness of any non-aqueous phase liquids (LNAPL and DNAPL).
- COMMENTS: Record any pertinent information not already covered in the form.
- SIGNATURE: Sign the form.

4.3 FIELD CALIBRATION FORMS (REFER TO FORM 10.2-E)

- Record time and date of calibration.
- Record calibration standard reference number.
- Record meter ID number.
- Record initial instrument reading, recalibration reading (if necessary), and final calibration reading on appropriate line.
- Record value of reference standard (as required).
- COMMENTS: Record any pertinent information not already covered on form.
- SIGNATURE: Sign form.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None.

6.0 REFERENCE

USEPA. 1991. *User's Guide to the Contract Laboratory Program*. EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response, January.

FIELD PARAMETER/LOGBOOK FORM 10.2-a
SOIL AND SEDIMENT SAMPLES

HIGH CONCENTRATION EXPECTED? _____ HIGH HAZARD?

INSTALLATION/SITE _____ AREA _____

INST NAME _____ FILE NAME _____

SAMPLE MATRIX CODE _____ SITE ID _____

ENV. FIELD SAMPLE IDENTIFIER _____

DATE (MM/DD/YY) __/__/__ TIME _____ AM PM SAMPLE PROGRAM

DEPTH (TOP) _____ DEPTH INTERVAL _____ UNIT _____

SAMPLING METHOD:

SPLIT SPOON ___ AUGER ___ SHELBY TUBE ___ SCOOP ___ OTHER

CHK ANALYSIS SAMPLE CONTAINER NO. REMARKS

TOTAL NUMBER OF CONTAINERS FOR SAMPLE_____

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION:_____

_____

_____

SAMPLE FORM _____ COLOR _____ ODOR _____

PID (HNu)_____ UNUSUAL FEATURES_____

_____

WEATHER/TEMPERATURE

SAMPLER _____

FIELD PARAMETER/LOGBOOK FORM 10.2-b
GROUNDWATER AND SURFACE WATER SAMPLES

HIGH CONCENTRATION EXPECTED? _____ HIGH HAZARD?

INSTALLATION/SITE _____ AREA

INST CODE _____ FILE NAME _____ SITE TYPE

SITE ID _____ FIELD SAMPLE NUMBER

DATE (MM/DD/YY) __/__/__ TIME _____ AM PM SAMPLE PROG.

DEPTH (TOP) _____ DEPTH INTERVAL _____ UNITS

SAMPLING MEASUREMENTS

CAL REF. ____ pH _____ TEMPERATURE °C _____ CONDUCTIVITY _____ REDOX _____

DISSOLVED OXYGEN ____ TURBIDITY _____ OTHER

CHK ANALYSIS SAMPLE CONTAINER NO. REMARKS

TOTAL NUMBER OF CONTAINERS FOR SAMPLE_____

DESCRIPTION OF SITE AND SAMPLE CONDITIONS

SITE DESCRIPTION_____

SAMPLING METHOD_____

SAMPLE FORM _____ COLOR _____ ODOR _____

PID (HNu)_____

UNUSUAL FEATURES_____

WEATHER/TEMPERATURE_____ SAMPLER _____

EXAMPLE MAP FILE LOGBOOK FORM 10.2-c
SURFACE WATER, SOIL, AND SEDIMENT SAMPLES

SITE ID_____ POINTER_____

DESCRIPTION/MEASUREMENTS_____

SKETCH/DIMENSIONS :

MAP REFERENCE_____

COORDINATE DEFINITION (X is _____ Y is _____)

COORDINATE SYSTEM _____ SOURCE _____ ACCURACY_____

X-COORDINATE _____ Y-COORDINATE _____ UNITS_____

ELEVATION REFERENCE_____

ELEVATION SOURCE _____ ACCURACY _____ELEVATION_____

UNITS_____

SAMPLER_____

EXAMPLE MAP FILE AND PURGING LOGBOOK FORM 10.2-d
GROUNDWATER SAMPLES

WELL COORD. OR ID _____ SAMPLE NO._____

WELL/SITE DESCRIPTION_____

_____

X-COORD. _____ Y-COORD. _____ ELEV. _____ UNITS

DATE ____/____/____ TIME _____ AIR TEMP.

WELL DEPTH _____ FT. _____ IN. CASING HT. _____ FT. _____ IN.

WATER DEPTH _____ FT. _____ IN. WELL DIAMETER _____ IN.

WATER COLUMN HEIGHT _____ FT. _____ IN. SANDPACK DIAM. _____ IN.

EQUIVALENT VOLUME OF STANDING WATER _____ (GAL) (L)

VOLUME OF BAILER _____ (GAL) (L) or PUMP RATE _____ (GPM) (LPM)

TOTAL NO. OF BAILERS (5 EV) _____ or PUMP TIME _____ MIN.

WELL WENT DRY? [Yes] [No] NUM. OF BAILERS _____ or PUMP TIME

VOL. REMOVED _____ (GAL) (L) RECOVERY TIME

PURGE AGAIN? [Yes] [No] TOTAL VOL. REMOVED _____ (GAL) (L)

DATE & TIME	QUANTITY REMOVED	TIME REQ'D	pH	Cond	Temp	ORD	Turb	DO	Character of water (color / clarity / odor / partic.)
(before)									
(during)									
(during)									
(during									
(after)									

COMMENTS_____

SIGNATURE_____

INITIAL CALIBRATION	**FINAL CALIBRATION**
DATE:	**DATE:**
TIME:	**TIME:**

pH METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

pH STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
7.0			
10.0			
4.0			

CONDUCTIVITY METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

COND. STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

TEMPERATURE METER CALIBRATION

METER ID_____

TEMP. STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
ICE WATER			
BOILING WATER			
OTHER _____			

TURBIDITY METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

ORD METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

DISSOLVED OXYGEN METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO:_____

METER ID_____

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING

COMMENTS_____

SIGNATURE_____

STANDARD OPERATING PROCEDURE 10.3
BORING LOGS

1.0 INTRODUCTION

The purpose of this standard operating procedure (SOP) is to describe the methods to be followed for classifying soil and rock, as well as preparing borehole logs and other types of soil reports.

2.0 MATERIALS

The following equipment is required for borehole logging:

- HTRW ENG Form 5056-R and 5056A-R boring log forms.
- Daily inspection report forms.
- Chain-of-custody forms.
- Request for analysis forms.
- ASTM D 2488 classification flow chart.
- Soil and/or Rock color chart (i.e., Munsell®).
- Grain size and roundness chart.
- Graph paper.
- Engineer's scale.
- Previous reports and boring logs.
- Pocketknife or putty knife.
- Hand lens.
- Dilute hydrochloric acid (10% volume).
- Gloves.
- Personal protective clothing and equipment, as described in work plan addenda health and safety plan.
- Photoionization detector or other appropriate monitoring equipment per site-specific health and safety plan.
- Decontamination supplies (SOP 80.1).

3.0 PROCEDURE

Each boring log should fully describe the subsurface environment and the procedures used to obtain this description.

Boring logs should be prepared in the field on USACE Engineer Form 5056-R and 5056-R. Logs should be recorded in the field directly on the boring log form and not transcribed from a field book.

A "site geologist" should conduct borehole logging and soil/rock identification and description or other professional trained in the identification and description of soil/rock.

3.1 BORING LOG INFORMATION

As appropriate, the following information should be recorded on the boring log during the course of drilling and sampling activities:

- Project information including name, location, and project number.
- Each boring and well should be uniquely numbered and located on a sketch map as part of the log.
- Type of exploration.
- Weather conditions including events that could affect subsurface conditions.
- Dates and times for the start and completion of borings, with notations by depth for crew shifts and individual days.
- Depths/heights in feet and in decimal fractions of feet.
- Descriptions of the drilling equipment including rod size, bit type, pump type, rig manufacturer and model, and drilling personnel.
- Drilling sequence and descriptions of casing and method of installation.
- Description and identification of soils in accordance with ASTM Standard D 2488.
- Descriptions of each intact soil sample for the parameters identified in Section 3.2.
- Descriptions and classification of each non-intact sample (e.g., wash samples, cuttings, auger flight samples) to the extent practicable.
- Description and identification of rock.
- Description of rock (core(s)) for the parameters identified in Section 3.7.
- Scaled graphic sketch of the rock core (included or attached to log) according to the requirements identified in Section 3.7.
- Lithologic boundaries, with notations for estimated boundaries.
- Depth of water first encountered in drilling, with the method of first determination (any distinct water level(s) below the first zone will also be noted).
- Interval by depth for each sample taken, classified, and/or retained, with length of sample recovery and sample type and size (diameter and length).
- Blow counts, hammer weight, and length of fall for driven samplers.

- Rate of rock coring and associated rock quality designation (RQD) for intervals cored.
- Drilling fluid pressures, with driller's comments.
- Total depth of drilling and sampling.
- Drilling fluid losses and gains should be recorded.
- Significant color changes in the drilling fluid returned.
- Soil gas or vapor readings with the interval sampled, with information on instrument used and calibration.
- Depth and description of any in-situ test performed.
- Description of other field tests conducted on soil and rock samples.

3.2 SOIL PARAMETERS FOR LOGGING

In general, the following soil parameters should be included on the boring log when appropriate:

- Identification per ASTM D 2488 with group symbol.
- Secondary components with estimated percentages per ASTM D 2488.
- Color.
- Plasticity per ASTM D 2488.
- Density of non-cohesive soil or consistency of cohesive soil.
- Moisture condition per ASTM D 2488 (dry, moist, or wet).
- Presence of organic material.
- Cementation and HCL reaction testing per ASTM D 2488.
- Coarse-grained particle description per ASTM D 2488 including angularity, shapes, and color.
- Structure per ASTM D 2488 and orientation.
- Odor.
- Depositional environment and formation, if known.

ASTM D 2488 categorizes soils into 13 basic groups with distinct geologic and engineering properties based on visual-manual identification procedures. The following steps are required to classify a soil sample:

- Observe basic properties and characteristics of the soil. These include grain size grading and distribution, and influence of moisture on fine-grained soil.
- Assign the soil an ASTM D 2488 classification and denote it by the standard group name and symbol.
- Provide a written description to differentiate between soils in the same group if necessary.

Many soils have characteristics that are not clearly associated with a specific soil group. These soils might be near the borderline between groups, based on particle distribution or plasticity characteristics. In such a case, assigning dual group names and symbols (e.g., GW/GC or

ML/CL) might be an appropriate method of describing the soil. The two general types of soils, for which classification is performed, coarse- and fine-grained soils, are discussed in the following sections.

3.3 COURSE-GRAINED SOIL IDENTIFICATION

For soils in the coarse-grained soils group, more than half of the material in the soil matrix will be retained by a No. 200 sieve (75-μm).

Coarse-grained soils are identified on the basis of the following:

- Grain size and distribution.
- Quantity of fine-grained material (i.e., silt and clay as a percentage).
- Character of fine-grained material.

2. The following symbols are used for classification:

Basic Symbols			Modifying Symbols		
G	=	gravel	W	=	well graded
S	=	sand	P	=	poorly graded
			M	=	with silty fines
			C	=	with clayey fines

3. The following basic facts apply to coarse-grained soil classification.

- The basic symbol G is used if the estimated percentage of gravel is greater than that for sand. In contrast, the symbol S is used when the estimated percentage of sand is greater than the percentage of gravel.
- Gravel ranges in size from 3-inch to 1/4-inch (No. 4 sieve) diameter. Sand ranges in size from the No. 4 sieve to No. 200 sieve. The Grain Size Scale used by Engineers (ASTM Standards D 422-63 and D 643-78) is the appropriate method to further classify grain size as specified by ASTM D 2488.
- Modifying symbol W indicates good representation of all particle sizes.
- Modifying symbol P indicates that there is an excess or absence of particular sizes.
- The symbol W or P is used only when there are less than 15% fines in a sample.
- Modifying symbol M is used if fines have little or no plasticity (silty).
- Modifying symbol C is used if fines have low to high plasticity (clayey).
- Figure 10.03a is a flowchart for identifying coarse-grained soils by ASTM D 2488.

3.4 FINE-GRAINED SOIL IDENTIFICATION

If one-half or more of the material will pass a No. 200 sieve (75 μm), the soil is identified as fine-grained.

- Fine-grained soils are classified based on dry strength, dilatancy, toughness, and plasticity.
- Classification of fine-grained soils uses the following symbols:

Basic Symbols			Modifying Symbols		
M	=	silt (non plastic)	L	=	low liquid limit (lean)
C	=	clay (plastic)	H	=	high liquid limit (fat)
O	=	organic			
Pt	=	peat			

3. The following basic facts apply to fine-grained soil classification:

- The basic symbol M is used if the soil is mostly silt, while the symbol C applies if it consists mostly of clay.
- Use of symbol O (group name OL/OH) indicates that organic matter is present in an amount sufficient to influence soil properties. The symbol Pt indicates soil that consists mostly of organic material.
- Modifying symbols (L and H) are based on the following hand tests conducted on a soil sample:
- Dry strength (crushing resistance).
- Dilatancy (reaction to shaking).
- Toughness (consistency near plastic limit).
- Soil designated ML has little or no plasticity and can be recognized by slight dry strength, quick dilatency, and slight toughness.
- CL indicates soil with slight to medium plasticity, which can be recognized by medium to high dry strength, very slow dilatancy, and medium toughness.
- Criteria for describing dry strength per ASTM D 2488 are as follows:
- Description Criteria
- None Dry sample crumbles into powder with pressure of handling.
- Low Dry specimen crumbles into powder with some finger pressure.
- Medium Dry specimen breaks into pieces or crumbles with considerable finger pressure.
- High Dry specimen cannot be broken with finger pressure but will break into pieces between thumb and a hard surface.
- Very high Dry specimen cannot be broken between the thumb and a hard surface stiffness.
- Criteria for describing dilatancy per ASTM D 2488 are as follows:
- None No visible change in the sample.
- Slow Water appears slow on the surface of the sample during shaking and does not disappear or disappears slowly upon squeezing.
- Rapid Water appears quickly on the surface of the sample during shaking and disappears quickly upon squeezing.
- Criteria for describing toughness per ASTM D 2488 are as follows:
- Description Criteria

- Low Only slight pressure is required to roll the thread near the plastic limit and the thread and lump are weak and soft.
- Medium Medium pressure is required to roll the thread to near the plastic limit and the thread and lump have medium stiffness.
- High Considerable pressure is required to roll the thread to near the plastic limit and the thread and lump have very high stiffness.
- Figure 10.03b is a flowchart for identifying fine-grained soils by ASTM D 2488.

3.5 DENSITY AND CONSISTENCY

Relative density for coarse-grained soils and consistency for fine-grained soils can be estimated using standard penetration test blow count data (ASTM D 1586). The number of blows required for each 6 inches of penetration or fraction thereof is recorded. If the sampler is driven less than 18 inches, the number of blows per each complete 6-inch interval and per partial interval is recorded.

For partial increments, the depth of penetration should be recorded to the nearest 1 inch. If the sampler advances below the bottom of the boring under the weight of rods (static) and/or hammer, then this information should be recorded on the log.

The following are some "rule-of-thumb" guidelines for describing the relative density of coarse-grained soils:

Blow Count	Relative Density for Sand
0–4	Very loose
4–10	Loose
10–30	Medium dense
30–50	Dense
>50	Very Dense

The following are some "rule-of-thumb" guidelines for describing the consistency of fine-grained soils:

Blow Count	Consistency for Clays	Description
0–2	Very Soft	Sample sags or slumps under its own weight.
2–4	Soft	Sample can be pinched in two between the thumb and forefinger.
4–8	Medium Stiff	Sample can be easily imprinted with fingers.
8–16	Stiff	Sample can be imprinted only with considerable pressure of fingers.
16–32	Very Stiff	Sample can be imprinted very slightly with fingers.
>32	Hard	Sample cannot be imprinted with fingers; can be pierced with pencil.

3.6 OTHER DESCRIPTIVE INFORMATION

The approximate percentage of gravel, sand, and fines (use a percentage estimation chart) should be recorded per ASTM D 2488 as follows:

Modifiers	Descriptions
Trace	Less than 5%
Few	5%–10%
Little	15%–25%
Some	30%–45%
Mostly	50%–100%

Color/discoloration should be recorded and described using a soil color chart, such as the Munsell® Soil Color Charts. A narrative and numerical description should be given from the color chart, such as Brown 10 YR, 5/3 (Munsell®). Odor should be described if organic or unusual.

Plasticity should be described as follows:

Description	Criteria
Non-plastic	A 1/8-inch thread cannot be rolled at any water content.
Low	Thread can barely be rolled and lump cannot be formed when drier than plastic limit.
Medium	Thread is easy to roll; plastic limit can be reached with little effort and lump crumbles when drier than plastic limit.
High	Considerable time is required to reach the plastic limit and lump can be formed without crumbling when drier than plastic limit

Moisture condition should be recorded as dry (absence of moisture), moist (damp but no visible water) or wet (visible free water).

Cementation should be recorded (carbonates or silicates) along with the results of HCL reaction testing. The reaction with HCL should be described as none (no visible reaction), weak (some reaction with slowly forming bubbles) or strong (violent reaction with bubbles forming immediately).

Particle description information for coarse-grained soil should be recorded where appropriate per ASTM D 2488 including maximum particle size, angularity (angular, subangular, subrounded, or rounded), shape (flat, elongated or flat and elongated), and color.

Structure (along with orientation) should be reported using the following ASTM D 2488 descriptions:

Description	Criteria
Stratified	Alternating layers of varying material or color with layers greater than 6 millimeters thick.
Laminated	Alternating layers of varying material or color with layers less than 6 millimeters thick.
Fissured	Breaks along definite planes of fracture with little resistance.

Slickensided Fracture planes that appear polished or glossy, can be striated.

Blocky Inclusion of small pockets of different soils.

Homogeneous Same color and appearance throughout.

3.7 ROCK CORE PARAMETERS FOR LOGGING

In general, the following parameters should be included on the boring log when rock coring is conducted:

- Rock type.
- Formation.
- Modifier denoting variety.
- Bedding/banding characteristics.
- Color.
- Hardness.
- Degree of cementation.
- Texture.
- Structure and orientation.
- Degree of weathering.
- Solution or void conditions.
- Primary and secondary permeability including estimates and rationale.
- Lost core interval and reason for loss.

A scaled graphic sketch of the core should provided on or attached to the log, denoting by depth, location, orientation, and nature (natural, coring-induced, or for fitting into core box) of all core breaks. Where fractures are too numerous to be shown individually, their location may be drawn as a zone.

The RQD values for each core interval (run) should be calculated and included on the boring log. The method of calculating the RQD is as follows per ASTM D 6032:

RQD = [Σ length of intact core pieces > 100 mm (4-inches)] x 100%/total core length.

3.8 PROCEDURES FOR ROCK CLASSIFICATION

For rock classification record mineralogy, texture, and structural features (e.g., biotite and quartz fine grains, foliated parallel to relict bedding oriented 15 to 20 degrees to core axis, joints coated with iron oxide). Describe the physical characteristics of the rock that are important for engineering considerations such as fracturing (including minimum, maximum, and most common and degree of spacing), hardness, and weathering.

- The following is to be used as a guide for assessing fracturing:

AEG Fracturing	Spacing
Crushed	up to 0.1 foot
Intense	0.1–0.5 foot
Moderate	0.5 foot–10 feet
Slight	1.0 foot–3.0 feet
Massive	>3.0 feet

- Record hardness using the following guidelines:

Hardness	Criteria
Soft	Reserved for plastic material
Friable	Easily crumbled by finger pressure
Low	Deeply gouged or carved with pocketknife
Moderate	Readily scratched with knife; scratch leaves heavy trace of dust
Hard	Difficult to scratch with knife; scratch produces little powder and is often faintly visible
Very Hard	Cannot be scratched with knife

- Describe weathering using the following guidelines:

Weathering	**Decomposition**	**Discoloration**	**Fracture Condition**
Deep	Moderate to complete alteration of minerals feldspars altered to clay, etc.	Deep and thorough	All fractures extensively coated with oxides, carbonates, or clay
Moderate	Slight alteration of minerals, cleavage surface lusterless and stained	Moderate or localized and intense	Thin coatings or stains
Weak	No megascopic alteration of minerals	Slight and intermittent and localized	Few strains on fracture surfaces
Fresh	Unaltered, cleavage, surface glistening		

3.9 PROCEDURE FOR LOGGING REFUSE

The following procedure applies to the logging of subsurface samples composed of various materials in addition to soil as may be collected from a landfill or other waste disposal site.

1. Observe refuse as it is brought up by the hollow stem auger, bucket auger, or backhoe.
2. If necessary, place the refuse in a plastic bag to examine the sample.
3. Record observations according to the following criteria:
    - Composition (by relative volume), e.g., paper, wood, plastic, cloth, cement, or construction debris. Use such terms as "mostly" or "at least half." Do not use percentages.
    - Moisture condition: dry, moist, or wet.
    - State of decomposition: highly decomposed, moderately decomposed, slightly decomposed, etc.
    - Color: obvious mottling and/or degree of mottling.
    - Texture: spongy, plastic (cohesive), friable.
    - Odor.
    - Combustible gas readings (measure down hole and at surface).
    - Miscellaneous: dates of periodicals and newspapers, ability to read printed materials, degree of drilling effort (easy, difficult, and very difficult).

3.10 SUBMITTAL REQUIREMENTS

Each original boring log should be submitted to the Contracting Officer Representative (CRO) after completion of the boring. When a monitoring well will be installed in a boring, the boring log and well installation diagram should be submitted together.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

Not applicable.

6.0 REFERENCES

ASTM Standard D 1586–84 (1992). 1992. *Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.*

ASTM Standard D 2488-93. 1993. *Standard Practice for Description and Identification of Soils Visual-Manual Procedure).*

ASTM Standard D 5434-93. 1993. *Guide for Field Logging of Subsurface Explorations of Soil and Rock.*

ASTM Standard D 6032-96. 1996. *Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core.*

Compton, R.R. 1962. *Manual of Field Geology.* John Wiley & Sons, Inc., New York.

USACE. 1998. *Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites.* EM 1110-1-4000, 1, November.

U.S. Department of the Interior. 1989. *Earth Manual.* Water and Power Resources Service, Washington, D.C.

STANDARD OPERATING PROCEDURE 10.4
CHAIN-OF-CUSTODY FORM

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for use of the chain-of-custody form. An example is provided as part of this SOP. Other formats with similar levels of detail are acceptable.

2.0 MATERIALS

- Chain-of-custody form.
- Indelible ink pen.

3.0 PROCEDURE

- Record the project name and number.
- Record the project contact's name and phone number.
- Print sampler's names in "Samplers" block.
- Enter the Field Sample No.
- Record the sampling dates for all samples.
- List the sampling times (military format) for all samples.
- Indicate, "grab" or "composite" sample with an "X."
- Record matrix (e.g., aqueous, soil).
- List the analyses/container volume across top.
- Enter the total number of containers per Field Sample No. in the "Subtotal" column.
- Enter total number of containers submitted per analysis requested.
- State the carrier service and airbill number, analytical laboratory, and custody seal numbers.
- List any comments or special requests in the "Remarks" section.
- Sign, date, and time the "Relinquished By" section when the cooler is relinquished to the next party.
- Upon completion of the form, retain the shipper copy and place the forms and the other copies in a zip seal bag to protect from moisture. Affix the zip seal bag to the inside lid of the sample cooler to be sent to the designated laboratory.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

Not applicable.

6.0 REFERENCES

USEPA. 1990. *Sampler's Guide to the Contract Laboratory Program.* EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C., December 1990.

USEPA. 1991. *User's Guide to the Contract Laboratory Program.* EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response, January 1991.

USEPA. 1998. *EPA Requirements for Quality Assurance Project Plans.* EPA/600/R-98/018, QA/R5, Final, Office of Research and Development, Washington, D.C.

FIGURE 10.4-a
EXAMPLE CHAIN-OF-CUSTODY FORM

Project Number	Project Name				Matrix	A N A L Y S E S									LAB :
Project Contact (Name and Phone Number)															AIRBILL No:
Samplers:															Courier:
Field Sample No.	Date (MM-DD-YY)	Time	Comp	Grab										Subtotal	REMARKS
TOTAL															

Relinquished by:	Date/time	Received by:	Relinquished by:	Date/Time	Received by:
Relinquished by:	Date/time	Received by: (for lab)	Date/Time	Remarks	

STANDARD OPERATING PROCEDURE 30.1
SOIL SAMPLING

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for sampling surface and subsurface soils.

2.0 MATERIALS

- Stainless steel scoop, spoon, trowel, knife, spatula, (as needed).
- Split-spoon, Shelby tube, or core barrel sampler.
- Hand auger or push tube sampler.
- Drill rig and associated equipment (subsurface soil).
- Stainless steel bowls.
- Photoionization detector or other appropriate instrument as specified in site-specific health and safety plan.
- Sampling equipment for collection of volatile organic samples.
- Appropriate sample containers.
- Appropriate sample labels and packaging material.
- Personal protective equipment and clothing (PPE) per site-specific health and safety plan.
- Decontamination equipment and supplies (SOP 80.1).

3.0 PROCEDURE

3.1 DOCUMENTATION

- Soil sampling information should be recorded in the field logbooks as described in SOPs 10.1 and 10.2.

3.1 SURFICIAL SOIL SAMPLES

The targeted depths for surficial soil samples (surface and near surface) will be specified in the work plan addenda developed for site-specific investigations.

- All monitoring equipment should be appropriately calibrated before beginning sampling according to the requirements of the work plan addenda and SOP 90.1 or 90.2.
- All sampling equipment should be appropriately decontaminated before and after use according to the requirements of the work plan addendum and SOP 80.1.
- Use a spade, shovel, or trowel or other equipment (manufactured from material, which is compatible with the soil to be sampled) to remove any overburden material present (including vegetative mat) to the level specified for sampling.

- Measure and record the depth at which the sample will be collected with an engineers scale or tape.
- Remove the thin layer that was in contact with the overburden removal equipment using a clean stainless steel scoop or equivalent and discard it.
- Begin sampling with the acquisition of any discrete sample(s) for analysis of volatile organic compounds (VOCs), with as little disturbance as possible. VOC samples will not be composited or homogenized.
- When a sample will not be collected with a core type of sampler (push tube, split spoon, etc.), the sample for VOC analysis will be collected from freshly exposed soil. The method of collection will follow the procedures specified in SOP 30.8 (Methanol Preservation Method) or 30.9 (En Core® Method) based on the requirements of the work plan addenda.
- Field screen the sample with properly calibrated PID or other appropriate instrument. Cut a cross-sectional slice from the core or center of the sample and insert the monitoring instrument(s). Based on the screening results, collect the VOC fraction, as applicable.
- Collect a suitable volume of sample from the targeted depth with a clean stainless steel scoop (or similar equipment), push tube sampler, or bucket auger
- For core type of samplers, rough trimming of the sampling location surface should be considered if the sampling surface is not fresh or other waste, different soil strata, or vegetation may contaminate it. Surface layers can be removed using a clean stainless steel, spatula, scoop, or knife. Samples collected with a bucket auger or core type of sampler should be logged per the requirements of SOP 10.3.
- If homogenization or compositing of the sampling location is not appropriate for the remaining parameters, the sample should be directly placed into appropriate sample containers with a stainless steel spoon or equivalent.
- If homogenization of the sample location is appropriate or compositing of different locations is desired, transfer the sample to a stainless steel bowl for mixing. The sample should be thoroughly mixed with a clean stainless steel spoon, scoop, trowel, or spatula and then placed in appropriate sample containers per the requirements for containers and preservation specified in work plan addenda. Secure the cap of each container tightly.
- Appropriately, label the samples (SOP 50.1), complete the chain-of-custody (SOP 10.4), and package the samples for shipping (SOP 50.2).
- Return any remaining unused soil to the original sample location. If necessary, add clean sand to bring the subsampling areas back to original grade. Replace the vegetative mat over the disturbed areas.

3.1 SUBSURFACE SAMPLES

- All sampling equipment should be appropriately decontaminated before and after use according to the requirements of the work plan addendum and SOP 80.1.
- All monitoring equipment should be appropriately calibrated before sampling according to the requirement of the work plan addendum and SOP 90.1 or SOP 90.2.

- All sampling equipment should be appropriately decontaminated before and after use according to the requirements of the work plan addendum and SOP 80.1.
- Collect split-spoon; core barrel, Shelby tube, sonic core or other similar samples during drilling.
- Upon opening sampler or extruding sample, immediately screen soil for VOCs using a PID or appropriate instrument. If sampling for VOCs, determine the area of highest concentration; use a stainless steel knife, trowel, or lab spatula to cut the sample; and screen for VOCs with monitoring instrument(s).
- Log the sample on the boring log before extracting from the sampler per the requirements of SOP 10.3.
- Any required VOC samples will be collected first followed by the other parameters. VOC samples will not be composited or homogenized and will be collected from the area exhibiting the highest screening level. The method of VOC sample collection will follow the procedures specified in SOP 30.8 (Methanol Preservation Method) or 30.9 (En Core® Method) based on the requirements of the work plan addenda.
- Field screen the sample with properly calibrated PID or other appropriate instrument. Cut a cross-sectional slice from the core or center of the sample and insert the monitoring instrument(s). Based on the screening results, collect the VOC fraction, as applicable.
- Rough trimming of the sampling location surface should be considered if the sampling surface is not fresh or other waste, different soil strata, or vegetation may contaminate it. Surface layers can be removed using a clean stainless steel, spatula, scoop, or knife.
- If homogenization or compositing of the sampling location is not appropriate for other parameters, the sample should be directly placed into appropriate sample containers with a stainless steel spoon or equivalent.
- If homogenization of the sample location is appropriate or compositing of different locations is desired, transfer the sample to a stainless steel bowl for mixing. The sample should be thoroughly mixed with a clean stainless steel spoon, scoop, trowel, or spatula and placed in appropriate sample containers per the requirements for containers and preservation specified in work plan addenda. Secure the cap of each container tightly.
- Appropriately, label the samples (SOP 50.1), complete the chain-of-custody (SOP 10.4), and package the samples for shipping (SOP 50.2).
- Discard any remaining sample into the drums used for collection of cuttings.
- Abandon borings according to procedures outlined in SOP 20.2.

3.1 INVESTIGATION DERIVED MATERIALS

Investigation-derived material will be managed in accordance with procedures defined in the work plan addenda for the site being investigated and SOP 70.1.

NOTES: If sample recoveries are poor, it may be necessary to composite samples before placing them in jars. In this case, the procedure will be the same except that two split-spoon samples (or other types of samples) will be mixed together. The boring log should clearly state that the samples have been composited, which samples were composited, and why the

compositing was done. In addition, VOC fraction should be collected from the first sampling device.

When specified, samples taken for geotechnical analysis (e.g., percent moisture, density, porosity, and grain size) will be undisturbed samples, such as those collected using a thin-walled (Shelby tube) sampler, sonic core sampler, etc.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

Refer to the site-specific health and safety plan.

Soil samples will not include vegetative matter, rocks, or pebbles unless the latter are part of the overall soil matrix.

6.0 REFERENCES

ASTM Standard D 1586-84. 1984. *Penetration Test and Split-Barrel Sampling of Soils.*

ASTM Standard D 1587-83. 1983. *Thin Walled Sampling of Soils.*

ASTM Standard D 5633-94. 1994. *Standard Practice for Sampling with a Scoop.*

USACE. 2001. *Requirements for the Preparation of Sampling and Analysis Plans.* EM 200-1-3. 1 February.

STANDARD OPERATING PROCEDURE 30.6
CONTAINERIZED MATERIAL

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for the opening and sampling of containerized liquids of potentially unknown substances.

2.0 MATERIALS

- Work Plans.
- Field logbooks.
- Personal protective equipment and clothing per the site-specific health and safety plan.
- Monitoring instruments per the site-specific health and safety plan.
- Decontamination equipment and supplies (SOP 80.1).
- Tools.
- Historical data, if available.
- Sampling tube.
- Remote samplers, as required.

3.0 PROCEDURE

Sealed containers with unknown contents represent potential severely hazardous situations for sampling teams. Even when the original identity of the contents is reasonably certain, contents may be under pressure or in a decomposed state and may readily react (sometimes violently) with air or water vapor in the atmosphere.

Only hazardous material specialists that have appropriate training and experience will inspect and sample unidentifiable drums or containers. Specialist team members will use extreme caution and care when opening sealed drums or cans of unknown content for purposes of inspection and sampling.

Efforts will be made to determine the identity of the contents, through markings, history of activities at the site, and similarity and proximity to containers of known contents. The range of possible hazards will dictate which specific procedure will be followed, and specific procedures will be identified in work plan addenda. All predetermined procedures will be strictly followed as designated by the site-specific conditions.

Using this SOP and appropriate health and safety protocols, field personnel will use extreme caution and care in opening sealed drums or cans of unknown contents for purposes of inspection and sampling. Specific activities include the following:

- Determine the identity of the contents through markings, history of activities at the site, and similarity and proximity to containers of known contents. The range of possible hazards will dictate which specific procedure should be followed.

- Handle containers as little as possible; however, if it is necessary to reorient a drum to allow access to a bung or cap, perform this activity using remote-handling forklift equipment with special drum-holding attachments.
- If contents are deemed to be under pressure, highly reactive, or highly toxic (or if these possibilities cannot be disproven), perform initial opening of the container remotely.
- Air monitoring stations will be established as necessary, using the following procedures:
- Affix a remote bung opener to the drum.
- Evacuate personnel to a safe distance or station them behind a barricade.
- Activate the non-sparking motor of the opener.
- After the bung is removed, monitor the drum for potential activity of the contents, such as vapor emission, smoking, or audible reaction.
- Approach cautiously while monitoring for toxic levels of airborne contaminants.
- If the contents of the drum pose acceptable hazards, accomplish opening (or inspection if previously opened remotely) and sampling with one of three approved devices. The preferred method is to use a clean glass tube, with or without bottom stopper, which can be placed in the drum (breaking it if necessary) after sampling is complete. Alternately (if a bung has been removed), a well sampler such as a Kemmererbailer can be used (but would require removal and cleaning or disposal according to the nature of the waste). By opening either of these devices at a desirable depth, stratified sampling can be performed. Also, the sampling tubes can be made with a plunger rod and O-ring seals at selected intervals, allowing simultaneous collection of multiple samples in a stratified medium.
- Following sampling, the drum will be resealed and/or overpacked to prevent any possibility of leakage while analysis determines the identity of the contents.
- Drums that do not have removable bungs may be opened remotely with a solenoid-activated punch (this requires that the drum be recontainerized or overpacked after sampling is complete).

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None

6.0 REFERENCE

USEPA. 1989. A Compendium of Superfund Field Operation Methods. EPA/540/P-87/001. December.

STANDARD OPERATING PROCEDURE 30.7
SAMPLING STRATEGIES

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate sampling strategies for sampling various media.

2.0 MATERIALS

- Historical site data.
- Site topography.
- Soil types.
- Sampled media.

3.0 PROCEDURE

The primary goal of any investigation is to collect samples representative of existing site conditions. Statistics are generally used to ensure samples are as representative as possible. Sampling plans may employ more than one approach to ensure project data quality objectives are adequately addressed. A comparison of sampling strategies is presented in Table 1.

3.1 CLASSICAL STATISTICAL SAMPLING

Classical statistical sampling strategies are appropriately applied to either sites where the source of contamination is known or small sites where the entire area is remediated as one unit. Primary limitations of this sampling approach include (1) inability to address media variability; (2) inadequate characterization of heterogenous sites; and (3) inadequate characterization of sites with unknown contamination characteristics.

3.1.1 Simple Random Sampling

Simple random sampling is generally more costly than other approaches because of the number of samples required for site characterization. This approach is generally used when minimal site information is available and visible signs of contamination are not evident and includes the following features:

- Sampling locations are chosen using random chance probabilities.
- This strategy is most effective when the number of sampling points is large.

3.1.2 Stratified Random Sampling

This sampling approach is a modification to simple random sampling. This approach is suited for large site investigations that encompass a variety of soil types, topographic features, and/or land uses. By dividing the site into homogenous sampling strata based on background and historical data, individual random sampling techniques are applied across the site. Data acquired from each stratum can be used to determine the mean or total contaminant levels and provide these advantages:

- Increased sampling precision results due to sample point grouping and application of random sampling approach.
- Control of variances associated with contamination, location, and topography.

3.1.3 Systematic Grid

The most common statistical sampling strategy is termed either systematic grid or systematic random sampling. This approach is used when a large site must be sampled to characterize the nature and extent of contamination.

Samples are collected at predetermined intervals within a grid pattern according to the following approach:

- Select the first sampling point randomly; remaining sampling points are positioned systematically from the first point.
- Determine the grid design: one or two-dimensional. One-dimensional sample grids may be used for sampling along simple man-made features. Two-dimensional grid systems are ideal for most soil applications.
- Determine the grid type: square or triangular. Sampling is usually performed at each grid-line intersection. Other strategies include sampling within a grid center or obtaining composite samples within a grid.
- Each stratum is sampled based on using the simple random sampling approach but determined using a systematic approach.

3.1.4 Hot-Spot Sampling

Hot spots are small, localized areas of media characterized by high contaminant concentrations. Hot-spot detection is generally performed using a statistical sampling grid. The following factors should be addressed:

- Grid spacing and geometry. The efficiency of hot-spot searches is improved by using a triangular grid. An inverse relationship exists between detection and grid point spacing, e.g., the probability of hot-spot detection is increased as the spacing between grid points is decreased.
- Hot-spot shape/size. The larger the hot spot, the higher the probability of detection. Narrow or semi-circular patterns located between grid sampling locations may not be detected.
- False-negative probability. Estimate the false negative (β-error) associated with hot-spot analysis.

3.1.5 Geostatistical Approach

Geostatistics describe regional variability in sampling and analysis by identifying ranges of correlation or zones of influence. The general two-stage approach includes the following:

- Conducting a sampling survey to collect data defining representative sampling areas.
- Defining the shape, size, and orientation of the systematic grid used in the final sampling event.

3.2 NON-STATISTICAL SAMPLING

3.2.1 Biased Sampling

Specific, known sources of site contamination may be evaluated using biased sampling. Locations are chosen based on existing information.

3.2.2 Judgmental Sampling Grid

This sampling approach entails the subjective selection of sampling locations that appear to be representative of average conditions. Because this method is highly biased, it is suggested that a measure of precision be included through the collection of multiple samples.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None

6.0 REFERENCE

USACE. 2001. *Requirements for the Preparation of Sampling and Analysis Plans.* EM200-1-3. 1 February.

TABLE 1
SAMPLING STRATEGIES

SAMPLING STRATEGY	DESCRIPTION	APPLICATION	LIMITATIONS
Classical Statistical Sampling Strategies			
Simple Random Sampling	Representative sampling locations are chosen using the theory of random chance probabilities.	Sites where background information is not available and no visible signs of contamination are present.	May not be cost-effective because samples may be located too close together. Does not take into account spatial variability of media.
Stratified Random Sampling	Site is divided into several sampling areas (strata) based on background or site survey information.	Large sites characterized by a number of soil types, topographic features, past/present uses, or manufacturing storage areas.	Often more cost-effective than random sampling. More difficult to implement in the field and analyze results. Does not take into account spatial variability of media.
Systematic Grid Sampling	Most common statistical strategy; involves collecting samples at predetermined, regular intervals within a grid pattern.	Best strategy for minimizing bias and providing complete site coverage. Can be used effectively at sites where no background information exists. Ensures that samples will not be taken too close together.	Does not take into account spatial variability of media.
Hot-Spot Sampling	Systematic grid sampling strategy tailored to search for hot spots.	Sites where background information or site survey data indicate that hot spots may exist.	Does not take into account spatial variability of media. Tradeoffs between number of samples, chance of missing a hot spot, and hot spot size/shape must be weighed carefully.
Geostatistical Approach	Representative sampling locations are chosen based on spatial variability of media. Resulting data are analyzed using kriging, which creates contour maps of the contaminant concentrations and the precision of concentration estimates.	More appropriate than other statistical sampling strategies because it takes into account spatial variability of media. Especially applicable to sites where presence of contamination is unknown.	Previous investigation data must be available and such data must be shown to have a spatial relationship.
Non-Statistical Sampling Strategies			
Biased Sampling	Sampling locations are chosen based on available information.	Sites with known contamination sources.	Contaminated areas can be overlooked if background information or visual signs of contamination do not indicate them. Best used if combined with a statistical approach, depending on the project objectives.
Judgmental Sampling	An individual subjectively selects sampling locations that appear to be representative of average conditions.	Homogenous, well-defined sites.	Not usually recommended due to bias imposed by individual, especially for final investigations.

STANDARD OPERATING PROCEDURE 50.1
SAMPLE LABELS

1.0 SCOPE AND APPLICATION

Every sample will have a sample label uniquely identifying the sampling point and analysis parameters. The purpose of this standard operating procedure (SOP) is to delineate protocols for the use of sample labels. An example label is included as Figure 50.1-A. Other formats with similar levels of detail are acceptable.

2.0 MATERIALS

- Sample label.
- Indelible marker.

3.0 PROCEDURE

The use of preprinted sample labels is encouraged and should be requested from the analytical support laboratory during planning activities.

As each sample is collected, fill out a sample label ensuring the following information has been collected:

- Project name.
- Sample ID: enter the SWMU number and other pertinent information concerning where the sample was taken. This information should be included in site-specific work plan addenda.
- Date of sample collection.
- Time of sample collection.
- Initials of sampler(s).
- Analyses to be performed (NOTE: Due to number of analytes, details of analysis should be arranged with lab *a priori*).
- Preservatives (water samples only).

Double-check the label information to make sure it is correct. Detach the label, remove the backing and apply the label to the sample container. Cover the label with clear tape, ensuring that the tape completely encircles the container.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

None

6.0 REFERENCE

USEPA. 1998. *EPA Requirements for Quality Assurance Project Plans.* EPA/600/R-98/018, QA/R5, Final, Office of Research and Development, Washington, D.C.

FIGURE 50.1-A
SAMPLE LABEL

PROJECT NAME _____

SAMPLE ID _____

DATE: ____/____/____ TIME: _____:_____

ANALYTES: VOC SVOC P/P METALS CN
PAH D/F HERBs ANIONS TPH
ALK TSS

PRESERVATIVE: [HCl] [HNO_3] [NaOH] [H_2SO_4]

SAMPLER: _____

STANDARD OPERATING PROCEDURE 50.2
SAMPLE PACKAGING

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to delineate protocols for the packing and shipping of samples to the laboratory for analysis.

2.0 MATERIALS

- Waterproof coolers (hard plastic or metal).
- Metal cans with friction-seal lids (e.g., paint cans).
- Chain-of-custody forms.
- Chain-of-custody seals (optional).
- Packing material.
- Sample documentation.
- Ice.
- Plastic garbage bags.
- Clear Tape.
- Zip-top plastic bags.
- Temperature blanks provided by laboratory for each shipment.

3.0 PROCEDURE

- Check cap tightness and verify that clear tape covers label and encircles container.
- Wrap sample container in bubble wrap or closed cell foam sheets. Samples may be enclosed in a secondary container consisting of a clear zip-top plastic bag. Sample containers must be positioned upright and in such a manner that they will not touch during shipment.
- Place several layers of bubble wrap, or at least 1 in. of vermiculite on the bottom of the cooler. Line cooler with open garbage bag, place all the samples upright inside the garbage bag and tie.
- Double bag and seal loose ice to prevent melting ice from soaking the packing material. Place the ice outside the garbage bags containing the samples.
- Pack shipping containers with packing material (closed-cell foam, vermiculite, or bubble wrap). Place this packing material around the sample bottles or metal cans to avoid breakage during shipment.
- A temperature blank (provided by laboratory) will be included in each shipping container to monitor the internal temperature. Samples should be cooled to 4 degrees C on ice immediately after sampling.
- Enclose all sample documentation (i.e., Field Parameter Forms, Chain-of-Custody forms) in a waterproof plastic bag and tape the bag to the underside of the cooler lid. If more than one

cooler is being used, each cooler will have its own documentation. Add the total number of shipping containers included in each shipment on the chain-of-custody form.

- Seal the coolers with signed and dated custody seals so that if the cooler were opened, the custody seal would be broken. Place clear tape over the custody seal to prevent damage to the seal.
- Tape the cooler shut with packing tape over the hinges and place tape over the cooler drain.
- Ship all samples via overnight delivery on the same day they are collected if possible.

4.0 MAINTENANCE

Not applicable.

5.0 PRECAUTIONS

5.1 PERMISSIBLE PACKAGING MATERIALS

- Non-absorbent.
- Bubble wrap.
- Closed cell foam packing sheets.
- Absorbent.
- Vermiculite.

5.2 NON-PERMISSIBLE PACKAGING MATERIALS

- Paper.
- Wood shavings (excelsior).
- Cornstarch “peanuts.”

6.0 REFERENCES

USEPA. 1990. *Sampler's Guide to the Contract Laboratory Program.* EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C., December 1990.

USEPA. 1991. *User's Guide to the Contract Laboratory Program.* EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response. January 1991.

USEPA. 1998. *EPA Requirements for Quality Assurance Project Plans.* EPA/600/R-98/018, QA/R5, Final, Office of Research and Development, Washington, D.C.

STANDARD OPERATING PROCEDURE 70.1
INVESTIGATION-DERIVED MATERIAL

1.0 SCOPE AND APPLICATION

Management of investigation-derived material (IDM) minimizes the potential for the spread of waste material onsite or offsite through investigation activities. The purpose of this standard operating procedure (SOP) is to provide general guidelines for appropriate management of potentially contaminated materials derived from the field investigations. Specific procedures related to the transportation and disposal of hazardous waste are beyond the scope of this SOP.

2.0 INTRODUCTION

Investigation-derived material (IDM) consists of waste materials that are known or suspected to be contaminated with waste substances through the actions of sample collection or personnel and equipment decontamination. These materials include decontamination solutions, disposable equipment, drill cuttings and fluids, and water from groundwater monitoring well development and purging. To the extent possible, the site manager will attempt to minimize the generation of these materials through careful design of decontamination schemes and groundwater sampling programs. Testing conducted on soil and water investigation-derived material will show if they are also hazardous wastes as defined by RCRA. This will determine the proper handling and ultimate disposal requirements.

The criteria for designating a substance as hazardous waste according to RCRA is provided in 40 CFR 261.3. If IDM meet these criteria, RCRA requirements will be followed for packaging, labeling, transporting, storing, and recordkeeping as described in 40 CFR 262.34. Those materials that are judged potentially to meet the criteria for a regulated solid or hazardous waste will be placed in DOT-approved 55-gallon steel drums or another type of DOT-approved container; based on waste characteristics and volume.

Investigation-derived material will be appropriately placed in containers, labeled, and tested to determine disposal options in accordance with RCRA regulations and Virginia Hazardous Waste Management Regulations.

3.0 INVESTIGATION-DERIVED MATERIAL MANAGEMENT

Procedures that minimize potential for the spread of waste material include minimizing the volume of material generated, material segregation, appropriate storage, and disposal according to RCRA requirements.

3.1 WASTE MINIMIZATION

In the development of work plan addenda, each aspect of the investigation will be reviewed to identify areas where excess waste generation can be eliminated. General procedures that will eliminate waste include avoidance of unnecessary exposure of materials to hazardous material and coordination of sampling schedules to avoid repetitious purging of wells and use of sampling equipment.

3.2 WASTE SEGREGATION

Waste accumulation and management procedures to be used depend upon the type of material generated. For this reason, IDM described below are segregated into separate 55-gallon storage drums or other appropriate DOT containers. Waste materials that are known to be free of potential hazardous waste contamination (such as broken sample bottles or equipment containers and wrappings) must be collected separately for disposal to municipal systems. Large plastic garbage or "lawn and leaf" bags are useful for collecting this trash. Even "clean" sample bottles or Tyvek should be disposed of with care. Although they are not legally a problem, if they are discovered by the public they may cause concern. Therefore, items that are known to be free from contamination but are also known to represent "hazardous or toxic waste" to the public must not be disposed of in any public trash receptacle, such as found at your hotel or park.

3.2.1 Decontamination Solutions

Solutions considered investigation-derived materials range from detergents, organic solvents, and acids used to decontaminate small hand samplers to steam-cleaning rinsate used to wash drill rigs and other large equipment. These solutions are to be placed in 55-gallon drums with bolt-sealed lids or other appropriate DOT approved containers. Residual liquid IDM from decontamination pads will be removed and appropriately placed in container(s) at the end of each field day.

3.2.2 Soil Cuttings and Drilling Muds

Soil cuttings are solid to semi-solid soils generated during trenching activities or drilling for the collection of subsurface soil samples or the installation of monitoring wells. Depending on the type of drilling, drilling fluids known as "muds" may be used to remove soil cuttings. Drilling fluids flushed from the borehole must be directed into a settling section of a mud pit. This allows reuse of the decanted fluids after removal of the settled sediments. Drill cuttings, whether generated with or without drilling fluids, are to be removed with a flat-bottomed shovel and placed in 55-gallon drums with bolt-sealed lids or other appropriate DOT containers, as conditions or volume of IDM dictate.

3.2.3 Well Development and Purge Water

Well development and purge water is removed from monitoring wells to repair damage to the aquifer following well installation, obtain characteristic aquifer groundwater samples, or measure aquifer hydraulic properties. The volume of groundwater to be generated will determine the appropriate container to be used for accumulation of IDM.

For well development and purging, 55-gallon drums are typically an efficient container for accumulation. When larger volumes of water are removed from wells, such as when pumping tests are conducted, the use of large-volume portable tanks such as "Baker Tanks" should be considered for IDM accumulation.

Analytical data for groundwater samples associated with the well development and purge water will be used to assist in characterizing IDM and evaluating disposal options.

3.2.4 Personal Protective Equipment and Disposable Sampling Equipment

Personal protective equipment and clothing (PPE) may include such items as Tyvek coveralls, gloves, booties, and APR cartridges. Disposable sampling equipment may include such items as plastic sheeting, bailers, disposable filters, disposable tubing and paper towels. PPE and disposable sampling equipment that have or may have contacted contaminated media (soil,

water, etc.) will be segregated and placed in 55-gallon drums separate from soil and water IDM. Disposition of this type of IDM will be determined by the results of IDM testing of the media in which the PPE and sampling equipment contacted.

3.3 MATERIAL ACCUMULATION

The IDM in containers must be placed in an appropriate designated RCRA container accumulation area at RFAAP, where it is permissible to accumulate such waste. IDM placed into a designated 90-day accumulation area will be properly sealed, labeled and covered. All drums will be placed on pallets.

A secure and controlled waste staging area will be designated by the installation prior the commencement of field sampling activities. Per the facility's requirements as a RCRA large quantity generator, waste accumulation cannot exceed 90 days for materials presumed or shown to be RCRA-designated hazardous wastes; waste which is known not to be RCRA-designated waste should be promptly disposed to municipal waste systems or appropriate facility.

3.3.1 IDM Accumulation Containers

Containers will be DOT-approved (DOT 17H 18/16GA OH unlined) open-head steel drums or other DOT approved container, as appropriate.

Container lids should lift completely off be secured by a bolt ring (for drum). Order enough containers to accumulate all streams of expected IDM including soil, PPE and disposable sampling equipment, decontamination water, purge water, etc.

Solid and liquid waste streams will not be mixed in a container. PPE and expendable sampling equipment will be segregated from other IDM and placed in different containers than soil. Containers inside containers are not permitted. PPE must be placed directly in a drum not in a plastic bag.

Pallets are often required to allow transport of filled drums to the staging area with a forklift. Normal pallets are 3×4 ft and will hold two to three 55-gallon drums depending on the filled weight. If pallets are required for drum transport or storage, field personnel are responsible for ensuring that the empty drums are placed on pallets before they are filled and that the lids are sealed on with the bolt-tighten ring after the drums are filled. Because the weight of one drum can exceed 500 lbs, under no circumstances should personnel attempt to move the drums by hand.

3.3.2 Containers Labeling

Each container that is used to accumulate IDM will be appropriately labeled at the time of accumulation and assigned a unique identification number for tracking purposes. The following information will be written in permanent marker on a drum label affixed on the exterior side at a location at least two-thirds of the way up from the bottom of the drum.

- Facility name.
- Accumulation start date and completion date.
- Site identifier information (SWMU, boring, well, etc.).
- Description of IDM.
- Drum ID No.

4.0 MATERIAL CHARACTERIZATION AND DISPOSAL

IDM will be characterized and tested to determine whether it is a hazardous waste as defined by 40 CFR Part 261 and to determine what disposal options exist in accordance with RCRA regulations and the Virginia Hazardous Waste Management Regulations (VHWMR).

In general, IDM will be considered a hazardous waste if it contains a listed hazardous waste or if the IDM exhibits a characteristic of hazardous waste.

Work plan addenda will identify the appropriate characterization and testing program for IDM based on the following:

- Site-specific conditions related to chemicals of concern, etc.
- The nature and quantity of expected IDM to be generated during site-specific investigations.
- Applicable Federal, State, and local regulations, such as RCRA, VHWMR regulations and policies and procedures, and Army Regulation 200-1.
- RFAAP specific requirements and policies for IDM characterization and disposal at the time of the investigation.

In general, appropriate USEPA SW 846 Test Methods for Evaluating Solid Waste will be used for testing IDM and will be specified in work plan addenda. Other appropriate test methods may be specified by RFAAP in addition to SW 846 Methods that are specific to installation operations, the site of interest (percent explosive content, reactivity, etc.), or requirements for disposal at RFAAP water treatment facilities or publicly owned treatment works.

Responsibility for the final disposal of IDM will be determined before field activities are begun and will be described in work plan addenda. Off-site disposal of IDM will be coordinated with RFAAP (generator) to ensure appropriate disposition. The contractor will coordinate IDM transportation and disposal activities for RFAAP (generator).

At the direction of RFAAP, appropriate waste manifests will be prepared by the USACE contractor or Alliant Techsystems subcontractor for transportation and disposal. Alliant Techsystems or other appropriate RFAAP entity will be listed as the generator and an appointed representative from RFAAP will review and sign the manifest for off-site disposal.

RFAAP will make the final decision on the selection of the transporter, storage, and disposal facility (TSDFs) or recycling facility. RFAAP will provide the contractor a listing of previously used TSDFs for priority consideration. Proposed facilities that are not included on the listing are required to provide a copy of the TSDFs most recent state or federal inspection to the installation. Waste characterization and testing results will be submitted to RFAAP (generator) for review and approval before final disposition of the material.

Hazardous waste: Prior to final disposition, a hazardous waste manifest will be furnished by the TSDF to accompany transport to the disposal facility. Following final disposition, a certificate of disposal will be furnished by the disposal facility. Copies of the manifests and certificates of disposal are to be provided to RFAAP and retained on file by the contractor or subcontractor.

5.0 PRECAUTIONS

- Because the weight of one drum can exceed 500 lbs, under no circumstances should personnel attempt to move drums by hand.
- Refer to the site-specific health and safety plan when managing IDM.

6.0 REFERENCE

Safety Rules for Contractors and Subcontractors, 1995. Alliant Techsystems, Incorporated, Radford Army Ammunition Plant.

STANDARD OPERATING PROCEDURE 80.1
DECONTAMINATION

1.0 SCOPE AND APPLICATION

Before leaving the site, all personnel or equipment involved in intrusive sampling or having entered a hazardous waste site during intrusive sampling must be thoroughly decontaminated to prevent adverse health effects and minimize the spread of contamination. Equipment must be decontaminated between sites to preclude cross-contamination. Decontamination water will be free of contaminants as evidenced through either chemical analyses or certificates of analysis. This standard operating procedure (SOP) describes general decontamination requirements for site personnel and sampling equipment. Decontamination procedures for contaminants requiring a more stringent procedure, e.g., dioxins/furans, will be included in site-specific addenda.

2.0 MATERIALS

- Plastic sheeting, buckets or tubs, pressure sprayer, rinse bottles, and brushes.
- U.S. Army Corps of Engineers or installation approved decontamination water source.
- Deionized ultra-filtered, HPLC-grade organic free water (DIUF).
- Non-phosphate laboratory detergent.
- Nitric Acid, 0.1 Normal (N) solution.
- Pesticide-grade solvent, Methanol.
- Aluminum foil.
- Paper towels.
- Plastic garbage bags.
- Appropriate containers for management of investigation-derived material (IDM).

3.0 PROCEDURE

3.1 SAMPLE BOTTLES

At the completion of each sampling activity the exterior surfaces of the sample bottles must be decontaminated as follows:

- Be sure that the bottle lids are on tight.
- Wipe the outside of the bottle with a paper towel to remove gross contamination.

3.2 PERSONNEL DECONTAMINATION

Review the site-specific health and safety plan for the appropriate decontamination procedures.

3.3 EQUIPMENT DECONTAMINATION

3.3.1 Drilling Rigs

Drilling rigs and associated equipment, such as augers, drill casing, rods, samplers, tools, recirculation tank, and water tank (inside and out), will be decontaminated before site entry, after over-the-road mobilization and immediately upon departure from a site after drilling a hole. Supplementary cleaning will be performed before site entry. There is a likelihood that contamination has accumulated on tires and as spatter or dust en route from one site to the next.

- Place contaminated equipment in an enclosure designed to contain all decontamination residues (water, sludge, etc.).
- Steam-clean equipment until all dirt, mud, grease, asphaltic, bituminous, or other encrusting coating materials (with the exception of manufacturer-applied paint) has been removed.
- Water used will be taken from an approved source.
- When cross-contamination from metals is a concern, rinse sampling components such as split spoons, geo-punch stems, and augers with nitric acid, 0.1N.
- Rinse with DIUF water.
- When semi-volatile and non-volatile organics may be present, rinse the sampling components with pesticide-grade solvent methanol.
- Double rinse the sampling components with DIUF water.
- Decontamination residues and fluids will be appropriately managed as IDM per work plan addenda and SOP 80.1.

3.3.2 Well Casing and Screen

Prior to use, well casing and screen materials will be decontaminated. This activity will be performed in the leak proof, decontamination pad, which will be constructed prior to commencement of the field investigation. The decontamination process will include:

- Steam cleaning with approved source water.
- Rinse with DUIF water.
- Air-dry on plastic sheeting.
- Wrap in plastic sheeting to prevent contamination during storage/transit.

3.3.3 Non Dedicated Submersible Pumps Used for Purging and Sampling

- Scrub the exterior of the pump to remove gross (visible) contamination using appropriate brushes, approved water, and non-phosphate detergent (steam cleaning may be substituted for detergent scrub).
- Pump an appropriate amount of laboratory detergent solution (minimum 10 gallons) to purge and clean the interior of the pump.
- Rinse by pumping no less than 10 gallons of approved water to rinse.
- Rinse the pump exterior with approved decontamination water.
- When cross-contamination from metals is a concern, rinse the pump exterior with approved nitric acid 0.1N solution.
- Rinse the pump exterior with DIUF water.

- When semi-volatile and non-volatile organics may be present, rinse the pump exterior with pesticide-grade solvent methanol.
- Double rinse the pump exterior with DIUF water.
- Air-dry on aluminum foil or clean plastic sheeting.
- Wrap pump in aluminum foil or clean plastic sheeting, or store in a clean, dedicated PVC or PTFE storage container.
- Solutions and residuals generated from decontamination activities will be managed appropriately as IDM per work plan addenda and SOP 80.1.

3.3.4 Sample Equipment and Measuring Water Level Devices

- Scrub the equipment to remove gross (visible) contamination using appropriate brush (es), approved water, and non-phosphate detergent.
- Rinse with approved source water.
- When cross-contamination from metals is a concern, rinse the sampling equipment with approved nitric acid 0.1N solution.
- Rinse equipment with DIUF water.
- When semi-volatile and non-volatile organics may be present, rinse the sampling equipment with pesticide-grade solvent methanol.
- Double rinse the sampling equipment with DIUF water.
- Air-dry on aluminum foil or clean plastic sheeting.
- Wrap in aluminum foil, clean plastic sheeting, or zip top bag or store in a clean, dedicated PVC or PTFE storage container.
- Solutions and residuals generated from decontamination activities will be managed appropriately as IDM per work plan addenda and SOP 80.1.

3.3.5 Other Sampling and Measurement Probes

Temperature, pH, conductivity, Redox, and dissolved oxygen probes will be decontaminated according to manufacturer's specifications. If no such specifications exist, remove gross contamination and triple-rinse probe with DIUF water.

5.0 PRECAUTIONS

- Manage IDM appropriately according to the requirements specified in work plan addenda.
- Follow appropriate procedures as specified in the site-specific health and safety plan.

6.0 REFERENCE

USACE. 2001. *Requirements for the Preparation of Sampling and Analysis Plans*. EM 200-1-3. 1 February.

Appendix C

Laboratory Quality Assurance Plan for TBD Laboratory

Appendix D

Health and Safety Forms

Form D–1
Worker Acknowledgment Form

SITE SAFETY AND HEALTH PLAN
FOR
INTERIM MEASURES REMEDIAL ACTIONS
AT
RADFORD ARMY AMMUNITION PLANT
RADFORD, VA

I have read and approve this Site Safety and Health Plan for activities associated with the Interim Measures at SWMU 51, Radford Army Ammunition Plant, Radford, VA with respect to project hazards, regulatory requirements, and Shaw Environmental, Inc. procedures.

Winston D. Russell
Health and Safety Manager

Jeff Parks P.G.
Project Manager

Prepared by:
Shaw Environmental and Infrastructure, Inc.
312 Directors Drive
Knoxville, TN 37923

February 1, 2008

Form D–2
Revision Form
SWMU 51 Interim Measures Work Plan

SITE DESIGNATION/
LOCATION

Radford Army Ammunition Plant
Radford, VA

SUBJECT:

Section: _____

Addendum: _____
Version: _____
Effective Date: _____

Approved By:
Field Operations Leader

_____

Date: _____

Concurrence:
Project Manager

_____

Date: _____

Sheet ____ of ____

Form D–3
Worker Acknowledgment Form

Document: SWMU 51 Interim Measures Work Plan

Version: Final

Project: Radford Army Ammunition Plant

Location: SWMU 51, the Trinitrotoluene (TNT) Waste Acid Neutralization Pit

Prior to the initiation of field activities, I have been given an opportunity to read and question the contents of the SWMU 51 Interim Measures Work Plan. With my signature I certify that I have read, understood, and agree to comply with the information and directions set forth in these plans. I further certify that I am in full compliance with 29 CFR 1910.120 in regard to training and medical monitoring requirements.

Site Personnel:

Name (please print)	Signature	Date

Appendix E

Shaw Health and Safety Procedures

PROCEDURE

Subject: ACCIDENT PREVENTION PROGRAM: REPORTING, INVESTIGATION, AND REVIEW

1.0 PURPOSE AND SUMMARY

The purpose of this procedure is to establish the requirements for incident reporting, investigation, and review. This procedure is an integral part of the company's overall accident prevention program and aids in the identification of potential causal factors and corrective actions. Key elements of this procedure include:

- **All occupational injuries/illnesses, vehicle accidents, and near miss incidents must be promptly reported and investigated.**

- All Occupational Safety and Health Administration (OSHA) recordable injuries/illnesses and chargeable vehicle accidents must be reviewed by an Accident Review Board. The Accident Review Board report is submitted to the Baton Rouge Corporate Safety Department, for production to and retention on behalf of the Legal Department.

- All incidents involving a fatality, major injury/illness, or resulting in significant property damage will be immediately reported to: the business line Health & Safety Manager; the Corporate Health and Safety Department; Business Line Vice President and the Legal Department.

- All investigations and associated materials obtained and/or produced, in association with OSHA recordable injuries/illnesses, chargeable vehicle accidents, fatalities, major injury/illness, or incidents resulting in significant property damage, are to be performed for & on behalf of the legal department and will be subject to being classified as Confidential Attorney-Client / Attorney Work Product.

- All business line Health & Safety Managers are required to prepare a Monthly Loss Report summarizing all current month, and year-to date, chargeable vehicle accidents, injury/illness cases (requiring outside medical care), lost work day totals and restricted work day totals. This report shall then be forwarded, by the 10th day of the following month, to the Baton Rouge Corporate Safety Office.

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The Corporate Health & Safety Department is responsible for the issuance, revision, and maintenance of this procedure.

3.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1.

4.0 DEFINITIONS

Chargeable Vehicle Accident - Any **at-fault** vehicle accident meeting any **one** of the following criteria:

- An individual other than an employee of the company is a party in the accident
- Property owned by a person or entity other than the company is damaged
- When company owned, leased or rented vehicles are involved and damage exceeds $2,500.00.
- When an employee is driving a personal vehicle while on company business and damage exceeds $2,500.00.

Company - All affiliates, indirect and wholly owned subsidiaries of Shaw Environmental & Infrastructure, Inc. (Shaw E & I).

Days Away From Work - Days away from work are the number of **calendar** days following the injury or illness, excluding the date of the injury.

Job Safety Analysis (JSA) – The JSA is an effective management technique for identifying hazardous conditions and unsafe acts in the workplace. A JSA is intended to analyze the individual steps or activities, which together create a job or specific work duty, and to detect any actual or potential hazards that may be present. (See HS045: Job Safety Analysis)

Restricted Work – Occurs when, as the result of a work-related injury or illness:

- A physician or other licensed health care professional recommends that the employee not perform one or more of the routine functions of his or her job, or not work the full workday that he or she would otherwise have been scheduled to work

Near Miss Incident - Any incident where no injury occurred, but where the potential for injury existed.

OSHA Recordable Case – See Attachment 8

Vehicle - Any passenger vehicle, including trucks, used upon the highway or in private facilities for transporting passengers and/or property. For the purpose of this procedure, off-road vehicles such as earthmoving equipment, forklifts, non-highway use trucks, etc., are not considered vehicles. (See HS800 Motor Vehicle Operation: General Requirements)

5.0 TEXT

5.1 Incident Reporting Process

Employees are required to immediately report to their direct supervisor all occupational injuries, illnesses, accidents and near miss incidents having the potential for injury. Site Business Line Managers or Supervisors (supervisor directly responsible for the employee involved in the incident) with first-hand knowledge of an incident is required to:

- Immediately arrange for appropriate medical attention and notify the responsible health and safety representative.

- **As soon as practical, but not longer than one hour after gaining knowledge of the occurrence**, notify the Shaw Notification Hotline/Helpdesk by calling 1-866-299-3445 (Attachment 10) of any injury requiring off-site medical treatment, any chargeable vehicle accident or equipment incident involving property damage exceeding $2,500 in value (Shaw or third party).

- Inform Health Resources of all incidents requiring off-site medical attention by calling 1-800-350-4511. This call should be made **prior** to transporting the employee such that they can coordinate physicians services prior to arrival of the employee to the clinic, and provide the following information:

  - Company Name (Shaw E&I) & Business Line (e.g. DOD, Commercial)
  - Employee Name
  - Name of anticipated, treating medical facility and phone number
  - Brief description of incident.

  Health Resource's role is to interface with the treating physician, to ensure that appropriate care is provided to the injured employee.

- Complete the *Authorization for Treatment, Release of Medical Information*, and *Return to Work* (Attachment 9A, 9B, 9C) and the *Supervisor's Employee Injury Report* (Attachment 2) for all cases requiring off-site medical attention. The Site Safety and Health Representative or responsible supervisor shall ensure that the forms are completed and faxed to Health Resources at (800) 853-2641 prior to leaving the medical facility or as soon as reasonably possible.

- Post accident drug and alcohol testing shall occur in accordance with HS101 Drug and Alcohol Testing, immediately following an incident.

  NOTE: Prior to performing non-DOT post accident testing, it is the responsibility of the employee's supervisor to ensure that Health Resources has verified that this testing is not prohibited or restricted by state or local regulations.

- Prior to an injured employee returning to his/her job duties, a follow-up call by Health Resources will be made to the project site. The purpose of this call is to ensure work restrictions are clarified and planned work activities are consistent with medical recommendations.

- The Supervisor shall initiate/complete the appropriate company documentation in accordance with the following incident classifications: (note: if a Site Safety and Health Representative is on site, he should work in concert with the supervisor)

  - OSHA Recordable Cases
    a. Supervisor's Employee Injury/Illness Report (Attachment 2)
    b. Incident Investigation Report (Attachment 5)
    c. Witness Statement Form (Attachment 6)
    d. Accident Review Board (Attachment 7)

  - First Aid Cases
    a. Supervisor's Employee Injury/Illness Report (Attachment 2)
    b. Incident Investigation Report (Attachment 5)
    c. Witness Statement Form (Attachment 6)

  - Chargeable Vehicle Accidents
    a. Vehicle Accident Report (Attachment 3)
    b. Incident Investigation Report (Attachment 5)
    c. Witness Statement (Attachment 6)
    d. Accident Review Board (Attachment 7)
    e. Driving Record Certification (Procedure HS800)

  - Non-Chargeable Vehicle Accidents
    a. Vehicle Accident Report (Attachment 3)
    b. Incident Investigation Report (Attachment 5)
    c. Witness Statement (Attachment 6)

- Equipment, Property Damage and General Liability Incidents
  a. Incident Investigation Report (Attachment 5)
  b. Witness Statement Form (Attachment 6)
  c. Equipment, Property Damage and General Liability Loss Report (Attachment 4).

- Near Miss
  a. Incident Investigation Report (Attachment 5)

5.2 Supervisor's Employee Injury/Illness Report (Attachment 2)

The Supervisor's Employee Injury Report is to be completed for all incidents that result in an employee occupational injury or illness requiring off-site medical attention. It is to be initiated by the supervisor of the injured employee and forwarded to the respective Business Line Safety Manager for review / comments. Upon completion of review and comments the report should be forwarded, **within 24 Hours,** to the Shaw Corporate Claims department in Baton Rouge, via the corporate claims fax number (225.932.2636).

5.3 Vehicle Accident Report (Attachment 3)

The Vehicle Accident Report must be completed for any vehicle accident in which a company vehicle is involved. This includes company-owned or leased vehicles, rental vehicles, and personal vehicles being used for company business. This report is to be initiated by both the employee involved in the accident and his/her direct supervisor and forwarded to the respective Business Line Safety Manager for review / comments. Upon completion of review and comments the report should be forwarded to the Shaw Corporate Claims department in Baton Rouge (fax number 225.932.2636).

5.4 Equipment, General Liability, Property Damage, and Loss Report (Attachment 4)

The General Liability, Property Damage, and Loss Report is to be used for all losses or damage to company property in excess of $2,500.00. This form must be completed for all third party property, regardless of value, damaged as a result of company activities. The employee most familiar with the events that contributed to the loss or damage will complete the form, and then forward it to the project/location manager. The Corporate Claims Department and the respective Business Line Safety Manager must receive a copy of the report within one business day of the incident.

5.5 Incident Investigation Report (Attachment 5)

All injuries, illnesses, accidents, and near miss incidents will be investigated. Once arrangements for immediate medical care have been made, the employee's direct supervisor, with assistance from the health and safety representative and Business Line Health and Safety Manager, will:

· Collect the facts;

· Describe and document (include sketch, photos, etc.) how the incident occurred;

- Collect support documentation (JSA's, AHA's, Tailgate Safety Meetings, Work Orders, etc.);

- List witnesses and collect written statements;

  If applicable, contact the employee's Functional Manager in an effort to gain relevant information

- Identify the causative factors;

- Identify potentially unsafe acts or unsafe conditions that may have contributed to the incident;

- Identify potential curative action; and

- List the corrective actions which are to be executed, appropriate curative action, the person(s) responsible for the corrective action, and the date by which action is to be completed.

The investigation will be started as soon as possible following the incident and the relevant reports and support documentation (JSA's, AHA's, Tailgate Safety Meetings, Work Orders, etc.) shall be submitted to the appropriate Business Line Health and Safety Manager within 72 hours. In addition to the previous information, reports from external sources (police, insurance carriers, testing laboratories, etc.) are to be obtained as soon as they become available and forwarded by the Business Line Safety Manager to the Corporate Claims department in Baton Rouge.

5.6 Injured Employee Statement & Witness Statement Forms (Attachment 6a & 6b)

The Injured Employee and Witness Statement Forms allow for consistency in the development of the investigation process. The Injured Employee Statement must be completed in all cases where an employee injury results in off site medical treatment. If there are witnesses to the accident/incident, the Witness Statement form should be completed and signed by the subject witness. Both of these forms should be attached to the incident investigation report. It is essential that these statements are executed immediately following the incident to ensure an accurate account of the events.

5.7 Accident Review Board (ARB) (Attachment 7)

The purpose of the Accident Review Board is to collect and review the information gathered for each incident, report that information to the Legal Department and take appropriate curative action. In all cases, the purpose of the entire investigative process, inclusive of conducting an ARB, is to identify curative actions as it relates to the incident / injury. Accordingly, a diligent and concerted effort to accomplish these tasks must be established at the onset of all of the subject incidents.

In order to assist the Legal Department in evaluating the risk to, or liability of, the company, associated with OSHA recordable injuries, chargeable vehicle accidents, fatalities or incidents resulting in significant property damage, the responsible Project / Location Manager is required to coordinate with all parties and set up the ARB such

that it occurs **within 10 days of the accident**. The respective Business Line Health and Safety Manager, whose project/location experiences accident is then required to conduct the subject ARB.

The Accident Review Board shall be composed of the project/location manager, the employee's direct supervisor (at time of incident), a health and safety representative, and the employee(s) involved in the incident.

Additionally, there may be cases that involve an employee that has been assigned to a project and the Functional Manager of that employee may not have direct knowledge of an incident. In cases such as these, the Functional Manager shall be notified of the incident and requested to participate in the ARB. Also, as determined by the Business Line Health and Safety Manager, a representative of other internal sources of expertise should be involved where applicable.

All investigations and associated materials obtained and/or produced, in association with injuries/illnesses resulting in OSHA recordable classification, chargeable vehicle accidents, fatalities or incidents resulting in significant property damage, are to be performed for and on behalf of the legal department and will be subject to being classified as Confidential Attorney-Client / Attorney Work Product. If the ARB is initiated under a Confidential Attorney-Client / Attorney Work Product status, all documents and other work product arising out of, or associated with, the investigation process, including the ARB, shall be prepared in anticipation of litigation. The Accident Review Board report, and associated documents, is submitted to the Corporate Safety Department, for production to and retention on behalf of the Legal Department.

The ARB report, and all associated documents, shall be completed as soon as practicable, but not more than 5 business days following the ARB meeting, and forwarded by the Business Line Safety Manager to the Corporate Safety Department, via the Corporate Claims fax number. The original documents shall then be mailed to the Corporate Safety Department. These documents shall then be filed in a lockable cabinet, separate from files not meeting the subject criteria, by the Corporate Safety Department, for production to and retention on behalf of the Legal Department. In the event that copies of these files are maintained by Business Line Safety Managers and / or the respective location in which the injury occurred, the same filing criteria shall be followed. The criteria shall be that these documents are filed in lockable cabinets, separate from files not meeting the subject Attorney-Client / Attorney Work Product criteria.

It is generally not acceptable to discipline an employee for having an accident. However, if in the opinion of the Accident Review Board, it is determined that the accident resulted from an intentional unsafe act or intentional violation of company procedure on the employee's part, the employee may be subject to disciplinary action in accordance with the company's progressive disciplinary action system (see Human Resources Procedure HR207).

5.8 Monthly Loss Report

Each business line Health and Safety Manager is responsible to submit a Monthly Loss Report summarizing incidents that took place within their business line during the previous month. The business line Health and Safety Manager is responsible for submitting a consolidated package for the entire business line to the corporate health and safety office for **receipt no later than the 10th working day of the following month**.

6.0 EXCEPTION PROVISIONS

Variances and exceptions may be requested pursuant to the provisions of Procedure HS013, Health and Safety Procedure Variances.

7.0 CROSS REFERENCES

HR207 Disciplinary Action
HS013 Health and Safety Procedure Variances
HS101 Drug and Alcohol Testing
HS800 Motor Vehicle Operations - General Requirements
HS810 Commercial Motor Vehicles

8.0 ATTACHMENTS

1. Responsibility Matrix
2. Supervisor's Employee Injury/Illness Report
3. Vehicle Accident Report
4. Equipment, Property Damage and General Liability Loss Report
5. Incident Investigation Report
6. a. Injured Employee Statement
   b. Witness Statement
7. Accident Review Board Report
8. Injury/Illness Classification Guidelines
9. Medical Forms
   a. Authorization for Treatment of Occupational Injury/Illness
   b. Authorization for Release of Medical Information
   c. Return to Work Examination Form.
10. Help Desk / Hotline Notification Guidelines

ATTACHMENT 1

ACCIDENT PREVENTION PROGRAM: REPORTING, INVESTIGATION, AND REVIEW RESPONSIBILITY MATRIX

Action	Procedure Section	*Responsible Party*					
		Employee	Supervisor	Project/ Location Manager	Site Health and Safety Rep. / Officer	Business Line Health and Safety Manager	Corporate Health & Safety Manager
Issue, Revise, and Maintain Procedure	3.1						X
Report All Incidents to Supervisor	5.1	X					
Notify Health and Safety Representative	5.1		X				
Arrange Medical Care	5.1		X		X		
Notify Health Resources or Gates McDonald of Incident	5.1		X		X		
Initiate/Complete Company Forms	5.1		X		X		
Complete Investigation of incident	5.5		X	X	X	X	
Complete Equipment, Property Damage and General Liability Loss Report Incident	5.4	X					
Coordinate and Set up Accident Review Board	5.7			X			
Conduct Accident Review Board	5.7					X	
Participate in Accident Review Board	5.7	X	X	X	X	X	
Complete Monthly Loss Report	5.8					X	

Attachment 2

REPORT ALL WORKER'S COMPENSATION INJURIES TO SHAW CLAIMS DEPARTMENT
FAX REPORT WITHIN 24 HOURS OF INCIDENT TO **225-932-2636**.
Phone all injuries/ illnesses to Shaw Notification Hotline/Helpdesk
1-866-299-3445

Supervisor's Employee Injury/Illness Report Form

EMPLOYEE INFORMATION

Employee's Social Security Number:		Claim Number:	
Employee's Name:		Home Phone Number:	
Home Address:			Business Line Code:
Male Female	Date of Birth:	Hire Date:	
Dependents:	Dependents Under 18:	Marital Status:	
Occupation:		Department Name:	
State Hired:	Currently Weekly Wage:	Hourly Wage:	
Hours/Days Worked Per Week:	Days Per Week	Hours Worked Per Day:	
Employment Status:	Employee Report No.: N/A		Employee ID No.: N/A
Salaried Continued:	Paid For Date of Injury:		Education No. of Years:
Ever Injured on the Job:	Supervisor Name & Phone:		

EMPLOYER INFORMATION

Employer Name:	**The Shaw Group, Inc.**		
Work Location:			
Contact Name:	**John Mollere**	Telephone Number:	**(800)747-3322, Ext. 572**
Employer SIC:		Employer Location Code:	
Employer FED ID:		Employer Code:	N/A
Nature of Business:			
Policy Number:			

ACCIDENT INFORMATION

Date and Time of Injury:			
Did the Accident Occur at the Work Location:		If no, where did the accident occur?	N/A
Accident Address:			
Nature of Accident:			

Give a Full Description of the Accident: (Be as Factually Complete As Possible)

Are Other WC Claims Involved?	No	Date and Time Reported to Employer:	
Person Reported To:			

WITNESS INFORMATION

Were There Any Witnesses?

If Yes, List Names and How to Contact Them:

INJURY INFORMATION

Which Part of the Body Was Injured? (e.g. Head, Neck, Arm Leg)

What Was the Nature of Injury? (e.g. Fracture, Sprain, Laceration)

Part of Body Location: (e.g. Left, Right, Upper, Lower)

Injury Description:

Source of Injury:	Is Employee Hospitalized?
Lost Time:	If Yes, What was First Full Day Out:
Date Last Day Worked:	Date Disability Began: N/A
Date Returned to Work:	Estimated Return Date: N/A

MEDICAL INFORMATION

ER Treated & Released:	Hospitalized:	Phy./Clinic:
Hospital - Name, Address, Phone Number:	Was Employee Transported via Ambulance:	Yes No

N/A

Clinic - Name, Address, Phone Number:

ADDITIONAL COMMENTS & INFORMATION

REPORT PREPARED BY

Name:	Title:
Signature:	Phone:

ATTACHMENT 3
VEHICLE ACCIDENT REPORT
Page 1 of 2

ACCIDENT DESCRIPTION

This report is to be initiated by the employee involved in the accident or his/her direct supervisor. Please answer all questions completely. This report must be forwarded to the appropriate health and safety representative within 24 HOURS of the accident. Attach police report.

ACCIDENT DATE _____ TIME _____ ☐ A.M. or ☐ P.M.

LOCATION OF ACCIDENT (CITY, STATE) _____

DESCRIPTION OF ACCIDENT _____

_____

_____

WITNESS _____ PHONE NO. _____

ADDRESS _____ CITY _____ STATE _____ ZIP _____

POLICE OFFICER'S NAME AND BADGE #_____ DEPARTMENT _____

COMPANY VEHICLE

DRIVER _____ DRIVERS LICENSE NO. _____ STATE _____

ADDRESS _____ _____ CITY _____ STATE _____ ZIP _____

WORK PHONE NO. _(_____)_____ S.S. NO. _____ PROJECT NAME/NO. _____

VEHICLE NO. _____ YEAR _____ MAKE _____ MODEL _____ LICENSE PLATE NO. _____

STATE _____ VEHICLE OWNER: ☐ COMPANY ☐ LEASED/RENTED ☐ PRIVATE VEHICLE

VEHICLE TYPE: ☐ COMMERCIAL MOTOR VEHICLE ☐ NON-COMMERCIAL

IF NOT COMPANY-OWNED: OWNER _____ PHONE NO _(____)_____

ADDRESS _____ _____ CITY _____ STATE _____ ZIP _____

VEHICLE DAMAGE _____

NO. OF VEHICLES TOWED FROM SCENE _____ NUMBER OF INJURIES _____ NUMBER OF FATALITIES _____

WERE HAZARDOUS MATERIALS RELEASED? ☐ NO ☐ YES IF YES, DESCRIBE MATERIALS _____

_____

OTHER VEHICLE

DRIVER _____ DRIVERS LICENSE NO. _____ STATE _____

ADDRESS _____ CITY _____ STATE _____ ZIP _____

PHONE NO. _(_____)_____ S.S. NO. _____

OWNER'S NAME (☐ CHECK IF SAME AS DRIVER) _____

ADDRESS _____ CITY _____ STATE _____ ZIP _____

INSURANCE COMPANY _____ POLICY NO. _____

AGENT'S NAME _____ PHONE NO. _(_____)_____

ADDRESS _____ CITY _____ STATE _____ ZIP _____

VEHICLE YEAR _____ MAKE _____ MODEL _____ PLATE NO. _____ STATE _____

VEHICLE I.D. NO. _____

VEHICLE DAMAGE _____

PASSENGERS: ☐ NO ☐ YES INJURIES: ☐ NO ☐ YES (If Yes, list names and telephone numbers below)

_____

_____

_____

VEHICLE ACCIDENT REPORT

WEATHER: ☐ Clear ☐ Cloudy ☐ Fog ☐ Rain ☐ Sleet ☐ Snow Other _____

PAVEMENT: ☐ Asphalt ☐ Steel ☐ Concrete ☐ Wood ☐ Gravel/Dirt ☐ Brick/Stone Other _____

CONDITION: ☐ Dry ☐ Wet ☐ Icy ☐ Pot Holes Other _____

TRAFFIC CONTROL: ☐ Traffic Light ☐ Stop Sign ☐ Railroad ☐ No Intersection ☐ No Control

ROADWAY: Number of Lanes Each Direction: _____ ☐ Residential ☐ Divided Highway ☐ Undivided Highway

Draw and name roadways showing each vehicle, direction of travel, and point of impact. Indicate travel before the accident with a solid line, and post-accident movement with a broken line.

SYMBOLS:

Your Vehicle ①

Other Vehicle(s) ②③

Pedestrian

Stop Sign

Yield

Railroad

ADDITIONAL INFORMATION:

_____

_____

_____

_____

EMPLOYEE _____ (Print) _____ (Signature) _____ (Date)

SUPERVISOR _____ (Print) _____ (Signature) _____ (Date)

HEALTH & SAFETY REP. _____ (Print) _____ (Signature) _____ (Date)

ATTACH POLICE REPORT TO VEHICLE ACCIDENT REPORT

REPORT MUST BE FAXED TO:
CORPORATE CLAIMS DEPARTMENT (FAX: 225-932-2636)
WITHIN 24 HOURS, OR NOT LATER THAN NEXT BUSINESS DAY.

REPORT ALL CHARGEABLE VEHICLE ACCIDENTS TO SHAW NOTIFICATION HOTLINE/HELPDESK
(PHONE: 1-866-299-3445)

ATTACHMENT 4

EQUIPMENT, PROPERTY DAMAGE AND GENERAL LIABILITY LOSS REPORT

This report is to be completed for all losses or damage to company property in excess of $2,500.00 and all third party damage, regardless of value, resulting from company activities.

PROJECT/LOCATION _____ PROJECT NO. _____ DATE _____

ADDRESS _____

HOW DID DAMAGE OR LOSS OCCUR: _____

_____

_____

DESCRIPTION AND VALUE ($) OF DAMAGED/LOST/STOLEN PROPERTY: _____

_____

LOCATION OF DAMAGED/LOST/STOLEN PROPERTY (Before Loss): _____

_____

DATE AND TIME OF DAMAGE, LOSS, OR THEFT: Date: _____ Time: _____ a.m./p.m.

OWNER OF DAMAGED/LOST/STOLEN PROPERTY:

Name _____ Phone No. (____) _____

Address _____ City _____

Employer and Address _____

INJURED PARTIES (Also complete a Supervisor's Employee Injury Report if a Company Employee):

Name _____ Phone No. (____) _____

Address _____ City _____

Employer and Address _____

Description of Injury _____

WITNESSES:

1. Name _____ Home Phone (____) _____
   Home Address _____ City _____
   Employer and Address _____
2. Name _____ Home Phone (____) _____
   Home Address _____ City _____
   Employer and Address _____

WERE PICTURES TAKEN? ☐ YES ☐ NO

WERE POLICE NOTIFIED? ☐ YES ☐ NO DEPT. _____ REPORT NO. _____

COMPLETED BY: _____ _____ _____
(Print) (Signature) (Date)

PROJECT/LOCATION MANAGER: : _____ _____ _____
(Print) (Signature) (Date)

REPORT MUST BE FAXED TO:
CORPORATE CLAIMS DEPARTMENT (FAX: 225-932-2636)
WITHIN 24 HOURS, OR NOT LATER THAN NEXT BUSINESS DAY

ATTACHMENT 5
INCIDENT INVESTIGATION REPORT

*** Must Be Completed Within 72 HOURS & Relevant Support Documentation Must Be Attached / Submitted***

Investigation Date _____ Date of Incident _____

Employee Name _____

Supervisor Name _____

Project Number/Name _____ / _____

Location of Incident _____

· Incident Classification

Injury	☐ First Aid	Vehicle	☐ Chargeable	DOT	☐ DOT Vehicle
	☐ OSHA Recordable		☐ Non-chargeable		☐ DOT Reportable
	☐ Lost Workday				
	☐ Restricted Workday	Near Miss	☐	General Liability	☐

· Description (Provide facts, describe how incident occurred, provide diagram [on back] or photos)

_____

_____

· Analysis (What unsafe acts or conditions contributed to the incident?)

_____

_____

_____

_____

· Corrective Action(s) (List corrective action items, responsible person, scheduled completion date)

_____

_____

_____

· Witness Names (Complete Attachment 6 – Employee Witness Statement)

_____

_____

_____

_____

Investigated By _____ (Print Name) _____ (Signature) _____ (Date)

Project/Location Mgr. _____ (Print Name) _____ (Signature) _____ (Date)

ATTACHMENT 6a
Injured Employee Statement
MUST BE COMPLETED WITHIN 24 HOURS OF THE INCIDENT

This form should be completed by the injured employee involved in the incident. Describe only the facts for which you have personal knowledge. If you have no knowledge of a particular question, write "no knowledge".

Company _____

Exact Location of Incident/Accident _____

Name of Injured Employee _____

Date of Incident/Accident _____ Time _____ am pm

Date of this Statement _____ Time _____ am pm

Time your shift begins? Time _____ am pm Time your shift ends? Time _____ am pm

Name of Known Witnesses:

Name _____

Name _____

Name _____

Name _____

Your Immediate Supervisors Name _____

If not employed by Shaw E&I, enter name of company and phone number _____

Have you had a prior injury similar to this injury? _____

Was it while you were at work? _____

What date did the prior injury occur? _____

Stating Only Factual Information, Describe in Detail What Happened and Include Any Applicable Events Leading to the Incident/Accident.

_____

_____

_____

_____

_____

_____

_____

_____

I certify that, to the best of my knowledge, all of the above information is complete, accurate and factual. I acknowledge that the intentional falsification or altering of facts or making misleading statements may be grounds for disciplinary action.

_____ _____

Signature/Date Print Name

ATTACHMENT 6b
Employee Witness Statement
MUST BE COMPLETED WITHIN 24 HOURS OF THE INCIDENT

This form should be completed by every employee working in the crew of the injured employee and by every other employee with knowledge of events or circumstances involved in the incident. This information is being solicited from you so that the company can accurately assess the reported incident to avoid similar occurrences in the future. Describe only the facts for which you have personal knowledge. If you have no knowledge of the incident, write "no knowledge".

Company _____

Exact Location of Incident/Accident _____

Name of Injured Employee _____

Date of Incident/Accident _____ Time _____ am pm

Date of this Statement _____ Time _____ am pm

Time your shift begins? Time _____ am pm Ends _____ am pm

Witness Information:

Name _____

Home Phone No. _____

Home Address _____

County _____ Zip _____

Witness' Supervisor Name _____

If not employed by Shaw E&I, enter name of company _____

Company Phone Number _____

Did You See the Incident/Accident? _____

How Far From You (approx., in feet) Did the Incident/Accident Occur? _____

Stating Only Factual Information, Describe in Detail What Happened and Include Any Applicable Events Leading to the Incident/Accident.

_____

_____

_____

_____

_____

_____

_____

_____

I certify that, to the best of my knowledge, all of the above information is complete, accurate and factual. I acknowledge that the intentional falsification or altering of facts or making misleading statements may be grounds for disciplinary action.

_____ _____

Witness Signature/Date Print Name

ATTACHMENT 7

ACCIDENT REVIEW BOARD

DATE:	LOCATION:
BOARD MEMBERS:	
ACCIDENT DATE:	EMPLOYEE(S) INVOLVED IN INCIDENT:
INVESTIGATION COMPLETE: YES ☐ NO ☐	ACCIDENT CLASSIFICATION:

THE FOLLOWING INFORMATION <u>MUST</u> BE PROVIDED BY THE REVIEW BOARD FOR THIS INCIDENT (PRINT):

SUPERVISOR: _____ **PROJECT/LOCATION MGR.:** _____

POTENTIAL CAUSE OF ACCIDENT:

ACTION BY BOARD*:

* ALL ACTIONS BY THE ACCIDENT REVIEW BOARD ARE SUBJECT TO FINAL REVIEW BY THE HUMAN RESOURCES AND LEGAL DEPARTMENTS.

ACCEPTED:

_____ (Employee Signature)

_____ (Supervisor Signature)

APPROVED:

_____ (Project/Location Manager)

REJECTED FOR:

_____

_____

APPROVED:

_____ (Business Line Health and Safety Manager or Designee)

REJECTED FOR:

_____

_____

APPROVED:

_____ (Business Line Vice President)

REJECTED FOR:

_____

_____

ATTACHMENT 8

INJURY/ILLNESS CLASSIFICATION GUIDELINES

First Aid Treatment – If the incident requires only the following types of treatment, consider it first aid. **Do Not** record the case if it involves only:

- Using non-prescription medications at non-prescription strength
- Administering tetanus immunizations
- Cleaning, flushing, or soaking wounds on the skin surface
- Using wound coverings such as bandages, Band-Aids™, gauze pads, etc., or using SteriStrips™ or butterfly bandages
- Using hot or cold therapy
- Using any totally non-rigid means of support, such as elastic bandages, wraps, non-rigid back belts, etc.
- Using temporary immobilization devices while transporting an accident victim (slings, neck collars, or back boards)
- Drilling a fingernail or toenail to relieve pressure, or draining fluids from blisters
- Using eye patches
- Using simple irrigation or a cotton swab to remove foreign bodies not embedded in or adhered to the eye
- Using irrigation, tweezers, cotton swab or other simple means to remove splinters or foreign material from areas other than the eye
- Using finger guards
- Using massages
- Drinking fluids to relieve heat stress

Medical Treatment – Includes managing and caring for a patient for the purpose of combating disease or disorder. The following are **not** considered medical treatments and are not recordable:

- Visits to a doctor or Licensed Health Care Professional (LHCP) solely for the purpose of observation or counseling
- Diagnostic procedures, including administering prescription medications that are used solely for diagnostic purposes
- Any procedure that can be labeled first aid (see above descriptions)

OSHA Recordable Injuries and Illnesses

Work related injuries and illnesses that result in the following should be recorded on the OSHA 300 Log:

- Death
- Loss of consciousness
- Days away from work
- Restricted work activity or job transfer
- Medical treatment beyond first aid.

You must also record any **work related** injury or illness that involves cancer, chronic irreversible disease, a fractured or cracked bone, or a punctured eardrum.

Additional Recordable Criteria

You must also record the following conditions when they are work related:

- Any needle stick injury or cut from a sharp object that is contaminated with another person's blood or other potentially infectious material
- Any case requiring an employee to be medically removed from a site under the requirements of an OSHA health standard
- Any Standard Threshold Shift (STS) in hearing (i.e., cases involving an average hearing loss of 10dB or more in either ear)
- Tuberculosis infection as evidenced by a positive skin test or diagnosis by a physician or other licensed health care professional after exposure to a known case of active tuberculosis.

ATTACHMENT 9B
MEDICAL FORMS

AUTHORIZATION FOR TREATMENT OF OCCUPATIONAL INJURY/ILLNESS

Employee Name: _____
Social Security #: _____ Injury: ☐ Illness: ☐
Job Title: _____ Incident Date: _____
Project/Location _____ Location of Accident/Exposure:
Telephone #: _____ _____
H&S Representative: _____
Body Part(s) Injured: _____
Describe in detail how incident occurred: _____
_____

TO TREATING PHYSICIAN:

In the case of occupational injury/illness, please examine the employee and render necessary conservative treatment directly related to the occupational injury/illness.

Light Duty Work:
It is the policy of our company to provide work assignments, whenever possible, for employees with physical activity restrictions resulting from an occupational injury/illness. If the employee will be subject to a restriction, please contact **Health Resources** before releasing the employee, so that a light duty assignment may be arranged.

Medically Unfit to Return to Work:
It is the policy of our company to assist employees unable to return to work, due to an injury/illness, in obtaining needed medical care and other available benefits. Medical findings are also used to help evaluate unsafe conditions that may have led to the incident. Please help us assist our employees by contacting **Health Resources** with your findings as soon as possible, preferably before the employee leaves your office, but not later than the close of business on the day of initial treatment.

Health Resources: Telephone: 1-800-350-4511 Fax: (800) 853-2641

Please Send Reports To Both of the Following:
Health Resources
600 West Cummings Park, Suite 3400
Woburn, Massachusetts 01801

AND

The Shaw Group, Inc. Corporate Claims Department
4171 Essen Lane
Baton Rouge, LA 70809

Please Send Bills To:
The Shaw Group, Inc. Corporate Claims Department
4171 Essen Lane
Baton Rouge, LA 70809

DOCTOR, Please provide:
Medical Diagnosis: _____
Treatment Provided: _____
_____
Recommended Work Limitation/Restriction: _____
Return Visit Needed: No ☐ Yes ☐ Date if Yes _____ First Aid Only ☐
Physician Name: _____ Physician Telephone: _____
Physician Signature: _____ Date: _____

YOU MUST CALL HEALTH RESOURCES FOR ALL OCCUPATIONAL INJURIES/ILLNESSES REQUIRING OUTSIDE MEDICAL TREATMENT: 1-800-350-4511.

FAX COMPLETED FORM TO HEALTH RESOURCES (800) 853-2641.

Send Bills to Shaw Corporate Claims Department

ATTACHMENT 9B
MEDICAL FORMS
AUTHORIZATION FOR RELEASE OF PROTECTED MEDICAL INFORMATION

Printed Name: _____ Date of Birth: _____

Address:_____

Social Security #:_____ Home Telephone:_____

Authority to Release Protected Health Information

I hereby authorize the release of medical information, identified in this authorization form, and provide such information to:

HEALTH RESOURCES
600 West Cummings Park, Suite 3400
Woburn, Massachusetts 01801
Phone: (800) 350-4511
Fax: (800) 853-2641

AND

The Shaw Group Inc.
4171 Essen Lane
Baton Rouge, Louisiana 70809
Phone: 225-932-2500
Fax: 225-932-2636

The Information To Be Released includes the following:

Complete health record	Discharge summary	Progress notes
History and physical exam	Consultation reports	X-ray films / images
Laboratory test results	X-ray & Image reports	Itemized bill
Diagnosis & treatment codes	Complete billing record	

Other, (specify)_____

Purpose of the Requested Disclosure of Protected Health Information

I am authorizing the release of my Protected Health Information.

Drug and/or Alcohol Abuse, and/or Psychiatric, and/or HIV/AIDS Records Release

I understand if my medical or billing record contains information in reference to, psychiatric care, sexually transmitted disease, hepatitis B or C testing, previous drug and/or alcohol abuse and/or other sensitive information, I agree to its release. ***Check One:*** ☐ **Yes** ☐ **No**

I understand if my medical or billing record contains information in reference to HIV/AIDS (Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome) testing and/or treatment I agree to its release. ***Check One:*** ☐ **Yes** ☐ **No**

Right to Revoke Authorization

Except to the extent that action has already been taken in reliance on this authorization, the authorization may be revoked at any time by submitting a written notice to ***The Corporate Claims Dept.*** **at** ***The Shaw Group Inc., 4171 Essen Lane, Baton Rouge, Louisiana 70809***. Unless revoked, this authorization will expire at which time completion of treatment for the injury or illness has been accomplished.

Re-disclosure

I understand the information disclosed by this authorization may be subject to re-disclosure by the recipient and no longer be protected by the Health Insurance Portability and Accountability Act of 1996.

Signature of Patient or Personal Representative Who May Request Disclosure

I understand that I do not have to sign this authorization. However, if health care services are being provided to me for the purpose of providing information to a third-party (e.g. fitness-for-work test), I understand that services may be denied if I do not authorize the release of information related to such health care services to the third-party. I can inspect or copy the protected health information to be used or disclosed. **I hereby release and discharge _*The Shaw Group Inc*** **of any liability and the undersigned will hold** ***The Shaw Group Inc*** **harmless for complying with this Authorization.**

Signature: _____ **Date:** _____

Description of relationship if not patient: _____

ATTACHMENT 9C
MEDICAL FORMS

RETURN-TO-WORK EXAMINATION FORM

Exam Date: _____ / _____ / _____ **Employee Name:** _____

Birth Date: _____ / _____ / _____ **Social Security #:** _____ - _____ - _____

Job Title: _____ **Sex:** ❑ Male ❑ Female

Examining Provider: **Please complete this form and fax to Health Resources at (800) 853-2641. Please contact Health Resources at (800) 350-4511 to report status of employee post-treatment.**

DIAGNOSIS: _____

TREATMENT PLAN: _____

MEDICATIONS: _____

PHYSICAL THERAPY: _____

OTHER: _____

- ❑ May return to full duty work effective ___/___/___
- ❑ May return to limited duty from ___/___/___ to ___/___/___
- ❑ Unable to return to work from ___/___/___ to ___/___/___

WORK LIMITATIONS:

- ❑ Restricted lifting/pushing/pulling: maximum weight in lbs: _____ (company limits all lifting to ≤ 60 lbs).
- ❑ Work only with right/left hand.
- ❑ Restricted repetitive motion right/left hand.
- ❑ Sitting job only.
- ❑ Restricted operation of moving equipment.
- ❑ Other: _____

FOLLOW-UP PLAN:

- ❑ Release from care.
- ❑ Schedule for follow-up appointment on ___/___/___.
  Time _____ AM/PM
- ❑ Referral to _____
  Appointment date ___/___/___ Time _____ AM/PM

Comments: _____

Examiner's Name (*print)*	Examiner's Signature	Date

ATTACHMENT 10

HELP DESK / HOTLINE NOTIFICATION GUIDELINES

Any incident, as defined in the bulleted items below, requires corporate notification **as soon as practical but not longer than one hour after occurrence**, via the Health and Safety Help Desk / Hotline. This requirement is a corporate wide directive and applies to all Shaw Group companies, not just Shaw E&I. As such, the responsibility for whom makes this notification has purposefully not been defined. This is due to the various types of projects in which The Shaw Group performs activities. Some projects may only consist of three technicians at a site; others may involve multiple levels of site management and consist of 200+ employees. Therefore, the intent is for the supervisory/management person to communicate the notification requirements to his/her employees and make the appropriate determination as to how the notification takes place.

Immediate Corporate Notification via Help Desk: 1-866-299-3445

- Illness and/or injury (doctors cases and above);
- Property damage (dollar amount greater than $2,500);
- Automobile accidents (All);
- Criminal activity (i.e. bomb threat, theft);
- Natural disaster (i.e. earthquakes, flood, storm damage, hurricanes);
- Explosion and/or fires (that results in property damage greater then $2,500 or result in injury);
- Environmental spills/releases (incidents that requires regulatory notification or have an offsite impact);
- Regulatory visit (i.e. OSHA, EPA, DEQ, MSHA, etc.);
- Fatalities

Note:

- Help Desk / Hotline notification is in addition to the requirement to inform Health Resources of all incidents requiring off-site medical attention by calling 1-800-350-4511. This call should be made **prior** to transporting the employee such that they can coordinate physicians' services prior to arrival of the employee to the medical facility.

- As stated above, the notification requirements are a corporate directive and apply to the entire Shaw Group. . Accordingly, Shaw E&I managers/supervisors should use sound judgment as it pertains to the two bulleted items that have been highlighted above. Although they may not be desired events, some Environmental spills/releases that occur may not be an uncommon situation at a particular site. In addition, there may be projects in which the EPA or some other regulatory agency visits on some normal frequency. Events such as these, which would typically be unusual at a construction or fabrication site, are not so unusual to some of our environmental projects. As such, a notification to the helpdesk would not be required.

PROCEDURE

Subject: TAILGATE SAFETY MEETINGS

1.0 PURPOSE AND SUMMARY

This procedure establishes the requirement for the conductance of tailgate safety meetings. These meetings are to be conducted at each company project site, on a daily basis, prior to the start of any work activities.

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The Vice President, Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

3.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1.

4.0 DEFINITIONS

Company - All wholly-owned subsidiaries of Shaw Environmental & Infrastructure, Inc. (Shaw E & I).

Tailgate Safety Meeting - A short training or informative session that provides safety guidelines for the planned work activities for the day or shift.

5.0 TEXT

The project supervisor or his/her designee conducts a tailgate safety meeting at the beginning of each shift or whenever new employees arrive at the work site. The topics discussed at the tailgate safety meeting should cover the work assignments for the day, the expected hazard(s) presented by the work, and an explanation on how employees will protect themselves from those hazards.

The meetings are to be documented by the completion of a Tailgate Safety Meeting Form. The project supervisor will assure that the form is properly completed and signed by all attendees. Completed forms will be maintained in the project files.

The following sections provide guidance for the completion of the form:

A. **Project Name/Number** - Specific project name and number assigned to the project.

B. **Date** - Date of meeting.

C. **Time** - Time at which meeting is held.

D. **Client** - Identification, name, etc. of entity for whom work is to be performed.

E. **Work Activities** - Detailed description of the work activities to be performed that day.

F. **Hospital Name/Address** - Hospital name and address designated to be used for the project.

G. **Phone Number** - Designated hospital non-emergency phone number.

H. **Ambulance** - Phone number for medical emergency transportation.

I. **Safety Topics Presented:**

1. **Chemical Hazards** - Specific chemical name and adverse properties of all chemicals to be encountered on the job that day. A Material Safety Data Sheet (MSDS) for each should be available and discussed in accordance with Procedure HS060.

2. **Physical Hazards** - Address physical hazards associated with the work site, such as slipping/tripping/falling hazards, pinch points, overhead hazards, and nearby operations that could pose a hazard.

3. **Personal Protective Equipment** - Specify levels of protective clothing and protective devices to be used by employees for each of the day's activities.
4. **New Equipment** - Indicate proper work techniques and any hazards associated with new or unfamiliar equipment.

5. **Other Safety Topic(s)** - List any remaining safety topics pertinent to the potential hazards of the job for that day. This is an area where different, unique subjects can be introduced to make the tailgate safety meeting more interesting.

J. **Attendees** - Printed name and signature of all persons in attendance. (Also, list affiliation if not employed by the company.)

K. **Meeting Conducted By** - Printed name and signature of individual conducting the tailgate safety meeting.

6.0 EXCEPTION PROVISIONS

Variances and exceptions may be requested pursuant to the provisions of Procedure HS013, Health and Safety Procedure Variances

7.0 CROSS REFERENCES

HS013 Health and Safety Procedure Variances
HS060 Hazard Communication Program

8.0 ATTACHMENTS

1. Responsibility Matrix
2. Tailgate Safety Meeting Form

ATTACHMENT 1
TAILGATE SAFETY MEETINGS

Responsibility Matrix

Action	Procedure Section	*Responsible Party*	
		Vice President of Health and Safety	**Project Supervisor**
Issuance, Revision, and Maintenance of Procedure	3.1	X	
Conduct Meeting	5.0		X

ATTACHMENT 2

TAILGATE SAFETY MEETING FORM

Project Name/Number: _____ Date: _____ Time: _____

Client: _____

Work Activities: _____

Hospital Name/Address: _____

Hospital Phone No.: _____ Ambulance Phone No.: _____

Safety Topics Presented

Chemical Hazards: _____

_____

Physical Hazards: _____

_____

Personal Protective Equipment:

Activity: _____ PPE Level: _____

Activity: _____ PPE Level: _____

Activity: _____ PPE Level: _____

Activity: _____ PPE Level: _____

Activity: _____ PPE Level: _____

New Equipment: _____

Other Safety Topic(s): _____

_____

Attendees

NAME PRINTED	SIGNATURE

Meeting conducted by: _____

PROCEDURE

Subject: EXCAVATION AND TRENCHING

1.0 PURPOSE AND SUMMARY

The purpose of this procedure is to describe the company requirements for excavation and trenching safety. These requirements are based on the federal Occupational Safety and Health Administration (OSHA) excavation standard found in 29 Code of Federal Regulations (CFR) 1926, Subpart P.

Some company activities are likely to occur in states or localities that either currently have or will have requirements that differ from those contained within the federal standard. In such circumstances, the local health and safety representative will be responsible for ensuring that these requirements are included in either a site health and safety plan or a similar document and conveyed to all affected employees. If federal, state, or local regulations vary or conflict, the more protective requirements and practices will be followed.

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The Vice President of Health & Safety is responsible for the issuance, revision, and maintenance of this procedure.

3.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1.

4.0 DEFINITIONS

Accepted Engineering Practices
Those requirements or practices which are compatible with standards required by a registered professional engineer.

Angle of Repose
The greatest angle above the horizontal plane at which a material will lie without sliding.

Benching
A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels of steps, usually with vertical or near-vertical surfaces between levels.

Competent Person
An employee 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 authority to take prompt corrective measures to eliminate them.

Company
All wholly-owned subsidiaries of Shaw Environmental & Infrastructure, Inc. (Shaw E & I).

Excavation
Any man-made cut, cavity, trench or depression in an earth surface, including its sides, walls, or faces, formed by earth removal.

Registered Professional Engineer
An individual currently registered as a professional engineer (preferably civil) in the state where work is to be performed.

Sheeting
Members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield
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. Shields may be pre-manufactured 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
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
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.

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
A narrow (in relation to its length) excavation made below the surface of the ground. In general, the depth is greater than the width at the bottom, but the width of a trench at the bottom is not greater than 15 feet.

Type A Soil
Cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144kPa) 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 hardpan are also considered Type A. However, soil is NOT 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; or
- The material is subjected to other factors that would require it to be classified as a less stable material.

Type B Soil
This classification refers to:

- Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa)
- Granular cohesionless 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 which would otherwise be classified Type C soil;
- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subjected to vibration;
- Dry rock that is not stable; or
- 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
This classification refers to:

- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less;
- Granular soils including gravel, sand, and loamy sand;
- Submerged soil or soil from which water is freely seeping;
- Submerged rock that is not stable; or
- Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

5.0 TEXT

5.1 Pre-Excavation Requirements

5.1.1 Underground Utilities. Prior to opening an excavation, the estimated location of underground utilities such as sewer, telephone, fuel, electric, water, or any other underground installation that may be reasonably expected to be encountered during the excavation work shall be determined.

Utility companies or a utility location service shall be contacted within the established pre-notification time, advised of the proposed work, and asked to deliniate the location of all underground utilities. Employees should be careful to protect and preserve the utility markings until they are no longer required for safe excavation. At least 3 feet of clearance between any underground utility and the cutting edge or point of powered excavation equipment will be maintained until the precise location of the utility is determined. Initial excavation within this 3 foot area will be conducted manually.

5.1.2 Surface Encumbrances. All surface encumbrances (trees, poles, boulders, etc.) that may create a hazard to employees shall be removed or supported.

5.1.3 Vehicular Traffic. Employees exposed to vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material. Traffic control devices (i.e., barricades, signs, cones, flagpersons, etc.) shall be specified and used in accordance with regulations applicable to the roadway or area in which excavation activities are occurring.

5.1.4 Training. Those who supervise the entry of personnel into an excavation must have completed a training course that included instruction in:

- Types of hazards associated with excavation operations;
- Safe work practices and techniques;
- A review of applicable Federal, state and local regulations; and
- A review of this procedure.

Employees who enter excavations are required to complete a site-specific training session to enable them to recognize unsafe conditions in and around the excavation. This training can be conducted during a tailgate safety meeting that emphasizes the specific excavation hazards that may be encountered.

Training documentation shall be maintained in the project file with a copy forwarded to the Knoxville Training Department.

As part of standard employee supervision process, training shall be complemented with on-the-job instruction and reinforcement of accepted practices to the extent necessary to assure compliance with this procedure and all other applicable regulations.

5.2 Excavation Work Practices

5.2.1 General. Each employee working within an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with 29 CFR 1926 Subpart P, except when the excavation is made entirely in stable rock or when the excavation is less that 5 feet deep and examination of the ground by a competent person provides no indication of a potential cave-in. A competent person shall ensure that protective systems, when required, are installed and maintained per the design specifications.

No employees shall be permitted to enter an excavation unless it is absolutely essential to do so and all requirements of this procedure are met.

5.2.2 Supervision. Work in an excavation shall at all times be supervised by a competent person. This individual will remain outside of the excavation at all times, and will be responsible for identifying any unusual developments above ground which may warn of impending earth movement.

5.2.3 Soil Classification. Based on the results of tests described in Attachment 3, the competent person will classify each soil/rock deposit as stable rock, Type A, Type B, or Type C. When layers of soil/rock exist, the weakest layer will be classified; however, each layer may be classified individually when a more stable layer lies under a less stable layer. If the properties or conditions of a soil/rock deposit change in any way, re-evaluation will be required.

5.2.4 Access and Egress. 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.

A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 or more feet in depth so as to require no more than 25 feet of lateral travel for employees.

5.2.5 Protective Systems. Protective systems shall be designed in accordance with 29 CFR 1926.652(b) or (c) and shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

5.2.6 Exposure to Falling Loads. No employees 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 spillage or falling materials. Operators may remain in the cabs of vehicles being

loaded or unloaded provided the vehicles are equipped with a cab shield and/or canopy adequate to protect the operator from shifting or falling materials.

5.2.7 Warning System for Mobil Equipment. 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, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs.

5.2.8 Hazardous Atmospheres. Where an oxygen deficient (less that 19.5% O_2) or hazardous atmosphere exists, or could reasonably be expected to exist, the excavation shall be tested before employees enter. Testing shall be conducted as often as necessary to ensure that the atmosphere remains safe. Some excavations may be considered confined spaces which require compliance with Shaw E & I Procedure HS300.

Adequate precautions shall be taken to prevent employee exposure to oxygen deficient or hazardous atmospheres. As appropriate, ventilation and/or respiratory protective devices shall be used.

5.2.9 Water Accumulation Hazards. 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. If water is controlled or prevented from accumulating by the use of water removal equipment, the process shall be monitored by a competent person to ensure proper operation.

If the excavation work interrupts the natural drainage of surface water (streams, run-off channels), 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 run-off from heavy rains shall be regularly inspected by a competent person.

5.2.10 Stability of Adjacent Structures. Structures adjoining an excavation shall be evaluated to assess their stability. Excavation below the level of the base or footing of any foundation or retaining wall that could reasonably be expected to pose a hazard to employees shall only be permitted when:

- A support system (underpinning) is provided to ensure the safety of employees and the stability of the structure;
- The excavation is in stable rock;
- A registered professional engineer has determined that the structure will be unaffected by the excavation; or
- A registered professional engineer has determined that such excavation will not pose a hazard to employees.

Sidewalks, pavements and other surface structures 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.

5.2.11 Protection from Loose Rock or Soil. Employees shall be protected from loose rock or soil which could fall or roll from the excavation face or edge. Such protection could consist of scaling to remove loose materials, or the installation of protective barriers. All spoil shall be placed at least 2 feet from the edge of the excavation. It is strongly recommended that spoil be placed 4 or more feet from the excavation edge so as not to cover surface indicators of subsidence (such as fissures or cracks).

5.2.12 Inspections. The competent person shall make daily inspections of excavations, adjacent areas, and protective systems for evidence of conditions that could result in a cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. The inspection shall be made prior to start of work, and as needed throughout the shift. Inspections shall be made after each rainstorm or other hazard-increasing event and will be documented using Attachment (2).

Where the inspection finds evidence of any hazardous condition, exposed employees shall be immediately removed from the hazardous area until necessary precautions have been taken.

5.2.13 Fall Protection. Where employees or equipment are permitted to cross over excavations, walkways or bridges shall be provided. Standard guardrails shall be provided where walkways are 6 feet or more above lower levels.

Adequate barriers or other types of physical protection shall be provided at all remotely located excavations. All wells, pits, shafts, etc., shall be barricaded or covered and shall be backfilled as soon as possible.

6.0 EXCEPTION PROVISIONS

Variances and exceptions may be requested pursuant to the provisions of procedure HS013, Health and Safety Procedure Variances.

7.0 CROSS REFERENCES

HS013 Health and Safety Procedure Variances
HS050 Training Requirements
HS051 Tailgate Safety Meetings
HS300 Confined Spaces
29 CFR 1926 Subpart P - Excavations

8.0 ATTACHMENTS

1. Responsibility Matrix
2. Excavation Inspection
3. Soil Classification Worksheet
4. Selection of Protective Systems for Excavations 20 Feet or Less in Depth
5. Sloping Options
6. Shoring or Shielding Options

ATTACHMENT 1
EXCAVATION AND TRENCHING

Responsibility Matrix

Action	Procedure Section	*Responsible Party*					
		Employee	Supervisor	Registered Professional Engineer	VP Health and Safety	Local H&S Representative	Competent Person
Incorporate state, local, or client-specific excavation requirements into project plans.	1.0					X	
Issue, revise, and maintain procedure	3.1				X		
Coordinate identification of underground utilities.	5.1.1		X				
Determine need for traffic control devices.	5.1.3		X				
Participate in excavation training.	5.1.4	X	X			X	X
Ensure that protective systems are installed and maintained.	5.2.1						X
Classify Soil Type	5.2.3						X
Design Structural Ramps	5.2.4						X
Selection and design of protective system(s)	5.2.5			X			
Determine stability of adjacent structures.	5.2.10			X			
Inspecting excavation for hazardous conditions	5.2.12	X	X				X

ATTACHMENT 2
EXCAVATION INSPECTION

THIS INSPECTION IS TO BE COMPLETED BY THE COMPETENT PERSON EACH DAY THAT EMPLOYEES WILL BE ENTERING AN EXCAVATION.

Project Name: _____ Project No.: _____

Date: _____ Time: _____ Competent Person: _____

Soil Classification (see Soil Classification Worksheet): _____

Excavation Depth: _____ Excavation Width: _____

Type of Protective System Used: _____

	☒ YES	NO	N/A
1 GENERAL:			
Surface encumbrances removed or supported			
Employees protected from loose rock or soil that could pose a hazard by falling or rolling into the			
Hard hats, steel-toed boots, and safety glasses worn by all employees.			
Spoils, materials, and equipment set back at least 2 feet from the edge of the excavation.			
Walkways over excavations 6 feet or more above lower levels are equipped with standard guardrails.			
Warning vest or other highly visible clothing provided and worn by all employees exposed to public			
Employees required to stand away from vehicles being loaded or unloaded.			
Warning system established and utilized when mobile equipment is operating near excavation edge.			
Employees prohibited from going under suspended loads.			
2 UTILITIES:			
Utility companies contacted and/or utility locations delineated.			
Underground installations protected, supported, or removed while excavation is open.			
3. MEANS OF ACCESS AND EGRESS:			
Lateral travel to means of egress no greater that 25 feet in trench excavations 4 feet or more in depth.			
Ladders used in excavations secured and extended 3 feet above the edge of the trench.			
Structural ramps used by employees designed by a competent person.			
Structural ramps used for equipment designed by a registered professional engineer.			
4. WET CONDITIONS:			
Precautions taken to protect from the accumulation of water.			

Water removal equipment monitored by a competent person.			
Surface water or runoff diverted or controlled to prevent accumulation in the excavation.			
Inspections made after every rainstorm or other hazard-increasing occurrence.			
5. HAZARDOUS ATMOSPHERE:			
Atmosphere within the excavation tested where there is a reasonable possibility of an oxygen deficient, combustible, or otherwise hazardous atmosphere.			
Adequate precautions taken to protect employee from exposure to a hazardous atmosphere.			
Testing conducted to ensure that the atmosphere remains safe.			
Emergency equipment, such as breathing apparatus, safety harness and line, and basket stretcher readily available where hazardous atmosphere does exist.			
6. SUPPORT SYSTEMS:			
Materials and/or equipment for support systems selected based on soil analysis, trench depth, and expected loads.			
Materials and equipment used for protective systems inspected and in good condition.			
Damaged materials and equipment used for protective systems inspected by a Registered Professional Engineer after repairs and before being placed back into service.			
Protective systems installed without exposing employees to the hazards of cave-ins, collapses, or from being struck by materials or equipment.			
Members of support systems securely fastened to prevent failure.			
Support systems provided to insure stability of adjacent structures, buildings, roadways, sidewalks, walls, etc.			
Excavations below the level of the base or footings approved by a registered professional engineer.			
Removal of support systems progresses from the bottom, and members are released slowly as to note any indication of possible failure.			
Excavation of material to a level of greater that 2 feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth.			
Shield system placed to prevent lateral movement.			
Employees are prohibited from remaining in shield system during vertical movement.			

7. REMARKS:

_____

_____

ATTACHMENT 3
SOILS CLASSIFICATION WORKSHEET

The following worksheet outlines the visual and manual tests that the competent person must perform at least once, and each time soil conditions change. At least one visual and one manual test must be performed; however, performing several tests is recommended so that the condition of the excavation is thoroughly examined.

Project Name:_____ Project Number: _____

Date: _____ Time: _____

Where was the sample taken from? _____

I.	**VISUAL TESTS:** *One or more visual tests are required for each classification and each time conditions change.*		
1.	Estimate range of particle sizes:	a. primarily fine-grained = cohesive material b. primarily coarse-grained = granular material	
2.	Observe excavated soil:	a. clumps = cohesive material b. breaks up easily = granular material	
3.	Observe sides and adjacent surface area of opened excavation:	a. crack like openings = fissured material b. soil spalls off vertical sides = possible fissured material	
4.	Previous excavation activities:	a. previously disturbed soil	b. not previously disturbed soil
5.	Observe opened side of excavation:	a. layered systems c. estimate degree of slope of layers:	b. layers sloped towards excavation _____
6.	Water condition:	a. evidence of surface water c. depth of water table :	b. water seeping from sides _____
7.	Vibration present:	a. area adjacent to excavation	b. area within excavation

II.	**MANUAL TESTS-** *One or more manual tests are required for classification and each time soil conditions change.*	
1.	Plastically- soil is cohesive if following is true:	a. mold soil samples into a small ball b. roll ball into thread ⅛" diameter c. pick up 2" length of ⅛" thread by one end without breaking
2.	Dry Soil Strength:	a. crumbles on its own or with moderate pressure = granular b. falls into clumps which break into smaller clumps that are only broken with difficulty = clay with gravel, sand, or silt. c. breaks into clumps which do not break into smaller clumps and can only be broken with difficulty with no visual indication of fissures = unfissured.
3.	Thumb penetration test: *(These tests are to be run on a large clump of material as soon as it is excavated.)*	a. can be easily indented by the thumb but penetrated by thumb only with great effortType A b. easily penetrated several inches by thumb and molded by light finger pressure = Type C
4.	Unconfined Compressive Strength: (*Saturated Soil Needed)*	a. Pocket Penetrometer reading (take 10 readings and average) 0 - 0.5 = Type C, 0.5 - 1.5 = Type B, 1.5 - 2.0 = Type A b. Shear Vane reading X2: 0 - 0.5 = Type C, 0.5 - 1.5 = Type B,1.5 - 2.0 = Type A
5.	Drying Test: *(A dry soil sample 1" thick X 6' diameter is needed)*	a. develops cracks = fissured material b. dries without cracks and breaks by hand with considerable force significant cohesive content = unfissured cohesive material. c. sample breaks easily by hand = fissured cohesive or granular material d. easily pulverize dry clumps by hand or by stepping on them = granular e. don't pulverize easily = fissured cohesive.

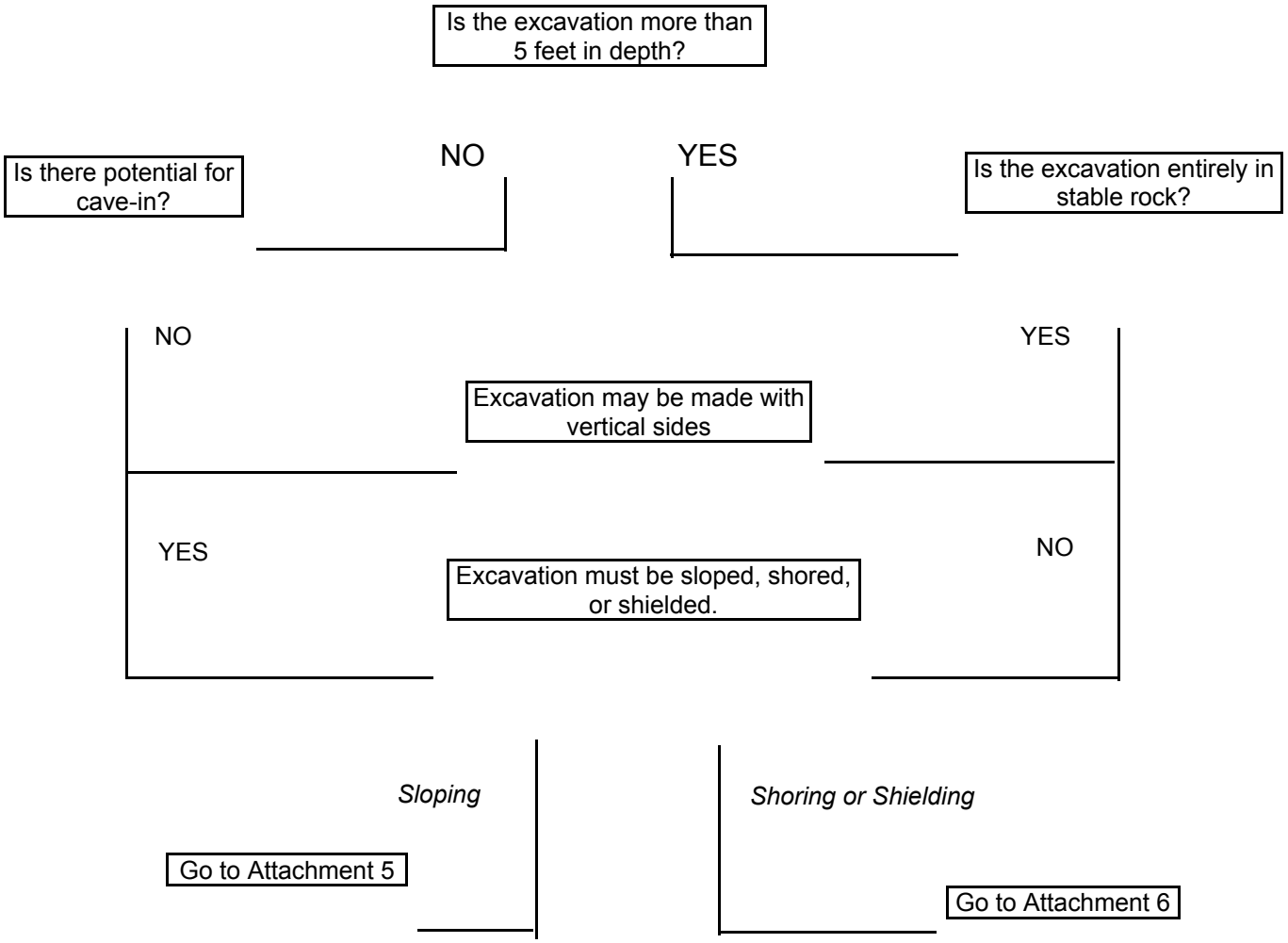
SOIL CLASSIFICATION: Type A Type B Type C Stable Rock Other _____

COMPETENT PERSON: _____ _____ _____

Print Name Signature Date

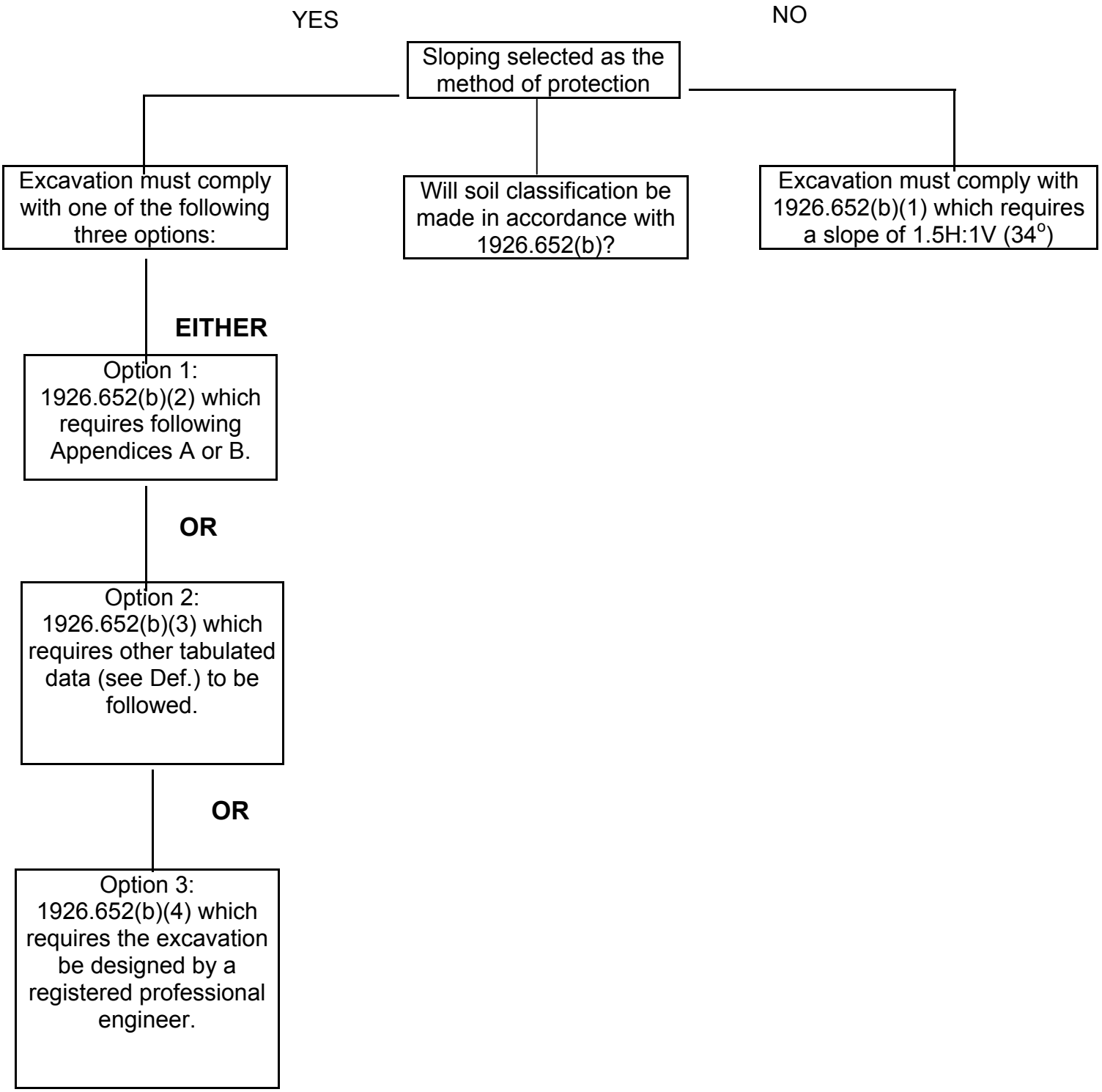
ATTACHMENT 4

SELECTION OF PROTECTIVE SYSTEMS FOR EXCAVATIONS 20 FEET OR LESS IN DEPTH



For excavations greater than 20 feet in depth, design by a registered professional engineer in compliance with 1926.652 (b) and (c) is required.

ATTACHMENT 5
SLOPING OPTIONS



ATTACHMENT 6
SHORING OR SHIELDING OPTIONS

Shoring or shielding selected as the method of protection.

Soil Classification is required. The excavation must comply with one of the four options below.

EITHER

Option 1:
1926.652(c)(1) which requires Appendices A and C to be followed (Timber Shoring).

OR

Option 2:
1926.652(c)(2) which requires manufacturer's data to be followed (trench jacks, etc.).

OR

Option 3:
1926.652(c)(3) which requires tabulated data (see Def.) to be followed.

OR

Option 4:
1926.652(c)(4) which requires the excavation be designed by a registered professional engineer.

PROCEDURE

Subject: UNDERGROUND/OVERHEAD UTILITY CONTACT PREVENTION

1.0 PURPOSE AND SUMMARY

This procedure prescribes the steps to be followed in order to prevent accidents involving the contact with or damage of underground/overhead utilities. The company provides the operational and training practices required to safely execute work where underground/overhead utility hazards may exist.

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure. Also, see Attachment 1 for matrix of responsibilities.

3.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1.

4.0 DEFINITIONS

Company
All wholly-owned subsidiaries of Shaw Environmental & Infrastructure, Inc. (Shaw E & I).

Competent Person – Drilling Oversight (CPDO) Training
When drilling activity is to take place the Shaw's Field Team Leader (FTL) must have successfully completed Shaw's in-house training pertinent to competent person drilling oversight (CPDO Training). The FTL is required not only to have successfully completed CPDO training but to have an appropriate educational background, coupled with field experience and, the authority to make changes to correct deficiencies, or to stop the job if need be.
NOTE: The CPDO training requirement will become effective September 1st 2006. This means that every FTL will have successfully completed CPDO Training prior to August 31, 2006.

Competent Person - Excavation and Trenching
A person who is capable of identifying existing and predictable hazards in the excavation/trenching work area and who has the authority to take prompt corrective measures to eliminate them. NOTE: Excavation/Trenching training is required when trenching/excavation hazards are present/anticipated (i.e. spoil piles, use of three foot (3') or larger diameter augers, or other circumstances) but only recommended when trenching/excavation hazards are not present/anticipated.

Excavation
Any manmade cut, cavity, trench or depression in an earth surface formed by earth removal.

Underground Utility
Any active or inactive subsurface or buried structure that is or was designed to service a public or private facility. These may include, but are not limited, to the following:

- Electric power lines
- Natural gas lines
- Telephone lines
- Telephone cables and fiber optic lines
- Water lines
- Steam and pneumatic lines
- Sewer lines
- Drain lines
- Underground storage tanks
- Septic tanks
- Process or product lines

Overhead Utility
Any active or inactive overhead structure that is or was designed to service a public or private facility. These may include, but are not limited, to the following:

- Overhead power lines
- Overhead telephone lines
- Overhead fiber optic lines
- Overhead cables
- Overhead supports
- Overhead piping
- Traffic lights
- Utility Bridges

One Call Center
Each state has a One Call, Dig Safe, Miss Dig, etc. dial-in number for requesting mark-out of buried public utilities, such as gas lines, electrical lines, telephone/cable lines, sewer lines, and water lines. This number is typically called a minimum of 72 hours prior to subsurface activities depending on the particular state the work will be conducted. The One Call Center will notify the local public utilities for a line location mark-out for the particular location. The individual public utilities must locate and mark-out the utilities upon request. In most cases, the markouts will not be performed on private property. A confirmation number is established and confirmation report generated and submitted to the requester.

As-Built Drawings
As-built drawings are blueprints that are usually obtained from the facility owner or client. They show original buried utilities and any modifications which have been made.

Private Utility Locating Service
A private utility locating service is a firm established to locate underground utilities using specialized locating equipment, such as ground penetrating radar location devices or radio transmitter type utility locating equipment.

Fiber Optic Service Lines
Fiber optic service lines are communication lines that are buried underground. When damaged, these lines are very expensive to replace. Fiber optic companies routinely provide on-site supervision, if requested. The company encourages this practice.

Field Team Leader (FTL)
The FTL is the person with whom the responsibility of the execution of the field work resides. This person may be the project manager, senior geologist, staff geologist, etc. This individual must have the sufficient experience, training and, field knowledge to ensure all site configuration information is collected and analyzed.

Site Survey
A site survey is an inspection of the work site to look for signs of other buried utilities that may not be indicated through as-built drawings or through utility locating services. The survey typically involves inspection of overhead electrical services, inspection of basements, utility rooms, garages, etc., for signs of old electrical conduits or fuel/water/septic lines. The FTL must contact the appropriate site representative to provide any additional information that may be marked on the as-builts.

5.0 TEXT

Underground/overhead utilities may be encountered at any job site. The guidelines established in this procedure were developed to help identify and mitigate the potential hazards associated with this type of work.

Any subsurface activity is subject to the underground utility locating regulations for the state where the work will be conducted. This procedure authorizes the use of state, local or other required practices, but requires that the practice which most limits the liability to Shaw for damaged utilities is utilized. No variance is required under these circumstances, but the project-specific Health and Safety Plan (HASP) or work plan shall fully document these more protective procedures.
.

5.1 Preliminary Requirements

The Project Manager or designee must visit the site to mark the boring/excavation locations so they can be clearly identified and then contact the One Call Center for the state in which the work is to be performed in to formally request a utility mark out at the particular work location(s).

Prior to assignment of work the Field Team Leader (FTL) will assure that all affected employees receive an overview of the hazards of encountering underground/overhead utilities. The FTL is responsible to review this procedure, the work practices to control these hazards, and the roles and responsibilities of each worker with the work crew. This procedure and other requirements that may be contained in the site specific HASP shall be reinforced during daily tailgate safety meetings.

5.2 Operating Requirements

5.2.1 Underground Utilities Requirements

Prior to conducting any project site activities, the FTL must ensure that all existing underground/overhead utilities in the work area are located per the state or local mark-out protocols. Documentation of utility mark-out must be completed using the Utility Mark-out Documentation form (Attachment 3). No boring/excavation work is to be performed until all utility mark-outs are verified.

While on-site, the FTL must conduct a site survey to search for signs of other buried or overhead utilities. This will include areas such as garages, basements, etc. The results of such surveys must be documented on the Utility Markout Documentation form (Attachment 3). The property owner, client, or facility operator must be consulted on the issue of underground utilities. All knowledge of past and present utilities must be evaluated prior to conducting work..

After all mark outs have been completed, and the boring locations have been accepted by the FTL prior to drilling, each borehole location must be hand dug to a minimum of five feet bgs.

If the investigation requires boreholes in an area not covered by a municipal one call system (on private property), then the FTL must utilize appropriate geophysical techniques, hand held utility locating devices, a private utility locating firm, or other approved method to determine the locations of underground utilities. The current accepted geophysical methods for the investigation and location of buried utilities include: Ground Penetrating Radar (GPR), Time Domain and/or Frequency Domain Electromagnetic methods, Magnetometer, and Inductive/Conductive Radio-Magnetic methods. The geophysical methods can be very useful for locating buried utility lines in areas where hand digging is not possible or practical. However, it must be noted that these methods do have limitations that are a function of soil conditions, depth of investigation, imaging resolution, or other factors.

If it is determined that a non-invasive geophysical investigation may be needed, assistance with selecting the appropriate method(s) can be obtained from the Shaw E & I Science and Technology Division, Geophysics & Mapping Group, and a variance request must be submitted and approved prior to the inception of intrusive field activity.

Should the local geology be prone to refusal or should there be any other reason the boring location cannot be cleared to a minimum of 5’ bgs then the appropriate aforementioned alternative methods should be utilized to ensure the boring location is clear of utilities 5’ bgs, and a variance request must be submitted for review.

5.2.2 Overhead Utilities Requirements

Overhead utility locations must be marked (warning tape, flags, etc.) where heavy equipment, or other equipment, has the potential for contacting overhead utilities. Conduct a site inspection on a daily basis to determine where activities will take place and the location of overhead utilities and overhead obstructions. Once they have been identified, place warning tape on poles and/or guy wires and attempt to plan the work so that no contact will be made with the overhead utilities or obstructions. Share the information with all site personnel during the tailgate safety meeting.

Maintain at least 10 feet from overhead power lines, up to 50 kV. For voltages over 50 kV, add 0.4 inches per kV to obtain the safe distance between equipment and power lines. If voltage is unknown, remain at least 20 feet from overhead power lines.

As a precaution, a spotter must be used at all times when it is possible to violate the minimum distance requirements for overhead utilities. If contact is deemed unavoidable, consult with the client and the respective health and safety representative to evaluate the area to determine if the particular overhead utility can be removed prior to engaging in the activity.

5.2.3 Other Requirements

Only hand digging is permitted within 3 feet of underground high voltage, product or gas lines. Once the line is exposed heavy equipment can be used but must remain at least 3 feet from the exposed line.

Only experienced, demonstrably proficient equipment operators will be used to operate such heavy equipment as drill rigs, backhoes, front-end loaders, cranes, etc.

Due the sensitivity and costs associated with damage to fiber optic cables the FTL must have documented verbal contact and an agreement with the fiber optic company for all work within 50' of the fiber optic cables. Subsurface investigations near fiber optic cables are more fully discussed in site specific HASP's. Contact your division Health and Safety Professional for specific information on this subject.

5.3 Training Requirements

Competent Person Drilling Oversight (CPDO) Training

The FTL (at least one onsite Shaw person will be performing the drilling oversight) will be required to have successfully completed the approved internal Competent Person Drilling Oversight (CPDO) training.

Prior to assignment of work the Field Team Leader (FTL) will assure that all affected employees receive an overview of the hazards of encountering underground/overhead utilities. The FTL is responsible to review this procedure, the work practices to control these hazards, and the roles and responsibilities of each worker with the work crew. This procedure and other requirements that may be contained in the site specific HASP shall be reinforced during daily tailgate safety meetings.

Trenching/Excavation Training

The Field Team Leader or at least one onsite Shaw employee will be required to have successfully completed Trenching/Excavation training prior to the inception of site work activity when trenching excavation hazards (i.e. spoil piles, use of 3' diameter augers, or anytime similar hazards are present) are present/anticipated. NOTE: This training is now recommended rather than required when trenching/excavation hazards are NOT anticipated/required

5.4 Incident Reporting Requirements

Employees are required to immediately report to their direct supervisor any overhead or underground utility contact incident, or near miss incidents. Any supervisor (but preferably the supervisor directly responsible for the involved employees) with first-hand knowledge of an incident is required to investigate the incident. The Project Manager and respective Health and Safety Manager or Representative shall be informed of the incident immediately.

At a minimum, the incident investigation will require completion of the incident investigation report and General Liability Property Damage and Loss Report form found in H&S Procedure HS020.

In addition, Attachment 5 provides a "Tip Sheet" to help properly assess and investigate the incident causes and recommendations or requirements.

5.5 Local Jurisdiction Requirements

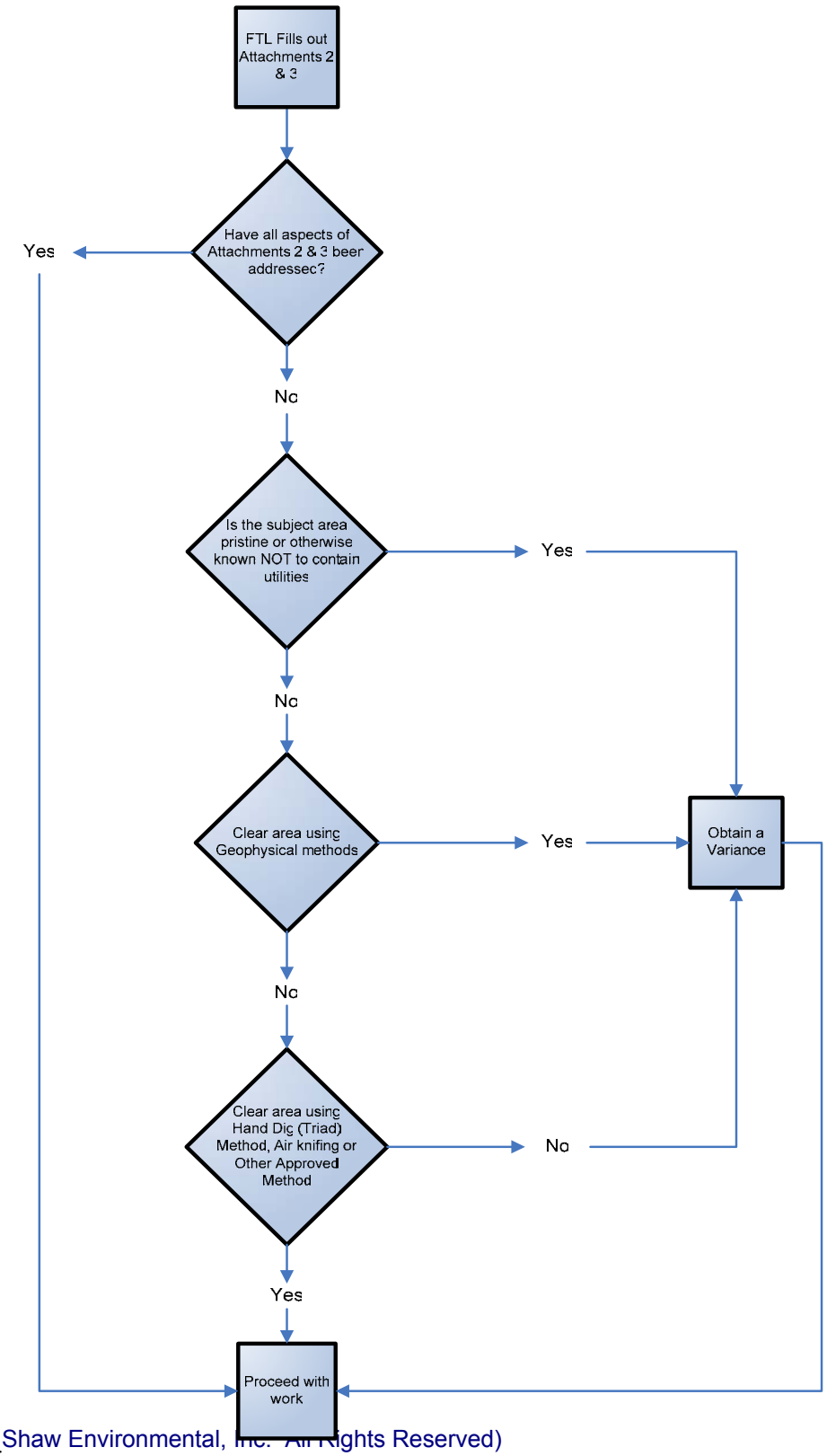
Where local jurisdictions or clients have established requirements different from those in this procedure, the practice which most limits the liability to Shaw for damaged utilities shall be utilized. No variance is required under these circumstances but the project-specific Health and Safety Plan or work plan shall fully document the alternate procedures.

6.0 EXCEPTION PROVISIONS

Anytime a minimum of a 5' clearance cannot be obtained by either hand digging or by using geophysical means, the FTL must obtain a variance from the Regional VP (or equivalent level such as Operations Director for Federal Business Line) or designee to proceed with drilling operations in that area. This would include an initial verbal variance documented in the field log followed up by a written (email) approval from either the Regional VP (or equivalent level or title) or designee. The record of communication will be noted in the field log for the project and, a record of the approval or denial will be placed in the project file.

A variance form can be obtained in HS 013. A flowchart to assist one in determining how and when a variance should be obtained can be found immediately following this section.

HS 308 Flow Chart



7.0 CROSS REFERENCES

HS013 Health and Safety Procedure Variances
HS020 Accident Prevention Program: Reporting, Investigation, and Review
HS050 Training Requirements
HS307 Excavation and Trenching

8.0 ATTACHMENTS

1. Responsibility Matrix
2. Pre Drilling Checklist
3. Utility Markout Documentation
4. Underground Utility Hits – Tip Sheet for Incident Investigations
5. Frequently Asked Questions

ATTACHMENT 1 - UNDERGROUND/OVERHEAD UTILITY CONTACT PREVENTION
Responsibility Matrix

Action	Procedure Section	Vice President	Project Manager	Field Team Leader	HS Representative
Project-specific HASP or Work Plan shall document the practices to be used at a particular site.	1.0		X	X	X
Contact the One Call Center for mark out of utilities at the site	5.1		X		
Complete Utility Markout Documentation Form	5.2		X	X	
As-built drawings shall be reviewed	5.2			X	
Only experienced demonstrably proficient equipment operators will be used to operate such heavy equipment as backhoes, front-end loaders, cranes, etc.	5.3			X	
Provide training*	5.3				
Incident Investigation and Reporting	5.4		X	X	X
Exceptions to Procedure	6.0	X	X	X	X

*Provided by Shaw's Training Department

ATTACHMENT 2 - PRE - DRILLING/BORING/GEOPROBE Checklist

Purpose: This form is designed to help the FTL make decisions drilling/boreholing/geoprobing around underground/overhead utilities.

DATE_____ PROJECT NAME/NUMBER_____
Field Team Leader Name: _____
DURATION/SUMMARY OF WORK TO BE PERFORMED: _____
_____

Consideration	Check	Check	Explanation	Initial
Has the state one-call been contacted?	□ Yes	□ No		
Are any as-built drawings available? If so, do they show any utilities?	□ Yes	□ No		
Has a visual inspection of the work area(s) been completed?	□ Yes	□ No		
If one-call not available has a private locating service or Shaw S&T group been contacted?	□ Yes	□ No		
Were any utilities identified through private locating service? If so, indicate on site drawings.	□ Yes	□ No		
Are there any fiber optic cables within 50 feet of hole locations?	□ Yes	□ No		
If fiber optic cables are within 50 feet has an agreement with the fiber optic company been established?	□ Yes	□ No		
Can a test borehole be advanced by hand digging, probing, post hole digging, and/or air knifed to 5 feet bgs?	□ Yes	□ No		
If hand digging, probing, post hole digging, and or air knifing to 5 feet bgs is not possible, can a non-invasive geophysical investigation be conducted? If not, why?	□ Yes	□ No		
Are you comfortable with approving this authorization?	□ Yes	□ No		
Other considerations:				

ATTACHMENT 3 - UTILITY MARK-OUT DOCUMENTATION

Project Name:_____ Location:_____
FTL Name: _____ Date:_____
Utility Called:_____ Confirmation #:_____
Subcontractor:_____ Task/Activity:_____
County of work:_____ Municipality of work:_____

Before work is done on any site, contact the appropriate local utility locating service (One Call, Miss Dig, Uloco, etc.) or a local utility contractor to have sub grade utilities marked. NOTE: Boring locations to be placed not in the public right of way are typically not marked out by the public utility mark out, and a private utility locate service must be engaged. Indicate to the utility locator the nearest intersecting street for the site: _____ Confirmation No:_____.

List utility firms (public and private) and the utility they will mark.

Utility Marker Emergency Telephone Numbers Major Utilities Marked by Color Code			
Name of Utility Company	**Utility**	**Color Code**	**Emergency Telephone Number**
	Water	Blue	
	Gas	Yellow	
	Electric	Red	
	Telephone/ Cable/ Communication	Orange	
	Sewer	Green	
"ALL UNDERGROUND UTILITIES MAY NOT BE LOCATED BY THE LOCAL UTILITY SERVICE". Accordingly, you must list other known utilities in the area that the "One Call" service will not contact:			

Attach photos of the area prior to placing boreholes.
Take photos of the area indicating minimum 5' hand dig, post hole dig, probe, GPR or other:
NOTE: For any borehole, should 5' minimum clearance not be obtained, you must contact Business Line VP or equivalent (Operations Director or other on the Federal Business Line) and obtain a variance.

Completed by:_____ _____ _____
Name Signature Date

ATTACHMENT 3 – UNDERGROUND UTILITY HITS
TIP SHEET FOR INCIDENT INVESTIGATIONS

1. Location of the incident.
2. The time of day the incident occurred.
3. What type of utility was hit?
4. How deep was the line hit (in feet)?
5. Who called Designated Locator Service?
6. Note the "One Call" number on the Incident Investigation Follow-up report.
7. Attach the "One Call" record keeping documentation.
8. Were mark-outs completed by the utilities? If so, please identify.
9. Were mark-outs legible at the site?
10. Was the mark-out of the line that was hit accurate?
11. Was the mark-out misinterpreted?
12. Is there a utility damage sheet attached to the Incident Investigation Follow-up Report?
13. Have there been any faults or oversights by any 3rd party? If so, is it documented on the Incident Investigation Follow-up Report?
14. Did the FTL interview the property owner/manager prior to the incident?
15. Was pre-screened by hand digging 5 feet?
16. Were any supplemental utility locator devices used? If so, did we obtain them? If so, were they used on site?
17. Were there blueprints/as built plans available? If so, did we obtain them? If so, were they used on site?
18. Who is paying for the repairs?
19. Please define the total hours and cost estimate/impact to address the utility damage incident:

    _____ Site time in hours (not billed to the job)
    _____ PM time hours (not billed to the job)
    _____ H&S time in hours (not billed to the job)
    _____ BLM Time in hours (not billed to the job)
    _____ Rework/non-billable time (estimate)
    _____ Subcontractor rework/non-billable costs (estimate)
    _____ Repair costs to company (estimate)
    _____ Repair cost to customer (estimate)

20. Has the FTL completed Shaw's in-house CPDO training?
21. Has the FTL completed trenching/excavation training?
22. Is he/she current with the OSHA 40 hour and 8 hour refresher? If so, what are the dates of the training?
23. Who was the Site Safety Officer on the job site?
24. Does he/she have OSHA 8 hour supervisor training? If so, what are the dates of the training?
25. What was the name of the drilling subcontractor that was on site?
26. Have we researched the training background for this vendor?
27. Was a JSA performed at least once during the day that covered utility contacts and associated hazards?
28. Does this vendor have approved status?
29. Was there a tailgate safety meeting that took place?
30. Were utility mark-outs addressed at the tailgate safety meeting?
31. Were there any markings nearby the "hit" area?

ATTACHMENT 5 – Frequently Asked Questions (FAQs)

During the roll-out of this revision of HS 308 a variety of questions/comments/concerns arose. These concerns have been put in the form of most frequently asked questions (FAQs) and their respective responses. These FAQs will clear up misunderstanding pertaining to this procedure, and provide valuable information that will help our workforce have a better understanding of how this procedure should be implemented. Please review the FAQs below:

1. *No other competitor of Shaw has felt the need to do anything as extreme as this procedure to ensure minimization of utility hits. Instituting this procedure will put us out of business.*

Response: After thorough review of claims and incidents involving drilling activities and underground utilities, the committee believes that our business/client needs are best served by adopting this policy. And that the likelihood of being put out of business is much greater from continuing to do business the way we currently do it than by adopting this improved policy. The committee realized that 100% adherence to this procedure at all work sites is likely not possible. For those cases where legitimate reasons exist for non-compliance, the committee realized that an effective responsive (variance) system must be in place. The committee believes that the variance procedure, as stated in the policy, should address the exceptions as they occur.

The Committee is not aware of any specific ASTM or true "industry standard". However, the committee is aware that best practices can vary tremendously and many times are client dependent. For example one extremely large Shaw client requires that we continuously probe. On the other end of the spectrum some clients look completely to Shaw for guidance in these matters.

2. *Our clients want us to do the work but do not wish to pay the additional fees involved with this new procedure. Could we offer them a two tiered pricing, one to do it the old way, and one to do it the new way?*

Response: The committee believes that contacting an underground utility of any type, no matter who is at fault or who ultimately pays for fixing, the outcome is a "black eye" for all involved. When these events occur, even if Shaw is not at fault, the committee believes that continued good client relations, and the potential for obtaining future business lessens as utility hits/incidents occur. This procedure is designed to minimize health and safety risks to our workers AND to mitigate liability to Shaw. Receiving the necessary compensation for the precautionary measures outlined in the procedure would be expected, and should be itemized in the initial proposal including a statement as to what will specifically be done in the field to mitigate risks relative to underground utilities and WHY Shaw believes these steps are necessary. However, if the client is willing to assume the entire liability resulting from "hitting" an underground utility, the contract should be written to reflect this

and a variance would be in order. Keep in mind that Shaw cannot allow a client's desires to take on liability to affect the health and safety of workers. No matter what the client desires might be, Shaw would still expect the basic procedures to be followed for health and safety purposes. The training though yet to be finalized will provide project manager's examples of wording to be used in proposals and contracts.

3. Hand digging to 5' is impossible during frost conditions in Minnesota, Wisconsin and many northern areas. How should this be addressed?

Response: When conditions present themselves that do not allow for hand digging each borehole, other methods must be used for clearance and a variance must be obtained. The alternative methods include a range of non-invasive geophysical survey techniques designed specifically for locating buried utilities, pipelines, tank (UST), and other buried objects that can interfere with drilling. These non-invasive geophysical methods are suggested and mentioned in the procedure.

4. What if the field crew runs into refusal during hand dig clearance?

Response: If refusal occurs and moving to an alternate spot presents the same problem, hand digging may not be possible as mentioned in #2 above. When conditions present themselves that do not allow for hand digging each borehole, other methods must be used for clearance and/or a variance must be obtained. Of course, we expect that the dig safe folks to be contacted, and that a private locating service be utilized if available. Should a private locating service not be available, we can use trained internal sources.
The alternative methods include a range of non-invasive geophysical survey techniques designed specifically for locating buried utilities, pipelines, tank (UST), and other buried objects that can interfere with drilling. The current accepted geophysical methods for the investigation and location of buried utilities include: Ground Penetrating Radar (GPR), Time Domain and/or Frequency Domain Electromagnetic methods, Magnetometer, and Inductive/Conductive Radio-Magnetic methods. These non-invasive geophysical methods are suggested and discussed in the procedures. The geophysical methods can be very useful for locating buried utility lines in areas where drilling and digging are not possible or practical, but these methods do have some limitations that are a function of soil conditions, depth of investigation, and imaging resolution.
If it is determined that a non-invasive geophysical investigation may be needed, assistance with selecting the appropriate method(s) can be obtained from the Shaw E & I Science and Technology Division, Geophysics & Mapping Group. Of course, it is expected that the "dig safe" folks will be contacted, and that a private utility locating service be utilized when appropriate (utility location method is known to be feasible), and if available. Should a private locating service not be available, we can use trained internal Shaw E & I personnel resources to perform utility line location work. Finally, if the Project Manager has determined that a variance to the procedure is justified, a variance request should be submitted for review.

5. Why is trenching/excavation training required for putting in Geoprobe® boreholes? This seems like tremendous overkill.

Response: The committee believes that, in general, trenching/excavation training is a good educational tool that promotes overall health and safety awareness and provides important information/techniques for our field staff. Trenching/excavation training provides insights into fall hazards, spoil pile placement, and many other related safety issues. Many of our drilling jobs have involved oversized auger bits (3' in diameter) where a large deep borehole is created. The committee agrees that when the diameter of the borehole lessens (i.e. use of a Geoprobe®), the impact of trenching/excavation training decreases. Trenching excavation training is now a requirement only when large boreholes are created or other hazards as mentioned above are present, but only recommended training when Geoprobe ® or similar equipment is being used and the result is trenching excavation type hazards do NOT exist. NOTE: Specific training pertinent to drilling/ Geoprobing ®/boring (CPDO training) will be provided and will be mandatory. Additionally, CPDO and trenching / excavation training are both required on projects where 3' or larger diameter boreholes are to be drilled.

6. Are there any training requirements besides trenching/excavation training?

Response: The committee evaluated a need for training specific to the HS 308 policy (drilling) and solicited the assistance of the training department and certain operations employees to develop CPDO training. This CPDO training includes basic steps needed to be taken from call the dig-safe number, private utility searches, geo-physical capabilities, probing, hand augering, air knifing, water pumping/knifing, hand digging and others.

7. Hand diggings creates heat stress, tripping hazards, back injuries, and other hazards and is unnecessary.

Response: The committee did not envision using a spade and a strong back to dig various 5' holes at the field site. The committee does envision using an air knife, water knife, probe, or other method rather than a hand shovel. The committee understands that not all methods may be acceptable in all states, municipalities or to all clients. The committee was also aware that when all else fails one could consider using a l" diameter stainless steel auger placing 5' bgs hand borings in a triangular pattern where the auger bit could be placed in between these small hand borings. The committee envisions this theme and methodology to be expanded within the upcoming training. Additional information on augering techniques will be provided in the specific training (CPDO) mentioned above.

8. I need to put borings in pristine farmland next door to a contamination zone. There are no and have never been any utilities in this area. What should I do?

Response: Once you go through the proper utility locate procedure and are confident that no utilities

exist in the subject area, you need to obtain a variance. This would also hold true for pristine forest preserves, wildlife refuges, or other areas not affected by utilities.

9. Who needs to sign off on a variance?

Response: Variances are signed by the Area Vice President (or designee, which may be delegated to the BLM for each office) along with the Project/Program Manager/Director. When we know in advance that HS308 cannot be adhered to, one should make plans to get a formal variance approval and appropriate paperwork developed two weeks prior to field activity. Variances can also be obtained when field conditions arise that make adherence to HS308 impossible. The variance can be obtained via cell phone in the field with the PM and appropriate management with the outcome noted in the field logbook followed up by an appropriate e-mail. This e-mail should be kept in the project file as proof of variance approval. It is recommended that variances be obtained as soon as it is known that they will be required.

10. What constitutes a "probe"? I assume a Geoprobe® is not valid?

Response: A Geoprobe® is NOT a valid probe in that Geoprobes® have caused damage to sewer lines and other utilities. Probes are typically made of a fiberglass-like material that have a pointed end but will not damage subsurface utilities and allows for the field staff to sense if underground items are encountered.

11. Under 5.1, is a subcontractor a designee?

Response: Although a subcontractor can make arrangements to contact dig safe and more, Shaw must ensure that the sub has, in fact, done what they had agreed to do. It should be remembered that typically on drilling projects, from many of our customer's perspective, the liability remains with Shaw, and they will look to Shaw, not our subs, for resolution of any events that occur. Hence, it is incumbent on Shaw to insure that our procedures are followed by Shaw and Shaw subs.

12. Does ground surface include concrete, asphalt or other man-made coverings?

Response: A simple NO. Some of our projects include drilling through airport runways or tarmacs which can be up to 15" in depth. Manmade surfaces do NOT count in the 5' hand dig clearance specification. If we are attempting to advance boreholes below existing concrete surfaces, the geology below the concrete will be exposed by cutting the concrete and removal of the concrete. After the concrete is removed and the geology is exposed, a hand auger can then be used. Hopefully, the twelve concerns above and the responses to these comments will have helped users understand the implementation of this HS 308 policy. More importantly the committee realizes that information on this subject will be provided during the training mentioned above. It is the committee's belief that once this program has been completely rolled out the need for variances will be minimal and the interactions of the safety department with operations management with this entire process will make ensure success.

PROCEDURE

Subject: CONTROL OF HAZARDOUS ENERGY AND HAZARDOUS MATERIAL SOURCES (LOCKOUT/TAGOUT)

1.0 PURPOSE AND SUMMARY

This procedure establishes the minimum requirements for the lockout and tagout of energy and hazardous material sources and must be used to:

- Ensure that all machinery, equipment, or confined spaces are isolated from all potential hazard sources (mechanical, electric, chemical hazards, etc.) and are locked out and tagged out prior to employees performing any servicing, maintenance, or entry activities.
- Ensure that field projects where hazardous energy/material sources are present develop a site-specific Lockout/Tagout procedure.
- Ensure that equipment can accommodate locks. Additional means such as a tagout program may be used to ensure safety when locks are not used.
- Establish procedures for release of the Lockout/Tagout that include machine inspections, notification and safe positioning of workers, and removal of the Lock/Tag.
- Ensure the use of standardized locks and tags that identify the worker using them, making sure that locks and tags are of sufficient quality and durability to ensure their effectiveness.
- Provide the necessary employee training.

For a basic overview of the Lockout/Tagout System refer to the "Flow Diagram - Overview: Lockout/Tagout System" (Attachment 2).

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedures Responsibility

The Corporate Director of Health & Safety is responsible for the issuance, revision and maintenance of this procedure.

3.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1.

4.0 DEFINITIONS

Affected Employee - An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout and tagout, or whose job requires the employee to work in an area in which isolation of hazards is necessary to provide a safe workplace.

Authorized Employee - A person who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance.

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 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.

Capable of Being Locked Out - An energy/hazard isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy/hazard isolating device or permanently alter its energy control capability.

Double Valve and Vent - A valve arrangement in a piping system in which three valves are arranged in conjunction with a vent line. One valve is upstream of the vent, another downstream, and one is on the vent itself. To isolate the downstream system, the vent valve is opened, the other two are closed, and all three valves are locked in this position.

Energized - Connected to an energy source or containing residual or stored energy.

Energy Isolating Device - A mechanical device that physically prevents the transmission or release or energy, including but not limited to the following: A manually operated electrical circuit breaker, a disconnect switch, a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.

Energy Source - Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

Group Lock Box - A device capable of holding and securing the key or other release mechanism for a group lock, which can accomodate the individual locks from all members of the work crew.

Hot Tap - A procedure used in repair, maintenance, and service activities which involves welding on a piece of equipment (pipeline, vessel or tank) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

Lockout - The placement of an energy/hazard isolating device, in accordance with an established procedure, which ensures that the equipment being controlled cannot be operated until the device is removed.

Lockout Device - A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy/hazard isolating device in the safe position and prevent the energization of a machine or equipment. This includes blank flanges and bolted slip blinds.

Normal Production Operations - The utilization of a machine or equipment to perform its intended production function.

Qualified Employee - An employee whose skills and training meet or exceed 29 CFR 1910.332(b)(3) for work on or near exposed energized parts must, at a minimum, be trained in and familiar with the skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment; to determine the nominal voltage of exposed lines; and the clearance distances to which the qualified persons will be exposed.

Servicing and/or Maintenance - Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming machines or equipment, making adjustments or tool changes, where the employee may be exposed to an unexpected energization or start-up of the equipment, or release of hazardous energy/or material.

Setting-up - Any work performed to prepare a machine or equipment to perform its normal production operation.

Tagout - The placement of a tagout device on an energy/hazard isolation device, in accordance with an established procedure, to indicate that the device and the equipment being controlled may not be operated until the tagout device is removed.

Tagout Device - A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolation device in accordance with an established procedure, that indicates that the device and the equipment being controlled may not be operated until the tagout device is removed.

5.0 TEXT

5.1 Scope/Application

This procedure covers any activity which requires isolation of a source of energy or hazardous material, such as, the servicing and maintenance of equipment and confined space entry. It outlines methods to prevent the unexpected energization or start-up of the equipment, or release of stored energy or material that could cause injury to employees. For any projects planned for more than 30 days with lockout/tagout planned for more than seven calendar days or when locking/tagging out specialized equipment having its own lockout requirements, a site-specific/equipment specific plan must be developed and incorporated as part of the Site-Specific Health and Safety Plan. Otherwise Attachments 4-7 (discussed later in text) must be utilized to document lockout/tagout.

In situations where our client has specific lockout/tagout requirements, Shaw Environmental & Infrastructure, Inc. (Shaw E & I) personnel can follow client procedures after an Shaw E & I health and safety professional has approved them as being at least as protective as Shaw E & I procedures. In such cases, the client procedures shall be incorporated into the Shaw E & I health and safety plan and all affected employees trained on these procedures.

5.1.1 Exclusions. Normal operations including repetitive, routine minor adjustments that do not require removal of equipment guarding.

When work is conducted on equipment where an employee has direct control over the cord(s) or plug(s) connected to the associated equipment.

5.1.2 References. OSHA General Industry Standard, 29 CFR 1910.147, The Control of Hazardous Energy (Lockout/Tagout), 29 CFR 1910.146, Permit-Required Confined Spaces, and 29 CFR1910.331-335, Safety-Related Work Practices.

5.2 Responsibility

Each new, transferred, authorized or affected employee and other employees whose work operations are or may be in an area where lockout/tagout procedures are utilized must be instructed in the purpose and use of this lockout/tagout procedure.

- **All Personnel**
  All site personnel will be responsible for continuous adherence to the health and safety procedures during the performance of assigned work. In no case may work be performed in a manner that conflicts with the intent of this procedure.

- **Authorized Employee**
  The authorized employee, or his/her designee, is responsible for reviewing the planned activities prior to commencement of work and confirming that the maintenance manager or his designee of the particular facility where the work is to be accomplished is made aware of the nature and extent of the work and when it is to commence.

- **Site Supervisor**
  The site supervisor is responsible for verifying that all proper lockout/tagout procedures have been followed. The site supervisor must ensure that the power disconnects, appropriate attachment of locks and tags, and proper documentation of the procedure are implemented. He/she is also the designated custodian and controller for all locks, tags, and group lock boxes issued to authorized employees.

- **Subcontractors, Visitors and Other On-Site Personnel**
  Subcontractors are responsible for the health and safety of their employees and for complying with the requirements established by the site Health & Safety Plan. All Shaw E & I subcontractors and visitors are responsible to the Shaw E & I site supervisor.

- **Site Health and Safety Coordinator**
  The health and safety coordinator will assist in compliance with the other applicable company policies and procedures, and the Health and Safety Plan.

5.3 Procedures for Lockout/Tagout

Lockout and tagout devices must be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.

Locks are to be used when a machine, equipment, or piping system is capable of being locked out. All locks must be accompanied by a tag to indicate the name of the employee applying the lockout device and warn against the hazard if the valve is opened, or the machine/equipment is energized. A legend such as "This lock and tag to be removed only by authorized personnel" with an additional message: "Do Not Start," "Do Not Open," "Do Not Close," "Do Not Energize," or "Do Not Operate" must be utilized.

All tags and their means of attachment must be sturdy enough to prevent inadvertent removal. The tag attachment will be attachable by hand, self-locking, non-releasable, and non-reusable, with a minimum unlocking strength of not less than 50 pounds. Tags must be durable and not deteriorate from exposure to weather conditions and corrosive environments or cause the message on the tag (hand-written or pre-existing) to become illegible. Lockout and tagout devices must be singularly identified; must be the only device(s) used for controlling energy; and must not be used for other purposes.

All equipment must be designed with a hazardous energy/material isolating device as a means of protection for the employee against injury during repairs. **All new equipment installed must be designed to accept a lockout device**.

Authorized padlocks will be assigned to each authorized employee. Each group's lock will be individually keyed and the supervisor on each shift will maintain possession of the master key for these padlocks. The specific project must provide a sufficient number of locks for each employee on site.

All tags must contain the authorized employee name, date of application of the lock, equipment name or number and the reason for lockout. The tag must be attached to the lockout device.

On any equipment that can start automatically, the main disconnect must be switched to the "off" position, locked, and tagged by the authorized employee. This switch must be turned off before opening the main power disconnect and remain off until the disconnect is closed. Locking out 220v, 440v and other equipment must always be done at the main feed or starter panel.

All hazardous material lines must be blanked, blinded, or double valve and vent locked to prevent release of hazardous material.

Blanking or blinding of hazardous material lines are preferable to the double valve and vent technique. All blanks and blinds must be identified with tags in the same manner as locks.

A "Lockout Log" (Attachment 3) must be maintained by the site supervisor. This log must be included in the Health and Safety Plan.

5.3.1 Lockout/Tagout Overview

- Check equipment file for specific lockout/tagout procedures.
- Determine the requirements for lockout. If there is more than one energy source to the equipment, document each source.
- Conduct a survey to locate and identify all energy isolation devices that apply to the equipment.
- Use the equipment type-specific procedures as outlined in Attachments 4-7, if applicable. Complete the "Lockout/Tagout Procedure for Specific Equipment" form (Attachment 8) logging all data and return to the site-supervisor.
- Shut off energy source(s) to affected equipment.
- Affix lock(s) and tag(s) to each energy source controlling device.
- Identify work on process lines or vessels and determine isolation requirements.
- Blind, blank, disconnect, or double valve and vent all hazardous material lines, including steam, and identify the isolation points with tags.
- When only tag is used because machine or equipment can't be locked out, the following steps must be taken: Remove fuses, block machine, etc. and complete the "Lockout/Tagout Procedure for Specific Equipment" form (Attachment 8) and give to the site supervisor for the record.
- Stored energy - Relieve all stored energy from capacitor banks, springs, compressed air, hydraulic, steam, etc.
- Verify isolation of energy has occurred by attempting to activate equipment by using the on/off switch.
- Return control switch to "off" position before proceeding with work.

5.3.2 Removal of Lockout/Tagout

- Ensure that nonessential items, such as tools, etc., are removed from equipment.
- Ensure that equipment components are intact.
- Check work area to ensure that all employees are safely positioned or removed from the area.
- Notify all affected employees and site supervisor before re-energizing the equipment.
- Remove lockout/tagout device.
- Re-energize equipment or open valves and restore flow in process line, place back in into service.

5.3.3 Preparation for Confined Space Entry

1. Refer to Shaw E & I Procedures HS300, HS301, or HS302 for Confined Space Entry.
2. Blank or blind piping, identify with tags.
3. Misalign or remove sections of lines, pipes, or ducts, identify with tags.
4. Double valve and vent system, identify with tags.
5. Lockout or tagout all sources of energy.
6. Block or disconnect all mechanical linkages.

If it is impossible or impractical to lockout a piece of equipment, the site supervisor, H&S Professional, and the Maintenance Engineer of the facility must approve a method to make the equipment safe before any activities beyond normal operations of the equipment are performed. This can be done by disconnecting wiring, removing fuses, disconnecting or blanking supply lines, etc. "Danger - Do Not Operate" tags must be used to describe the condition.

The practice of permitting a person to place or remove a lock for someone else is prohibited. No employee can be sure he/she is safe until he/she places their own lock correctly.

5.4 Safety Audit

5.4.1 Verification Audit. A periodic audit of the lockout/tagout system must be performed to ensure that the requirements of this procedure are being implemented. The audit will be conducted by authorized and qualified employees other than the ones(s) utilizing the procedurebeing inspected. Any deficiencies that are observed must be corrected immediately. For each project, the site-supervisor will be responsible for daily audits of lockout/tagout systems to

ensure proper installation of locks and tags to the equipment and adherence to the appropriate procedures.

Where lockout or tagout is used for energy control, the periodic inspection must include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected.

5.4.2 Follow-up Audit. A follow-up audit must be conducted to ensure that all deficiencies noted have been corrected.

5.4.3 Documentation. Audit documentation must identify the machine or equipment on which the lockout procedure is being utilized, the date of the inspection, employees interviewed and employee(s) performing the inspection. The audit results must be provided to the Health & Safety Department to be documented as being performed.

5.5 Training

Training must be provided to ensure that the purpose and function of the energy control program are understood by employees, and that the knowledge and skills required for the safe application, usage, and removal of the energy controls are acquired by employees.

- Each authorized employee must receive training in the recognition of applicable hazardous energy/material sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for isolation and control.

- All affected employees must be instructed in the purpose and use of the lock and tag system.

- All other employees (including new hires) whose work operations are or may be in an area where lockout/tagout may be utilized, must be instructed about the procedure, and the prohibition relating to attempts to restart or re-energize machines or equipment that are locked out or tagged out.

- Retraining must be conducted for all authorized and affected employees whenever there is a change in job assignment, change in equipment, changes in a process that presents a new hazard or there is a change in the lockout/tagout procedure. Retraining must also be conducted whenever there is significant evidence, based on the periodic audits, indicating employee deviation from, or lack of understanding of, the lockout/tagout procedure.

- Employee site-specific training must be documented to ensure that it has been accomplished and is being kept up to date. The documentation must contain each employee's name and dates of training.

Documentation of employee training and retraining must be maintained and kept up to date by the Shaw E & I H&S representative and forwarded to the Shaw E & I Training Department.

5.6 Shift or Personnel Changes

Specific procedures must be utilized during shift or personnel changes to ensure the continuity of lockout or tagout protection. These must include provision for the orderly transfer of lockout or tagout device protection between off-going and oncoming employees to minimize exposure to hazards from the unexpected energization or start-up of the machine or equipment or the release of stored energy. All site-specific locks in place must be covered in the tailgate safety meetings on each shift.

All individual lock(s) of the outgoing shift working on equipment will be removed and replaced by the on-coming shift's individual lock(s). The authorized employees of the on-coming shift must inspect and "try" the system to ensure de-energization.

The site supervisor must re-audit the system as necessary.

5.7 Troubleshooting

Special precautions must be observed when the authorized employee must perform maintenance troubleshooting tasks with energized equipment. This function requires added caution and communications between all other affected employees to ensure employee protection.

An authorized employee must identify all start-stop locations and circuit breakers for disconnecting equipment. All other affected employees must be kept informed throughout the testing and troubleshooting. If the job is left incomplete, the authorized employee must install his/her individual lock and tag before leaving the job.

The following sequence must be followed when troubleshooting any equipment:

1. Written approval including detailed work plan, must be obtained from the site supervisor and H&S Professional to ensure that troubleshooting can be performed safely.

2. Inspect and clear machine or equipment of all tools and unnecessary materials.

3. Ensure that all affected employees are positioned out of the way of machine activation. Instruct all affected employees in the procedures that must be followed, the potential hazards that may exist, and the safety precautions that have been taken. Document this training on the Tailgate Safety meeting form.
4. Remove the lockout and tagout devices.

5. Energize and proceed with the troubleshooting, testing or positioning of the machine or equipment.

6. De-energize, reapply all lockout and tagout devices and "try" the system to ensure de-energization or place machine back into service.

5.8 Group Lockout/Tagout

When servicing and/or maintenance is performed by a crew, craft, department or other group, the work crew must use a procedure which affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.

- Primary responsibility is vested in an authorized employee for a set number of employees working under the protection of a group lockout or tagout device.

- Provision for the authorized employee to ascertain the exposure status of individual group members with regard to the lockout or tagout of the machine or equipment; and

- When more than one crew, craft, department, etc. is involved, assignment of overall job-associated lockout or tagout control responsibility to an authorized employee to coordinate affected work forces and ensure continuity of protection; and

- Each authorized employee must affix a personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism when he or she begins work, and must remove those devices when he or she stops working on the machine or equipment being serviced or maintained.

The following procedure applies to distribution and utilities systems. The employee authorized to "Group Lockout" will lock and tag out the system. Using the "group lockout" locks and tags. The "Group Lockout" must be signed by the authorized employee.

1. Use of personal tags and locks on the "Group Lock Box" must follow the normal lockout/tagout procedure.

2. The authorized employee must verify that all energy sources are in a neutral state.

3. The authorized employee places the group lock and tags on the hazard isolation device.

4. The authorized employee then places the "Group Lock Key" in the "Group Lock Box", and tag the box with a "DANGER DO NOT OPERATE" tag stating which system is locked out and why.

5. Each employee, prior to working on the "Group Lockout" system, must attach his/her personal tag and lock to the "Group Lockout Box."

6. Upon completion of work, all employees must remove their personal lock and tag.

7. The authorized employee must them remove the "Group Lock" locks and tags and follow normal procedures for restoring energy.

8. If repairs take more than the initiating shift, and the authorized employee is not remaining on the job for the completion, he/she may transfer "Authorization" to another employee by stating so on the "DANGER DO NOT OPERATE" tag. The employee identified then becomes the authorized employee. He/she is now authorized to remove the "Group Lockout" locks and tags installed by the original authorized employee if the work is completed on that shift. The follow-up shift must them follow normal procedures for "Group Lock/Tagout."

5.9 Outside Personnel (Contractors, etc.)

Whenever outside servicing personnel are to be engaged in activities covered by the scope and application of this standard, the on-site employer and the outside employer must inform each other of their respective lockout or tagout procedures.

All subcontractor's lockout/tagout procedures must be reviewed and approved by Shaw E & I prior to the project.

5.10 Special Situations

If lockout/tagout lasts for more than one shift, the appropriate protection must not be interrupted. No lock is to be removed until the next shift is ready to lockout the equipment.

When the employee(s) who originally applied a lock(s) is not at the site to remove it, the lock can be removed only in an emergency and only under the direction of an authorized employee, the site-supervisor, and if applicable the site-safety and health coordinator. Such actions and associated personnel safeguards shall be documented on the Field Activity Daily Log and the Lockout Log.

6.0 EXCEPTION PROVISIONS

Variances to this procedure shall be requested in accordance with procedure HS013 Health and Safety Procedure Variances.

7.0 CROSS REFERENCE

HS050 Training Requirements
HS052 Health and Safety Plans
HS300 Confined Spaces
HS301 Confined Spaces, Marine
HS302 Confined Spaces, Leaded Product
HS310 Hazardous Waste Operations
HS311 Emergency Response Operations
HS312 Hazardous Waste Operations at TSD Facilities

8.0 ATTACHMENTS

1. Responsibility Matrix
2. Flow Diagram - Overview: Lockout/Tagout System
3. Lockout Log
4. Lockout/Tagout for Electrical Equipment
5. Lockout/Tagout for Compressed Air and Gases
6. Lockout/Tagout for Steam, Water, and Fluid Lines
7. Lockout/Tagout for Hydraulic Equipment
8. Lockout/Tagout Procedure for Specific Equipment

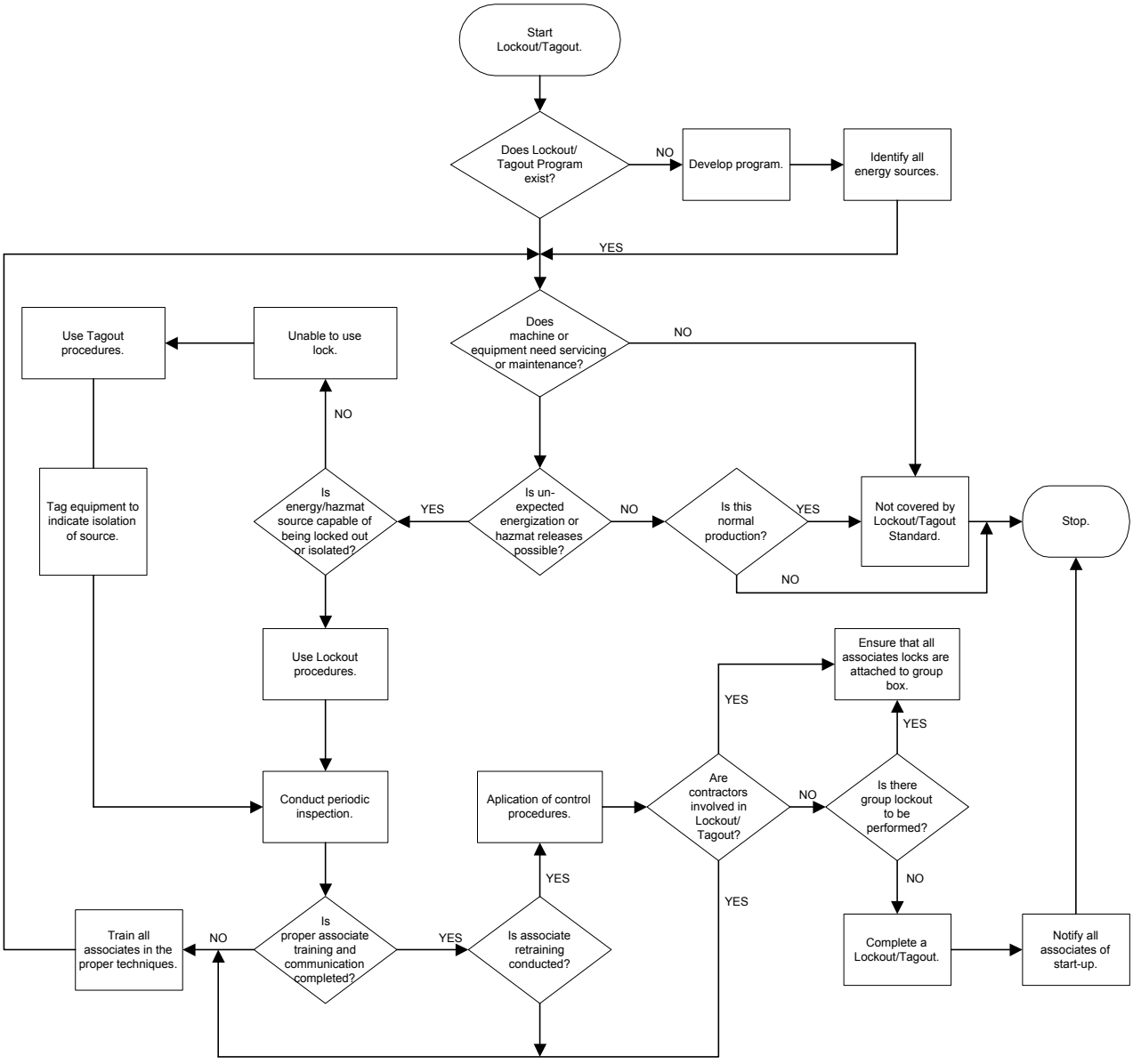
ATTACHMENT 1
CONTROL OF HAZARDOUS ENERGY SOURCE (LOCKOUT/TAGOUT)

Responsibility Matrix

Action	Procedure Section	*Responsible Party*						
		Location Mgr.	Authorized Associate	Site Supervisor	Sub-contractor	HS	All	Training Dept.
Comply with procedure	5.2				X		X	
Review plan & notify maintenance	5.2		X					
Verify proper procedures followed	5.2`	X		X		X		
Verification audit - daily	5.4.1			X				
Provide training to associates	5.5	X						
Attend appropriate training	5.5						X	
Maintain training records	5.5							X
Write/approve location lockout plan, if required	5.1		X			X		

ATTACHMENT 2

FLO DIAGRAM:
OVERVIEW of the LOCKOUT/TAGOUT SYSTEM



ATTACHMENT 3

LOCKOUT LOG

AUTHORIZED EMPLOYEE	DATE	EQUIPMENT NAME	EQUIPMENT NUMBER	REASON FOR LOCKOUT

ATTACHMENT 4
LOCKOUT/TAGOUT FOR ELECTRICAL EQUIPMENT

Job:_____

Device:_____

Location:_____

Authorized Person:_____

Site Supervisor:

PREPARATION FOR SHUTDOWN

1. Determine power type and shutoff location
2. Determine if there is more than one energy source
3. Determine magnitude of power (voltage)
4. Notify affected employees in the area that equipment will be under lockout for maintenance.
5. Shutoff power sources to machine.

LOCKOUT/TAGOUT

6. Lock and tag main power switches in the OFF position, remove fuses.
7. Verify that no power is available to the equipment using a voltmeter, if necessary.
8. Drain devices such as capacitor banks.
9. Verify that these devices have no stored energy by use of the voltmeter.
10. Repair equipment.

RETURN TO SERVICE

11. Be sure all connections are made and any unused tools and equipment are removed.
12. Remove lock if necessary to verify machine is repaired. The maintenance employee, while verifying the machine is repaired cannot leave the immediate area.
13. Remove tag from machine.
14. Notify employees in the area that the equipment is available.

Signature:

Authorized Person:_____

Site Supervisor: _____

ATTACHMENT 5
LOCKOUT/TAGOUT FOR COMPRESSED AIR AND GASES

Job:_____

Device:_____

Location:_____

Authorized Person:_____

Site Supervisor:

PREPARATION FOR SHUTDOWN

1. Determine types and shutoff location
2. Determine if there is more than one energy source
3. Determine magnitude of compressed air, gas, steam, water, or fluids.
4. Notify affected employees in the area that equipment will be locked out for maintenance.
5. Shutoff main supply to machine.

LOCKOUT/TAGOUT

6. Lock and tag main supply in the OFF position.
7. Bleed line and verify that no air or gases remain in the equipment.
8. Repair equipment.

RETURN TO SERVICE

9. Be sure all connections are made and any unused tools and equipment are removed.
10. Remove lock if necessary to verify proper operation.
12. Remove tag.
13. Notify employees in the area that the equipment is available.

Signature:

Authorized Person:_____

Site Supervisor: _____

ATTACHMENT 6
LOCKOUT/TAGOUT FOR STEAM, WATER, AND FLUID LINES

Job:_____

Device:_____

Location:_____

Authorized Person:_____

Site Supervisor:_____

PREPARATION FOR SHUTDOWN

1. Determine types and shutoff location
2. Determine if there is more than one energy source
3. Determine magnitude of compressed air or gas.
4. Notify affected employees in the area that equipment will be under lockout for maintenance.
5. Disconnect/shutoff main steam, water or fluid lines to equipment.

LOCKOUT/TAGOUT

6. Lock and tag main supply (i.e. chaining through valve handle with lock) in the OFF position with a bleeder open on the load side.
7. Drain fluids from shutoff valves to equipment.
8. Repair equipment.

RETURN TO SERVICE

9. Be sure all connections are made and any unused tools and equipment are removed.
10. Remove lock if necessary to verify machine is repaired. The maintenance employee cannot leave the immediate area, while verifying the machine is repaired.
11. Remove tag from machine.
12. Notify employees in the area that the equipment is available.

Signature:

Authorized Person:_____

Site Supervisor: _____

ATTACHMENT 7
LOCKOUT/TAGOUT FOR HYDRAULIC EQUIPMENT

Job:_____

Device:_____

Location:_____

Authorized Person:_____

Site Supervisor: _____

PREPARATION FOR SHUTDOWN

1. Determine types and shutoff location
2. Determine if there is more than one energy source
3. Determine magnitude of energy (pressure).
4. Notify affected employees in the area that equipment will be under lockout for maintenance.
5. Shutoff main hydraulic to equipment.

LOCKOUT/TAGOUT

6. Lock and tag main supply in the OFF position.
7. Drain fluids from shutoff valves to equipment.
8. Verify that the hydraulic fluid is disconnected.
9. Block ram or items controlled by the hydraulic system using the appropriate blocking.
10. Repair equipment.

RETURN TO SERVICE

11. Be sure all connections are made and any unused tools and equipment are removed.
12. Remove lock if necessary to verify machine is repaired. Maintenance employee cannot leave the immediate area, while verifying the machine is repaired.
13. Remove tag from machine.
14. Notify employees in the area that the equipment is available.

Signature:

Authorized Person:_____

Site Supervisor:_____

ATTACHMENT 8
LOCKOUT/TAGOUT PROCEDURE FOR SPECIFIC EQUIPMENT

Equipment:

Cat. No. and Location:

Serial Number (if available):

Electrical: Voltage: Location:

Describe:

Air (Type): Location:

Describe:

Gases (Type): Location:

Describe:

Steam (Type): Location:

Describe:

Water: Location:

Describe:

Fluids: Location:

Describe:

Hydraulic: Location:

Describe:

Stored Energy- Capacitors, Springs, Etc.:

Describe:

LOG DATA AND RETURN TO SITE-SUPERVISOR

PROCEDURE

Subject: HEAT STRESS

1.0 PURPOSE AND SUMMARY

This procedure establishes the guidelines to protect employees from the effects of heat related illness. It describes the four major types of heat-induced illnesses, methods of prevention, types of treatment, and includes discussions on the monitoring of heat stress situations.

Some clients may have monitoring requirements that differ from those contained in this procedure. In such circumstances, the more protective monitoring requirements will be followed.

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The Vice President, Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

3.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1.

4.0 DEFINITIONS

Acclimatization - Series of physiological and psychological adjustments that occur in an employee during initial exposures to hot environmental conditions that increase the employee's tolerance to elevated work environment temperature.

Company - All wholly-owned subsidiaries of Shaw Environmental & Infrastructure, Inc. (Shaw E & I).

Maximum Heart Rate - Amount of work (beats) per minute a healthy person's heart can be expected to safely deliver. Maximum heart rate (MHR) is calculated by subtracting an employee's age from 200.

5.0 TEXT

Adverse climatic conditions are important considerations in planning and conducting site operations. High ambient temperature can result in deleterious health effects ranging from transient heat fatigue, physical discomfort, reduced efficiency, personal illness, increased accident probability, etc., to serious illness or death. Heat stress is of particular concern when chemical protective garments are worn, since these garments prevent evaporative body cooling. Wearing personal protective equipment places employees at considerably higher risk of developing heat stress.

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses, regular monitoring and other preventive precautions are vital.

5.1 Signs, Symptoms, and Treatment

5.1.1 Heat Rash

Heat rash can be caused by continuous exposure to hot and humid air and skin abrasion from sweat soaked clothing.

Signs and Symptoms: The condition is characterized by a localized red skin rash and reduced sweating. Aside from being a nuisance, the ability to tolerate heat is reduced.

Treatment: Keep skin hygienically clean and allow it to dry thoroughly after using chemical protective clothing.

5.1.2 Heat Cramps

Heat cramps are caused by profuse perspiration with inadequate electrolytic fluid replacement. This often robs the larger muscle groups (stomach and quadriceps) of blood which can cause painful muscle spasms and pain.

Signs and Symptoms: Muscle spasms and pain in the extremities and abdomen.

Treatment: Remove employee to a cool place and give sips of water or an electrolytic drink. Watch for signs of heat exhaustion or stroke.

5.1.3 Heat Exhaustion

Heat exhaustion is a mild form of shock caused by increased stress on various organs to meet increased demand to cool the body. Onset is gradual and symptoms should subside within one hour.

Signs and Symptoms: Weak pulse; shallow breathing; pale, cool, moist skin; profuse sweating; dizziness; fatigue.

Treatment: Remove employee to a cool place and remove as much clothing as possible. Give sips of water or electrolytic solution and fan the person continually to remove heat by convection. CAUTION: Do not allow the affected person to become chilled ☞ treat for shock if necessary.

5.1.4 Heat Stroke

Heat stroke is the most severe form of heat stress; the body must be cooled immediately to prevent severe injury and/or death. **THIS IS A MEDICAL EMERGENCY!**

Signs and Symptoms: Red, hot, dry skin (skin may be wet from previous perspiration particularly when evaporation-preventing clothing is worn); body temperature of 105 degrees Fahrenheit (☛F) or higher; no perspiration; nausea; dizziness and confusion; strong, rapid pulse.

Treatment: Heat stroke is a true medical emergency. Transportation of the victim to a medical facility must not be delayed. Prior to transport, remove as much clothing as possible and wrap the victim in a sheet soaked with water. Fan vigorously while transporting to help reduce body temperature. Apply cold packs, if available; place under the arms, around the neck, or any other place where they can cool large surface blood vessels. If transportation to a medical facility is delayed, reduce body temperature by immersing victim in a cool water bath (however, be careful not to over-chill the victim once body temperature is reduced below 102☛F). If this is not possible, keep victim wrapped in a sheet and continuously douse with water and fan.

5.2 Prevention

The implementation of preventative measures is the most effective way to limit the effects of heat-related illnesses. During periods of high heat, adequate liquids must be provided to replace lost body fluids. Replacement fluids can be a 0.1 percent salt water solution, a commercial mix such as Gatorade, or a combination of these with fresh water. The replacement fluid temperature should be kept cool, 50 degrees F to 60 degree F, and should be placed close to the work area. Employees must be encouraged to drink more than the amount required to satisfy thirst. Employees should also be encouraged to salt their foods more heavily during hot times of the year.

Cooling devices such as vortex tubes or cooling vests can be worn beneath impermeable clothing. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

All workers are to rest when any symptoms of heat stress are noticed. Rest breaks are to be taken in a cool, shaded rest area. Employees shall remove chemical protective garments during rest periods and will not be assigned other tasks.

All employees shall be informed of the importance of adequate rest and proper diet in the prevention of heat stress and the harmful effects of excessive alcohol and caffeine consumption.

5.3 Monitoring

The initiation of heat stress monitoring will be required when employees are working in environments exceeding 90 degree F ambient air temperature. If employees are wearing impermeable clothing, this monitoring will begin at 78 degree F. There are two general types of monitoring that the health and safety representative can designate to be used: wet bulb globe temperature (WBGT) and physiological. Attachment 2 will be used to record the results of heat stress monitoring.

5.3.1 Wet Bulb Globe Temperature

The WBGT index is the simplest and most suitable technique to measure the environmental factors which most nearly correlate with core body temperature and other physiological responses to heat. When WBGT exceeds 25.9 degree C (78 degree F), the work regiment in Table 2 of the section “Heat Stress” in the latest edition of the American Conference of Governmental Industrial Hygiene (ACGIH) Threshold Limit Value (TLV) Booklet should be followed.

5.3.2 Physiological

Physiological monitoring can be used in lieu of or in addition to WBGT. It is anticipated that this monitoring can be self-performed once the health and safety representative demonstrates appropriate techniques to affected employees. Since individuals vary in their susceptibility to heat, this type of monitoring has its advantages. The two parameters that are to be monitored at the beginning of each rest period are:

- Heart Rate - Each individual will count his/her radial (wrist) pulse as early as possible during each rest period. If the heart rate of any individual exceeds 75 percent of their calculated maximum heart rate (MHR = 200 - age) at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. An individual is not permitted to return to work until his/her sustained heart rate is below 75 percent of their calculated maximum heart rate.

- Temperature - Each individual will measure his/her oral temperature with a disposable thermometer for one minute as early as possible in the first rest period. If the temperature exceeds 99.6 degrees F at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same.

- An individual is not permitted to return to work if his/her temperature exceeds 100.4 degrees F

5.4 Training

Employees potentially exposed to heat stress conditions will be instructed on the contents of this procedure. This training can be conducted during daily tailgate safety meetings.

6.0 EXCEPTION PROVISIONS

Variances and exceptions may be requested pursuant to the provisions of Procedure HS013, Health and Safety Procedure Variances

7.0 CROSS REFERENCES

HS013 Health and Safety Procedure Variances
HS051 Tailgate Safety Meetings

8.0 ATTACHMENTS

1. Responsibility Matrix
2. Heat Stress Monitoring Record

ATTACHMENT 1
HEAT STRESS

Responsibility Matrix

Action	Procedure Section	*Responsible Party*		
		Vice President, Health and Safety	**Project Supervisor**	**Health and Safety Representative**
Issuance, Revision, and Maintenance of Procedure	3.1	X		
Conduct Monitoring	5.3			X
Inform Employees About Procedure	5.4		X	X

ATTACHMENT 2
HEAT STRESS MONITORING RECORD

Project/Location ______________________________ Date ______________

Employee Name	Initial Reading Time	First Work Period Time		Second Work Period Time		Third Work Period Time		Fourth Work Period Time		Fifth Work Period Time		Sixth Work Period Time	
	WBGT (☚F)	WBGT (☚F)		WBGT (☚F)		WBGT (☚F)		WBGT (☚F)		WBGT (☚F)		WBGT (☚F)	
	Air Temp. (☚F)	Air Temp. (☚F)		Air Temp. (☚F)		Air Temp. (☚F)		Air Temp. (☚F)		Air Temp. (☚F)		Air Temp. (☚F)	
	Initial Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.
	Initial H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.
	Initial Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.
	Initial H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.
	Initial Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.
	Initial H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.
	Initial Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.	Initial Temp.	Final Temp.
	Initial H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.	Initial H.R.	Final H.R.

PROCEDURE

Subject: COLD STRESS

1.0 PURPOSE AND SUMMARY

The purpose of this procedure is to establish the guidelines necessary to protect employees from the adverse health effects caused by exposure to low temperature environments.

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The Vice President, Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

3.2 Action/Approval Responsibilities

The responsibility matrix is Attachment 1.

4.0 TEXT

Most cold related worker fatalities have resulted from failure to escape low air temperatures, or from immersion in low temperature water. Employees should be protected from exposure to cold so that their deep core temperature does not fall below 96.8 degrees Fahrenheit. Core body temperatures below this level will likely result in reduced mental alertness, reduction in rational decision making, or loss of consciousness with the threat of fatal consequences.

4.1 Signs and Symptoms of Cold Stress

Several factors increase the harmful effects of cold including, being very young or old, wet clothing, having wounds or fractures, smoking, drinking alcoholic beverages, fatigue, emotional stress and certain diseases and medications. The two most prominent adverse effects from exposure to cold temperatures are frostbite and hypothermia. Treatment for cold related injuries should be administered by a person qualified in first aid or a professional medical provider.

4.1.1 Frostbite. Frostbite is the most common injury caused by exposure to cold temperatures. It occurs when cells of the body freeze restricting blood flow and causing tissue damage. The first sign of frostbite is slightly flushed skin which then changes to white or grayish yellow and finally grayish blue. Pain is sometimes initially felt but is often followed by a cold numb feeling.

4.1.2 Hypothermia. Hypothermia is the most severe form of cold stress and results from a drop in the body's core temperature. The initial signs include; shivering, numbness, confusion, weakness, impaired judgement, impaired vision, and drowsiness. Hypothermia victims typically progress through five stages of the condition including; (1) shivering, (2) apathy, (3) loss of consciousness, (4) decreasing pulse and breathing rate, and (5)death.

4.2 Precautionary Measures

It is recommended that employees wear insulated clothing to maintain core temperatures above 96.8 degrees F when working in air temperatures below 40 degrees F. This protective clothing may include but is not limited to:

- Insulated suits, such as whole-body thermal underwear
- Wool or polypropylene socks
- Insulated gloves and boots
- Insulated head cover, such as knit caps, hard hat liners, etc.

When conducting work in air temperatures below 35 degrees F, the following practices shall be followed:

- If the clothing of an employee is expected to become wet, the outer layers of clothing must be impermeable to water.

- If an employees underclothing becomes wet it must be changed immediately. If the clothing becomes wet from sweating, the employee may finish the task which caused the sweating before changing into dry clothing.

- Employees will be provided a warm area (65 degrees F or above) to change from work clothing into street clothing and for breaks.
- Hot liquids, such as soups, warm drinks, etc. shall be provided in the break area. The intake of caffeine containing products shall be discouraged due to their diuretic and circulatory effects.

- If appropriate, approved space heaters may be provided in the work area to warm the hands, feet, etc.

- The buddy system shall be practiced. Any employee observed with signs of cold stress shall immediately proceed to the break area.

- Employees will be reminded to layer their clothing, i.e., wear thinner, lighter clothing next to the body with heavier clothing layered outside the inner clothing.

- Avoid overdressing when going into warm areas or when performing activities which are strenuous. This could potentially lead to heat stress situations.

- Auxiliary heated versions of handwear, footwear, etc., can be used in lieu of mittens, insulated socks, etc. if extremely cold conditions exist.

- Employees handling liquids with high evaporation rates (gasoline, hexane, alcohol, etc.) shall take special precautions to avoid soaking of clothing with the liquids because of the added danger of cold injury caused by evaporative cooling.

- Work shall be arranged in such a way that sitting still or standing for long periods is minimized.

- If the air temperature is 20 degrees F or below the hands shall be protected by mittens or gloves prior to contact with cold surfaces such as metal, etc.

Air temperature is not the only factor to be considered while evaluating cold stress situations. Wind chill cooling rate and the cooling power of air are critical factors. The higher the wind speed the greater the risk of experiencing cold related injuries. For exposed skin, continuous exposure should not be permitted when the air speed and temperature result in an equivalent chill temperature of –25 degrees F of less. The wind chill table provided in attachment two can be used to help assess hazardous conditions attributable to wind chill effects.

4.3 Training

Training on the contents of this procedure will be conducted during tailgate safety meetings held at project or office locations where employees are exposed to cold temperatures. Topics to be discussed during this training will include:

- Proper rewarming procedures and first aid treatment of cold related cases
- Proper clothing practices
- Eating and drinking habits
- Recognition of signs and symptoms of cold stress
- Safe cold weather work practices.

5.0 EXCEPTION PROVISIONS

Variances may be requested as described in procedure HS013; Health and Safety Procedure Variances.

6.0 CROSS REFERENCES

Shaw Environmental & Infrastructure, Inc. (Shaw E & I) Procedure HS051-Tailgate Safety Meetings

Shaw E & I Procedure HS600-Personal Protective Equipment

Threshold Limit Values and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists.

Standard First Aid Workbook, American Red Cross

7.0 ATTACHMENTS

1. Responsibility Matrix
2. Windchill Table

ATTACHMENT 1
COLD STRESS

Responsibility Matrix

Action	Procedure Section	Employee	Local HS Representative	Vice President Health and Safety
Issuance, revision and maintenance of this procedure	3.1			X
Provide training	4.2		X	
Receive training	4.2	X		

ATTACHMENT 2

Windchill Table

Estimated Wind Speed (mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER In under an hour with dry skin. Maximum danger is false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute.			GREAT DANGER Flesh may freeze within 30 seconds.				
	Trenchfoot and immersion foot may occur at any point on this chart.											

PROCEDURE

Subject: HEARING CONSERVATION PROGRAM

1.0 PURPOSE AND SUMMARY

The purpose of this procedure is to establish guidelines for the company hearing conservation program. Regulatory requirements mandate that the company administer a hearing conservation program whenever employee sound exposures equal or exceed an 8-hour time-weighted average (TWA) sound level of 85 decibels (dB).

Evidence is well established that worker exposure to sound of sufficient intensity and duration can result in hearing damage. This procedure prescribes the control measures required to prevent employee exposure to excessive sound levels and includes provisions for:

- Monitoring of the workplace to determine employee exposures.
- An audiometric testing program which includes baseline and annual audiograms.
- An employee training and information program.
- Description of various control measures that can be used to decrease exposures.
- Providing hearing protection to all affected employees when administrative or engineering controls fail to reduce sound levels to below the action level.
- Recordkeeping requirements.

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The Vice President, Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

3.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1.

4.0 DEFINITIONS

Action Level - An 8-hour TWA of 85 dB or a dose of 50 percent.

Company - All wholly-owned subsidiaries of Shaw Environmental & Infrastructure, Inc. (Shaw E & I).

Standard Threshold Shift (STS) - Change in hearing threshold relative to the baseline audiogram of 10 dB or more at 2,000, 3,000, and 4,000 hertz (Hz) in either ear.

5.0 TEXT

5.1 General

The company hearing conservation program will be implemented and protection against the effects of sound exposure will be provided whenever sound levels exceed the action level.

5.2 Monitoring

Monitoring of employee exposures to sound will be conducted whenever it is anticipated that exposure may exceed the action level. This monitoring will be conducted by a qualified individual who, through professional credentials, training, or experience, has the necessary qualifications to specify and use the type of monitoring equipment (area or personal) that will best represent employee exposures. This monitoring will be repeated whenever changes in the work environment lead to the possibility of additional exposures or inadequacy of selected hearing protection. Employees will be provided the opportunity to observe monitoring and will be notified when the results exceed the action level.

Sound level monitoring instrumentation will be operated on the A-weighted scale in slow response mode. Employee sound exposures will be computed in accordance with Attachment 2 and without regard to any attenuation provided by the use of hearing protection.

5.3 Audiometric Testing

Audiometric testing will be provided to all employees exposed at or above the action level. Testing will be in accordance with Procedure HS100, Medical Policies and Procedures.

5.3.1 Baseline Audiogram. Audiometric test results obtained from the pre-hire medical examination will be used as the baseline audiogram. Testing to establish a baseline audiogram shall be preceded by at least 14 hours without exposure to workplace sound. Employees will also be notified of the need to avoid high levels of non-occupational sound exposure during this 14-hour period.

5.3.2 Annual Audiograms. Annual audiograms will be conducted for all employees exposed at or above the action level during the preceding year. Each annual audiogram will be compared to that employee's baseline audiogram to determine if the audiogram is valid and if a STS has occurred.

5.4 Employee Training and Information

All employees who are exposed to sound levels above the action level are required to participate in a formal training program. This program will be presented by a health and safety representative and include, as a minimum, the following information:

- The effects of sound on hearing.
- The purpose of hearing protection; the advantages, disadvantages, and attenuation of various types; and instructions on selection, fitting, use, and care.
- The specific nature of operations which could result in exposure to excessive sound levels.
- The purpose of audiometric testing and an explanation of the test procedures.
- The engineering controls and administrative practices associated with the employee's job assignment.

This training program will be repeated annually. Participating employees are required to complete the Hearing Protection Training Completion Record (Attachment 3). This record will be maintained by the company Training Department in Knoxville. In addition, tailgate safety meetings will be periodically used to instruct employees on the need for hearing protection in designated areas.

The project/location manager will make available to affected employees or their authorized representatives a copy of 29 Code of Federal Regulations (CFR) 1910.95 and will also post a copy in the workplace.

5.5 Control Measures

A straightforward method of controlling sound exposure is to examine the problem in terms of its three basic elements including:

- Sound arises from a source;
- Travels over a path; and
- Affects a receiver or listener.

The solution to a given sound problem might require alteration or modification of any or all of these three basic elements including:

- Modifying the source to reduce its sound output;
- Altering or controlling the transmission path to reduce the sound level reaching the listener; or
- Providing the receiver with hearing protection (but only if the sound source or path cannot be controlled).

5.5.1 Sound Control at the Source. Perhaps the best method for controlling sound at its source is the initial equipment selection process. The following summarizes those features that the buyer should look for and steps to be taken in selecting equipment:

- Low-sound certification.
- Advertisement of "quiet" operation, evidence of sound control design.
- Evidence of "lower" and "slower" operating characteristics.
- Conductance of side-by-side sound tests of equipment.
- Request an "on-site" or "in operation" inspection of mechanical equipment before purchase.

Most mechanical devices are complex sound generators. Though it is impractical to discuss all possible solutions to all sound problems, some general control measures and methods have been provided below:

- Reduce impact or impulse sound by reducing the weight, size, or height of fall of impacting mass.

- Reduce speed in machines and flow velocities and pressure in fluid conveyance systems.

- Balance rotating parts to control machinery sound and vibration of fans, fly wheels, pulleys, cams, shafts, etc.

- Reduce frictional resistance between rotating, sliding, or moving parts by frequent lubrication and proper alignment; static and dynamic balancing of rotating parts; and/or correction of eccentricity or "out-of-roundness" of wheels, gears, rollers, pulleys, etc.

- Reduce resistance in air or fluid systems by use of low flow velocities, smooth surfaces of duct or pipe systems, and long-radius turns and flared sections in pipes, etc., to reduce turbulence.

- Isolate vibration elements in machinery; install motors, pumps, etc., on most massive part of machine; use belt or roller drives in place of gear trains; use flexible hoses and wiring instead of rigid piping and stiff wiring; etc.

- Apply vibration damping materials such as liquid mastics; pads of rubber, felt, foam, or fibrous blankets; or sheet metal viscoelastic laminates or composites to vibrating machine surface.

- Reduce sound leakage from the interior of machines such as compressors by sealing or covering all openings or applying acoustical materials to machine interiors.

5.5.2 Sound Control in the Transmission Path. Another effective way to limit employee exposure to sound is through the use of transmission path controls. These controls may include, but are not necessarily limited to:

- Separation of the sound source and receiver.

- Use of sound absorbing materials on ceiling, floor, or wall surfaces.

- Use of sound barriers and deflectors in the sound path.

- Use of acoustical lining on inside surfaces of passageways, ducts, pipe chases, or electrical channels.

- Use of mufflers or silencers on all gasoline or diesel engines, regardless of size, and particularly on equipment when large quantities of high-pressure, high-velocity gases, liquids, steam, or air are discharged.

- Use vibration isolators and flexible couplers where the sound transmission path is structural in character.

5.5.3 Protection for the Receiver. When engineering controls fail to reduce sound levels to below the action level, hearing protection will be provided. Hearing protection will be provided at no cost to employees and will be replaced as necessary.

Supervisors will ensure that hearing protection is worn by all employees who are exposed at or above the action level. Employees will be given the opportunity to select their hearing protection from a variety of suitable protection devices that attenuate their exposure to the action level or below. Attenuations are determined by subtracting 7 dB from the noise reduction rating (NRR) of the protector and subtracting the remainder from the TWA sound level.

5.6 Recordkeeping

The company will maintain records of all audiometric test records required by this procedure and retain them for at least the following periods:

- Sound exposure measurement records will be retained for two (2) years.

- Audiometric test records will be retained for the duration of the affected employee's employment.

All records required by this procedure will be provided upon request to employees, former employees, representatives designated by the individual employee, and any authorized government representative.

6.0 EXCEPTION PROVISIONS

Variances and exceptions may be requested pursuant to the provisions of Procedure HS013, Health and Safety Procedure Variances.

7.0 CROSS REFERENCES

HS013 Health and Safety Procedure Variances
HS100 Medical Policies and Procedures

8.0 ATTACHMENTS

1. Responsibility Matrix
2. Sound Exposure Computation
3. Hearing Protection Training Completion Record

ATTACHMENT 1
HEARING CONSERVATION PROGRAM

Responsibility Matrix

Action	Procedure Section	*Responsible Party*		
		Health and Safety Representative	**Project/Location Manager**	**Vice President, Health and Safety**
Issue, Revise, and Maintain Procedure	3.1			X
Monitor Employee Exposures	5.2	X		
Provide Training	5.4	X		
Make Available/Post 29 CFR 1910.95	5.4		X	

ATTACHMENT 2

SOUND EXPOSURE COMPUTATION

Computation of Employee Sound Exposure

A. Sound dose is computed using Table 1 as follows:

When the sound level is constant over the entire work shift, the sound dose (D), in percent, is given by:

$$D = 100\ C/T$$

Where C is the total length of the work day, in hours, and T is given in Table 1.

B. When the work shift sound exposure is composed of two or more periods of sound at different levels, the total sound dose over the work day is given by:

$$D = 100\ (C_1/T_1 + C_2/T_2 \ldots + C_n/T_n)$$

Where C_n indicates the total time of exposure at a specific sound level and T_n indicates the reference duration for that level as given by Table 1.

C. The eight-hour TWA sound level, in decibels, may be computed from the dose, in percent, by means of the formula:

$$TWA = 16.61\ \log_{10}\ (D/100) + 90$$

For an eight-hour work shift with the sound level constant over the entire shift, the TWA is equal to the measured sound level.

Conversion Between ☛Dose☚ and ☛8-Hour TWA☚ Sound Level

Sound exposure is usually measured with an audio dosimeter which gives a readout in terms of "dose." Dosimeter readings can be converted to an 8-hour TWA sound level.

In order to convert the reading of a dosimeter into TWA, use Table 2. This table applies to dosimeters that are set to calculate dose or percent exposure according to the relationships in Table 1. So, for example, a dose of 91 percent over an 8-hour day results in a TWA of 89.3 decibels and a dose of 50 percent corresponds to a TWA of 85 decibels.

If the dose as read on the dosimeter is less than or greater than the values found in Table 2, the TWA may be calculated by using the formula:

$$TWA= 16.61\ \log_{10}\ (D/100) + 90$$

Where TWA equals 8-hour TWA sound level and D equals accumulated dose in percent exposure.

Table 1
Permissible Sound Exposure

A-Weighted Sound Level (decibels)	Permitted Duration Per Workday (T) (hours)	A-Weighted Sound Level (decibels)	Permitted Duration Per Workday (T) (hours)
80	32.0	106	0.87
81	27.9	107	0.76
82	24.3	108	0.66
83	21.1	109	0.57
84	18.4	110	0.50
85	16.0	111	0.44
86	13.9	112	0.38
87	12.1	113	0.33
88	10.6	114	0.29
89	9.2	115	0.25
90	8.0	116	0.22
91	7.0	117	0.19
92	6.1	118	0.16
93	5.3	119	0.14
94	4.6	120	0.125
95	4.0	121	0.11
96	3.5	122	0.095
97	3.0	123	0.082
98	2.6	124	0.072
99	2.3	125	0.063
100	2.0	126	0.054
101	1.7	127	0.047
102	1.5	128	0.041
103	1.3	129	0.036
104	1.1	130	0.031
105	1.0		

Table 2
Conversion From ☛Percent Sound Exposure☚ or ☛Dose☚ To ☛8-Hour TWA Sound Level☚

Dose or Percent Sound Exposure (D)	TWA	Dose or Percent Sound Exposure (D)	TWA	Dose or Percent Sound Exposure (D)	TWA	Dose or Percent Sound Exposure (D)	TWA
10	73.4	104	90.3	260	96.9	640	103.4
15	76.3	105	90.4	270	97.2	650	103.5
20	78.4	106	90.4	280	97.4	660	103.6
25	80.0	107	90.5	290	97.7	670	103.7
30	81.3	108	90.6	300	97.9	680	103.8
35	82.4	109	90.6	310	98.2	690	103.9
40	83.4	110	90.7	320	98.4	700	104.0
45	84.2	111	90.8	330	98.6	710	104.1
50	85.0	112	90.8	340	98.8	720	104.2
55	85.7	113	90.9	350	99.0	730	104.3
60	86.3	114	90.9	360	99.2	740	104.4
65	86.9	115	91.1	370	99.4	750	104.5
70	87.4	116	91.1	380	99.6	760	104.6
75	87.9	117	91.1	390	99.8	770	104.7
80	88.4	118	91.2	400	100.0	780	104.8
81	88.5	119	91.3	410	100.2	790	104.9
82	88.6	120	91.3	420	100.4	800	105.0
83	88.7	125	91.6	430	100.5	810	105.1
84	88.7	130	91.9	440	100.7	820	105.2
85	88.8	135	92.2	450	100.8	830	105.3
86	88.9	140	92.4	460	101.0	840	105.4
87	89.0	145	92.7	470	101.2	850	105.4
88	89.1	150	92.9	480	101.3	860	105.5
89	89.2	155	93.2	490	101.5	870	105.6
90	89.2	160	93.2	500	101.6	880	105.7
91	89.3	165	93.6	510	101.8	890	105.8
92	89.4	170	93.8	520	101.9	900	105.8
93	89.5	175	94.0	530	102.0	910	105.9
94	89.6	180	94.2	540	102.2	920	106.0
95	89.6	185	94.4	550	102.3	930	106.1
96	89.7	190	94.6	560	102.4	940	106.2
97	89.8	195	94.8	570	102.6	950	106.2
98	89.9	200	95.0	580	102.7	960	106.3
99	89.9	210	95.4	590	102.8	970	106.4
100	90.0	220	95.7	600	102.9	980	106.5
101	90.1	230	96.0	610	103.0	990	106.5
102	90.1	240	96.3	620	103.2	999	106.6
103	90.2	250	96.6	630	103.3		

ATTACHMENT 3

HEARING PROTECTION TRAINING COMPLETION RECORD

	INITIAL
1. I have been informed about the health hazards associated with exposure to excessive sound levels and its potential effect on hearing.	
2. I have been informed about the types of work that may result in exposure to excessive sound levels, and the necessary protective steps to prevent excessive exposure, including engineering controls and administrative practices.	
3. I understand the purpose for, proper use, and limitations of hearing protection devices, and I have received instructions on selection, fitting, use, and care of such devices.	
4. I have been informed about the purpose of audiometric testing and an explanation of the test procedures.	
5. Copies of the applicable regulations governing occupational exposure to excessive sound have been made available to me.	

PRINT NAME: _____

SIGNATURE: _____

EMPLOYEE NUMBER: _____

DATE: _____

Please File Completed Forms and Forward a Copy to the Knoxville Training Department

PROCEDURE

Subject: CADMIUM COMPLIANCE PLAN

1.0 PURPOSE AND SUMMARY

The purpose of this document is to provide associate protection against cadmium, and to comply with the OSHA requirement for a written compliance plan. It essentially duplicates OSHA language in the Shaw Environmental & Infrastructure, Inc. (Shaw E & I) format and should be referenced (not duplicated) in applicable HASPs.

Key provisions include:

- Definitions
- Exposure monitoring
- Regulated areas
- Methods of compliance
- Compliance program
- Respiratory Protection (exposures > 10 x PEL require quantitative fit testing)
- Personal Protective Equipment
- Hygiene practices
- Medical requirements
- Hazard Communication
- Recordkeeping
- Observation of monitoring
- Reporting requirements

It is the responsibility of the Project Manager (PM) and Site Safety Officer (SSO) to implement the provisions of this document as appropriate for a particular project. This document shall work in conjunction with the site-specific HASP to form a complete site plan. Topics which must be addressed in the site-specific HASP are listed below:

- Describe each operation or task where cadmium is or may be emitted.
- Describe the specific means (work practices, equipment, etc.) that will be used to comply with this plan.
- Describe the technologies considered to keep exposures below the Permissible Exposure Limit.
- Results and sources of any previous air monitoring, if any.
- Briefly describe how and when engineering and administrative controls will be implemented, if any.
- Work practices for emergency situations.
- Personal protective equipment requirements.
- Hygiene facilities.
- Emergency contingency planning.
- Specific identity of the competent person(s).

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The Corporate Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

3.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1.

4.0 DEFINITIONS

Action Level (AL) is defined as an airborne concentration of cadmium of 2.5 micrograms per cubic meter of air (2.5 Fg/m^3), calculated as an 8-hour time-weighted average (TWA).

Associate exposure and **similar language referring to the air cadmium level to which an associate is exposed** means the exposure to airborne cadmium that would occur if the associate were not using respiratory protective equipment.

Authorized person means any person authorized by the company and required by work duties to be present in regulated areas or any person authorized by the OSH Act or regulations issued under it.

Chief means the Chief of the Division of Occupational Safety and Health (OSHA), or designee.

Competent person means a person who is capable of identifying existing and potential cadmium hazards in the workplace and the proper methods to control them in order to protect workers, and has the authority necessary to take prompt corrective measures to eliminate or control such hazards. The duties of a competent person include at least the following: determining prior to the performance of work whether cadmium is present in the workplace; establishing, where necessary, regulated areas and assuring that access to and from those areas is limited to authorized associates; assuring the adequacy of any associate exposure monitoring required by the standard; verifying that associates exposed to air cadmium levels above the PEL wear appropriate personal protective equipment and are trained in the use of appropriate methods of exposure control; verifying that proper hygiene facilities are provided and that workers are trained to use those facilities; and verifying that the engineering controls required by this standard are implemented, maintained in proper operating condition, and functioning properly. Generally, this will be a member of the Shaw E & I HS staff.

Emergency means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which results in an unexpected and potentially hazardous release of cadmium.

Final medical determination is the written medical opinion of the associate=s health status by the examining physician under sections 58.3-.12 or, if multiple physician review under section 5.8.13 or the alternative physician determination under section 5.8.14 is involved, it is the final, written medical finding, recommendation or determination that emerges from that process.

High-efficiency particulate air (HEPA) filter means a filter capable of trapping and retaining at least 99.97 percent of mono-dispersed particles of 0.3 micrometers in diameter.

NIOSH means the Director of the National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health and Human Services, or designee.

Permissible Exposure Limit (PEL) means an airborne concentration of cadmium of 5 micrograms per cubic meter of air (5 Fg/m^3), calculated as an 8-hour time-weighted average exposure (TWA).

Regulated area means an area demarcated by the company where an associate=s exposure to airborne concentrations of cadmium exceeds, or can reasonably be expected to exceed the permissible exposure limit (PEL).

5.0 TEXT

This procedure applies to all occupational exposures to cadmium and cadmium compounds, in all forms, in all construction work where an associate may potentially be exposed to cadmium.

Construction work is defined as work involving construction, alteration and/or repair, including but not limited to the following:

1. Wrecking, demolition or salvage of structures where cadmium or materials containing cadmium are present;

2. Use of cadmium containing-paints and cutting, brazing, burning, grinding or welding on surfaces that were painted with cadmium-containing paints;

3. Construction, alteration, repair, maintenance, or renovation of structures, substrates, or portions thereof, that contain cadmium, or materials containing cadmium;

4. Cadmium welding; cutting and welding cadmium-plated steel; brazing or welding with cadmium alloys;

5. Installation of products containing cadmium;

6. Electrical grounding with cadwelding, or electrical work using cadmium-coated conduit;

7. Maintaining or retrofitting cadmium-coated equipment;

8. Cadmium contamination/emergency cleanup; and

9. Transportation, disposal, storage, or containment of cadmium or materials containing cadmium on the site or location at which construction activities are performed.

5.1 Exposure Monitoring

5.1.1 General. Prior to performance of any construction work where associates may be potentially exposed to cadmium, establish the applicability of this standard by determining whether cadmium is present in the workplace and whether there is the possibility that associate exposures will be at or above the action level. The Project Manager shall designate a competent person who will make this determination. Investigation and material testing techniques shall be used, as appropriate, in the determination. Investigation shall include a review of relevant plans, past reports, material safety data sheets, and other available records, and consultations with the property owner and discussions with appropriate individuals and agencies.

Where cadmium has been determined to be present in the workplace, and it has been determined that there is a possibility the associate=s airborne exposure will be at or above the action level, the competent person shall identify associates potentially exposed to cadmium at or above the action level.

Determinations of associate exposure shall be made from breathing-zone air samples that reflect the monitored associate=s regular, daily 8-hour TWA exposure to cadmium.

Eight-hour TWA exposures shall be determined for each associate on the basis of one or more personal breathing-zone air samples reflecting full shift exposure on each shift, for each job classification, in each work area. Where several associates perform the same job tasks, in the same job classification, on the same shift, in the same work area, and the length, duration, and level of cadmium exposures are similar, sample a representative fraction of the associates instead of all associates in order to meet this requirement. In representative sampling, the company shall sample the associate(s) expected to have the highest cadmium exposures.

5.1.2 Specific. During initial monitoring, where a determination shows the possibility of associate exposure to cadmium at or above the action level, the company shall immediately conduct exposure monitoring that is representative of the exposure for each associate in the workplace who is or may be exposed to cadmium at or above the action level (see 29 CFR 1910.1027, Appendix E).

In addition, if the associate periodically performs tasks that may expose the associate to a higher concentration of airborne cadmium, the associate shall be monitored while performing those tasks.

Where we have objective data, demonstrating that associate exposure to cadmium will not exceed airborne concentrations at or above the action level under the expected conditions of processing, use, or handling, we may rely upon such data instead of implementing initial monitoring.

Where a determination is made that a potentially exposed associate is not exposed to airborne concentrations of cadmium at or above the action level, the PM or SSO shall make a written record of such determination. The record shall include data developed and shall also include the date of determination, and the name and social security number of each associate.

5.1.3 Monitoring Frequency (Periodic Monitoring). If the initial monitoring or periodic monitoring reveal exposures to be at or above the action level, monitoring will be conducted at a frequency and pattern needed to assure that the monitoring results reflect with reasonable accuracy the associate's typical exposure levels, given the variability in the tasks performed, work practices, and environmental conditions on the job site, and to assure the adequacy of respiratory selection and the effectiveness of engineering and work practice controls.

If the initial monitoring or the periodic monitoring indicates that exposures are below the action level and that result is confirmed by the results of another monitoring taken at least seven days later, the SSO may discontinue the monitoring for those associates whose exposures are represented by such monitoring.

5.1.4 Additional Monitoring. The PM shall institute the initial exposure monitoring required whenever there has been a change in the raw materials, equipment, personnel, work practices, or finished products that may result in additional associates being exposed to cadmium at or above the action level or in associates already exposed to cadmium at or above the action level being exposed above the PEL, or whenever the competent person has any reason to suspect that any other change might result in such further exposure.

5.1.5 Associate Notification of Monitoring Results. No later than five working days after the receipt of the results of any monitoring performed under this section, the SSO shall notify each affected associate individually in writing of the results. In addition, within the same time period, the SSO shall post the results of the exposure monitoring in an appropriate location that is accessible to all affected associates.

Wherever monitoring results indicate that associate exposure exceeds the PEL, the SSO shall include in the written notice a statement that the PEL has been exceeded and a description of the corrective action being taken by the company to reduce associate exposure to or below the PEL.

5.1.6 Accuracy of Measurement. The company shall use a method of monitoring and analysis that has an accuracy of not less than plus or minus 25 percent ("25%), with a confidence level of 95 percent, for airborne concentrations of cadmium at or above the action level and the permissible exposure limit.

5.2 Regulated Areas

The company shall establish a regulated area wherever an associate's exposure to airborne concentrations of cadmium is, or can reasonably be expected to be in excess of the permissible exposure limit (PEL).

Regulated areas shall be demarcated from the rest of the workplace in any manner that adequately establishes and alerts associates of the boundaries of the regulated area, including associates who are or may be incidentally in the regulated areas, and that protects persons outside the area from exposure to airborne concentrations of cadmium in excess of the PEL.

Access to regulated areas shall be limited to authorized persons.

Each person entering a regulated area shall be supplied with and required to use a respirator, selected in accordance with section 5.5.

The company shall assure that associates do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas, or carry the products associated with any of these activities into regulated areas or store such products in those areas.

5.3 Methods of Compliance/Compliance Hierarchy

Except as specified below, the PM shall implement engineering and work practice controls to reduce and maintain associate exposure to cadmium at or below the PEL, except to the extent that it can be demonstrated that such controls are not feasible.

The requirement to implement engineering controls to achieve the PEL does not apply where it can be demonstrated that:

1. The associate is only intermittently exposed; and
2. The associate is not exposed above the PEL on 30 or more days per year (12 consecutive months)

Wherever engineering and work practice controls are not sufficient to reduce associate exposure to or below the PEL, the company nonetheless shall implement such controls to reduce exposures to the lowest achievable levels. Such controls shall be supplemented with respiratory protection.

Use of associate rotation as a method of compliance is prohibited.

High speed abrasive disc saws and similar abrasive power equipment shall not be used for work on cadmium or cadmium-containing materials unless they are equipped with appropriate engineering controls to minimize emissions, if the exposure levels are above the PEL.

Materials containing cadmium shall not be applied by spray methods, if exposures are above the PEL, unless associates are protected with supplied-air respirators with full face piece, hood, helmet, suit, operated in positive pressure mode and measures are instituted to limit overspray and prevent contamination of adjacent areas.

Mechanical Ventilation

When ventilation is used to control exposure, measurements that demonstrate the effectiveness of the system in controlling exposure, such as capture velocity, duct velocity, or static pressure shall be made as necessary to maintain its effectiveness.

Measurements of the system's effectiveness in controlling exposure shall be made as necessary within five working days of any change in production, process, or control that might result in a significant increase in associate exposure to cadmium.

If air from exhaust ventilation is recirculated into the workplace, the system shall have a high efficiency filter and be monitored to assure effectiveness.

If mechanical ventilation is used, procedures shall be developed and implemented to minimize associate exposure to cadmium when maintenance of ventilation systems and changing of filters is being conducted.

5.4 Compliance Program

Written compliance programs shall be reviewed and updated at least annually, but as often and as promptly as necessary to reflect significant changes in compliance status or significant changes in the lowest air cadmium level that is technologically feasible.

A competent person shall review the comprehensive compliance program initially and after each change.

5.5 Respirator Protection

5.5.1 General. Where respirators are required, they shall be provided at no cost to the associate and the PM shall assure that they are used in compliance with the requirements. Respirators shall be used in the following circumstances:

- **$** Where exposure levels exceed the PEL, during the time period necessary to install or implement feasible engineering and work practice controls;
- **$** In those maintenance and repair activities and during those brief or intermittent operations where exposures exceed the PEL and engineering and work practice controls are not feasible, or are not required;
- **$** In regulated areas;
- **$** Where all feasible engineering and work practice controls and such controls are not sufficient to reduce exposures to or below the PEL;
- **$** In emergencies;
- **$** Wherever an associate who is exposed to cadmium at or above the action level requests a respirator; and
- **$** Wherever an associate is exposed to cadmium above the PEL and engineering controls are not required.

5.5.2 Respirator Selection. Where respirators are required, the SSO shall select and provide the appropriate respirator as specified below. Respirators will be selected from among those jointly approved as acceptable protection against cadmium dust, fume, and mist by the Mine Safety and Health Administration (MSHA) and by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11 and Shaw E & I Procedure HS601.

The SSO shall provide a powered, air-purifying respirator (PAPR) in lieu of a negative pressure respirator wherever:

(1) An associate entitled to a respirator chooses to use this type of respirator; and

(2) This respirator will provide adequate protection.

(3) **Respirator Program**
Where respiratory protection is required, the provisions of HS601 shall be followed.

RESPIRATORY PROTECTION FOR CADMIUM

Airborne Concentration or Condition of Use[a] (1)	Required Respirator Type[b] (2)
10 X or less	A half mask, air-purifying respirator equipped with a HEPA[c(3)] filter[d](4)
25 X or less	A powered air-purifying respirator ('PAPR') with a loose-fitting hood or helmet equipped with a HEPA filter, or a supplied-air respirator with a loose-fitting hood or helmet face piece operated in the continuous flow mode
50 X or less	A full face piece air-purifying respirator equipped with a HEPA filter, or a powered air-purifying respirator with a tight-fitting half mask equipped with a HEPA filter, or a supplied air respirator with a tight-fitting half mask operated in the continuous flow mode
250 X or less	A powered air-purifying respirator with a tight-fitting full face piece equipped with a HEPA filter, or supplied-air respirator with a tight-fitting full face piece operated in the continuous flow mode
1000 X or less	A supplied-air respirator with half mask or full face piece operated in the pressure demand or other positive pressure mode
1000 X or unknown	A self-contained breathing apparatus with unknown concentrations, a full face piece operated in the pressure demand or other positive pressure mode, or a supplied-air respirator with a full face piece operated in the pressure demand or other positive pressure mode and equipped with an auxiliary escape type self-contained breathing apparatus operated in the pressure demand mode

[a] Concentrations expressed as multiple of the PEL.

[b] Respirators assigned for higher environmental concentrations may be used at lower exposure levels. Quantitative fit testing is required for all tight-fitting air purifying respirators where airborne concentration of cadmium exceeds 10 times the TWA PEL (10 x 5 m/mŠ3‹ = 50 m/mŠ3‹). A full face piece respirator is required when eye irritation is experienced.

[c] HEPA means High Efficiency Particulate Air.

[d] Fit testing, qualitative or quantitative, is required.

5.5.3 Respirator Fit Testing. For each associate wearing a tight-fitting, air purifying respirator (either negative or positive pressure) who is exposed to airborne concentrations of cadmium that do not exceed 10 times the PEL (10 x 5 mg/m3 = 50 mg/m3), either quantitative or qualitative fit test will be performed at the time of initial fitting and at least annually thereafter. If quantitative fit testing is used for a negative pressure respirator, a fit factor that is at least 10 times the protection factor for that class of respirators shall be achieved at testing.

For each associate wearing a tight-fitting air purifying respirator (either negative or positive pressure) who is exposed to airborne concentrations of cadmium that exceed 10 times the PEL (10 x 5 mg/m3 = 50 mg/m3), the company shall perform quantitative fit testing at the time of initial fitting and at least annually thereafter. For negative-pressure respirators, a fit factor that is at least ten times the protection factor for that class of respirators shall be achieved during quantitative fit testing.

For each associate wearing a tight-fitting, supplied-air respirator or self-contained breathing apparatus, the company shall perform quantitative fit testing at the time of initial fitting and at least annually thereafter. This shall be accomplished by fit testing an air purifying respirator of identical type face piece, make, model, and size as the supplied air respirator or self-contained breathing apparatus that is equipped with HEPA filters and tested as a surrogate (substitute) in the negative pressure mode. A fit factor that is at least 10 times the protection factor for that class of respirators shall be achieved during quantitative fit testing. A supplied-air respirator or self-contained breathing apparatus with the same type face piece, make, model, and size as the air purifying respirator with which the associate passed the quantitative fit test may then be used by that associate up to the protection factor listed for that class of respirators.

Fit testing shall be conducted in accordance with 29 CFR 1910.1027, Appendix C.

Emergency Situations

Each project-specific HASP shall provide for dealing with emergency situations involving substantial releases of airborne cadmium. The plan shall include provisions for the use of appropriate respirators and personal protective equipment. In addition, associates not essential to correcting the emergency situation shall be restricted from the area and normal operations halted in that area until the emergency is abated.

5.6 Protective Work Clothing and Equipment

5.6.1 Provision and Use. If an associate is exposed to airborne cadmium above the PEL or where skin or eye irritation is associated with cadmium exposure at any level, the PM shall provide at no cost to the associate, and assure that the associate uses, appropriate protective work clothing and equipment that prevent

contamination of the associate. Protective work clothing and equipment includes, but is not limited to:

- **$** Coveralls or similar full-body work clothing;
- **$** Gloves, head coverings, and boots or foot coverings; and
- **$** Face shields, vented goggles, or other appropriate protective equipment.

5.6.2 Removal and Storage. Associates shall remove all protective clothing and equipment contaminated with cadmium at the completion of the work shift and do so only in change rooms.

No associate may take cadmium-contaminated protective clothing or equipment from the workplace, except for associates authorized to do so for purposes of laundering, cleaning, maintaining, or disposing of cadmium-contaminated protective clothing and equipment at an appropriate location or facility away from the workplace.

Contaminated protective clothing and equipment, when removed for laundering, cleaning, maintenance, or disposal, must be placed and stored in sealed, impermeable bags or other closed, impermeable containers that are designed to prevent dispersion of cadmium dust.

Containers of contaminated protective clothing and equipment that are to be taken out of the change rooms or the workplace for laundering, cleaning, maintenance or disposal shall bear labels in accordance with section 5.9.3.

5.6.3 Cleaning, Replacement, and Disposal. Provide the protective clothing and equipment in a clean and dry condition as often as necessary to maintain its effectiveness, but in any event at least weekly. The PM is responsible for cleaning and laundering the protective clothing and equipment to maintain its effectiveness and is also responsible for disposing of such clothing and equipment

The PM also is responsible for repairing or replacing required protective clothing and equipment as needed to maintain its effectiveness. When rips or tears are detected while an associate is working they shall be immediately mended, or the worksuit shall be immediately replaced.

The removal of cadmium from protective clothing and equipment by blowing, shaking, or any other means that disperses cadmium into the air is prohibited.

Laundering of contaminated clothing or cleaning of contaminated equipment in the workplace will be done in a manner that prevents the release of airborne cadmium in excess of the permissible exposure limit.

Any person who launders or cleans protective clothing or equipment contaminated with cadmium will be informed of the potentially harmful effects

of exposure to cadmium, and that the clothing and equipment should be laundered or cleaned in a manner to effectively prevent the release of airborne cadmium in excess of the PEL.

5.7 Hygiene Areas and Practices

5.7.1 General. For associates whose airborne exposure to cadmium is above the PEL, provide clean change rooms, handwashing facilities, showers, and lunchroom facilities.

5.7.2 Change Rooms. Change rooms must be equipped with separate storage facilities for street clothes and for protective clothing and equipment, which are designed to prevent dispersion of cadmium and contamination of the associate's street clothes (see also 29 CFR 1910.141).

5.7.3 Showers and Handwashing Facilities. Associates whose airborne exposure to cadmium is above the PEL must shower during the end of the work shift.

Associates who are exposed to cadmium above the PEL must wash their hands and faces prior to eating, drinking, smoking, chewing tobacco or gum, or applying cosmetics.

5.7.4 Lunchroom Facilities. Lunchroom facilities must be readily accessible to associates, tables for eating must be maintained free of cadmium, and no associate in a lunchroom facility may be exposed at any time to cadmium at or above a concentration of 2.5 mg/m3.

Associates may not enter lunchroom facilities with protective work clothing or equipment unless surface cadmium has been removed from the clothing and equipment by HEPA vacuuming or some other method that removes cadmium dust without dispersing it.

5.7.5 Housekeeping. All surfaces shall be maintained as free as practicable of accumulations of cadmium.

All spills and sudden releases of material containing cadmium shall be cleaned up as soon as possible.

Surfaces contaminated with cadmium shall, wherever possible, be cleaned by vacuuming or other methods that minimize the likelihood of cadmium becoming airborne.

HEPA-filtered vacuuming equipment or equally effective filtration methods shall be used for vacuuming. The equipment shall be used and emptied in a manner that minimizes the reentry of cadmium into the workplace.

Shoveling, dry or wet sweeping, and brushing may be used only where vacuuming or other methods that minimize the likelihood of cadmium becoming airborne have been tried and found not to be effective.

Compressed air shall not be used to remove cadmium from any surface unless the compressed air is used in conjunction with a ventilation system designed to capture the dust cloud created by the compressed air.

Waste, scrap, debris, bags, containers, personal protective equipment, and clothing contaminated with cadmium and consigned for disposal shall be collected and disposed of in sealed impermeable bags or other closed, impermeable containers. These bags and containers shall be labeled in accordance with Section 5.9.3.

5.8 Medical Surveillance

5.8.1 General. Currently exposed - A medical surveillance program shall be instituted for all associates who are or may be exposed at or above the action level and all associates who perform the following tasks, operations or jobs: remediation of cadmium containing wastes, electrical grounding with cadwelding; cutting, brazing, burning, grinding or welding on surfaces that were painted with cadmium -containing paints; electrical work using cadmium-coated conduit; use of cadmium containing paints; cutting and welding cadmium-plated steel; brazing or welding with cadmium alloys; fusing of reinforcing steel by cadmium welding; maintaining or retrofitting cadmium-coated equipment; and, wrecking and demolition where cadmium is present. A medical surveillance program will not be required if the associate:

- Is not currently exposed by the company to airborne concentrations of cadmium at or above the action level on 30 or more days per year (twelve consecutive months); and,
- Is not currently exposed by the company in those tasks on 30 or more days per year (twelve consecutive months).

Previously exposed - A medical surveillance program shall be instituted for all associates who might previously have been exposed to cadmium prior to the effective date of this standard in tasks specified under above, unless the company demonstrates that the associate did not in the years prior to the effective date of this section work in those tasks with exposure to cadmium for an aggregated total of more than 12 months.

To determine an associate's fitness for using a respirator, the company shall provide the limited medical examination specified in section 5.5.

The company shall assure that all medical examinations and procedures required by this section are performed by or under the supervision of a licensed physician, who has read and is familiar with the health effects section of 29 CFR 1910.1027,

Appendix A, the regulatory text of this section, the protocol for sample handling and lab selection in 29 CFR 1910.1027, Appendix F, and the questionnaire of 29 CFR 1910.1027, Appendix D.

The company shall provide the medical surveillance required by this section, including multiple physician review without cost to associates, and at a time and place that is reasonable and convenient to associates.

The company shall assure that the collecting and handling of biological samples of cadmium in urine (CdU), cadmium in blood (CdB), and beta-2 microglobulin in urine (b2-M) taken from associates under this section is done in a manner that assures their reliability and that analysis of biological samples of cadmium in urine (CdU), cadmium in blood (CdB), and beta-2 microglobulin in urine (b2-M) taken from associates under this section is performed in laboratories with demonstrated proficiency to perform the particular analysis. (See 29 CFR 1910.1027, Appendix F)

5.8.2 Initial Examination. For associates covered by medical surveillance, thecompany shall provide an initial medical examination. The examination shall beprovided to those associates within 30 days after initial assignment to a job with exposure to cadmium.

The initial medical examination shall include:

- A detailed medical and work history, with emphasis on:
- Past, present, and anticipated future exposure to cadmium;
- Any history of renal, cardiovascular, respiratory, hematopoietic, reproductive, and/or musculo-skeletal system dysfunction;
- Current usage of medication with potential nephrotoxic side-effects;
- Smoking history and current status; and
- Biological monitoring that includes the following tests:

    a. Cadmium in urine (CdU), standardized to grams of creatinine (g/Cr);

    b. Beta-2 microglobulin in urine (b2-M), standardized to grams of creatinine (g/Cr), with pH specified, as described in 29 CFR 1910.1027, Appendix F; and

    c. Cadmium in blood (CdB), standardized to liters of whole blood (lwb).

Recent Examination: An initial examination is not required to be provided if adequate records show that the associate has been examined in accordance with the requirements of this section within the past 12 months. In that case, such records shall be maintained as part of the associate's medical record and the prior exam shall be treated as if it were an initial examination.

5.8.3 Actions Triggered by Initial Biological Monitoring. If the results of the biological monitoring tests in the initial examination show the associate's CdU level to be at or below 3 mg/g Cr, b2-M level to be at or below 300 mg/g Cr and CdB level to be at or below 5 mg/lwb, then:

1. For associates who are subject to medical surveillance because of current or anticipated exposure to cadmium, the company shall provide the minimum level of periodic medical surveillance.

2. For associates who are subject to medical surveillance because of prior but not current exposure, the company shall provide biological monitoring for CdU, b2-M, and CdB within one year after the initial biological monitoring and then follow the requirements for periodic medical surveillance.

For all associates who are subject to initial medical surveillance if the results of the initial biological monitoring tests show the level of CdU to exceed 3 mg/g Cr, the level of b2-M to be in excess of 300 mg/g Cr, or the level of CdB to be in excess of 5 mg/lwb, the company shall:

1. Within two weeks after receipt of biological monitoring results, reassess the associate's occupational exposure to cadmium as follows:

   - **$** Reassess the associate's work practices and personal hygiene;
   - **$** Reevaluate the associate's respirator use, if any, and the respirator program;
   - **$** Review the hygiene facilities;
   - **$** Reevaluate the maintenance and effectiveness of the relevant engineering controls; and
   - **$** Assess the associate's smoking history and status;

2. Within 30 days after the exposure reassessment, take reasonable steps to correct any deficiencies found in the reassessment that may be responsible for the associate's excess exposure to cadmium; and,

3. Within 90 days after receipt of biological monitoring results, provide a full medical examination to the associate. After completing the medical examination, the examining physician shall determine in a written medical opinion whether to medically remove the associate. If the physician determines that medical removal is not necessary, then until the associate's CdU level falls to or below 3 mg/g Cr, b2-M level falls to or

below 300 mg/g Cr and CdB level falls to or below 5 mg/lwb, the company shall:

- **$** Provide biological monitoring in accordance with section 5.8.2. on a semiannual basis; and

- **$** Provide annual medical examinations in accordance with section 5.8.4.

For all associates who are subject to medical surveillance under section 5.8.1 (Current), if the results of the initial biological monitoring tests show the level of CdU to be in excess of 15 mg/g Cr, or the level of CdB to be in excess of 15 mg/lwb, or the level of b2-M to be in excess of 1,500 mg/g Cr, the company shall comply with the requirements of section 5.8.3. Within 90 days after receipt of biological monitoring results, the company shall provide a full medical examination. After completing the medical examination, the examining physician shall determine in a written medical opinion whether to medically remove the associate. However, if the initial biological monitoring results and the biological monitoring results obtained during the medical examination both show that: CdU exceeds 15 mg/g Cr, or CdB exceeds 15 mg/lwb; or b2-M exceeds 1500 mg/g Cr, and in addition CdU exceeds 3 mg/g Cr or CdB exceeds 5 mg/liter of whole blood, then the physician shall medically remove the associate from exposure to cadmium at or above the action level. If the second set of biological monitoring results obtained during the medical examination does not show that a mandatory removal trigger level has been exceeded, then the associate is not required to be removed by the mandatory provisions of this section. If the associate is not required to be removed by the mandatory provisions of this section or by the physician's determination, then until the associate's CdU level falls to or below 3 mg/g Cr, b2-M level falls to or below 300 mg/g Cr and CdB level falls to or below 5 mg/lwb, the company shall:

1. Periodically reassess the associate's occupational exposure to cadmium;
2. Provide biological monitoring on a quarterly basis; and
3. Provide semiannual medical examinations.

For all associates to whom medical surveillance is provided, beginning on January 1, 1999, whenever the results of initial biological monitoring tests show the associate's CdU level to be in excess of 7 mg/g Cr, or b2-M level to be in excess of 750 mg/g Cr, or CdB level to be in excess of 10 mg/lwb, the company shall comply with the requirements of section 5.8.3 for initial surveillance. Within 90 days after receipt of biological monitoring results, the company shall provide a full medical examination to the associate. After completing the medical examination, the examining physician shall determine in a written medical opinion whether to medically remove the associate. However, if the initial biological monitoring results and the biological monitoring results obtained during the medical examination both show that: CdU exceeds 7 mg/g Cr; or CdB exceeds 10 mg/lwb; or b2-M exceeds 750 mg/g Cr, and in addition

CdU exceeds 3 mg/g Cr or CdB exceeds 5 mg/liter of whole blood, then the physician shall medically remove the associate from exposure to cadmium at or above the action level. If the second set of biological monitoring results obtained during the medical examination does not show that a mandatory removal trigger level has been exceeded, then the associate is not required to be removed by the mandatory provisions of this section. If the associate is not required to be removed by the mandatory provisions of this section or by the physician's determination, then until the associate's CdU level falls to or below 3 mg/g Cr, b2-M level falls to or below 300 mg/g Cr and CdB level falls to or below 5 mg/lwb, the company shall:

1. Periodically reassess the associate's occupational exposure to cadmium;
2. Provide biological monitoring on a quarterly basis; and
3. Provide semiannual medical examinations.

5.8.4 Periodic Medical Surveillance. For each associate who is covered by initial medical surveillance because of current or anticipated exposure to cadmium, the company shall provide at least the minimum level of periodic medical surveillance, which consists of periodic medical examinations and periodic biological monitoring. A periodic medical examination shall be provided within one year after the initial examination and thereafter at least biennially. Biological sampling shall be provided at least annually either as part of a periodic medical examination or separately as periodic biological monitoring.

The periodic medical examination shall include:

1. A detailed medical and work history, or update thereof, with emphasis on: past, present and anticipated future exposure to cadmium; smoking history and current status; reproductive history; current use of medications with potential nephrotoxic side-effects; any history of renal, cardiovascular, respiratory, hematopoietic, and/or musculo-skeletal system dysfunction; and as part of the medical and work history, for associates who wear respirators, questions 3-11 and 25-32 in 29 CFR 1910.1027, Appendix D;

2. A complete physical examination with emphasis on: blood pressure, the respiratory system, and the urinary system;

3. A 14 inch by 17 inch, or a reasonably standard sized posterior-anterior chest X-ray (after the initial X-ray, the frequency of chest X-rays is to be determined by the examining physician);

4. Pulmonary function tests, including forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV1);

5. Biological monitoring;

6. Blood analysis, including blood urea nitrogen, complete blood count, and serum creatinine;

7. Urinalysis, including the determination of albumin, glucose, and total and low molecular weight proteins;

8. For males over 40 years old, prostate palpation, or other at least as effective diagnostic test(s); and

9. Any additional tests or procedures deemed appropriate by the examining physician.

Periodic biological monitoring shall be provided in accordance with section 5.8.3.

If the results of periodic biological monitoring or the results of biological monitoring performed as part of the periodic medical examination show the level of the associate's CdU, b2-M, or CdB to be in excess of the levels specified in sections 5.8.1; or, beginning on January 1, 1999, in excess of the levels specified, the company shall take the appropriate actions specified in section 5.8.3.

For previously exposed associates:

1. If the associate's levels of CdU did not exceed 3 mg/g Cr, CdB did not exceed 5 mg/lwb, and b2-M did not exceed 300 mg/g Cr in the initial biological monitoring tests, and if the results of the followup biological monitoring within one year after the initial examination confirm the previous results, the company may discontinue all periodic medical surveillance for that associate.

2. If the initial biological monitoring results for CdU, CdB, or b2-M were in excess of the levels specified in section 5.8.3, but subsequent biological monitoring results show that the associate's CdU levels no longer exceed 3 mg/g Cr, CdB levels no longer exceed mg/lwb, and b2-M levels no longer exceed 30 mg/g Cr, the company shall provide biological monitoring for CdU, CdB, and b2-M within one year after these most recent biological monitoring results. If the results of the followup biological monitoring within one year confirm the previous results, the company may discontinue all periodic medical surveillance for that associate.

3. However, if the results of the follow-up tests indicate that the level of the associate's CdU, b2-M, or CdB exceeds these same levels, the company is required to provide annual medical examinations until the results of biological monitoring are consistently below these levels or the examining physician determines in a written medical opinion that further medical surveillance is not required to protect the associate's health.

A routine, biennial medical examination is not required to be provided if adequate medical records show that the associate has been examined in accordance with the requirements of section 5.8.4 within the past 12 months. In that case, such records shall be maintained by the company as part of the associate's medical record, and the next routine, periodic medical examination shall be made available to the associate within two years of the previous examination.

5.8.5 Actions Triggered by Medical Examinations. If the results of a medical examination carried out in accordance with this section indicate any laboratory or clinical finding consistent with cadmium toxicity that does not require action under sections 5.8.2-4, the company shall take the following steps and continue to take them until the physician determines that they are no longer necessary.

1. Periodically reassess: the associate's work practices and personal hygiene; the associate's respirator use, if any; the associate's smoking history and status; the respiratory protection program; the hygiene facilities; the maintenance and effectiveness of the relevant engineering controls; and take all reasonable steps to correct the deficiencies found in the reassessment that may be responsible for the associate's excess exposure to cadmium.

2. Provide semi-annual medical reexaminations to evaluate the abnormal clinical sign(s) of cadmium toxicity until the results are normal or the associate is medically removed; and

3. Where the results of tests for total proteins in urine are abnormal, provide a more detailed medical evaluation of the toxic effects of cadmium on the associate's renal system.

5.8.6 Examination for Respirator Use. To determine an associate's fitness for respirator use, the company shall provide a medical examination that includes the elements specified below. This examination shall be provided prior to the associate's being assigned to a job that requires the use of a respirator to any associate without a medical examination within the preceding 12 months that satisfies the requirements of this section. It will include:

1. A detailed medical and work history, or update thereof, with emphasis on: past exposure to cadmium; smoking history and current status; any history of renal, cardiovascular, respiratory, hematopoietic, and/or musculo-skeletal system dysfunction; a description of the job for which the respirator is required; and questions 3-11 and 25-32 in 29 CFR 1910.1027, Appendix D;

2. A blood pressure test;

3. Biological monitoring of the associate's levels of CdU, CdB and b2-M, unless such results already have been obtained within the twelve months; and

4. Any other test or procedure that the examining physician deems appropriate.

After reviewing all the information obtained from the medical examination, the physician shall determine whether the associate is fit to wear a respirator.

Whenever an associate has exhibited difficulty in breathing during a respirator fit test or during use of a respirator, the company, as soon as possible, shall provide the associate with a periodic medical examination to determine the associate's fitness to wear a respirator.

Where the results of the examination are abnormal, medical limitation or prohibition of respirator use shall be considered. If the associate is allowed to wear a respirator, the associate's ability to continue to do so shall be periodically evaluated by a physician.

5.8.7 Emergency Examinations. In addition to the medical surveillance, the company shall provide a medical examination as soon as possible to any associate who may have been acutely exposed to cadmium because of an emergency.

The examination shall include the requirements of section 5.8.4, with emphasis on the respiratory system, other organ systems considered appropriate by the examining physician, and symptoms of acute overexposure, per 29 CFR 1910.1027, Appendix A.

5.8.8 Termination of Employment Examination. At termination of employment, the company shall provide a medical examination, including a chest X-ray where necessary, to any associate to whom at any prior time the company was required to provide medical surveillance (5.8.1 or .7) However, if the last examination satisfied the requirements and was less than six months prior to the date of termination, no further examination is required unless otherwise specified in sections 5.8.3 or .5.

In addition, if the company has discontinued all periodic medical surveillance under 5.8.4, no termination of employment medical examination is required.

5.8.9 Information Provided to the Physician. The company shall provide the following information to the examining physician:

$ A copy of this standard and appendices;

$ A description of the affected associate's former, current, and anticipated duties as they relate to the associate's occupational exposure to cadmium;

- The associate's former, current, and anticipated future levels of occupational exposure to cadmium;
- A description of any personal protective equipment, including respirators, used or to be used by the associate, including when and for how long the associate has used that equipment; and
- Relevant results of previous biological monitoring and medical examinations.

5.8.10 Physician's Written Medical Opinion. The company shall promptly obtain a written, signed medical opinion from the examining physician for each medical examination performed on each associate. This written opinion shall contain:

- The physician's diagnosis for the associate;
- The physician's opinion as to whether the associate has any detected medical condition(s) that would place the associate at increased risk of material impairment to health from further exposure to cadmium, including any indications of potential cadmium toxicity;
- The results of any biological or other testing or related evaluations that directly assess the associate's absorption of cadmium;
- Any recommended removal from, or limitation to, the activities or duties of the associate or to the associate's use of personal protective equipment, such as respirators; and
- A statement that the physician has clearly and carefully explained to the associate the results of the medical examination, including all biological monitoring results and any medical conditions related to cadmium exposure that requires further evaluation or treatment, and any limitation on the associate's diet or use of medications.

The company shall promptly obtain a copy of the results of any biological monitoring provided by the company to an associate independently of a medical examination, and, in lieu of a written medical opinion, an explanation sheet explaining those results.

The company shall instruct the physician not to reveal orally or in the written medical opinion given to the company specific findings or diagnoses unrelated to occupational exposure to cadmium.

5.8.11 Medical Removal Protection (MRP). The company shall temporarily remove an associate from work where there is excess exposure to cadmium on each occasion that medical removal is required under sections 5.8.3, .4, or .6 and on

each occasion that a physician determines in a written medical opinion that the associate should be removed from such exposure. The physician's determination may be based on biological monitoring results, inability to wear a respirator, evidence of illness, other signs or symptoms of cadmium-related dysfunction or disease, or any other reason deemed medically sufficient by the physician.

The company shall medically remove an associate in accordance with section 5.8.11 regardless of whether at the time of removal a job is available into which the removed associate may be transferred.

Whenever an associate is medically removed under section 5.8.11, the company shall transfer the removed associate to a job where the exposure to cadmium is within the permissible levels specified in that section as soon as one becomes available.

For any associate who is medically removed under the provisions of section 5.8.11, the company shall provide follow-up medical examinations semi-annually until, in a written medical opinion, the examining physician determines that either the associate may be returned to his/her former job status or the associate must be permanently removed from excess cadmium exposure.

The company may not return an associate who has been medically removed for any reason to his/her former job status until a physician determines in a written medical opinion that continued medical removal is no longer necessary to protect the associate's health.

Where an associate is found unfit to wear a respirator, the company shall remove the associate from work where exposure to cadmium is above the PEL.

Where removal is based upon any reason other than the associate's inability to wear a respirator, the company shall remove the associate from work where exposure to cadmium is at or above the action level.

Except as specified in section 5.8.11, no associate who was removed because his/her level of CdU, CdB and/or b2-M exceeded the trigger levels in sections 5.8.3 or .4 may be returned to work with exposure to cadmium at or above the action level until the associate's levels of CdU fall to or below 3 m/g Cr, CdB fall to or below 5 m/lwb, and b2-M fall to or below 300 m/g Cr.

However, when in the examining physician's opinion continued exposure to cadmium will not pose an increased risk to the associate's health and there are special circumstances that make continued medical removal an inappropriate remedy, the physician shall fully discuss these matters with the associate, and then in a written determination may return a worker to his/her former job status despite what would otherwise be unacceptably high biological monitoring results. Thereafter and until such time as the associate's biological monitoring results have decreased to levels where he/she could have been returned to his/her former

job status, the returned associate shall continue medical surveillance as if he/she were still on medical removal. Until such time, the associate is no longer subject to mandatory medical removal. Subsequent questions regarding the associate's medical removal shall be decided solely by a final medical determination.

Where the company, although not required by this section to do so, removes an associate from exposure to cadmium or otherwise places limitations on an associate due to the effects of cadmium exposure on the associate's medical condition, the company shall provide the same medical removal protection benefits to that associate as would have been provided had the removal been required under section 5.8.11.

5.8.12 Medical Removal Protection Benefits. The company shall provide medical removal protection benefits to an associate for up to a maximum of 18 months each time, and while the associate is temporarily medically removed.

For purposes of this section, the requirement that the company provide medical removal protection benefits means that the company shall maintain the total normal earnings, seniority, and all other associate rights and benefits of the removed associate, including the associate's right to his/her former job status, as if the associate had not been removed from the associate's job or otherwise medically limited.

Where, after 18 months on medical removal because of elevated biological monitoring results, the associate's monitoring results have not declined to a low enough level to permit the associate to be returned to his/her former job status:

1. The company shall make available to the associate a medical examination pursuant to this section in order to obtain a final medical determination as to whether the associate may be returned to his/her former job status or must be permanently removed from excess cadmium exposure; and

2. The company shall assure that the final medical determination indicates whether the associate may be returned to his/her former job status and what steps, if any, should be taken to protect the associate's health;

The company may condition the provision of medical removal protection benefits upon the associate's participation in medical surveillance provided in accordance with this section.

5.8.13 Multiple Physician Review. If the company selects the initial physician to conduct any medical examination or consultation provided to an associate under this section, the associate may designate a second physician to:

1. Review any findings, determinations, or recommendations of the initial physician; and

2. Conduct such examinations, consultations, and laboratory tests as the second physician deems necessary to facilitate this review.

The company shall promptly notify an associate of the right to seek a second medical opinion after each occasion that an initial physician provided by the company conducts a medical examination or consultation pursuant to this section. The company may condition its participation in, and payment for, multiple physician review upon the associate doing the following within fifteen (15) days after receipt of this notice, or receipt of the initial physician's written opinion, whichever is later:

1. Informing the company that he or she intends to seek a medical opinion; and
2. Initiating steps to make an appointment with a second physician.

If the findings, determinations, or recommendations of the second physician differ from those of the initial physician, then the company and the associate shall assure that efforts are made for the two physicians to resolve any disagreement.

If the two physicians have been unable to quickly resolve their disagreement, then the company and the associate, through their respective physicians, shall designate a third physician to:

1. Review any findings, determinations, or recommendations of the other two physicians; and

2. Conduct such examinations, consultations, laboratory tests, and discussions with the other two physicians as the third physician deems necessary to resolve the disagreement among them.

The company shall act consistently with the findings, determinations, and recommendations of the third physician, unless the company and the associate reach an agreement that is consistent with the recommendations of at least one of the other two physicians.

5.8.14 Alternate Physician Determination. The company and an associate may agree upon the use of any alternate form of physician determination in lieu of the multiple physician review, so long as the alternative is expeditious and at least as protective of the associate.

5.8.15 Information the Company Must Provide the Associate. The company shall provide a copy of the physician's written medical opinion to the examined associate within five working days after receipt thereof.

The company shall provide the associate with a copy of the associate's biological monitoring results and an explanation sheet explaining the results within five working days after receipt thereof.

Within 30 days after a request by an associate, the company shall provide the associate with the information the company is required to provide the examining physician.

5.8.16 Reporting. In addition to other medical events that are required to be reported on the OSHA Form No. 200, the company shall report any abnormal condition or disorder caused by occupational exposure to cadmium associated with employment as specified in Chapter (V)(E) of the Reporting Guidelines for Occupational Injuries and Illnesses.

5.9 Communication of Cadmium Hazards to Associates

5.9.1 General. In communications concerning cadmium hazards, companies shall comply with the requirements of the Hazard Communication Standard, including but not limited to the requirements concerning warning signs and labels, material safety data sheets (MSDS), and associate information and training.

5.9.2 Warning Signs. Warning signs shall be provided and displayed in regulated areas. In addition, warning signs shall be posted at all approaches to regulated areas so that an associate may read the signs and take necessary protective steps before entering the area.

Warning signs required by this section shall bear the following information:

DANGER
CADMIUM
CANCER HAZARD
CAN CAUSE LUNG AND KIDNEY DISEASE
AUTHORIZED PERSONNEL ONLY
RESPIRATORS REQUIRED IN THIS AREA

The company shall ensure that signs required by this section are illuminated, cleaned, and maintained as necessary so that the legend is readily visible.

5.9.3 Warning Labels. Shipping and storage containers containing cadmium, cadmium compounds, or cadmium contaminated clothing, equipment, waste, scrap, or debris shall bear appropriate warning labels, as specified in Section 5.9.2.

The warning labels shall include at least the following information:

DANGER - CONTAINS CADMIUM - CANCER HAZARD - AVOID CREATING DUST - CAN CAUSE LUNG AND KIDNEY DISEASE

Where feasible, installed cadmium products shall have a visible label or other indication that cadmium is present.

5.9.4 Associate Information and Training. The company shall institute a training program for all associates who are potentially exposed to cadmium, assure associate participation in the program, and maintain a record of the contents of such program.

Training shall be provided prior to or at the time of initial assignment to a job involving potential exposure to cadmium and at least annually thereafter.

The company shall make the training program understandable to the associate and shall assure that each associate is informed of the following:

- The health hazards associated with cadmium exposure, with special attention to the information incorporated in 29 CFR 1910.1027, Appendix A;
- The quantity, location, manner of use, release, and storage of cadmium in the workplace and the specific nature of operations that could result in exposure to cadmium, especially exposures above the PEL;
- The engineering controls and work practices associated with the associate's job assignment;
- The measures associates can take to protect themselves from exposure to cadmium, including modification of such habits as smoking and personal hygiene, and specific procedures the company has implemented to protect associates from exposure to cadmium such as appropriate work practices, emergency procedures, and the provision of personal protective equipment;
- The purpose, proper selection, fitting, proper use, and limitations of respirators and protective clothing;
- The purpose and a description of the medical surveillance program required by section 5.8;
- The contents of this procedure and its attachments, and
- The associate's rights of access to records.

The company shall make a copy of this section and its appendices readily available to all affected associates and shall provide a copy without cost if requested.

In a multi-company workplace, if the company produces, uses, or stores cadmium in a manner that may expose employees of other companies to cadmium, those companies will be notified of the potential hazard.

5.10 Recordkeeping

5.10.1 Exposure Monitoring. The company shall establish and keep an accurate record of all air monitoring for cadmium in the workplace.

This record shall include at least the following information:

- The monitoring date, shift, duration, air volume, and results in terms of an 8-hour TWA of each sample taken, and if cadmium is not detected, the detection level;
- The name, social security number, and job classification of all associates monitored and of all other associates whose exposures the monitoring result is intended to represent, including, where applicable, a description of how it was determined that the associate's monitoring result could be taken to represent other associate's exposures;
- A description of the sampling and analytical methods used and evidence of their accuracy;
- The type of respiratory protective device, if any, worn by the monitored associate and by any other associate whose exposure the monitoring result is intended to represent;
- A notation of any other conditions that might have affected the monitoring results.
- Any exposure monitoring or objective data that were used and the levels.

The company shall maintain this record for at least thirty (30) years.

5.10.2 Objective Data for Exemption from Requirement for Initial Monitoring. For purposes of this section, objective data are information demonstrating that a particular product or material containing cadmium or a specific process, operation, or activity involving cadmium cannot release dust or fumes in concentrations at or above the action level even under the worst-case release conditions. Objective data can be obtained from an industry-wide study or from laboratory product test results from manufacturers of cadmium-containing products or materials. The data the company uses from an industry-wide survey

must be obtained under workplace conditions closely resembling the processes, types of material, control methods, work practices and environmental conditions in the company's current operations.

The company shall maintain the record of the objective data relied upon for at least 30 years.

5.10.3 Medical Surveillance. Records shall be maintained per Shaw E & I Procedure HS102.

5.10.4 Training. The company shall certify that associates have been trained by preparing a certification record which includes the identity of the person trained, the signature of the company or the person who conducted the training, and the date the training was completed. The certification records shall be prepared at the completion of training and shall be maintained on file for one (1) year beyond the date of training of that associate.

5.10.5 Availability. Access to records shall be per Shaw E & I Procedure HS102. Within 15 days after a request, the company shall make an associate's medical records available for examination and copying to the subject associate, to designated representatives, to anyone having the specific written consent of the subject associate, and after the associate's death or incapacitation, to the associate's family members.

5.11 Observation of Monitoring

5.11.1 Associate Observation. The company shall provide affected associates or their designated representatives an opportunity to observe any monitoring of associate exposure to cadmium.

5.11.2 Observation Procedures. When observation of monitoring requires entry into an area where the use of protective clothing or equipment is required, the company shall provide the observer with that clothing and equipment and shall assure that the observer uses such clothing and equipment and complies with all other applicable safety and health procedures.

5.12 Reporting Requirements

5.12.1 Use (California Only). All uses of cadmium that are covered by this procedure and require the establishment of regulated areas shall be reported in writing to Cal/OSHA within 15 calendar days. Any changes in the reported information shall be similarly reported in writing within 15 calendar days of such change. The report shall include:

- The name of the company and the address of each workplace where regulated areas are required;

- **$** An identifying description of where the regulated areas are located in the workplace;

- **$** A brief description of each process or operation which creates associate exposure to cadmium including the estimated number of associates engaged in each process or operation; and

- **$** The names and addresses of any collective bargaining units or other representatives of the affected associates.

5.12.2 Temporary Worksite Notification (California Only). Temporary worksites need to be reported to Cal/OSHA only once. Such notice shall also provide the time and date of commencement of work, the approximate duration of the work, the location, the type of business, and the kind of work for each temporary worksite at least 24 hours prior to the commencement of each job when feasible, to the nearest OSHA office.

5.12.3 Emergency (California Only). Any emergency as defined shall be reported as follows:

- **$** A report of the occurrence of the emergency and the facts obtainable at that time shall be made within 24 hours to the nearest district office of Cal/OSHA.

- **$** A written report shall be filed within 15 calendar days after the emergency occurred. The written report shall include:

    1. A description of the operation or process involved including its location, the amount of cadmium released, and the duration of the emergency.

    2. A statement of the known or estimated extent of associate exposure to cadmium and area of contamination.

    3. An analysis of the circumstances that led up to the emergency.

    4. A description of the measures taken or to be taken, with specific completion dates, to prevent further similar emergencies from occurring again.

5.12.4 Posting. A copy of each written report shall be posted in the regulated areas or other appropriate location where the posting is conspicuous to affected associates.

6.0 EXCEPTION PROVISIONS

(None Permitted.**)**

7.0 CROSS REFERENCES

HS100 Medical Policies and Procedures
HS102 Management of Employee Exposure and Medical Records
HS104 Employee Notification of Industrial Hygiene
29 CFR 1910.1027 Appendix B: Substance Technical Guidelines for Cadmium
29 CFR 1910.1027 Appendix C: Qualitative and Quantitative Fit Testing Requirements
29 CFR 1910.102 Appendix D: Occupational Health History Interview with Reference to Cadmium Exposure
29 CFR 1910.1027 Appendix E: Cadmium in Workplace Atmospheres
29 CFR 1910.1027 Appendix F: Non-Mandatory Protocol for Biological Monitoring

8.0 ATTACHMENTS

1. Responsibility Matrix
2. 29 CFR 1910.1027, Appendix A: Substance Safety Data Sheet

ATTACHMENT 1

Responsibility Matrix

Action	Procedure Section	*Responsible Party*	
		Project Manager	**Site Safety Officer**
Implement the provisions of this document as appropriate for a particular project.	1.0	X	X

ATTACHMENT 2
29 CFR 1910.1027 APPENDIX A

Title:	**Substance Safety Data Sheet - Cadmium**
Subpart	**Z**
Subpart Title:	**Toxic and Hazardous Substances**

I. Substance Identification

A. Substance: Cadmium.

1910.1027 App A, Paragraph 1 B. 8-Hour, Time-weighted-average, Permissible Exposure Limit (TWA PEL):

1910.1027 App A, Paragraph 2 1. TWA PEL: Five micrograms of cadmium per cubic meter of air 5 ug/m(3), time-weighted average (TWA) for an 8-hour workday.

1910.1027 App A, Paragraph 3 C. Appearance: Cadmium metal-soft, blue-white, malleable, lustrous metal or grayish-white powder. Some cadmium compounds may also appear as a brown, yellow, or red powdery substance.

1910.1027 App A, Paragraph 4

II. Health Hazard Data

A. Routes of Exposure. Cadmium can cause local skin or eye irritation. Cadmium can affect your health if you inhale it or if you swallow it.

1910.1027 App A, Paragraph 5

B. Effects of Overexposure.

1910.1027 App A, Paragraph 6 1. Short-term (acute) exposure: Cadmium is much more dangerous by inhalation than by ingestion. High exposures to cadmium that may be immediately dangerous to life or health occur in jobs where workers handle large quantities of cadmium dust or fume; heat cadmium-containing compounds or cadmium-coated surfaces; weld with cadmium solders or cut cadmium-containing materials such as bolts.

1910.1027 App A, Paragraph 7 2. Severe exposure may occur before symptoms appear. Early symptoms may include mild irritation of the upper respiratory tract, a sensation of constriction of the throat, a metallic taste and/or a cough. A period of 1-10 hours may precede the onset of rapidly progressing shortness of breath, chest pain, and flu-like symptoms with weakness, fever, headache, chills, sweating and muscular pain. Acute pulmonary edema usually develops within 24 hours and reaches a maximum by three days. If death from asphyxia does not occur, symptoms may resolve within a week.

1910.1027 App A, Paragraph 8 3. Long-term (chronic) exposure. Repeated or long-term exposure to cadmium, even at relatively low concentrations, may result in kidney damage and an increased risk of cancer of the lung and of the prostate.

1910.1027 App A, Paragraph 9

C. Emergency First Aid Procedures.

1910.1027 App A, Paragraph 10 1. Eye exposure: Direct contact may cause redness or pain. Wash eyes immediately with large amounts of water, lifting the upper and lower eyelids. Get medical attention immediately.

1910.1027 App A, Paragraph 11 2. Skin exposure: Direct contact may result in irritation. Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water. Get medical attention immediately.

1910.1027 App A, Paragraph 12 3. Ingestion: Ingestion may result in vomiting, abdominal pain, nausea, diarrhea, headache and sore throat. Treatment for symptoms must be administered by medical personnel. Under no circumstances should the employer allow any person whom he retains, employs, supervises or controls to engage in therapeutic chelation. Such treatment is likely to translocate cadmium from pulmonary or other tissue to renal tissue. Get medical attention immediately.

1910.1027 App A, Paragraph 13 4. Inhalation: If large amounts of cadmium are inhaled, the exposed person must be moved to fresh air at once. If breathing has stopped, perform cardiopulmonary resuscitation. Administer oxygen if available. Keep the affected person warm and at rest. Get medical attention immediately.

1910.1027 App A, Paragraph 14 5. Rescue: Move the affected person from the hazardous exposure. If the exposed person has been overcome, attempt rescue only after notifying at least one other person of the emergency and putting into effect established emergency procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the location of the emergency equipment before the need arises.

1910.1027 App A, Paragraph 15

III. Employee Information

A. Protective Clothing and Equipment.

1910.1027 App A, Paragraph 16 1. Respirators: You may be required to wear a respirator for non-routine activities; in emergencies; while your employer is in the process of reducing cadmium exposures through engineering controls; and where engineering controls are not feasible. If respirators are worn in the future, they must have a joint Mine Safety and Health Administration (MSHA) and National Institute for Occupational Safety and Health (NIOSH) label of approval. Cadmium does not have a detectable odor except at levels well above the permissible exposure limits. If you can smell cadmium while wearing a respirator, proceed immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

1910.1027 App A, Paragraph 17 2. Protective Clothing: You may be required to wear impermeable clothing, gloves, foot gear, a face shield, or other appropriate protective clothing to prevent skin contact with cadmium. Where protective clothing is required, your employer must provide clean garments to you as necessary to assure that the clothing protects you adequately. The employer must replace or repair protective clothing that has become torn or otherwise damaged.

1910.1027 App A, Paragraph 18 3. Eye Protection: You may be required to wear splash-proof or dust resistant goggles to prevent eye contact with cadmium.

1910.1027 App A, Paragraph 19

B. Employer Requirements.

1910.1027 App A, Paragraph 20 1. Medical: If you are exposed to cadmium at or above the action level, your employer is required to provide a medical examination, laboratory tests and a medical history according to the medical surveillance provisions under paragraph (l) of this standard. (See summary chart and tables in this Appendix A.) These tests shall be provided without cost to you. In addition, if you are accidentally exposed to cadmium under conditions known or suspected to constitute toxic exposure to cadmium, your employer is required to make special tests available to you.

1910.1027 App A, Paragraph 21 2. Access to Records: All medical records are kept strictly confidential. You or your representative are entitled to see the records of measurements of your exposure to cadmium. Your medical examination records can be furnished to your personal physician or designated representative upon request by you to your employer.

1910.1027 App A, Paragraph 22 3. Observation of Monitoring: Your employer is required to perform measurements that are representative of your exposure to cadmium and you or your designated representative are entitled to observe the monitoring procedure. You are entitled to observe the steps taken in the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, you or your representative must also be provided with, and must wear the protective clothing and equipment.

1910.1027 App A, Paragraph 23

C. Employee Requirements.

You will not be able to smoke, eat, drink, chew gum or tobacco, or apply cosmetics while working with cadmium in regulated areas. You will also not be able to carry or store tobacco products, gum, food, drinks or cosmetics in regulated areas because these products easily become contaminated with cadmium from the workplace and can therefore create another source of unnecessary cadmium exposure.

1910.1027 App A, Paragraph 24 Some workers will have to change out of work clothes and shower at the end of the day, as part of their workday, in order to wash cadmium from skin and hair. Handwashing and cadmium-free eating facilities shall be provided by the employer and proper hygiene should always be performed before eating. It is also recommended that you do not smoke or use tobacco products, because among other things, they naturally contain cadmium. For further information, read the labeling on such products.

1910.1027 App A, Paragraph 25

IV. Physician Information

A. Introduction.

1910.1027 App A, Paragraph 26 The medical surveillance provisions of paragraph (l) generally are aimed at accomplishing three main interrelated purposes: First, identifying employees at higher risk of adverse health effects from excess, chronic exposure to cadmium; second, preventing cadmium-induced disease; and third, detecting and minimizing existing cadmium-induced disease. The core of medical surveillance in this standard is the early and periodic monitoring of the employee's biological indicators of: (a) recent exposure to cadmium; (b) cadmium body burden; and (c) potential and actual kidney damage associated with exposure to cadmium.

1910.1027 App A, Paragraph 27 The main adverse health effects associated with cadmium overexposure are lung cancer and kidney dysfunction. It is not yet known how to adequately biologically monitor human beings to specifically prevent cadmium-induced lung cancer. By contrast, the kidney can be monitored to provide prevention and early detection of cadmium-induced kidney damage. Since, for non-carcinogenic effects, the kidney is considered the primary target organ of chronic exposure to cadmium, the medical surveillance provisions of this standard effectively focus on cadmium-induced kidney disease. Within that focus, the aim, where possible, is to prevent the onset of such disease and, where necessary, to minimize such disease as may already exist. The by-products of successful prevention of kidney disease are anticipated to be the reduction and prevention of other cadmium-induced diseases.
1910.1027 App A, Paragraph 28

B. Health Effects.

1910.1027 App A, Paragraph 29 The major health effects associated with cadmium overexposure are described below.

1910.1027 App A, Paragraph 30 1. Kidney. The most prevalent non-malignant disease observed among workers chronically exposed to cadmium is kidney dysfunction. Initially, such dysfunction is manifested as proteinuria. The proteinuria associated with cadmium exposure is most commonly characterized by excretion of low-molecular weight proteins (15,000 to 40,000 MW) accompanied by loss of electrolytes, uric acid, calcium, amino acids, and phosphate. The compounds commonly excreted include: beta-2-microglobulin (B(2)-M), retinol binding protein

(RBP), immunoglobulin light chains, and lysozyme. Excretion of low molecular weight proteins are characteristic of damage to the proximal tubules of the kidney (Iwao et al., 1980).

1910.1027 App A, Paragraph 31 It has also been observed that exposure to cadmium may lead to urinary excretion of high-molecular weight proteins such as albumin, immunoglobulin G, and glycoproteins (Ex. 29). Excretion of high-molecular weight proteins is typically indicative of damage to the glomeruli of the kidney. Bernard et al., (1979) suggest that damage to the glomeruli and damage to the proximal tubules of the kidney may both be linked to cadmium exposure but they may occur independently of each other.

1910.1027 App A, Paragraph 32 Several studies indicate that the onset of low-molecular weight proteinuria is a sign of irreversible kidney damage (Friberg et al., 1974; Roels et al., 1982; Piscator 1984; Elinder et al., 1985; Smith et al., 1986). Above specific levels of B(2)-M associated with cadmium exposure it is unlikely that B(2)-M levels return to normal even when cadmium exposure is eliminated by removal of the individual from the cadmium work environment (Friberg, Ex. 29, 1990).

1910.1027 App A, Paragraph 33 Some studies indicate that such proteinuria may be progressive; levels of B(2)-M observed in the urine increase with time even after cadmium exposure has ceased. See, for example, Elinder et al., 1985. Such observations, however, are not universal, and it has been suggested that studies in which proteinuria has not been observed to progress may not have tracked patients for a sufficiently long time interval (Jarup, Ex. 8-661).

1910.1027 App A, Paragraph 34 When cadmium exposure continues after the onset of proteinuria, chronic nephrotoxicity may occur (Friberg, Ex. 29). Uremia results from the inability of the glomerulus to adequately filter blood. This leads to severe disturbance of electrolyte concentrations and may lead to various clinical complications including kidney stones (L-140-50).

1910.1027 App A, Paragraph 35 After prolonged exposure to cadmium, glomerular proteinuria, glucosuria, aminoaciduria, phosphaturia, and hypercalciuria may develop (Exs. 8-86, 4-28, 14-18). Phosphate, calcium, glucose, and amino acids are essential to life, and under normal conditions, their excretion should be regulated by the kidney. Once low molecular weight proteinuria has developed, these elements dissipate from the human body. Loss of glomerular function may also occur, manifested by decreased glomerular filtration rate and increased serum creatinine. Severe cadmium-induced renal damage may eventually develop into chronic renal failure and uremia (Ex. 55).

1910.1027 App A, Paragraph 36 Studies in which animals are chronically exposed to cadmium confirm the renal effects observed in humans (Friberg et al., 1986). Animal studies also confirm problems with calcium metabolism and related skeletal effects which have been observed among humans exposed to cadmium in addition to the renal effects. Other effects commonly reported in chronic animal studies include anemia, changes in liver morphology, immunosuppression and hypertension. Some of these effects may be associated with co-factors. Hypertension, for example, appears to be associated with diet as well as cadmium exposure. Animals injected with cadmium have also shown testicular necrosis (Ex. 8-86B).

1910.1027 App A, Paragraph 37 2. Biological Markers It is universally recognized that the best measures of cadmium exposures and its effects are measurements of cadmium in biological fluids, especially urine and blood. Of the two, CdU is conventionally used to determine body burden of cadmium in workers without kidney disease. CdB is conventionally used to monitor for recent exposure to cadmium. In addition, levels of CdU and CdB historically have been used to predict the percent of the population likely to develop kidney disease (Thun et al., Ex. L-140-50; WHO, Ex. 8-674; ACGIH, Exs. 8-667, 140-50).

1910.1027 App A, Paragraph 38 The third biological parameter upon which OSHA relies for medical surveillance is Beta-2-microglobulin in urine (B(2)-M), a low molecular weight protein. Excess B(2)-M has been widely accepted by physicians and scientists as a reliable indicator of functional damage to the proximal tubule of the kidney (Exs. 8-447, 144-3-C, 4-47, L-140-45, 19-43-A).

1910.1027 App A, Paragraph 39 Excess B(2)-M is found when the proximal tubules can no longer reabsorb this protein in a normal manner. This failure of the proximal tubules is an early stage of a kind of kidney disease that commonly occurs among workers with excessive cadmium exposure. Used in conjunction with biological test results indicating abnormal levels of CdU and CdB, the finding of excess B(2)-M can establish for an examining

physician that any existing kidney disease is probably cadmium-related (Trs. 6/6/90, pp. 82-86, 122, 134). The upper limits of normal levels for cadmium in urine and cadmium in blood are 3 ug Cd/gram creatinine in urine and 5 ug Cd/liter whole blood, respectively. These levels were derived from broad-based population studies.

1910.1027 App A, Paragraph 40 Three issues confront the physicians in the use of B(2)-M as a marker of kidney dysfunction and material impairment. First, there are a few other causes of elevated levels of B(2)-M not related to cadmium exposures, some of which may be rather common diseases and some of which are serious diseases (e.g., myeloma or transient flu, Exs. 29 and 8086). These can be medically evaluated as alternative causes (Friberg, Ex. 29). Also, there are other factors that can cause B(2)-M to degrade so that low levels would result in workers with tubular dysfunction. For example, regarding the degradation of B(2)-M, workers with acidic urine (pH > 6) might have B(2)-M levels that are within the "normal" range when in fact kidney dysfunction has occurred (Ex. L-140-1) and the low molecular weight proteins are degraded in acid urine. Thus, it is very important that the pH of urine be measured, that urine samples be buffered as necessary (See Appendix F.), and that urine samples be handled correctly, i.e., measure the pH of freshly voided urine samples, then if necessary, buffer to pH > 6 (or above for shipping purposes), measure pH again and then, perhaps, freeze the sample for storage and shipping. (See also Appendix F.) Second, there is debate over the pathological significance of proteinuria, however, most world experts believe that B(2)-M levels greater than 300 ug/g Cr are abnormal (Elinder, Ex. 55, Friberg, Ex. 29). Such levels signify kidney dysfunction that constitutes material impairment of health. Finally, detection of B(2)-M at low levels has often been considered difficult, however, many laboratories have the capability of detecting excess B(2)-M using simple kits, such as the Phadebas Delphia test, that are accurate to levels of 100 ug B(2)-M/g Cr U (Ex. L-140-1).

1910.1027 App A, Paragraph 41 Specific recommendations for ways to measure B(2)-M and proper handling of urine samples to prevent degradation of B(2)-M have been addressed by OSHA in Appendix F, in the section on laboratory standardization. All biological samples must be analyzed in a laboratory that is proficient in the analysis of that particular analyte, under paragraph (l)(1)(iv). (See Appendix F). Specifically, under paragraph (l)(1)(iv), the employer is to assure that the collecting and handling of biological samples of cadmium in urine (CdU), cadmium in blood (CdB), and beta-2 microglobulin in urine (B(2)-M) taken from employees is collected in a manner that assures reliability. The employer must also assure that analysis of biological samples of cadmium in urine (CdU), cadmium in blood (CdB), and beta-2 microglobulin in urine (B(2)-M) taken from employees is performed in laboratories with demonstrated proficiency for that particular analyte. (See Appendix F.)

1910.1027 App A, Paragraph 42 3. Lung and Prostrate Cancer. The primary sites for cadmium-associated cancer appear to be the lung and the prostate (L-140-50). Evidence for an association between cancer and cadmium exposure derives from both epidemiological studies and animal experiments. Mortality from prostrate cancer associated with cadmium is slightly elevated in several industrial cohorts, but the number of cases is small and there is not clear dose-response relationship. More substantive evidence exists for lung cancer.

1910.1027 App A, Paragraph 43 The major epidemiological study of lung cancer was conducted by Thun et al., (Ex. 4-68). Adequate data on cadmium exposures were available to allow evaluation of dose-response relationships between cadmium exposure and lung cancer. A statistically significant excess of lung cancer attributed to cadmium exposure was observed in this study even when confounding variables such as co-exposure to arsenic and smoking habits were taken into consideration (Ex. L-140-50).

1910.1027 App A, Paragraph 44 The primary evidence for quantifying a link between lung cancer and cadmium exposure from animal studies derives from two rat bioassay studies; one by Takenaka et al., (1983), which is a study of cadmium chloride and a second study by Oldiges and Glaser (1990) of four cadmium compounds.

1910.1027 App A, Paragraph 45 Based on the above cited studies, the U.S. Environmental Protection Agency (EPA) classified cadmium as "B1", a probable human carcinogen, in 1985 (Ex. 44). The International Agency for Research on Cancer (IARC) in 1987 also recommended that cadmium be listed as "2A", a probable human carcinogen (Ex. 4-15). The American Conference of Governmental Industrial Hygienists (ACGIH) has recently recommended that cadmium be labeled as a carcinogen. Since 1984, NIOSH has concluded that cadmium is possibly a human carcinogen and has recommended that exposures be controlled to the lowest level feasible.

1910.1027 App A, Paragraph 46 4. Non-carcinogenic Effects. Acute pneumonitis occurs 10 to 24 hours after initial acute inhalation of high levels of cadmium fumes with symptoms such as fever and chest pain (Exs. 30,

8-86B). In extreme exposure cases pulmonary edema may develop and cause death several days after exposure. Little actual exposure measurement data is available on the level of airborne cadmium exposure that causes such immediate adverse lung effects, nonetheless, it is reasonable to believe a cadmium concentration of approximately 1 mg/m(3) over an eight hour period is "immediately dangerous" (55 FR 4052, ANSI; Ex. 8-86B).

1910.1027 App A, Paragraph 47 In addition to acute lung effects and chronic renal effects, long term exposure to cadmium may cause other severe effects on the respiratory system. Reduced pulmonary function and chronic lung disease indicative of emphysema have been observed in workers who have had prolonged exposure to cadmium dust or fumes (Exs. 4-29, 422, 442, 450, 463). In a study of workers conducted by Kazantzis et al., a statistically significant excess of worker deaths due to chronic bronchitis was found, which in his opinion was directly related to high cadmium exposures of 1 mg/m(3) or more (Tr. 6/8/90, pp. 156-157).

1910.1027 App A, Paragraph 48 Cadmium need not be respirable to constitute a hazard. Inspirable cadmium particles that are too large to be respirable but small enough to enter the tracheobronchial region of the lung can lead to bronchoconstriction, chronic pulmonary disease, and cancer of that portion of the lung. All of these diseases have been associated with occupational exposure to cadmium (Ex. 8-86B). Particles that are constrained by their size to the extra-thoracic regions of the respiratory system such as the nose and maxillary sinuses can be swallowed through mucocillary clearance and be absorbed into the body (ACGIH, Ex. 8-692). The impaction of these particles in the upper airways can lead to anosmia, or loss of sense of smell, which is an early indication of overexposure among workers exposed to heavy metals. This condition is commonly reported among cadmium-exposed workers (Ex. 8-86-B).

1910.1027 App A, Paragraph 49

C. Medical Surveillance.

In general, the main provisions of the medical surveillance section of the standard, under paragraphs (l)(1)-(17) of the regulatory text, are as follows:

1910.1027 App A, Paragraph 50 1. Workers exposed above the action level are covered;

1910.1027 App A, Paragraph 51 2. Workers with intermittent exposures are not covered;

1910.1027 App A, Paragraph 52 3. Past workers who are covered receive biological monitoring for at least one year;

1910.1027 App A, Paragraph 53 4. Initial examinations include a medical questionnaire and biological monitoring of cadmium in blood (CdB), cadmium in urine (CdU), and Beta-2-microglobulin in urine (B(2)-M);

1910.1027 App A, Paragraph 54 5. Biological monitoring of these three analytes is performed at least annually; full medical examinations are performed biennially;

1910.1027 App A, Paragraph 55 6. Until five years from the effective date of the standard, medical removal is required when CdU is greater than 15 ug/gram creatinine (g Cr), or CdB is greater than 15 ug/liter whole blood (lwb), or B(2)-M is greater than 1500 ug/g Cr, and CdB is greater than 5 ug/lwb or CdU is greater than 3 ug/g Cr;

1910.1027 App A, Paragraph 56 7. Beginning five years after the standard is in effect, medical removal triggers will be reduced;

1910.1027 App A, Paragraph 57 8. Medical removal protection benefits are to be provided for up to 18 months;

1910.1027 App A, Paragraph 58 9. Limited initial medical examinations are required for respirator usage;

1910.1027 App A, Paragraph 59 10. Major provisions are fully described under section (l) of the regulatory text; they are outlined here as follows:

1910.1027 App A, Paragraph 60 A. Eligibility B. Biological monitoring C. Actions triggered by levels of CdU, CdB, and B(2)-M (See Summary Charts and Tables in Attachment 1.)

1910.1027 App A, Paragraph 61 D. Periodic medical surveillance E. Actions triggered by periodic medical surveillance (See appendix A Summary Chart and Tables in Attachment 1.)

1910.1027 App A, Paragraph 62 F. Respirator usage G. Emergency medical examinations H. Termination examination I. Information to physician J. Physician's medical opinion K. Medical removal protection L. Medical removal protection benefits M. Multiple physician review N. Alternate physician review O. Information employer gives to employee P. Recordkeeping Q. Reporting on OSHA form 200 11. The above mentioned summary of the medical surveillance provisions, the summary chart, and tables for the actions triggered at different levels of CdU, CdB and B(2)-M (in Appendix A Attachment-1) are included only for the purpose of facilitating understanding of the provisions of paragraphs (l)(3) of the final cadmium standard. The summary of the provisions, the summary chart, and the tables do not add to or reduce the requirements in paragraph (l)(3).

1910.1027 App A, Paragraph 63

D. Recommendations to Physicians.

1. It is strongly recommended that patients with tubular proteinuria are counseled on: the hazards of smoking; avoidance of nephrotoxins and certain prescriptions and over-the-counter medications that may exacerbate kidney symptoms; how to control diabetes and/or blood pressure; proper hydration, diet, and exercise (Ex. 19-2). A list of prominent or common nephrotoxins is attached. (See Appendix A Attachment-2.)

1910.1027 App A, Paragraph 64 2. DO NOT CHELATE; KNOW WHICH DRUGS ARE NEPHROTOXINS OR ARE ASSOCIATED WITH NEPHRITIS.

1910.1027 App A, Paragraph 65 3. The gravity of cadmium-induced renal damage is compounded by the fact there is no medical treatment to prevent or reduce the accumulation of cadmium in the kidney (Ex. 8-619). Dr. Friberg, a leading world expert on cadmium toxicity, indicated in 1992, that there is no form of chelating agent that could be used without substantial risk. He stated that tubular proteinuria has to be treated in the same way as other kidney disorders (Ex. 29).

1910.1027 App A, Paragraph 66 4. After the results of a workers' biological monitoring or medical examination are received the employer is required to provide an information sheet to the patient, briefly explaining the significance of the results. (See Attachment 3 of this Appendix A.)

1910.1027 App A, Paragraph 67 5. For additional information the physician is referred to the following additional resources:

1910.1027 App A, Paragraph 68 a. The physician can always obtain a copy of the preamble, with its full discussion of the health effects, from OSHA's Computerized Information System (OCIS).

1910.1027 App A, Paragraph 69 b. The Docket Officer maintains a record of the rulemaking. The Cadmium Docket (H-057A), is located at 200 Constitution Ave. N.W., Room N-2625, Washington, D.C. 20210; telephone: 202-219-7894.

1910.1027 App A, Paragraph 70 c. The following articles and exhibits in particular from that docket (H-057A):

Exhibit Number	Author and Paper Title
8-447	Lauwerys et. al., Guide for physicians, AHealth Maintenance of Workers Exposed to Cadmium@, published by the Cadmium Council
4-67	Takenaka, S., H. Oldiges, H. Konig, D. Hochrainer, G. Oberdorster. ACarcinogenicity of Cadmium Chloride Aerosols in Wistar Rats@. JNCI 70:367 373, 1983. (32)
4-68	Thun, M.J., T.M. Schnoor, A.B. Smith, W.E. Halperin, R.A. Lemen. AMortality Among a Cohort of U.S. Cadmium Production Workers - An Update@. JNCI 74(2) :325-33, 1985. (8)
4-25	Elinder, C.G., Kjellstrom, T., Hogstedt, C. et al., ACancer Mortality of Cadmium Workers@. Brit. J. Ind. Med. 42:651-655, 1985. (14)
4-26	K.J. Ellis et al., ACritical Concentrations of Cadmium in Human Renal Cortex: Dose Effect Studies to Cadmium Smelter Workers@. J. Toxicol. Environ. Health 7:691-703, 1981. (76)
4-27	K.J. Ellis, S.H. Cohn and T.J. Smith. ACadmium Inhalation Exposure Estimates: Their Significance with Respect to Kidney and Liver Cadmium Burden@. J. Toxicol. Environ. Health 15:173-187, 1985.
4-28	F.Y. Falck, Jr., L.J. Fine, R.G. Smith, K.D. McClatchey, T. Annesley, B. England, and A.M. Schork. AOccupational Cadmium Exposure and Renal Status@. Am. J. Ind. Med. 4:541, 1983. (64)
8-86A	L. Friberg, C.G. Elinder, et al. ACadmium and Health, a Toxicological and Epidemiological Appraisal Volume I Exposure, Dose, and Metabolism@. CRC Press, Inc., Boca Raton, FL, 1986. (Available from the OSHA Technical Data Center)
8-86B	L. Friberg, C.G. Eliner, et al. ACadmium and Health, a Toxicological and Epidemiological Appraisal Volume II Effects and Response@. CRC Press, Inc., Boca Raton, FL, 1986. (Available from the OSHA Technical Data Center)
L-140-45	C.G. Elinder, ACancer Morality of Cadmium Workers@, Brit. J. Ind. Med., 42, 651-655, 1985.
L-140-50	M. Thun, C.G. Elinder, L. Friberg. AScientific Basis for an Occupational Standard for Cadmium@. Am. J. Ind. Med., 20; 629-642, 1991.

V. Information Sheet. The information sheet (Appendix A Attachment-3.) or an equally explanatory one should be provided to you after any biological monitoring results are reviewed by the physician, or where applicable, after any medical examination.

1910.1027 App A, Paragraph 87

Appendix A

Attachment 1: Appendix A Summary Chart and Tables A and B of Actions Triggered by Biological Monitoring

Appendix A - Summary Chart: Section (1)(3) Medical Surveillance- Categorizing Biological Monitoring Results (A) Biological monitoring results categories are set forth in Appendix A Table A for the periods ending December 31, 1998 and for the period beginning January 1, 1999.

1910.1027 App A, Paragraph 88 (B) The results of the biological monitoring for the initial medical exam and the subsequent exams shall determine an employee's biological monitoring result category.

1910.1027 App A, Paragraph 89 Actions Triggered by Biological Monitoring (A)(i) The actions triggered by biological monitoring for an employee are set forth in Appendix A Table B.

1910.1027 App A, Paragraph 90 (ii) The biological monitoring results for each employee under section (1)(3) shall determine the actions required for that employee. That is, for any employee in biological monitoring category C, the employer will perform all of the actions for which there is an X in column C of Appendix A Table B.

1910.1027 App A, Paragraph 91 (iii) An employee is assigned the alphabetical category ("A" being the lowest) depending upon the test results of the three biological markers.

1910.1027 App A, Paragraph 92 (iv) An employee is assigned category A if monitoring results for all three biological markers fall at or below the levels indicated in the table listed for category A.

1910.1027 App A, Paragraph 93 (v) An employee is assigned category B if any monitoring result for any of the three biological markers fall within the range of levels indicated in the table listed for category B, providing no result exceeds the levels listed for category B.

1910.1027 App A, Paragraph 94 (vi) An employee is assigned category C if any monitoring result for any of the three biological markers are above the levels listed for category C.

1910.1027 App A, Paragraph 95 (B) The user of Appendix A Tables A and B should know that these tables are provided only to facilitate understanding of the relevant provisions of paragraph (l)(3) of this section. Appendix A Tables A and B are not meant to add to or subtract from the requirements of those provisions.

1910.1027 App A, Paragraph 96 Appendix A - Table A Categorization of Biological Monitoring Results

APPLICABLE THROUGH 1998 ONLY

Biological Marker	Monitoring Result Categories		
	A	B	C
Cadmium in urine (CdU) (ug/g creatinine)	< = 3	>3 and < = 15	>15
B(2)-microglobulin (B(2)-M) (ug/g creatinine)	< = 300	>300 and < = 1500	>1500 (1)
Cadmium in blood (CdB) (ug/liter whole blood)	< = 5	>5 and < = 15	>15

(1) If an employee's B(2)-M levels are above 1,500 ug/g creatinine, in order for mandatory medical removal to be required (See Appendix A Table B.), either the employee's CdU level must also be >3 ug/g creatinine or CdB level must also be >5 ug/liter whole blood.

1910.1027 App. A, Paragraph 97

APPLICABLE BEGINNING JANUARY 1, 1999

Biological Marker	Monitoring Result Categories		
	A	**B**	**C**
Cadmium in urine (CdU) (ug/g creatinine)	< = 3	>3 and < = 7	>7
B (2)-microglobulin (B(2)-M) (ug/g creatinine)	< = 300	>300 and < = 750	>750 (1)
Cadmium in blood (CdB) (ug/liter whole blood)	< = 5	>5 and < = 10	>10

(1) If an employee's B(2)-M levels are above 750 ug/g creatinine, in order for mandatory medical removal to be required (See Appendix A Table B.), either the employee's CdU level must also be >3 ug/g creatinine or CdB level must also be >5 ug/liter whole blood.

1910.1027 App A, Paragraph 98 Appendix A - Table B - Actions Determined by Biological Monitoring

This table presents the actions required based on the monitoring result in Appendix A Table A. Each item is a separate requirement in citing non-compliance. For example, a medical examination within 90 days for an employee in category B is separate from the requirement to administer a periodic medical examination for category B employees on an annual basis.

Required Actions	Monitoring Result Category		
	A[(1)]	**B[(1)]**	**C[(1)]**
(1) Biological Monitoring:			
(a) Annual	X		
(b) Semiannual		X	
(c) Quarterly			X
(2) Medical Examination:			
(a) Biennial	X		
(b) Annual		X	
(c) Semiannual			X
(d) Within 90 days		X	
(3) Assess within two weeks:			
(a) Excess cadmium exposure		X	X
(b) Work practices		X	X
(c) Personal hygiene		X	X
(d) Respirator usage		X	X
(e) Smoking history		X	X
(f) Hygiene facilities		X	X
(g) Engineering controls		X	X
(h) Correct within 30 days		X	X
(i) Periodically Assess Exposures			X
(4) Discretionary Medical Removal		X	X
(5) Mandatory Medical Removal			X[(2)]

[(1)] For all employees covered by medical surveillance exclusively because of exposures prior to the effective date of this standard, if they are in Category A, the employer shall follow the requirements of paragraphs (l)(3)(i)(B) and (l)(4)(v)(A). If they are in Category B or C, the employer shall follow the requirements of paragraphs (l)(4)(v)(B)-(C).
[(2)] See footnote Appendix A Table A.

1910.1027 App A, Paragraph 101

Appendix A - Attachment - 2: List of Medications. A list of the more common medications that a physician, and the employee, may wish to review is likely to include some of the following:

(1) anticonvulsants: paramethadione, phenytoin, trimethadone;
(2) antihypertensive drugs: captopril, methyldopa;
(3) antimicrobials: aminoglycosides, amphotericin B, cephalosporins, ethambutol;
(4) antineoplastic agents: cisplatin, methotrexate, mitomycin-C, nitrosoureas, radiation;
(5) sulfonamide diuretics: acetazolamide, chlorthalidone, furosemide, thiazides;
(6) halogenated alkanes, hydrocarbons, and solvents that may occur in some settings: carbon tetrachloride, ethylene glycol, toluene; iodinated radiographic contrast media; nonsteroidal anti-inflammatory drugs; and,
(7) other miscellaneous compounds: acetominophen, allopurinol, amphetamines, azathioprine, cimetidine, cyclosporine, lithium, methoxyflurane, methysergide, D-penicillamine, phenacetin, phenendione.

A list of drugs associated with acute interstitial nephritis includes:

(1) antimicrobial drugs: cephalosporins, chloramphenicol, colistin, erythromycin, ethambutol, isoniazid, paraaminosalicylic acid, penicillins, polymyxin B, rifampin, sulfonamides, tetracyclines, and vancomycin;
(2) other miscellaneous drugs: allopurinol, antipyrene, azathioprine, captopril, cimetidine, clofibrate, methyldopa, phenindione, phenylpropanolamine, phenytoin, probenecid, sulfinpyrazone, sulfonamid diuretics, triamterene; and,
(3) metals: bismuth, gold.

1910.1027 App A, Paragraph 102 This list has been derived from commonly available medical textbooks (e.g., Ex. 14-18). The list has been included merely to facilitate the physician's, employer's, and employee's understanding. The list does not

represent an official OSHA opinion or policy regarding the use of these medications for particular employees. The use of such medications should be under physician discretion.

1910.1027 App A, Paragraph 103 - Appendix A - Attachment 3 - Biological Monitoring and Medical Examination Results

Employee

Testing Date

Cadmium in Urine _____ ug/g Cr

Cadmium in Blood _____ ug/lwb

Beta-2-microglobulin in Urine _____ ug/g Cr

(Normal Levels: < = 3 ug/g Cr, < = 5 ug/lwb, < = 300 ug/g Cr)

Physical Examination Results:

N/A

Satisfactory

Unsatisfactory _____ (see physician again)

Physician's Review of Pulmonary Function:

Test: N/A _____ Normal _____ Abnormal

Next biological monitoring or medical examination scheduled for

The biological monitoring program has been designed for three main purposes:

1) to identify employees at risk of adverse health effects from excess, chronic exposure to cadmium;
2) to prevent cadmium-induced disease(s); and
3) to detect and minimize existing cadmium-induced disease(s).

1910.1027 App A, Paragraph 104 The levels of cadmium in the urine and blood provide an estimate of the total amount of cadmium in the body. The amount of a specific protein in the urine (beta-2-microglobulin) indicates changes in kidney function. All three tests must be evaluated together. A single mildly elevated result may not be important if testing at a later time indicates that the results are normal and the workplace has been evaluated to decrease possible sources of cadmium exposure. The levels of cadmium or beta-2-microglobulin may change over a period of days to months and the time needed for those changes to occur is different for each worker.

1910.1027 App A, Paragraph 105 If the results for biological monitoring are above specific "high levels" [cadmium urine greater than 10 micrograms per gram of creatinine (ug/g Cr), cadmium blood greater than 10 micrograms per liter of whole blood (ug/lwb), or beta-2-microglobulin greater than 1000 micrograms per gram of creatinine (ug/g Cr)], the worker has a much greater chance of developing other kidney diseases.

1910.1027 App A, Paragraph 106 One way to measure for kidney function is by measuring beta-2-microglobulin in the urine. Beta-2-microglobulin is a protein which is normally found in the blood as it is being filtered in the kidney, and the kidney reabsorbs or returns almost all of the beta-2-microglobulin to the blood. A very small amount (less than 300 ug/g Cr in the urine) of beta-2-microglobulin is not reabsorbed into the blood, but is released in the urine. If cadmium damages the kidney, the amount of beta-2-microglobulin in the urine increases because the kidney cells are unable to reabsorb the beta-2-microglobulin normally. An increase in the amount of beta-2-microglobulin in the urine is a very early sign of kidney dysfunction. A small increase in beta-2-microglobulin in the urine will serve as an early warning sign that the worker may be absorbing cadmium from the air, cigarettes contaminated in the workplace, or eating in areas that are cadmium contaminated.

1910.1027 App A, Paragraph 107 Even if cadmium causes permanent changes in the kidney's ability to reabsorb beta-2-microglobulin, and the beta-2-microglobulin is above the "high levels", the loss of kidney function may not lead to any serious health problems. Also, renal function naturally declines as people age. The risk for changes in kidney function for workers who have biological monitoring results between the "normal values" and the "high levels" is not well known. Some people are more cadmium-tolerant, while others are more cadmium-susceptible.

1910.1027 App A, Paragraph 108 For anyone with even a slight increase of beta-2-microglobulin, cadmium in the urine, or cadmium in the blood, it is very important to protect the kidney from further damage. Kidney damage can come from other sources than excess cadmium-exposure so it is also recommended that if a worker's levels are "high" he/she should receive counseling about drinking more water; avoiding cadmium-tainted tobacco and certain medications (nephrotoxins, acetaminophen); controlling diet, vitamin intake, blood pressure and diabetes; etc.

1910.1027 App A, Paragraph 109
[57 FR 42389, Sept. 14, 1992, as amended at 58 FR 21781, Apr. 23, 1993]

PROCEDURE

Subject: PERSONAL PROTECTIVE EQUIPMENT

1.0 PURPOSE AND SUMMARY

This procedure stipulates that the company will provide the personal protective equipment necessary for employees to perform their work safely, as established by the Health & Safety Department. Special purchasing programs for prescription safety glasses and safety shoes are also described. Head, eye, body, and foot protection are discussed in this procedure. Respiratory and hearing protection are cross referenced to the appropriate company procedures.

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The EH&S Operations Manager, is responsible for the issuance, revision, and maintenance of this procedure.

3.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1.

4.0 DEFINITIONS

Company – All wholly-owned subsidiaries of Shaw Environmental & Infrastructure, Inc (Shaw E & I).

5.0 TEXT

The company will provide suitable personal protective equipment as required for the nature of the job being performed, such as, but not limited to, boots, protective clothing, respirators, face shields, safety eyewear, respirator ophthalmic hanger devices, hard hats, and gloves. This personal protective equipment will be specified by the Health & Safety Department prior to use, subject to an assessment of the hazards to which employees will be potentially exposed. Documentation shall be in the project-specific Health and Safety Plan (HASP) or equivalent document.

Employees shall use HS-approved protective equipment on any task where there is potential exposure to: physical hazards such as equipment operation, objects dropping from above, or flying particles; or exposure to toxic or irritating gases, fumes, vapors, liquids, or other materials which might cause respiratory distress or skin irritation.

Employees shall be trained in the proper use, maintenance, and limitations of protective equipment. Safety equipment shall be replaced when it is damaged, contaminated, or has worn out. Training requirements are summarized in company Procedure HS050.

Employees shall wear hard hats, eye protection, and steel-toed foot protection (chemical resistant when required) at all job sites (excluding field offices) and industrial facilities, unless HASP/site rules provide exemption. It is the responsibility of all employees to report to any work site prepared to work in Level D PPE. All other protective equipment is the responsibility of the project.

5.1 Eye Protection

All employees engaged in or working in areas adjacent to eye-hazardous activities or operations shall wear appropriate eye protection.

- Safety glasses are required for impact protection, and shall meet ANSI Standard Z87.1 requirements.
- Chemical goggles are required for protection against chemical splash.
- Face shields are required for face protection from chemical splash and are not a substitute for eye protection.
- Full-face respirators can provide eye and face protection in lieu of safety glasses, goggles, or face shields.

5.1.1 Prescription Eye Protection. The company will provide prescription safety glasses (meeting ANSI Standard Z87.1) for field/shop/lab personnel, and computer glasses for computer users, as required by their individual vision status and job. Glasses will be provided every two years unless damaged on-the-job, or the employee exhibits a significant change of prescription.

Lenses shall be clear polycarbonate or plastic. Special tints or dark lenses can be obtained for special applications (e.g., extended outdoor work) with prior written approval from the Health & Safety Department.

Employees requiring corrective lenses inside of respirator face-pieces will be provided with safety lenses and frames sized for respirators and the respirator insert, in addition to conventional prescription safety glasses.

Employees will arrange and pay for the eye examination through the company-provided vision care program. The company will pay for fitting services and the safety glasses.

The company has established a national contract with a protective eyewear provider. Employees should contact the local HS representative (with current lens prescription), who will coordinate with the local purchasing representative to order eyewear. Employees choosing to use another provider will be reimbursed up to $65 for safety or computer glasses, after the Health & Safety Department has verified that the glasses meet the ANSI Standard requirements.

5.2 Foot Protection

Basic foot protection is required for all job sites and industrial locations. Specialized footwear shall be provided as required by the nature of the work. Special foot protection may include, but is not limited to, chemically resistant, thermally shielded, metatarsal guards, etc.

5.2.1 Leather Safety Shoes. Safety shoes may be used in place of chemical resistant footwear when an employee will be working in a clean or uncontaminated work areas. Generally, when the employee desires to use safety footwear other than standard chemical resistant footwear provided, the company considers it the responsibility of the employee to provide such footwear and ensure that it meets ANSI Standard Z41. Company supervision will enforce the use of appropriate protective footwear per the requirements of the site-specific Health and Safety Plan. Where state or local regulations require (i.e., California and Connecticut), the company will provide all necessary safety equipment.

Employees can purchase safety shoes through national purchasing agreements established by the company. Under the limited circumstances where the company will provide safety shoes, such purchases must be approved by the project or appropriate department/local manager. After the Health & Safety Department has verified that the safety shoes meet ANSI requirements, the employee will be reimbursed for the actual purchase price of the shoes up to a maximum of $90.00.

Athletic-style safety shoes ("safety sneakers") are <u>prohibited</u> for all field operations due to the difficulties created by these styles in supervising proper use of protective footwear. Employees in fixed laboratory operations may wear athletic-style safety shoes with the prior approval of the Lab Director or HS Coordinator.

5.3 Head Protection

Hard hats meeting ANSI Z89.1 shall be provided to protect employees from impact, penetration, falling objects, and/or limited electrical shock and burn, as appropriate for work site hazards.

5.4 Respiratory Protection

Respirators shall be provided, in accordance with Procedure HS601, Respiratory Protection Program.

5.5 Hearing Protection

Hearing protection shall be provided, in accordance with Procedure HS402, Hearing Conservation Program.

5.6 Body Protection

Protective clothing, gloves, boots, and other protective equipment shall be provided as appropriate for the hazards associated with the tasks being performed.

5.7 Providing Personal Protective Equipment to Non-Company Personnel

The following personal protective equipment may be provided to non-company personnel:

- Hard hats
- Chemical goggles
- Safety glasses (non-prescription)
- Face shields
- Chemical resistant boots
- Chemical resistant gloves
- Hearing protectors
- Disposable chemical resistant personal protective clothing

5.8 Management Duties

It is the responsibility of the Health & Safety Department to specify safety equipment requirements for each job.

It is the responsibility of project managers or location managers to provide adequate quantities of safety equipment required for their job(s) or project(s).

It is the responsibility of supervisors to verify that required safety equipment is properly used and to ensure that any employee provided protective equipment is adequate, properly maintained and in a sanitary condition.

6.0 EXCEPTION PROVISIONS

Variances and exceptions shall be permitted pursuant to the provisions of Procedure HS013, "Health & Safety Procedure Variances".

7.0 CROSS REFERENCES

HS050 Training Requirements
HS402 Hearing Conservation Program
HS601 Respiratory Protection Program
ANSI Standard Z41, *Personal Protection - Protective Footwear*
ANSI Standard Z87.0, *Practice for Occupational and Educational Eye and Face Protection*
ANSI Standard Z89.1, *Protective Headwear for Industrial Workers*

8.0 ATTACHMENTS

1. Responsibility Matrix

ATTACHMENT 1
PERSONAL PROTECTIVE EQUIPMENT

Responsibility Matrix

Action	Procedure Section	*Responsible Party*			
		EH&S Operations Manager	**Local HS Department**	**Project/ Location Managers**	**Supervisors**
Issue, revise, and maintain this procedure.	3.1	X			
Approve all personal protective equipment prior to use.	5.0		X		
Coordinate reimbursement to employee for PPE purchases.	5.1.1, 5.2.1		X		
Provide adequate quantities of safety equipment as required.	5.8			X	
Verify that required safety equipment is properly used.	5.8				X

PROCEDURE

Subject: RESPIRATORY PROTECTION PROGRAM

1.0 PURPOSE AND SUMMARY

The purpose of this procedure is to prescribe the requirements of the company Respiratory Protection Program (RPP). This procedure provides information and guidance on the proper selection, medical evaluation, training, use, and care of respiratory protective equipment and complies with the requirements of 29 CFR 1910.134 (1998).

All operations which require the use of respiratory protection are subject to the provisions of this procedure.

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The Vice President, Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

3.2 Action/Approval Responsibilities

Program responsibilities are detailed throughout this procedure. The Responsibility Matrix summarizes these items and can be found as Attachment 1.

4.0 DEFINITIONS

Action Level (AL) - Airborne contaminant concentration which is one-half of the Permissible Exposure Guideline (PEG).

Air Purifying Respirator (APR) - Negative pressure respirator (also referred to as a cartridge respirator) which filters contaminated air through chemical or mechanical filter elements. APRs include: cartridge, canister, gas masks, and single-use respirators (single-use respirators are not approved for use by the company).

Approved Respirator - Any respirator, identified by manufacturer and model, that has been approved by NIOSH 42 CFR Part 84 and has been incorporated into the List of Approved Respiratory Protective Equipment (Attachment 2).

Assigned Protection Factor (APF) - A term that is reserved in the OSHA Standard 1910.134 (January, 1998). Attachment 3 provided PFs for the respiratory protective equipment based upon type of device and method of fit testing. The company will continue to use the PFs established by NIOSH until OSHA issues their definition of APF.

Company - All wholly-owned subsidiaries of Shaw Environmental & Infrastructure, Inc. (Shaw E & I).

Contractor Personnel - A group of persons hired to perform a specific activity based on their expertise and ability to operate independent of direct supervision. Contractor personnel are supervised by their management group which reports to an employee of the company for project direction.

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.

Emergency - Emergency means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

Exposure Limit - Several published airborne contaminant concentration values exist which are used in establishing acceptable personnel exposures to contaminants. OSHA publishes the Permissible Exposure Limit (PEL), NIOSH publishes the Recommended Exposure Limit (REL), and the ACGIH publishes the Threshold Limit Value (TLV). All of these exposure limits are based on an 8-hour work shift, 40-hour work week, and 40-year work life. The values may vary from contaminant to contaminant as well as between publishing bodies.

Field Office - Any office or satellite office performing field activities which may require the use of respiratory protection.

Filtering Facepiece (Dust Mask) - A negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

Fit Factor (FF) - This term means a quantitative estimate of the fit of a particular respirator to a specific individual and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn. The FF incorporates a safety factor of 10 because protection factors in the workplace tend to be much lower than the fit factors achieved during fit testing. Acceptable fit factors are 100 for a tight-fitting half facepiece and 500 for a tight-fitting full facepiece respirators.

HASP - Health and Safety Plan.

Health and Safety Representative - A member of the company Health and Safety Functional Resource Group who, through credentials, training, or experience, has the necessary qualifications and authority to specify respiratory protection and evaluate respiratory protection program elements.

Immediately Dangerous to Life or Health (IDLH) - An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Labor Pool Personnel - Temporary personnel hired for a given expertise or ability. Labor pool personnel report directly to an employee of the company.

Nuisance Level - Level of airborne contaminants which is below one-half the action level for that contaminant and presents no other health or safety hazard.

Permissible Exposure Guideline (PEG) - This term designates a specific exposure limit and is based on the best available information. The PEG will be the lower (more protective) of the values for the PEL and TLV. However, the REL shall take precedence for Hazardous Waste Operations (subject to 29 CFR 1910.120 or 1926.65) if no PEL exists, or for contaminants where no PEL or TLV exists. If there is no PEL, TLV, or REL, a Health and Safety Representative shall determine an appropriate permissible exposure guideline.

Permissible Exposure Limit (PEL) - An occupational exposure index promulgated by OSHA which carries the force of law. This value represents the allowable concentration to which it is believed an employee may be exposed to 8 hours a day, 40 days a week, for a 40-year working life without experiencing adverse health effects.

Positive Pressure Respirator - A respirator in which the pressure inside the respirator exceeds the ambient air pressure outside the respirator.

Powered Air Purifying Respirator (PAPR) - A positive pressure APR which incorporates a fan an battery pack unit. The system pulls contaminated air through the filter elements before delivery to the facepiece under positive pressure. Air pressure in the mask must remain above ambient pressure.

Qualitative Fit Test - A procedure for assuring that the respirator provides adequate protection based on a pass/fail fit test that relies on the individual's response to the test agent. Standard fit test protocol will utilize the irritant smoke methods as described in Attachment 4.

Quantitative Fit Test - A fit test that provides an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Respiratory Protection Program Coordinator (RPP Coordinator) - A person designated by the Health and Safety Representative to administer and supervise the respiratory program at a local facility or project location. This person will have the necessary training or credentials to execute this task.

Recommended Exposure Limit (REL) - An occupational exposure index published by NIOSH which is a recommended guideline for employee protection. This value represents the allowable concentration to which it is believed an employee may be exposed to 10 hours a day, 40 hours a week, for a 40-year working life without experiencing health effects.

Supplied Air Respirator (SAR) - Positive pressure respirator which supplies an independent source of breathing air to the user. Two types of SARs are available: self-contained breathing apparatus (SCBA) and airline.

Threshold Limit Value (TLV) - An occupational exposure index published by ACGIH which is recognized as an industry guideline and represents the concentration to which it is believed that nearly all employees may be exposed to 8 hours a day, 40 hours a week without experiencing adverse health effects.

5.0 TEXT

The company will employ engineering controls (e.g., enclosure, ventilation, material substitution, etc.) as the primary method to limit employee exposure. However, for those situations where engineering and administrative controls are ineffective at controlling employee exposure, the use of respiratory protective equipment may be required.

This RPP provides specific requirements for selection, assignment, training, and medical evaluation for persons expected to wear respiratory protection.

5.1 Assignment of Equipment to Contractor/Labor Pool Personnel

Contractor personnel shall provide their own respiratory protective equipment and shall also confirm meeting all other requirements of their own RPP and that of the company's RPP (i.e., medical clearance, training, etc.).

The company may provide the following respiratory protective equipment to Contractor Personnel:

- Disposable equipment such as filter elements.
- Hardware for airline systems (up to, but not including, the airline and facepiece) which employees are sharing.

The company will not provide the following respiratory protective equipment to Contractor Personnel:

- APR or PAPR facepieces.
- SCBAs, SAR respirators, or airline.

The company may provide respiratory protective equipment to Labor Pool Personnel if the following have been established:

- The labor pool personnel have successfully completed training as required by 29 CFR 1910.134 and other applicable regulations.
- The labor pool personnel have been fit tested in relation to projected exposure levels and contaminants to be encountered.
- The labor pool personnel have been medically approved to wear respirators.
- All other RPP requirements have been met.

5.2 Approval, Selection, and Purchase of Respiratory Protective Equipment

The following requirements are designed to guide correct selection of respiratory protective equipment.

5.2.1 Approval. The Vice President, Health and Safety has approved respirators manufactured by Survivair as the primary respirators for use by employees. For employees who cannot achieve a satisfactory fit or comfort factor in Survivair respirator, Mine Safety Appliance (MSA) respirators will be selected. The list of approved model respirators is included in Attachment 2. Contractor personnel may select any respiratory protective equipment that has received approval from NIOSH.

5.2.2 Selection. The Health and Safety Representative shall base the selection of respiratory protective equipment upon an assessment of potential respiratory hazards that may be encountered. This assessment may utilize a variety of written information such as the NIOSH Pocket Guide to Chemical Hazards, Material Safety Data Sheets, analytical data, air monitoring results, or other applicable information. The selection process shall incorporate the following guidelines:

- Respiratory protection is to be selected by Health and Safety Representatives only. Full facepiece respirators are the usual preference because of superior protection factor and the face/eye protection afforded. Half facepiece respirators can only be used in situations where less than one-half the PEG is expected. The type of respirator selected will be documented in the Project HASP.

- Selection of the appropriate respiratory protective equipment shall include factors such as the chemical state and physical form of the chemical contaminant, atmospheric concentration during routine and emergency events, potential physical hazards, expected job task requirements, and the performance of the respirator in providing the appropriate level of protection against these hazards.

- Consideration shall be given to the nature of the hazardous operation, location of the hazardous area relative to nonhazardous breathing air supply, duration of wear, activities to be performed, and characteristics and function of the respiratory protective equipment to be worn.

- Selected respirators (i.e., Survivair or MSA) shall be NIOSH certified and used in compliance with the conditions of its certification when employees are exposed to toxic materials or other hazardous atmospheres.

- Respirators must provide adequate face and eye protection for the expected task.

- If an APR or PAPR is used, the respirator shall be equipped with an end-of-service life-indicator (ESLI) certified by NIOSH for the contaminant. If an ESLI is not available for the contaminant, a cartridge element change schedule shall be implemented which is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. This information will be described in the HASP.

- The PF for the respirator selected (Attachment 3) shall be used according to the following relationship with the PEG to establish justification for selection:

PF x PEG > Maximum anticipated contaminant concentration

If this equation is false, a respirator with a greater PF must be selected. Also review Attachment 3 to determine the required fit testing for the expected maximum anticipated contaminant concentration. The Health and Safety Representative may determine that a more conservative approach (e.g., 50 percent PF) may be needed. Decision to do so should be documented in the Project HASP.

- Manufacturer-established limitations of the APR filter elements relative to the contaminants of concern shall be used to establish further justification for the selected respirator should the APR's FF not disqualify its use (e.g., maximum anticipated contaminant concentration).

5.2.3 Purchase. The purchase request of respiratory protective equipment (including cartridges, airlines, compressed air) should be reviewed by a Health and Safety Representative to indicate that the ordered material meets established requirements. **Under no circumstances may anyone (purchasing, warehouse, project manager, etc.) purchase or provide other than the specific respiratory protection equipment selected by the Health and Safety Representative.**

5.3 Medical Evaluation

No employee shall be assigned to a task that requires the use of a respirator unless it has been determined that he/she is physically able to perform the work while using the required respirator. The medical evaluation must be conducted prior to fit testing and work requiring the use of respiratory equipment.

The medical evaluation shall be performed by a physician typically in conjunction with a physical examination meeting the requirements of 29 CFR 1910.120 (f) *Medical Surveillance*. The physician will be informed of the type of work expected of the employee, the types of respiratory protection and personal protective equipment required, and other information indicating the expected stresses of the task. The company medical director shall be given a copy of the company RPP and a copy of 1910.134 (e) *Medical Evaluation*.

The company medical director shall provide a written recommendation regarding the employee's ability to use respiratory protection. The company shall ensure that the company medical director supplies the employee with a copy of this recommendation.

Additional medical evaluations will be provided to the employee if:

- Any medical signs or symptoms due to respirator use are reported by the employee, supervisory, or health and safety personnel.

- A change in workplace conditions (e.g., physical work effort, protective clothing, temperature) that may result in a substantial increase in the physiological burden placed on an employee.

5.4 General Program Requirements

5.4.1 Responsibilities. The following information describes the responsibilities for the selection, use, and maintenance of respiratory protective equipment based upon job function:

Management

- Management shall take necessary and cost-effective measures to reduce, where possible, the need for respiratory protective equipment (e.g., enclosed cabs on heavy equipment to reduce airborne dust, operations performed upwind, etc.)

- Respiratory protective equipment shall be provided by management whenever it is determined that such equipment is necessary to protect the health of the employee or when requested by an employee and approved by the Health and Safety Representative.

- Management shall assign work tasks requiring the use of respiratory protective equipment to only those employees who are medically qualified to wear respiratory protective equipment.

- Management shall ensure that employees are trained in the use of respiratory protection prior to being assigned to an activity that requires its use.

- Management shall provide the means for the maintenance of respiratory protection as required.

Health and Safety Representative

- Health and Safety Representatives shall determine appropriate respiratory protection for each job. The decision logic for this selection shall be documented in the Project HASP.

- Health and Safety Representatives shall monitor compliance with the various aspects of this program, provide technical assistance regarding respirator selection and use, evaluate the effectiveness of the RPP, and support respirator training and fit testing at locations under their control.

- Health and Safety Representatives shall conduct regular audits to determine compliance with this procedure. This audit can include a review of maintenance, training, medical and air monitoring records, and review the status of this procedure with regard to current regulatory requirements.

- Health and Safety Representatives shall maintain or oversee maintenance of all other records required by this RPP and shall provide for the training and fit testing of personnel assigned respiratory protective equipment.

- Health and Safety Representatives shall appoint a RPP Coordinator for each location which uses or may have a need to use respiratory protection. The Health and Safety Representative must assure the RPP Coordinator has the necessary training to fulfill his/her responsibilities.

RPP Coordinator

- The RPP Coordinator shall be responsible for cleaning, maintenance, and storage of all respirators not routinely used or not individually assigned.

- The RPP Coordinator shall maintain respirator supplies, including spare parts; submit purchase requests for new equipment; and assure that sufficient quantities of cartridges are available for each field office/project.

- The RPP Coordinator shall assure that air supply and emergency respiratory protection is properly inspected and maintained.

- Respirators shall be repaired by either qualified personnel under the direction of the RPP Coordinator, or by contracted supplier.

- The RPP Coordinator shall maintain models and sizes of respirators available for selection and fitting.

- The RPP Coordinator shall conduct fit testing.

Training Department

- Records pertaining to training and fit testing will be maintained by the Training Department.

Employee

- The employee shall use the provided respiratory protective equipment when instructed to do so in accordance with training received.

- The employee shall clean, disinfect, and properly store the assigned respirator, unless other arrangements are made on a project level.

- The employee shall guard against damage to the assigned respirator.

- The employee shall inspect the respirator before each use and after cleaning.

- The employee shall report any malfunction of the respirator immediately to their supervisor and/or the RPP Coordinator.

- The employee shall report to their supervisor any change in their medical status that may impact their ability to wear a respirator safely.

5.4.2 Use of Corrective Lens Eyewear. In general, contact lenses are permitted to be worn when respiratory protection is used. Although in certain instances, client- or project-specific rules may not allow for their use.

If an employee chooses not to wear contact lenses, management shall assure that the appropriate frames or ophthalmic device attachments are obtained and provided at no cost to the employee.

5.4.3 Obstruction of Face Seal. Employees who wear respirators are required to be clean shaven to the extent that there is no obstruction between the wearer's skin and the facepiece. Trimmed mustaches and facial hair which does not interfere with the seal are allowable.

In addition, respirators shall not be worn when conditions prevent a good face-to-facepiece seal such as corrective lenses or goggles, or other personal protective equipment.

5.5 Instruction, Training, and Fit Test

5.5.1 Instruction and Training. The Training Department shall provide a standard respiratory protective equipment training program for use by qualified personnel such as the Health and Safety Representative or RPP Coordinator. The Training Department will support training at the project location if the project does not have the qualified personnel and/or the equipment to support its own program. As an alternative, the project location may use a respiratory manufacturer's training program if the program meets company requirements, a competent person conducts the training, adequate equipment is available for demonstration, and fit testing is conducted along guidelines established in this procedure. The Training Department must approve all alternative training methods.

The basic respirator training program shall include, as a minimum, the following:

- Training and annual retraining of employees in the selection, use, maintenance, and limitation of each respirator type used.

- Instruction on the nature of the respiratory hazards and potential health effects resulting from exposure.

- Opportunity for "hands on" experience with the respiratory protective equipment.

- Proper fitting, including demonstrations and practice in wearing, adjusting, and determining the fit of the respirator. A selection of respirators shall be available to determine the most comfortable respirator and the best fit.

- Instruction on how to test the face-to-facepiece seal.

- A familiarization period of wear in ambient air.

- For APRs, wearing the respirator in a test atmosphere (typically irritant smoke) for qualitative fit testing. The qualitative fit test shall follow the guidelines outlined in Section 5.5.2.

- Training to recognize and cope with emergency situations (including respirator failure)

- Training and fit testing shall be repeated annually, unless specific OSHA regulations require a more frequent time period (e.g., asbestos, lead operations). Each person receiving training shall complete the Respirator Fit Test Form (Attachment 5).

- Training records will be maintained by the Training Department and the location Health and Safety Representative. On-site records of training and fit testing will be maintained as required by specific regulation (e.g., asbestos work) (refer to Section 5.8).

- It is the responsibility of the RPP Coordinator to verify that all project personnel meet the requirements of this RPP.

5.5.2 Fit Testing. Prior to the use of any negative or positive pressure tight-fitting facepiece, the employee must be fit tested.

- All employees assigned to operations requiring the use of respiratory protective equipment shall have been fit tested within 12 months, or as required by specific regulations (e.g., asbestos, lead operations). Fit test and qualification cards (or a copy of the completed Attachment 5) must be available during operations.

- The employee shall be fit tested with the same size and model as they are expected to wear.

- Qualitative fit test (QLFT) shall be used when a protection factor of 10 or less is required for a negative pressure respirator.

- Quantitative fit test (QNFT) shall be used when a protection factor of greater than 10 is required for a negative pressure respirator. When

executing the QNFT, the acceptable test result is 100 for tight fitting half-facepiece respirators and 500 for full-facepiece respirators.

- Fit testing for tight-fitting atmosphere supplying respirators and tight-fitting APRs shall be in a negative pressure mode regardless of the mode of operation that is used for respiratory protection.

- Assessment of comfort shall be made after allowing adequate time for this evaluation. This evaluation shall include reviewing the following points with the employee: positioning of the mask on nose, room for eye protection if required, room to talk, and positioning of the mask on the face and cheeks.

- The following criteria shall be used to help determine the adequacy of the respirator fit: chin properly placed, strap tension, fit across the nose bridge, and tendency to slip.

- If physical obstruction (e.g., facial hair, eyeglasses) interferes with the face-to-facepiece seal, then it shall be altered or removed so as to eliminate any interference and allow for a satisfactory fit. If the employee refuses to alter the physical obstruction, then they shall be denied a satisfactory fit report and referred to his/her supervisor for consideration.

- The fit test protocol (Attachment 4) shall be followed. The Health and Safety Representative and Training Department shall determine which fit test protocol shall be followed depending upon the situation.

5.6 Maintenance Program

Each RPP Coordinator is responsible for verifying the respirator maintenance program is implemented in an effective manner for the facility or project site, the working conditions, and the potential hazards involved. As a minimum, the following aspects must be implemented:

- Inspection
- Cleaning and sanitizing
- Repair
- Respirator storage
- Inspection and repair documentation, as required
- Compliance with manufacturer recommendations.

Detailed information regarding cleaning, inspection, maintenance, and storage is found in Attachment 7. The RPP Coordinator shall verify compliance with the maintenance program by periodic inspections and field audits.

5.6.1 Inspection

- All respiratory protective equipment systems shall be inspected by the wearer for defects and/or deterioration immediately prior to and after each use.

- Any defects shall be reported to their supervisor immediately and the respirator removed from use until it can be repaired or replaced.

- Respiratory protective equipment systems not used routinely (including all SCBAs and equipment designated only for emergency use) shall be inspected before and after each use and at least every 30 days. Cylinders shall be recharged whenever the pressure falls below 90 percent of the manufacturer's recommended pressure level. This inspection shall be documented by some method on the unit (i.e., tag). Records of inspections shall be kept through appropriate documentation. Attachment 6 provides an example of inspection documentation for SCBAs. At a minimum, these records will include: date, inspector, and any unusual finding or condition. Any repairs or modifications shall be documented in detail.

- General field inspection shall include a check of the following: tightness of all connections, facepiece, valves, and any connecting tubes or filtering elements.

- Employees who are manufacturer-qualified repair technicians shall be used for all maintenance beyond field inspections, tests, and user-performed cleaning.

- Air supplied respiratory systems shall be inspected by a manufacturer's authorized representative at the manufacturer's recommended schedule. Manufacturers typically require an annual flow test and a complete overhaul every 5 to 7 years.

- **Specific inspection procedures are outlined in Attachment 7.**

5.6.2 Cleaning and Sanitizing. Employees maintaining their own respirators shall be thoroughly briefed on how to clean and disinfect them. On projects where employees clean their own respirator, the generally accepted procedure involves washing with detergent and warm water using a soft brush, submersion in sanitizing agent, thoroughly rinsing in clean water, drying in a clean place, and storage in sealed plastic bags or equivalent. Precautions to be taken to prevent damage from rough handling during this procedure are detailed in Attachment 7.

At locations where employees share respirators, a centralized cleaning and maintenance facility with specialized equipment and/or materials and personnel

trained in respirator maintenance must be established. Cleaning and inspection is primarily the responsibility of the user.

5.6.3 Repair. The company will only use respiratory protective equipment that is physically sound.

- If defects are found during any inspection, two remedies are possible. If parts and trained personnel are available, repair and/or adjustment may be made immediately. If parts or trained repair people are unavailable, the device shall be removed from service until it can be repaired. Under no circumstances shall a device that is known to be defective remain in service.

- Replacement or repair shall be done by adequately trained personnel. For negative pressure respirators, the Health and Safety Representative or RPP Coordinator may train or supervise personnel in the replacement of items such as inhalation/exhalation valves, head harness, cartridge adapters, and lenses. For air-supplied respirators, field repairs are limited to replacement of head harness and lenses. All other work must be completed by a factory-certified repair person.

Repair shall only be made with parts designed for the respirator. Substitution of parts from a different brand or type invalidates the respirator's approval and is prohibited.

5.6.4 Storage. Respirators must be stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and mechanical damage.

- Respirators shall be stored in such a manner that the facepiece, exhalation valve, and straps are not distorted.

- Respirators shall be stored in sealable containers (e.g., ziplock bags) after cleaning and disinfecting.

- The storage location of emergency respiratory protection shall be readily accessible and prominently identified.

- Respirators shall be stored in an area free of contamination.

5.7 Field Use

The following guidelines for the use of respirators (or equivalent) shall be incorporated into the Project HASP as appropriate. Additional guidelines may be required based on working conditions and hazards involved. Each location where respiratory protective equipment is required or worn shall include in the Project HASP justification for the selected respiratory protective equipment systems worn as outlined in Section 5.2 of this procedure.

5.7.1 General Requirements. The following general requirements shall be followed whenever respiratory protection is used:

- Employees shall be allowed to leave the regulated area to readjust the facepiece or to wash their faces and to wipe clean the facepieces of their respirators in order to minimize potential skin irritation associated with respirator use.

- Respiratory protective equipment shall not be passed on from one person to another until it has been cleaned and sanitized, per program requirements.

- Respirators will be inspected, and a positive/negative pressure test performed prior to each use.

- Entry into oxygen-deficient (< 19.5 percent O_2) atmospheres, Immediately Dangerous to Life and Health (IDLH) atmospheres, or areas requiring EPA Level A protection is prohibited without the prior approval of the Vice President, Health and Safety or the CIH assigned to the business line.

- Head coverings such as Tyvek hoods shall not be allowed to pass between the face-to-facepiece seal.

- The harness straps of tight-fitting respirators shall not be positioned or worn over hard hats.

5.7.2 Specific Requirements. The following information details specific requirements by respirator class:

Air Purifying Systems

- When APRs are worn, new filter elements shall be installed at the beginning of operations. The filter elements shall be changed whenever the ESLI (color indicators) indicates that cartridge life has expired (e.g., mercury cartridges). When no ESLIs are available, filter replacement will be based on the calculations performed by the Health and Safety Representative. Additionally, the cartridges will be replaced if "breakthrough" is perceived or whenever an increase in breathing resistance is detected. In most cases, the cartridges will be replaced a minimum of once daily, usually at the end of the work shift.

Powered Air Purifying Systems

- When PAPRs are worn, employees shall change filter elements after each day's activities. The filter elements shall be changed whenever the ESLI (color indicators) indicates that cartridge life has expired (e.g., mercury

cartridges). When no ESLIs are available, filter replacement will be based on the calculations performed by the Health and Safety Representative. Additionally, the cartridges will be replaced if "break-through" is perceived or when airflow through filter elements decreases to an unacceptable level as indicated by the manufacturer's test device.

Compressed Air

- Compressed air used for breathing shall meet at least the requirements of the specification for Grade D breathing air or better (D, E, or G; not A, K, or L) as described in the American National Standard Commodity Specification for Air, ANSI/CGA G-7.1-1989. Further information is provided in Attachment 7, Guide to Respiratory Protective Equipment Cleaning, Inspection, Maintenance, and Storage.

- Breathing air suppliers must provide certification of analysis stating conformance, as a minimum, to Grade D breathing air standards as previously referenced for each cylinder and/or air lot.

- Air delivered in bulk, e.g., tube trailers, shall have each tube or unit, or a representative number of tubes or units verified as to oxygen content prior to using that tube.

- Pure oxygen shall NOT be used at any time in open-circuit SCBAs or airline respirators.

- Breathing air cylinders shall be legibly identified with the word "AIR" by means of stenciling, stamping, or labeling as near to the valve end as practical.

- Breathing air cylinders may be stored on their sides provided the valve caps are in place.

Supplied Air Breathing Systems

- Airline couplings shall be incompatible with outlets for other gas systems to prevent inadvertent servicing of airline respirators with nonrespirable gases or oxygen.

- Standard airline couplings for breathing air systems are Foster quick connect fittings with locking dots. Hansen quick connect fitting may also be used, but must not be used where they can be inadvertently actuated and disconnected. For example, Hansen fittings could be used at the regulator connection, but not on the airline unless protected from disconnection by some other means.

- The hose line length shall not exceed 300 feet from the air bank regulator to the user.

- No more than three connections, excluding the connection to the regulator and final connection to the respirator, shall be between the breathing air cylinders and the user.

- Breathing air hose shall be protected from direct contact with chemical materials which may permeate the hose. Acceptable methods of protection include suspension of the hose from the surface or covering with a commercially available sleeve or visqueen. Breathing air hose which has become contaminated will be removed from service and disposed of properly.

- The breathing air regulator shall be adjusted to provide air pressure as per the manufacturer's recommendations. For Survivair units, this pressure shall be between 80 to 125 psi pressure.

- Cascade systems shall be equipped with low pressure warning alarms or similar warning devices to indicate air pressure in the manifold below 500 psi.

- When a cascade system is used to supply breathing air, a worker outside the Exclusion Zone shall be assigned as safety standby within audible range of the low pressure alarm.

- When a cascade system is used to recharge SCBA air cylinders, it shall be equipped with a high-pressure supply hose and coupling rated at a capacity of at least 3,000 psi. The supply hose and coupling shall be relatively short ($\leq$ 3 feet) and secured to prevent whipping when pressurized.

- Large supplied air cylinders shall be stored and handled to prevent damage to the cylinder or valve. Cylinders shall be stored upright with the protective valve cover in place and in such a way (e.g., supported with substantial rope or chain in the upper one-third of the cylinder, or in racks designed for the purpose) as to prevent the cylinder from falling. Cylinders shall not be dropped, dragged, rolled, or allowed to strike each other or to be struck violently. Cylinders shall never be exposed to temperatures exceeding 125 degrees F. Cylinders with visible external damage, evidence of corrosion, or exposure to fire shall not be accepted or used.

- Only cylinders within current hydrostatic test periods shall be used. For fiber wrapped bottles designated by the DOT-E label, hydrostatic testing shall be completed every 3 years. Maximum service life for these cylinders is 15 years. Steel or aluminum cylinders shall be

hydrostatically tested every 5 years. No maximum service life is established for steel or aluminum cylinders.

- SCBAs shall only be used in the positive pressure mode when in the Exclusion Zone.

- Standby SCBA equipment must be present when air supply systems are used in IDLH or potentially IDLH atmospheres.

Escape/Egress Units

- These respirators are intended for use in areas where escape with a short-term (5 minute) air supply is necessary. They may be used as adjuncts to airline respirators as a backup air supply, or as independent emergency devices in areas where respiratory protective equipment is not normally required.

- Appropriate training shall be accomplished and documented prior to assigning employees to tasks or locations subject to the use of these respirators.

- Escape/egress units (5-minute air supply) shall never be used as primary standby respirators for confined space entry.

- Escape/egress units shall never be used to enter, or continue working in, a hazardous atmosphere.

5.7.3 IDLH Atmospheres. For all IDLH atmospheres, the company shall ensure that:

- One employee or, when needed, more than one employee is located outside the IDLH atmosphere.

- Visual, voice, or signal line communication is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere.

- The employee(s) located outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue.

- The employer or designee is notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue.

- The employer or designee authorized to do so by the employer, once notified, provides necessary assistance appropriate to the situation.

- Employee(s) located outside the IDLH atmosphere are equipped with:

- Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied air respirator with escape/egress unit.

- Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry. Equivalent means of rescue can be considered.

5.8 Recordkeeping

The following documents must be part of the site recordkeeping program:

- Employees' medical clearances for respirator use
- Respirator training and fit testing forms.

5.9 Program Evaluation

This RPP shall be reviewed annually at the direction of the Vice President, Health and Safety.

6.0 EXCEPTION PROVISIONS

Variances and exceptions may be requested pursuant to the provisions of Procedure HS013, Health and Safety Procedure Variances.

7.0 CROSS REFERENCES

Title 29, Code of Federal Regulations, Section 1910.134.

AIHA, ***Respiratory Protection, A Manual and Guideline***, 1980.

American National Standards Institute Practices for Respiratory Protection Z88.2-1992 (or most recent publication)

NIOSH, ***Certified Equipment List*** (most recent version)

Company Health and Safety Procedures:

HS013 Health and Safety Procedure Variances
HS040 Stop Work Authority
HS050 Training Requirement
HS052 Health and Safety Plans
HS102 Management of Employee Exposure and Medical Records
HS104 Employee Notification of Industrial Hygiene Monitoring Records
HS300 Confined Spaces
HS304 Compressed Gas Cylinders
HS600 Personal Protective Equipment

8.0 ATTACHMENTS

1. Responsibility Matrix
2. List of Approved Respiratory Protective Equipment
3. Respirator Type, Protection Factor, and Fit Testing Method
4. Mandatory Respirator Fit Test Protocol
5. Respirator Fit Test Form
6. Emergency Respiratory Protective Equipment Monthly Inspection Checklist
7. Guide to Respiratory Protective Equipment Cleaning, Inspection, Maintenance, and Storage

ATTACHMENT 1
RESPIRATORY PROTECTION PROGRAM

Responsibility Matrix

Action	Procedure Section	*Responsible Party*					
		Employee	**Health and Safety Representative**	**Project/ Location Management**	**VP, Health and Safety**	**Training**	**RPP Coordinator**
Issue, Revise, and Maintain Procedure	3.1				X		
Assure Proper Selection of Respirators	5.2.2		X				
Review Purchase Requests for Respiratory Equipment	5.2.3		X				
Conduct Fit Testing	5.4		X				X
Assure Compliance with RPP	5.4		X	X			X
Assure Training	5.4		X	X			X
Audit Program Compliance	5.4		X		X		X
Assist/Approve Local Training Program	5.4					X	
Maintenance Program	5.6	X	X	X			X
Field Use	5.7	X	X	X			X
Recordkeeping	5.8	X	X			X	X
Program Evaluation	5.9				X		

ATTACHMENT 2

LIST OF APPROVED RESPIRATORY PROTECTIVE EQUIPMENT

AIR PURIFYING RESPIRATORS (APR)					
Respirator Class	**Respirator Type**	**Respiratory Performance**	**Manufacturer**	**Model Name**	**Model Number**
Standard APR	Half-Face	Negative Pressure	Survivair	Blue 1	2100-10 S 2200-10 M 2300-10 L
			MSA	Comfo II	479529 S 479428 M 479530 L
	Full-Face	Negative Pressure	Survivair	20/20	202062 S 202072 M 202082 L
			MSA	Ultra Twin	480263 S 480259 M 480267 L
Powered APR	Hood	Continuous Positive Pressure	Survivair	PAPR	5200-15
			MSA	Optimair 6	480251 S 480247 M 480255 L

SUPPLIED AIR RESPIRATORS (SAR)					
Respirator Class	**Respirator Type**	**Respiratory Performance**	**Manufacturer**	**Model Name**	**Model Number**
Airline SAR	Full-Face	Positive Pressure Demand	Survivair	Panther	P968455
			MSA	Premaire	497291
SCBA SAR	Full-Face	Positive Pressure Demand	Survivair	Cougar	P 9643310
			MSA	MMR WorkMask 2216	Varies on Components
Emergency	Escape/Egress Unit	Continuous Flow	Survivair	5 min. EEGA	9750870
			MSA	Custom Air V	484353

ATTACHMENT 3

RESPIRATOR TYPE, PROTECTION FACTOR, AND FIT TESTING METHOD

Respirator Type	Protection Factor	QLFT	QNFT
Half-Face, Negative Pressure (<100 Fit Factor)[1]	10	Yes	Yes
Full-Face, Negative Pressure (<100 Fit Factor) Used in Atmosphere up to 10 Times the PEG	10	Yes	Yes
Full-Face, Negative Pressure (>100 Fit Factor) Used in Atmospheres Over 10 Times the PEG[2]	50	No	Yes
PAPR	100	Yes	Yes
SCBA/SAR Used in Positive Pressure (Pressure Demand Mode)	10,000	Yes	Yes

Footnotes:

1. If quantitatively fit tested, the device must demonstrate a fit factor of at least 100.
2. If quantitatively fit tested, the device must demonstrate a fit factor of at least 500.

ATTACHMENT 4

MANDATORY RESPIRATOR FIT TEST PROTOCOL

OSHA-Accepted Fit Test Protocols

A. Fit Testing Procedures - General Requirements

The company shall conduct fit testing using the following procedures. The requirements in this attachment apply to all OSHA-accepted fit test methods, both QLFT and QNFT. There are several OSHA-accepted fit test protocols for QLFT. This procedure includes only the irritant smoke protocol since it requires less equipment and is more practical for field use.

1. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension, and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.

3. The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.

4. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.

5. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following Item A.6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:
   a. Position of the mask on the nose;
   b. Room for eye protection;
   c. Room to talk; and
   d. Position of mask on face and cheeks.

7. The following criteria shall be used to help determine the adequacy of the respirator fit:
   a. Chin properly placed;
   b. Adequate strap tension, not overly tightened;
   c. Fit across nose bridge;
   d. Respirator of proper size to span distance from nose to chin;
   e. Tendency of respirator to slip; and
   f. Self-observation in mirror to evaluate fit and respirator position.

8. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks. Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side-to side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.

9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache, or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

10. If a test subject exhibits difficulty in breathing during the tests, he/she shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing his/her duties.

11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

12. *Exercise Regimen*: Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

13. The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use which could interfere with respirator fit.

14. *Test Exercises*: The following test exercises are to be performed for all fit testing methods prescribed in this attachment, except for the controlled negative pressure (CNP) method. A separate fit testing exercise regimen is contained in the CNP protocol.

    Each test exercise shall be performed for one minute, except for the grimace exercise which shall be performed for 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried. The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated.

    The test subject shall perform exercises, in the test environment, in the following manner:

    a. *Normal Breathing*: In a normal standing position, without talking, the subject shall breathe normally.

    b. *Deep Breathing*: In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

    c. *Turning Head Side to Side*: Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

d. *Moving Head Up and Down*: Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

e. *Talking*: The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can count backward from 100, recite a memorized poem or song or read from a prepared text such as the Rainbow Passage.

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

f. *Grimace*: The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT.)

g. *Bending Over*: The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.

h. *Normal Breathing*: Same as Item A.14.a.

B. Qualitative Fit Test (QLFT) Protocols

1. General:

   a. The employer shall ensure that persons administering QLFT are able to perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.

   b. The employer shall ensure that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

2. Irritant Smoke (Stannic Chloride) Protocol: This qualitative fit test uses a person's response to the irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

   a. General Requirements and Precautions:

      1. The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).

      2. Only stannic chloride smoke tubes shall be used for this protocol.

      3. No form of test enclosure or hood for the test subject shall be used.

4. The smoke take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

5. The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the buildup of irritant smoke in the general atmosphere.

b. Sensitivity Screening Check: The person to be tested must demonstrate his/her ability to detect a weak concentration of the irritant smoke.

1. The test operator shall break both ends of a ventilation smoke tube containing stannic chloride, and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute, or an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.

2. The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.

3. The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

c. Irritant Smoke Fit Test Procedure:

1. The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).

2. The test subject shall be instructed to keep his/her eyes closed.

3. The test operator shall direct the stream of irritant smoke from the smoke tube toward the face seal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within 6 inches of the respirator.

4. If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.

5. The exercises identified in Item A.14 of this attachment shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.

6. If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.

7. Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.

8. If a response is produced during this second sensitivity check, then the fit test is passed.

C. Quantitative Fit Test (QNFT) Protocols

The following quantitative fit testing procedures have been demonstrated to be acceptable: quantitative fit testing using a nonhazardous test aerosol (such as corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS], or sodium chloride) generated in a test chamber, and employing instrumentation to quantify the fit of the respirator; quantitative fit testing using ambient aerosol as the test agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit; quantitative fit testing using controlled negative pressure and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit.

1. General:

   a. The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly, and ensure that test equipment is in proper working order.

   b. The employer shall ensure that QNFT equipment is kept clean, and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

2. Ambient Aerosol Condensation Nuclei Counter (CNC) Quantitative Fit Testing Protocol: The ambient aerosol CNC quantitative fit testing (Portacount®) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device, installed on the respirator, that allows the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator and a minimum fit factor pass level of at least 500 is required for a full facepiece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to conducting the screening test.

   a. Portacount® Fit Test Requirements:

      1. Check the respirator to make sure the sampling probe and line are properly attached to the facepiece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 Series 100, Series 99, or Series 95 particulate filter) per manufacturer's instruction.

      2. Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the

wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.

3. Check the following conditions for the adequacy of the respirator fit: chin properly placed; adequate strap tension, not overly tightened; fit across nose bridge; respirator of proper size to span distance from nose to chin; tendency of the respirator to slip; and self-observation in a mirror to evaluate fit and respirator position.

4. Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting facepiece, try another size of the same model respirator, or another model of respirator.

5. Follow the manufacturer's instructions for operating the Portacount® and proceed with the test.

6. The test subject shall be instructed to perform the exercises in Item A.14 of this attachment.

7. After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

b. Portacount® Test Instrument:

1. The Portacount® will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.

2. Since the pass or fail criterion of the Portacount® is user programmable, the test operator shall ensure that the pass or fail criterion meet the requirements for minimum respirator performance in this attachment.

3. A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

3. Controlled Negative Pressure (CNP) Quantitative Fit Testing Protocol - The CNP protocol provides an alternative to aerosol fit test methods. The CNP fit test method technology is based on exhausting air from a temporarily sealed respirator facepiece to generate and then maintain a constant negative pressure inside the facepiece. The rate of air exhaust is controlled so that a constant negative pressure is maintained in the respirator during the fit test. The level of pressure is selected to replicate the mean inspiratory pressure that causes leakage into the respirator under normal use conditions. With pressure held constant, air flow out of the respirator is equal to air flow into the respirator. Therefore, measurement of the exhaust stream that is required to hold the pressure in the temporarily sealed respirator constant yields a direct measure of leakage air flow into the respirator. The CNP fit test method measures leak rates through the facepiece as a method for determining the facepiece fit for negative pressure respirators. The CNP instrument manufacturer, Dynatech Nevada, also provides attachments (sampling manifolds) that replace the filter cartridges to permit fit testing in an employee's own respirator. To perform the test, the test subject closes his/her mouth and holds his/her breath, after which an air pump removes air from the respirator facepiece at a pre-selected constant pressure. The facepiece fit is expressed as the leak rate through the facepiece, expressed as milliliters per minute. The quality and validity

of the CNP fit tests are determined by the degree to which the in-mask pressure tracks the test pressure during the system measurement time of approximately five seconds. Instantaneous feedback in the form of a real-time pressure trace of the in-mask pressure is provided and used to determine test validity and quality. A minimum fit factor pass level of 100 is necessary for a half-mask respirator and a minimum fit factor of at least 500 is required for a full facepiece respirator. The entire screening and testing procedure shall be explained to the test subject prior to conducting the screening test.

a. CNP Fit Test Requirements:

1. The instrument shall have a non-adjustable test pressure of 15.0 mm water pressure.

2. The CNP system defaults selected for test pressure shall be set at 15 mm of water (-0.58 inches of water) and the modeled inspiratory flow rate shall be 53.8 liters per minute for performing fit tests.

   (Note: CNP systems have built-in capability to conduct fit testing that is specific to unique work rate, mask, and gender situations that might apply in a specific workplace. Use of system default values, which were selected to represent respirator wear with medium cartridge resistance at a low-moderate work rate, will allow inter-test comparison of the respirator fit.)

3. The individual who conducts the CNP fit testing shall be thoroughly trained to perform the test.

4. The respirator filter or cartridge needs to be replaced with the CNP test manifold. The inhalation valve downstream from the manifold either needs to be temporarily removed or propped open.

5. The test subject shall be trained to hold his/her breath for at least 20 seconds.

6. The test subject shall don the test respirator without any assistance from the individual who conducts the CNP fit test.

7. The QNFT protocol shall be followed according to Item C.1 of this attachment with an exception for the CNP test exercises.

b. CNP Test Exercises:

1. Normal Breathing: In a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject needs to hold head straight ahead and hold his/her breath for 10 seconds during the test measurement.

2. Deep Breathing: In a normal standing position, the subject shall breathe slowly and deeply for 1 minute, being careful not to hyperventilate. After the deep breathing exercise, the subject shall hold his/her head straight ahead and hold his/her breath for 10 seconds during test measurement.

3. Turning Head Side to Side: Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side for 1 minute. The head shall be held at each extreme momentarily so the subject can inhale at each side. After the

turning head side to side exercise, the subject needs to hold head full left and hold his/her breath for 10 seconds during test measurement. Next, the subject needs to hold head full right and hold his/her breath for 10 seconds during test measurement.

4. Moving Head Up and Down: Standing in place, the subject shall slowly move his/her head up and down for 1 minute. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling). After the moving head up and down exercise, the subject shall hold his/her head full up and hold his/her breath for 10 seconds during test measurement. Next, the subject shall hold his/her head full down and hold his/her breath for 10 seconds during test measurement.

5. Talking: The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song for 1 minute. After the talking exercise, the subject shall hold his/her head straight ahead and hold his/her breath for 10 seconds during the test measurement.

6. Grimace: The test subject shall grimace by smiling or frowning for 15 seconds.

7. Bending Over: The test subject shall bend at the waist as if he/she were to touch his/her toes for 1 minute. Jogging in place shall be substituted for this exercise in those test environments such as shroud-type QNFT units that prohibit bending at the waist. After the bending over exercise, the subject shall hold his/her head straight ahead and hold his/her breath for 10 seconds during the test measurement.

8. Normal Breathing: The test subject shall remove and re-don the respirator within a one-minute period. Then, in a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject shall hold his/her head straight ahead and hold his/her breath for 10 seconds during the test measurement. After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of a respirator shall be tried.

c. CNP Test Instrument:

1. The test instrument shall have an effective audio warning device when the test subject fails to hold his/her breath during the test. The test shall be terminated whenever the test subject failed to hold his/her breath. The test subject may be refitted and retested.

2. A record of the test shall be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

ATTACHMENT 5
RESPIRATOR FIT TEST FORM

NAME (Please Print): _____ SIGNATURE: _____

SSN: _____-_____-_____ HOME DEPT: _____ DATE: _____

CONDUCTED BY: _____ LOCATION: _____

FIT TEST PROTOCOL

QUANTITATIVE:
Fit Factor _____

QUALITATIVE:
Irritant Smoke:
Other (specify):

TYPE OF RESPIRATOR
(Circle Appropriate One)

APR/HF APR/FF SCBA
SAR/EGS PAPR OTHER

Respirator Manufacturer: _____
Model: _____
Size: _____

		INITIAL:
1.	I understand why respiratory protection is needed and where and when it should be used.	
2.	I know how to use this respirator properly.	
3.	I know how to clean and inspect this respirator.	
4.	I understand the limitations and restrictions of this respirator.	
5.	I wore this respirator in normal air and performed the user seal.	
6.	I wore this respirator equipment in a test atmosphere.	
7.	I understand that a good gas-tight face seal cannot be achieved with obstructions such as facial hair or glasses.	
8.	I understand that corrective lenses compatible with the full facepiece are available by my manager.	

ATTACHMENT 6

EMERGENCY RESPIRATORY PROTECTIVE EQUIPMENT MONTHLY INSPECTION CHECKLIST

INSPECTED BY (Print):_____ DATE:

BACKPACK#: _____ AIR CYLINDER#:

			PASS	FAIL
A. Backpack and Harness Assembly	1. Straps	Inspect for complete set	☐	☐
		Inspect for damaged straps	☐	☐
	2. Buckles	Inspect for mating ends	☐	☐
		Check locking function	☐	☐
	3. Backplage and Cylinder Lock	Inspect backplage for cracks, missing screws/rivets	☐	☐
		Inspect cylinder hold down strap	☐	☐
		Inspect strap tightener	☐	☐
B. Cylinder and Cylinder Valve Assembly	1. Cylinder	Cylinder tight to backplate	☐	☐
		Current Hydrostatic Test	☐	☐
		Inspect cylinder for dents, gouges	☐	☐
		Is cylinder at least 90% filled?	☐	☐
	2. Head and Valve Assembly	Inspect cylinder valve lock for presence	☐	☐
		Inspect cylinder gauge for condition	☐	☐
		Proper function of cylinder valve lock	☐	☐
		Test for cylinder leakage	☐	☐
C. Regulator and High Pressure Hose	1. High Pressure Hose and Connector	Leakage in hose	☐	☐
		Leakage in hose to cylinder connector	☐	☐
	2. Regulator and Low Pressure Alarm	Read regulator gauge (at least 1,000 psi)	☐	☐
		Low pressure alarm sounds at 500 psi	☐	☐
		Test integrity of diaphragm	☐	☐
		Test for positive pressure	☐	☐
		Test bypass system	☐	☐
D. Facepiece and Corrugated Breathing Tube	1. Facepiece	Inspect harness for deterioration	☐	☐
		Inspect facepiece body for deterioration	☐	☐
		Inspect lens	☐	☐
		Inspect exhalation valve	☐	☐
	2. Breathing Tube and Connector	Inspect breathing tube for deterioration	☐	☐
		Inspect connector for threads and gasket	☐	☐
	3. Leak Test and Cleaning	Perform negative pressure test on facepiece/ breathing tube	☐	☐
		Clean and sanitize facepiece	☐	☐

Note: Any item marked ☛Fail☚ will place the equipment out of service until repaired or replaced.

ATTACHMENT 7

GUIDE TO RESPIRATORY PROTECTIVE EQUIPMENT: CLEANING, INSPECTION, MAINTENANCE, AND STORAGE

A program for the maintenance of respirators shall include the following:

- Cleaning and sanitizing
- Inspection for defects
- Maintenance and repair
- Storage
- Assurance of breathing air quality.

The following maintenance, inspection, and storage program is recommended.

1. Cleaning and Sanitizing

Respirators issued to an individual shall be cleaned and sanitized regularly. Each respirator shall be cleaned and sanitized before being worn by different individuals. Respirators intended for emergency use shall be cleaned and sanitized after being used. The following shall be completed in addition to the manufacturer's instruction for cleaning:

a. Remove, when necessary, the following components of respiratory inlet covering assemblies before cleaning and sanitizing:

   1. Filters, cartridges, canisters
   2. Speaking diaphragms
   3. Valve assemblies
   4. Any components recommended by the respirator manufacturer.

b. Wash respiratory inlet covering assemblies in warm (43 degrees C or 110 degrees F maximum temperature) cleaner sanitizer solution. A stiff bristle (not wire) brush may be used to facilitate removal of dirt or other foreign material.

c. Rinse the respirator inlet covering assemblies in clean, warm (43 degrees C or 110 degrees F maximum temperature) water.

d. Drain all water, and air dry the respiratory inlet covering assemblies.

e. Clean and sanitize all parts removed from the respiratory inlet covering assemblies as recommended by the manufacturers

f. If necessary to remove foreign material, hand wipe respiratory inlet covering assemblies, all parts, and all gasket- and valve-sealing surfaces with damp, lint-free cloth.

g. Inspect parts and replace any that are defective.

h. Reassemble parts on respirator inlet covering assemblies.

i. Visually inspect and, where possible, test parts and respirator assemblies for proper function.

j. Place assembled respirators in appropriate containers for storage.

Machines may be used to expedite the cleaning, sanitizing, rinsing, and drying of large numbers of respirators. Extreme care shall be taken to ensure against tumbling, agitation, or exposure to temperatures above those recommended by the manufacturer (normally 43 degrees C or 100 degrees F maximum), as these conditions are likely to result in damage to the respirators.

Ultrasonic cleaners, clothes washing machines, dishwashers, and clothes dryers have been specially adapted and successfully used for cleaning and drying respirators.

Cleaner sanitizers that effectively clean the respirator and contain a bactericidal agent are commercially available. The bactericidal agent frequently used is a quaternary ammonium compound. Strong cleaning and sanitizing agents and many solvents can damage rubber or elastomeric respirator parts. These materials must be used with caution.

Alternatively, respirators may be washed in a detergent solution and then sanitized by immersion in a sanitizing solution. Some sanitizing solutions that have proven effective are: (a) a hypochlorite (bleach) solution (50 parts per million chlorine), 2-minute immersion; (b) an aqueous iodine solution (50 parts per million of iodine), 2-minute immersion; or (c) a quaternary ammonium solution (200 parts per million of quaternary ammonium compounds in water with less than 500 parts per million total hardness), 2-minute immersion.

Inflammation of the skin of the respirator user (dermatitis) may occur if the quaternary ammonium compounds are not completely rinsed from the respirator. The hypochlorite and iodine solutions are unstable and break down with time; they may cause deterioration of rubber or other elastomeric parts and may be corrosive to metallic parts. Immersion times should not be extended beyond the mentioned time periods, and the sanitizers shall be thoroughly rinsed from the respirator parts.

Respirators may become contaminated with toxic materials. If the contamination is light, normal cleaning procedures should provide satisfactory decontamination; otherwise, separate decontamination steps may be required before cleaning.

2. Inspection

The user shall inspect the respirator immediately prior to each use to ensure that it is in proper working condition. After cleaning and sanitizing, each respirator shall be inspected to determine if it is in proper working condition, if it needs replacement parts or repairs, or if it should be discarded. Each respirator stored for emergency or rescue use shall be inspected at least monthly.

Respirator inspection shall include a check for tightness of connections; for the condition of the respiratory inlet covering, head harness, valves, connecting tubes, harness assemblies, hoses, filters, cartridges, canisters, end-of-service indicators, electrical components, and shelf-life date(s); and for the proper function of regulators, alarms, and other warning systems. Each rubber or other elastomeric part shall be inspected for pliability and signs of deterioration. Each air and oxygen cylinder shall be inspected to ensure that it is fully charged according to the manufacturer's instructions.

A record of inspection dates shall be kept for each respirator maintained for emergency or rescue use. Respirators that do not meet applicable inspection criteria shall be immediately removed from service (a temporary replacement assigned) and repaired or permanently replaced.

Inspection of hoop-wrapped air cylinders will follow the recommendations set forth in the Compressed Gas Association, Inc. publication CGA C-6.2-1988, "Guidelines for Visual Inspection & Requalification of Fiber Reinforced High Pressure Cylinders," and will be examined for the following five types of damage:

- Abrasion is damage caused by wearing, grinding, or rubbing away by friction. Abrasions less than 0.005 inch (0.127 mm) deep are acceptable and should have no adverse effects on the safety of the cylinder. Abrasions with isolated groups of fibers exposed or flat spots with a depth greater than 0.005 inch (0.127 mm) but less than 0.0075 inch (0.191 mm) are acceptable if the damage is repaired. Cylinders abraded in excess of 0.0075 inch (0.191 mm) should be taken out of service until professionally inspected.

- Cuts are damage inflicted by a sharp object. Cuts or scratches less than 0.005 inch (0.127 mm) deep are acceptable regardless of length, number, or direction. For cuts greater than 0.005 inch (0.127 mm) deep and up to a depth of 0.015 inch (0.038 mm) with a maximum 1- or 2-inch (25.4 mm or 50.8 mm) length transverse to the fiber direction, the cylinder should be removed from service until repaired. Cylinders with cuts greater than 0.015 inch (0.038 mm) with a maximum greater than 2 inches (50.8 mm) length transverse to the fiber direction or with bare metal showing through must be condemned.

- Impact damage is caused by a cylinder striking or being struck by another object. Impact damage is considered slight if a frosted area is noted in the impact area. These cylinders may be returned to service. Impact damage is severe if evidence of fiber cutting, delamination, and possible structural damage is apparent. Cylinders sustaining severe impact damage should be evaluated using the guidelines for cuts and structural damage.

- Structural damage is damage which causes a visual change in original cylinder configuration. This change can include any evidence of bulges, a cocked end fitting, concave areas on the domes or on the cylinder section, or, if by visual inspection of the cylinder interior, there is evidence of damage involving deformation of the liner. Structurally damaged cylinders must be immediately removed from service and condemned.

- Heat or fire damage to a cylinder is evident by discoloration, charring, or burning of the composite, labels, paint, or plastic components of the valve. Such damage would cause a cylinder to be removed from service and condemned. Note: If the cylinder is only soiled from smoke or other debris and is found to be intact underneath, it may be returned to service.

3. Maintenance and Repair

Replacement of parts or repairs shall be done only be persons trained in proper respirator maintenance and assembly. Replacement parts shall be only those designated for the specific respirator repaired. Reducing or admission valves, regulators, and alarms shall be adjusted or repaired by the respirator manufacturer or a technician trained by the manufacturer. Instrumentation for valve, regulator, and alarm adjustments and tests should be calibrated to a standard traceable to the National Institute of Standards and Technology (NIST), at a minimum of every 3 years.

4. Storage

Respirators shall be stored in a manner that will protect them against physical and chemical agents such as vibration, shocks, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirators shall be stored to prevent distortion of rubber or other elastomeric parts. Respirators shall not be stored in such places as lockers and tool boxes, unless they are protected from contamination, distortion, and damage. Emergency and rescue respirators that are placed in the work areas shall be quickly accessible at all times, and the storage cabinet or container in which they are stored shall be clearly marked.

5. Assurance of Breathing Air Quality

Compressed gaseous air, compressed gaseous oxygen, liquid air, and liquid oxygen used for respiration shall be of high purity. Compressed gaseous air shall meet at least the requirements of the specification for Type I-Grade D breathing air, and liquid air shall meet at least the requirements for Type II-Grade B breathing air as described in ANSI/CGA G-7.1-1989.

The CGA designation for Grade D and Grade E breathing air is as follows:

- Grade D breathing air, as per ANSI/CGA G-7.1-1989, shall contain between 19.5 and 23.5 percent oxygen with the balance predominantly nitrogen, a maximum of 5 mg/m^3 oil (condensed), a maximum of 10 ppm carbon monoxide, no pronounced odor, and a maximum of 1,000 ppm carbon dioxide.

- Grade E breathing air, as per ANSI/CGA G-7.1-1989, shall contain between 20 and 22 percent oxygen with the balance predominantly nitrogen, a maximum of 5 mg/m^3 oil (condensed), a maximum of 10 ppm carbon monoxide, no pronounced odor, a maximum of 500 ppm carbon dioxide, and 25 ppm total hydrocarbon content (as methane).

- Note: The quality verification for oil is not required for synthesized air whose oxygen and nitrogen components are produced by air liquefaction. Carbon monoxide quality verification is not required for Grade D breathing air if synthesized air when nitrogen component was previously analyzed and meets National Foundry (NF) specification and

when the oxygen component was produced by air liquefaction and meets United States Pharmacopeia (USP) specification.

Compressed gaseous air may contain low concentrations of oil introduced from equipment during processing or normal operation. If high-pressure oxygen passes through an oil- or grease-coated orifice, an explosion or fire may occur. Therefore, compressed gaseous oxygen shall not be used in supplied air respirators or in open-circuit type self-contained breathing apparatus that have previously used compressed air. Oxygen concentrations greater than 23.5 percent shall be used only in equipment designed for oxygen service or distribution.

The dew point of air used to recharge self-contained breathing apparatus shall be –65 degrees F or lower (less than 25 ppm water vapor). The driest air obtainable (dew point of –100 degrees F or lower) should be used for recharging SCBA cylinders to be used in environments with ambient temperatures below –25 degrees F. The dew point of breathing air used with supplied air respirators should be lower than the lowest ambient temperature to which any regulator or control valve on the respirator or air-supplied system will be exposed.

Breathing air couplings shall be incompatible with outlets for nonrespirable plant air or other gas systems to prevent inadvertent servicing of supplied air respirators with nonrespirable gases. **It is recommended that Foster or Hansen fittings be reserved for breathing air systems.** Breathing air outlets shall be labeled.

Breathing air may be supplied to supplied air respirators from cylinders or air compressors. Cylinders shall be tested and maintained in accordance with applicable DOT specifications for shipping containers (49 CFR 173 and 178). Breathing gas containers shall be marked in accordance with ANSI/CGA C-4-1990. Specific test recommendations for purchased breathing air are given in the following table.

Method of Preparation	Analysis Recommended
Compression: Supplier does not fill cylinders with any other gases.	Check 10% of cylinders from each lot for ppm CO and odor.
Compression: Supplier fills cylinders with gases other than air.	Analyze all cylinders for percent oxygen. Check 10% of cylinders from each lot for ppm CO and odor.
Reconstitution.	Analyze all cylinders for percent oxygen. Check 10% of cylinders from each lot for ppm CO and odor.

A compressor shall be constructed so as to avoid entry of contaminated air. For all air compressors, including portable types, the air intake location shall be carefully selected, and monitored closely to ensure continued quality of air supply to the compressor. The system shall be equipped as necessary with a suitable in-line air-purifying sorbent bed and filter to further assure breathing air quality. Maintenance and replacement/refurbishment of compressor and associated air-purifying/filter media shall be performed periodically, by trained personnel following manufacturer's recommendations and instructions.

As part of acceptance testing, and prior to initial use, representative sampling of the compressor air output shall be performed to ensure that it complies with the requirements in Paragraph 1 of this section. To ensure a continued high-quality air supply, and to account for any distribution system contaminant input, a representative sample should be taken at distribution supply points. Samples should be collected on a periodic basis, as directed by the Program Coordinator. Specific test recommendations are given in the following table.

Type/Sample	Oil Lubricated	Non-Oil Lubricated	Combustion Engine Powered
Water Vapor	☒	☒	☒
Carbon Monoxide	☒		☒
Condensed Hydrocarbon	☒		☒
Carbon Dioxide			☒
Odor	☒	☒	☒

NOTES:

1. When using air compressors, intake location shall be carefully selected and monitored closely to ensure air supplied to the compressor is of adequate quality.

2. No frequency for periodic checks of air quality is specified, due to wide variation in equipment types, use, working environments, and operating experience.

3. Continuous monitoring of temperature and carbon monoxide are not required.

4. For non-oil lubricated compressors that operate at less than 35 psi, no sampling for water is required.

5. These requirements apply to systems designed for breathing air, other air-supply systems need to be evaluated on a case-by-case basis for the type and frequency of testing.

Further details on sources of compressed air and its safe use can be found in CGA G-7-1988.

PROCEDURE

Subject: MOTOR VEHICLE OPERATION: GENERAL REQUIREMENTS

1.0 PURPOSE AND SUMMARY

This procedure prescribes the general requirements for the operation of motor vehicles on company business. All operators of company owned, leased, and rented vehicles, as well as personal vehicles used on company business, are covered by this procedure. U.S. Department of Transportation (DOT) regulated personnel must also comply with the guidelines contained in Procedure HS810. Key elements of this procedure include:

- All employees who drive or may drive on company business must be familiar with the requirements of this procedure and certify their acceptance of the Company Rules for Motor Vehicle Operation (Attachment 2). In addition, covered employees shall sign a copy of the most current version of Attachment 2 on an annual basis.

- All new hire candidates shall complete the Pre-employment Driving Record Certification (Attachment 3). This certification will be evaluated via the established point system to determine driving privilege status.

- Employees must report all vehicular citations incurred while on company business to their supervisor as soon as possible, but not longer than 24 hours after the occurrence. Once reported, the established evaluation criteria in Section 5.4 will be used to determine corrective actions.

- Employees have the responsibility to keep track of their non-work related vehicular citations and utilize the established evaluation criteria found in Section 5.3 to determine if their overall MVR citations exceed the Overall Driving Record limits (See Section 5.3.2).

- Employees utilizing vehicles while on company business are required to review this procedure and attend a company-designated driver training class at least once every two years.

- Requests for the re-instatement of denied or revoked driving privileges can be made to the appropriate business line Vice-President and the Director of Health & Safety.

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The Director of Health and Safety is responsible for the issuance, revision, and maintenance of this procedure.

3.2 Action/Approval Responsibilities

The Responsibility Matrix is Attachment 1.

4.0 DEFINITIONS

Chargeable Vehicle Accident - Any at fault vehicle accident meeting any one of the following criteria:

- An individual other than an employee of the company is a party in the accident.
- Property owned by a person or entity other than the company is damaged.
- When only company employees, company owned or leased (not rented) vehicles, and property is involved and damage exceeds $2,500.00.

Company - Shaw Environmental & Infrastructure, Inc. (Shaw E & I) and it's subsidiaries and affiliates.

Motor Vehicle - Any passenger vehicle, including trucks, used upon the highway or in private facilities for transporting passengers and/or property. This includes personal vehicles operated on company business. For the purpose of this procedure, off-road vehicles, such as ATV's (Four Wheelers) earthmoving equipment, forklifts, non-highway use trucks, etc., are not considered vehicles. The use of motorcycles on company business is prohibited

Project Assigned Employees – Any employee that is assigned to a field operations project position. This designation includes Project Managers, Site Managers/Supervisors, Foremen, Technicians, Scientists, Geologists, Project Business Accountants, etc. This does not include employees that are typically assigned to an office but are visiting a site for brief periods of time, such as to provide technical assistance, perform audits, perform program reviews, etc.

5.0 TEXT

5.1 Company Rules for Motor Vehicle Operation

All employees who will or may be required to operate a company owned, leased, or rented motor vehicle or a personal vehicle used on company business shall acknowledge acceptance of the Company Rules for Motor Vehicle Operation (Attachment 2) prior to such operation. The signed form shall be retained by the Monroeville, PA Health & Safety Records Department. Each year, the company shall require covered employees to sign a copy of the most current Company Rules for Motor Vehicle Operation.

FAILURE OF EMPLOYEES TO COMPY WITH COMPANY RULES FOR MOTOR VEHICLE OPERATION OR THIS POLICY SHALL BE SUBJECT TO DISCIPLINARY ACTION UP TO AND INCLUDING (BUT NOT LIMITED TO) REVOCATION OF DRIVING PRIVILEGES FOR COMPANY BUSINESS AND TERMINATION OF EMPLOYMENT.

5.1.1 Project Assigned Employee Vehicle Use Requirements

The following requirements are set forth as it pertains to Project Assigned Employees.

- Project-assigned employees are not permitted to operate company vehicle (owned, leased or rented) on non-company business after 10:00 p.m. without written authorization from the project manager or the appointed Site Manager/Supervisor with jurisdiction over the vehicle. In those cases where there is shift work, a non-traditional workday (i.e. 3PM to 11PM workday, etc.) or other non-typical circumstances, it is understood that the after 10:00 PM restriction would not be appropriate. However, even in these non-typical circumstances, the Project Manager or the appointed site manager/supervisor shall be required to execute the required written authorization for use of a company vehicle, including the time frame in which employees shall be permitted to use the vehicle after their non-traditional workday.

- Project assigned personnel that are residing in temporary housing / hotels are

granted permission to drive to and from the temporary residence and work. Additionally, the Project Manager, or the appointed Site Manager/Supervisor his/her designee (Site Manager, Supervisor, etc.) is required to evaluate and optimize the potential of carpooling of project assigned personnel in an effort to reduce the number of company vehicles being driven to and from the project site.

- Project assigned employees shall not use company vehicles for sight seeing or any other personal/recreational activities.

- Vehicles may be used in support of "daily life activities" such as going to restaurants for dinner, laundromats, local retail stores, grocery stores, etc.
- A maximum distance for "daily life activity" driving shall be no further than 20-miles from the temporary housing in which an employee resides. In those cases where the maximum allowed distance does not permit daily life activities to be conducted, a written authorization, from the Project Manager or the appointed Site Manager/Supervisor , is required to travel further distances.

- Should an employee be required to live at his/her permanent residence due to it's proximity to the project site, that employee shall utilize his/her own personal transportation to drive to and from work. At the site, employees shall be allowed to use a company vehicle as required to perform project activities.

- If an employee is assigned to a project site that is located within driving distance from the employee's permanent residence, but is too far away to allow for a daily commute, that employee shall utilize their own personal transportation to drive to and from their permanent residence and the project site. (i.e. for initial assignment arrival to the project, trips home on rotation, etc.) Upon arrival to the site, employees shall be allowed to use a company vehicle as required to perform project activities. In these cases, the employee will also be required to drive their personal vehicle to and from the project site from their temporary housing / hotel residence, for personal "daily life activities", etc.

5.2 Pre-employment Evaluation

The local Health and Safety Assistant shall distribute a copy of this procedure to all new hire candidates for the completion of Attachments 2 and 3. Information provided should be evaluated via the point system in Section 5.3, and the hiring manager advised regarding any hiring or driving privilege restrictions that may apply. Hiring of persons with regular driving duties (e.g., field technicians and leadmen, sales persons, or others with assigned company motor vehicles) may only proceed after the information contained in Attachment 3 is evaluated.

Once Attachment 3 is completed, it is to be faxed to the Monroeville, PA Health and Safety Records Department at (412) 858-3976. The driving status of the prospective employee will be reported to the appropriate Human Resources Department in two to three working days. The local Health & Safety Assistant will notify the appropriate Human Resources manager when the attachments are not returned.

Discrepancies between the certified driving record report and Attachment 3 shall be reviewed with the prospective employee. Deliberate falsification of driving record information will disqualify prospective employees from being hired.

5.3 Driving Record Point System

The following point system will be used to evaluate the driving record of all existing employees and new hire candidates that can reasonably be expected to operate a motor vehicle during their employment. This data is to be collected through Motor Vehicle Records (MVR) search and by the employee completing Attachment 3 of this policy. Attachment 3 is to be completed by the new hire candidate and reviewed by the regional H&S Assistant to ensure compliance.

Driving Record Point System	
Description	**Assigned Point Value**
Overweight, loss of load, vehicular equipment infraction, etc.	1
Moving violation: speeding, failure to stop, failure to signal, etc.	2
At-fault accident	3
Major citation: reckless driving, tailgating, suspended license, speed contest, improper lane usage, Open Container (Non-Work Related), etc.	6
Driving under the influence, Hit and Run (leaving the scene)	8
Open Alcohol Container (Work Related)	8

5.3.1 Pre-Employment Driving Record Point System Evaluation

If a new hire candidate has accumulated three (3) points or less in the last twelve (12) months or five (5) points or less in the last twenty-four (24) months, they will be given the privilege to drive motor vehicles on company business without restrictions.
If a new hire has accumulated four (4) to six (6) points in the last twelve (12) months or six (6) to eight (8) points in the last twenty-four (24) months, they will be placed on probation for a period of twelve (12) months. They will be afforded the privilege to drive motor vehicles on company business during this probationary period. Any driving infractions (i.e., speeding tickets, at-fault accidents, citations, etc.) accumulated during this probationary period will result in termination of the privilege to drive a motor vehicle on company business.

If the new hire candidate has accumulated seven (7) to eleven (11) points in the last twelve (12) months or nine (9) to fifteen (15) points in the last twenty-four (24) months, they will not be eligible for company driving privileges. Employment can only be offered with the strict understanding of denial of the privilege to drive motor vehicles on company business. After the first twelve (12) months of employment, the employee can petition the appropriate business line Vice President and the Director of Safety and Health for reconsideration of driving privileges.

If a new hire candidate is expected to drive a vehicle, to fulfill the responsibilities of his/her role, and there has been an accumulation of twelve (12) points or more in the last twelve (12) months or sixteen (16) points or more in the last twenty-four (24) months, the candidate shall not be hired. See Table below:

Candidate's Driving Privilege Status Description	Past 12 Months	Past 24 Months
Can drive without restriction.	0 to 3 points	0 to 5 points
Can drive with understanding of probationary status.	4 to 6 points	6 to 8 points
Not eligible for company driving privileges for first 12 months of employment.	7 to 11 points	9 to 15 points
Candidate not eligible for hire.	12 points or more	16 points or more

5.3.2 Existing Employee Driving Record Point System

An acceptable traffic record is one requirement for continued driving privileges. Accordingly, all affected employee's MVR traffic record is subject to periodic and annual review to ensure compliance with state and federal regulations, as well as company policy.

WORK RELATED TRAFFIC VIOLATIONS

It is the responsibility of all affected employees to provide verbal notice to their supervisor of any work related traffic violations that have occurred as soon as practicable but not longer than 24 hours after the occurrence. This verbal notice shall be followed by the employee completing an updated "Employee Driving Record Certification" (Attachment 3), and "Notification of Work Related Citation" form (Attachment 4). Both Attachment 3 and 4 shall then be immediately forwarded to the Monroeville, PA Health and Safety Records office.

NON-WORK RELATED TRAFFIC VIOLATIONS

Employees have the responsibility to keep track of their non-work related vehicular citations and utilize the established evaluation criteria, as described below, to determine if their overall traffic citations exceed acceptable company limits. It is not necessary for employees to report non-work related citations to their supervisor as they occur. However, if an employee's overall MVR record (work related or not) exceeds the company's established points system criteria, the employee must verbally inform their supervisor as soon as practicable but not longer than the following business day after the occurrence. This verbal notice shall be followed by the employee completing an updated "Employee Driving Record Certification" (Attachment 3), and it shall then be immediately forwarded to the Monroeville, PA Health and Safety Records office.

OVERALL DRIVING RECORD EVALUATION

If it is determined that an employee has accumulated three (3) points or less in the last twelve (12) months or five (5) points or less in the last twenty-four (24) months, they will be allowed to continue with the privilege to drive motor vehicles on company business without restrictions.

If an employee has accumulated four (4) to six (6) points in the last twelve (12) months or six (6) to eight (8) points in the last twenty-four (24) months, the employee will be placed on probation for a period of twelve (12) months. The employee can continue to drive motor vehicles on company business during this probationary period.

If the employee has accumulated seven (7) to eleven (11) points in the last twelve (12) months or nine (9) to fifteen (15) points in the last twenty-four (24) months, they will not

be eligible for company driving privileges. Continued employment may only be extended with the strict understanding of denial of the privilege to drive company owned, leased or rented motor vehicles on company business. After the first twelve (12) months following driving privilege revocation, the employee can petition their respective Business Line VP and the Director of Safety and Health for reconsideration of driving privileges. See Table below:

Employee's Driving Privilege Status Description	Past 12 Months	Past 24 Months
Can drive without restriction.	0 to 3 points	0 to 5 points
Can drive with understanding of probationary status.	4 to 6 points	6 to 8 points
Company driving privileges are revoked.	7 to 11 points	9 to 15 points

5.4 Employee Evaluation Criteria

All employees who may operate a motor vehicle on company business will become familiar with the requirements of this procedure, complete the currently-designated company driver training class, and complete Attachment 2 prior to such operation. The employee driving evaluation criteria is based upon all infractions including those incurred while on company business and during off-work hours. It is imperative that employees notify their supervisors as immediately as possible and no later than 24 hours following a work-related citation/accident. Once notified, the supervisor will ensure the completion of Attachment 3 and Attachment 4, forward it to the Monroeville, PA H&S Records Office, and initiate one of the following corrective actions as required. Additionally, as it relates to non-work related and work related traffic violations, it is the employee's responsibility to ensure that their overall driving record does not allow for the exceeding of the driving records points system. Should the employee's driving record points exceed the system limits, that they must notify their supervisor immediately, complete an updated "Employee Driving Record Certification" (Attachment 3) and forwarded it to the **Monroeville, PA Health & Safety Records Department.**

5.4.1 Work-Related Minor Citation

When an employee is given a work related minor citation (i.e., speeding ticket, moving violation, failure to signal turn, loss of load, etc.), the employee's supervisor will meet with the employee to discuss the corrective action that must be taken so that further violations do not occur. At a minimum, the supervisor shall require the employee to attend a recognized course in defensive driving on his/her own time and the cost of this training will be borne by the employee. This course shall be pre-approved by the Division Health & Safety Manager. The supervisor will provide written direction to the employee regarding the assigned corrective action(s). The supervisor shall forward a copy of an updated Employee Driving Record Evaluation form (Attachment 3) and a form of verification showing the employee's successful completion of an approved defensive driving course to the appropriate regional Human Resources Department for inclusion in the employee's personnel file. These documents shall also be forwarded to the **Monroeville, PA Health & Safety Records Department.**

5.4.2 Work Related Major Citation

When an employee is given a work related major citation (i.e., reckless driving, tailgating, suspended license, speed contest, etc.), the supervisor will hold a meeting with the employee, at which time the supervisor will complete the company Disciplinary Action Form (Procedure HR207) thereby informing the employee that any additional infractions will lead to more severe disciplinary action. In addition, the employee will be required to attend a recognized defensive driving course on his/her own time, as described in section 5.4.1, and will be suspended from work for one day without pay. A copy of the Disciplinary Action Form shall be forwarded to the appropriate Human Resources Department for their information and inclusion in the employee's personnel file.

5.4.3 Failure to Notify

Should an employee fail to notify his/her supervisor of a citation or accident within the required reporting time, his/her company driving privilege may be revoked. The supervisor will also take disciplinary action that is appropriate for the unreported event. If the unreported event is work related and is either an at-fault accident, driving under the influence case, or a hit and run violation, the termination process will be initiated. All disciplinary actions shall be documented to the employee by the supervisor. This copy, and any written response by the employee, shall be forwarded to the appropriate Human Resources Department for their information and inclusion in the employee's personnel file.

5.4.4 At-Fault Accident

Whenever an employee is operating a company owned/leased/rented vehicle or their personal vehicle on company business is involved in an at-fault vehicle accident, an Accident Review Board shall be convened and recommend the corrective action to be taken. At a minimum, the action shall include the completion of a recognized driver safety course on their time and at their expense, as described in section 5.4.1. All disciplinary actions resulting from at-fault vehicle accidents will be reviewed for consistency by the appropriate Safety Council.

Depending upon the circumstances and severity of the accident, termination of the employee can be considered. As above, this must be approved by the appropriate Human Resources Department. All communication to the employee regarding the accident and resulting action shall be in writing with a copy to the appropriate Human Resources Department for their information and inclusion in the employee's personnel file.

5.4.5 Driving Under the Influence, Hit & Run (Leaving The Scene) and Open Container

If an employee is charged with Driving Under the Influence, Hit and Run or an Open Alcohol Container violation, he/she will have their driving privileges temporarily suspended pending final resolution of the charge. If the charge is resolved in the employee's favor, with a final adjudication holding no penalty, driving privileges may be re-instated. However, if any penalty is attached, such as probation, license restrictions, etc., the employee may be considered unqualified to drive for the company. Whenever an employee is convicted or pleads no contest to a company-

related driving under the influence, hit and run or open container charge, he/she will be immediately terminated.

In a case that is not work related, and an employee is convicted or pleads no contest to a hit and run or driving under the influence charge, the employee shall notify his supervisor. Accordingly, the employee's company driving privileges will then be revoked for twelve (12) months. After the first twelve (12) months following driving privilege revocation, the employee can petition their respective Business Line VP and the Director of Safety and Health for reconsideration of driving privileges.

5.5 Training

All employees who will, or may reasonably be expected to, drive a company owned/leased/rented vehicle shall review this procedure and complete the currently-designated company driver training class prior to such operation. This class is designed to be taught either via the company's Web-based training program or by local Health and Safety personnel and must include the following elements: federal/state/local driving rules, company driving rules, emergency/accident procedures, and defensive driving techniques. Specific information on the vehicle to be operated will be provided locally. Personnel conducting this class shall provide the Knoxville Health and Safety Training Department with a copy of the course attendance sheet for inclusion in individual training records. All affected employees shall complete a driver safety training class at least once every two years.

5.6 Reinstatement of Driving Privilege

Any employee who has had his/her privilege to drive a motor vehicle on company business revoked or denied, and who desires to reinstate this privilege, must apply to the business line Vice President and the Director of Health and Safety for reinstatement. The Director of H&S, or his designee, shall specify a rehabilitation program (if applicable), an external safe driving course, and any other requirements in which he/she deems appropriate. Once the employee completes the program, documentation of successful completion must be formally presented to the appropriate Vice President and the Director of H&S. If the documentation is accepted, the driving privilege may be reinstated. Copies of all documents shall then be forwarded, by the responsible H&S Manager, to Human Resources and to the Monroeville, PA Health & Safety Records Department.

Reinstatement of the driving privilege may occur one (1) time, at the discretion of the Director of Health & Safety and the responsible Business Line Vice President. If employee driving performance leads to a subsequent revocation of this privilege, such revocation shall be permanent.

5.7 Non-Shaw Employee Vehicle Use Requirements

Only approved non-Shaw employees (client, subcontractor or temporary/temp agency employees) who have completed and signed the "Non-Shaw Employee Driver Questionnaire" (HS800 Attachment 5) will be allowed to drive a Shaw owned, leased, or rented vehicle. Upon completing the questionaire and prior to the driver operating a Shaw vehicle, the subject questionnaire must be signed , dated and placed on file at

the job site. The primary vehicle operator or the Shaw Project Management representative shall review the questionnaire and determine whether the non-Shaw employee satisfies the driver qualification requirements of HS800. The driver qualification point system can be found in section 5.3 of this policy.

In addition to the above requirement, it is also a requirement of the responsible Shaw Project Manager to forward a fully executed, company specific version of the correspondence that is found in Attachment 6, to the employer of the non-Shaw driver. This correspondence should not be modified except for the fields that specify the name and address of the subcontractor or client to which the letter is being written. This written correspondence will serve to notify that any employee that is assigned by their company to a Shaw project, and is required to operate/drive a Shaw owned, leased, or rented vehicle, will be subject to either meeting or exceeding the operator requirements for Shaw employees.

As the employer of individuals who are assigned to a Shaw project, the authorized non-Shaw employer representative shall sign and return Attachment 6 to the respective Shaw Project Manager. By signing Attachment 6, the non-Shaw employer is acknowledging that they are either adopting the requirements set forth in this policy (HS800, Motor Vehicle Operation) or have developed a similar policy that meets or exceeds these requirements. Failure of a non-Shaw employer to comply with the requirements set forth in HS800 shall result in the prohibition of their employees driving any Shaw owned, leased or rented vehicles.

5.8 DRIVER SAFETY NOTIFICATION STICKER

A safety notification bumper sticker shall be applied to all Shaw owned / leased vehicles in an effort to ensure continued compliance with driving safety regulations. The notification service will be managed by a third party fleet safety management company and will serve as the recipient of all calls that are placed concerning unsafe driving behavior. The Findlay, OH equipment division will serve as the first point of contact as it pertains to notifications that are received from the third party company who administers the bumper sticker safety call in service. Upon receiving a report from the third party administrator, the equipment division shall determine what business line the vehicle / driver is located within and then contact the respective business line Divisional H&S Manager. The Divisional H&S Manager will then contact the affected employee and the employee's supervisor for a counseling/discussion meeting, concerning the complaint. Upon conclusion of the meeting, the information will be reviewed by the supervisor and the Divisional H&S Manager for determination of corrective or disciplinary action.

The company shall endeavor to ensure that all company owned/leased fleet vehicles shall have a safety notification bumper sticker applied to the rear of the vehicle. It is the responsibility of the driver, who is deemed the primary / responsible operator of the vehicle, to ensure that the sticker remains on the vehicle and remains legible and in no way defaced. If the vehicle is project or program assigned and there is no designated primary operator, then the Project Manager will be considered the primary / responsible

operator. The primary / responsible operator shall contact the Equipment Division in Findlay, OH, at 1-800-225-6464 ext. 6051 or direct dial 419-425-605, immediately upon recognizing that the sticker is defaced or removed such that a new one can be re-applied. Failure, on the part of the primary operator, to ensure that a legible sticker remains on the vehicle shall result in disciplinary action, up to and including vehicle usage being revoked, in addition to possible termination of employment.

5.9 INSURANCE

All employees who operate their personal vehicles for Company business, no matter how frequently, shall have in place the minimum insurance required for the state in which the vehicle is registered. If an employee uses his or her own personal vehicle for more than 60% of his working hours, Company may require employee to carry increased insurance coverage and limits. Employees agree that in the event of an accident occurring during working hours in his or her own vehicle, the insurance on the employee's vehicle will be primary and recovery of any claims by employee or third persons shall come first from the employee's personal vehicle insurance policy. By an employee driving his or her vehicle on Company business, employee consents to this policy including this provision for employee and employee's insurer.

6.0 EXCEPTION PROVISIONS

Variances and exceptions may be requested pursuant to the provisions of Procedure HS013, Health and Safety Procedure Variances.

7.0 CROSS REFERENCES

HR207 Employee Disciplinary Action
HS013 Health and Safety Procedure Variances
HS020 Accident Prevention Program: Reporting, Investigation, and Review
HS810 Motor Vehicle Operation: Federal Motor Carrier Safety Regulations for Driver Qualifications

8.0 ATTACHMENTS

1. Responsibility Matrix
2. Company Rules for Motor Vehicle Operation
3. Pre-employment Driving Record Certification
4. Notification of Work-Related Citation
5. Non-Shaw Employee Driver Questionnaire
6. Memo Template for Employers of Non-Shaw Drivers

ATTACHMENT 1

MOTOR VEHICLE OPERATION: GENERAL REQUIREMENTS RESPONSIBILITY MATRIX

Action	Procedure Section	*Responsible Party*					
		Local Health & Safety Assistant	Business Line Health and Safety Manager	Supervisor	Accident Review Board	Corporate Human Resources	Director of H&S
Issue, Revise, and Maintain This Procedure	3.1						X
Ensure Employees Complete Attachment 2	5.1	X		X		X	
Distribute HS800 to New Hire Candidates for Completion of Attachments 2 and 3	5.2	X				X	
Request Evaluation of New Hire Driving Record	5.2	X				X	
Obtain Driving Record and Determine Driving Status	5.2	X					
Initiate Corrective Actions	5.4			X			
Ensure Completion and Distribution of Attachment 4	5.4			X			
Accident Review	5.4.4				X		
Ensure Drivers Meet Training Requirements	5.5			X			
Specify Program for Reinstatement of Driving Privilege	5.6						X
Reinstatement of Driving Privilege	5.6						X
Non-Shaw Employee Vehicle Use Requirements	5.7			X			
Contact Employee to discuss report from Safety Notification Sticker Service	5.8		X	X			

ATTACHMENT 2
COMPANY RULES FOR MOTOR VEHICLE OPERATION

1. Prior to motor vehicle operation, all motor vehicle operators are required to provide the company with current documentation of licensing for the motor vehicle(s) to be operated. Supervisors shall review and approve said documentation.

2. The motor vehicle operator is responsible for the vehicle, and for conducting a pre-trip, walk around inspection prior to use (including load evaluation, if applicable). No vehicle with any mechanical defect, which endangers the safety of the driver, passengers, or the public, shall be used.

3. All company owned/leased trucks, should have small convex mirrors attached to the side mirrors.

4. The operator shall drive defensively at all times and is responsible for complying with all state and local traffic laws, as well as customer regulations concerning motor vehicle operation.

5. The operator and all passengers shall use seat belts at all times when the vehicle is in motion.

6. No employee shall operate a motor vehicle when abnormally tired, temporarily disabled, or under the influence of alcohol or drugs.

7. No employee shall allow a company owned, leased, or rented motor vehicle to be operated by an unauthorized employee or non-employee. (See also: unauthorized personal use of company vehicles)

8. The operator shall not allow for any open alcoholic beverage containers within a company vehicle or within a personal vehicle while it is being utilized for company business.

9. No employee shall drive beyond any barricades or into any area with designations such as HAZARDOUS, DO NOT ENTER, etc.

10. Use caution when driving through congested areas, or near where personnel and equipment are working.

11. Whenever possible, a spotter shall be used for backing all vehicles. This may be a fellow company employee, or a non-company employee who is willing to help.

12. Unless required, such as on a client's property, keys shall not be left in an unattended vehicle.

13. Employees shall not leave the driver's seat of a vehicle while the motor is running. Exemption: Vehicles equipped with a power take-off device with parking brake set and chocks in place.

14. No motorcycles are to be operated on company business.

15. Radar detectors are prohibited in all company owned, leased, or rented vehicles or in personal vehicles while being used for company business.

16. Analytical samples will be transported in accordance with 49 CFR regulations. Regulated hazardous substances shall not be transported in personal vehicles.

17. In case of an accident, the following steps shall be taken:
    A. Stop.
    B. Call for medical assistance in case of injuries.
    C. Notify police.
    D. Complete Vehicle Accident Report and submit to your supervisor as soon as possible.

18. Whenever a vehicle is stopped upon the traveled portion of a highway or the shoulder of a highway, for any cause other than necessary traffic stops, the driver shall, as soon as possible, place or activate the warning devices with which the vehicle is equipped.

19. Employee must notify the supervisor as soon as possible, but not longer than 24 hours after occurrence, for work related citations, accidents, and license expiration, suspension, or revocation.

20. No employee is authorized to operate a company vehicle (including rentals) after having been on duty for a period of 16 hours. No employee may drive for more than 12 hours in any single on-duty period. Once either of these criteria has been met, a period of 8 consecutive hours off duty is required before driving duties may be resumed. These are maximum, not minimum, requirements and employees may be unfit to drive after shorter on-duty periods. Commercial DOT drivers are subject to the more restrictive hours of service regulations described in Procedure HS810.

21. Project-assigned employees are not permitted to operate company owned, leased, or rented vehicles after 10:00 p.m. without written authorization from their supervisor. (See section 5.1.1)

22. Employees shall not operate company vehicles for any type of personal use, no exceptions. Personal use includes any usage that is not directly related to company business. See section 5.1.1 for definitions concerning “daily life activities” for Project Assigned Employees.

23. Employees shall not use a company vehicle to visit an establishment that has a primary function of providing nighttime entertainment including the dispensing of alcoholic beverages.

24. Temporary or non-Shaw employees shall be allowed to utilize Shaw company vehicles only after the driver has completed Attachment 5 and has satisfied the point system requirements set forth in Section 5.3 of this policy. In addition, the employer of that driver shall have satisfied the requirement set forth in section 5.7 of this policy and signed a copy of the memo set forth in Attachment 6. This includes clients or subcontractors.

25. Employees shall not transport family members, friends or any other unauthorized guest passenger unless it is arising out of course and scope of company business.

26. No employee shall be assigned use of a vehicle to take home when off of duty.

I have read and understand company Procedure HS800 and the company Rules for Motor Vehicle Operation, and agree to abide by all requirements.

Employee’s Name (Printed) Employee’s Signature Date

ATTACHMENT 3

EMPLOYEE DRIVING RECORD CERTIFICATION

DATE _____ REQUESTOR _____ PHONE NO. _____

CANDIDATE / EMPLOYEE'S HOME DEPARTMENT NUMBER _____

	Assigned Point Value
Overweight, loss of load, vehicular equipment infraction, etc.	1
Moving violation: speeding, failure to stop, failure to signal turn, etc.	2
At-fault accident	3
Major citation: reckless driving, tailgating, suspended license, speed contest, improper lane usage, open container, etc.	6
Driving under the influence or Hit and Run (Leaving the Scene)	8

In the space provided below, please list all violations and accidents currently listed on your driving record by the state issuing your driver's license (include all states for which you have held a driver's license during the last two [2] years). Determine the number of points assigned from the table above, and write in column labeled Points.≅ Finally, write the sum total of all points where indicated.

Violations/Accidents	**Driver License #/State**	**Date (mo/yr)**	**Points**

Total Points _____

I hereby certify that the information provided is a complete and accurate statement of my driving record for the previous twenty-four (24) months. I authorize the company to obtain a copy of my driving record from the state of issuance of my license(s). I understand that falsification of data will disqualify me from being hired or may result in revocation of my company driving privileges.

Driver's License No. _____ State of Issuance _____

Expiration Date _____ Date of Birth _____

_____ _____

New Hire Candidate Name (Printed) Social Security Number

_____ _____

Signature Date

PLEASE FAX THIS FORM TO THE MONROEVILLE H & S RECORDS DEPARTMENT AT (412) 858-3976

ATTACHMENT 4

NOTIFICATION OF WORK-RELATED CITATION

This form is to be completed by employees incurring a work-related vehicular citation. Once complete, it is to be signed by the employee's supervisor and forwarded to the appropriate Human Resources Department for inclusion in the employee's personnel file.

Employee Name _____ Employee No. _____ Date _____

Nature of Citation _____

_____

Location of Citation (City, State) _____

Date/Time Citation Received _____

Is Citation Being Contested? ☐ No ☐ Yes Details _____

_____

_____

Employee Signature _____ Date _____

Corrective Action Being Taken _____

_____

_____

Supervisor Signature _____ Date _____

PLEASE FAX THIS FORM TO THE MONROEVILLE H & S RECORDS DEPARTMENT AT (412) 858-3976

ATTACHMENT 5

Non-Shaw Employee Driver Questionnaire

_____ _____

Date *Time*

_____ _____

Vehicle is assigned to what Shaw Employee? *Signature of Shaw Employee*

_____

Non-Shaw Driver's Name

Do you have a valid driver's license? Yes No

State in which license was issued, DL Number and Exp Date_____

Have you had any citations or accidents in the past 24 months? Yes No

If yes, please list type of citations and the associated dates below:

_____

_____

_____

_____

(Refer to HS800, Section 5.3, to determine driver eligibility based on the points system provided)

By signing below, I, the temporary driver, am acknowledging that the above information is true and accurately represents my driving record. I understand and agree that any misrepresentation or omission of material fact on this questionnaire will constitute sufficient grounds for your removal from the project site and will restrict the future use of Shaw vehicles.

I have read and fully understand the above:

_____

Signature of Non-Shaw Driver

_____

Date

ATTACHMENT 6

Address
Address
Phone
Fax:

Memorandum

Date:

To:

CC:

From: Project Manager

RE: Requirements for Motor Vehicle Operation

Attached is Shaw Environmental & Infrastructure, Inc. (Shaw) policy HS800 - Motor Vehicle Operation: General Requirements. As you can see, this policy applies to all operators of Shaw owned, leased, or rented vehicles, as well as personal vehicles used on Shaw business.

Accordingly, you are hereby notified that any employee that is assigned by your company to a Shaw Environmental & Infrastructure, Inc project and is required to operate/drive Shaw owned, leased, or rented vehicles, will be subject to either meeting or exceeding the operator requirements for Shaw employees. Please be aware that as the employer of individuals who are assigned to a Shaw project, you must ensure that your company either adopts the requirements set forth in policy HS800 (Motor Vehicle Operation) or develop a similar policy that meets or exceeds those requirements

Only approved non-Shaw employees, who have completed and signed the "Non-Shaw Employee Driver Questionnaire" (HS800 Attachment 5) will be allowed to drive a Shaw vehicle. Furthermore, prior to the driver operating a Shaw vehicle, the subject questionnaire must be completed and placed on file at the job site. The primary vehicle operator or responsible Shaw management representative shall review the questionnaire and determine whether the non-Shaw employee satisfies the driver qualification requirements of HS800.

Failure to comply with the requirements of this correspondence or the requirements set forth in HS800 shall result in disciplinary action up to and including driving privilege revocation or removal of an affected non-Shaw employee from a project site. If the duties of your employees are expected to include driving a Shaw owned, leased or rented vehicle, please complete Attachment 5, for all of your affected personnel, and provide these to Shaw's site management. Alternatively, please be aware and make your employees aware that they are not authorized to drive a Shaw owned, leased, or rented vehicle without such compliance.

By signing this document, I, an authorized employee and agent of the subject company/employer, am acknowledging acceptance of the above information and agree to my employer's compliance with the referenced requirements stated herein.

_____
Signature / Title

_____
Date

PROCEDURE

Subject: COMMERCIAL MOTOR VEHICLE OPERATION AND MAINTENANCE

1.0 PURPOSE AND SUMMARY

This procedure covers the general requirements for operation and maintenance of commercial motor vehicles. Requirements are based upon Federal regulations covering interstate (and intrastate for drug and alcohol testing) activity and/or activity in non-agreement states. Locations are authorized to use applicable State regulations for intrastate activity, but must fully comply with Federal regulations whenever an "intrastate" unit engages in "interstate" activity. Key provisions include:

- General Requirements;
- Financial Responsibility;
- Notification and Reporting of Accidents;
- Qualifications of Drivers;
- Driving of Motor Vehicles;
- Inspection, Repair and Maintenance;
- Hours of Service of Drivers; and
- Management Review and Follow-up.

Any location or major project wishing to establish a pool of commercial drivers, or even one commercial driver, **must** contact the DOT Administrator in Findlay and the Corporate Health & Safety office in Pittsburgh for enrollment in the random drug testing pool.

2.0 TABLE OF CONTENTS

3.0 RESPONSIBILITY MATRIX

3.1 Procedure Responsibility

The Vice President of Health & Safety is responsible for the issuance, revision and maintenance of this procedure.

3.2 Action/Approval Responsibilities

See Responsibility Matrix, Attachment 1.

4.0 DEFINITIONS

General definitions can be found in 49 CFR 390.5. Other definitions can be found at the beginning of the regulatory reference for each section of this procedure.

Commercial Motor Vehicles Requiring CDL Drivers

In accordance with Federal Motor Carrier Safety Regulations (FMCSR) 383.91, there are three vehicle groups which require a fully qualified, documented DOT driver holding a Commercial Driver's License. These classes are as follows:

Group A "Any combination of vehicles with a GCWR of 26,001 or more pounds provided the GVWR of the vehicle(s) being towed is in excess of 10,000 pounds. (Holders of a Group A license may, with any appropriate endorsements, operate all vehicles within Groups B and C.)"

Group B "Any single vehicle with a GVWR of 26,001 or more pounds, or any such vehicle towing a vehicle not in excess of 10,000 pounds GVWR. (Holders of a Group B license may, with any appropriate endorsements, operate all vehicles within Group C.)"

Group C "Any single vehicle, or combination of vehicles, that does not meet the definition of Group A or Group B as contained herein, but that either is designed to transport 16 or more passengers including the driver, or is placarded for hazardous materials."

All three of the above groups require a qualified driver holding a CDL. This includes a complete DQ file, filing Driver's Daily Logs (or time cards), etc.

Commercial Motor Vehicles NOT Requiring CDL Drivers
In accordance with FMCSR 390.5(a):

> "Commercial motor vehicle means any self-propelled or towed vehicle used on public highways in interstate commerce to transport passengers or property when...the vehicle has a gross weight rating or gross combination weight rating of 10,001 or more pounds."

The CMV (commercial motor vehicle) described here is not covered in FMCSR 383.91 and thus would not require a driver holding a CDL. However, since the vehicle is considered a CMV by Federal regulations, any employee operating such a vehicle must have a complete DQ file in Findlay, is responsible for completing Driver's Daily Logs (or time cards), etc.; the regulations for the driver are exactly the same as for a driver holding a Commercial Driver's License, with the exception that these drivers are not required to hold a CDL; a State license is sufficient.

Also, the vehicle described in this section would automatically, as a CMV, fall into the group of vehicles requiring maintenance documentation at Findlay (Annual Inspections, Preventative Maintenance, Driver Inspection Reports, etc).

Company – All wholly-owned subsidiaries of the Shaw Environmental & Infrastructure, Inc. (Shaw E & I).

5.0 TEXT

This section is organized to follow the DOT Safety/Compliance Review Checklist.

5.1 General Requirements

5.1.1 All locations operating commercial motor vehicles shall maintain a current copy of the Federal Motor Carrier Safety Regulations (FMCSR) and the Hazardous Materials Regulations (HMR), both of which are found in Title 49 of the Code of Federal Regulations.

5.1.2 Training requirements for all drivers include the following minimum classes:

- Safe Driver Training (SDT)
- Hazardous Waste Hauling (HWH)
- Vacuum Truck Safety Training (VTST) (Note: Vacuum truck operators only)

Refresher training is required every two (2) years.

5.1.3 All locations shall include safe commercial motor vehicle operation in their safety incentive/awareness programs.

5.1.4 Each location shall monitor overall compliance as required in HS021, Accident Prevention Program: Management Safety Audits and Inspections; and HS018, Safety Councils.

5.1.5 A person is qualified to operate a commercial motor vehicle if he or she:

- Is at least 21 years old;
- Can read and speak the English language sufficiently to converse with the general public, to understand highway traffic signs and signals in the English language, to respond to official inquiries, and make entries on reports and records;
- Can by reason of experience, training, or both, safely operate the type of motor vehicle he or she drives;
- Can by reason of experience, training, or both, determine whether the cargo to be transported has been properly located, distributed and secured in or on the motor vehicle;
- Is familiar with methods and procedures for securing cargo in or on the motor vehicle; and
- Has a complete and current Driver Qualification File (See Section 5.2) in the possession of the Findlay DOT Administrator.

5.2 Minimum Levels of Financial Responsibility for Motor Carriers

(See 49 CFR 387 for further details)

5.2.1 The Corporate Risk Management Department shall maintain insurance/financial responsibility as required in the current version of referenced regulation.

5.2.2 An executed DOT MCS90 shall be maintained, with a copy forwarded to the DOT Administrator in Findlay.

5.3 Notification and Reporting of Accidents

(See 49 CFR 390 for further details)

5.3.1 All accidents and near misses shall be reported in accordance with HS020 Accident Prevention Program: Reporting, Investigation and Review, and HS091 Serious Injury and Fatality Reporting Requirements. All required accident documentation shall accompany the Monthly Loss Reports.

5.3.2 DOT procedures require that motor carriers maintain, for a period of one year after an accident occurs, an "Accident Register" containing specific information. This applies to all commercial vehicle accidents. Corporate Health & Safety will maintain the Register. The Register must include: date and time of accident, city/state, driver's name, number of injuries and/or fatalities, and whether hazardous materials other than fuel were released. Motor carriers are also required to maintain copies of all accident reports required by State or other governmental entities or insurers. **This is effective for all accidents occurring after March 3, 1993. Motor carriers must continue to retain copies of all accident reports previously submitted to FHWA for a period of three (3) years after the date of the accident.** (49 CFR 390, Subpart A)

5.3.3 Corporate Health & Safety must be notified by telephone or fax of all commercial vehicle accidents within 24 hours, or not later than the next business day. Use the current Vehicle Accident Report found in Shaw E & I Procedure HS020.

5.3.4 The Accident Register shall include the most reliable information on "reportable accidents" available to the motor carrier. A "reportable accident" means an occurrence involving a commercial motor vehicle operating on a public road which results in:

1. A fatality;
2. Bodily injury to a person who, as a result of the injury, immediately receives medical treatment away from the scene of the accident; or
3. One or more vehicles incurring disabling damage as a result of the accident, requiring the vehicle(s) to be transported away from the scene by a tow truck or other vehicle.

The term "accident" does not include:

1. An occurrence involving only boarding and alighting from a stationary motor vehicle;
2. An occurrence involving only the loading or unloading of cargo; or
3. An occurrence in the course of the operation of a passenger car or a multipurpose passenger vehicle (as defined in section 571.3 of 49 CFR) by a motor carrier and is not transporting passengers for hire or hazardous materials of a type and quantity that require the motor vehicle to be marked or placarded in accordance with section 177.823 of 49 CFR.

"Disabling damage" means damage which precludes departure of a motor vehicle from the scene of the accident in its usual manner in daylight after simple repairs.

Inclusions:

1. Damage to motor vehicles that could have been driven, but would have been further damaged if so driven.

Exclusions:

1. Damage which can be remedied temporarily at the scene of the accident without special tools or parts;
2. Tire disablement without other damage even if no spare tire is available;
3. Damage to turn signals, horn or windshield wipers which makes them inoperative.

"Fatality" means any injury which results in the death of a person at the time of the motor vehicle accident or within 30 days of the accident.

5.3.5 All Vehicle Accident Reports shall include the most reliable information available to the motor carrier on the following subjects:

1. Date of accident;
2. Time of accident;
3. Location (city, state) of the accident;
4. Name of driver;
5. Number of persons injured;
6. Number of persons killed; and
7. Whether hazardous materials were released (other than fuel).

5.3.6 Follow-up action with drivers involved with vehicle accidents shall be per HS800 Motor Vehicle Operation: General Requirements and the Shaw E & I progressive discipline system.

5.4 Qualifications of Drivers

(See 49 CFR 391 for further details)

5.4.1 All hiring of drivers shall be done in accordance with the requirements of HS800 Motor Vehicle Operation: General Requirements and 49 CFR 391.

5.4.2 All prospective drivers shall be interviewed to verify the accuracy of information on the application.

5.4.3 All prospective drivers shall be required to show proof of current automobile insurance prior to hiring.

5.4.4 All locations shall track and verify that the following driver documents are current: driver's license, Driver's Certification of Violations, Annual Review of Driving Record and medical. The Employee's Records Expiration Dates form may be used for this purpose.

5.4.5 Prior to being allowed to operate a commercial motor vehicle, all drivers will be required to establish with the company (original in Findlay, copy at home terminal) a Driver Qualification File with the following minimum contents.

- **Commercial Drivers License (CDL)**

  Combination Vehicle (Group A) - Any combination of vehicles with a Gross Combination Weight Rating (GCWR) of 26,001 or more pounds provided the GVWR of the vehicle(s) being towed is in excess of 10,000 pounds.

Heavy Straight Vehicle (Group B) - Any single vehicle with a GVWR of 26,001 or more pounds, or any such vehicle towing a vehicle not in excess of 10,000 pounds GVWR.

Small Vehicle (Group C) - Any single vehicle, or combination of vehicles, that meets neither the definition of Group A nor that of Group B as contained in this section, but that either is designed to transport 16 or more passengers including the driver, or is used in the transportation of materials found to be hazardous for the purposes of the Hazardous Materials Transportation Act and which require the motor vehicle to be placarded under the Hazardous Materials Regulations (49 CFR Part 172, Subpart F).

(See 49 CFR 383.91 Figure 1 for further details on vehicles and CDL Groups.)

- **State License** - A driver operating a combination vehicle with a gross combined weight rating exceeding 10,001 pounds, but never operating a vehicle in one of the CDL categories (A,B,C), may perform these duties with an appropriate state license instead of a CDL.

  - Receipt for Federal Motor Carrier Safety Regulations (FMCSR)
  - Application for Employment
  - DOT Driver Supplemental Application for Employment
  - Driver's Road Test Examination
  - Written Examination
    This exam must be graded and incorrect responses reviewed with the driver. Supervisor and driver shall initial test when done.
  - Certification of Road Test and Written Examination
    A copy of this form must be provided to the driver.
  - Annual Driver's Certification of Violations
  - Inquiry to Previous Employers
    This form pertains to experience operating commercial motor vehicles.
  - Alcohol & Controlled Substance Test Information Inquiry to Previous Employers
    This is a Federal requirement which went into effective January 1, 1995. Whereas the Inquiry to Previous Employers regarding experience does not required a response, this form <u>requires a response from the previous employer with 14 days of the driver being qualified</u>. If a response is not received within the specified time, the driver is automatically disqualified.
  - Inquiry to State Agencies for Driver's Record
  - Annual Review of Driving Record.
  - Driver Data Sheet
  - Medical Examiner's Certificate

The certificate must be signed by the driver and Shaw E & I's Medical Review Officer. A copy must also be provided to the driver.

- DOT Long Form
- Medical Clearance and Drug and Alcohol Test Report

NOTE: All drug and alcohol test results for commercial drivers must be retained in the Pittsburgh files only. Medical Clearance must be endorsed for DOT and signed on back by supervisor and driver. DOT requires examination every two years. Shaw E & I requires examination every year due to hazardous waste operations duties. Also note that issuance of medical clearance signifies a negative drug test result for baseline and update exams. See Shaw E & I Procedures HS100 Medical Policies and HS101 Drug and Alcohol Testing for further information.

- Vehicle Types
  This list details which vehicles a driver is qualified and/or authorized to operate based on his CDL class and endorsements. Applicable to all states.
- Certification of Drug and Alcohol Awareness Training

5.5 Driving of Motor Vehicles

(See 49 CFR 392 for further detail)

5.5.1 Use, possession, or sale of drugs, alcohol, or other illicit substances is generally prohibited. Specific procedures are found in HR024 Illegal Drugs, Alcohol, and Other Substances and HS101 Drug and Alcohol Testing.

5.5.2 Authorized passengers are limited to employees of Shaw E & I and those subcontractor, client or regulatory personnel who are integral to a task being performed.

5.5.3 Management shall monitor compliance with speed laws by reviewing daily miles of operation versus actual driving time. Runs in excess of 500 miles shall have documentation attached that speed laws and hours of service rules were not violated (e.g. operations were in an area where speed laws exceed 55 mph).

5.6 Inspection, Repair, and Maintenance

(See 49 CFR 396 for further detail)

5.6.1 All commercial motor vehicles shall be included in a scheduled preventive maintenance program. Service intervals shall be in terms of miles or hours of operation. Service intervals and service requirements shall be per the manufacturer's recommendations with manufacturer recommendations documented in the Vehicle Maintenance File in Findlay.

5.6.2 Whenever manufacturer service recommendations either fail to cover company's utilization of the equipment or are unavailable, preventative maintenance shall be done in accordance with Shaw E & I Procedure FE006, Minimum Preventive Maintenance Standards for Corporate Equipment.

5.6.3 All drivers shall conduct and document a pre-trip inspection (including tow bars and saddle mounts as applicable) before operating a commercial motor vehicle. No vehicle shall be operated unless the following parts and accessories are in good working order: service brakes (including trailer brake connections), parking brake, steering mechanism, lighting devices and reflectors, tires, horn, windshield wiper(s), rear-vision mirror(s) and coupling devices. The Driver's Inspection Report Form shall be used. A copy is to be submitted to the Maintenance Supervisor and the original is to remain with the vehicle.

When repairs are complete the mechanic is to make the appropriate entry in the Vehicle Maintenance File and sign the original Driver's Inspection Report in the vehicle. The on-coming driver shall verify that repairs have been made, sign the Driver's Inspection Report and turn in the final copy. Final (original) copy must be forwarded to the DOT Administrator in Findlay for comparison with Driver's Daily Logs and retention.

5.6.4 All Driver's Inspection Report forms shall be forwarded to the DOT Administrator in Findlay not later than the twentieth day of the following month, and retained there for three months.

5.6.5 All vehicles shall be subject to an annual safety inspection in accordance with 49 CFR 396.17. A copy of this inspection shall be forwarded to the DOT Administrator. Note that the vehicle must either carry a copy of the inspection or be marked with a sticker/decal displaying the information required in 49 CFR 396.17(c)(2).

5.6.6 A limited safety inspection is required no less often than 90 days, and is to be noted in the home terminal Vehicle Maintenance File.

5.6.7 Inspectors shall meet the qualification requirements in 49 CFR 396.19. (Use forms provided in DOT Manual.)

5.6.8 Brake inspectors shall meet the qualification requirement in 49 CFR 396.25, which generally includes completion of an approved training program or one year of documented experience. (Use forms provided in DOT Manual.) Any driver making brake adjustments must also have certification of qualifications on file in Findlay.

5.6.9 Where Shaw E & I employees perform inspections and repairs, documentation of qualifications shall be on file with the DOT Administrator.

5.6.10 Where an outside vendor is used for inspection and repair, Shaw E & I management shall verify that the vendor understands and will comply with inspector qualification requirements.

5.6.11 The Maintenance/Inspection Check list (see DOT Manual) shall be used to check completeness of Vehicle Maintenance Files.

5.6.12 The current version of the North American Uniform Out-of-Service criteria must be followed in determining the service status of all commercial motor vehicles.

5.6.13 All cargo tanks shall have a copy of the manufacturer's data report and required recertifications in the maintenance file. Qualifications for recertification vendors shall be on file with the DOT Administrator. Recertification requirements can be found in 49 CFR 180.

5.6.14 All exemption vehicles or trailers are required to carry a copy of the exemption on the vehicle.

5.7 Hours of Service of Drivers

(See 49 CFR 395 for further details)

5.7.1 Drivers shall not operate a commercial motor vehicle under the following conditions:

- More than 10 hours following 8 consecutive hours off-duty;
- For any period after having been on duty for 15 hours; or
- For any period after having been on duty for 70 hours during the period of eight consecutive days with the eighth day being the current date.

5.7.2 All drivers shall record their duty status on the Driver's Daily Log (see DOT Manual), including recap. Logs shall be completely filled out and submitted to home terminal management daily, or no less often than every 13 days for extended trips. Note that a drivers daily log cannot be used as a time card only.

5.7.3 Local management shall carefully review all Driver's Daily Logs. They shall require the driver to correct any errors, and take follow-up action (training or progressive discipline) where regulations or company procedures have been violated.

5.7.4 Dispatchers shall track drivers hours of service via the driver's recap for local service, and via recap and daily phone calls during extended trips.

5.7.5 100 air mile radius drivers may use the time card included in the DOT Manual, as long as they comply with the instructions provided. Whenever these instructions are not met, a Driver's Daily Log must be completed for that day or

days. Note that switching between time cards and daily logs makes it easy to introduce errors into the recap. It is recommended that driver logs be used so that switching between the two forms is minimized.

5.7.6 The DOT Log Book Compliance Checklist shall be used by management to review Driver's Daily Logs.

5.7.7 All original Driver's Daily Logs are to be forwarded to the DOT Administrator in Findlay by the twentieth day of the following month, and retained there for six months. Copies must also be retained at the local office for six months.

5.8 Transportation of Hazardous Materials Driving and Parking Rules

(See 49 CFR 397 for further details).

5.8.1 A motor vehicle containing hazardous materials must not be operated near an open fire unless its driver has first taken precautions to ascertain that the vehicle can safely pass the fire without stopping.

5.8.2 A motor vehicle containing hazardous materials must not be parked within 300 feet of an open fire.

5.8.3 No person may smoke or carry a lighted cigarette, cigar, or pipe on or within 25 feet of:

- A motor vehicle which contains explosives, oxidizing materials, or flammable materials; or
- An empty tank motor vehicle which has been used to transport flammable liquids or gases and which, when so used, was required to be marked or placarded in accordance with the rules in subsection 177.823 or 49 CFR.

5.8.4 When a motor vehicle which contains hazardous materials is being fueled:

- Its engine must not be operating, and
- A person must be in control of the fueling process at the point where the fuel tank is filled.

5.8.5 A motor vehicle transporting hazardous materials of a kind or quantity that require the vehicle to be marked or placarded in accordance with subsection 177.823 of 49 CFR must also display the information required in subsection 390.21 of 49 CFR, including USDOT 197183 (the Shaw E & I DOT number).

5.8.6 Special consideration shall be given to avoidance of heavily populated areas when hauling hazardous material/waste loads.

5.9 Carriage by Public Highway

(See 49 CFR 177 for further details)

5.9.1 All loads of hazardous materials or hazardous wastes shall be accompanied by shipping papers or hazardous waste manifest, respectively. These documents shall be prepared in accordance with 49 CFR 177.817 and 49 CFR 172 Subpart C. All documents shall be retained for at least three years. Shipping documents using any generic descriptions (e.g.. "n.o.s.") must also contain the technical name of the hazardous substance in parentheses following the basic description.

5.9.2 Shipping documents shall be within the drivers reach and readily visible. When the driver is out of the cab, they shall be in the drivers door pocket or on the drivers seat.

5.9.3 All hazardous materials/wastes loads shall be marked, labeled, and placarded in accordance with 49 CFR 192 Subparts D, E, and F, respectively.

5.9.4 All hazardous materials/wastes loads shall be reported and segregated in accordance with 49 CFR 177.848.

5.9.5 Spill incidents meeting any of the criteria listed below shall be reported to the DOT Administrator on DOT Form F 5800.1 (Attachment 2):

- Any quantity of hazardous waste,
- A reportable quantity (RQ) of hazardous material,

(Criteria listed below require immediate phone notification)

- A fatal injury or hospitalization occurs;
- Property damage exceeds $50,000;
- Radioactive materials are spilled;
- The general public is evacuated for more than one hour; or
- Etiologic agent(s) are discharged.

6.0 EXCEPTION PROVISIONS

Variances to this procedure shall be requested in accordance with procedure HS013 Health & Safety Procedure Variances.

7.0 CROSS REFERENCES

HS018	Safety Councils
HS020	Accident Prevention Program: Reporting, Investigation and Review
HS021	Accident Prevention Program: Management Safety Audits and Inspections
HS091	Serious Injury and Fatality Reporting Requirements
HS100	Medical Policies
HS101	Drug and Alcohol Testing
HS800	Motor Vehicle Operation: General Requirements

FE006 Minimum Preventive Maintenance Standards for Corporate Equipment

8.0 ATTACHMENTS

1. Responsibility Matrix
2. Hazardous Materials Incident Report (Form DOT F 5800.1)

NOTE: All other DOT forms can be found in the DOT Manual. Contact your DOT Administrator in Findlay.

ATTACHMENT 1
COMMERCIAL MOTOR VEHICLE OPERATION AND MAINTENANCE

Responsibility Matrix

Action	Procedure Section	*Responsible Party*			
		DOT Administrator	**Risk Mgmt. Dept.**	**Corporate HS**	**Driver**
Verify driver meets general requirements, including training	5.1	X		X	
Maintain statutory financial responsibility	5.2		X		
Accident Reporting: Internal	5.3	X			X
Accident Reporting: External	5.3			X	
Document driver qualification: ▪ Establish DQ file ▪ Maintain DQ file	 5.4 5.4	 X X			
Monitor driver performance	5.5	X			
Maintain, inspect and service vehicles, and document (retain working copy)	5.6	X			
Hold maintenance documents	5.6	X			
Verify drivers comply with and document hours of service requirements	5.7	X			
Hold Driver's Daily Logs for six (6) months	5.7	X			

ATTACHMENT 2
HAZARDOUS MATERIALS INCIDENT FORM

DEPARTMENT OF TRANSPORTATION
HAZARDOUS MATERIALS INCIDENT REPORT

Form Approved DMB No. 2137 0039

INSTRUCTIONS: Submit this report in duplicate to the Information Systems Manager, Office of Hazardous Materials Transportation, DHM-63, Research and Special Programs Administration, U.S. Department of Transportation, Washington, D.C. 20590. If space provided for any item is inadequate, complete that item under Section IX, keying to the entry number being completed. Copies of this form, in limited quantities, may be obtained from the Information Systems Manager, Office of Hazardous Materials Transportation. Additional copies in this prescribed format may be reproduced and used, if on the same size and king of paper.

I. MODE, DATE, AND LOCATION OF INCIDENT

1. MODE OF TRANSPORTATION ℗ Air ℗ Highway ℗ Rail ℗ Water ℗ Other

2. DATE AND TIME OF INCIDENT (Use Military time [e.g., 8:30 am=0830, Noon=1200, 6 pm=1800, Midnight=2400])
   Date: Time:

3. LOCATION OF INCIDENT (Include airport name in ROUTE/STREET if incident occurs at an airport.)
   CITY: STATE:
   COUNTY: ROUTE/STREET:

II. DESCRIPTION OF CARRIER, COMPANY, OR INDIVIDUAL REPORTING

4. FULL NAME	5. ADDRESS (Principal place of business)

6. LIST YOUR OMC MOTOR CARRIER CENSUS NUMBER, REPORTING RAILROAD ALPHABETIC CODE, MERCHANT VESSEL NAME AND ID NUMBER OR OTHER REPORTING CODE OR NUMBER.

III. SHIPMENT INFORMATION (From Shipping Paper or Packaging)

7. SHIPPER NAME AND ADDRESS (Principal place of business)	8. CONSIGNEE NAME AND ADDRESS (Principal place of business)
9. ORIGIN ADDRESS (If different from Shipper address)	10. DESTINATION ADDRESS (If different from Consignee address)

11. SHIPPING PAPER/WAYBILL IDENTIFICATION NO.

IV. HAZARDOUS MATERIAL(S) SPILLED (NOTE: REFERENCE 49 CFR SECTION 172.101.)

12. PROPER SHIPPING NAME	13. CHEMICAL/TRADE NAME	14. HAZARD CLASS	15. IDENTIFICATION NO. (i.e., UN 2020)

16. IS MATERIAL A HAZARDOUS SUBSTANCE? ℗ YES ℗ NO	17. WAS THE RO MET? ℗ YES ℗ NO

18. ESTIMATED QUANTITY HAZARDOUS MATERIAL RELEASED (Include easurement)	19. FATALITIES	20. HOSPITALIZED	21. NON-HOSPITALIZED
22. NUMBER OF PEOPLE EVACUATED			

23. ESTIMATED DOLLAR AMOUNT OF LOSS AND/OR PROPERTY DAMAGE, INCLUDING COST OF DECONTAMINATION OR CLEANUP (Round off in dollars):

A. PRODUCT LOSS	B. CARRIER DAMAGE	C. PUBLIC/PRIVATE PROPERTY DAMAGE	D. DECONTAMINATION/ CLEANUP	E. OTHER

24. CONSEQUENCES ASSOCIATED WITH INCIDENT:
℗ SPILLAGE ℗FIRE ℗EXPLOSION ℗ VAPOR (GAS) DISPERSION ℗ ENVIRONMENTAL DAMAGE ℗MATERIAL ENTERED WATERWAY SEWER ℗ NONE ℗ OTHER

VI. TRANSPORT ENVIRONMENT

25. INDICATE TYPE(S) OF VEHICLE(S) INVOLVED: ❑ CARGO TANK ❑ VAN TRUCK/TRAILER ❑ FLAT BED TRUCK TRAILER
❑ TANK CAR ❑ RAIL CAR ❑ TOFC/COFC ❑ AIRCRAFT ❑ BARGE ❑ SHIP ❑ OTHER_____

26. TRANSPORTATION PHASE DURING WHICH INCIDENT OCCURRED OR WAS DISCOVERED:
❑ EN ROUTE BETWEEN ORIGIN/DESTINATION ❑ LOADING ❑ UNLOADING ❑ TEMPORARY STORAGE TERMINAL

27. LAND USE AT INCIDENT SITE:
❑ INDUSTRIAL ❑ COMMERCIAL ❑ RESIDENTIAL ❑ AGRICULTURAL ❑ UNDEVELOPED

28. COMMUNITY TYPE AT SITE: ❑ URBAN ❑ SUBURBAN ❑ RURAL

29. WAS THE SPILL THE RESULT OF A VEHICLE ACCIDENT/DERAILMENT? ❑ YES ❑ NO
IF YES AND APPLICABLE, ANSWER PARTS A THRU C.

A ESTIMATED SPEED:	B. HIGHWAY TYPE: ❑ DIVIDED/LIMITED ACCESS ❑ UNDIVIDED	C. TOTAL NUMBER OF LANES: [ ] ONE [ ] THREE [ ] TWO [ ] FOUR OR MORE	**SPACE FOR DOT USE ONLY**

VII. PACKAGING INFORMATION: If the package is overpacked (consists of several packages [e.g., glass jars within a fiberboard box]), begin with for information on the innermost package.

ITEM	A	B	C
30. TYPE OF PACKAGING. INCLUDE INNER RECEPTACLES l drum, tank car)			
31. CAPACITY OR WEIGHT PER UNIT PACKAGE (e.g., 55 gallons, 65 lbs.)			
32. NUMBER OF PACKAGES OF SAME TYPE WHICH FAILED CAL MANNER			
33. NUMBER OF PACKAGES OF SAME TYPE IN SHIPMENT			
34. PACKAGE SPECIFICATION IDENTIFICATION (e.g., DOT 17E, DOT 105A 100, UN1A1 or none)			
35. ANY OTHER PACKAGING MARKINGS (e.g., STC, 18/16-55-88, Y1.4/150/87)			
36. NAME AND ADDRESS, SYMBOL OR REGISTRATION OF PACKAGING MANUFACTURER			
37. SERIAL NUMBER OF CYLINDERS, PORTABLE TANKS, ANKS, TANK CARS			
38. TYPE OF LABELING OR PLACARDING APPLIED			
39. IF RECONDITIONED OR FIED — A. REGISTRATION OR SYMBOL			
B. DATE OF LAST TEST OR ON			
40. EXEMPTION/APPROVAL/COMPETENT AUTHORITY IF APPLICABLE (e.g., DOT E1012)			

VIII. DESCRIPTION OF PACKAGING FAILURE: Check all applicable boxes for the package(s) identified above.

41. ACTION CONTRIBUTING TO PACKAGING FAILURE:

	A	B	C		A	B	C	
a.	❑	❑	❑	TRANSPORT VEHICLE COLLISION	j.	❑	❑	❑ CORROSION
b.	❑	❑	❑	TRANSPORT VEHICLE OVERTURN	k.	❑	❑	❑ METAL FATIGUE
c.	❑	❑	❑	OVERLOADING/OVERFILLING	l.	❑	❑	❑ FRICTION/RUBBING
d.	❑	❑	❑	LOOSE FITTINGS, VALVES	m.	❑	❑	❑ FIRE/HEAT
e.	❑	❑	❑	DEFECTIVE FITTINGS, VALVES	n.	❑	❑	❑ FREEZING
f.	❑	❑	❑	DROPPED	o.	❑	❑	❑ VENTING
g.	❑	❑	❑	STRUCK/RAMMED	p.	❑	❑	❑ VANDALISM
h.	❑	❑	❑	IMPROPER LOADING	q.	❑	❑	❑ INCOMPATIBLE MATERIALS
i.	❑	❑	❑	IMPROPER BLOCKING	r.	❑	❑	❑ OTHER

42. OBJECT CAUSING FAILURE:

	A	B	C	
a.	❑	❑	❑	OTHER FREIGHT
b.	❑	❑	❑	FORKLIFT
c.	❑	❑	❑	NAIL/PROTRUSION
d.	❑	❑	❑	OTHER TRANSPORT VEHICLE
e.	❑	❑	❑	WATER/OTHER LIQUID
f.	❑	❑	❑	GROUND/FLOOR/ROADWAY
g.	❑	❑	❑	ROADSIDE OBSTACLE
h.	❑	❑	❑	NONE
i.	❑	❑	❑	OTHER

43. HOW PACKAGE(S) FAILED:

	A	B	C	
a.	❑	❑	❑	PUNCTURED
b.	❑	❑	❑	CRACKED
c.	❑	❑	❑	BURST/INTERNAL PRESSURE
d.	❑	❑	❑	RIPPED
e.	❑	❑	❑	CRUSHED
f.	❑	❑	❑	RUBBED/ABRADED
g.	❑	❑	❑	RUPTURED
h.	❑	❑	❑	OTHER_____

44. PACKAGE AREA THAT FAILED:

	A	B	C	
a.	❑	❑	❑	END, FORWARD
b.	❑	❑	❑	END, READ
c.	❑	❑	❑	SIDE, RIGHT
d.	❑	❑	❑	SIDE, LEFT
e.	❑	❑	❑	TOP
f.	❑	❑	❑	BOTTOM
g.	❑	❑	❑	CENTER
h.	❑	❑	❑	OTHER_____

45. WHAT FAILED ON PACKAGE(S):

	A	B	C	
a.	❑	❑	❑	BASIC PACKAGE MATERIAL
b.	❑	❑	❑	FITTING/VALVE
c.	❑	❑	❑	CLOSURE
d.	❑	❑	❑	CHIME
e.	❑	❑	❑	WELD/SEAM
f.	❑	❑	❑	HOSE/PIPING
g.	❑	❑	❑	INNER LINER
h.	❑	❑	❑	OTHER

IX. DESCRIPTION OF EVENTS: Describe the sequence of events that led to incident, action taken at time discovered, and action taken to prevent idents. Include any recommendations to improve packaging, handling, or transportation of hazardous materials. Photographs and diagrams should ted when necessary for clarification. ATTACH A COPY OF THE HAZARDOUS WASTE MANIFEST FOR INCIDENTS INVOLVING HAZARDOUS WASTE. on additional sheets if necessary.

46. NAME OF PERSON RESPONSIBLE FOR PREPARING REPORT (Please Print)	47. SIGNATURE	
48. TITLE OF PERSON RESPONSIBLE FOR PREPARING REPORT	49. TELEPHONE NUMBER (Area Code) ( ) -	50. DATE REPORT SIGNED

Appendix F

Material Safety Data Sheets

SIGMA-ALDRICH-FLUKA
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN-UL-14C **Revised: 04/30/1999**

MSDS Contents

MFG. NAME:SIGMA CHEMICAL
TRADE NAME:2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN-UL-14C
REV DATE:04/30/99
CAS#:
MFG. PROD.#:315370G
START_MSDS

Sigma Chemical Co.
P.O. Box 14508
St. Louis, MO 63178 USA
Phone: 314-771-5765

PRODUCT #:	315370
NAME:	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN-UL-14C

NO MATERIAL SAFETY DATA CURRENTLY AVAILABLE.
THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA, ALDRICH, FLUKA SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

SIGMA-ALDRICH
2,4,6-TRINITROTOLUENE,1X1ML, ACN 1000UG/ML Revised: 04/30/2007

MSDS Contents

Valid 02/07 - 04/07

SIGMA-ALDRICH 2007.1
MATERIAL SAFETY DATA SHEET

Date Printed: 12/14/2006
Date Updated: 02-06-2006
Version 1.4

Section 1 - Product and Company Information

Product Name	2,4,6-TRINITROTOLUENE,1X1ML, ACN 1000UG/ML
Product Number	47244
Brand	SUPELCO
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS, MO 63103 USA
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
2,4,6-TRINITROTOLUENE SOLUTION IN ACETONITRILE	None	Yes

Ingredient Name	CAS #	Percent	SARA 313
ACETONITRILE	75-05-8	> 99	Yes

2,4,6-TRINITROTOLUENE	118-96-7	0.12

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Flammable (USA) Highly Flammable (EU). Toxic (USA) Harmful (EU). Explosive when dry. Harmful by inhalation, in contact with skin and if swallowed. Irritating to respiratory system and skin. Risk of serious damage to eyes.
This material can produce a cyanide-like effect. Target organ(s): Central nervous system. Liver.

HMIS RATING

HEALTH: 2*
FLAMMABILITY: 3
REACTIVITY: 3

NFPA RATING

HEALTH: 2
FLAMMABILITY: 3
REACTIVITY: 3

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE

If swallowed, wash out mouth with water provided person is conscious. Call a physician immediately.

INHALATION EXPOSURE

If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

DERMAL EXPOSURE

In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

EYE EXPOSURE

In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

FLAMMABLE HAZARDS

Flammable Hazards: Yes

EXPLOSION HAZARDS
Vapor may travel considerable distance to source of ignition and flash back. Container explosion may occur under fire conditions.

FLASH POINT
35.6 °F 2 °C Method: closed cup

EXPLOSION LIMITS
Lower: 4.4 % Upper: 16 %

AUTOIGNITION TEMP
523 °C

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Specific Hazard(s): Flammable liquid. Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area. Shut off all sources of ignition.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Cover with dry-lime, sand, or soda ash. Place in covered containers using non-sparking tools and transport outdoors. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe vapor. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep container closed. Keep away from heat, sparks, and open flame. Handle and store under nitrogen.

Unsuitable: Warning: this material is classified as an explosive when dry. Fire fighting should be done from a remote position. Store at 2-8°C

SPECIAL REQUIREMENTS
Handle and store under inert gas. Do not allow material to become dry.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Safety shower and eye bath. Use nonsparking tools. Use only in a chemical fume hood.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash contaminated clothing before reuse. Wash thoroughly after handling.

EXPOSURE LIMITS

Country	Source	Type	Value
Poland		NDS	70 MG/M3
Poland		NDSCh	140 MG/M3
Poland		NDSP	-

Section 9 - Physical/Chemical Properties

Appearance — Physical State: Liquid

Property	Value	At Temperature or Pressure
pH	N/A	
BP/BP Range	81.0 - 82.0 °C	760 mmHg
MP/MP Range	N/A	
Freezing Point	N/A	
Vapor Pressure	72.8 mmHg	20 °C
Vapor Density	N/A	
Saturated Vapor Conc.	N/A	
SG/Density	N/A	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	

Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	
Surface Tension	N/A	
Partition Coefficient	N/A	
Decomposition Temp.	N/A	
Flash Point	35.6 °F 2 °C	Method: closed cup
Explosion Limits	Lower: 4.4 %	
	Upper: 16 %	
Flammability	N/A	
Autoignition Temp	523 °C	
Refractive Index	N/A	
Optical Rotation	N/A	
Miscellaneous Data	N/A	
Solubility	N/A	

N/A = not available

Section 10 - Stability and Reactivity

STABILITY
Stable: Stable.
Reactions to Avoid: Do not distill to dryness.
Conditions to Avoid: Dry material explodes when heated.
Materials to Avoid: Acids, Bases, Oxidizing agents, Reducing agents, Alkali metals.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide, Nitrogen oxides, Hydrogen cyanide.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: May cause skin irritation.
Skin Absorption: Harmful if absorbed through skin.
Eye Contact: Causes eye irritation.
Inhalation: Harmful if inhaled. Material may be irritating to mucous membranes and upper respiratory tract.
Ingestion: Harmful if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)
Blood. Lungs. Liver. Kidneys. Central nervous system.

SIGNS AND SYMPTOMS OF EXPOSURE
This material can produce a cyanide like effect. Always have a cyanide first-aid kit present when using this material. The onset of symptoms is generally delayed pending conversion to cyanide. Adverse effects may include nausea, vomiting, diarrhea, headache, dizziness, rashes and cyanosis. Other symptoms include mental excitement or depression, drowsiness, impaired

perception, incoordination, stupor, coma, and death.

CONDITIONS AGGRAVATED BY EXPOSURE
Acetonitrile is metabolized in the liver to water, formic acid, and hydrogen cyanide. The cyanide is further metabolized to thiocyanate.

CHRONIC EXPOSURE - CARCINOGEN
Result: This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

Section 12 - Ecological Information

No data available.

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Contact a licensed professional waste disposal service to dispose of this material. Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: Substances, explosive, n.o.s.
UN#: 0481
Class: 1.4S
Packing Group: Packing Group II
Hazard Label: Explosive 1.4S
PIH: Not PIH

IATA
Proper Shipping Name: Substances, explosive, n.o.s.
IATA UN Number: 0481
Hazard Class: 1.4S

Section 15 - Regulatory Information

EU ADDITIONAL CLASSIFICATION
Symbol of Danger: F-Xn
Indication of Danger: Highly Flammable. Harmful.
R: 1-11-20/21/22-36
Risk Statements: Explosive when dry. Highly flammable. Harmful by inhalation, in contact with skin and if swallowed. Irritating

to eyes.
S: 26-36/37
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing and gloves.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Flammable (USA) Highly Flammable (EU). Toxic (USA) Harmful (EU).
Risk Statements: Explosive when dry. Harmful by inhalation, in contact with skin and if swallowed. Irritating to respiratory system and skin. Risk of serious damage to eyes.
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing, gloves, and eye/face protection.
US Statements: This material can produce a cyanide-like effect.
Target organ(s): Central nervous system. Liver.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: Yes
NOTES: This product is or contains a component that is subject to SARA313 reporting requirements.

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

ACROS ORGANICS
1,3-DINITROBENZENE Revised: 10/25/2007

MSDS Contents

Material Safety Data Sheet

1,3-Dinitrobenzene
MSDS# 07316

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MSDS Name:
1,3-Dinitrobenzene
Catalog Numbers:
AC116970000, AC116970250, AC116971000
Synonyms:
m-Dinitrobenzene.
Company Identification:
Acros Organics BVBA
Janssen Pharmaceuticalaan 3a
2440 Geel, Belgium
Company Identification: (USA)Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410
For information in the US, call:
800-ACROS-01
For information in Europe, call: +32 14 57 52 11
Emergency Number, Europe: +32 14 57 52 99
Emergency Number US:201-796-7100
CHEMTREC Phone Number, US:
800-424-9300
CHEMTREC Phone Number, Europe:
703-527-3887

SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS

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---------------------------------------
CAS#:          99-65-0
Chemical Name: 1,3-Dinitrobenzene
%:             98
EINECS#:      202-776-8
---------------------------------------
Hazard Symbols:
 T+ N
Risk Phrases:
 26/27/28 33 50/53
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SECTION 3 - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Warning! Harmful if swallowed. May cause severe eye irritation and possible injury. May cause liver and kidney damage. May cause severe skin irritation. May cause reproductive and fetal effects.
Methemoglobin formation is the prinicipal cause of toxicity.
Target Organs: Blood, kidneys, liver, male reproductive system.
Potential Health Effects

Eye:

Causes severe eye irritation. May cause eye injury. Effects may be delayed.

Skin:

Absorption into the body may cause cyanosis (bluish discoloration of skin due to deficient oxygenation of the blood).

Ingestion:

Harmful if swallowed. Causes gastrointestinal irritation with nausea, vomiting and diarrhea. May cause systemic toxicity with acidosis. May cause liver and kidney damage.

Inhalation:

Causes respiratory tract irritation. May cause effects similar to those described for ingestion.

Chronic:

Adverse reproductive effects have been reported in animals. Chronic exposures of workers to dinitrobenzene have caused anemia; liver injury has been reported in a few cases. Visual impairment has occurred in the form of reduced visual acuity and central scotomas (loss or depression of vision within the central visual field), particularly for red and green colors. A yellow discoloration of the conjunctiva and the sclera was a common observation in these exposures (ACGIH Documentation of the TLV).

SECTION 4 - FIRST AID MEASURES

Eyes:

Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin:

Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion:

Call a poison control center. If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.

Inhalation:

Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Notes to Physician:

SECTION 5 - FIRE FIGHTING MEASURES

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:

Use foam, dry chemical, or carbon dioxide.

Autoignition Temperature:Not applicable.

Flash Point:150 deg C (302.00 deg F)

Explosion Limits: Lower:Not available

Explosion Limits: Upper:Not available

NFPA Rating:

health: 2; flammability: 1; instability: 0;

SECTION 6 - ACCIDENTAL RELEASE MEASURES

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Vacuum or sweep up material and place into a suitable disposal container. Reduce airborne dust and prevent scattering by moistening with water. Clean up spills immediately, observing precautions in the Protective Equipment section.

SECTION 7 - HANDLING AND STORAGE

Handling:

Wash thoroughly after handling. Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Avoid contact with skin and eyes. Avoid ingestion and inhalation.

Storage:

Store in a cool, dry place. Store in a tightly closed container.

SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION

Engineering Controls:

Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
1,3-Dinitrobenzene	0.15 ppm; Skin - potential significant contribution to overall exposure by the cutaneous r oute	1 mg/m3 TWA 50 mg/m3 IDLH	1 mg/m3 TWA

OSHA Vacated PELs:
1,3-Dinitrobenzene:
1 mg/m3 TWA (listed under Dinitrobenzene, all isomers)

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

Wear appropriate protective gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Crystals
Color:	yellow
Odor:	None reported.
pH:	Not available
Vapor Pressure:	Not available
Vapor Density:	Not available
Evaporation Rate:	Not available
Viscosity:	Not available
Boiling Point:	297 deg C (566.60°F)
Freezing/Melting Point:	88 - 90 deg C
Decomposition Temperature:	Not available
Solubility in water:	Slightly soluble in water.
Specific Gravity/Density:	1.36
Molecular Formula:	C6H4N2O4
Molecular Weight:	168.11

SECTION 10 - STABILITY AND REACTIVITY

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Dust generation.
Incompatibilities with Other Materials
Strong oxidizing agents, strong bases.
Hazardous Decomposition Products
Nitrogen oxides, carbon monoxide, carbon monoxide, carbon dioxide.
Hazardous Polymerization
Has not been reported.

SECTION 11 - TOXICOLOGICAL INFORMATION

RTECS#:
CAS# 99-65-0: CZ7350000
LD50/LC50:
RTECS: CAS# 99-65-0: Draize test, rabbit, eye: 100 mg;
Oral, mouse: LD50 = 74700 ug/kg; Oral, rat: LD50 = 59500
ug/kg; Skin, rabbit: LD50 = 1900 mg/kg;.
Carcinogenicity:
1,3-Dinitrobenzene -
Not listed as a carcinogen by ACGIH, IARC, NTP, or CA Prop 65.
Epidemiology:
Not available
Teratogenicity:
Not available
Reproductive:
m-Dinitrobenzene impairs sperm production and fertility in rats.
The o- and p- isomers did not demonstrate testicular toxicity.
Neurotoxicity:
Not available
Mutagenicity:
Not available
Other:
See actual entry in RTECS for complete information.

SECTION 12 - ECOLOGICAL INFORMATION

Not available

SECTION 13 - DISPOSAL CONSIDERATIONS

Chemical waste generators must determine whether a discarded chemical
is classified as a hazardous waste.
US EPA guidelines for the classification determination are listed in
40 CFR Parts 261.3. Additionally, waste generators must consult state
and local hazardous waste regulations to ensure complete and accurate
classification.

RCRA P-Series: None listed.
RCRA U-Series: None listed.

SECTION 14 - TRANSPORT INFORMATION

US DOT
Shipping Name: DINITROBENZENES, SOLID
Hazard Class: 6.1
UN Number: UN3443
Packing Group: II
Canada TDG
Shipping Name: Not available
Hazard Class:
UN Number:
Packing Group:
USA RQ: CAS# 99-65-0: 100 lb final RQ (listed under Dinitrobenzene, mixed); 45.4 kg

SECTION 15 - REGULATORY INFORMATION

US Federal
TSCA
CAS# 99-65-0 is listed on the TSCA Inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.

SECTION 12B

None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 99-65-0: 100 lb final RQ (listed under Dinitrobenzene, mixed); 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.

SECTION 313

This material contains 1,3-Dinitrobenzene (CAS# 99-65-0, 98%),which
is subject to the reporting requirements of Section 313 of SARA Title
III and 40 CFR Part 372.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 99-65-0 is listed as a Hazardous Substance under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

STATE

1,3-Dinitrobenzene can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains 1,3-Dinitrobenzene, a chemical known to the state of California to cause birth defects or other reproductive harm.

California No Significant Risk Level:

None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T+ N

Risk Phrases:

R 26/27/28 Very toxic by inhalation, in contact with skin and if swallowed.
R 33 Danger of cumulative effects.
R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 28A After contact with skin, wash immediately with plenty of water.
S 36/37 Wear suitable protective clothing and gloves.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 60 This material and its container must be disposed of as hazardous waste.
S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

WGK (Water Danger/Protection)

CAS# 99-65-0: 3

Canada

CAS# 99-65-0 is listed on Canada's DSL List
Canadian WHMIS Classifications: D1A, D2B
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.
CAS# 99-65-0 is listed on Canada's Ingredient Disclosure List

SECTION 16 - OTHER INFORMATION

MSDS Creation Date:
9/02/1997
Revision #8 Date
10/25/2007
Revisions were made in Sections:
5
The information above is believed to be accurate and represents the

best information currently available to us. However, we make no warranty of merchantibility or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential, or exemplary damages howsoever arising, even if the company has been advised of the possibility of such damages.

ACCUSTANDARD
2,4-DINITROTOLUENE Revised: 09/14/2006

MSDS Contents

MATERIAL SAFETY DATA SHEET

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

COMPANY:
ACCUSTANDARD, INC.
125 MARKET STREET
NEW HAVEN, CT 06513

INFORMATION PHONE NUMBER: 203-786-5290

EMERGENCY PHONE NUMBER: 203-786-5290

HOURS: MON. TO FRI. 8AM-5PM EDT

CATALOG NUMBER: AS-E0033

PRODUCT NAME: 2,4-DINITROTOLUENE

SYNONYMS: N/A

FORMULA: N/A

MOLECULAR WEIGHT: N/A

DATE MSDS PRINTED: 9/14/2006

PREPARATION DATE: 9/14/2006

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT(S)(2)	CAS#	APPR. %	ACGIH-TLV (MG/M3)			OSHA-PEL (MG/M3)		
			TWA	STEL	SKIN	TWA	STEL	SKIN

2,4-DINITROTOLUENE	121-14-2	0.5	1.5		X	1.5	X
METHANOL	67-56-1	99.5	262	328	X	260	

SECTION 3 - HAZARDS IDENTIFICATION

SYMPTOMS OF EXPOSURE:
IRRITATING TO EYES, SKIN, MUCOUS MEMBRANES AND UPPER RESPIRATORY SYSTEM.
OVER EXPOSURE MAY CAUSE DIZZINESS, NAUSEA, MUSCLE WEAKNESS, NARCOSIS AND RESPIRATORY FAILURE.
AFTER INGESTION OR INHALATION, INITIAL SYMPTOMS MAY BE ONLY THAT OF MILD INTOXICATION, BUT MAY BECOME SEVERE AFTER 12 OR 18 HOURS.

POTENTIAL HEALTH EFFECTS:
TOXIC IF INHALED, ABSORBED THROUGH SKIN, OR SWALLOWED.
MAY CAUSE EYE, KIDNEY, LIVER, AND SKIN DAMAGE.
MAY CAUSE CENTRAL NERVOUS SYSTEM DAMAGE.
POISON, MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED.
FETAL DEVELOPMENT ABNORMALITIES AND EFFECTS ON EMBRYO OR FETUS HAVE BEEN REPORTED FROM PROLONGED EXPOSURE TO METHANOL IN LABORATORY TESTS INVOLVING PREGNANT RATS.

ROUTES OF ENTRY: INHALATION, INGESTION OR SKIN CONTACT.

CARCINOGENICITY:
THIS PRODUCT IS OR CONTAINS A COMPONENT THAT IS CLASSIFIED (ACGIH, IARC, NTP, OSHA) AS A POSSIBLE CANCER HAZARD.

SECTION 4 - FIRST AID MEASURES

EMERGENCY FIRST AID: GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

SKIN CONTACT:
IMMEDIATELY WASH SKIN WITH SOAP AND PLENTY OF WATER. REMOVE CONTAMINATED CLOTHING. GET MEDICAL ATTENTION IF SYMPTOMS OCCUR. WASH CLOTHING BEFORE REUSE.

EYE CONTACT:
IMMEDIATELY FLUSH WITH PLENTY OF WATER. AFTER INITIAL FLUSHING, REMOVE AND CONTACT LENSES AND CONTINUE FLUSHING FOR AT LEAST 15 MINUTES. ASSURE ADEQUATE FLUSHING BY SEPARATING THE EYELIDS WITH FINGERS.

INHALATION:
REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION OR GIVE OXYGEN BY TRAINED PERSONNEL. SEEK IMMEDIATE MEDICAL ATTENTION.

INGESTION:
DRINK WATER AND INDUCE VOMITING IMMEDIATELY AS DIRECTED BY MEDICAL PERSONNEL. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. GET MEDICAL ATTENTION IMMEDIATELY.

SECTION 5 - FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES:

FLASH POINT: 52 DEG. F (11 DEG. C) (TCC)

FLAMMABLE LIMITS LEL (%): 6.7
FLAMMABLE LIMITS UEL (%): 36.5

AUTOIGNITION TEMPERATURE: 385 DEG. C

DANGEROUS FIRE AND EXPLOSIVE HAZARD.

CONTAINERS CAN BUILD UP PRESSURE IF EXPOSED TO HEAT.

VAPORS CAN TRAVEL TO A SOURCE OF IGNITION AND FLASH BACK.

DURING A FIRE, IRRITATING AND HIGHLY TOXIC GASES MAY BE GENERATED BY THERMAL DECOMPOSITION OR COMBUSTION.

EXTINGUISHING MEDIA:
USE ALCOHOL FOAM, CARBON DIOXIDE, DRY CHEMICAL, OR WATER SPRAY WHEN FIGHTING FIRES INVOLVING THIS MATERIAL.

FIRE FIGHTING PROCEDURES:
AS IN ANY FIRE, WEAR SELF-CONTAINED BREATHING APPARATUS PRESSURE DEMAND, MSHA/NIOSH (APPROVED OR EQUIVALENT) AND FULL PROTECTIVE GEAR.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

SPILL RESPONSE:
WEAR SUITABLE PROTECTIVE EQUIPMENT LISTED UNDER EXPOSURE CONTROLS/PERSONAL PROTECTION. ELIMINATE ANY IGNITION SOURCES UNTIL THE AREA IS DETERMINED TO BE FREE FROM EXPLOSION OR FIRE HAZARDS. CONTAIN THE RELEASE AND ELIMINATE ITS SOURCE, IF THIS CAN BE DONE WITHOUT RISK. DISPOSE AS HAZARDOUS WASTE. COMPLY WITH FEDERAL, STATE AND LOCAL REGULATIONS.

SECTION 7 - HANDLING AND STORAGE

STORE IN A TIGHTLY CLOSED CONTAINER.
STORE IN A COOL AREA AWAY FROM IGNITION SOURCES AND OXIDIZERS.
AVOID BREATHING VAPORS OR MISTS.
DO NOT GET IN EYES, ON SKIN OR CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
THIS PRODUCT SHOULD ONLY BY USED BY PERSONS TRAINED IN THE SAFE HANDLING OF HAZARDOUS CHEMICALS.

SECTION 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTION EQUIPMENT (PPE):

RESPIRATORY PROTECTION:
IF WORKPLACE EXPOSURE LIMIT(S) OF PRODUCT OR ANY COMPONENT IS EXCEEDED (SEE TLV/PEL), A NIOSH/MSHA APPROVED AIR SUPPLIED RESPIRATOR IS ADVISED IN ABSENCE OF PROPER ENVIRONMENTAL CONTROL. OSHA REGULATIONS ALSO PERMIT OTHER NIOSH/MSHA RESPIRATORS (NEGATIVE PRESSURE TYPE) UNDER SPECIFIED CONDITIONS (SEE YOUR SAFETY EQUIPMENT SUPPLIER). ENGINEERING AND/OR ADMINISTRATIVE CONTROLS SHOULD BE IMPLEMENTED TO REDUCE EXPOSURE.
MATERIAL SHOULD BE HANDLED OR TRANSFERRED IN AN APPROVED FUME HOOD OR WITH ADEQUATE VENTILATION.
PROTECTIVE GLOVES MUST BE WORN TO PREVENT SKIN CONTACT.
(CHLOROPRENE, NATURAL RUBBER, NITRILE, OR EQUIVALENT)
SAFETY GLASSES WITH SIDE SHIELDS MUST BE WORN AT ALL TIMES.

GENERAL HYGIENE CONSIDERATIONS:
WASH THOROUGHLY AFTER HANDLING. DO NOT TAKE INTERNALLY. EYE WASH AND SAFETY EQUIPMENT SHOULD BE READILY AVAILABLE.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: CLEAR LIQUID

ODOR: N/A

pH: N/A

VAPOR PRESSURE: 97 MMHG (20 DEG. C)

VAPOR DENSITY (AIR=1): 1.1 G/L

BOILING POINT: 65 DEG. C

MELTING POINT: -93.9 DEG. C

SOLUBILITY IN WATER (%): VERY SOLUBLE

SPECIFIC GRAVITY (H2O=1): 0.791 G/CM3

FLASH POINT: 52 DEG. F (11 DEG. C) (TCC)

EXPLOSION LIMITS (%): 6.7 TO 36.5

AUTOIGNITION TEMPERATURE: 385 DEG. C

PERCENT VOLATILE: 99.9+

EVAPORATION RATE (BUAC=1): 5.9

MOLECULAR WEIGHT: N/A

MOLECULAR FORMULA: N/A

SECTION 10 - STABILITY AND REACTIVITY

STABILITY: STABLE

CONDITIONS TO AVOID: HEAT; CONTACT WITH IGNITION SOURCES

MATERIALS TO AVOID:
ACIDS
OXIDIZERS
ALKALI METALS; REDUCING AGENTS

HAZARDOUS DECOMPOSITION: CARBON OXIDES; FORMALDEHYDE

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

SECTION 11 - TOXICOLOGICAL INFORMATION

SEE SECTION 3 FOR SPECIFIC TOXICOLOGICAL INFORMATION FOR THE INGREDIENTS OF THIS PRODUCT.

SECTION 12 - ECOLOGICAL INFORMATION

BY COMPLYING WITH SECTIONS 6 AND 7 THERE WILL BE NO RELEASE TO THE ENVIRONMENT.

SECTION 13 - DISPOSAL CONSIDERATIONS

RECYCLE OR INCINERATE AT ANY EPA APPROVED FACILITY OR DISPOSE IN COMPLIANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS. EMPTY CONTAINERS MUST BE TRIPLE-RINSED PRIOR TO DISPOSAL.

SECTION 14 - TRANSPORT INFORMATION

DOT:
UN NUMBER: UN1230
SHIPPING CLASS: 3
PACKING GROUP: II
FLAMMABLE

SECTION 15 - REGULATORY INFORMATION

IN ADDITION TO FEDERAL AND STATE REGULATIONS, LOCAL REGULATIONS MAY APPLY. CHECK WITH YOUR LOCAL REGULATORY AUTHORITIES.

WARNING:
THIS PRODUCT CONTAINS CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

SECTION 16 - OTHER INFORMATION

THIS DOCUMENT HAS BEEN DESIGNED TO MEET THE REQUIREMENTS OF OSHA, ANSI AND CHIPS REGULATIONS.

THE STATEMENTS CONTAINED HEREIN ARE OFFERED FOR INFORMATIONAL PURPOSES ONLY AND ARE BASED ON TECHNICAL DATA THAT WE BELIEVE TO BE ACCURATE. IT IS INTENDED FOR USE ONLY BY PERSONS HAVING THE NECESSARY TECHNICAL SKILL AND AT THEIR OWN DISCRETION AND RISK. SINCE CONDITIONS AND MANNER OF USE ARE OUTSIDE OUR CONTROL, WE MAKE NO WARRANTY, EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

LEGEND:
N/A = NOT AVAILABLE
ND = NOT DETERMINED
NR = NOT REGULATED

CATALOG NUMBER: AS-E0033

PREPARATION DATE: 9/14/2006

SIGMA-ALDRICH
2,6-DINITROTOLUENE Revised: 04/30/2007

MSDS Contents

Valid 02/07 - 04/07

SIGMA-ALDRICH 2007.1
MATERIAL SAFETY DATA SHEET

Date Printed: 12/14/2006
Date Updated: 01-31-2006
Version 1.3

Section 1 - Product and Company Information

Product Name	2,6-DINITROTOLUENE
Product Number	62559
Brand	RIEDEL
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS, MO 63103 USA
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
2,6-DINITROTOLUENE	606-20-2	Yes

Formula	C7H6N2O4
Synonyms	Benzene, 2-methyl-1,3-dinitro- (9CI) * 2,6-Dinitro toluene * 2,6-DNT * 1-Methyl-2,6-dinitrobenzene * 2-Methyl-1,3-dinitrobenzene * RCRA waste number U1

06
RTECS Number: XT1925000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW
Highly Toxic (USA) Toxic (EU).
May cause cancer. Heating may cause an explosion. Also toxic in contact with skin and if swallowed. Also very toxic by inhalation. May cause sensitization by inhalation and skin contact. Possible risk of impaired fertility. Also possible risks of irreversible effects. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Probable Carcinogen (US). Readily absorbed through skin. Possible reproductive hazard. Target organ(s): Blood. Liver. Calif. Prop. 65 carcinogen & developmental hazard.

HMIS RATING
HEALTH: 3*
FLAMMABILITY: 0
REACTIVITY: 0

NFPA RATING
HEALTH: 3
FLAMMABILITY: 0
REACTIVITY: 0

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE
If swallowed, wash out mouth with water provided person is conscious. Call a physician.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If breathing becomes difficult, call a physician.

DERMAL EXPOSURE
In case of contact, immediately wash skin with soap and copious amounts of water.

EYE EXPOSURE
In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

EXPLOSION HAZARDS
May explode when heated.

EXPLOSION DATA
Sensitivity to Mechanical Impact: May be shock-sensitive.
Dust Potential: This material, like most materials in powder form, is capable of creating a dust explosion.

FLASH POINT
404 °F 206.7 °C Method: closed cup

AUTOIGNITION TEMP
N/A

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves. Wear disposable coveralls and discard them after use.

METHODS FOR CLEANING UP
Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe dust. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Use only in a chemical fume hood. Safety shower and eye bath.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash contaminated clothing before reuse. Wash thoroughly after handling.

EXPOSURE LIMITS, RTECS

Country	Source	Type	Value
USA	NIOSH	TWA	1.5 MG/M3 (SK)

Section 9 - Physical/Chemical Properties

Appearance	Physical State: Solid Color: Light yellow Form: Crystalline	
Property	Value	At Temperature or Pressure
Molecular Weight	182.14 AMU	
pH	N/A	
BP/BP Range	285 °C	
MP/MP Range	56 °C	
Freezing Point	N/A	
Vapor Pressure	0.006 mmHg	25 °C
Vapor Density	6.28 g/l	
Saturated Vapor Conc.	N/A	
SG/Density	1.283 g/cm3	111 °C
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	
Surface Tension	N/A	
Partition Coefficient	Log Kow: 2.1	
Decomposition Temp.	N/A	
Flash Point	404 °F 206.7 °C	Method: closed cup
Explosion Limits	N/A	
Flammability	N/A	
Autoignition Temp	N/A	
Refractive Index	1.479	

Optical Rotation	N/A
Miscellaneous Data	N/A
Solubility	Other Solvents: CHLOROFORM, ETHER

N/A = not available

Section 10 - Stability and Reactivity

STABILITY
Stable: Stable.
Materials to Avoid: Oxidizing agents, Reducing agents, Strong bases.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide, Nitrogen oxides.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: May cause skin irritation.
Skin Absorption: Readily absorbed through skin. Toxic if absorbed through skin.
Eye Contact: May cause eye irritation.
Inhalation: Material may be irritating to mucous membranes and upper respiratory tract. Toxic if inhaled.
Ingestion: Toxic if swallowed.

SENSITIZATION
Sensitization: May cause allergic respiratory and skin reactions

TARGET ORGAN(S) OR SYSTEM(S)
Blood. Liver. Spleen.

CONDITIONS AGGRAVATED BY EXPOSURE
May cause nervous system disturbances.

TOXICITY DATA

Oral
Rat
177 mg/kg
LD50

Inhalation
Rat
240 mg/m3
LC50
Remarks: Lungs, Thorax, or Respiration:Changes in Lung Weight.
Lungs, Thorax, or Respiration:Fibrosing alveolitis.
Behavioral:General anesthetic.

Oral
Mouse
621 mg/kg
LD50
Remarks: Behavioral:Somnolence (general depressed activity).

IRRITATION DATA

Skin
Rabbit
500 mg
24H
Remarks: Mild irritation effect

CHRONIC EXPOSURE - CARCINOGEN
Result: Carcinogen. This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Species: Rat
Route of Application: Oral
Dose: 2555 MG/KG
Exposure Time: 1Y
Frequency: C
Result: Liver:Tumors. Tumorigenic:Carcinogenic by RTECS criteria.

Species: Rat
Route of Application: Oral
Dose: 5110 MG/KG
Exposure Time: 1Y
Frequency: C
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Liver:Tumors.

IARC CARCINOGEN LIST

Rating: Group 2B

CHRONIC EXPOSURE - MUTAGEN
Result: Laboratory experiments have shown mutagenic effects.

Species: Rat
Route: Oral
Dose: 58800 UG/KG
Exposure Time: 3W
Mutation test: Morphological transformation.

Species: Rat
Route: Intraperitoneal
Dose: 219 UG/KG
Mutation test: DNA

Species: Rat
Route: Oral
Dose: 10 MG/KG
Mutation test: DNA

Species: Rat
Dose: 3 MMOL/L

Cell Type: liver
Mutation test: DNA damage

Species: Rat
Route: Oral
Dose: 10 MG/KG
Mutation test: Other mutation test systems

Species: Rat
Dose: 10 UMOL/L
Cell Type: Other cell types
Mutation test: Unscheduled DNA synthesis

Species: Rat
Route: Oral
Dose: 5 MG/KG
Mutation test: Unscheduled DNA synthesis

Species: Rat
Route: Intraperitoneal
Dose: 20 MG/KG
Exposure Time: 8W
Mutation test: DNA inhibition

Species: Rat
Dose: 75 MG/KG
Cell Type: S. typhimurium
Mutation test: Body fluid assay

Species: Rat
Route: Oral
Dose: 1260 MG/KG
Exposure Time: 6W
Mutation test: Cytogenetic analysis

Species: Mouse
Route: Skin
Dose: 192 UMOL/KG
Mutation test: DNA

Species: Mouse
Dose: 75 MG/KG
Cell Type: S. typhimurium
Mutation test: Body fluid assay

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD
Result: Overexposure may cause reproductive disorder(s) based on tests with laboratory animals.

Section 12 - Ecological Information

ACUTE ECOTOXICITY TESTS

Test Type: EC50 Algae
Species: Scenedesmus subspicatus
Time: 72 h
Value: 11.0 - 20.0 mg/l

Test Type: EC50 Daphnia
Species: Daphnia magna
Time: 48 h
Value: 21.7 mg/l

Test Type: LC50 Fish
Species: Pimephales promelas (Fathead minnow)
Time: 96 h
Value: 17.2 - 50.0 mg/l

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Contact a licensed professional waste disposal service to dispose of this material. Observe all federal, state, and local environmental regulations. (DN)Requires special label: "Contains a substance which is regulated by Dannish work environmental law due to the risk of carcinogenic properties."

Section 14 - Transport Information

DOT
Proper Shipping Name: Dinitrotoluenes, solid
UN#: 3454
Class: 6.1
Packing Group: Packing Group II
Hazard Label: Toxic substances.
PIH: Not PIH

IATA
Proper Shipping Name: Dinitrotoluenes, solid
IATA UN Number: 3454
Hazard Class: 6.1
Packing Group: II

Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION
Symbol of Danger: T
Indication of Danger: Toxic.
R: 45-23/24/25-48/22-62-68-52/53
Risk Statements: May cause cancer. Also toxic by inhalation, in contact with skin and if swallowed. Also harmful: danger of serious damage to health by prolonged exposure if swallowed. Possible risk of impaired fertility. Also possible risks of irreversible effects. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S: 53-45-61
Safety Statements: Restricted to professional users. Attention - Avoid exposure - obtain special instructions before use. In case

of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Avoid release to the environment. Refer to special instructions/safety data sheets.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Highly Toxic (USA) Toxic (EU).
Risk Statements: May cause cancer. Heating may cause an explosion. Also toxic in contact with skin and if swallowed. Also very toxic by inhalation. May cause sensitization by inhalation and skin contact. Possible risk of impaired fertility. Also possible risks of irreversible effects. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Safety Statements: Restricted to professional users. Attention - Avoid exposure - obtain special instructions before use. Do not breathe dust. Wear suitable protective clothing and gloves. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Avoid release to the environment. Refer to special instructions/safety data sheets.
US Statements: Probable Carcinogen (US). Readily absorbed through skin. Possible reproductive hazard. Target organ(s): Blood. Liver. Calif. Prop. 65 carcinogen & developmental hazard.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: Yes
DEMINIMIS: 1 %
NOTES: This product is subject to SARA section 313 reporting requirements.
TSCA INVENTORY ITEM: Yes

UNITED STATES - STATE REGULATORY INFORMATION

CALIFORNIA PROP - 65
California Prop - 65: This product is or contains chemical(s) known to the state of California to cause cancer. This product is or contains chemical(s) known to the state of California to cause male developmental toxicity. This product is or contains chemical(s) known to the state of California to cause cancer. This product is or contains chemical(s) known to the state of California to cause male developmental toxicity.

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
The above information is believed to be correct but does not

purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

SIGMA-ALDRICH
2-NITROTOLUENE Revised: 04/30/2007

MSDS Contents

Valid 02/07 - 04/07

SIGMA-ALDRICH 2007.1
MATERIAL SAFETY DATA SHEET

Date Printed: 12/14/2006
Date Updated: 11-10-2006
Version 1.6

Section 1 - Product and Company Information

Product Name	2-NITROTOLUENE
Product Number	74060
Brand	FLUKA
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS, MO 63103 USA
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
2-NITROTOLUENE	88-72-2	No

Formula	C7H7NO2
Synonyms	Benzene, 1-methyl-2-nitro- (9CI) * o-Methylnitrobenzene * 1-Methyl-2-nitrobenzene * 2-Methylnitrobenzene * o-Nitrotoluene * 2-Nitrotoluene * o-Nitroto

luene (ACGIH:OSHA) * ortho-Nitrotoluol * 2-Nitroto
luol * ONT
RTECS Number: XT3150000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW
Toxic. Dangerous for the environment.
May cause cancer. May cause heritable genetic damage. Harmful if swallowed. Toxic by inhalation. Irritating to eyes, respiratory system and skin. Possible risk of impaired fertility. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Probable Carcinogen (US). Calif. Prop. 65 carcinogen. Readily absorbed through skin. Target organ(s): Male reproductive system. Female reproductive system.

HMIS RATING
HEALTH: 2*
FLAMMABILITY: 1
REACTIVITY: 0

NFPA RATING
HEALTH: 2
FLAMMABILITY: 1
REACTIVITY: 0

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE
If swallowed, wash out mouth with water provided person is conscious. Call a physician immediately.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

DERMAL EXPOSURE
In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

EYE EXPOSURE
In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

EXPLOSION HAZARDS
May explode when heated.

EXPLOSION DATA
Sensitivity to Mechanical Impact: May be shock-sensitive.

FLASH POINT
203 °F 95 °C Method: closed cup

EXPLOSION LIMITS
Lower: 2.2 %

AUTOIGNITION TEMP
305 °C

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Absorb on sand or vermiculite and place in closed containers for disposal. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe vapor. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Use only in a chemical fume hood. Safety shower and eye bath.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash contaminated clothing before reuse. Wash thoroughly after handling.

EXPOSURE LIMITS, RTECS

Country	Source	Type	Value
USA	ACGIH	TWA	2 PPM
Remarks: Skin			
USA	OSHA.	PEL	8H TWA 5 PPM (30 MG/M3) (SKIN)
New Zealand OEL			
Remarks: check ACGIH TLV			
USA	NIOSH	TWA	2 PPM (SK)

Section 9 - Physical/Chemical Properties

Appearance	Physical State: Liquid Color: Deep yellow-green Form: Clear liquid	
Property	Value	At Temperature or Pressure
Molecular Weight	137.14 AMU	
pH	N/A	
BP/BP Range	220.0 - 222.0 °C	
MP/MP Range	- 10.0 °C	
Freezing Point	N/A	
Vapor Pressure	N/A	
Vapor Density	4.7 g/l	
Saturated Vapor Conc.	N/A	
SG/Density	1.163 g/cm3	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	
Surface Tension	N/A	
Partition Coefficient	N/A	

Decomposition Temp.	N/A	
Flash Point	203 °F 95 °C	Method: closed cup
Explosion Limits	Lower: 2.2 %	
Flammability	N/A	
Autoignition Temp	305 °C	
Refractive Index	1.544	
Optical Rotation	N/A	
Miscellaneous Data	N/A	
Solubility	N/A	

N/A = not available

Section 10 - Stability and Reactivity

STABILITY
Stable: Stable.
Materials to Avoid: Oxidizing agents, Strong bases.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide, and nitrogen oxides, Nitrogen oxides.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: May cause skin irritation.
Skin Absorption: May be harmful if absorbed through the skin. Readily absorbed through skin.
Eye Contact: May cause eye irritation.
Inhalation: May be harmful if inhaled. Material may be irritating to mucous membranes and upper respiratory tract.
Ingestion: Harmful if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)
Male reproductive system. Female reproductive system. Kidneys. Spleen. Liver.

SIGNS AND SYMPTOMS OF EXPOSURE
Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer. To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

TOXICITY DATA

Oral
Rat
891 mg/kg
LD50

Inhalation
Rat
790 mg/m3
LC50
Remarks: Blood:Methemoglobinemia-Carboxyhemoglobin. Liver:Fatty liver degeneration. Brain and Coverings:Recordings from specific areas of CNS.

Oral
Mouse
970 mg/kg
LD50

Inhalation
Mouse
328 mg/m3
LC50
Remarks: Liver:Fatty liver degeneration. Brain and Coverings:Recordings from specific areas of CNS. Blood:Methemoglobinemia-Carboxyhemoglobin.

Oral
Rabbit
1750 mg/kg
LD50
Remarks: Brain and Coverings:Recordings from specific areas of CNS. Liver:Fatty liver degeneration. Blood:Methemoglobinemia-Carboxyhemoglobin.

CHRONIC EXPOSURE - CARCINOGEN
Result: This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Species: Rat
Route of Application: Oral
Dose: 54600 MG/KG
Exposure Time: 26W
Frequency: C
Result: Tumorigenic:Neoplastic by RTECS criteria. Tumorigenic Effects: Other reproductive system tumors.

IARC CARCINOGEN LIST

Rating: Group 3

CHRONIC EXPOSURE - MUTAGEN
Result: May alter genetic material.

Species: Rat
Route: Oral
Dose: 150 MG/KG
Mutation test: DNA

Species: Rat
Route: Oral
Dose: 200 MG/KG
Mutation test: Unscheduled DNA synthesis

Species: Rat

Dose: 500 UG/L
Cell Type: liver
Mutation test: Unscheduled DNA synthesis

Species: Hamster
Dose: 355 MG/L
Cell Type: ovary
Mutation test: Sister chromatid exchange

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD

Species: Rat
Dose: 32123 MG/KG
Route of Application: Oral
Exposure Time: (13W MALE)
Result: Paternal Effects: Spermatogenesis (including genetic material, sperm morphology,motility, and count). Paternal Effects: Testes, epididymis, sperm duct.

Species: Rat
Dose: 69154 MG/KG
Route of Application: Oral
Exposure Time: (13W PRE)
Result: Maternal Effects: Menstrual cycle changes or disorders.

Species: Mouse
Dose: 140 GM/KG
Route of Application: Oral
Exposure Time: (13W MALE)
Result: Paternal Effects: Spermatogenesis (including genetic material, sperm morphology,motility, and count).

Section 12 - Ecological Information

No data available.

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: Nitrotoluenes, [liquid] [o-; m-; p-;]
UN#: 1664

Class: 6.1
Packing Group: Packing Group II
Hazard Label: Toxic substances.
PIH: Not PIH

IATA
Proper Shipping Name: NITROTOLUENES, LIQUID
IATA UN Number: 1664
Hazard Class: 6.1
Packing Group: II

Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION
Symbol of Danger: T-N
Indication of Danger: Toxic. Dangerous for the environment.
R: 45-46-22-62-51/53
Risk Statements: May cause cancer. May cause heritable genetic damage. Harmful if swallowed. Possible risk of impaired fertility. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S: 53-45-61
Safety Statements: Avoid exposure - obtain special instructions before use. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Avoid release to the environment. Refer to special instructions/safety data sheets.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Toxic. Dangerous for the environment.
Risk Statements: May cause cancer. May cause heritable genetic damage. Harmful if swallowed. Toxic by inhalation. Irritating to eyes, respiratory system and skin. Possible risk of impaired fertility. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Safety Statements: Avoid exposure - obtain special instructions before use. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing and gloves. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Avoid release to the environment. Refer to special instructions/safety data sheets.
US Statements: Probable Carcinogen (US). Calif. Prop. 65 carcinogen. Readily absorbed through skin. Target organ(s): Male reproductive system. Female reproductive system.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: No
TSCA INVENTORY ITEM: Yes

UNITED STATES - STATE REGULATORY INFORMATION

CALIFORNIA PROP - 65
California Prop - 65: This product is or contains chemical(s) known to the state of California to cause cancer.

CANADA REGULATORY INFORMATION

WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER

For R&D use only. Not for drug, household or other uses.

WARRANTY

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

SIGMA-ALDRICH
4-NITROTOLUENE Revised: 04/30/2007

MSDS Contents

Valid 02/07 - 04/07

SIGMA-ALDRICH 2007.1
MATERIAL SAFETY DATA SHEET

Date Printed: 12/14/2006
Date Updated: 11-10-2006
Version 1.6

Section 1 - Product and Company Information

Product Name	4-NITROTOLUENE
Product Number	74080
Brand	FLUKA
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS, MO 63103 USA
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
4-NITROTOLUENE	99-99-0	No

Formula	C7H7NO2
Synonyms	Benzene, 1-methyl-4-nitro- (9CI) * p-Methylnitrobenzene * 1-Methyl-4-nitrobenzene * 4-Methylnitrobenzene * NCI-C60537 * 4-Nitrotoluene * p-Nitrotoluen

e (ACGIH:OSHA) * para-Nitrotoluol * 4-Nitrotoluol
* PNT
RTECS Number: XT3325000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW
Toxic. Dangerous for the environment.
Toxic by inhalation, in contact with skin and if swallowed. Danger of cumulative effects. Irritating to eyes, respiratory system and skin. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Readily absorbed through skin. Target organ(s): Blood. Central nervous system.

HMIS RATING
HEALTH: 2*
FLAMMABILITY: 1
REACTIVITY: 0

NFPA RATING
HEALTH: 2
FLAMMABILITY: 1
REACTIVITY: 0

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE
If swallowed, wash out mouth with water provided person is conscious. Call a physician immediately.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

DERMAL EXPOSURE
In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

EYE EXPOSURE
In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

EXPLOSION HAZARDS
May explode when heated.

EXPLOSION DATA
Sensitivity to Mechanical Impact: May be shock-sensitive.
Dust Potential: This material, like most materials in powder form, is capable of creating a dust explosion.

EXPLOSION LIMITS
Lower: 1.6 %

AUTOIGNITION TEMP
390 °C

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe dust. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Use only in a chemical fume hood. Safety shower and eye bath.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N99 (US) or type P2 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash contaminated clothing before reuse. Wash thoroughly after handling.

EXPOSURE LIMITS, RTECS

Country	Source	Type	Value
USA	ACGIH	TWA	2 PPM
Remarks: Skin			
USA	OSHA.	PEL	8H TWA 5 PPM (30 MG/M3) (SKIN)
New Zealand OEL			
Remarks: check ACGIH TLV			
USA	NIOSH	TWA	2 PPM (SK)

Section 9 - Physical/Chemical Properties

Appearance: Physical State: Solid
Color: Slightly yellow
Form: Fine crystals

Property	Value	At Temperature or Pressure
Molecular Weight	137.14 AMU	
pH	N/A	
BP/BP Range	238 °C	760 mmHg
MP/MP Range	51 °C	
Freezing Point	N/A	
Vapor Pressure	N/A	
Vapor Density	4.7 g/l	
Saturated Vapor Conc.	N/A	
SG/Density	1.392 g/cm3	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	
Surface Tension	N/A	
Partition Coefficient	N/A	
Decomposition Temp.	N/A	
Explosion Limits	Lower: 1.6 %	
Flammability	N/A	

Autoignition Temp	390 °C
Refractive Index	N/A
Optical Rotation	N/A
Miscellaneous Data	N/A
Solubility	N/A

N/A = not available

Section 10 - Stability and Reactivity

STABILITY
Stable: Stable.
Materials to Avoid: Oxidizing agents, Reducing agents, Strong bases.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide, and nitrogen oxides.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: May cause skin irritation.
Skin Absorption: Toxic if absorbed through skin. Readily absorbed through skin.
Eye Contact: May cause eye irritation.
Inhalation: Material may be irritating to mucous membranes and upper respiratory tract. Toxic if inhaled.
Ingestion: Toxic if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)
Skin. Cardiovascular system. G.I. System. Central nervous system. Blood.

SIGNS AND SYMPTOMS OF EXPOSURE
Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer.

TOXICITY DATA
Skin
Rat
> 750 mg/kg
LDLO
1 HOUR
Inhalation
Rat
4.2 ppm
LCLO

Oral
Rat
1960 mg/kg
LD50

Inhalation
Rat
975 mg/m3
LC50
Remarks: Blood:Methemoglobinemia-Carboxyhemoglobin. Liver:Fatty liver degeneration. Brain and Coverings:Recordings from specific areas of CNS.

Skin
Rat
> 16000 mg/kg
LD50
Remarks: Lungs, Thorax, or Respiration:Other changes. Liver:Fatty liver degeneration. Nutritional and Gross Metabolic:Weight loss or decreased weight gain.

Intraperitoneal
Rat
940 MG/KG
LD50
Remarks: Lungs, Thorax, or Respiration:Cyanosis. Behavioral:Ataxia. Lungs, Thorax, or Respiration:Respiratory stimulation.

Oral
Mouse
1231 mg/kg
LD50

Inhalation
Mouse
419 mg/m3
LC50
Remarks: Brain and Coverings:Recordings from specific areas of CNS. Liver:Fatty liver degeneration. Blood:Methemoglobinemia-Carboxyhemoglobin.

Oral
Rabbit
1750 mg/kg
LD50
Remarks: Liver:Fatty liver degeneration. Brain and Coverings:Recordings from specific areas of CNS. Blood:Methemoglobinemia-Carboxyhemoglobin.

CHRONIC EXPOSURE - CARCINOGEN
Result: This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC CARCINOGEN LIST

Rating: Group 3

CHRONIC EXPOSURE - MUTAGEN

Species: Rat
Dose: 100 UG/L
Cell Type: liver
Mutation test: Unscheduled DNA synthesis

Species: Hamster
Dose: 500 MG/L
Cell Type: ovary
Mutation test: Cytogenetic analysis

Species: Hamster
Dose: 200 MG/L
Cell Type: ovary
Mutation test: Sister chromatid exchange

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD

Species: Rat
Dose: 65793 MG/KG
Route of Application: Oral
Exposure Time: (13W MALE)
Result: Paternal Effects: Spermatogenesis (including genetic material, sperm morphology,motility, and count). Paternal Effects: Testes, epididymis, sperm duct.

Species: Rat
Dose: 30 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (1D PRE)
Result: Maternal Effects: Uterus, cervix, vagina.

Section 12 - Ecological Information

ACUTE ECOTOXICITY TESTS

Test Type: EC50 Daphnia
Species: Daphnia magna
Value: 11 mg/l

Test Type: LC0 Fish
Species: Leuciscus idus
Value: 20 mg/l

ELIMINATION

Elimination: > 50 %

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
The material should be ignited in the presence of sodium carbonate and slaked lime (calcium hydroxide). The substance should be mixed

with vermiculite and then with the dry caustics, wrapped in paper and burned in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: Nitrotoluenes, solid
UN#: 3446
Class: 6.1
Packing Group: Packing Group II
Hazard Label: Toxic substances.
PIH: Not PIH

IATA
Proper Shipping Name: Nitrotoluenes, solid
IATA UN Number: 3446
Hazard Class: 6.1
Packing Group: II

Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION
Symbol of Danger: T-N
Indication of Danger: Toxic. Dangerous for the environment.
R: 23/24/25-33-51/53
Risk Statements: Toxic by inhalation, in contact with skin and if swallowed. Danger of cumulative effects. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S: 28-37-45-61
Safety Statements: After contact with skin, wash immediately with plenty of soap-suds. Wear suitable gloves. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Avoid release to the environment. Refer to special instructions/safety data sheets.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Toxic. Dangerous for the environment.
Risk Statements: Toxic by inhalation, in contact with skin and if swallowed. Danger of cumulative effects. Irritating to eyes, respiratory system and skin. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of water. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Wear suitable protective clothing and gloves. Avoid release to the environment. Refer to special instructions/safety data sheets.
US Statements: Readily absorbed through skin. Target organ(s): Blood. Central nervous system.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: No
TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

ADMIRAL METALS SERVICENTER
ALUMINUM Revised: 10/01/1990

MSDS Contents

EXCEPTION TO MSDS:

(???1) INFORMATION IS MISSING, ILLEGIBLE OR INCOMPLETE

- - - - - - BEGINNING OF MSDS- - - - - -
MATERIAL SAFETY DATA SHEET

MAY BE USED TO COMPLY WITH OSHA'S HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. STANDARD MUST BE CONSULTED FOR SPECIFIC REQUIREMENTS.

U.S. DEPARTMENT OF LABOR
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
(NON-MANDATORY FORM)
FORM APPROVED
OMB NO. 1218-0072

IDENTITY (AS USED ON LABEL AND LIST): ALUMINUM (SEE ATTACHMENT)

NOTE:
BLANK SPACES ARE NOT PERMITTED. IF ANY ITEM IS NOT APPLICABLE, OR NO INFORMATION IS AVAILABLE, THE SPACE MUST BE MARKED TO INDICATE THAT.

SECTION I

DISTRIBUTOR'S NAME: ADMIRAL METALS SERVICENTER CO. INC

ADDRESS (NUMBER, STREET, CITY, STATE, AND ZIP CODE):
11 FORBES ROAD
BOX 228
WOBURN, MA 01801-0328

EMERGENCY TELEPHONE NUMBER: 1 (617) 933-8300 (ALL HOURS)

TELEPHONE NUMBER FOR INFORMATION: 1 (617) 933-8300

DATE PREPARED: NOVEMBER 25, 1985

REVISED: OCTOBER 1, 1990

SIGNATURE OF PREPARER (OPTIONAL):

SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

HAZARDOUS COMPONENTS (SPECIFIC CHEMICAL IDENTITY; COMMON NAME(S))	OTHER LIMITS RECOMMENDED	% (OPTIONAL)
SEE ATTACHMENT		

SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS

BOILING POINT: N/A

SPECIFIC GRAVITY (H2O = 1): 2.5 - 2(???1)

VAPOR PRESSURE (MM HG.): N/A

MELTING POINT: WIDE RANGE 870 DEG. F 1453 DEG. F

VAPOR DENSITY (AIR=1): N/A

EVAPORATION RATE (BUTYL ACETATE = 1): N/A

SOLUBILITY IN WATER: N/A

APPEARANCE AND ODOR: GREY TO SILVER METALLIC COLOR. NO ODOR.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED): N/A

FLAMMABLE LIMITS: N/A
LEL:
UEL:

EXTINGUISHING MEDIA: NOT A FIRE HAZARD EXCEPT IN FINELY DIVIDED FORM. IN CASE OF FIRE, USE A CLASS "D" (DRY POWDER) FIRE EXTINGUISHER.

SPECIAL FIRE FIGHTING PROCEDURES: SMOTHER WITH POWDER OR SAND. DO NOT USE WATER OR HALOGEN EXTINGUISHERS.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
FINE METALLIC DUSTS MAY EXPLODE WHEN MIXED WITH HALOGEN ACIDS, HALOGENATED SOLVENTS OR AMMOMNIUN NITRATES. MOISTURE TRAPPED IN MOLTEN ALUMINUM MAY CAUSE AN EXPLOSION. IF REMELTED MAKE CERTAIN WATER OR ANY MOISTURE IS NOT PRESENT IN CAVITIES AND EXTERNAL SERVICES.

SECTION V - REACTIVITY DATA

STABILITY: UNSTABLE ( )
STABLE (X)

CONDITIONS TO AVOID: SEE SECTION IV

INCOMPATIBILITY (MATERIALS TO AVOID): SEE ATTACHMENT

HAZARDOUS DECOMPOSITION OR BYPRODUCTS:

HAZARDOUS POLYMERIZATION: MAY OCCUR ( )
WILL NOT OCCUR (X)

CONDITIONS TO AVOID: NONE

SECTION VI - HEALTH HAZARD DATA

ROUTE(S) OF ENTRY:
INHALATION? (X)
SKIN? ( )
INGESTION? ( )

HEALTH HAZARDS (ACUTE AND CHRONIC): SEE ATTACHMENT VI

CARCINOGENICITY:
NTP? NO
IARC MONOGRAPHS? NO
OSHA REGULATED? NO

SIGNS AND SYMPTOMS OF EXPOSURE: EYE AND RESPIRATORY IRRITATION WHEN EXPOSED TO FINE DUST CONDITIONS.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: RESPIRATORY PROBLEMS WILL BE AGGRAVATED BY FINE METALLIC DUSTS.

EMERGENCY AND FIRST AID PROCEDURES: EYES TO BE FLUSHED WITH WATER TO REMOVE PARTICLES. IN CASE OF ANY DISCOMFORT CAUSED BY HEAVY DUST CONDITIONS, REMOVE TO VENTILATED AREA.

SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
COLLECT SCRAP FOR REMELTING AND RECYCLING. FINE DUST ACCUMULATIONS SHOULD BE WET-SWEPT OR VACUUMED AND SEALED IN A CONTAINER.

WASTE DISPOSAL METHOD: NOT REGULATED.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: HANDLING MOLTEN ALUMINUM PRESENTS A SPECIAL HAZARD. FOR MORE INFORMATION ON MOLTEN ALUMINUM, REQUEST A COPY OF GUIDELINES FOR HANDLING MOLTEN ALUMINUM FROM THE ALUMINUM ASSOC., 818 CONNECTICUT AVE., N.W. WASHINGTON, DC. 20008.

OTHER PRECAUTIONS:

SECTION VIII - CONTROL MEASURES

RESPIRATORY PROTECTION (SPECIFY TYPE):
USE NIOSH APPROVED CARTRIDGE RESPIRATOR OR AIR-SUPPLIED MASK WHEN TLV LEVEL ARE EXCEEDED.

VENTILATION:
LOCAL EXHAUST: SEE ATTACHMENT
MECHANICAL (GENERAL): NONE
SPECIAL: SEE ATTACHMENT
OTHER: NONE

PROTECTIVE GLOVES: YES, WHEN HANDLING HEATED METAL

EYE PROTECTION: YES, DURING MACHINING OF METAL

OTHER PROTECTIVE CLOTHING OR EQUIPMENT: MOLTEN METAL HANDLING REQUIRES THE USE OF PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT.

WORK/HYGIENIC PRACTICES: KEEP METAL DUSTS/PARTICLES TO MINIMUM AND KEEP WORK AREA CLEAN.

(REPRODUCE LOCALLY)
OSHA 174, SEPT. 1985

* USGPO 1986-491-529/45775

(ATTACHMENT)

ADMIRAL METALS SERVICENTER CO. INC. (ALUMINUM-MSDS)

PRODUCT NAME/CLASS

1XXX SERIES - ALLOY 1100
2XXX SERIES - ALLOYS 2011, 2017, 2024, 2219
3XXX SERIES - ALLOY 3003
5XXX SERIES - ALLOYS 5005, 5050, 5052, 5083, 5086
6XXX SERIES - ALLOYS 6061, 6063, 6262
7XXX SERIES - ALLOY 7075

SECTION II

COMPONENT	CAS NO.	ACGIH FUME MG/M3	TLV DUST MG/M3	%
1XXX*ALUMINUM (Al)	7429-90-5	5	10	MIN. 99.0
2XXX*ALUMINUM (Al)	7429-90-5	5	10	MIN. 85.0
SILICON (Si)	7440-21-3	5	10	MAX. 1.3
#IRON (Fe)	7439-89-6	5	10	MAX. 1.3
*MANGANESE(Mn)	7439-96-5	1	5c	MAX. 1.3
MAGNESIUM(Mg)	7439-95-4	10		MAX. 1.9
*COPPER (Cu)	7440-50-8	0.2	1	MAX. 6.8
3XXX*ALUMINUM (Al)	7429-90-5	5	10	MIN. 95.0
SILICON (Si)	7440-21-3	5	10	MAX. 1.8
*MANGANESE(Mn)	7439-96-5	1	5c	MAX. 1.8
MAGNESIUM(Mg)	7439-95-4	10		MAX. 1.3

5XXX	*ALUMINUM (Al)	7429-90-5	5	10	MIN. 91.0
	*MANGANESE(Mn)	7439-96-5	1	5c	MAX. 1.4
	MAGNESIUM(Mg)	7439-95-4	10		MAX. 4.1
	*ZINC (Zn)	7440-66-6	5	5	MAX. 4.0
6XXX	*ALUMINUM (Al)	7429-90-5	5	10	MIN. 93.0
	SILICON (Si)	7440-21-3	5	10	MAX. 1.8
	#IRON (Fe)	7439-89-6	5	10	MAX. 1.0
	*COPPER (Cu)	7440-50-8	0.2	1	MAX. 1.2
	*MANGANESE(Mn)	7439-90-5	1	5c	MAX. 1.1
	MAGNESIUM(Mg)	7439-95-4	10		MAX. 1.5
	*ZINC (Zn)	7440-66-6	5	5	MAX. 2.4
	**CHROMIUM (Cr)	7440-47-3			MAX. .35
7XXX	*ALUMINUM (Al)	7429-90-5	5	10	MIN. 84.0
	*MANGANESE(Mn)	7439-96-5	1	5c	MAX. 1.5
	MAGNESIUM(Mg)	7439-95-4	10		MAX. 3.7
	*COPPER (Cu)	7440-50-8	0.2	1	MAX. 2.6
	*ZINC (Zn)	7440-66-6	5	10	MAX. 8.7

SECTION V - REACTIVITY DATA (CONT'D)

FOR FINELY DIVIDED ALUMINUM (E.G. SMALL CHIPS, FINES):

WITH WATER: GENERATES HYDROGEN AND HEAT SLOWLY. WATER/ALUMINUM MIXTURES MAY BE HAZARDOUS WHEN CONFINED.

WITH HEAT: OXIDIZES AT A TEMPERATURE-DEPENDENT RATE.

WITH STRONG OXIDIZERS: VIOLENT REACTION WITH MUCH HEAT GENERATION.

WITH ACIDS & ALKALIES: REACTS TO GENERATE HYDROGEN.

WITH HALOGENATED COMPOUNDS: HALOGENATED HYDROCARBONS CAN REACT VIOLENTLY WITH FINELY DIVIDED ALUMINUM.

SECTION VI - HEALTH HAZARDS

ALUMINUM DUST/FINES AND FUMES ARE LOW HEALTH RISK BY INHALATION. FOR STANDARD OPERATIONS (E.G. MILLING, CUTTING, GRINDING), ALUMINUM SHOULD BE TREATED AS A NUISANCE DUST AND IS SO DEFINED BY THE AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH).

ACCORDING TO AIHA HYGIENE GUIDE:

TOXICITY BY INGESTION: NONE EXPECTED

SKIN: NOT AN IRRITANT.

AS STATED ABOVE, MOST ALLOYS HAVE A LOW HEALTH RISK POTENTIAL. THE POTENTIAL FOR OVEREXPOSURE TO COPPER FUME, HOWEVER, MAY EXIST WHEN WELDING, FLAME CUTTING, ETC. ON ALLOYS CONTAINING HIGH AMOUNTS OF COPPER (E.G. 2.5%). REFER TO APPROPRIATE PUBLICATIONS ON ALLOYS CONTAINING COPPER AT LEVELS OF 2.5% OR MORE. OVEREXPOSURE TO COPPER FUME CAN RESULT IN UPPER RESPIRATORY TRACT IRRITATION, NAUSEA, AND METAL FUME FEVER.

NICKEL AND CHROMIUM ARE CONTAINED IN CERTAIN ALLOYS AT LEVELS OF 0.1% OR MORE.

CHROMIUM AND NICKEL AND THEIR COMPOUNDS ARE LISTED IN THE 3RD ANNUAL REPORT ON CARCINOGENS, AS PREPARED BY THE NATIONAL TOXICOLOGY PROGRAM (NTP). THEIR PRESENCE IN OUR ALLOYS, HOWEVER, DOES NOT PRESENT A CARCINOGENIC OR OTHER HEALTH CONCERN DUE TO EITHER THEIR LOW CONCENTRATIONS OR THE CHEMICAL FORM IN WHICH THEY ARE PRESENT.

PLASMA ARC CUTTING OR WELDING ALUMINUM CAN GENERATE OZONE. OVEREXPOSURES TO OZONE CAN RESULT IN MUCOUS MEMBRANE IRRITATIONS, AS WELL AS PULMONARY CHANGES INCLUDING IRRITATION, CONGESTION AND EDEMA.

SECTION VI - CONTROL MEASURES (CONT'D)

VENTILATION REQUIREMENTS: IF VENTILATION IS TO BE USED TO CONVEY FINELY DIVIDED ALUMINUM GENERATED BY GRINDING, SAWING OR ETC., SPECIAL VENTILATION PROVISIONS MAY BE REQUIRED. SEE NATIONAL FIRE PROTECTION ASSOCIATION CODES, NFPA 65 AND 651.

NOTE: THE INFORMATION IN THIS MSDS IS DERIVED FROM MANUFACTURING SOURCES, WHICH WE BELIEVE IS RELIABLE. HOWEVER, THIS INFORMATION IS PROVIDED WITHOUT ANY REPRESENTATION OF WARRANTY, EXPRESSED OR IMPLIED, REGARDING THE ACCURACY OR CORRECTNESS.

THE CONDITIONS OR METHODS OF HANDLING,STORAGE, USE AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THIS HANDLING, STORAGE, USE AND DISPOSAL OF THIS PRODUCT.

*LISTED AS A TOXIC CHEMICAL UNDER SECTION 313 OF THE EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT (TITLE III OF SARA)

**SUSPECTED OR KNOWN CARCINOGEN IN HUMANS.

#POTENTIAL HEALTH HAZARD.

BDH UK
LEAD METAL **Revised:**

MSDS Contents

BDH

HEALTH AND SAFETY INFORMATION

BDH CHEMICALS LTD
POOLE DORSET BH12 4NN

TELEPHONE: PARKSTONE 745520 (STD 0202)

PRODUCT

LEAD METAL

PHYSICAL DATA

APPEARANCE & ODOUR: GREY, FOIL, GRANULES, POWDER, GRAIN, SHOT, STICKS OR WIRE

MELTING POINT: 327 DEG. C

VAPOUR PRESSURE:

BOILING POINT: 1620 DEG. C

VAPOUR DENSITY:

WT. PER ML AT 20 DEG. C:

SOLUBILITY IN WATER: INSOLUBLE

FIRE & EXPLOSION HAZARD

FLASH POINT:

EXPLOSIVE LIMITS:

FIREFIGHTING MEASURES:

AUTOIGNITION TEMPERATURE:

HEALTH HAZARD

TLV: Pb FUME AND DUST - 0.15 MG/M3

LD50: TDLO 450 MG/KG/6 YEARS - ORAL, WOMAN (CNS EFFECTS)

EFFECT ON		EMERGENCY FIRST AID
INHALATION:	SEE BELOW	REMOVE FROM EXPOSURE
EYES:	PHYSICAL	IRRIGATE THOROUGHLY WITH WATER; OBTAIN MEDICAL ATTENTION
SKIN CONTACT:		
INGESTION:	SEE BELOW	WASH OUT MOUTH THOROUGHLY WITH WATER; OBTAIN MEDICAL ATTENTION

OTHER COMMENTS:
HARMFUL IF TAKEN INTERNALLY FOR PROLONGED PERIODS. INHALATION OF FUME CAN CAUSE NAUSEA, HEADACHE ETC

REACTIVITY

STABILITY: STABLE

REACTION WITH WATER:
FORMS A SURFACE COATING OF LEAD CARBONATE IN THE PRESENCE OF CO2

DECOMPOSITION PRODUCTS:

OTHER KNOWN HAZARDS:
FINELY DIVIDED MATERIAL CAN REACT VIGOROUSLY OR VIOLENTLY WITH OXIDIZING MATERIALS, EG HYDROGEN PEROXIDE, AMMONIUM NITRATE.

SPILLAGE DISPOSAL

WEAR APPROPRIATE PROTECTIVE CLOTHING

SMALL SPILLAGE: DISPOSE OF AS GARBAGE

LARGE SPILLAGE:
TRANSFER TO SALVAGE CONTAINER AND DISPOSE OF RESIDUE AS GARBAGE

SPECIAL PROTECTIVE MEASURES

RESPIRATOR:
OR DUST MASK)
) IF HANDLING AS FUME OR DUST
)
VENTILATION:)
LOCAL EXHAUST
GENERAL
SPECIAL

GLOVES: RUBBER OR PLASTIC

EYE PROTECTION: GOGGLES

OTHER PRECAUTIONS:

STORAGE AND HANDLING

SPECIAL REQUIREMENTS:

IMPORTANT:
1. THE INFORMATION IN THIS DOCUMENT SHOULD BE REVIEWED PERIODICALLY.
2. THE HEALTH AND SAFETY INFORMATION DOES NOT COVER ALL USES AND SHOULD BE CHECKED FOR A PARTICULAR USE.

MDL INFORMATION SYSTEMS
NITROGLYCERIN Revised: 09/18/2003

MSDS Contents

SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MDL INFORMATION SYSTEMS, INC.
1281 Murfreesboro Road, Suite 300
Nashville, TN 37217-2423
1-615-366-2000

EMERGENCY TELEPHONE NUMBER:
1-800-424-9300 (NORTH AMERICA)
1-703-527-3887 (INTERNATIONAL)

SUBSTANCE: NITROGLYCERIN

TRADE NAMES/SYNONYMS:
NITROGLYCERINE, NITROGLYCOL; NTG; BLASTING GELATIN; NITRO-SPAN;
1,2,3-PROPANETRIOL, TRINITRATE; GLYCERYL TRINITRATE; NITROL; SOUP;
NITROGLYCEROL; NITROGLYN; GLYCEROL, NITRIC ACID TRIESTER; GLYCERYL NITRATE;
NITRIC ACID TRIESTER OF GLYCEROL; GLYCERIN TRINITRATE; GLYCEROL TRINITRATE;
TRINITROGLYCERIN; PROPANETRIOL TRINITRATE; RCRA P081; C3H5N3O9; OHS16670;
RTECS QX2100000

CHEMICAL FAMILY: nitro

CREATION DATE: May 14 1985
REVISION DATE: Sep 18 2003

SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: NITROGLYCERIN
CAS NUMBER: 55-63-0
EC NUMBER (EINECS): 200-240-8
EC INDEX NUMBER: 603-034-00-X
PERCENTAGE: 100.0

SECTION 3 HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=2 REACTIVITY=4

EMERGENCY OVERVIEW:
COLOR: colorless to yellow
PHYSICAL FORM: liquid
MAJOR HEALTH HAZARDS: harmful if swallowed, skin irritation, blood damage
PHYSICAL HAZARDS: May explode if exposed to shock, friction or heating. Combustible liquid and vapor.

POTENTIAL HEALTH EFFECTS:
INHALATION:
SHORT TERM EXPOSURE: nausea, vomiting, stomach pain, irregular heartbeat, headache, symptoms of drunkenness, disorientation, blindness, bluish skin color, coma
LONG TERM EXPOSURE: chest pain
SKIN CONTACT:
SHORT TERM EXPOSURE: same as effects reported in other routes of exposure, irritation, allergic reactions, rash, bluish skin color
LONG TERM EXPOSURE: same as effects reported in other routes of exposure
EYE CONTACT:
SHORT TERM EXPOSURE: irritation
LONG TERM EXPOSURE: same as effects reported in short term exposure
INGESTION:
SHORT TERM EXPOSURE: bluish skin color
LONG TERM EXPOSURE: same as effects reported in other routes of exposure

CARCINOGEN STATUS:
OSHA: No
NTP: No
IARC: No

SECTION 4 FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: Contact local poison control center or physician immediately. Never make an unconscious person vomit or drink fluids. When vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.

NOTE TO PHYSICIAN: For inhalation, consider oxygen. For ingestion, consider gastric lavage and activated charcoal slurry.

SECTION 5 FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Moderate fire hazard. Severe explosion hazard.

EXTINGUISHING MEDIA: Flood with water. If no water is available, use dry chemical, halogenated extinguishing agents or earth.

FIRE FIGHTING: Do not move containers which have been damaged or exposed to heat. Do not try to fight fire in cargo or storage areas. Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. For tank, rail car or tank truck, evacuation radius: 1600 meters (1 mile). Explosive. Do not try to fight fire in cargo or storage areas. Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Avoid inhalation of material or combustion by-products. Evacuation radius: 1600 meters (1 mile).

FLASH POINT: explodes
AUTOIGNITION: 518 F (270 C)

SECTION 6 ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:
Avoid heat, flames, sparks and other sources of ignition. Do not touch spilled material. Remove sources of ignition. Evacuation radius: 800 meters (1/2 mile). Keep unnecessary people away, isolate hazard area and deny entry. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

SECTION 7 HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Keep separated from incompatible substances. Subject to storage regulations: U.S. Department of Treasury 27 CFR Subpart K. U.S. OSHA 29 CFR 1910.109 NFPA 495 Standard for Storage, Use and Handling of Explosives.

SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
NITROGLYCERIN:
0.2 ppm (2 mg/m3) OSHA ceiling (skin) (civilian manufacture)
0.1 mg/m3 OSHA STEL (skin) (production for military and space uses) (vacated by 58 FR 35338, June 30, 1993)
0.05 ppm ACGIH TWA (skin)
0.1 mg/m3 NIOSH recommended STEL (skin)
0.47 mg/m3 (0.05 ml/m3) DFG MAK (peak limitation category - II, with excursion factor of 1) (cutaneous absorption danger)
UK OES (Chemical Hazard Alert Notice issued) (OES has been withdrawn)

MEASUREMENT METHOD: Tenax(R) GC tube; Ethanol; Gas chromatography with electron capture detection; NIOSH IV # 2507

VENTILATION: Provide local exhaust ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.
1 mg/m3
Any supplied-air respirator.
2.5 mg/m3
Any supplied-air respirator operated in a continuous-flow mode.
5 mg/m3
Any supplied-air respirator with a tight-fitting facepiece that is operated in a continuous-flow mode.
Any self-contained breathing apparatus with a full facepiece.
Any supplied-air respirator with a full facepiece.
75 mg/m3
Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode.
Escape -
Any air-purifying respirator with a full facepiece, an organic vapor canister and high-efficiency particulate filter.
Any appropriate escape-type, self-contained breathing apparatus.
For Unknown Concentrations or Immediately Dangerous to Life or Health -
Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.
Any self-contained breathing apparatus with a full facepiece.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid
COLOR: colorless to yellow
TEXTURE: viscous
ODOR: Not available
TASTE: burning taste
MOLECULAR WEIGHT: 227.11
MOLECULAR FORMULA: C3-H5-(N-O3)3
BOILING POINT: 424 F (218 C) (explodes)
FREEZING POINT: 55 F (13 C)
VAPOR PRESSURE: 0.0015 mmHg @ 20 C
VAPOR DENSITY (air=1): 7.8
SPECIFIC GRAVITY (water=1): 1.6
WATER SOLUBILITY: 0.125%
PH: Not available
VOLATILITY: Not available
ODOR THRESHOLD: Not available
EVAPORATION RATE: Not available
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available
SOLVENT SOLUBILITY:

Soluble: alcohol, ether, acetone, benzene, chloroform, organic solvents
Slightly Soluble: carbon disulfide

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: May explode if exposed to shock, friction or heating.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition.

INCOMPATIBILITIES: acids, combustible materials, oxidizing materials

NITROGLYCERIN:
ACIDS: Fire and explosion hazard.
COMBUSTIBLES: Incompatible.
OXIDIZERS: Fire and explosion hazard.
OZONE: Explosive reaction upon mixing.

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: oxides of nitrogen

POLYMERIZATION: Will not polymerize.

SECTION 11 TOXICOLOGICAL INFORMATION

NITROGLYCERIN:
IRRITATION DATA:
500 mg/24 hour(s) skin-rabbit mild
TOXICITY DATA:
8 ug/kg oral-woman TDLo; 8 ug/kg oral-woman TDLo; 51429 ug/kg/2 day(s) intermittent intravenous-man TDLo; 105 mg/kg oral-rat LD50; >29200 ug/kg skin-rat LD50; 102 mg/kg intraperitoneal-rat LD50; 94 mg/kg subcutaneous-rat LD50; 23200 ug/kg intravenous-rat LD50; 115 mg/kg oral-mouse LD50; >35200 ug/kg skin-mouse LD50; 104 mg/kg intraperitoneal-mouse LD50; 110 mg/kg subcutaneous-mouse LD50; 10600 ug/kg intravenous-mouse LD50; 19 mg/kg intravenous-dog LD50; 150 mg/kg subcutaneous-cat LDLo; 1607 mg/kg oral-rabbit LD50; >280 mg/kg skin-rabbit LD50; 189 mg/kg intraperitoneal-rabbit LD50; 400 mg/kg subcutaneous-rabbit LDLo; 45 mg/kg intravenous-rabbit LD50; 1450 mg/kg oral-guinea pig LD50; 230 mg/kg unreported-mammal LD50; 5 mg/kg oral-woman TDLo; 8 ug/kg intravenous-rat TDLo; 7.14 ng/kg intravenous-man TDLo; 0.0083 mg/kg oral-human TDLo; 1360 mg/kg oral-rat TDLo; 1 mg/kg intravenous-cat TDLo; 5 mg/kg intravenous-cat LDLo; 30 mg/kg intravenous-mouse LD50; 0.5 mg/kg intravenous-cat TDLo; 1500 mg/kg/30 day(s) intermittent skin-rat TDLo; 25480 mg/kg/26 week(s) intermittent skin-rat TDLo; 825 mg/kg/33 day(s) continuous intraperitoneal-rat TDLo; 1575 mg/kg/13 week(s) intermittent intraperitoneal-rat TDLo; 300 mg/kg/30 day(s) intermittent intravenous-dog TDLo; 4900 mg/kg/5 week(s) intermittent skin-rabbit TDLo; 86 ug/m3/17 week(s) intermittent inhalation-mammal TCLo; 0.6 mg/kg/14 day(s) intermittent oral-human TDLo; 22.75 mg/kg/26 week(s) continuous oral-rat TDLo; 4080 mg/kg/30 day(s) intermittent oral-rat TDLo; 30 mg/kg/26 week(s) continuous oral-rabbit TDLo; 4080 mg/kg/30 day(s) intermittent oral-rabbit TDLo
LOCAL EFFECTS:
Irritant: skin

ACUTE TOXICITY LEVEL:
Toxic: ingestion
TARGET ORGANS: blood
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: low blood pressure, blood system disorders, eye disorders, heart or cardiovascular disorders, hormonal disorders, metabolic disorders
TUMORIGENIC DATA:
36500 mg/kg oral-rat TDLo/2 year(s) continuous; 438 gm/kg oral-rat TD/2 year(s) continuous
MUTAGENIC DATA:
mutation in microorganisms - Salmonella typhimurium 2500 nmol/plate (+S9); mutation in microorganisms - Salmonella typhimurium 50 ug/well (-S9); specific locus test - human other cell types 800 umol/L 24 hour(s); mutation in mammalian somatic cells - mouse intraperitoneal 5 mg/kg
REPRODUCTIVE EFFECTS DATA:
3640 mg/kg skin-rat TDLo 17-21 day(s) pregnant female/21 day(s) post pregnancy continuous; 11 mg/kg intraperitoneal-rat TDLo 7-17 day(s) pregnant female continuous; 220 mg/kg intraperitoneal-rat TDLo 7-17 day(s) pregnant female continuous; 2580 mg/kg intraperitoneal-rat TDLo 91 day(s) male day(s) pre pregnancy/2 week(s) pregnant female/7 day(s) continuous; 520 mg/kg intraperitoneal-rat TDLo 17 day(s) pregnant female/20 day(s) post pregnancy continuous
ADDITIONAL DATA: Alcohol may enhance the toxic effects.

HEALTH EFFECTS:
INHALATION:
ACUTE EXPOSURE:
NITROGLYCERIN: Exposure to small amounts may cause severe throbbing headaches with dizziness, dullness, reduced blood pressure, nausea, vomiting, and abdominal pain. Severe headaches may be delayed for several days after exposure. In higher concentrations, flushing of the skin, sweating, delirium, maniacal manifestations, pugnaciousness, hallucinations, transient loss of vision or decreased visual acuity, foggy vision, respiratory rales, persistent tachycardia, diastolic hypertension, arterial dilation, central nervous system depression, methemoglobinemia with cyanosis, coma, and death due to cardiac arrest may occur.

CHRONIC EXPOSURE:
NITROGLYCERIN: In addition to the effects detailed in acute exposure, repeated or prolonged exposure may cause digestive troubles, tremors, and neuralgia. Anginal pains may occur several days after discontinuing repeated daily exposure. Headaches have been reported to occur in workers exposed to 0.03 to 0.11 ppm. Temporary tolerance to the headaches may develop, however may be lost after a few days without exposure. An excess frequency of ischemic heart disease and stroke has been reported among dynamite workers; excess deaths from acute myocardial infarction has been reported in a similar group of workers.

SKIN CONTACT:
ACUTE EXPOSURE:
NITROGLYCERIN: May cause local irritation, skin eruptions on the palmar and intradigital surfaces of the hands, and ulcers under the nails. Nitroglycerin is readily absorbed through the skin and may cause effects as detailed in acute inhalation. Allergic contact dermatitis has been reported. One case of an anaphylactic reaction with oral mucosa and conjunctival edema was reported following a 6 hour cutaneous application.

CHRONIC EXPOSURE:
NITROGLYCERIN: May cause effects as detailed in chronic inhalation. Reproductive effects have been reported in animals.

EYE CONTACT:
ACUTE EXPOSURE:
NITROGLYCERIN: May cause irritation. Absorption through mucous membranes may result in systemic toxicity.

CHRONIC EXPOSURE:
NITROGLYCERIN: Repeated or prolonged exposure may cause conjunctivitis.

INGESTION:
ACUTE EXPOSURE:
NITROGLYCERIN: In addition to the effects described in acute inhalation, may cause death due to respiratory paralysis. Topically sensitive persons may react to sublingual or oral doses.

CHRONIC EXPOSURE:
NITROGLYCERIN: Repeated or prolonged ingestion may cause effects as detailed in chronic inhalation.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY DATA:
FISH TOXICITY: 1910 ug/L 96 month(s) LC50 (Mortality) Bluegill (Lepomis macrochirus)

INVERTEBRATE TOXICITY: 20000 ug/L 48 month(s) LC50 (Mortality) Midge (Chironomus tentans)

FATE AND TRANSPORT:
BIOCONCENTRATION: 15 ug/L 8 hour(s) BCF (Residue) Bluegill (Lepomis macrochirus) 420 ug/L

SECTION 13 DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): P081.

SECTION 14 TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:
PROPER SHIPPING NAME: Nitroglycerin, liquid, not desensitized
HAZARD CLASS OR DIVISION: Forbidden

CANADIAN TRANSPORTATION OF DANGEROUS GOODS: No classification assigned.

LAND TRANSPORT ADR: No classification assigned.

LAND TRANSPORT RID: No classification assigned.

AIR TRANSPORT IATA:
PROPER SHIPPING NAME: Nitroglycerin, liquid, not desensitized

AIR TRANSPORT ICAO:
PROPER SHIPPING NAME: Nitroglycerin, liquid, not desensitized
CLASS OR DIVISION: Forbidden

MARITIME TRANSPORT IMDG: No classification assigned.

SECTION 15 REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):
NITROGLYCERIN: 10 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30):
Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40):
Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):
ACUTE: Yes
CHRONIC: No
FIRE: Yes
REACTIVE: Yes
SUDDEN RELEASE: Yes

SARA TITLE III SECTION 313 (40 CFR 372.65):
NITROGLYCERIN

OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.

STATE REGULATIONS:
California Proposition 65: Not regulated.

CANADIAN REGULATIONS:
WHMIS CLASSIFICATION: Not determined.

EUROPEAN REGULATIONS:
EC CLASSIFICATION (ASSIGNED):
E Explosive
T+ Very Toxic

EC Classification may be inconsistent with independently-researched data.

DANGER/HAZARD SYMBOL:
E Explosive
T+ Very Toxic

EC RISK AND SAFETY PHRASES:
R 3 Extreme risk of explosion by shock, friction, fire or other sources of ignition.
R 26/27/28 Very toxic by inhalation, in contact with skin and if swallowed.
R 33 Danger of cumulative effects.

S 1/2 Keep locked-up and out of reach of children.
S 33 Take precautionary measures against static discharges.

S 35 This material and its container must be disposed of in a safe way.
S 36/37 Wear suitable protective clothing and gloves.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

NATIONAL INVENTORY STATUS:
U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

SECTION 16 OTHER INFORMATION

MSDS SUMMARY OF CHANGES
SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION
SECTION 11 TOXICOLOGICAL INFORMATION

Appendix G

Letter of Authority

Shaw Environmental, Inc.
2113 Emmorton Park Rd
Edgewood, MD 21040
410 612 6350
FAX: 410 612 6350

Shaw® Shaw Environmental, Inc.

DATE

Mr. Steve Kritak
Shaw Environmental, Inc.
1725 Duke Street
Alexandria, VA 22314

Re: CQC System Manager
USACE District Louisville LMARC
Radford AAP Interim Measures Removal
Contract No. W912QR-04-D-0027,
Delivery Order DA0101

Dear Mr. Kritak:

This letter will serve as your appointment as the CQC System Manager on the referenced project and will also clarify your duties and authority in this position. In this position, you will be authorized to use available resources to satisfy all applicable quality requirements of the Program and Task Order Plan(s).

This authorization specifically gives you the authority to direct removal and replacement or correction of nonconforming materials or work and stop work authority when continuation would be unsafe to personnel, harmful to the environment, or result in a significant degradation of quality.

You will be expected to work closely with the Project Manager, Interim Measures Task Manager, Site Supervisor, customer and other project personnel, but you will not be directly responsible to anyone but myself for resolution of quality issues when working in your capacity.

If you have any question in this matter, please call me at (609) 584-6840.

Sincerely,

Kenneth Martinez
Shaw Quality Manager

Appendix H

QC Forms

Shaw® Shaw Environmental, Inc.

FINAL INSPECTION FORM

DATE:

Page ___of ___

CONTRACT NO.: DACA31-02-F-0080 W912QR-04-D-0027	TITLE AND LOCATION: SWMU 51 IM, Radford, Virginia	DELIVERY ORDER NO.:
CONTRACTOR: Shaw Environmental, Inc.	NAME OF SITE SUPERINTENDENT: Steve Kritak	

INSPECTED WORK:	COMPLETION DATE:

PERFORMANCE SPECIFICATION BY CONTRACT DELIVERY ORDER REFERENCE	STATUS OF INSPECTION

On behalf of Shaw Environmental, Inc., I certify that the work inspected is complete and meets the performance specifications cited above and that all material and equipment used and work performed was completed in accordance with approved plans and work instructions and meets contract delivery order requirements.

_____ _____

QC Officer Date

Shaw Environmental, Inc.

INITIAL INSPECTION

Contract No: DACA31-02-F-0080 W912QR-04-D-0027	Date:
Definable Feature of Work:	Specification References:
CQC System Manager: Steve Kritak	Project Manager: Jeff Parks
Notifications:	

I. Personnel Present

Name	Position	Affiliation

II. Preparatory Inspection

Verify full compliance with procedures identified at preparatory inspection. Coordinate plans, specifications, and submittals. Comments:

Shaw® Shaw Environmental, Inc.

INITIAL INSPECTION

III. Preliminary Work

Is all preliminary work complete and correct? If not, what action is taken?

IV. Level of Workmanship

Where is work located?
Is a sample panel required?
Will the initial work be considered as a sample?

V. Discrepancies

Are there any discrepancies between planned and actual conditions and/or practices? If so, explain the discrepancies and actions taken.

VI. Safety

Review job conditions against governing safety documents (e.g. HASP, USACE EM 385-1-1) and job hazard analysis.

Shaw® Shaw Environmental, Inc.

INSPECTION SCHEDULE AND TRACKING FORM

Project: SWMU 51 IM	Project Manager: Jeff Parks	CQC System Manager: Steve Kritak

Reference No.	Definable Feature of Work	Preparatory		Initial		Follow-up		Completion		
		Date Planned	Actual Date	Date Planned	Actual Date	Planned Begin/End	Actual Dates	Planned Begin/End	Actual Dates	Status

Shaw Environmental, Inc.

PREPARATORY INSPECTION

Contract No: DACA31-02-F-0080 W912QR-04-D-0027	Date:
Definable Feature of Work:	Specification Reference: NA
CQC System Manager: Steve Kritak	Project Manager: Jeff Parks
Notifications:	

I. Personnel Present

Name	Position	Affiliation

Shaw Environmental, Inc.

PREPARATORY INSPECTION

II. Submittals

Have all submittals been approved? If not, what items have not been submitted? The site Work Plan rewrite will be submitted for review and approval.
Are all materials on hand? If not, what items are missing?
Do approved submittals correspond to delivered materials? All delivered materials have been inspected to be in accordance with the Procurement Requisition. No discrepancies have been noted. If not, what discrepancies are found?

III. Material Storage

Are materials stored properly? If not, what action is taken?

IV. Specifications

Required Action	Comments
Review each paragraph of specifications.	
Discuss procedure for accomplishing work.	

Shaw Environmental, Inc.

PREPARATORY INSPECTION

Clarify any differences.	

V. Preliminary Work Permits

Ensure preliminary work is correct and permits are on file. If not, what action is taken?

VI. Testing

Is test plan complete and accurate? If not, what action is taken?
Has each testing organization been approved? If not, what action is taken?

VII. Safety

Review applicable portion of governing safety document (e.g., USACE EM 385-1-1).
Activity Hazard Analysis approved?

VIII. Client Comments

CQC System Manager Signature/Date: _____

Shaw® Shaw Environmental, Inc.

PREPARATORY INSPECTION

NCR Number	Date of Issue	Subject	Responsible Organization	Impact on Other Activities	Date of Disposition Approval	Date of Corrective Action Verification	Remarks

Shaw® Shaw Environmental, Inc.

PREPARATORY INSPECTION

Shaw

Shaw Environmental, Inc.

NONCONFORMANCE REPORT

NCR Report No.

Date:

Project:

Delivery/Task Order No.

Feature of Work:

Responsible Organization:
(Shaw E&I, Subcontractor, Supplier, etc.)

References: (Specification, Drawing, Procedure, incl. rev.)

Description of Nonconforming Condition:

Organization Code:_____ Inspection Code:_____ Nonconformance Cause Code:_____

Disposition Category:

Rework Repair Use-As-Is Return to Vendor Scrap/Reject

Disposition & Corrective Action:

NCR Initiated By:_____ Date:
QC Representative

Disposition and Corrective Action Provided By:_____ Date:_____.
Shaw Engineer / Responsible Organization

Disposition and Corrective Action Approved By:_____ Date:_____.
Project Manager

Disposition and Corrective Action Completed By:_____ Date:_____.
Responsible Organization

Disposition and Corrective Action Verified By:_____ Date:_____.
QC Representative

Shaw® Shaw Environmental, Inc.

Nonconformance Report Form Instructions:

Initiator: Complete the upper portion of the report by providing the following information:

NCR Report Number - Unique NCR number per procedure (e.g. 97-19656-01).
Date - Date that the Nonconforming Condition was detected.
Project - Name of the Project.
Delivery / Task Order Number - Delivery / Task Order number applicable to project work.
Feature of Work - Actual feature of work i.e. Soil/concrete placement, pump installation, etc.
Responsible Organization - Organization responsible for the nonconformance.
References - Source requirements in which the condition is nonconforming to.
Description Of Non-conforming Condition - Complete description of the condition supplemented by photographs, sketches, reports and other documents.
Organization Code - See below
Inspection Code - See Below
Cause Code - See Below

Provide signature and issue date at the bottom of the form

Organization Codes:

001 Engineering/Design
002 Vendor/Supplier
003 Operations
004 Subcontractor
005 Quality Control
006 Field Sampling/Analytical
007 Purchasing
008 Project Management
009 Health & Safety
010 Program Management

Inspection Codes:

100 Receipt Inspection
200 In-process Inspection (incl. Preparatory, Initial or Follow up)
300 Completion / Final Inspection

Nonconformance Codes:

101 Indeterminate
102 Inadequate Documentation
103 Inadequate Plan/Procedure
104 Failure to Follow Plan/Procedure
105 Fails to meet Specification
106 Fails to meet Drawing Dimensions
107 Damage
108 Improper Handling, Storage, or Shipping
109 Poor Workmanship
110 Incomplete Work Performance
111 Test Failure
112 Poor Maintenance

Disposition Category: To be checked by the individual responsible for providing both disposition and corrective action. Check the appropriate box.

Corrective Action: Provide a complete corrective action that will ensure that the condition will be made to meet the disposition requirements. Corrective action shall include identification of the cause, steps to be taken to correct the condition, and steps to be taken to preclude recurrence, where possible. Use attachments where necessary.

Responsible Organization: Complete the corrective action as describe in the corrective action portion of the form and its attachments. Sign and date the Disposition and Corrective Action Completed By line at the bottom portion of the form.

Disposition & Corrective Action Verification: Disposition and Corrective Action will be verified by QC Representative. Once verification is considered complete and acceptable the QC Representative will sign and date the Disposition and Corrective Action Verified By line at the bottom of the form indicating closure of the report.

Shaw Environmental, Inc.

DAILY CONSTRUCTION QUALITY CONTROL REPORT

SWMU 51 IM Report No. _____

Contract No. DACA31-02-F-0080 CTO No. _____ Date: _____
W912QR-04-D-0027

Number of Manhours worked onsite through today

WEATHER: ☐ Clear ☐ P. Cloudy ☐ Cloudy Wind _____

Temperature: High _____ Low _____

Precipitation: Today None Previous Period (e.g., weekend) _____

Site Conditions: Dry
Lost Time Due to Inclement Weather: _____ %

PRIME CONTRACTOR/SUBCONTRACTORS AND AREAS OF RESPONSIBILITY/LABOR COUNT:
(Include number, trade, hours, employer, location, and description of work)

a.

WORK PERFORMED (Include location and description of work performed including equipment used. Refer to work performed by prime and/or subcontractors as previously designated by letter above. Attach subcontractor daily activity reports when applicable):

1.

MATERIALS AND/OR EQUIPMENT DELIVERED: (Include a description of materials and/or equipment, quantity, date/hours used, date of safety check, and supplier).

RESULTS OF SURVEILLANCE: (Include satisfactory work completed or deficiencies with action to be taken)

a. Preparatory Inspection: (Attach minutes)

b. Initial Inspection: (Attach minutes) See attached Initial Inspection Form

c. Follow-Up Inspection: (List results of inspection compared to specification requirements.)

d. Final Inspection:

e. Completion Inspection: (USACE)

f. Safety Inspection:(Include safety violations and corrective actions taken.)

OFF-SITE SURVEILLANCE ACTIVITIES:(Include action taken)

QC TESTS PERFORMED AND RESULTS: (As required by plans and/or specifications.)

1.

VERBAL INSTRUCTIONS RECEIVED OR GIVEN: (List any instructions received from government personnel or given by IT on construction deficiencies identified, required retesting, etc., and the corresponding action to be taken.)

CHANGED CONDITIONS/DELAYS/CONFLICTS ENCOUNTERED: (List any conflicts with the delivery order [e.g., scope of work and/or drawings], delays to the project attributable to site, and weather conditions, etc)

SUBMITTALS REVIEWED: (Include submittal number, specification reference, and name of submitter.)
1.

Shaw Environmental, Inc.

DAILY CONSTRUCTION QUALITY CONTROL REPORT

MEETINGS: (List the meetings, e.g., Health and Safety, Site Operations, Cost/Schedule, etc.)

VISITORS: (See attached visitors log)

REMARKS: (Any additional information pertinent to the project not defined by the previous entries.)

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Attachments:

CONTRACTOR'S VERIFICATION: The above report is complete and correct. All materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications except as noted above:

Construction QC System Manager

Shaw Environmental, Inc.

CORRECTIVE ACTION REQUEST

CAR Number:_____ Date Issued:_____.
Subject:_____.
Responsible Organization:_____ Location:_____ Project Number:
_____

Reference Requirement(s):

Description of Condition:

Classification: Significant ? Yes_____ No_____ (If Yes, Corrective Actions 1, 2, 3, & 4 Below Apply)
Stop Work Warranted ? Yes_____ No_____.

Corrective Action Required:

1. Remedial Action Required (always) Yes__X__ No_____.
2. Root Cause Determination Yes_____ No_____.
3. Action to Prevent Recurrence Yes_____ No_____.
4. Action Regarding Similar Work Yes_____ No_____.

Response Due Date:_____.

Initiator:_____ Date:_____.

Proposed Corrective Action:

Proposed Completion Date:_____.

Responsible Individual:_____ Date:_____.

Evaluated By:_____ Date: _____.

Completed Corrective Action Verification & Closure:

Verification Method:

Verifier:_____ Date:_____.

Shaw

CORRECTIVE ACTION REQUEST TRACKING & STATUS LOG

Shaw Environmental, Inc.

CAR No.	Date Issued	Subject	Response Due Date	Date Evaluated	Date Completed	Date Verified

CAP NUMBER:	
[ ] FYI	[ ] APPROVAL REQ'D

CORRECTIVE ACTION PLAN (CAP)

1. CAP number is lowest corresponding CAR number. Designate revisions with original CAP number followed by consecutive letter.
2. Attach clarifications and additional information as needed. List attached material in appropriate section of the CAP.

PART A: TO BE COMPLETED BY PROJECT MANAGER OR DESIGNEE.

CONTRACT: DACA31-02-F-0080 W912QR-04-D-0027	PROJECT: SWMU 51 IM	
PROJECT MANAGER: Jeff Parks	QUALITY MANAGER: Kenneth Martinez	
CAR NO(S) & DATE(S) ISSUED:		
DEFICIENCY DESCRIPTION & LOCATION:		
RESULTS OF ROOT CAUSE ANALYSIS:		
PLANNED ACTIONS 1, 2. 3.	ASSIGNED RESPONSIBILITY	COMPLETION DUE DATE
PROJECT MANAGER SIGNATURE:		DATE:

PART B: TO BE COMPLETED BY ISSUING AGENT OR DESIGNEE.

CAP REVIEWED BY:	DATE:
REVIEWER COMMENTS:	
CAP DISPOSITION: (CHECK ONLY ONE & EXPLAIN WHERE NEEDED) [ ] APPROVED WITHOUT STIPULATIONS [ ] APPROVED WITH STIPULATIONS: [ ] APPROVAL DELAYED, FURTHER PLANNING REQUIRED:	
AUTHORIZED BY (PRINTED NAME & TITLE): SIGNATURE:	DATE: