

Safety and Health for Field Operations



**USGS Handbook 445-3-H,
Safety and Environmental
Health Handbook**



U.S. Department of the Interior
United States Geological Survey

445-3-H
Safety and Environmental Health Field Manual

INTRODUCTION

This Manual Handbook was developed to complement USGS Manual Handbook SM 445-2-H. This Handbook lays the groundwork for incorporating occupational safety and health into the planning of all USGS work projects and tasks. This Handbook will assist supervisors in providing a safe and healthful workplace for USGS employees and volunteers. It will provide employees with information on safe work practices, identification of hazards, and reporting of unsafe working conditions.

This Handbook is a tool that supports the supervisor's and manager's responsibility to promote positive safety and health attitudes among employees, and integrates safe procedures standards into all USGS activities. Supervisors are responsible for recognizing and rewarding employees for outstanding performance in the area of occupational safety and health.

Every USGS supervisor, employee, and volunteer is responsible for following safe work practices and procedures, and identifying and reporting unsafe conditions. The purpose of this Handbook is to provide assistance in carrying out those responsibilities.

All USGS employees and volunteers are responsible for familiarizing themselves with this Handbook and for utilizing safe work practices and procedures during performance of duties. For the purposes of this Handbook, USGS volunteers are considered to be employees.

TOPICS

- Topic 1 Job Hazard Analysis
- Topic 2 Training
- Topic 3 Field Work
- Topic 4 Motor Vehicle and Equipment Safety
- Topic 5 Heavy Equipment
- Topic 6 Aviation Safety
- Topic 7 Occupational Health Hazards/Industrial Hygiene
- Topic 8 Personal Protective Clothing and Equipment
- Topic 9 Fire Safety
- Topic 10 Field Injury Prevention and First Aid
- Topic 11 Materials Handling and Storage
- Topic 12 Machines and Tools
- Topic 13 Electrical Systems and Equipment
- Topic 14 Watercraft Operations and Water Safety
- Topic 15 Explosives
- Topic 16 Firearms Safety
- Topic 17 Visiting Public Safety and Health
- Topic 18 Search and Rescue
- Topic 19 Contractor Safety and Health
- Topic 20 Concessionaire Safety and Health
- Topic 21 Radiation Safety
- Topic 22 Inspections and Abatements
- Topic 23 Employee Records of Unsafe/Unhealthful Working Conditions
- Topic 24 Accident/Incident Investigations
- Topic 25 Confined Space
- Topic 26 Hydrogen Sulfide (H₂S) Protection
- Topic 27 Breakaway Sounding Reel Cable Installation
- Topic 28 Technical Information For The A-55 Reel Drag Break
- Topic 29 Cableway and Gaging Station

Topic 30	Drilling Safety
Topic 31	Policy for Collecting, Shipping and Analyzing Samples That May Contain Pfisteria
Topic 32	Formaldehyde
Topic 33	Hantavirus Infection Prevention Plan
Topic 34	Working on Ice-Covered Rivers
Topic 35	Laboratory Safety
Topic 36	Medical Surveillance and Immunizations
Topic 37	Office Safety
Topic 38	Prevention of Arthropod (Insect) Borne Diseases
Appendix	Facilities Safety Inspection Checklist

TOPIC 1 — JOB HAZARD ANALYSIS	
1.1	References3
1.2	Procedures3
1.3	Responsibility3
	A. Conducting a Job Hazard Analysis3
	B. Job Hazard Analysis Review5
	C. Job Hazard Analysis Reevaluation6
	D. Job Hazard Analysis Recordkeeping7
TOPIC 2 — TRAINING	
2.1	References11
2.2	Procedures11
	A. General Training11
	B. Mandatory Training Requirements11
TOPIC 3 — FIELD WORK	
3.1	References19
3.2	Procedures19
	A. Check-Out/Check-In System19
3.3	Field Attire19
3.4	Foot Travel19
3.5	Vehicle Travel21
3.6	Winter Travel21
3.7	Desert and Arid Areas22
3.8	Mineral Examination and Mine Safety Practices22
	A. References23
	B. Mine Safety23
3.9	Remote Camp Safety and Sanitation25
	A. References25
	B. Gray Water25
	C. Potable Water26
	D. Toilet Facilities26
	E. Kitchen Tents26
	F. Propane Tanks and Generators26
3.10	Camp Aviation Procedures26
3.11	Lightning Storms27
	A. General Guidelines During Lighting Storms27
3.12	Potentially Violent Personal Encounters28

TOPIC 4 — MOTOR VEHICLE AND EQUIPMENT SAFETY

4.1 **References**33

4.2 **Procedures**33

 A. Driving Limitations33

 B. Types of Operators34

 C. Supervisory Responsibility35

 D. Poor Drivers/Unsafe Drivers35

 E. Drivers Training35

4.3 **Equipment**36

 A. Defective Vehicle36

 B. Disabled Vehicle36

 C. Vehicle Inspections36

 D. Seat Belts36

 E. Safety/Survival Equipment37

 F. Fire Extinguishers37

 G. Accident Reporting Kit37

4.4 **Vehicle Servicing and Repairs**37

4.5 **Trailers Less Than 10,000 lb. GVW**38

4.6 **Off-Road Vehicles**39

 A. Three-Wheeled ATVs39

TOPIC 5 — HEAVY EQUIPMENT

5.1 **References**43

 A. OSHA Standards43

5.2 **Procedures**43

 A. Heavy Equipment Operators43

 B. Hazardous Conditions44

 C. Compliance with Applicable Regulations44

 D. Job Hazard Analysis44

 E. Personal Protective Equipment and Other Safety
 Equipment44

5.3 **Other Machinery -General**44

 A. Basic Safety Rules45

 B. Battery Servicing46

TOPIC 6 — AVIATION SAFETY

6.1 **References**51

6.2 **Pilot Qualifications**51

6.3 **Flying Practices**51

6.4 **Special-Use Flights**52

 A. Airplanes52

	B. Helicopters	52
	C. Personal Protective Equipment (PPE) Requirements for Special-Use Flights	52
6.5	Fixed-Wing Aircraft Predeparture Preparations	53
6.6	Passenger Procedures and Safety Precautions	53
6.7	Helicopters	54
	A. Cargo Loading	54
	B. Tail Rotor	55
	C. Main Rotor	56
	D. Procedure for Landing and Take-off Hand Signals	57
	E. Take-off Procedures	59
 TOPIC 7 — OCCUPATIONAL HEALTH HAZARDS/ INDUSTRIAL HYGIENE		
7.1	References	63
7.2	Procedures	64
	A. Health Hazards	64
	B. Routes of Entry	64
	C. Standards of Exposure	65
	D. Reducing or Eliminating Employee Exposure	65
7.3	Respiratory Protection Program	67
	A. General Requirements	68
	B. Classification and Description of Respiratory Protective Devices	68
	C. Respirator Training	68
	D. Training Records	69
	E. Facepiece Fit and Leak Testing	69
	F. Maintenance and Cleaning	70
7.4	Hearing Conservation Program	70
	A. General Requirements	70
	B. Identification of Exposed Employees	71
	C. Hearing-Protection Devices	71
7.5	Hazard Communication Program	72
	A. Manufacturers' Instructions	72
	B. Hazard Determination	72
	C. Material Safety Data Sheet	72
	D. Employee Training	73

	E. Hazard Communication Plan (HazCom Plan) . . . . .	.73
	F. Labeling . . . . .	.73
	G. Storage/Handling of Hazardous Materials . . . . .	.73
7.6	Hazardous Materials Management . . . . .	.73
	A. Hazardous Materials in the Field . . . . .	.74
7.7	Ergonomics . . . . .	.75
	A. Principles of Ergonomics . . . . .	.75
	B. Types of Injuries . . . . .	.76
	C. Hazard Prevention and Control . . . . .	.77

**TOPIC 8 — PERSONAL PROTECTIVE CLOTHING
 AND EQUIPMENT**

8.1	References . . . . .	.81
8.2	Procedures . . . . .	.81
	A. Using the Job Hazard Analysis to Determine Appropriate Personal Protective Equipment . . . . .	.81
	B. Mandatory Use of Personal Protective Equipment . . . . .	.82
8.3	Eye and Face Protection . . . . .	.82
	A. Goggles and Glasses . . . . .	.82
	B. Care of Goggles . . . . .	.83
8.4	Head Protection . . . . .	.83
	A. Hard Hats . . . . .	.83
	B. Nonconductive Hard Hats . . . . .	.84
	C. Proper Fit and Care . . . . .	.84
8.5	Respirators . . . . .	.84
8.6	Hand Protection . . . . .	.84
8.7	Safety Belts, Ropes, and Nets . . . . .	.84
	A. Inspection of Safety Belts . . . . .	.85
8.8	Out-of-the-Ordinary Personal Protective Equipment . . . . .	.85
	A. Procedures for Purchase . . . . .	.85

TOPIC 9 — FIRE SAFETY

9.1	References . . . . .	.89
9.2	Procedures . . . . .	.89
	A. Detection Devices . . . . .	.89
	B. Fire Extinguishers . . . . .	.89
	C. Exits . . . . .	.90

9.3	Emergency Procedures and Evacuation Plans	90
9.4	Personal Safety for Fire Emergencies	91
9.5	Vehicle Fires	92
9.6	Prescribed/Wildland Fire Safety	92
	A. Wildfire Hazards	92
	B. 18 Situations That Shout, "Watch Out!"	93
	C. 10 Standard Firefighting Orders	94
	D. Safe Fireline Procedures	94
	E. Advise Employees	95
	F. Fire Shelter	95

TOPIC 10 — FIELD INJURY PREVENTION AND FIRST AID

10.1	References	99
10.2	Procedures	99
	A. Camp Safety	99
	B. Preventive Inoculations	99
10.3	Poisonous Plants	100
	A. Identifying Poisonous Plants	101
10.4	Poisonous Insects (Arthropod Stings and Bites) See Topic 40	101
10.5	Poisonous Snakes	101
	A. First Aid for Snake Bites	102
10.6	Cold Injuries	103
	A. Types of External Cold Injuries (Frostbite)	103
	B. Types of Internal Cold Injuries (Hypothermia)	105
10.7	Heat-Related Injuries	106
	A. Heat Cramps	107
	B. Heat Exhaustion	107
	C. Heat Stroke	107
10.8	Lightning Strike Injuries	109
10.9	Altitude-Related Problems (above 8,000 feet)	109
10.10	Bloodborne Pathogens	109
	A. Scope	110
	B. Exposure Determination	110
	C. Exposure Control Plan	110
	D. Post-Exposure Incident Evaluation	111

TOPIC 11 — MATERIALS HANDLING AND STORAGE

11.1	References	115
	A. OSHA Standards	115
11.2	Procedures	115
	A. Lifting Heavy Loads	115
	B. Lifting in a Proper Manner	116
	C. When Two or More Persons Lift	117
	D. Equipment	118
11.3	Powered Industrial Trucks and Tractors (Forklifts, etc.)	118
	A. Minimum Forklift Operation Requirements . . .	118
	B. Basic Safety Rules for Operating Forklifts . .	119
11.4	Storage Yards	122
11.5	Warehouse Storage	123
11.6	Storage and Handling of Hazardous Materials	125
	A. OSHA Standards	125
	B. Flammable and Combustible Liquids	127

TOPIC 12 — MACHINES AND TOOLS

12.1	References	131
12.2	Procedures	132
12.3	Portable Hand Tools	132
	A. Chopping Tools (Axe, Pulaski, Hoedad, etc.) .	132
	B. Chipping Tools	133
	C. Wrenches	133
	D. Screwdrivers	133
	E. Hammers	133
	F. Picks	133
	G. Files	133
	H. Handsaws	134
	I. Air Tools	134
	J. Chainsaws	134
12.4	Portable Electric Tools	135
12.5	Radio Equipment	137
12.6	Fixed Machines	137
	A. Woodworking and Metalworking	137
12.7	Compressors	138
12.8	Welding and Cutting	138
12.9	Spray Painting	139

TOPIC 13 — ELECTRICAL SYSTEMS AND EQUIPMENT

13.1	References	143
	A. The National Electric Code	143
	B. National Fire Protection Association (NFPA 70)	143
	C. OSHA Standards — Subpart S — Electrical	143
13.2	Procedures	144
13.3	Inspections of Electrical Equipment	144
13.4	Other Electrical Appliances and Equipment	144
13.5	Electrical Work at USGS Facilities	145
13.6	Electrical Safety	145
13.7	Electrical Equipment	146
13.8	Power Lines	146
13.9	Lockout/Tagout	146
	A. Sequence of Lockout System Procedure	147
	B. Restoring Equipment to Normal Operation	148
	C. Multiple Lockout Procedures	148
	D. Shift or Personnel Change	148
	E. Outside Contractors	149
	F. Glossary	149

TOPIC 14 — WATERCRAFT OPERATIONS AND WATER SAFETY

14.1	References	153
14.2	Motorized Watercraft Procedures	153
	A. Motorized Watercraft under 26 Feet in Length (Class A and I Boats)	154
	B. Motorized Watercraft over 26 Feet in Length (Class II and III Boats)	155
14.3	Non-motorized Watercraft	156
14.4	Operations Aboard All Watercraft	156
14.5	Loading and Unloading from Watercraft	158
14.6	Personal Protection	159
14.7	Emergencies	160
14.9	Safety of Watercraft and Equipment	161

TOPIC 15 — EXPLOSIVES

15.1	References	165
15.2	General Requirements	165

15.3	Personal Protective Equipment	166
15.4	Storage	166
15.5	Training	166
15.6	Transportation	166
15.7	List of Explosive Materials	168

TOPIC 16 — FIREARMS SAFETY

16.1	References	179
16.2	Procedures	179
	A. Expiration of Firearms Authorization	179
	B. Shooting Proficiency of Seasonal or Part-Time Non-Law-Enforcement Employees, or Full-Time Employees Who Have Occasional Need to Carry Firearms	179
16.3	Equipment	180
16.4	Firearms Certification for Non-Law- Enforcement Personnel	180
	A. Contents of Classroom Component of Firearms Training Course	180
	B. Shooting Proficiency Component	180
16.5	Use of Firearms	182
	A. Firearms in Camp	182
	B. Taking Game in Defense of Life or Property	183
16.6	Firearms and Ammunition Storage	183

TOPIC 17 — VISITING PUBLIC SAFETY AND HEALTH

17.1	References	187
17.2	Procedures	187
17.3	Inspections	187
17.4	Accident Reporting	187
17.5	Coordination with Other USGS Programs ..	187
17.6	Coordination with Outside Agencies	188

TOPIC 18 — SEARCH AND RESCUE

18.1	References	191
18.2	Procedures	191
	A. Coordination with Other Organizations	191
	B. Skills and Training to Participate in Search and Rescue	191

18.3	Search and Rescue Assistance	192
	A. USGS's Involvement in SAR	192
	B. Response to Search Requests	192
18.4	Specialized Search and Rescues	193
	A. Search Procedures for Lost, Overdue, or Missing Employees	193
18.5	Planning	195

TOPIC 19 — CONTRACTOR SAFETY AND HEALTH

19.1	References	199
19.2	Procedures	199
19.3	Contracts	200
19.4	Records	200

TOPIC 20 — CONCESSIONAIRE SAFETY AND HEALTH

20.1	References	203
20.2	Procedures	203
	A. Concessionaires' Safety Program	203
	B. Review of Concessionaires' Safety Program	204

TOPIC 21 — RADIATION SAFETY

21.1	References	207
21.2	Radioactive Decay	207
21.3	Radiation Units	207
	A. Units of Activity	207
	B. Units of Exposure	208
	C. Rad and the Rem	208
21.4	Tissue and Cell Sensitivity	208
21.5	External Radiation Exposures	210
21.6	Internal Radiation Exposures	211
21.7	Routes of Exposure	212
21.8	Monitoring Operations Involving Radioactive Materials	212
21.9	Time, Distance and Shielding	213
	A. Time	213
	B. Distance	213
	C. Shielding	213
21.10	Protective Equipment	214
21.11	General Rules for Radiation Safety	214

TOPIC 22 — INSPECTIONS AND ABATEMENTS

22.1	References	219
22.2	Procedures	219
	A. Routine Inspections	219
22.3	Formal Inspections	219
22.4	Inspection Checklists	219
22.5	Collateral Duty Safety Officer Responsibility	219

**TOPIC 23 — EMPLOYEE RECORDS OF
 UNSAFE/UNHEALTHFUL WORKING
 CONDITIONS**

23.1	References	223
23.2	Procedures	223
	A. Supervisor Responsibilities	223
	B. Safety Manager Responsibilities	224
	C. Management Responsibilities	224
23.3	Employee Rights	224
23.4	Reports to OSHA	225
23.5	Workplace Violence	225

TOPIC 24 — ACCIDENT/INCIDENT INVESTIGATIONS

24.1	References	229
24.2	Procedures	229
	A. Accident Report Forms and Descriptions	229
	B. Workers Compensations Program	231
	C. Tort Claims	232
	D. Summary of Required Accident Forms	234

TOPIC 25 — CONFINED SPACE

25.1	References	239
25.2	Procedures	239
25.3	Program Elements for Confined Space Entry	239
25.4	Stilling Wells	240
25.5	Caves	245

TOPIC 26 — HYDROGEN SULFIDE (H₂S) PROTECTION

26.1	References	249
26.2	Procedures	249
	A. Buddy System Procedure	249
	B. Tank-Gauging Inspections	250

	C. Meter Calibration Inspections	250
	D. Entering Buildings and Enclosed Structures	250
	E. Drilling Operations	250
	F. Plugging and Abandonment, and All Other Oil and Gas Operations	250
	G. Surface Compliance Inspections	250
	H. All Other Field Activities or Inspections	250
26.3	Personal Protective Equipment	252
	A. H2S Monitors	252
	B. Self-Contained Breathing Apparatus	252
26.4	Training	253
26.5	Medical Evaluation	254

TOPIC 27 — BREAKAWAY SOUNDING REEL CABLE INSTALLATION

27.1	Procedures	257
27.2	Parts Identification	257
27.3	Calculating Breakaway Strength	258
27.4	Installation	259
27.5	Part Information and Procurement	265

TOPIC 28— TECHNICAL INFORMATION FOR THE A-55 REEL DRAG BRAKE

28.1	Procedure	269
28.2	Initial Installation	271
	A. Unpack and Identify Installation Kit Components	271
	B. Removing the Existing Ratchet Assembly	272
	C. Replacing the Bearing Retainer Plate	272
	D. Replace the Spring Anchor and Anti-Backlash- Roller Pivot	273
	E. Install the New Ratchet Pawl Assembly (See Fig. 4 and Fig.5)	273
	F. Adjust the Pawl Disengagement Ball Plunger	275
	G. Fit the Drag Brake Assembly to the Reel Axle Shaft	275
	H. Assembly for Service	278
	I. Operation	279
	J. Maintenance	281

TOPIC 29— CABLEWAY AND GAGING STATIONS

29.1	References	289
29.2	Procedures	289
29.3	Preplanning	289
29.4	General	290
29.5	Wire Rope	291
29.6	Gage Stations	294
29.7	Cableways	294
29.8	Sample Checklists	296

TOPIC 30— DRILLING SAFETY

30.1	Procedures	305
30.2	Responsibilities	305
	A. Project Chief	305
	B. Site Supervisor	305
	C. Employee Responsibilities	307
30.3	Personal Protective Equipment	308
30.4	Site Selection and Working Platforms	309
30.5	Drilling Unit	310
30.6	Surface Drilling Operations	313
30.7	Equipment Grounding and Bonding	316
30.8	Flammable and Combustible Liquids	318
30.9	Basic Sanitation	327

**TOPIC 31— POLICY FOR COLLECTING, SHIPPING,
 AND ANALYZING SAMPLES THAT MAY
 CONTAIN PFIESTERIA**

31.1	General	333
31.2	Procedures	333
	A. Sample Collection	333
	B. Sample Shipment	334
	C. Sample Analysis	334

TOPIC 32— FORMALDEHYDE

32.1	Reference	339
32.2	Procedures	339
	A. Health Effects	339
	B. Exposure Limits	340
32.3	Hazard Communication	341
32.4	Regulated Areas	341
32.5	Respiratory Protection	342

TOPIC 33— HANTAVIRUS INFECTION PREVENTION PLAN

33.1	General Information	.347
33.2	Equipment and Supplies	.348
33.3	Killing the Virus and Cleaning the Gage House	.349
33.4	Sealing the Gage House	.357

TOPIC 34— WORKING ON ICE-COVERED RIVERS

34.1	General Information	.361
34.2	Measurements Through Ice	.361
34.3	Personal Flotation Devices	.363
34.4	Job Hazard Analysis (JHA)	.363
34.5	Communication	.364

TOPIC 35— LABORATORY SAFETY

35.1	References	.367
35.2	Procedures	.367
35.3	General Safety Procedures	.367
35.4	Health and Hygiene	.368
35.5	Food and Drink in the Laboratory	.369
35.6	Housekeeping	.369
35.7	Transferring of Chemicals	.370
35.8	Compressed Gases	.370
35.9	Personal Protective Equipment	.371
35.10	Gases	.373
35.11	Physical Hazards	.374
35.12	Hazardous Waste Disposal	.374
35.13	Chemical Storage Guidelines	.380

**TOPIC 36— MEDICAL SURVEILLANCE
AND IMMUNIZATIONS**

36.1	References	.383
36.2	Medical Surveillance	.383
36.3	Immunization	.384

TOPIC 37— OFFICE SAFETY

37.1	References	.389
37.2	Procedures	.389
	A. General Housekeeping	.389
	B. Tripping Hazards	.389
	C. Furniture	.390

D. File Cabinets/Shelves . . . . .	.390
E. Office Machinery/Tools . . . . .	.391
F. Electrical Hazards . . . . .	.391
G. Extension Cords . . . . .	.392
H. Visual Display Terminals (VDT's) . . . . .	.392
I. Fire Protection . . . . .	.393

**TOPIC 38— PREVENTION OF ARTHROPOD (INSECT)
BORNE DISEASES**

38.1	General . . . . .	.397
38.2	Reducing Exposure . . . . .	.397
38.3	Mosquitos . . . . .	.398
38.4	Ticks . . . . .	.398

**APPENDIX — FACILITIES SAFETY INSPECTION
CHECKLIST401**



TOPIC 1

JOB HAZARD ANALYSIS

1.1 **References**

- A. 485 DM Safety & Health Handbook Chapter 14
- B. SM 445-2-H, Chapter 15, Job Hazard Analysis

1.2 **Procedures.** Job Hazard Analysis (JHA) procedures include identification of tasks, potential hazards, and safe job practices/procedures. Employees and supervisors should work together in the development of the JHA to assure that all characteristics of the job are addressed and that the safest and most efficient means of performing a job will be utilized. A JHA is required to be completed for:

- A. Jobs or work practices that have potential hazards.
- B. New, nonroutine, or hazardous tasks to be performed where potential hazards exist.
- C. Jobs that may require employee use of out-of-the-ordinary personal protective equipment (PPE).
- D. Changes in equipment, work environment, conditions, practices, policies, or materials.

1.3 **Responsibility.** Supervisors shall discuss the job hazards with employees prior to beginning new projects or upon changing work sites, identify any hazards not noted on the JHA, and discuss ways to reduce these hazards, including the use of protective equipment. Supervisors and appropriate line managers shall ensure that established JHAs are reviewed and signed prior to any nonroutine task, or at the beginning of the field season or fire season.

- A. **Conducting** a Job Hazard Analysis. In order to develop a JHA, the job to be evaluated is broken down into basic steps by the supervisor and the employee assigned to perform the job. They identify hazards and safe job procedures.

USGS Form template, Job Hazard Analysis is used for the preparation of JHAs (see Illustration 1-1).

JOB HAZARD ANALYSIS	JOB DESCRIPTION:	PAGE OF	DATE:	<input type="checkbox"/> NEW
	EMPLOYEE/OPERATOR: All Employees	SUPERVISOR:	ANALYSIS BY:	<input type="checkbox"/> REVISED
ORGANIZATION: U. S. Geological Survey	LOCATION:		CERTIFIED BY:	
JOB TASK	POTENTIAL HAZARDS UNSAFE ACTS OR CONDITIONS	REQUIRED PERSONAL PROTECTIVE EQUIPMENT		
1.	1.	1.		
2.	2.	2.		
3.	3.	3.		
4.	4.	4.		
5.	5.	5.		
6.	6.	6.		
7.	7.	7.		
8.	8.	8.		
9.	9.	9.		
10.	10.	10.		
11.	11.	11.		
12.	12.	12.		
13.	13.	13.		

Illustration 1-1

INSTRUCTIONS FOR COMPLETING JOB HAZARD ANALYSIS	
<p>BASIC JOB STEPS</p> <p>Break the job down into steps. Each of the job steps should accomplish a major task. The task will consist of a set of movements. For example, loading fence-building materials from the warehouse into a pickup. Let's break the job down into the following steps: (1) loading materials from the warehouse into the pickup; (2) driving to the job site; (3) unloading materials from the pickup; (4) setting up the fence. Everything related to that one set of movements is part of that job step.</p> <p>The next set of movements might be pushing the loaded handtruck to the loading dock or to the pickup. Removing the materials from the truck and placing them in the pickup bed is another set of movements. Finally, returning the handtruck to the warehouse area might be the final step in this job.</p> <p>List all the steps in a job. Some steps may not be done each time—checking the cater on the handtruck, for example. However, that task of the job should be listed and analyzed.</p>	<p>POTENTIAL HAZARDS</p> <p>Examine each step to find and identify hazards—actions, conditions, or possibilities that could lead to an accident. It's important to look beyond the obvious hazards, to look at the entire environment and discover every hazard that might exist.</p> <p>Be sure to list health hazards as well, even though harmful effect may not be immediate. An example might be the harmful effect of inhaling a specific chemical over a long period of time.</p> <p>It's important to identify all hazards. Hazards contribute to accidents, injuries, and occupational illnesses and diseases.</p> <p>In order to do part three of a JHA effectively, you must identify both past and existing hazards. That is why it's important to distinguish between a hazard, an accident, and an injury. Each of these terms has a specific meaning:</p> <p>HAZARD—a potential danger. Oil on the floor is a hazard.</p> <p>ACCIDENT—an unintended occurrence that may result in injury, loss, or damage. Slipping on the oil is an accident.</p> <p>INJURY—the result of an accident. A sprained wrist from the fall would be an injury.</p> <p>Sometimes it is easier to identify possible accidents and illnesses and work back from them to the hazards. But be sure you focus on the hazard for developing recommended actions and safe work procedures.</p>
<p>SAFE JOB PROCEDURES</p> <p>Using the first two columns as a guide, decide what actions are needed to eliminate or reduce the hazard that could lead to an accident, injury, or occupational illness or disease.</p> <p>Actions that can be taken are: (1) engineering the hazard out; (2) changing work practices or procedures; (3) training; (4) good housekeeping; (5) providing personal protective equipment; (6) providing equipment, materials, or other elements in the environment in such a way as to eliminate stresses and strain).</p> <p>List recommended safe job procedures in column three, and remember to list required or recommended personal protective equipment for each step of the job.</p> <p>BE SPECIFIC. Say exactly what needs to be done to eliminate the hazard, as with using your leg muscles. Avoid general statements such as "be careful" or "caution" or "work safely."</p> <p>Give a recommended safe job procedure for every hazard. If a serious hazard is identified, it should be corrected immediately.</p> <p>Your JHA should be revised to reflect changes in equipment, environment, policy, materials, or in work conditions.</p>	<p>SAFE JOB PROCEDURES</p> <p>Using the first two columns as a guide, decide what actions are needed to eliminate or reduce the hazard that could lead to an accident, injury, or occupational illness or disease.</p> <p>Actions that can be taken are: (1) engineering the hazard out; (2) changing work practices or procedures; (3) training; (4) good housekeeping; (5) providing personal protective equipment; (6) providing equipment, materials, or other elements in the environment in such a way as to eliminate stresses and strain).</p> <p>List recommended safe job procedures in column three, and remember to list required or recommended personal protective equipment for each step of the job.</p> <p>BE SPECIFIC. Say exactly what needs to be done to eliminate the hazard, as with using your leg muscles. Avoid general statements such as "be careful" or "caution" or "work safely."</p> <p>Give a recommended safe job procedure for every hazard. If a serious hazard is identified, it should be corrected immediately.</p> <p>Your JHA should be revised to reflect changes in equipment, environment, policy, materials, or in work conditions.</p>

- 1. Identification of Tasks.** Each step of a job should identify a major task and briefly describe each in the order in which it is performed. Three or four words may be sufficient to describe each job step. Avoid steps that are too detailed. They will make the JHA unnecessarily long and trivial. For example, sanding and painting a picnic table are major tasks to be listed; opening a paint can is not considered a major task and would not be included on the JHA. Most jobs can be separated into 12 to 15 basic steps.

2. **Potential Hazards.** Each step is examined to identify potential hazards. Hazards may be associated with work practices, procedures, equipment, materials, or environment. Questions to be considered to help identify specific hazards include: Could the worker come in contact with; be struck by; strike against; be caught in, under, between; slip, trip, or fall; or suffer from overexertion?
 3. **Safe Job Procedures.** Safe job procedures to reduce or abate the hazards are identified. The use of general terms such as "be careful", "use caution", or "work safely" should be avoided. Safe job procedures will normally fall into one of the categories listed below:
 - a. Environmental change
 - b. Reduction in the frequency task is performed
 - c. Personal protective equipment changes
 - d. Job procedures/work practices
 - e. Safe behaviors
- B. **Job Hazard Analysis Review.** A JHA review by the local safety manager is done to ensure that USGS policy and OSHA standards are integrated into the JHA, and that the PPE required is properly selected and meets the appropriate ANSI standard. Organizational managers and supervisors will identify all hazardous operations or activities under their control and develop/approve corresponding written JHA's.
- C. **Job Hazard Analysis Reevaluation.** Established JHAs should be reevaluated periodically, at least every three years, to ensure that they reflect the latest, safest, and most efficient way to perform the task. New equipment, tools, methods, and changes in safety standards should require modifications in JHAs.

D. Job Hazard Analysis Recordkeeping.

Supervisors are responsible for maintaining JHA records within their work group.



TOPIC 2 **TRAINING**

2.1 References

- A. 29 CFR 1960 Subpart H
- B. Occupational Health and Safety Act of 1970
- C. DM 485 Chapter 13.1
- D. SM 445-2-H, Chapter 14 Safety Training

2.2 **Procedures.** Supervisors are responsible for establishing when, where, and how to do each job safely. They are to ensure the proper use and care of personal protective equipment (PPE) and USGS property. Supervisors shall ensure that their employees receive the training necessary to safely perform job tasks. The supervisor may obtain assistance for developing and conducting safety training from qualified and experienced employees, District safety personnel, safety managers, private industry, OSHA, Environmental Protection Agency (EPA), etc. However, it is the supervisor's responsibility to ensure the quality and timeliness of the safety training.

- A. **General Training.** It is imperative that all Bureau employees be provided safety training prior to assignment and throughout the course of their employment.
- B. **Mandatory Training Requirements.** There are numerous jobs throughout the Bureau that require training and/or certification prior to performing certain tasks. Supervisors are advised to check with appropriate safety personnel if an area is not covered. Mandatory training must be documented.
- C. The following table summarizes mandatory and optional training requirements based upon tasks assigned and do not apply to everyone. Consult with the local safety manager or training officer for specific requirements.

Mandatory Safety Training Dependent on Position or Job Hazard Analysis (JHA)

Position/Task	Authority	Frequency
Safety Training for Managers	29 CFR 1960.54	Once
Safety Training for Supervisors	29 CFR 1960.55	Once
Safety Training for Collateral Duty Safety Personnel	29 CFR 1960.58	Once—within 90 days
Safety Training for Safety Specialists	29 CFR 1960.56	Yearly
HazCom (Employee Right-to-Know)	29 CFR 1910.1200	Once—unless job change or new chemical added (all employees)
Job Hazard Analysis	485 DM Chapter 14	
Bloodborne Pathogen Level I	29 CFR 1910.1030	Once
Forklift Safety	29 CFR 1910.178	Once—or as determined by JHA
Respiratory Protection	29 CFR 1910.134	Once—as determined by JHA
First Responder Awareness Level (HazMat)	29 CFR 1910.120(a)	Once—all employees

Mandatory Safety Training Dependent on Position or Job Hazard Analysis (JHA)

Position/Task	Authority	Frequency
Fire Extinguisher	29 CFR 1910.157	Once
Evacuation/Fire Drill	29 CFR 1910.38	Once—yearly
Hearing Conservation	29 CFR 1910.95	Once—as determined by JHA
Hazardous Waste Operations and Emergency Response (HAZWOPER)	29 CFR 1910.120	40 hours initial 8 hours refresher yearly — as determined by JHA
Welding	29 CFR 1910.252	Once—as determined by JHA
Sign and Tag Recognition	29 CFR 1910.145	Once—as determined by JHA
Lockout/Tagout	29 CFR 1910.147	Once—as determined by JHA
Confined Spaces	29 CFR 1926.21	Each space—as determined by JHA
OSHA PPE Standard Personal Protective Measures	29 CFR 1910.132 29 CFR 1926.21	Once—as determined by JHA

Mandatory Safety Training Dependent on Position or Job Hazard Analysis (JHA)

Position/Task	Authority	Frequency
Power Operated Handtools	29 CFR 1926.302	Once—as determined by JHA
Woodworking Tools	29 CFR 1926.304	Once—as determined by JHA
Gas Welding	29 CFR 1926.350	Once—as determined by JHA
Arc Welding	29 CFR 1926.354	Once—as determined by JHA
Commercial Driver's License (CDL)	49 CFR 383-395	5 years—as determined by JHA
Fall Protection	29 CFR 1926.500	As determined by JHA
-Towers	29 CFR 1910.29	
-Telecommunication	29 CFR 1910.268	
Watercraft Operation	SM 445-2H, Chapter 14 and 485 DM	
Anhydrous Ammonia	29 CFR 1910.111	As determined by JHA
Asbestos	29 CFR 1910.1001	As determined by JHA
Lead	29 CFR 1910.1025	As determined by JHA

Mandatory Safety Training Dependent on Position or Job Hazard Analysis (JHA)

Position/Task	Authority	Frequency
Winch Operation	Optional	As determined by JHA
Chain Saw Certification	Optional	As determined by JHA
Safe Lifting techniques	Optional	As determined by JHA
Swiftwater Rescue	Optional	As determined by JHA
Emergency Trauma Training (ETT)	Optional	As determined by JHA
Emergency Medical Training (EMT)	Optional	As determined by JHA
Wilderness Trauma Care	Optional	As determined by JHA
Submerged Aircraft Rescue	Optional	As determined by JHA
Dangerous Animal Encounters	Optional	As determined by JHA
Ergonomics	Optional	As determined by JHA



TOPIC 3

FIELD WORK

3.1 **References**

- A. 29 CFR 1910.142 Temporary Labor Camps SM
- B. 445-2-H, Chapter 14 Safety and Health Training

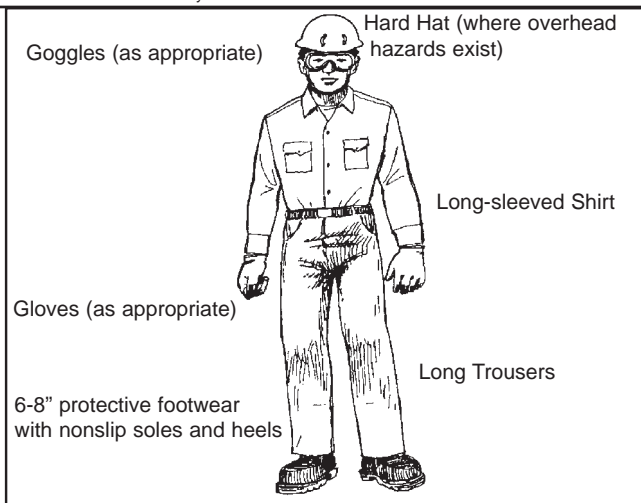
3.2 **Procedures.** Bureau activities sometimes require employees to travel and work alone in remote and hazardous areas. At least two employees should be assigned to work in such areas, and always with dependable, established communications. Assessing field hazards is a continual process. The Job Hazard Analysis (JHA) process will assist both supervisors and employees in minimizing or eliminating those hazards. Safety orientation is mandatory for employees involved in field activities.

- A. **Check-Out/Check-In System.** The Bureau's check-out/check-in system requires maintaining a written record containing the itinerary, name of employee, work area, estimated time of return, and miscellaneous information such as names of other crew members, etc. In the event an employee does not return or contact the office at the designated times, search and rescue procedures shall be initiated. All field camps must have established communications to request assistance.

3.3 **Field Attire.** Safe field attire will be determined by management, JHA, or as required by specific activity. For general working conditions, the recommended attire is the following: 6- to 8-inch protective footwear with nonslip soles and heels, long trousers, and long sleeved shirt (see Illustration 3-1).

3.4 **Foot Travel.** Always notify other workers of intended route and destination, and work close enough to them to permit a quick response to a call for assistance.

- A. **Avoid travel,** resting, or camping in snag or high windfall areas when windy weather or lightning may endanger life and property.



- B. **Avoid using** rotten or loose-barked logs as foot logs over creeks or gullies. Have secure footing at all times. Rocky slopes, especially slide rock and steep country, can be treacherous. Have one hand free to protect against falls or obstructions. Carry hand tools on lower side when walking along contours or slopes.
- C. **Always be on guard against injury** from falling trees, snags, limbs, rolling logs, or rocks. Don't run blindly from a falling rock, log, or tree. Determine its falling direction, get out of its path, and alert others.
- D. **Guard against** twigs or branches striking face and protect co-workers from similar whiplashes.
- E. **When possible, detour around hazardous areas** such as rock slides, lava flows, rim rock, sanddunes, steep or undercut river banks, quicksand, dense brush, deep gullies, canyons, bear dens, hornet nests, poison ivy or poison oak, etc.

- 3.5 **Vehicle Travel.** In case of a disabled or stuck vehicle, remain with the vehicle. The vehicle can be more easily seen from the air than a person can alone, and it also provides shelter from the sun or the cold. If lost and without radio contact, sweep the horizon during the daytime with the light beam of a signal mirror. This beam is visible over a great distance and might be seen by someone. Flash vehicle headlights (three rapid flashes) at night, especially if aircraft can be heard.
- 3.6 **Winter Travel.** Prior to winter travel, follow office check-out/check-in procedures for personnel and winter-survival equipment. To minimize the hazards associated with winter driving, both the vehicle and the driver must be prepared in advance. Always drive at a speed that matches visibility, traffic, and road conditions.
- A. To see and be seen by others requires the driver to clean all snow and ice from the **entire** vehicle — hood, roof, trunk, lights, and windows. Snow left on any of these areas increases the possibility that visibility will be affected when the vehicle is in motion.
 - B. Follow manufacturers' recommendations when equipping vehicles with studded tires or chains.
 - C. Snow tires are recommended, but chains provide the best starting and stopping performance in severe snow and on icy surfaces. Radial tires are not snow tires unless they have a snowtread configuration and are marked "M&S" for "mud and snow."
 - D. If your vehicle breaks down and you are stranded, it is best to stay with your vehicle. You should only run your heat for 10 minutes every hour or so to conserve fuel. Make sure the exhaust pipe is clear of snow. Open a window every once in a while to let in fresh air.

- 3.7 **Desert and Arid Areas.** Never go into the desert with out first informing someone of your destination, your route, and when you will return (check-out/check-in). Stick to your plan.
- A. Carry at least 1 gallon of water per person per day of your trip. Plastic jugs are handy and portable.
 - B. Be sure your vehicle is in good condition.
 - C. Keep an eye on the sky. Flash floods may occur any time you are downslope from "thunderheads," even though it may not rain where you are.
 - D. If your vehicle breaks down, stay near it. Your emergency supplies are with the vehicle.
(See 4.3 C and E)
 - E. If water is limited, keep your mouth shut and breathe through your nose to reduce water loss and drying of mucous membranes. **DO NOT** talk, eat, smoke, drink alcohol, or take salt.
 - F. **DO NOT** sit or lie directly on the ground. It may be 30 degrees or more hotter than the air.
 - G. Although nights can be very cold, necessitating proper attire, clothing for the desert should be lightweight, light colored, and cover the whole body. Have appropriate eyewear to protect eyes from sunglare.
- 3.8 **Mineral Examination and Mine Safety Practices.** Before going underground, all employees must have completed the Mine Safety and Health Administration (MSHA) "Mine Safety Equipment and Survival Training". This ensures that personnel recognize hazards and informs them of approved survival gear and how it is used in the event of an emergency. Inexperienced employees must not enter underground mine workings or deep open cuts unless accompanied by a qualified mining engineer or geologist.

A. References

1. 29 CFR 1910.151, 29 CFR 1910 Subpart I, Federal Mine Safety and Health Act.

B. **Mine Safety.** USGS personnel must be aware of their personal safety at all times during inspections, even though they may be accompanied by the operator or a representative of the operator. Inexperienced personnel must not be taken underground until fully informed of the associated dangers. Experienced USGS personnel should pay special attention to their colleagues until they have gained confidence and knowledge of proper behavior and procedures. Personnel must be familiar with the use and maintenance of safety equipment. In addition to hard hats, steel-toe shoes, and safety glasses, a mine belt, earplugs, and both types of self-rescuers, as appropriate, should be used for inspection of underground mines. Know the areas of active mining and reclamation, blasting, and other activities on-site that may involve equipment that could pose a danger to an individual. Care must be taken at all times around any mechanized equipment operating in the vicinity of the inspection.

1. **In underground mine situations**, personnel must have training in the use of self-rescuers and be aware of the following dangers:
 - a. **Gas and dust conditions and emergency mine escape procedures.** The atmosphere in old or idle mines must be tested prior to entry to determine if it is oxygen deficient or methane contaminated.
 - b. **Unstable roof and rib conditions.** Do not enter any section of the mine that has

not been properly supported. **Entry into areas marked “Danger” is expressly prohibited except by MSHA personnel or those company person nel authorized by the operator to correct the hazard.**

- c. **If a mine uses electrical equipment** such as electric locomotives, be aware of high-voltage cables.
 - d. **Keep limbs and clothing away from conveyer belts, drive wheels, idlers, and other operating equipment** and their haulage routes. Be familiar with hazards and procedures associated with blasting, and obtain a blaster’s certification if you are responsible for inspecting mines in which explosives are used regularly.
2. **When inspecting surface facilities**, employees should be accompanied by a company official whenever possible. Adhere to “No Smoking” signs posted by the operator. These facilities, which include mills and processing plants, present the following dangers:
- a. **An abundance of machinery with moving parts** can snag loose items. Clothing should not be loose-fitting, long hair should be secured and confined under a hard hat, and all should be jewelry removed.
 - b. **Chemicals and fuel.** Be aware of storage areas, obey company rules regarding these areas, and know emergency procedures to be taken after accidental exposure or contact with these substances. Extreme care must be taken in the vicinity of any storage facilities for hazardous substances (e.g., holding

ponds at cyanide operations).

3. **Personnel responsible for inspection of exploration activities** should receive training in the use of 4-wheel-drive vehicles, since exploration involves a great deal of off-road driving.

3.9 **Remote Camp Safety and Sanitation.** All sites used for camps must be adequately drained. They shall not be subject to periodic flooding, nor located within 200 feet of swamps, pools, sinkholes, or other surface collections of water, unless mosquitoes can be controlled on such still-water surfaces. The camp must be located so the drainage from and through the camp will not endanger any domestic or public water supply. All sites must be graded, ditched, and rendered free from depressions in which water may become a nuisance. All sites must be adequate in size to prevent over crowding of necessary structures. The principal camp area where food is prepared and served and where sleeping quarters are located must be at least 500 feet from any area in which livestock are kept.

A. **Reference**

29 CFR 1910.141-142

- B. **Gray Water.** Gray water disposal pits shall be constructed to permit leaching within 24 hours. If leaching does not occur because of water table, a series of shallow small canals shall be constructed for evaporation and leaching. Gray water disposal area will be located at least 50 feet down gradient from water source.
- C. **Potable Water.** Transported potable water must be obtained from a treated source, or chlorinated, if obtained from a nontreated source, and kept pure and free from contamination through proper

handling and storage procedures. Request the advice of local health departments, prior to the use of any surface water such as lakes, springs, rivers, and streams. Canteens, if not in use, must be emptied, disinfected, and dried.

- D. **Toilet Facilities.** Approved toilet facilities adequate for the capacity of the camp must be provided and must be located 200 feet or more from any water source. A description of toilet facilities requirements is stated in 29 CFR 1910.142(d).

- E. **Kitchen Tents.** Keep kitchen tents clean and tidy and keep foodstuffs away from cleaning supplies. Two fire extinguishers should be present and ready.
 - 1. Store foodstuffs in rodent and pest-proof containers.
 - 2. Make sure pots and pans are clean and inverted for dust and germ control. Silverware should be clean and covered.
 - 3. Freezer temperature should be set at zero or below; refrigerators should be set at 45 degrees.

- F. **Propane Tanks and Generators.** Propane tanks will be properly anchored. Generators should be placed downwind with plywood noise control. Electrical panel boxes are to be protected from the weather. Propane tank and other fuel storage containers should be at least 50 feet away from camp and properly posted with "No Smoking" signs.

- 3.10 **Camp Aviation Procedures.** When established, a camp fueling site must have the proper fuel containment. Both fuel bladders and barreled fuel must be kept in secondary containment (diked) in case of a

fuel spill. The daily fuel log must be kept current. "No Smoking" signs must be posted and visible at any approach to the site. (No smoking is allowed within 50 feet of fueling site). Fuel source must be grounded and bonded through machinery (filters, pumps, etc.) and then to aircraft. The site must be located a minimum of 100 feet from personnel quarters and must be kept tidy with no loose articles allowed in area that might be blown into helicopter rotors or aircraft propellers.

- A. A windsock shall be installed in accordance with OAS Heliport Specifications.
- B. The fuel tank pump will be equipped with a remote switch.

3.11 Lightning Storms. Lightning seeks the easiest route (not necessarily the shortest) between positive and negative regions within a cloud or between positive charges on the ground and negative charges in the cloud. The human body offers a path of least resistance. The hazard of lightning occurs in two ways, either as a direct hit or as a ground current.

A. General Guidelines During Lightning Storms

- 1. Seek shelter inside a building.
- 2. Select fiberglass or plastic hard hats rather than those of metal construction.
- 3. Don't work on fences, electrical lines, pipelines, or structural steel fabrication.
- 4. Don't use metal objects like fishing rods, soil augers, well-logging equipment, etc., that are in contact with the ground.
- 5. Automobiles provide a safe shelter because the metal body creates a pathway for the lightning around your body. Avoid contact with

metal objects in the car where your body could become a pathway.

6. Lightning tends to strike the highest electrically conductive object in the area—peaks, ridges, towers, trees, isolated sheds (especially with metal roof or siding), wire fences, etc. Seek lower elevation, as in valleys or canyons.
7. Avoid streams and lakes. If in a low area, be cautious of flash floods and sloughing off of earthen or rock materials from above.
8. Sit on some insulating material if possible, such as coiled rope, a wooden pack board, a folded sleeping bag, a wool shirt, etc.
9. A crouched position—sitting on your feet with the knees drawn up and feet close together—seems best to minimize the distance spanned by your contact points. Avoid any position with a hand, shoulder, or head touching a surface.

3.12 **Potentially Violent Personal Encounters.** Employees need to be aware of the potential for personal violence directed against them while they are in the field and be alert to the warning signs during personal encounters with individuals. Employees need to plan ahead and request permission in advance from landowners to ensure that they are not trespassing on private lands. If advance permission is not obtained from the landowner, an employee needs to find another way around the property or must wait until permission is granted. Employees need to be aware of potential criminal activity. (e.g., illegal dumping on public lands, clandestine drug labs, marijuana cultivation, etc.) in remote areas of public lands and be prepared to leave the area immediately, if necessary, because persons engaged in such criminal activity can be hostile and violent if discovered. If an employee meets a member of the public who is hostile, the employee should be polite and nonthreatening, and leave the area as soon

as possible and report the incident to his or her supervisor and law enforcement authorities if appropriate.

The vast majority of public land users are courteous and friendly, and want to use public lands properly and legally. Most employees' contacts with them will be friendly and educational to both parties. However, there are exceptions to this rule, and employees should cultivate a situational awareness when they are out in the field. If an employee feels at all uneasy or uncertain about a situation in the field, he or she should not be embarrassed to leave the area. The job can always be completed with help at a later time. Employee safety and health are always primary considerations on the job.



TOPIC 4
**MOTOR VEHICLE AND
EQUIPMENT SAFETY**

4.1 References

- A. 370 DM Appendix A
- B. 485 DM Chapter 16
- C. 5 CFR 930 Subpart A Motor Vehicle Operators
- D. 49 CFR 383-395 Commercial Drivers License (CDL)
- E. 29 CFR 1926.601 Motor Vehicles
- F. USGS SM 445-2-H, Chapter 16 Motor Vehicle Safety

4.2 **Procedures.** When an employee's duties require operation of a motor vehicle for official business, whether USGS-owned, GSA Fleet, commercially leased, or privately owned, the employee will be required to submit Form DI-131 (Application for U.S. Government Motor Vehicle Operator's Identification Card) and Form OF-345 (Physical Fitness Inquiry for Motor Vehicle Operators), or equivalent form, to obtain driving authorization. The employee must hold a valid state driver's license in order to obtain and retain the authorization. Authorization to drive on official business must be renewed at the time the state driver's license is renewed, or a minimum of every four years.

A. Driving Limitations

1. **Maximum Driving Time Restriction.**
Employees will not exceed eight hours of driving time (behind the wheel) during a 16-hour duty period. Breaks of 15 minutes are recommended every two hours when driving continuously.

2. **Rest Requirement.** At least eight consecutive hours of rest, without duty, are required prior to each duty period that requires driving.
3. **Other Limitations.** Management/employees may place further limitations on the above hours of duty and/or driving time due to safety factors (i.e., fatigue, weather, illness). Supervisor should be notified of changes and delays.

B. Types of Operators

1. **Operators of Sedans and Light Trucks.** The 5 CFR 930 requires the employee to have a valid state driver's license in his or her possession at all times while driving on official business. An incidental operator is any employee who is required to operate a motor vehicle in order to properly carry out his/her assigned duties but whose principal duties are not operating a motor vehicle and his/her position is not classified as a motor vehicle operator.
2. **Full-Time Operators.** Employees operating any motor vehicle with a GVWR of 26,000 pounds or more, towing a vehicle 10,000 pounds GVWR or more, hauling hazardous material requiring the vehicle to be placarded, or transporting 16 or more persons, including the driver, must possess a valid Commercial Drivers License (CDL) with all applicable endorsements. Employees shall be at least 21 years of age and shall comply with the necessary health monitoring requirements for a CDL. Authorization must be noted in the personnel file on Form DI- 131 or equivalent.

3. **Operators of Specialized Equipment.**

Authorization to operate specialized equipment (i.e., 4x4 vehicles, dump trucks, front-end loaders, dozers, forklifts, backhoes, tracksters, skid-steer equipment, snowmobiles, all-terrain vehicles (ATVs), boats, etc.) must be noted in the personnel file or maintained following local recordkeeping procedures.

C. **Supervisory Responsibility.** Supervisors are responsible for ensuring that employees can satisfactorily operate the vehicle/equipment for which they are authorized. Supervisors have the authority to restrict or terminate authorizations of poor or unsafe drivers. Supervisors are responsible for educating the employee regarding USGS/Government policy on:

1. Mandatory seat belt use
2. Alcohol/drugs prohibition
3. Vehicle misuse
4. Official passengers
5. Accident reports

D. **Poor Drivers/Unsafe Drivers.** A driver whose known deficiencies make his/her driving unsafe will not drive on official business until deficiencies are remedied, or his/her driving must be restricted to compensate for limiting factors. Any driver who has a poor accident record, is careless, uses poor judgment at the wheel, or has numerous driving violations may have his or her driving privileges suspended or revoked even though he or she possesses a valid state driver's license.

E. **Driver Training.** All drivers whose job duties require the use of a motor vehicle will receive initial

defensive driver training within three months of entering on duty and refresher driver training every three years thereafter.

- 4.3 **Equipment.** Government-owned or Government-leased vehicles will be maintained in good mechanical condition.
- A. **Defective Vehicle.** Vehicle defects identified by the operator or during safety inspections shall be immediately reported to the supervisor and fleet manager. Defective vehicles shall be removed from service until repaired.
 - B. **Disabled Vehicle.** The operator may make only authorized emergency repairs to a government vehicle. The operator shall have it towed, if necessary. (Refer to the vehicle book).
 - C. **Vehicle Inspections.** Monthly vehicle inspections shall be performed and documented by the vehicle operator or designated person. The inspection shall include checking vehicle lights (brake, tail, backup), mirrors, wipers, washers, defroster, gauges, brakes, fluids, and belts. Operators will ensure emergency equipment (first-aid kit, reflectors, jack/lug wrench) is in the vehicle.
 - D. **Seat Belts.** Seat belts must be available and used in Bureau motor vehicles. (Reference Executive Order 13043, April 16, 1997)
 - 1. Without exception, seat belts must be worn at all times by motor vehicle operators and passengers, regardless of the distance to be traveled or the time involved. If any employee fails to fasten his/her seat belt while riding in a vehicle on official business, he/she is subject to disciplinary action as determined by local management.

2. All heavy, self-propelled equipment fitted with rollover protective structures must have a seat belt for the operator. Seat belt use by the operator is mandatory.

E. **Safety/Survival Equipment.** Every field vehicle shall be equipped with warning flags or reflectors, a tool kit, and a first-aid kit. Additional emergency equipment may be carried in each vehicle as determined by local need.

F. **Fire Extinguishers.** Approved fire extinguishers are required in buses, ambulances, fire engines, fire trucks, heavy motorized mobile equipment, special use vehicles, and as required by Department of Transportation (e.g., hauling of hazardous materials, such as gasoline, explosives, chemicals, etc.). (49 CFR 393.95) Fire extinguishers (ABC type) are not required in other vehicles, except by order of the State Director. If installed, they must always be properly maintained and inspected annually.

G. **Accident Reporting Kit.** All Bureau-owned or operated motor vehicles, including off-road vehicles and special-use equipment, will carry a packet containing all accident report forms and other information needed by the driver in case of an accident or other emergency.

4.4 **Vehicle Servicing and Repairs.** Maintain and operate vehicles as recommended by the manufacturer. Comply with GSA and USGS requirements on use, care, maintenance, and inspections contained in the loose-leaf vehicle book in each vehicle. In case of accident, be familiar with "WHAT TO DO IN CASE OF ACCIDENT" material. Additionally all drivers should:

- A. Maintain records of all repairs and inspections.

- B. Replace tire when the tread depth of any tire on the front steering wheels of any vehicle exceeding 10,000 GVWR falls below 4/32 inch.
- C. Keep interior and exterior of vehicle clean at all times and free of trash and loose items.
- D. Have maintenance done by a qualified mechanic. Always check items repaired before driving vehicle away from repair shop.
- E. Comply with local laws on studded tire use.
- F. Emergency equipment and tools carried inside vehicles shall be secured.
- G. Securely anchor weight ballasts in pickup trucks, if needed. **DO NOT** use rocks or boulders.
- H. If vehicles or equipment to be used or transported are equipped with hydraulic lifts, ensure that they are secured in place with safety locks or other devices to prevent accidental lowering.
- I. Before adjusting the chassis of a dump truck with the dump box in an elevated position, secure body with props to prevent accidental lowering.
- J. Use only approved-type safety cans for storage and transportation of gasoline and other flammable liquids. Approved metal cans carried in a pickup bed with a plastic liner can become highly charged with static electricity. Grounding is to be done by placing the safety can on the ground or by using grounding devices.

4.5 **Trailers Less Than 10,000 lbs. GVW.** All drivers towing trailers must be properly qualified and authorized.

- A. Vehicles towing trailers must comply with local,

State, and Interstate Commerce Commission (ICC) regulations concerning size and weight of towing vehicle. Towing vehicles must have sufficiently heavy brakes and be heavy enough to ensure complete braking control in stopping and holding trailer.

- B. All trailers shall be equipped with suitable warning devices (i.e., reflective triangles) for use in emergency situations.
- C. All trailers shall be equipped with standard workable trailer lights and stoplights.
- D. All horse and similar trailers shall be equipped with trailer jacks or loading gear.
- E. Use of a safety chain is mandatory.
- F. Trailers, having 1,500 pounds gross trailer weight and over must be equipped with brakes adequate to stop and hold the trailer.
- G. Electric breakaway switch to automatically apply trailer brakes is required.

4.6 **Off-Road Vehicles.** Operation of off-road vehicles (ORVs), such as all-terrain vehicles (ATVs), snowmobiles, and motorcycles, will require training in safe operating procedures and appropriate protective equipment (e.g., helmets, gloves, goggles, boots, etc.). Documentation of training will be maintained at USGS offices. Specific authorization for operation of ORVs is required. Where required by state law, operators must have a special state endorsement to operate off-road vehicles.

- A. The use of three-wheeled ATVs by USGS employees for Government business is prohibited.



TOPIC 5 **HEAVY EQUIPMENT**

5.1 References

A. OSHA Standards

1926.600 Equipment

1926.602 Material Handling Equipment

1926.604 Site Clearing

1926.1000 Rollover Protective Structures (ROPS)
for Material Handling Equipment

1926.1001 Minimum Performance Criteria for
Rollover Protective Structures for Designated
Scrapers, Loaders, Dozers, Graders, and Crawler
Tractors

1926.1002 Protective Frame (ROPS) Test
Procedures and Performance Requirements for
Wheel-Type Agricultural and Industrial Tractors
Used in Construction

1926.1003 Overhead Protection for Operators of
Agricultural and Industrial Tractors

1928.51 Rollover Protective Structures, Agriculture

1928.57 Guarding of Farm Field Equipment

5.2 Procedures

- A. **Heavy Equipment Operators.** Bureau operators of Government-owned or leased heavy equipment must have a valid state driver's license and Bureau authorization. Prior to authorization, operators must study and comprehend the operator's manuals for the equipment they will be authorized to operate. Prior to operating specialized equipment, including dozer, loader, grader, etc., proper training will be completed and documented on the OF-346.

- B. **Hazardous Conditions.** Under hazardous conditions or in hazardous locations (i.e., weather conditions or environmental features that increase risk), radio contact should be maintained with operators. When contact cannot be maintained, another employee should accompany operators.

- C. **Compliance with Applicable Regulations.** Load weight, width, height limits, and other requirements for transporting equipment and materials shall be observed. Loads shall be secured and flagged as required.

- D. **Job Hazard Analysis.** Prior to operating equipment and performing job tasks, a Job Hazard Analysis (JHA) will be completed as required by SM 445-2-H, Chapter 15 Job Hazard Analysis. The JHA will be completed jointly by supervisor and employees and reviewed by the safety manager.

- E. **Personal Protective Equipment and Other Safety Equipment.** Personal protective equipment (PPE) will be provided and used in accordance with OSHA requirements and USGS SM 445-2-H, Chapter 26. Rollover Protective Structures (ROPS) and Falling Object Protective Structures (FOPS) will be installed on equipment as required by the OSHA standards previously referenced. Seat belts will be installed and used on all equipment equipped with ROPS or FOPS. Backup alarms will be installed on all bi-directional heavy equipment such as rollers, compactors, loaders, track-mounted excavators, dump trucks, bulldozers, etc. The alarms will be maintained and operable at all times, and will be audible above the background noise at the work site.

5.3 **Other Machinery** — General. Investigate and correct hazards before moving machines into operating positions. Locate and operate machines where there is no danger of blasts, cave-ins, etc. Don't move

machines into blasting area until instructed to do so by foreman or blaster in charge.

A. **Basic Safety Rules**

1. Provide heavy-equipment operator with an observer when needed to ensure safety or to assist with work.
2. When changing operators, make sure that person in charge discusses plan of work, existing hazards, hand signals, etc., with new operator and crew.
3. Don't stand directly in front or in back of a self-propelled machine while it is being started.
4. Don't go under or around equipment without notifying operator. Look out for hazards.
5. Never get on or off moving equipment.
6. Rope off area of swing to provide ample clearance for a person between any solid material and tail swing of a dragline, shovel, or crane.
7. Stop all engines before refueling. When filling gasoline tank, keep funnel or container in contact with tank to prevent static spark. Never fill tank over a hot engine. Provide grounding as appropriate.
8. Always leave machines with movable parts that are lowered by gravity, such as shovels, buckets, and skip loaders, resting on the ground while not operating.
9. Don't operate internal combustion engines indoors, except with proper ventilation.

10. Have a qualified person inspect machinery or equipment, including that under contract, when it's received or repaired. Be sure it's in safe operating condition before turning it over to the operator.
 11. Have operators continually inspect their machines for safe operating conditions. Promptly notify supervisors when repairs are needed. Shut down defective machinery until repairs are made.
 12. All gears, sprockets, shafts, augers, drive belts or chains, pulleys, drums, gears, fans, or other hazardous moving parts must have guards. Replace guards after any repairs are completed.
 13. Install operating platforms surfaced with nonskid materials on footwalks, ladders, steps, handholds, guardrails, and toeboards before operating machine.
 14. Provide suitable protection for the operator against falling objects, swinging loads, and similar hazards.
 15. Use safety glass in shields, cabs, or enclosures on machines.
 16. Post signalman at dangerous or congested points near crews, blind areas, camp, etc.
 17. Check route of travel for hazards such as insufficient overhead and side clearance, bridges, high-tension lines, etc.
- B. Battery Servicing.** Remember to exercise caution; recharging batteries generates explosive hydrogen gas. Acid can cause severe burns. Always use appropriate PPE such as face shield, gloves, etc.

An eyewash station must be provided within 25 feet. "No Smoking" signs shall be posted.

1. Use battery chargers in well-ventilated areas free of sources of ignition.
2. Shut off battery charger before batteries are connected, disconnected, or tested. Place a sign stating the procedures on or near the battery charger. Prior to charging battery, cap vents must be checked to ensure function.
3. In preparing electrolyte solutions, pour acid slowly into the water. Never pour water into the acid.
4. Keep battery acid away from skin, clothing, and metal.



TOPIC 6
AVIATION SAFETY

6.1 **References**

- A. SM 445-2-H, Chapter 27, Aviation Safety
- B. DM 352, DOI Aviation Policy

6.2 **Pilot Qualifications.** Always check the Pilot's Qualification Card before boarding aircraft to make sure he/she is qualified for aircraft type and mission. Never fly if Pilot's Qualification Card is outdated, or one is not available.

6.3 **Flying Practices.**

- A. Always file a Flight Plan with the FAA, Survey, or others as needed.
- B. Make sure pilot is briefed on mission objective and parameters of the flight.
- C. Always check the Data Aircraft Card to make sure aircraft is capable of performing mission.
- D. Make sure you have been briefed by the pilot on the following:
 - 1. Approach and boarding
 - 2. Seat belt (use and adjustment)
 - 3. Smoking rules
 - 4. Fire extinguisher (location and use)
 - 5. Emergency exits (location and use)
 - 6. Survival equipment (location and use)
 - 7. Oxygen (if available)
 - 8. Emergency locator transmitter (location

and use)

9. Other emergency procedures
10. Deplaning and departing

6.4. **Special-Use Flights.**

A. **Airplanes** involved in the following activities are considered to be special-use:

1. Changes to the airplane that invalidate the airplane's standard airworthiness certificate (i.e., door removal).
2. Flight conducted below 500 feet above ground level.
3. Wheel or ski operations conducted on unprepared landing sites.

B. **Helicopters** involved in the following activities are considered to be special-use:

1. Flights conducted below 500 feet above ground level.
2. Night vision goggles.
3. Offshore navigation.

C. **Personal Protective Equipment (PPE) Requirements for Special-Use Flights.**

1. An aviator's protective helmet (pilots' and crew members' must have communications, passengers may have helmets without communication).
2. Fire retardant clothing.
3. All-leather boots which extend above the ankle.

4. All-leather or leather and "Nomex" gloves.

6.5 Fixed-Wing Aircraft - Predeparture Preparations.

- A. Provide a close estimate of your cargo weight. Cargo that is questionable with regard to aircraft and passenger safety shall be cleared in advance of your flight. Extremely large items should be itemized separately to insure that space will be available.
- B. Report the number of passengers to determine the gross weight of the aircraft.
- C. Always give the destination, latitude, longitude, and elevation (if possible) of your field camp and the airstrip, if you know the location. Prominent place names in the area are also helpful.
- D. Have a radio available in camp for monitoring of aircraft arrival, departure, and emergencies.

6.6 Passenger Procedures and Safety Precautions.

- A. Do not disembark from aircraft until pilot has given the okay. If deplaning from front door of aircraft, make sure propellers have stopped. Even with propellers stopped, use caution when walking near them; they're about head high and a serious head injury could occur. Normally, deplane from cargo door and proceed straight out from aircraft, not forward.
- B. When approaching a fixed-wing aircraft always approach the cargo door from the side or the rear of the aircraft.
- C. After unloading any aircraft, inspect the area around the aircraft for any loose materials that might be picked up by air blast upon take off and

cause damage to the aircraft or injury to personnel.

- D. Always observe the seat belt sign and make sure seatbelts are fastened during take-offs and landings and or whenever the aircraft encounters turbulence.
- E. Always observe the "NO SMOKING" signs or the instructions by the pilot. Also there will be "NO SMOKING" while refueling or on the ramp.

6.7 Helicopters.

A. Cargo Loading.

1. Consideration of center of gravity (CG) limitations is important in loading of all air craft, but is particularly important and critical in helicopters. In a helicopter the load is carried under a single point like a pendulum; therefore, very little out-of-CG loading can greatly affect the controllability of the helicopter.
2. It is important to properly secure all materials loaded on or in a helicopter.
3. Do not overload the aircraft. Normally the pilot will stow equipment and distribute the weight. However, during the work day, you might be loading and unloading equipment as well as adding other materials. Therefore, it is your responsibility to insure that gear is always stowed properly and that weight is properly distributed.
4. Normally loading and unloading equipment at camp is no problem because the engine is usually shut down, but if the engine is still running, the following precautions must be taken:
 - a. Make sure there are no loose or light

materials that might be pulled into the main rotor blade or tail rotor.

- b. If light materials are placed near the helicopter, make sure that heavier materials are placed over them.
- c. Long items should always be carried horizontally while they are being loaded.

B. Tail Rotor.

1. The tail rotor constitutes the most serious hazard on a helicopter and is unprotected and nearly invisible when in motion.
2. Never proceed rearward of the tail boom and the main cabin.
3. Never duck under tail boom.
4. Never deplane to the rear. Walk straight out to the side or to the front in a low position and always stay in view of the pilot. (See Figures 1 & 2.)

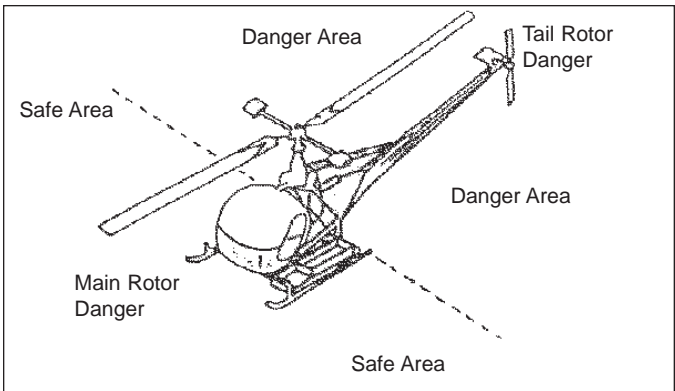


Figure 1. Helicopter Safe and Danger Areas.

Helicopter safe and danger areas.

C. Main Rotor.

1. When the helicopter is setting on level ground, the main rotor is sufficiently above the ground not to be of danger, but still leave in a crouched position. (See Figure 2.)

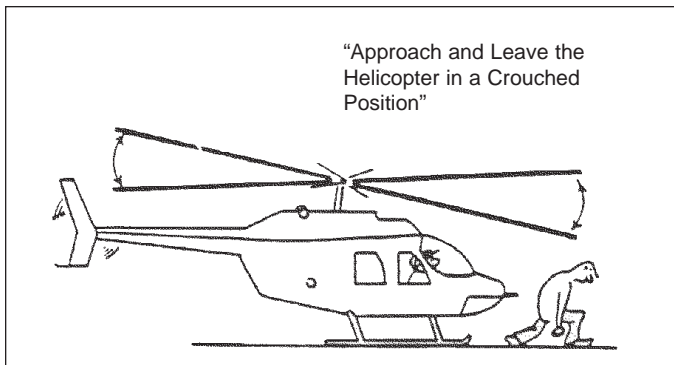
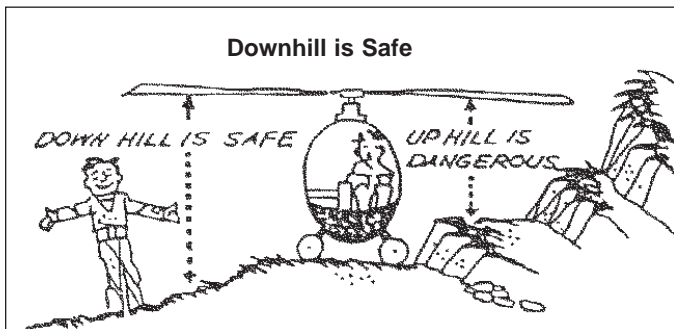


Figure 2. Main Rotor

2. While on uneven ground, the rotor presents a major hazard. Always approach or exit the



helicopter on the downhill side. (See Figure 3.)

Figure 3. Downhill is Safe.

Safe direction for departing helicopter on uneven terrain.

D. Procedure for Landing and Take-off Hand Signals.

1. Assume a squatting position approximately 6 feet and on a 45 degree angle from the front skid. (See Figure 7.) Figure 4 gives hand signals to be used when directing the pilot during take off.

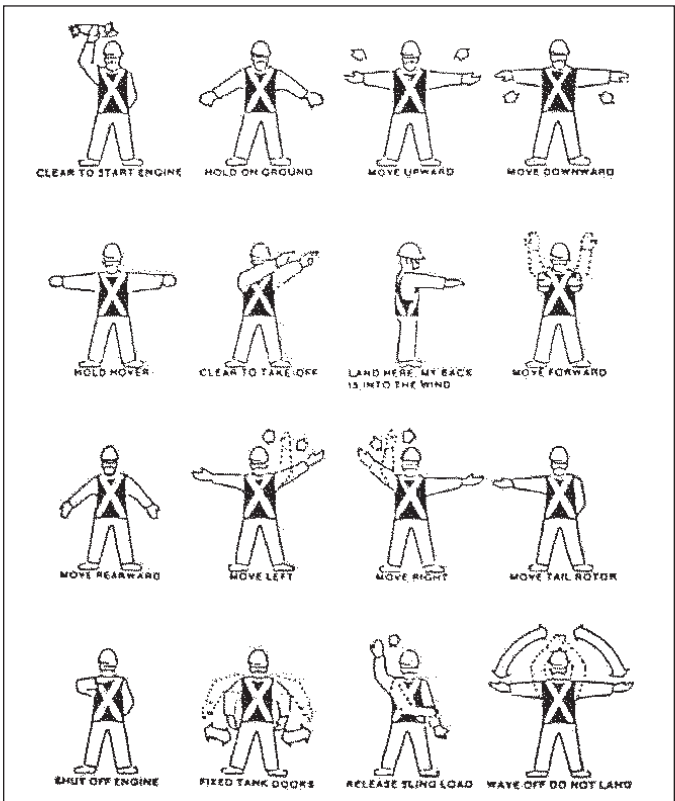


Figure 4. Helicopter Hand Signals

1. If on the ground waiting to be picked up, provide the pilot with wind direction, either by holding out a piece of cloth or by standing with your back to the wind. (See Figure 5)

Figure 5. Indicate Wind Direction to Pilot

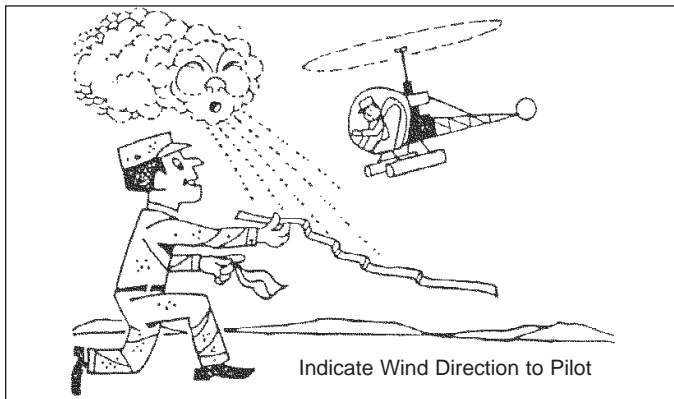
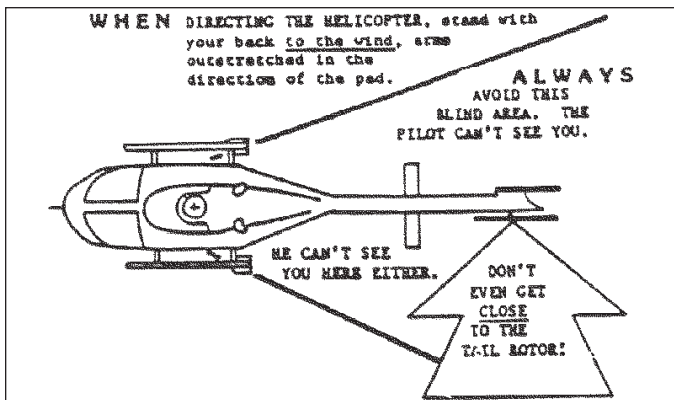


Figure 6. Directing the Helicopter

2. Always stay within the pilot's view. (See Figure 6.)



E. Take-Off Procedures.

- 1 If on the ground waiting for the helicopter to take off, move to a position about 6 feet and on a 45 degree angle from the front skid. (See Figure 7.)
- 2 Squat down and give the pilot the "thumbs-up" sign, which indicates "okay for take-off."
- 3 Always stay within the pilot's view.

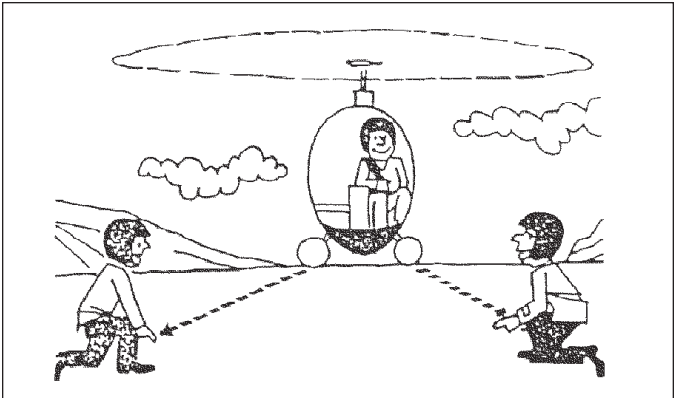


Figure 7. Take-Off Procedures

Proper position for passenger after departing a helicopter and prior to and during helicopter departure.



TOPIC 7
**OCCUPATIONAL HEALTH
HAZARDS/INDUSTRIAL
HYGIENE**

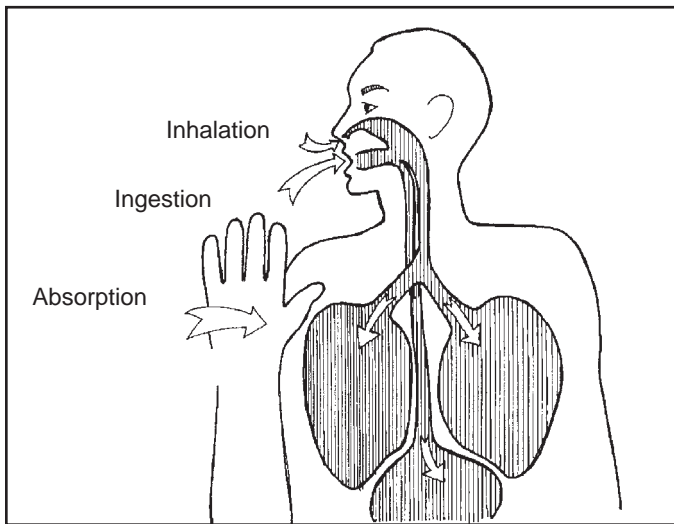
7.1 References

- A. Executive Order 12196
- B. 370 DM 792.7 Medical Surveillance Program
- C. 485 DM 17 Occupational Health (Industrial Hygiene) Program
- D. 29 CFR 1910.20 Employee Exposure and Medical Records
- E. 29 CFR 1910.95 Occupational Noise Exposure
- F. 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response
- G. 29 CFR 1910.134 Respiratory Protection
- H. 29 CFR 1910.1000 Air Contaminants
- I. 29 CFR 1910.1200 Hazard Communication
- J. 29 CFR 1910 Subpart H Hazardous Materials
- K. 29 CFR 1960 Subpart C Standards
- L. SM 445-2-H, Chapter 18, Respiratory Protection
- M. SM 445-2-H, Chapter 19, IH-Hearing Conservation Program
- N. SM 445-2-H, Chapter 20, IH-Hazard Communication Program
- O. SM 445-2-H, Chapter 23 Medical Monitoring Protection Program
- P. SM 445-2-H, Chapter 23, IH-Medical Monitoring Protection Program

7.2 **Procedures.** Because of the potential for exposing employees and volunteers to unhealthful, noisy, and ergonomically incorrect work environments, it is imperative that safety managers assist in designing work place settings that inhibit such conditions. It is also important to ensure that designs and conditions are planned and prepared in a manner that ensures the safety and health of the visiting public. Employee exposure and medical records will be maintained in accordance with 29 CFR 1910.20.

- A. **Health Hazards.** Health hazards may exist in a wide spectrum of chemical forms, including: mist, liquid, vapor, gas, dust, and fumes.
- B. **Routes of Entry.** Employees may be exposed to health hazards in the following ways: skin absorption, inhalation (air contaminants), injection, and ingestion through poor hygiene practices (see Illustration 7-1).

Illustration 7-1



- C. **Standards of Exposure.** To safeguard workers against health hazards, there are specific standards and exposure limits for each type of exposure. The limits sometimes have very strict boundaries between what is safe and unsafe. The safety manager or industrial hygienist should be consulted concerning standards of exposure.
- D. **Reducing or Eliminating Employee Exposure.** Once an industrial hygiene evaluation has been conducted and a hazardous exposure has been identified, immediate action must be taken to reduce the exposure, as outlined below.
1. **Engineering Controls.** The most effective and inexpensive engineering controls are designed into the facility or process before construction. For existing construction, personal protective equipment (PPE) will be required as an interim measure until engineering controls are implemented.
 - a. **Ventilation Controls**
 1. Local exhaust ventilation installed in an enclosure, or as close as possible to the point of contaminant generation, is much more effective and provides better protection than general or building ventilation.
 2. Ventilation systems frequently are ineffective if adequate make-up air is not provided. Temper (heat) make-up air before it is introduced into the workplace in winter.
 3. For information regarding lab safety, refer to 29 CFR 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories, or consult the safety manager.

4. **Many well-designed systems fail to protect employees because maintenance is minimal or nonexistent after installation. Regularly scheduled maintenance of environmental control systems must be provided to ensure continued employee health protection.**
 2. **Work Methods as Controls.** Safe work practice, proper equipment, and good housekeeping will minimize unnecessary exposure to spilled substances. A housekeeping program must be established at each facility to clean up any spills of nontoxic substances promptly, and for regular cleanup and maintenance.
 - a. **Vacuum Cleaning.** Vacuum cleaning is the most efficient method of collecting settled dust particles without causing appreciable re-entry into the workplace air. Blowing the settled dust particles with an air hose should never be done.
 - b. **Wet Methods.** When vacuum cleaning equipment is not available, wet methods, such as using water and/or other wetting agents to remove dust particles on floors, may be done to minimize airborne dust caused by sweeping.
 - c. **Cleaning Up Liquid Spills.** Contact the Hazardous Materials Program Coordinator in the event of a chemical or toxic spill.
3. **Administrative Controls.** Administrative controls assist in reducing employee exposure. Time exposure limitation is achieved by rotating jobs or by reducing work periods. At best, administrative controls should only be

used for brief periods until engineering corrections can be implemented.

4. **Personal Protective Equipment (PPE).** Some operations are not amenable to engineering controls, so PPE may be the only practical way to limit employee exposure. PPE may also be used for brief periods during repair of engineering controls and/or to ensure greater personal protection. It is essential that PPE be fitted to the individual employee and that the employee be carefully trained in the use and limitations of the equipment.

5. **Substitution/Isolation.** Eliminate or minimize, to the extent possible, hazardous materials, equipment, or processes by replacing all or part of the hazardous elements. Carefully investigate all substitutions to ensure that new hazards are not introduced. Hazardous processes may be isolated or enclosed to eliminate employee contact.

7.3 **Respiratory Protection Program.** This program applies to all USGS personnel whose duties require wearing respiratory protective equipment. It is intended to prevent exposure to airborne contaminants greater than permissible exposure limits (PEL) established by OSHA standards. In the absence of OSHA standards, use guidelines established by agencies such as the National Institute for Occupational Safety and Health (NIOSH), the American Conference of Governmental Industrial Hygienists (ACGIH), and the Environmental Protection Agency (EPA). Respiratory protection must not be considered a substitute for installing engineering controls to reduce hazardous conditions. When engineering controls are not possible or feasible, in case of an emergency, or when working with carcinogens, these respiratory protection measures must be implemented.

-
- A. **General Requirements.** Assign respirators only to workers who have been determined by a physician to be physically able to perform the work and use the equipment. The physician should determine which health and physical conditions are limiting. The respirator user's medical status should be reviewed annually by a physician.
1. **Personnel in charge of operating activities** must route all requests for the requisition of respirators through the safety manager for approval to ensure that the proper equipment is properly matched to the level of hazard. Acquisition of the equipment is the responsibility of the operating activity.
- B. **Classification and Description of Respiratory Protective Devices.** Respiratory protective devices generally fall into two categories: air purifying and atmosphere supplying.
1. **Air-purifying respirators** remove contaminants from the atmosphere. This type of respirator cannot be used in oxygen-deficient atmospheres. Half-mask respiratory devices cover the nose, mouth, and chin, and do not afford protection against eye irritation from exposure to airborne contaminants. Full facepiece devices cover a larger facial area, including the eyes.
 2. **Air-supplying devices** are used in oxygen-deficient atmospheres, defined as less than 19.5 percent oxygen.
- C. **Respirator Training.** Qualified personnel must conduct training for both supervisors and workers. Training must be documented and maintained by the local field office. Minimum training includes the following:

1. Instructions on the nature of the hazards (whether acute, chronic, or both) and a description of what may happen if the respirator is not used.
 2. A discussion of the respirator's capabilities and limitations, including recognition of the end of the service life of cartridges/canisters or filters (e.g., tasting or smelling of contaminants), manufacturers' expiration date, or increased breathing resistance.
 3. Classroom and field training to recognize and cope with emergency situations.
 4. Instructions on cleaning and maintaining a respirator.
- D. **Training Records.** Local records of respirator training, facepiece fit, and leak testing must be kept for at least the duration of employment of the user or as specified by specific contaminant exposure.
- E. **Facepiece Fit and Leak Testing.** Each respirator wearer must receive fitting instructions, including demonstrations and practice on how the respirator is to be worn, how to adjust it, and how to determine whether it fits properly.
1. Before initial use, each respirator must be properly fitted, leakage tests performed, and the face piece seal tested.
 2. Good face piece-to-face seals cannot normally be obtained when the wearer has a beard, long sideburns, or a skull cap that projects under the face piece. Facial deformities, such as scars, deep skin creases, prominent cheekbones, severe acne, and the lack of teeth or dentures can prevent a respirator from sealing properly. Individuals with any of these

conditions should be precluded from using any respiratory protection devices.

3. Sealing tests for routine donning of respirators, which consist of both positive and negative pressure tests, must be performed each time the respirator is worn.
4. Warning properties. Odor, as well as eye and respiratory irritation, should alert the wearer that the respiratory protection is malfunctioning or inadequate. This may be the result of improper facepiece fitting, old/inappropriate cartridges or canisters, etc. The worker should leave the hazardous area and rectify the problem. The worker must notify the supervisor if the condition persists. It should be noted that some chemicals and substances have no warning properties.

F. **Maintenance and Cleaning.** When respirators are issued to individuals, the responsibility for primary maintenance and cleaning of the respirator rests with the user. Equipment must be properly maintained, in accordance with manufacturers' specifications, to retain its original effectiveness.

7.4 **Hearing-Conservation Program.** USGS's hearing conservation program must comply with 29 CFR 1910.95 and address the points identified in the following:

A. **General Requirements.** Implement hearing conservation programs at workplaces where noise exposures for an eight-hour time-weighted average (TWA) are 85 decibels measured on the A scale (dBA) or higher. The exposed employees must be provided with, and required to use, hearing protectors. Workplaces where exposure to noise equals or exceeds an eight-hour TWA of 85 dBA (permissible exposure during an eight-hour shift)

must be identified and employees' hearing tested annually.

1. Warning signs indicating high noise levels and the requirement that hearing protectors must be worn shall be posted in work areas or on equipment where the noise level is 85 dBA or higher.
2. Audiometric test results will be maintained in the employee's medical folder as required by 29 CFR 1910.95.
3. No employee will be exposed to the following noise levels without protection in excess of 115 dBA for one-fourth hour or in excess of 85 dBA eight-hour TWA.
4. Employees or their representatives will be provided noise measurements upon request. Audiogram results will be provided to tested employees.

B. Identification of Exposed Employees. A roster will be maintained at the local level of employees at risk to noise hazardous situations and revised as necessary. These employees must be included in all aspects of the hearing-conservation program.

C. Hearing-Protection Devices. Supervisors shall provide and replace as necessary a variety of hearing-protection devices (HPD) for all employees in a designated high-noise area. Hearing protection is provided at 85 dBA and is mandatory at 90 dBA.

1. Each employee will use and maintain the HPD as originally intended. Re-usable insert type HPDs should be disposed of or cleaned after each use and stored in a sanitary location.

2. Supervisors will evaluate the HPD for effectiveness in the particular environment in which it will be used.
3. Employees shall be trained in the selection, use, and maintenance of HPDs and shall be responsible for using them in designated high-noise areas.

7.5 **Hazard Communication Program.** The Hazard Communication Program (Employee Right-to-Know) encompasses handling and storage of hazardous materials (products) in the workplace. The Hazard Communication Program does not apply to hazardous waste, tobacco or tobacco products, wood or wood products, articles (as defined in 29 CFR 1910.1200(c)), food, drugs, cosmetics, alcoholic beverages, or products/ substances used in the workplace in the same manner as household use.

- A. **Manufacturers' Instructions.** Manufacturers' instructions for safe handling and storage should be followed.
- B. **Hazard Determination.** The manufacturer, supplier, or employer must evaluate chemicals to determine the hazards. Normally, this evaluation is done by the manufacturer and provided via a Material Safety Data Sheet (MSDS).
- C. **Material Safety Data Sheet.** The MSDSs are to be available at the point of use. Consult the product MSDS for information regarding:
 - Physical and chemical characteristics (flash point, vapor pressure)
 - Physical hazards (fire, explosion, reactivity)
 - Health hazards
 - Primary routes of entry
 - Permissible Exposure Limit (PEL) or Threshold Limit Value (TLV)

Carcinogenicity
Safe handling procedures
Control measures (engineering controls,
work practices, PPE)
Emergency and first-aid procedures

D. **Employee Training.** Supervisors shall ensure that employees using hazardous materials have been trained as mandated in 29 CFR 1910.1200 Hazard Communication Standard.

E. **Hazard Communication Plan (HazCom Plan).** Each facility is required to have a written HazCom Plan. That plan includes information on:
Site-Specific Policy
Nonroutine Tasks
Employee Information
Informing Contractor Employees
Inventory of Hazardous Materials

F. **Labeling.** All products must be properly labeled to include:

Contents
Appropriate Warning
Name and Address of Manufacturer
Cross-check with MSDS

Note: Pesticides are excepted from the HazCom labeling requirements.

G. **Storage/Handling of Hazardous Materials.** Storage/handling of flammable and combustibles shall be in compliance with 29 CFR 1910.106. This is outlined under Topic 11, Materials Handling and Storage.

7.6 **Hazardous Materials Management.** The USGS is required to comply with all Federal environmental and safety laws and regulations governing storage, handling, and use of hazardous materials, and

governing disposal of hazardous waste. USGS must also comply with state hazardous materials laws and regulations, as required.

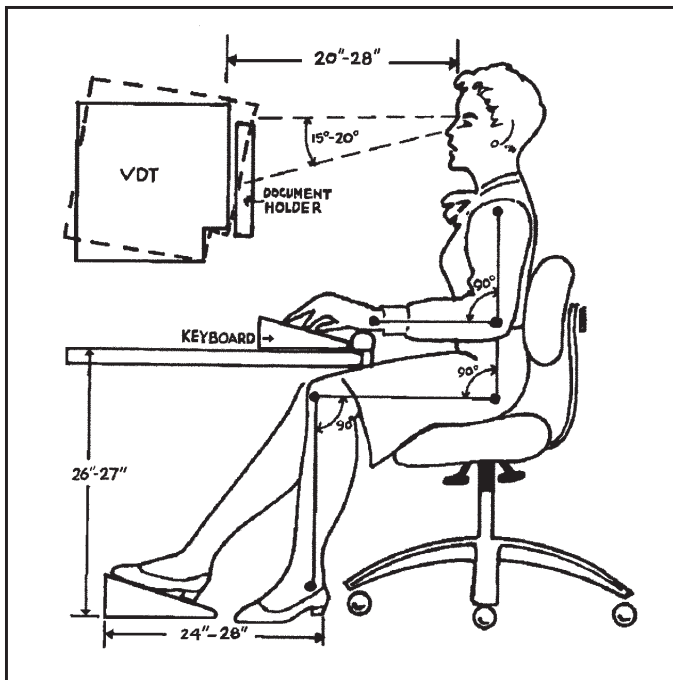
- A. **Hazardous Materials in the Field.** Any employee may encounter hazardous materials situations in the field. Hazardous materials or waste may be found on public lands in a variety of forms, such as clandestine drug lab waste, mining wastes, midnight dumping, and transportation accidents. USGS employees who may encounter such situations in the field must be trained as mandated by OSHA 1910.120(q), First Responder Awareness Level, to recognize, retreat, and report any discovery.
1. **Clandestine Drug Lab Waste.** This waste material is often the result of illegal manufacturing of the drug commonly known as “methamphetamine” or “crank.” The waste may look like household garbage at first glance. Drug lab waste can be identified by the presence of gallon plastic jugs, large plastic bags, 5-gallon buckets, and various laboratory equipment (beakers and tubes). Drug lab waste may contain any number of chemical combinations and should be considered dangerous. Employees shall retreat from the area immediately, and report to the program manager (i.e., Supervisor, HazMat, Law Enforcement Ranger, or Special Agent). DO NOT examine, investigate, touch, smell, or taste such waste for any reason.
 2. **Midnight Dumping.** The presence of barrels or other containers, discoloration of land, plants, or water, and the presence of dead vegetation or animals may recognize a midnight dumping on public lands. Upon discovery of midnight dumping waste, retreat from the area immediately and report to the

program manager (i.e., Supervisor, HazMat, Law Enforcement Ranger, or Special Agent). If you discover a midnight dumping site, remember that **self-protection is your primary responsibility.**

3. **Transportation Accidents.** Truck, rail, or pipeline accidents on public lands may result in danger to life, property, or resources. When encountering such an accident, take steps to protect yourself by retreating from the area and reporting to the District Hazardous Materials Coordinator.

- 7.7 **Ergonomics.** Ergonomics is the study of the relationship between the worker and the work environment. It recognizes that work methods, equipment, facilities, and tool design all influence the worker's fatigue, motivation, productivity, and the likelihood of sustaining an occupational injury or illness.
- A. **Principles of Ergonomics.** The objective of ergonomics is to adapt the job and workplace to the worker by designing tasks, workstations (see Illustration 7-2), controls, displays, safety devices, tools, lighting, and equipment to fit the worker. Some jobs expose workers to excessive vibration and noise, eye strain, heavy lifting, and repetitive motion. Also, workplace temperature extremes may aggravate or increase ergonomic stress.

Illustration 7-2



- B. **Types of Injuries.** Pulled or strained muscles, ligaments, tendons, and disks are the most common back problems. The majority of workplace back disorders result from chronic or long-term injury to the back rather than from one specific incident. Back disorders are frequently caused by excessive or repetitive twisting, bending, and reaching; carrying, moving, or lifting loads that are too heavy or bulky; staying in one position for too long; poor physical condition; and poor posture.

Cumulative trauma disorders (CTDs) are disorders of the musculoskeletal and nervous systems that are caused or made worse by

repetitive motions or prolonged activities. Other risk factors for cumulative trauma and back disorders include:

1. forceful exertions, usually with the hands,
2. pinch grips,
3. prolonged static postures, either sitting or standing,
4. awkward postures of the upper body, including reaching above the shoulders or behind the back,
5. excessive bending or twisting of the wrist,
6. continued elevation of the elbow,
7. inappropriate or inadequate hand tools,
8. restrictive workstations and inadequate clearances,
9. vibration from power tools,
10. improper seating or support,
11. poor body mechanics, and
12. lifting heavy objects or objects of abnormal sizes.

The combined effect of several risk factors often results in the onset of CTDs.

- C. **Hazard Prevention and Control.** Ergonomic hazards are prevented primarily by the effective design of a job or job site and the tools or equipment used in that job. Based on information obtained in an analysis of the work site, procedures can be established to correct or control ergonomic hazards using the following methods:

1. **Engineering Controls.** Workstations should be designed to accommodate the full range of required movements of the workers who are actually using them to perform the job. Attention should be given to prolonged or sustained exertion of a body part, proper work activity height, the reach at which tasks are

performed, and the force requirements. Other factors to look at include hard or sharp edges, contact with thermally conducting work surfaces, proper seating, workpiece orientation, lighting, and layout of the workstation.

2. **Work Practice Controls.** Key elements include instruction in proper work techniques, employee training and conditioning, regular monitoring, feedback, adjustments, modification, and maintenance. For example, after employees are trained in a particular work activity, such as proper lifting, workers should be monitored to ensure that they continue to use proper techniques. Improper practices should be corrected to prevent injury.



TOPIC 8
**PERSONAL PROTECTIVE
CLOTHING AND EQUIPMENT**

8.1 References

A. OSHA Standards. Subpart I Personal Protective Equipment.

29 CFR 1910.132 General Requirements

29 CFR 1910.133 Eye and Face Protection

29 CFR 1910.134 Respiratory Protection

29 CFR 1910.135 Occupational Head Protection

29 CFR 1910.136 Occupational Foot Protection

29 CFR 1910.137 Electrical Protective Devices

29 CFR 1910.252 Welding

29 CFR 1910.1030 Bloodborne Pathogens

B. 29 CFR 1926 Subpart E Personal Protective and Life-Saving Equipment

SM 445-2-H, Chapter 26 Personal Protective Equipment

8.2 **Procedures.** Field offices shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE). Refer to 1910.132 General Requirements for guidance.

A. **Using the Job Hazard Analysis to Determine Appropriate PPE.** The Job Hazard Analysis (JHA) process is used to identify hazards in a job task (see Topic 1). The JHAs are reviewed by the local safety manager to ensure PPE meets appropriate standards (ANSI, NIOSH, MSHA).

B. **Mandatory Use of PPE.** When specific PPE is found necessary and is purchased, it is mandatory for the employee to use such equipment. Should an employee fail to do so, it is the supervisor's responsibility to take the necessary steps to ensure compliance, including appropriate disciplinary action within the guidelines of DM 370.

8.3 **Eye and Face Protection.** Protective eye and face shields shall be required when there is a reasonable probability of injury that can be prevented by use of such equipment. Eye protection shall meet ANSI 287.1.

A. **Goggles and Glasses.** Use goggles, safety glasses, face shields, or welder helmets when subjected to the following:

1. Small flying particles when cutting, drilling, scaling, and grinding metals; cutting, chipping, or dressing stone and brick; wood working; overhead pruning; brushing; and machine plating.
2. Flying objects when hand drilling, chipping, caulking, riveting, quarrying, rock cutting and crushing, or when using a cyclone seeder or brush cutter.
3. Concentrations of cement or other dust, or dust and sand when sandblasting.
4. Hot metal when handling babbitt or pouring lead joints, or shaping metal on an anvil.
5. Gases, fumes, and liquids when handling acids and caustics such as sulfuric or muriatic acids, ammonia or creosote.
6. Injurious radiant energy and flying hot particles.

7. Grinding wheels. Wear goggles, glasses, or face shields at all times when using grinders or buffer wheels.
8. Welding. Appropriate eye protection shall be worn. Refer to 29 CFR 1910.252(e)(2) when purchasing eye protection.
9. In field situations where eye injury hazards such as brush, twigs, and limbs exist.

B. Care of Goggles.

1. Keep goggles in protective containers.
2. Wipe the lenses frequently with a clean cloth or soft tissue.
3. Keep goggle frames, including side screens, free from dust and grit.
4. Change headband frequently, keeping the webbing flat.
5. Treat lenses to prevent fogging when necessary, or use goggles ventilated around the lenses.
6. Replace goggles when they become scratched, pitted, or otherwise damaged in a way that inhibits visibility.

8.4 **Head Protection.** Protective headgear shall be required where there is a reasonable probability of injury, which could be prevented by use of such equipment. Refer to 29 CFR 1910.135. Head protection shall meet ANSI 289.1 standards.

- A. **Hard Hats.** Hard hats must be worn when working in all construction activities, working in confined spaces, or engaged in active fire suppression work.

Hard hats must be worn if there is danger from falling or flying objects or in timber areas due to danger of falling loose bark, limbs, or weak tops.

- B. **Nonconductive Hard Hats.** Wear electrically insulated hard hats, if working near electrical conductors.

- C. **Proper Fit and Care.** Adjust headband and hammock to fit snugly, with an air space of one-half inch or more between the head and top of crown of hat. Wear hard hat evenly centered to protect head properly. Clean and sterilize head band and hammock regularly. Integrity of head protection is essential; therefore, head protection shall be replaced when it becomes dented or damaged (some paints weaken integrity).

- 8.5 **Respirators.** Use of respirators shall be required when there is a reasonable probability of injury that could be prevented by use of such equipment. Respirators must provide adequate protection against the particular hazard for which they were designed and must be approved by the National Institute for Occupational Safety and Health (NIOSH) and Mine Safety and Health Administration (MSHA). Refer to Topic 7 of this Handbook.
- 8.6 **Hand Protection.** Use of hand protection shall be required when there is a reasonable probability of injury that could be prevented by use of such equipment. Appropriate hand protection will be provided for the task. It is especially important when working with chemicals to ensure that the appropriate glove is selected for the chemical being used.
- 8.7 **Safety Belts, Ropes, and Nets.** Employees must use safety belts, ropes, and nets on unguarded above-ground surfaces over excavations, moving machinery, swift or deep waters, on steep slopes, or where there is danger of falling.

- A. **Inspection of Safety Belts.** Inspect safety belts for worn, dry, hard leather; pliability; worn or broken stitching; cuts; cracks; loose rivets; worn buckles, snaps, rollers, tongues, D-rings, etc. Check safety ropes and nets frequently for broken fibers. Twist the strands back to check. Never weaken safety belts or straps by punching extra holes in them.

8.8 **Out-of-the-Ordinary PPE.** The selection of appropriate out-of-the-ordinary PPE, such as safety boots, prescription eyewear, etc., must be made in consultation with local safety managers/coordinators.

- A. **Procedures for Purchase.** Use the following procedures to document the need for out-of-the-ordinary PPE, secure approvals, and initiate procurement:
1. The employee or his/her supervisor initiates requests for PPE.
 2. The supervisor and the employee(s) shall work together to develop a JHA that identifies job hazards and proper abatement procedures. PPE will sometimes be part of this hazard abatement. The JHA will be reviewed by the safety manager or specialist to ensure compliance with OSHA standards, USGS policy, and ensure that PPE meets appropriate standards.
 3. The supervisor is responsible for providing the servicing procurement office with the signed requisition and a copy of the JHA for acquisition. Where credit cards are used, the JHA will be necessary.



TOPIC 9

FIRE SAFETY

9.1 References

- A. 29 CFR 1910.35-39 Means of Egress
- B. 29 CFR 1910.157-165 Portable Fire Suppression Equipment
- C. 29 CFR 1926.150-155 Fire Protection and Prevention
- D. National Fire Codes
- E. Uniform Building Codes
- F. National Fire Protection Association (NFPA) 101 Life Safety Code
- G. 485 DM Chapter 19
- H. SM 445-2-H, Chapter 36, Fire Safety

9.2 **Procedures.** The responsible Bureau official must ensure that buildings and facilities are inspected annually by qualified safety inspectors.

- A. **Detection Devices.** All Bureau facilities used to house employees and their families on a year-round basis must be equipped with approved smoke-detection devices. Trailers and other facilities used as sleeping quarters by field crews must be similarly equipped.
- B. **Fire Extinguishers.** Place approved and appropriate fire extinguishers inside of repair shops and storage areas, or near oil or gas dispensers and other potential hazard areas. Fire extinguishers need to be placed near doors or other areas that have quick accessibility, and in a position that does not endanger personnel when a fire emergency arises.

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- C. **Exits.** Every building designed for human occupancy must be provided with a sufficient number of exits to permit the prompt escape of occupants in case of emergency.
1. One- and two-family dwellings are to have a second means of escape, in accordance with NFPA 101 21-2.
 2. Exits and the paths of approach and travel from exits must be maintained so that they are unobstructed and are accessible at all times. Widths of aisles and corridors must be in compliance with NFPA 101.
 3. All exits must discharge directly to the street or other open space that gives safe access to a public way.
 4. Exits must be marked by readily visible or suitably illuminated exit signs. Specifications for color and size of exit signs can be found in 29 CFR 1910.37.

9.3 **Emergency Procedures and Evacuation Plans.**

Every USGS business facility for employees, volunteers, or other personnel that is leased or USGS - owned must have an Emergency Procedures and Evacuation Plan that is current and posted on-site.

- A. **The plan shall address** emergency and evacuation procedures for fire and other emergencies such as bomb threats, chemical spills, earth quakes, sabotage/ecotage, public demonstrations, and civil disobedience. The plan shall be updated annually. The plan shall include the following:
1. Building evacuation routes.
 2. Procedures to account for evacuated employees.

3. Special duties, such as rescue, medical, and physically challenged assistance, and names of designated personnel.
4. Proper reporting procedures.
5. Names and job titles of emergency procedures personnel.

9.4 **Personal Safety for Fire Emergencies.** The Federal Hotel and Motel Safety Act of 1990 prohibits employees from staying at non-sprinkler-equipped hotels with more than three floors. Although approved hotels and motels will have smoke detectors and sprinkler systems, self-protection is essential.

- A. **Become familiar** with emergency exits, evacuation routes, fire extinguishers, fire alarms, emergency telephone numbers, first-aid supply locations, etc.
- B. **Do not use** elevators during fire emergencies.
- C. **Look over your room.** Take notice of what is outside the window and make sure it can be opened. Make sure there a smoke detector and that it appears to be operational.
- D. **If there is a fire, or a suspected fire,** before opening the door, feel the door and knob. If they are hot, do not open the door. Close vents and cover cracks around doors to keep smoke out of the room.
- E. **Get in the habit** of placing your room key and a flashlight where you can grab them on your way out of the room. Always take the key with you the key with you. You should close the door behind you to keep smoke and heat out of the room, but you may find conditions in the hall to be unbearable and need to return. The key is vital.

9.5 **Vehicle Fires.** The inherent danger from vehicle fires is from explosions, burns, and asphyxiation. Immediate response is key to your survival. Getting away from the fire is in your best interest. A frequent cause of vehicle fires has been ignition of dry grass by hot parts of vehicle exhaust systems — that is, catalytic converters. If there is time, the following actions can be taken:

- A. **Turn off ignition.**
- B. **Exit the vehicle** and use a fire extinguisher, if available. Use sand, dirt, blanket, or coat to smother flames if no extinguisher is available. Remember that water may be used, but petroleum fires react violently to water if it is not applied correctly.
- C. **Remember that** smoke from vehicle fires may emit noxious and/or fatal emissions from fabrics, petroleum, rubber, and plastics. Avoid these emissions or minimize them when possible.

9.6 **Prescribed/Wildland Fire Safety.**

- A. **Wildfire Hazards.** The wildland fire environment has hazards not normally found in a typical work environment, including lightning, fire-weakened timber (standing or down), rolling materials, entrapment by running fires, smoke, aerially delivered fire suppressants, heat exposure, dehydration, and many others. When these hazards are present, there are two options: not to enter the environment or to adhere to safe procedures.

B. 18 Situations That Shout, “Watch Out!”

18 Situations That Shout, “Watch Out!”

1. Fire not scouted and sized up.
2. No familiarity with location in daylight.
3. Safety zones and escape routes not identified.
4. Unfamiliar with weather and local factors influencing fire behavior.
5. Uninformed on strategy, tactics, and hazards.
6. Instructions and assignments not clear.
7. No communication link with crew members or supervisor.
8. Constructing line without safe anchor line.
9. Building fireline downhill with fire below.
10. Attempting frontal assault on fire.
11. Unburned fuel between you and fire.
12. Cannot see main fire; not in contact with someone who can.
13. On a hillside where rolling material can ignite fuel below.
14. Weather becoming hotter and drier.
15. Wind increases and/or changes direction.
16. Getting frequent spot fires across line.
17. Terrain and fuels make escape to safety zones difficult.
18. Taking nap near fireline.

C. **10 Standard Firefighting Orders**

10 Standard Firefighting Orders

1. Fight fire aggressively, but provide for safety first.
2. Initiate all action based on current and expected fire behavior.
3. Recognize current weather conditions and obtain forecasts.
4. Ensure instructions are given and understood.
5. Obtain current information on fire status.
6. Remain in communication with crew members, your supervisor, and adjoining forces.
7. Determine safety zones and escape routes.
8. Establish lookouts in potentially hazardous situations.
9. Retain control at all times.
10. Stay alert, keep calm, think clearly, act decisively.

- D. **Safe Fireline Procedures.** The wildland fire environment has many hazards, as stated above, but four basic hazards exist: lightning, fire-weakened timber (standing and down), rolling rocks, and entrapment by running fires.

When these hazards exist, there are two options: a) not to enter the environment, or b) adhere to safe procedures. The key to these safe procedures is "LCES."

1. LCES stands for “lookout(s), communication(s), escape route(s), and safety zone(s).” These are the same items stressed in the FIRE ORDERS and “Watchout Situations.” They should be viewed from a “systems” point of view, all interconnected and interdependent. Each should be evaluated independently, but also as a system. For example, the best safety zone is of no value if your escape route does not offer timely access when needed.
 2. A key concept — the LCES system is identified to each firefighter prior to when it must be used. The nature of wildfire suppression dictates continuous evaluation of LCES and, when necessary, re-establishment of LCES as time and fire growth progress.
- E. **Advise Employees.** Brief all employees concerning area hazards and safe work practices before they start to work. Maintain close supervision and communication at all times.
- F. **Fire Shelter.** Wildland fire personnel must carry a fire shelter and know how to use it. Employees participating in prescribed fire activities will carry fire shelters during ignition and holding.



TOPIC 10
**FIELD INJURY PREVENTION
AND FIRST AID**

10.1 References

- A. American Red Cross
- B. 29 CFR 1910.151 Medical Services and First Aid
- C. CFR 1910.1030 Bloodborne Pathogens
- D. SM 445-2-H, Chapter 24, Lyme Disease Protection Program
- E. SM 445-2-H, Chapter 25, Bloodborne Pathogen Program

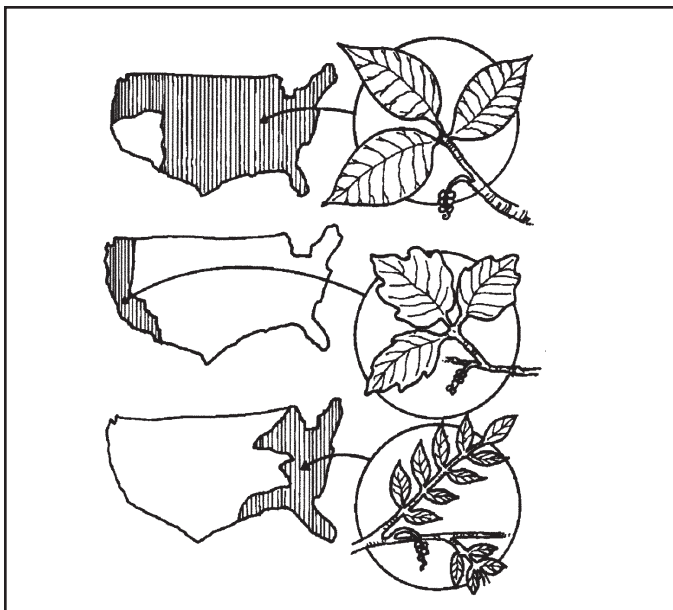
10.2 **Procedures.** All employees whose work assignment in the field places them beyond reasonable accessibility to a medical facility in terms of time and distance (15 minutes and/or 10 miles) must be trained to render first aid or be accompanied by someone who has a valid certificate in first aid and CPR.

- A. **Camp Safety.** First-aid kits should be available in two central areas (e.g., kitchen, shop area, recreation tent, project leaders tent, etc.). Kits should be large enough to accommodate the number of people in the crew.
- B. **Preventive Inoculations.** Preventive inoculations may be obtained for Rocky Mountain Spotted Fever, certain insect stings, poison oak and ivy, Hepatitis B, or other diseases. Hepatitis A Virus (formerly called infectious hepatitis) is excreted or shed in feces. Direct contact with an infected person's feces or indirect fecal contamination of food, the water supply, raw shellfish, hands, and utensils may result in sufficient amounts of virus entering the mouth to cause infection. Hepatitis B Virus (HBV; formerly called serum hepatitis) is spread through sexual contact, blood transfusions, contaminated needles, contact with body fluids, or from mother-to-child at birth.

1. Inoculations may be obtained at Bureau expense.
2. Inoculations may be administered only if it can be clearly shown that conditions warrant preventive inoculations, that the inoculations are necessary to protect employee health, and that the official duties of the employees expose them to contact by poison or disease.

10.3 **Poisonous Plants.** Instruct all employees subject to exposure to poison sumac, oak, and ivy on how to identify them (see Illustration 10-1). Take extra precautions with persons known to be highly sensitive to poison sumac, oak, and ivy. If practical, do not assign allergic people work in areas where exposure could occur.

Illustration 10-1



A. Identifying Poisonous Plants

1. **Wear proper field attire.** Since dried poison oak resin on clothing can cause a rash if it touches the skin, wash clothing at regular intervals — daily if you are very sensitive.
2. The palms of the hands rarely are affected, but poison oak resin can be transferred from the hands to other parts of the body. It can be removed by rinsing the affected areas with water. Wash hands before urinating. Be careful about wiping sweat from the face and around the eyes with your hands.
3. **DO NOT** use unidentified leaves as emergency toilet paper in the field.
4. Tools can also be contaminated with the resin. This can be removed by rinsing them with water.
5. **DO NOT** attempt to desensitize yourself by eating the leaves. This can cause severe lesions in the mouth, and around the rectum, and can cause kidney damage.
6. **DO NOT** stand in the smoke of fires made of brush; it may contain unburned particles of poison oak.
7. **DO NOT** use a leaf mulcher in areas with poison oak unless your legs and arms are covered and you are wearing a face shield.

10.4 **Poisonous Insects (Arthropod Stings and Bites).**
See Topic 38.

10.5 **Poisonous Snakes.** Snakes tend to be temperaturesensitive. At cool to cold temperatures, they are slow and lethargic; at hot temperatures, they are

quick, but also uncomfortable and will seek cool shelter. On a cool morning, the snake may be sunning on a warm ledge; in the heat of the day, it might be under a rock or brush where it is cool. Be aware also of these other characteristics:

Snakes have excellent camouflage, so train your eye to see the correct shapes and colorations.

Don't underestimate the speed and agility of a snake. Rattlesnakes can strike over a distance of about one-half their length and can strike faster than you can jump. Give them a wide margin.

Wear clothing and appropriate boots. Be careful when walking in back country, especially if ground is obscured by foliage. Walk on clear paths as much as possible. Don't step over a large log without looking on the other side first.

Watch where you are putting your feet and hands at all times. Don't pick up rocks or other objects that might conceal a snake. Use a tool to turn the rock over first.

- A. **First Aid for Snake Bites.** If medical help can be secured within one hour, no first-aid measures are necessary.
1. Keep still; avoid panic.
 2. Get away from the snake.
 3. Apply constricting band, 2-inches wide, above the bite.
 4. Immobilize extremity.
 5. Do not give aspirin.
 6. Remember that not all strikes by rattle-snakes deposit venom. If there is an absence of pain

and swelling shortly after the strike, it was probably a “dry bite.” In such a case, extraordinary measures are not indicated. “Dry bites” occur about 20 to 25 percent of the time.

- 10.6 **Cold Injuries.** Hypothermia and frostbite are the two most common types of cold injuries. Frostbite is local cooling. Most commonly affected are the ears, nose, hands, and feet. When a part of the body is exposed to intensely cold air or liquid, blood flow to that particular part is limited by the constriction of blood vessels. When this happens tissues do not receive enough warmth to prevent freezing. Ice crystals can form in the skin. There are three degrees of frostbite.

A. Types of External Cold Injuries (Frostbite)

1. **Frostnip** is the first stage of frostbite, brought about by direct contact with a cold object or exposure of a body part to cold air. Wind chill and water chill also can be major factors. This condition is not serious. Frostnip develops slowly, and often a person is not aware of the condition until someone calls attention to it. The affected part blanches, or becomes discolored or pale. As the cooling process continues, numbness replaces any sensation of cold or discomfort.
 - a. **Treatment.** A person afflicted with frost nip usually cares for the problem by gently warming the affected body part, holding it in his or her bare hand, blowing warm air on it, or, if fingertips are involved, holding them in the armpits. If for some reason a person is unable to do this alone, another person can take the same steps. Transfer the frostbite victim to a medical facility if it appears he or she has suffered more than a mild case of frostnip.

2. **Superficial Frostbite** is commonly called “frostbite”. The outer and inner layers of skin become involved. If frostnip goes untreated, it becomes superficial frostbite. The affected part becomes discolored and pale. It will feel frozen to your gentle touch. However, when the skin is gently pressed, it will feel soft and pliable beneath the frozen area.
 - a. **Treatment.** Superficial frostbite treatment includes applying a cover and gentle handling of the affected part. If transportation to a hospital is delayed, apply steady warmth by submerging the body part in warm water. The skin turns purple during thawing and can be painful. The person should receive follow-up medical care.

3. **Deep Frostbite** is where the inner and outer layers of the skin and the deeper structures of the body are affected. Muscles, bones, deep blood vessels, and organ membranes can become frozen. The affected part becomes a mottled or blotchy blue or gray. The tissue feels frozen to the touch, without the underlying resilience that is characteristic of superficial frostbite.
 - a. **Treatment.** Emergency care for deep frostbite requires the victim to be immediately transported to a hospital. Dry clothing over frostbite will help prevent further injury. The frostbitten part should not be rubbed. Do not apply ointment or cover frostbitten parts with snow. If the tissue is frozen, keep it frozen until care can be initiated. Also, never initiate thawing procedures if there is any danger of refreezing — keeping the tissue frozen is less dangerous than submitting it to

refreezing. If blisters appear, do not open them.

B. Types of Internal Cold Injuries (Hypothermia).

Hypothermia is caused by exposure to cold. It is a condition that occurs when inner body temperature drops to a subnormal level. It impairs a person's ability to think and act rationally and can cause death. It is accelerated by wet or damp clothing, wind, exhaustion, or sudden contact with cold water.

1. **Detection of Hypothermia.** Watch for symptoms of hypothermia in yourself and others whenever outdoors. The following are symptoms of hypothermia:
 - a. Uncontrollable spells of shivering or continuous shivering over a long period of time.
 - b. Slurred or slow speech; incoherent and vague statements.
 - c. Memory lapses.
 - d. Fumbling hands; frequent stumbling; lurching gait.
 - e. Drowsiness.
 - f. Exhaustion — inability to get up after a rest.
2. **Treatment.** Move the victim of hypothermia to shelter and warmth as quickly as possible. If shelter is not readily available, immediately build a fire to warm the person. Prevent further heat loss.
 - a. Handle the victim with care and prevent

him or her from walking around.

- b. If the victim is only mildly impaired, give him or her warm drinks (do not give alcohol) and get him or her into dry clothes and a warm sleeping bag.
- c. If the victim is semiconscious or worse, try to keep him or her awake. Remove the victim's clothing and put him or her in a sleeping bag with another person, also stripped, allowing that person's body heat to warm the victim.
- d. Transport the victim to the nearest medical facility. Transport him or her gently and keep the victim lying down, as still as possible.
- e. Do not ever assume that a person suffering from severe hypothermia is dead, even though he or she may appear to be. There may be no detectable heartbeat, breathing, or any other sign of life. CPR can be given en route to a hospital.

3. **Prevention.** The best defense against hypothermia is to avoid exposure. Recognize hypothermia-producing weather and dress for it. Choose clothing that will keep the body dry and warm. Check weather conditions and be familiar with the area before trips. Prepare and pack a survival kit to be carried by each person.

10.7 **Heat-Related Injuries.** The body's chemical activities take place in a limited temperature range. They cannot occur with the efficiency needed for life if the body temperature is too high or too low. Heat is generated as a result of the constant chemical processes within the body. A certain amount of this heat is required to

maintain normal body temperature. Any heat that is not needed for temperature maintenance must be lost from the body or hyperthermia, an abnormally high body temperature, will ensue. If allowed to go unchecked, it will lead to death.

- A. **Heat Cramps** are severe muscle cramps, usually in the legs or abdomen, brought about by dehydration and exhaustion, and sometimes accompanied by dizziness and periods of faintness.
1. **Treatment.** Move the victim to a nearby cool place. Give person water to drink, or half-strength commercial electrolyte fluids. Massage the “cramped” muscle to help ease the person’s discomfort.
- B. **Heat Exhaustion’s** symptoms include displays rapid and shallow breathing, weak pulse, cold and clammy skin, heavy perspiration, total body weakness, and dizziness that sometimes leads to unconsciousness.
1. **Treatment.** Move the person to a nearby cool place. Keep the person at rest. Remove enough clothing to cool the person without chilling him or her (watch for shivering). Fan the person’s skin. Give the person salted water or half-strength commercial electrolyte fluids. Do not try to give fluids to an unconscious person. At this stage, treatment at a medical facility is essential.
- C. **Heat Stroke** starts out with deep breaths, followed by shallow breathing, then rapid, strong pulse, followed by rapid weak pulse. The skin becomes hot and dry. The victim may lose consciousness, and seizures or muscular twitching may occur.
1. **Treatment.** Cool the victim rapidly in any manner. Move the victim out of the sun or

away from the heat source. Remove the victim's clothing and wrap him or her in wet towels and sheets. Pour cold water over these wrappings. Body heat must be lowered rapidly or brain cells will die.

- a. If cold packs or ice bags are available, wrap them and place them under victim's armpits, behind each knee, on the groin, on each wrist and ankle, and on each side of the his or her neck.
 - b. Transport the victim to a hospital as soon as possible. Should transport be delayed, immerse the person up to the face in a tub or container of cool (not cold) water. Constantly watch the victim so he or she does not drown. This is a life-threatening, heat-related emergency. CPR may need to be given.
2. **Prevention.** Reduce activity level immediately and seek a cooler environment. Stay in the shade. Keep food intake, especially intake of protein, to a minimum if sufficient water is not available, since protein increases metabolic heat production and water loss.
- a. Keep clothing on, including shirt and hat. Clothing slows the evaporation rate of perspiration and prolongs the cooling effect, in addition to giving protection from the sun.
 - b. Drink water to prevent dehydration.
 - c. Do not sit or lie on the hot ground. It can be up to 30 degrees hotter on the ground than it is just one foot above the ground. To avoid skin burns, avoid sitting on metal surfaces unless material is placed

between skin and place of contact.

- d. If foot travel is unavoidable, walk only at night and rest often.

10.8 **Lightning-Strike Injuries.** The passage of electricity through the body can either burn tissues or cause only muscle spasms or contractions. Vital nerve centers may be blocked, causing the heart or breathing to stop. Immediate revival should be attempted using appropriate artificial respiration and cardiac massage (CPR) techniques. Be assured, however, that a lightning-shock victim can be touched without any risk of shock to you.

10.9 **Altitude-Related Problems (above 8,000 feet).** Most difficulties at high altitude are a direct result of the lowered concentration of oxygen in the atmosphere. High-altitude pulmonary edema (excessive fluid in the lungs) usually occurs in the unacclimatized individual who rapidly ascends to an altitude that exceeds 8,000 feet, particularly if heavy exertion is involved. Symptoms include shortness of breath, coughing up white phlegm, weakness, easy fatigue, rapid heart rate (greater than 90 to 100 beats per minute at rest), nausea, vomiting, headache, insomnia, and acidic taste in mouth.

- A. The definitive treatments are descent to a lower altitude at which there were previously no symptoms and the administration of oxygen, if available, by mask at 10 liters per minute. Do not take sleeping pills, alcohol, or smoke cigarettes. Stop strenuous activity.

10.10 **Bloodborne Pathogens.** USGS must comply with OSHA standard 29 CFR 1910.1030. This standard establishes exposure determination, exposure control plan, engineering controls and safe work practices, personal protective equipment (PPE), housekeeping, training requirements, Hepatitis B vaccinations, and

postincident exposure requirements for employees with occupational exposure to blood and other fluids.

- A. **Scope.** This standard covers all employees who could, as the result of performing their job duties, be reasonably expected to come in contact with blood, or any body fluid visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids.

- B. **Exposure Determination.** USGS shall identify those employees and job classifications with occupational exposure to bloodborne pathogens, without regard to use of PPE.

- C. **Exposure Control Plan.** Where employees are identified as having occupational exposure, a written Exposure Control Plan shall be established to eliminate or minimize employee exposure. The plan shall include:
 - 1. **Housekeeping and Work Practice Controls.** The employer shall provide antiseptic hand cleaner and/or towelettes, as well as paper towels, where handwashing facilities are not available. Equipment that may be contaminated with blood or other potentially infectious material shall be decontaminated. The contaminated equipment must be labeled. Procedures must be developed for handling sharp objects, such as needles, glass, etc., and for prohibiting eating, drinking, smoking, etc., in work areas.

 - 2. **Personal Protective Equipment.** The employer shall provide, at no cost to the employee, appropriate PPE such as gloves, CPR face shields, bag type resuscitators, etc. The employee shall use the protective equipment when deemed necessary by USGS.

Disposable masks, gloves, etc., shall not be washed or decontaminated for reuse.

3. **Training.** Training must be provided for all employees whose job puts them at risk for an occupational exposure. Training must be provided initially, upon assignment, and cover the major elements of the bloodborne pathogens regulation.

 4. **Hepatitis B Vaccination.** This vaccination shall be made available, at no cost, to all employees who have the potential for occupational exposure to blood or other potentially infectious material. The vaccine should be administered within 10 working days of assignment. Employees must sign a declination form if they choose not to be vaccinated. The employee may later opt to receive the vaccine at no cost.
- D. **Post-Exposure Incident Evaluation.** This evaluation will address medical evaluation for exposed employees and incident evaluation to ensure corrective measures are taken and source testing is conducted.



TOPIC 11
**MATERIALS HANDLING
AND STORAGE**

11.1 References

A. OSHA Standards

29 CFR 1910.132 Personal Protective Equipment

29 CFR 1910.176 Handling Materials — General

29 CFR 1926.250 Materials Handling, Storage,
Use and Disposal

29 CFR 1926.550 Cranes and Derricks,
Helicopter, Hoists, Conveyors, etc.

29 CFR 1926.602 Material Handling Equipment

29 CFR 1926.953 Materials Handling

29 CFR 1926.1000 ROPS, Protective Frames,
Enclosures, etc., on Vehicles

- 11.2 **Procedures.** Observe established procedures and precautions when lifting, carrying, or otherwise handling heavy loads. Remember that weight, shape, and size of objects determine limits of safe handling. Don't overexert. If help is needed, get it. Use required personal protective equipment (PPE).

A. Lifting Heavy Loads

1. Inspect ground or floor area immediately around object.
2. Inspect route of travel for clearance and tripping hazards.
3. Examine object to determine safest way to handle. Check for snags, burrs, splinters, greasy surfaces, etc.
4. Wear protective gloves and safety shoes.

B. Lifting in a Proper Manner

1. Make a trial lift to be sure load can be handled safely.
2. Stand close to object, with feet solid and slightly apart.
3. Assume a crouching position close to load. Bend legs at knee.
4. Keep back as straight as possible without arching. Leg and arm muscles should do the work.
5. Secure a firm grip on object. Lift by straightening legs.
6. To shift the load to shoulder height or higher, bend knees. Rest object on a bench or ledge. Shift hands and boost.
7. Don't twist. Shift feet to turn body.
8. Make allowances for fatiguing effects of stairs and ramps.
9. Take precautions to avoid bruising or crushing hands and arms in narrow passageways.
10. Lower object in same manner in which it was raised. Take necessary precautions to keep fingers clear when placing object.

Illustration 11-1



C. When Two or More Persons Lift

1. Select persons of similar size and strength.
2. Station one person at rear to give predetermined signals or orders.
3. Carry long objects such as ladders, pipes, and lumber on shoulders on same side. Walk in step.
4. Handle packaged articles in boxes by grasping them at opposite top and bottom corners. Grasp sacked material by opposite corners.
5. Upending full drums is a two-person job. When rolling a drum, push hands on center of the barrel. Snub drums with safety ropes or other tackle on inclines or skids.
6. Provide help for handling odd-shaped objects if combination of irregularities and weight makes them hazardous for one person.

D. Equipment

1. Provide a wide range of tools, fixtures, jigs, hooks, crowbars, cribbing, rollers, blocks and tackle, slings, jacks, chain hoists, hand trucks, dollies, etc., for safe handling of materials and equipment.
2. Provide appropriate hand protection.
3. Inspect all tools and equipment frequently to ensure safe operating conditions.
4. Use bolted-down tool boxes to carry loose tools in vehicles. Fasten other materials securely so they don't shift and strike occupants in case of a vehicle accident, or drop out of vehicles.

11.3 **Powered Industrial Trucks and Tractors (Forklifts, etc.).** Each operator is responsible for the safe and careful handling of the equipment. Operators shall be qualified and authorized to operate such equipment, and the authorization shall be noted on individual training records. Equipment and operators shall be in compliance with OSHA 1910.178 and ANSI B56.1- 1969.

A. Minimum Forklift Operation Requirements

1. Falling Object Protective Structures (FOPS).
2. Backup alarm.
3. Capacity decal.
4. No passenger on lift.
5. No passengers on pallets.
6. Initial training and documentation.

B. Basic Safety Rules for Operating Forklifts

1. Before operating, check brakes, steering, horn, gas, oil, and water levels. Irregularities should be reported to supervisor.
2. Do not exceed the truck's rated capacity or the floor load limits. Take a good look at the load before picking it up. Consider its weight and balance. If load appears unsafe, split load or use other equipment.
3. Pick up load squarely and do not make quick or jerky starts and stops.
4. Never "butt" the loads with the forks or the rear end of a truck.
5. Always face the direction the truck is moving and maintain clear vision of the way ahead.
6. Keep arms and legs inside truck. Do not put them between the mast's uprights nor outside the running lines of the truck.
7. Passengers are prohibited on forklifts and forklift loads.
8. If following other trucks, maintain safe distance.
9. On wet or slippery floors, slow down. Use low gear when descending ramps.
10. Be sure the wheels of highway trucks and trailers at loading docks are chocked.
11. Make certain that bridge plates into trucks are wide enough, strong, and secured.

12. Don't cut corners. Before passing a doorway or turning a blind corner, slow down and sound horn.
13. When entering main aisles, intersections, or roadways, come to a full stop; look and sound horn.
14. Watch out for pedestrians.
15. Carry the loads of high-lift trucks 6 inches off the floor and tilted backward for better stability.
16. Always travel forward up ramps and in reverse down ramps.
17. When high-lift trucks are unloaded and in motion, keep their forks near the floor to prevent damage or injury.
18. Be careful in elevating loads. Watch out for overhead and wall obstructions, fire extinguishers, sprinklers, pipes, electrical conduits, switches, etc.
19. Use extreme caution in high tiering.
20. Do not use the fork of a high-lift truck as a personnel elevator, unless a safety platform is attached to the forks.
21. Lower loads slowly and stop gently. Never lift or lower when truck is in motion.
22. Park safely, without obstructing aisles. Before leaving a gas or diesel truck, turn off the engine.
23. Stop the engine when refueling.

24. Lock the truck or remove control handle when not in service.
25. Observe fire-prevention rules. Equip industrial trucks with a fire extinguisher, and make sure that drivers know how to operate it.
26. Use gas-, diesel-, or propane-fueled equipment in well-ventilated areas.
27. Forklift battery management:
 - a. Always wear the proper personal protective equipment when changing a battery.
 - b. Be aware of the nearest eyewash or shower station.
 - c. Shut off the engine.
 - d. Do not smoke or have an open flame in the battery-changing area.
 - e. Make sure the brake is set on the fork lift before changing the battery.
 - f. Make sure the battery-lifting device is secure operating lifting it.
 - g. Stand clear when moving the battery.
 - h. Make sure that the ventilation system is working properly before charging a battery.
 - i. Always add battery acid to water — never add water to battery acid.
 - j. If charging the battery on the forklift, uncover the battery compartment to

prevent the build-up of heat and hydrogen gas.

- k. Make sure that metal objects do not come in contact with the terminals on the battery.
- l. Make sure the charger is off before connecting it to the battery.
- m. Make sure the vent caps are not plugged.
- n. Make sure charger is properly connected to battery before plugging it into electrical outlet.

11.4 **Storage Yards.** Use a level, well-drained wareyard for storing materials, vehicles, equipment, etc. Storage yard should be fenced in with an 8-foot high, vandal proof fence.

- A. Provide adequate roadways and walkways for safe movement of personnel, trucks, lifts, and cranes, etc.
- B. Keep storage yards free of surplus material and obsolete equipment that clutter the area.
- C. Provide and maintain approved types of fire extinguishers in storage yards.
- D. Provide 5- to 8-foot corridors both inside and outside of perimeter fence to facilitate fire control and keep out rodents and snakes.
- E. Keep storage area free of vegetation, debris, and rubbish.
- F. Use cribbing to prevent direct contact with the ground. Dunnage may inhibit bottom ventilation.

- G. Use tarpaulins to protect materials subject to weather and sun damage.
 - H. Arrange heavy pieces and palletized material in a manner that will allow for mechanical handling.
 - I. Block or nest round objects to prevent roll. If drums and kegs are piled on end, use planks between layers.
 - J. Stack piles of lumber. Make the height of the pile no greater than the width.
 - K. Use cross-binding and stepback methods when storing bagged material and masonry products.
 - L. Store reinforcing steel and small-diameter pipe on racks. Make permanent separations to prevent pulling from the pile.
 - M. Provide loading docks and hand trucks for moving heavy and bulky items.
 - N. Label all barrels according to their contents and properly dispose of unneeded barrels.
 - O. Sign flammable storage areas as “No Smoking” areas.
 - P. Ensure that surface of storage yard is protected from contamination by stored liquid materials.
- 11.5 **Warehouse Storage.** Store materials at safe distances from heating devices such as stoves, steam pipes, heating ducts, and radiators. Store materials in separate areas, according to the degree of hazard. DO NOT defeat the effectiveness of fire sprinklers by placing stored materials within the restricted distances (18-inch clear space) established by National Fire Protection Association.

-
- A. Provide adequate aisle space for handling heavy or bulky bounded, stacked, or racked materials. Plainly define aisles and passageways. Keep them free of obstacles and other materials.
 - B. Plan storage to permit safe lifting and handling and prevent toppling. Don't load storage bins beyond safe capacity.
 - C. Keep tops of storage bins, racks, and cabinets free of material.
 - D. Provide racks designed to hold stock of pipes and bars.
 - E. Don't allow stored materials to exceed safe floor loads. Keep floors clean and in good repair.
 - F. Keep areas around warehouses and other buildings free of dry grass, vegetation, and debris. Take adequate fire-prevention measures to prevent loss or damage of stored materials.
 - G. Provide metal containers with tight-fitting covers for disposing of waste packing materials and rubbish. Never permit large amounts of waste material to accumulate in warehouse.
 - H. Provide adequate illumination for storage and warehouse operations. (See 29 CFR 1926.56.)
 - I. Store compressed gas cylinders in cool, dry, well-ventilated places. Close valves tightly. Keep protective caps in place. Place cylinders upright and fasten securely. Store cylinders compatibly. (For example, oxygen and acetylene must be stored separately.) Separate full and empty cylinders. See Illustration 11-2 for more information on compressed gas cylinders.

- J. Store corrosive and toxic liquids in a cool, dry, well-ventilated, isolated place, with concrete floors treated to reduce solubility.
- K. Segregate flammable materials or supplies from other items. Store flammable liquids, paints, oils, etc., in approved containers equipped with tight-fitting closures. Use metal storage cabinets and safety containers for even small quantities of flammable liquids.
- L. Provide good ventilation in buildings where flammable liquids are stored. Where mechanical ventilation, heating, lighting, or exhaust systems are necessary, install them in accordance with electrical and fire code requirements.
- M. Prohibit smoking in areas in which flammable liquids are stored or handled. Post “No Smoking” signs in these areas. Be sure this rule is strictly observed. Don’t store empty drums that have contained low-flash-point products (e.g., gasoline, acetone, alcohol, etc.) inside buildings.

11.6 Storage and Handling of Hazardous Materials

A. OSHA Standards

29 CFR Subpart H Hazardous Materials

29 CFR 1910.101 Compressed Gases
(General Requirements)

29 CFR 1910.102 Acetylene

29 CFR 1910.103 Hydrogen

29 CFR 1910.104 Oxygen

29 CFR 1910.105 Nitrous Oxide

29 CFR 1910.106 Flammable and Combustible Liquids

29 CFR 1910.107 Spray Finishing Using Flammable and Combustible Liquids

29 CFR 1910.108 Dip Tanks Containing Flammable or Combustible Liquids

29 CFR 1910.109 Explosives and Blasting Agents

29 CFR 1910.110 Storage and Handling of Liquefied Petroleum Gases

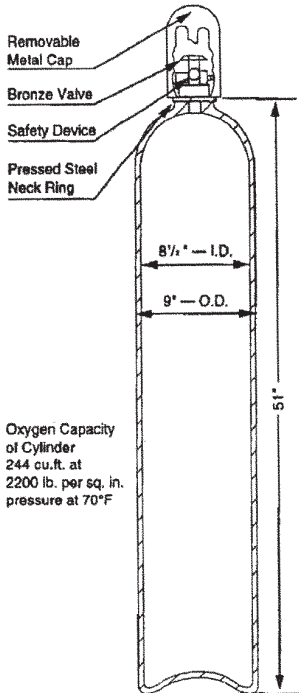
29 CFR 1910.111 Storage and Handling of Anhydrous Ammonia

Illustration 11-2

THE SLEEPING GIANT

I AM A HIGH PRESSURE, COMPRESSED GAS CYLINDER

I stand 57 inches tall.
I am 9 inches in diameter.
I weigh in at 155 pounds when filled.
I am pressurized at 2,200 pounds per square inch (psi).
I have a wall thickness of about .25 inch.
I wear a regulator and hose when at work.
I wear a label to identify the gas I'm holding. My color is not the answer.
I transform miscellaneous stacks of material into glistening ships and many other things — when properly used.
I may transform glistening ships and many other things into miscellaneous stacks of material — when allowed to unleash my fury unchecked.
I can be ruthless and deadly in the hands of the careless or uninformed.
I am too frequently left standing alone on my small base without other visible means of support — my cap removed and lost by an unthinking workman.
I am ready to be toppled over — when my naked valve can be damaged or even snapped off — and all of my power unleashed through an opening no larger than a lead pencil.
I am proud of my capabilities — here are a few of them:
— I have on rare occasions been known to jetaway — faster than any dragster.
— I might smash my way through brick walls.
— I might even fly through the air.
— I may spin, ricochet, crash and slash through any thing in my path.
You can be my master only under these terms:
— Full or empty — see to it that my cap is on, straight and snug.
— Never — repeat — never leave me standing alone.
Secure me so that I cannot fall.



B. Flammable and Combustible Liquids.

Flammable liquids are those that give off flammable or explosive vapors at or below 100°F (37.8C).

1. **Flammable liquids** (Class I) have a flash point below 100°F, such as:

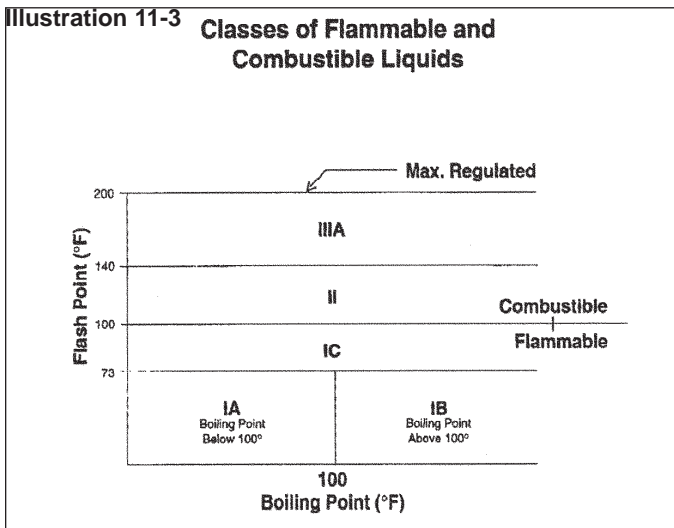
Gasoline 49

- Acetone 0
- Lacquer 0 to 80
- Shellac 40
- Ether 45
- Alcohol 52 to 91
- Varnish 80 or less
- Turpentine 95

2. **Combustible liquids** (Class II) that have flash points above 100°F and below 200°F include:

- Diesel Fuel 100
- Kerosene 150+
- Stoddard Solvent 100+
- Penetrating Oil 100+

3. **Class III Liquids** are those combustible liquids with flash points at or above 140°F, such as creosote oil, which is 165°F. See Illustration 11-3.





TOPIC 12

MACHINES AND TOOLS

12.1 References

- 29 CFR 1910.211 Definitions
- 29 CFR 1910.212 General Requirements
- 29 CFR 1910.213 Woodworking Machinery Requirements
- 29 CFR 1910.215 Abrasive Wheel Machinery
- 29 CFR 1910.219 Mechanical Power-Transmission Apparatus
- 29 CFR 1910.241 Definitions
- 29 CFR 1910.242 Hand and Portable Powered Tools Equipment — General
- 29 CFR 1910.243 Guarding of Portable Power Tools
- 29 CFR 1910.244 Other Portable Tools and Equipment
- 29 CFR 1910.252 Welding, Cutting, and Brazing
- 29 CFR 1926.300 General Requirements
- 29 CFR 1926.301 Hand Tools
- 29 CFR 1926.302 Power-Operated Hand Tools
- 29 CFR 1926.303 Abrasive Wheels and Tools
- 29 CFR 1926.304 Woodworking Tools
- 29 CFR 1926.305 Jacks
- 29 CFR 1926.350 Gas Welding and Cutting
- 29 CFR 1926.351 Arc Welding and Cutting

29 CFR 1926.352 Fire Prevention

29 CFR 1926.353 Ventilation and Protection

29 CFR 1910.268 Telecommunications

12.2 **Procedures.** Machines and tools shall be properly maintained, operated, stored, and inspected.

12.3 **Portable Hand Tools**

A. **Chopping Tools (Axe, Pulaski, Hoedad, etc.)**

1. Use the right tool for the job. Keep it well sharpened with a splinter-free handle and a tight head.
2. Treat the ends of ax handles and other swinging tools to prevent slippage. Inspect wedges for tightness.
3. When swinging an ax or similar tool, place feet firmly and shoulder-width apart. Grip handle near the end. Make sure there is ample clearance from objects and persons near the swing arc. Always chop away from feet, legs, and body. Guard against loss of grip or control of tool if a glancing blow is struck against the target object.
4. Sheathe all chopping tools when not in use. Never leave an ax or similar tool in normal path of movement or sticking in a tree or stump.
5. Observe safe spacing between crew members carrying sharp or pointed tools. Travel on foot in single file. Sheathe tools and hand-carry on the downhill side, but do not carry on shoulder. Keep other hand free. If tripping, slipping, or falling, throw the tool to the downhill side. Use both hands to regain balance or break fall.

6. Be watchful of the force released by cutting a sapling that is being held in a bowed position by adjacent trees or brush.
 7. Maintain 15-foot intervals between workers using tools.
 8. Allow overhead clearance when using a brush-cutting tool. Use the proper handhold. Keep body well braced and balanced. Make each stroke productive.
- B. **Chipping Tools.** Protect eyes from flying particles. Use screens to protect other persons from flying chips. Use tool holders when holding chisels or drills.
- C. **Wrenches.** Place the wrench on the nut so that pull on the handle tends to force the jaws further onto the nut. Make sure you have a good footing before applying force to the wrench. Pull, don't push, the wrench when turning the nuts.
- D. **Screwdrivers.** Never use a screwdriver as a chisel. Don't carry a screwdriver loose in pockets. Use a screwdriver with an insulated handle and shaft for all electrical work.
- E. **Hammers.** Select hammers with secure heads that are of suitable type, and weight, and have a proper handle length for the job to be done. Allow sufficient working space.
- F. **Picks.** Use picks with handles that are free from splinters and securely fastened to the head. When swinging a pick, make sure that you have overhead and side clearance.
- G. **Files.** Fit files with substantial handles and guards. Never use a file as a pry. Keep files clean to reduce slipping. Protect hands with proper gloves

when filing sharp objects.

- H. **Handsaws.** Keep handsaws properly sharpened. Use the thumb to guide the handsaw in starting a cut. Use teeth guards when carrying a crosscut or rip saw.

I. **Air Tools**

1. Wear specified personal protective equipment (PPE) when operating air tools, such as earplugs, protective shoes, respirator, gloves, etc.
2. Do not use air tools unless a fixture on the tool retains the replaceable bit or jack set. Inspect retainers daily for cracks.
3. Air hose couplings must have safety chains to keep them from whipping loose if coupling fails.
4. Place line oilers so that oil cannot drain back into the air tank.
5. Release pressure before connections are broken; do not kink hose.
6. Make sure no one is in line of airflow. Never aim an air hose at anyone.
7. If the tool becomes detached from air hose under pressure, turn air off at the base control valve before air is turned on. Keep it closed until hammer is ready to use.
8. Never use pressurized air to blow dust or chips from hair or clothing.

- J. **Chainsaws.** Follow manufacturers' operating and safety instructions. Training and PPE are required for chain-saw operators. Required PPE for chain-saw operators are chaps, ear, eye, face, head, foot, and hand protection. Other required

equipment includes wedges and a single-bit ax.

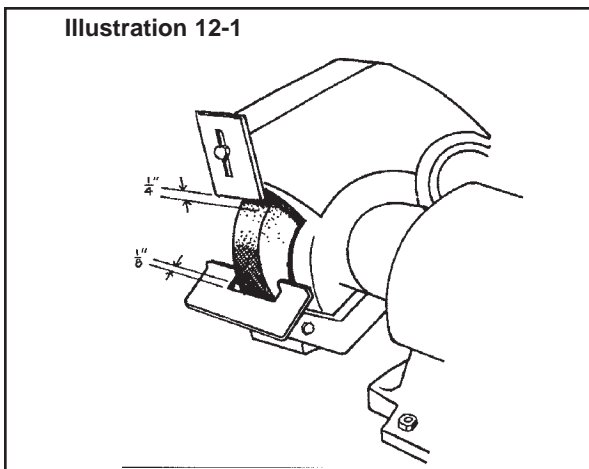
1. Stop and place the blade vertically before carrying a saw. The chain must be guarded. Carry saw on downhill side with blade to rear. Secure saw when transporting it in a vehicle.
2. Stop the engine and cool for about 5 minutes before refueling. Fill the fuel tank on bare ground. Wipe spilled fuel off the engine. Start saw at least 10 feet away from refueling area. Do not smoke while fueling or while saw is running.
3. Safe chain-saw starting techniques should be established and followed, always keeping the saw away from the body. Keep co-workers away from chain-saw starting and operation.
4. Stop engine for cleaning, adjustments, or repair.
5. Fuel tanks shall be purged prior to storage.

12.4 **Portable Electric Tools**

- A. Inspect and test all power tools regularly and maintain in good condition. Establish a definite schedule for inspection, testing, maintenance, and repairs. All electric tools must be three-wire grounded, and fault-interrupter protected, or double-insulated.
- B. Regularly test and maintain three-wire ground systems supplying electric power tools.
- C. Use only electric cords and plugs in good condition. Make sure tool cords do not become tripping hazards. Protect tool cords against insulation damage during use. Unplug tools when not in use.
- D. Do not operate power tools without training and

- authorization.
- E. Do not operate portable electric tools where flammable vapors or gases are present or in wet areas.
 - F. All portable electric circular saws must have automatic guards that completely cover the cutting edges when saw is not in use. Do not use cracked, bent, dull, or damaged blades.
 - G. Drill-chuck wrenches must be eject type. Unplug the tool when changing bits or accessories. Anchor any material being drilled.
 - H. Keep portable grinder guards in place. Tool rest must be one-eighth inch away from stone; tongue guard must be one-fourth inch away (see Illustration 12-1).
 - I. Inspect motor-driven grinding stones at least weekly for cracks. Discard defective stones.
 - J. Keep stones free from oil and properly dressed.

Illustration 12-1



- 12.5 **Radio Equipment.** AC-powered radio equipment cabinets must be locked, and keys must be available only to specially instructed and authorized radio technicians or personnel.
- A. Never use any radio or extend any antenna on a portable set if a lightning storm is within 1 mile.
 - B. Do not use radio transmitter within 300 feet of any electric blasting or any area where electric detonators are handled or stored.
 - C. Provide unextended whip antennas with safety knobs, closed loops, or other protective devices to prevent injury.
 - D. Only those qualified and trained may climb high structures. Wear appropriate PPE, such as safety belt, harness, etc., when climbing high structures. Do not work on energized antennas.

12.6 **Fixed Machines**

- A. **Woodworking and Metalworking.** Only qualified and authorized personnel may operate shop equipment. Personnel must not wear loose clothing, ties, or jewelry, or have loose hair that may catch in moving machinery. Required PPE must be used.
 - 1. Machines will be located to ensure adequate space for movement of the operator and handling of stock. Safety zones must be marked around each machine. Machine switches must be within immediate reach of the operator.
 - 2. Floor and work areas must be kept free of sawdust, scrap, and excess material.
 - 3. Machines designed for a fixed location shall be

anchored.

4. Machines must be shut down and locked in accordance with lockout/tagout requirements before authorized and experienced persons make repairs only.
5. Machines that are operating must be attended at all times.
6. No machines may be operated unless required guards are in place and functional.

12.7 **Compressors.** All tanks must be in compliance with the American Society of Mechanical Engineers (ASME) standard and conform with state laws.

- A. Make thorough monthly inspections for leaks and signs of corrosion on surfaces. Replace any worn parts and remove corrosion.
- B. Don't replace the brass fusible plug with an ordinary pipe plug.
- C. Clean or replace air filters as needed.
- D. Make sure that all pressure tanks or lines have safety valves, air-pressure gauges, and a drain cock at the lowest point on the tank that is opened at least monthly to drain the condensation.

12.8 **Welding and Cutting.** Allow only qualified welders, mechanics, machinists, or specially qualified personnel to use welding equipment.

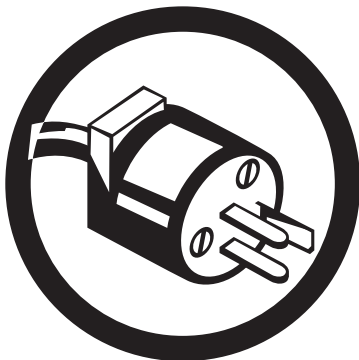
- A. Welders shall wear appropriate PPE.
- B. Confine welding activities to well-ventilated areas and away from flammable and combustible materials.
- C. Keep sparks and flames away from cylinders and hose lines. All flammable or explosive material in the areas of welding operations must be removed.

- D. Keep the correct type of fire-extinguishing equipment easily accessible at all times during welding operation.
- E. Before cutting into tanks or drums, determine the present or previous contents. Drain, steam clean, and thoroughly dry if they held oil, gasoline, or other highly flammable fluids. Fill with water up to the point to be welded. Leave an opening for steam generated during welding to escape.
- F. Use a respirator or point-of-operation exhaust ventilation when welding on metals coated with paint containing lead or zinc or when welding brass, because fumes from these metals are toxic. Adequate exhaust systems must be provided to ensure removal of injurious fumes and gases. If respirator is used, make sure that it is appropriately matched to the toxicity types and levels being generated, and that it meets all respiratory requirements in 7.3.
- G. Inspect hose lines and/or power cables frequently. Replace or repair damaged items.
- H. Curtains or screens must be used around all welding locations.

12.9 **Spray Painting.** Where spray-painting operations are regularly performed indoors, painting must be done in specially constructed, isolated, fire-resistant areas with approved electrical equipment. All motors, fixtures, switches, and electrical devices must be explosion-proof. All sources of ignition must be eliminated, and spray booths are to be fitted with sprinkler heads in accordance with National Fire Protection Association requirements.

- A. Only qualified and authorized personnel may operate painting equipment.

- B. Painting areas must have adequate ventilation to remove flammable and toxic substances. Respirators must be worn when spray painting.
- C. Smoking is expressly prohibited. A fire extinguisher of the correct type and size must be available.
- D. All paint labeled flammable must be stored and mixed in an approved flammable liquid storage cabinet or flammable storage shed.



TOPIC 13
**ELECTRICAL SYSTEMS
AND EQUIPMENT**

13.1 References

A. The National Electric Code

B. National Fire Protection Association (NFPA 70)

C. OSHA Standards — Subpart S — Electrical

29 CFR 1910.147 Control of Hazardous Energy
(Lockout/Tagout)

29 CFR 1910.211 Definitions

29 CFR 1910.212 General Requirements

29 CFR 1910.213 Woodworking Machinery
Requirements

29 CFR 1910.215 Abrasive Wheel Machinery

29 CFR 1910.219 Mechanical Power- Transmission
Apparatus

29 CFR 1910.241 Definitions

29 CFR 1910.242 Hand and Portable Powered
Tools Equipment — General

29 CFR 1910.243 Guarding of Portable
Power Tools

29 CFR 1910.244 Other Portable Tools
and Equipment

29 CFR 1910.252 Welding, Cutting, and Brazing

C. USGS Standards

29 CFR 1910.334 Use of Equipment
SM 445-2-H, Chapter 37, Lockout/Tagout Program

- 13.2 **Procedures.** Only trained and qualified personnel are to operate electrical devices in accordance with manufacturers' instructions applicable to the device. Supervisors are to ensure that all equipment (devices) identified as not meeting specifications contained in 29 CFR 1910 and the National Electric Code are properly tagged and removed from use.
- 13.3 **Inspections of Electrical Equipment.** Inspections of portable electrical devices shall be conducted prior to use and shall include: inspection of the service cord and plug; inspection of the case for cracks, corrosion, and loose or missing parts; inspection of on/off switches and "dead man" switches; inspection of guards over blades and rotating/reciprocating parts; and inspection of electrical filter assemblies.
- 13.4 **Other Electrical Appliances and Equipment.** Electrical appliances and equipment are defined as coffee pots, computer systems, fans, radios, clocks, typewriters, and other equipment not normally moved from one location to another. Only equipment listed by Underwriters Laboratories (UL) or other recognized certifying authority are allowed in the work space and shall be used only for their intended purpose. They shall be energized only through approved electrical outlets and power poles installed in accordance with the National Electric Code. Use of extension cords (flexible cords) for permanent installation of appliances and equipment, except as provided by the manufacturer as service cords, is prohibited. Use of electric space heaters is prohibited unless such heaters are equipped with tip-over safety switches and thermostat heat controls, and their use is authorized.
- A. If using extension cords in a temporary situation (not to exceed 90 days per Uniform Building Code of authority having jurisdiction), observe these safe practices:
1. Disconnect by pulling the plug, not the cord.

2. Replace when worn, frayed, or brittle. Don't splice, kink, allow to overheat, or come in contact with chemicals.
3. Use cord to operate one appliance only. Don't use cords in lieu of fixed wiring, and do not run through openings, attach to building surface, or conceal in walls, ceilings, and floors.
4. Protect from physical damage, keep them from being run over by wheeled equipment, etc.
5. Extension cords shall be used only as allowed in 29 CFR 1910.305(g).
6. It is good management practice to test extension cords for proper wiring, impedance, and plug tension.

13.5 **Electrical Work at USGS Facilities.** All work, repair, or maintenance will be performed only by a licensed electrician.

13.6 **Electrical Safety.** (See 29 CFR 1910.301-399) Use only UL listed wire and apparatus and only as intended.

- A. Ensure that breaker-box switches always indicate on the index the room, office number(s), and area or item where they control the electricity. Other markings indicating voltage, current, or wattage are required.
- B. Treat all loose wires hanging from buildings or poles as "hot," unless certain they are not connected to a live source of electricity.
- C. Exercise caution when installing or using fixed power equipment or portable power tools in hazardous or damp locations. Be careful when using household appliances in kitchens, bathrooms, or basements, because of the proximity to ground sources such as water pipes.

- D. Branch circuit receptacles should be tested periodically (annually) to ensure proper connection, low impedance, and tension.
 - E. De-energize switch before removing or replacing cartridge-type fuses.
 - F. Don't overload circuits. Where excessive use of appliances results in frequent fuse failure, redistribute plug-in appliances or install additional circuits. Don't change fuses to higher rating than wire size permits and do not use an alternate item as a fuse replacement.
- 13.7 **Electrical Equipment.** Keep electrical test equipment and hand tools in good repair. Restrict them to proper use.
- A. Use only nonconducting ladders for electrical work. Keep ladders clean and free from dirt.
- 13.8 **Power Lines.** Treat all power lines as dangerous. Notify power company in advance concerning work on or near power lines or installations. Have the electrical utility perform work for which they are responsible, such as tree trimming or other maintenance activities.
- 13.9 **Lockout/Tagout.** This policy establishes the minimum requirements for the lockout of energy-isolating devices whenever maintenance or servicing is done. It ensures that the machine or equipment is stopped, isolated from all potentially hazardous energy sources, and locked out before employees perform any servicing or maintenance, where the unexpected energization or startup of the machine, or release of stored energy, could cause injury. Authorized employees or contractors shall do servicing with these procedures followed at all times. All employees, upon observing a machine or piece of equipment that is locked out for servicing or maintenance, shall not attempt to start, energize, or use that machine or equipment.

This policy does not apply to cord-and-plug-connected electric equipment where unexpected energization of the equipment is controlled by unplugging the equipment and under the exclusive control of the person performing the service or maintenance.

A. Sequence of Lockout System Procedure

1. Notify all affected employees that a lockout system is going to be utilized and the reason for this step. The authorized employee will know the type and magnitude of energy that the machine or equipment utilizes and will understand the hazards.
2. If the machine or equipment is operating, shut it down by the normal stopping procedure (i.e., depress stop button, open toggle switch, etc.).
3. Operate the switch, valve, or other energyisolation device(s) so that the equipment is isolated from its energy source(s). Stored energy (such as that in springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc.) must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleed down, etc.
4. Lockout the energy-isolating devices with assigned individual locks with attached identification tags.
5. After ensuring that no personnel are exposed, and as a check to ensure that the energy sources are disconnected, operate the push button or other operating controls to make certain the equipment will not operate.
6. The equipment is now locked out.

B. Restoring Equipment to Normal Operation

1. After the servicing and/or maintenance is complete and equipment is ready for production, check the area around the machines or equipment to ensure that components are operational.
2. Check the work area to ensure that all employees have safely been positioned or removed from the area. Remove the lockout devices and tags, then re-energize the machine or equipment.

C. Multiple Lockout Procedures

1. If more than one individual is required to lock out equipment, each will place his/her own personal lockout device and identification tag on the energy isolating device(s). When an energy-isolating device cannot accept multiple locks, a multiple lockout device (hasp) must be used that allows the use of multiple locks to secure it. Each employee will use his/her own lock to secure the multiple lockout device complete with his or her identification tag.
2. When work is completed and each person no longer needs to maintain his or her lockout protection, that person will remove his/her lock and tag from the multiple lockout device. This is the only procedure to be used for multiple lockout.

D. Shift or Personnel Change

1. If a machine or piece of equipment must be locked out beyond the end of one shift, the supervisor of the shift going off duty must place his/her lock and tag on the machinery. Then all other employees who had locked the machine out may remove their locks and tags.

The maintenance supervisor on the next shift will then place his or her lock and tag on the machine. When all employees who may be working on the machinery the next shift, have placed their locks and tags on the machine, the supervisor of the present shift may then remove his or her lock.

2. If a machine will be locked out for several shifts and no work will be done during that time, then a supervisor's lock must be left on the machine. In this case the importance of the identification tag is paramount.

E. **Outside Contractors**

1. When outside service personnel are engaged in service or maintenance activities that require energy control procedures, management and the outside contractor shall inform each other of their respective lockout procedures.
2. USGS Management shall ensure that all employees understand and comply with the restrictions and prohibitions of the outside contractors' lockout procedures.

F. **Glossary**

Affected employee — An employee who performs the duty of his or her job in an area in which the energy control procedure is implemented and servicing or maintenance operations are performed. An affected employee does not perform servicing or maintenance on machines or equipment and is not responsible for implementing the energy control procedure. An affected employee becomes an "authorized" employee whenever he or she performs servicing or maintenance functions on machines or equipment that must be locked out.

Authorized employee — An employee who performs servicing or maintenance on machines and equipment. Lockout and tagout is used by these employees for their own protection.

Capable of being locked out — An energy-isolating device is considered capable of being locked out if it meets one of the following requirements: (1) It is designed with a hasp to which a lock can be attached; (2) It is designed with any other integral part through which a lock can be affixed; (3) It has a locking mechanism built into it; or (4) It can be locked without dismantling, rebuilding, or replacing the energy isolating device or permanently altering its energy control capability.

Energized — Machines and equipment are energized when they are connected to an energy source or they contain residual or stored energy.

Energy-isolating device — Any mechanical device that physically prevents the transmission or release of energy. These include, but are not limited to, manually operated electrical circuit breakers, disconnect switches, line valves, and blocks.

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

Energy control procedure — A written document that contains those items of information an authorized employee needs to know in order to safely control hazardous energy during servicing or maintenance of machines or equipment.

Examples — Some common examples of machinery to be locked and tagged out while being worked on are table and reciprocal saws, drill presses, hydraulic lifts, grinders and cutters, presses, and electric motors.



TOPIC 14
**WATERCRAFT OPERATIONS
AND WATER SAFETY**

14.1 References.

- A. 46 CFR 24, 25, 26;
- B. 33 CFR Subchapter C, D, F, and S;
- C. 41 CFR 114-38.55,
- D. 485 DM 22
- E. SM 445-2-H, Chapter 31 Watercraft Safety Program

14.2 **Procedures.** Only USGS employees who have successfully passed the DOI Motorboat Operator Certification Course (MOCC) are authorized to operate USGS watercraft under 65 feet and under 300 tons. In addition operators of watercraft from 26 to less than 65 feet and under 300 tons will possess the appropriate U.S. Coast Guard license for the vessel operated. The MOCC requires a minimum of 24 hours training provided by a DOI-certified motorboat operator instructor in the following mandatory subject areas:

- Agency Watercraft Policies
- Required Safety Equipment
- Motorboats and Motorboat Maintenance
- Trailers and Trailer Maintenance
- Navigation Aids/Rules of the Road
- Emergency Operations
- Fire Suppression
- Motorboat Orientation/Marlinespike
- Motorboat At-Speed and Low-Speed Maneuvering
- Alongside Maneuvering
- Trailing
- Towing/Anchoring

MOCC certification will be valid for a period of five years. Prior to being recertified, operators will complete the appropriate recertification procedure described in SM 445-2-H, Chapter 31.

A. Motorized Watercraft Under 26 Feet in Length
(Class A and I Boats)

1. Watercraft will be equipped with the appropriate fire extinguishers for marine use (Type B1 or B2, dry chemical). Fire extinguishers and bracket must be USCG approved, and properly mounted.
2. Watercraft will carry spare gasoline in an approved safety can only. During refueling, always shut off engine, close all spaces where fumes can accumulate, and move fuel cans to a dock or shore if possible. After refueling is completed place full fuel cells on board, open all enclosed spaces and ventilate up to approximately 5 minutes prior to restarting the engine or reactivating electrical or electronic equipment.
3. Except in emergencies, have only experienced operators make surf landings.
4. Equip craft with appropriate materials to respond to emergency situations. Craft that are used in areas where a reliable source of aid is more than two hours away should carry tools, commonly needed spare parts, a radio or cell phone, and hull patching materials regardless of construction material.
5. Standard safety equipment will include the following:
 - a. Adequate first aid kit
 - b. Reach pole
 - c. Type IV personal flotation device (PFD) (mounted) with at least 60 feet of line attached

- d. Sufficient line or chain and proper anchor.
 - e. Oars or paddles.
- B. Motorized Watercraft over 26 Feet in Length (Class II and III Boats)
- 1. Safety regulations will be posted as required by the U.S. Coast Guard.
 - 2. Assign only operators with current MOCC certification and valid U.S. Coast Guard licenses for the class of craft and type of water being navigated.
 - 3. Instructions for starting and operating main and auxiliary engines, anchor gear, radio, and other equipment will be prepared and conspicuously posted, so that in emergencies, someone other than the assigned operator can move the craft.
 - 4. Personnel who regularly travel on boats must know how to start and operate the main and auxiliary engines, as well as other equipment, gear, and radio, etc., in case of emergency.
 - 5. Standard safety equipment must include:
 - a. Items identified in 14.2A.5 and the following.
 - b. When operating in open water, sufficient lifeboat capacity for all passengers. Lifeboats equipped with oars, survival equipment, and, where required, outboard motors.
 - c. Readily accessible life preservers in clearly marked locations for all persons aboard. Sufficient lifejackets or vests for each rowboat or lifeboat.

- d. One USCG approved life ring (Type IV throwable) on each side of pilothouse with at least 60 feet of buoyant line attached.
- e. Sufficient line or chain and proper anchor.
- f. Appropriate size and type of fire extinguishers (Type B1, B2, or B3) rated for the length of watercraft being operated. Extinguishers must be of marine type and USCG approved, including proper mounting of extinguisher and bracket.

14.3 **Non-motorized Watercraft.** All operators of non-motorized craft, such as canoes, rafts, kayaks, rowboats, etc., should complete a basic training course appropriate to the watercraft they will be operating and appropriate for the class of water on which they will be boating. Contact the Bureau Watercraft Safety Program Manager for information regarding acceptable courses. At a minimum, courses should include both lecture and on-the-water sessions (practical) covering the following topics: terminology, basic boat types, safety equipment, emergency procedures (self and assisted rescue), boating techniques, and water classification. Courses that are offered by other entities that meet our standards may be accepted as satisfying this requirement (e.g., state requirements for meeting outfitting and guiding licenses).

14.4 **Operations Aboard All Watercraft**

- A. Operators must be qualified to handle the size, type, and class of watercraft they are operating.
- B. On motorized craft, the anchor is to be attached to the bow, never the stern. Exercise care in releasing and raising the anchor. Make sure anchor line and anchor type are adequate for the size of watercraft being anchored and for the type of bottom material

present. Use extreme caution in tidal influenced areas. On non-motorized craft, the anchor may be attached to the stern if it is designed to be attached there.

- C. Personnel at the bow are the principal lookouts for submerged obstructions that can damage or capsize the craft. Mid-ship personnel should keep movements to a minimum.
- D. All transportation at night should be kept to a minimum. Appropriate navigational lighting is mandatory for all craft. Use of other lighting at night should be kept to a minimum so as to protect night vision and avoid confusing operators of other vessels in the area.
- E. Avoid traveling in high winds and rough water, or if a storm threatens. If caught in a storm keep the bow to the sea or open water, and reduce speed. Beware of broaching. If in a canoe, lower the center of gravity by kneeling on the bottom.
- F. Avoid operating during lightning storm activity. Upon sighting an approaching storm, proceed to the closest shore and beach the craft, if possible. Do not take refuge under a tree. If unavoidably caught on open water during a lightning storm, watercraft constructed of metal offer the best grounding and will more readily distribute the energy of a lightning strike. If you are in a metal craft insulate yourself from metal surfaces by sitting on nonconductive material. Do not handle metal oars, tools, motors, or fishing equipment. In lightning prone areas nonmetal watercraft should be equipped with a lightning protection system consisting of a conductor, extending to a height above all persons and equipment on board, connected directly to a ground plate mounted on the outside of the hull. Contact the Bureau Watercraft Safety Program *Manager if more*

specific information is needed.

14.5 Loading and Unloading from Watercraft

- A. Cargo plus personnel, fuel, water, and onboard equipment should not exceed the rated capacity of the watercraft. Always maintain a safe margin below the danger point and consider weather and other adverse conditions that might be encountered. Post the maximum safe load limit or refer to the U.S. Coast Guard capacity plate on each craft under 26 feet in length. Load computation must take into consideration the actual weight of each person to be onboard rather than the mean 150# per person used by the USCG for determining the allowable number of persons onboard (e.g., a capacity plate indicating 6 persons would equal a 900# personnel load, but if each person weighed 200 - 225# the 900# personnel load limit would only allow for 4 people onboard).
- B. When transporting cargo, balance the load evenly between port and starboard. Secure cargo so that it will not shift when the craft is in motion. Where possible, load and unload from the side rather than over the bow or stern.
- C. Do not stack cargo above gunnels, since this could affect the boat's center of gravity and the watercraft's initial stability.
- D. When possible, enter or leave the craft from the side rather than the bow or stern, and always step in the center of the craft. Steady yourself while moving in a canoe or kayak by placing one hand on each gunnel.
- E. Do not stand up, change places, or make sudden moves in a watercraft. Go to shore if necessary to change places, repair motor, or reposition cargo.

14.6 Personal Protection

- A. While not a term of employment, all watercraft operators should be able to swim and be familiar with techniques of self-rescue.
- B. All personnel must wear an appropriate U.S. Coast Guard approved PFD in all USGS watercraft under 26 feet in length (Class A and I). Personnel working on exposed decks of watercraft larger than 26 feet (Class II and III) must wear appropriate U.S. Coast Guard approved PFDs. The wearing of PFDs by other crew members or passengers on class II and III vessels is up to the discretion of the boat operator/captain.
- C. Avoid traveling in small craft in heavy tidal currents.
- D. The USGS watercraft operator is solely responsible for the safety of the crew and craft.
- E. Never wear hipboots or loose waders when working from boats in swift water or water over 3 feet deep. If use of waders is necessary, they should be made of neoprene and should fit snugly. If made of other material, have a belt secured around the outside of the waders and fitted firmly around the waist.
- F. Personnel operating in cold water conditions should wear additional personal protective equipment (PPE) appropriate to the job and conditions (i.e., wet suits, dry suits, or Type III/V Anti-Exposure Coveralls/Worksuits [USCG approved]).
- G. Remain seated while in watercraft. Horseplay is prohibited.
- H. If by chance you find yourself in the water in Arctic or sub-Arctic environments, keep all outer clothing

on your body. Hang on to the boat, oar, or anything that is floating nearby until help comes. Initiate “Help/ Huddle” techniques to reduce loss of body heat.

- I. When working on, in, or over water where danger exists, a JHA shall be completed.

14.7 Emergencies

- A. Personnel assigned to watercraft must be trained in emergency procedures.
- B. Do not attempt to swim to shore from an overturned craft. Hang on to the craft until it drifts, or can be paddled to shore, or until help arrives. Maintain extra caution in moving water conditions (Class II+ rivers).
- C. First-aid gear (waterproof) and survival gear appropriate for the environment should always be included in the watercraft.
- D. When involved in an overturned or sinking craft, surviving the incident is often dependent on what you carry on your person. Equip your own PFD with personal survival items that you can use in emergencies (e.g., strobe light, mirror, whistle, pencil flares, smoke flares, knife, small waterproof flashlight, sunscreen, etc.).
- E. Learn how to use personal clothing as a flotation device, should you find yourself in the water without a PFD. This procedure requires that you discard your heavy outer clothing and shoes.
- F. Plan your trip, and, regardless of its length, let someone know your itinerary and when you will be back. Always close out your float plan with the responsible person assigned to initiate search and rescue operations in the event of an accident.

14.8 Safety of Watercraft and Equipment

- A. All USGS watercraft must be maintained in first class condition. All USGS watercraft will be inspected annually and documented accordingly.
- B. All motorized and non-motorized boats, rafts, or other craft owned or used by USGS employees will be operated and maintained with safety as the prime consideration.
- C. For rubberized boats or lifeboats, inspect all seams, surfaces, fabric condition, valves, and ability to hold air under operating pressure before each use.
- D. Metal and plastic craft should have skid-proof paint applied to the deck of the craft to avoid slipping. The outer surface of tubes on rubber/ PVC/hypalon rafts should be of nonskid/slick- type coating.
- E. Keep oars and oarlocks in good condition. Spare oars, oarlocks, or paddles should be carried on long trips.
- F. Check with local residents when operating in unfamiliar rivers and lakes for weather conditions or water conditions that may be unique to that area.
- G. Get reliable weather reports if area is subject to storms.
- H. Use Boating Checklists

Basic Boat Inspection Checklist

Annual inspections must be done before watercraft is used. This checklist also applies to any use of privately owned boats that are administratively determined to be used to the advantage of the government.

Boat ID: _____ **Insp. by:** _____ **Date:** _____

Storage Location: _____

Satisfactory Required Action
 (yes/no)

Life jackets		
Floation Devices		
Safety Work Vests		
Ring Lifebuoy		
Fire Extinguisher		
Paddles, oars		
Anchors, lines		
Gas tanks		
Flame arrester		
Blower		
Navigation lights		
Steering Controls		
Emergency lights		
Search lights		
Whistle		
Horn, bell		
Compass		
Bilge pump, hand pump, bailing bucket		
Flares Warning lights, flags		
Outboard motor safety chain		
Emergency tools		
Tagline flags		
Marine first aid kit		
Additional equipment (radio, etc)		
Trailer tires, wheels, spare bearings		
Trailer taillights. Turn/Brake		
Trailer safety chains, boat straps		
Trailer winch, cable, or line		
Trailer brakes		



TOPIC 15 **EXPLOSIVES**

15.1 References

- A. SM 445-2-H, Chapter 38, Blasting Safety
- B. 29 CF 1910.109, Blasting Agents

15.2 General Requirements.

- A. Written procedures should be developed for the operation or activity where explosives are to be used. Every person involved with explosives use must be thoroughly familiar with those written procedures.
- B. Good housekeeping is extremely important for all areas where explosives are stored, used, or handled.
- C. Explosives work should not be conducted during extreme inclement weather, such as thunderstorms.
- D. Explosives should be kept in closed containers when not in use. All containers must be labeled to identify the contents present.
- E. "No Smoking" requirements must be established where explosives are stored, used, or handled.
- F. At least one person who is thoroughly familiar with accepted firing procedures, knowledgeable of static electricity, hazards of electromagnetic radiation to ordnance, grounding procedures, and overall safety procedures should be present at any firing site.
- G. Do not use 2-way radios when working with explosives.

15.3 **Personal Protective Equipment.**

- A. Safety glasses should be worn when working with or in proximity to explosives.
- B. Flame-retardant coveralls should be worn, especially when working with primary explosives.
- C. Silk, wool, or synthetic outer or under garments should not be worn in activity where the generation of static electricity would create a hazard. Cotton undergarments are preferred.

15.4 **Storage.** Explosives must be stored in unoccupied buildings, unless a room has been specially constructed and the local fire department has given its approval.

15.5 **Training.**

- A. All persons who handle or use explosives must receive training in the basics of explosives safety.
- B. The training should be approved by the regional or Bureau Safety Manager.
- C. The training program should include discussions on the proper methods for transportation, as well as waste disposal.
- D. Refresher training should be given annually.

15.6 **Transportation.**

- A. Explosives have been classified by the Department of Transportation. Placarding and labeling of the vehicle must be consistent with the load.
 - 1. Division 1.1 - explosives that are detonating or otherwise of maximum hazard.
 - 2. Division 1.2 - Explosives with a projection hazard.

3. Division 1.3 - Explosives with predominantly a fire hazard.
4. Division 1.4 – Explosives with no significant blast hazard.
5. Division 1.5 – Very insensitive explosives; blasting agents.
6. Division 1.6 - Extremely insensitive detonating articles.

B. Forbidden Explosives.

1. An explosive that has not been approved in accordance with 49 CFR Section 173.56.
2. An explosive mixture or device containing a chlorate and either (1) an ammonium salt, including a substituted ammonium or quaternary ammonium salt or (2) an acidic substance, including the salt of a weak base or strong acid.
3. A propellant that is unstable, condemned, or deteriorated.
4. An initiating explosive that is dry.
5. Nitroglycerine, diethylene glycol dinitrate, or other liquid explosive, except as authorized by DOT.
6. Any type of explosive in a leaking or damaged package.

15.7 List of Explosive Materials

List of Explosive Materials

A

Acetylides of heavy metals.
Aluminum containing polymeric propellant.
Aluminum ophorite explosive.
Amatex.
Amatol.
Ammonal.
Ammonium nitrate explosive mixtures (cap sensitive).
*Ammonium nitrate explosive mixtures
(non cap sensitive).
Aromatic nitro-compound explosive mixtures.
Ammonium perchlorate explosive mixtures.
Ammonium perchlorate composite propellant.
Ammonium picrate [picrate of ammonia, Explosive D]
Ammonium salt lattice with isomorphously
substituted inorganic salts.
*ANFO [ammonium nitrate-fuel oil].

B

Baratol.
Baronol.
BEAF [1, 2-bis (2, 2-difluoro-2-nitroacetoxyethane)].
Black powder.
Black powder based explosive mixtures.
*Blasting agents, nitro-carbo-nitrates, including non
cap sensitive slurry and water gel explosives.
Blasting caps.
Blasting gelatin.
Blasting powder.
BTNEC [bis (trinitroethyl) carbonate].
Bulk salutes.
BTNEN [bis (trinitroethyl) nitramine].
BTTN [1,2,4 butanetriol trinitrate].
Butyl tetryl.

C

Calcium nitrate explosive mixture.
Cellulose hexanitrate explosive mixture.
Chlorate explosive mixtures.
Composition A and variations.
Composition B and variations.
Composition C and variations.
Copper acetylide.
Cyanuric triazide.
Cyclotrimethylenetrinitramine [RDX].
Cyclotetramethylenetetranitramine [HMX].
Cyclonite [RDX].
Cyclotol.

D

DATB [diaminotrinitrobenzene].
DDNP [diazodinitrophenol].
DEGDN [diethyleneglycol dinitrate].
Detonating cord.
Detonators.
Dimethylol dimethyl methane dinitrate composition.
Dinitroethyleneurea.
Dinitroglycerine [glycerol dinitrate].
Dinitrophenol.
Dinitrophenolates.
Dinitrophenyl hydrazine.
Dinitroresorcinol.
Dinitrotoluene-sodium nitrate explosive mixtures.
DIPAM.
Dipicryl sulfone.
Dipicrylamine.
Display fireworks.
DNPD [dinitropentano nitrile].
DNPA [2,2-dinitropropyl acrylate].
Dynamite.

E

EDDN [ethylene diamine dinitrate].
EDNA.
Ednatol.
EDNP [ethyl 4,4-dinitropentanoate].
Erythritol tetranitrate explosives.
Esters of nitro-substituted alcohols.
EGDN [ethylene glycol dinitrate].
Ethyl-tetryl.
Explosive conitrates.
Explosive gelatins.
Explosive mixtures containing oxygen releasing
inorganic salts and hydrocarbons.
Explosive mixtures containing oxygen releasing
inorganic salts and nitro bodies.
Explosive mixtures containing oxygen releasing
inorganic salts and water insoluble fuels.
Explosive mixtures containing oxygen releasing
inorganic salts and water soluble fuels.
Explosive mixtures containing sensitized nitromethane.
Explosive mixtures containing tetranitromethane
(nitroform).
Explosive nitro compounds of aromatic hydrocarbons.
Explosive organic nitrate mixtures.
Explosive liquids.
Explosive powders.

F

Flash powder.
Fulminate of mercury.
Fulminate of silver.
Fulminating gold.
Fulminating mercury.
Fulminating platinum.
Fulminating silver.

G

Gelatinized nitrocellulose.
Gem-dinitro aliphatic explosive mixtures.
Guanyl nitrosamino guanyl tetrazene.
Guanyl nitrosamino guanylidene hydrazine.
Guncotton.

H

Heavy metal azides.
Hexanite.
Hexanitrodiphenylamine.
Hexanitrostilbene.
Hexogen (RDX).
Hexogene or octogene and a nitrated N-methylaniline.
Hexolites.
HMX [cyclo-1,3,5,7-tetramethylene 2,4,6,8-tetranitramine; Octogen].
Hydrazinium nitrate/hydrazine/aluminum explosive system.
Hydrazoic acid.

I

Igniter cord.
Igniters.
Initiating tube systems.

K

KDNBF [potassium dinitrobenzofuroxane].

L

Lead azide.
Lead mannite.
Lead mononitroresorcinate.
Lead picrate.
Lead salts, explosive.

Lead styphnate [styphnate of lead, lead trinitroresorcinate].
Liquid nitrated polyol and trimethylolethane.
Liquid oxygen explosives.

M

Magnesium ophorite explosives.
Mannitol hexanitrate.
MDNP [methyl 4,4-dinitropentanoate].
MEAN [monoethanolamine nitrate].
Mercuric fulminate.
Mercury oxalate.
Mercury tartrate.
Metriol trinitrate.
Minol-2 [40% TNT, 40% ammonium nitrate, 20% aluminum].
MMAN [monomethylamine nitrate]; methylamine nitrate.
Mononitrotoluene-nitroglycerin mixture.
Monopropellants.

N

NIBTN [nitroisobutametriol trinitrate].
Nitrate sensitized with gelled nitroparaffin.
Nitrated carbohydrate explosive.
Nitrated glucoside explosive.
Nitrated polyhydric alcohol explosives.
Nitrates of soda explosive mixtures.
Nitric acid and a nitro aromatic compound explosive.
Nitric acid and carboxylic fuel explosive.
Nitric acid explosive mixtures.
Nitro aromatic explosive mixtures.
Nitro compounds of furane explosive mixtures.
Nitrocellulose explosive.
Nitroderivative of urea explosive mixture.
Nitrogelatin explosive.
Nitrogen trichloride.
Nitrogen tri-iodide.

Nitroglycerine [NG, RNG, nitro, glyceryltrinitrate, trinitroglycerine].
Nitroglycide.
Nitroglycol (ethylene glycol dinitrate, EGDN)
Nitroguanidine explosives.
Nitroparaffins Explosive Grade and ammonium nitrate mixtures.
Nitronium perchlorate propellant mixtures.
Nitrostarch.
Nitro-substituted carboxylic acids.
Nitrourea.

O

Octogen [HMX].
Octol [75 percent HMX, 25 percent TNT].
Organic amine nitrates.
Organic nitramines.

P

PBX [RDX and plasticizer].
Pellet powder.
Penthrinite composition.
Pentolite.
Perchlorate explosive mixtures.
Peroxide based explosive mixtures.
PETN [nitropentaerythrite, pentaerythrite tetranitrate, pentaerythritol tetranitrate].
Picramic acid and its salts.
Picramide.
Picrate of potassium explosive mixtures.
Picratol.
Picric acid (manufactured as an explosive).
Picryl chloride.
Picryl fluoride.
PLX [95% nitromethane, 5% ethylenediamine].
Polynitro aliphatic compounds.
Polyolpolynitrate-nitrocellulose explosive gels.
Potassium chlorate and lead sulfocyanate explosive.

Potassium nitrate explosive mixtures.
Potassium nitroaminotetrazole.
Pyrotechnic compositions.
PYX (2,6-bis(picrylamino))-3,5-
dinitropyridine.

R

RDX [cyclonite, hexogen, T4, cyclo-1,3,5,-trimethyl ene-
2,4,6,-trinitramine; hexahydro-1,3,5-trinitro-S-tri-
azine].

S

Safety fuse.
Salutes, (bulk).
Salts of organic amino sulfonic acid explosive mixture.
Silver acetylide.
Silver azide.
Silver fulminate.
Silver oxalate explosive mixtures.
Silver styphnate.
Silver tartrate explosive mixtures.
Silver tetrazene.
Slurried explosive mixtures of water, inorganic
oxidizing salt, gelling agent, fuel and sensitizer (cap
sensitive).
Smokeless powder.
Sodatol.
Sodium amatol.
Sodium azide explosive mixture.
Sodium dinitro-ortho-cresolate.
Sodium nitrate-potassium nitrate explosive mixture.
Sodium picramate.
Special fireworks.
Squibs.
Styphnic acid explosives.

T

- Tacot [tetranitro-2,3,5,6-dibenzo-1,3a,4,6a tetraza-pentalene].
- TATB [triaminotrinitrobenzene].
- TEGDN [triethylene glycol dinitrate].
- Tetrazene [tetracene, tetrazine, 1(5-tetrazolyl)-4-guanyl-tetrazene hydrate].
- Tetranitrocarbazole.
- Tetryl [2,4,6 tetranitro-N-methylaniline].
- Tetrytol.
- Thickened inorganic oxidizer salt slurred explosive mixture.
- TMETN [trimethylolethane trinitrate].
- TNEF [trinitroethyl formal].
- TNEOC [trinitroethylorthocarbonate].
- TNEOF [trinitroethylorthoformate].
- TNT [trinitrotoluene, trotyl, trilitite, triton].
- Torpex.
- Tridite.
- Trimethylol ethyl methane trinitrate composition.
- Trimethylolthane trinitrate-nitrocellulose.
- Trimonite.
- Trinitroanisole.
- Trinitrobenzene.
- Trinitrobenzoic acid.
- Trinitrocresol.
- Trinitro-meta-cresol.
- Trinitronaphthalene.
- Trinitrophenetol.
- Trinitrophenylroglucinol.
- Trinitroresorcinol.
- Tritonal.

U

- Urea nitrate.

W

Water bearing explosives having salts of oxidizing acids and nitrogen bases, sulfates, or sulfamates (cap sensitive).

Water-in-oil emulsion explosive compositions.

X

Xanthamomas hydrophilic colloid explosive mixture.



TOPIC 16

FIREARM SAFETY

16.1 References

- A. State and Local Laws
- B. SM 445-2-H, Chapter 29 Firearms Safety Program

16.2 **Procedures.** State directors may authorize non-law-enforcement personnel to carry firearms when functions or circumstances related to their official duties necessitate such permission. Use of firearms by USGS personnel while on official business will be limited to those individuals who have been authorized by the State Director and have successfully completed a firearm safety course. Authorizations will be in writing and training documented.

- A. **Expiration of Firearm Authorization.** The authorization to carry a firearm shall expire:
 - 1. at the end of the calendar year;
 - 2. upon completion of the project;
 - 3. if there is a change of duty station, status, or transfer;
 - 4. upon failure to demonstrate shooting proficiency as required; or
 - 5. If rescinded for any other reason.
- B. **Shooting Proficiency of Seasonal or Part-Time Non-Law-Enforcement Employees, or Full-Time Employees Who Have Occasional Need to Carry Firearms.** Seasonal or part-time non-law-enforcement employees, or full-time employees who have only an occasional need to carry firearms, are required to demonstrate proficiency once at the commencement of each term of employment or at the beginning of each field period requiring the use of firearms.

- 16.3 **Equipment.** The bureau will issue only 12-gauge pump shotguns and solid slug ammunition for animal protection. Employees wishing to use their personal firearms must meet the minimum caliber and power requirements (.30-.06 or equivalent for rifles; .44-caliber Magnum or greater for sidearms), and complete the firearm training course and a safety check of these firearms by an approved instructor. No reloads allowed.
- 16.4 **Firearm Certification for Non-Law-Enforcement Personnel.** Only those non-law-enforcement personnel who are competent and qualified marksmen and have completed a firearm training program may be authorized to use or carry firearms. Such a course must consist of at least four hours of classroom time culminating in a prescribed shooting regimen at a firing range. The instructor administering the firing range component will be a certified Federal Law Enforcement Training Center graduate, Federal Bureau of Investigation officer, or a National Rifle Association instructor.
- A. **Contents of Classroom Component of Firearm Training Course.** A firearm training course, classroom component, shall consist of the following subject matters:
1. Basic firearm safety review
 2. Legal and moral aspects of firearms use
 3. Animal behavior (optional)
- B. **Shooting Proficiency Component.** This portion of the firearm training course will take place on the firing range under the control of an authorized instructor. The target for animal protection will be 8 1/2 inches by 11 inches in size and will be placed a distance of 15 yards from the firing line. Proficiency is achieved when 70 percent of the shots are on the target and when all sequences of

shots are fired within the allowable time of 25 seconds. Each sequence will be performed twice to attain proficiency, the shooter must demonstrate proper safe handling of the firearm(s).

1. **Pump and semi-automatic shotguns:** two sequences of fire consisting of magazine capacity for the shotgun, plus one (i.e., Remington 870, four rounds in magazine, plus one).
 - a. The shooter will start with a full magazine and empty chamber. The weapon will have the action closed and the safety on.
 - b. On the command to fire, the shooter will be required to fire the rounds in the magazine, then reload and fire one additional round. Upon completion, the shooter will open the action and make sure the safety is on. The time limit will be 25 seconds. This sequence will be repeated.
2. **Double-barrel shotguns:** two sequences of fire consisting of four rounds per sequence.
 - a. Shooter will start with the shotgun fully loaded and the safety on.
 - b. On the command to fire, the shooter will be required to fire the two rounds of ammunition in the firearm, then load and fire two additional rounds. Upon completion, the shooter will open the action and make sure the safety is on. The time limit will be 25 seconds. This sequence will be repeated.
3. **Rifles:** two sequences of fire consisting of magazine capacity for the rifle, plus one round

(i.e., a bolt action rifle with magazine capacity of three rounds; the course will be four rounds for each sequence).

- a. The shooter will start with the magazine fully loaded. The action will be closed on an empty chamber and the safety on.
- b. On command to fire, the shooter will fire the rounds in the magazine, then reload and fire one additional round. Upon completion, the shooter will open the action and make sure the safety is on. The time limit will be 25 seconds. This sequence will be repeated.

4. **Handguns:** two sequences of fire, each consisting of cylinder/magazine capacity for the handgun.

- a. The shooter will start with a fully loaded handgun.
- b. On the command to fire, the shooter will fire all rounds contained in the cylinder/magazine. Upon completion, the shooter will open the cylinder/slide and make sure the handgun is unloaded. The time limit will be 25 seconds. This sequence will be repeated.

16.5 **Use of Firearms.** Bureau employees must observe all Federal, state, and local laws in regard to the licensing, use, transportation, etc., of firearms and ammunition. Bureau employees are prohibited at all times from using Government-owned vehicles or equipment for the express or incidental purpose of hunting, shooting, or transporting of game, hunters, firearms, or ammunition. Violators are subject to disciplinary action and/or prosecution under the law.

- A. **Firearms in Camp.** The use of firearms is prohibited in camp areas or during working hours by non-law-enforcement personnel except when required for the safety of personnel or if in the best interest of the Bureau.

- B. **Taking Game in Defense of Life or Property.** As a job requirement, firearms may be carried in work areas and used if necessary for the protection of work parties from dangerous animals. The necessity of taking game animals must not be brought about by harassment or provocation of the animal or the unreasonable invasion of the animal's habitat.

- C. If Bureau employees are specifically requested by local officials to carry firearms to help curb an epidemic of rabid animals, to reduce the number of undesirable, crippled, or infected animals, or to carry out other authorized activities, such as cone harvesting, the purpose of the action and the caliber of the firearm(s) must be stated in the letter of authorization.
 - 1. Game animals taken may become property of the state. Different parts of the animal may have to be provided to the state for administrative reasons. This may have to be done in required time frames. Bureau personnel should check local regulations prior to carrying a firearm.

16.6 **Firearms and Ammunition Storage.** All firearms, when not in active use, shall be stored in a secure place, out of sight, under lock and key. Firearms will be unloaded prior to storage.

Illustration 16-1

Form DR-1112-18
(October 1981)

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Oregon State Office

REQUEST TO CARRY AND USE FIREARMS

Full Name: _____ Date of Birth: _____

Sex: Female Male _____

District: _____ Area/Division: _____

Duties requiring employee to carry/use firearms: _____

Firearms Information

Firearm(s) to be used: Caliber: _____ Make: _____ Model: _____

Serial No.: _____ Registered owner: _____

Employee Safety Requirements

Firearms Safety Course Attended (minimum 4 hours in safety, handling, firing, and legal/moral aspects of the use of firearms):

Course Name: _____ Date Attended: _____

Certifying Official/Instructor: _____

Course Sponsor (NRA, FLETC, FBI): _____

Non-law enforcement employees authorized to carry firearms in the course of employment must demonstrate their shooting proficiency (70% or better); permanent employees twice a year; seasonal or part-time employees once a year or at the commencement of each term of employment.

Proficiency Certification: _____ by _____
Date Approved Instructor

_____ by _____
Date Approved Instructor

Authorization Required (Dates): From _____ To _____

Location(s) Required: _____



TOPIC 17
**VISITING PUBLIC SAFETY
AND HEALTH**

17.1 References

- A. SM 445-2-H, Chapter 35, Public Safety and Health
- B. 485 DM Chapter 23.1
- C. 43 U.S.C. 1457

17.2 **Procedures.** Established USGS visitor sites and facilities shall be managed to provide reasonable safe guards against known hazards and still provide a quality outdoor recreation experience for all visitors. USGS sites and facilities shall be designed for maximum accessibility and maintained to minimize the risk of injury or illness to all visitors.

17.3 **Inspections.** USGS -developed recreation sites, camp grounds, and facilities shall be inspected periodically, but no less than annually, for compliance with policies, standards, and codes to help ensure the safety and health of the visiting public. Qualified inspectors shall conduct safety and health inspections.

17.4 **Accident Reporting.** All known visitor accident/incidents on public lands that could reasonably result in tort claim action, must be reported on Form SMIS, Report of Accident/Incident, or a similar form. Known accidents/ incidents involving visitors on the public lands shall be subject to the same reporting and investigation requirements as those involving USGS employees and volunteers.

17.5 **Coordination with Other USGS Programs.** The Visitor Safety Program shall be coordinated with the Occupational Safety and Health, Law Enforcement, Volunteer, Recreation, Engineering, and Hazardous Materials programs. Law Enforcement is responsible for ensuring compliance with visitor use and conduct regulations, including the requirement for seat belt use by the driver and all occupants of motor vehicles equipped with safety belts. The Recreation, Volunteer,

and Engineering programs are responsible for managing and maintaining established USGS visitor sites and facilities, pursuant to policies, standards, and codes. The Hazardous Materials Program is responsible for identifying and eliminating hazardous waste sites on the public lands that may pose safety or health dangers to the visiting public.

- 17.6 **Coordination with Outside Agencies.** The Occupational Safety and Health Program shall coordinate visitor safety and health activities with recognized national safety and health organizations. Coordination with Federal, state, and local law-enforcement agencies, search and rescue units, and emergency medical service providers is the responsibility of the Law Enforcement Program.



TOPIC 18
SEARCH AND RESCUE

18.1 References

- A. 43 U.S.C; 1742
- B. Federal Land Policy Management Act (FLPMA)
Section 312

18.2 **Procedures.** USGS employees may provide emergency assistance to persons whose lives or safety are in danger on or adjacent to public lands. Such assistance must be fully coordinated with local agencies who have the primary responsibility for emergency assistance. Bureau personnel do not replace existing search and rescue (SAR) organizations, but merely supplement those already in existence. Where SAR needs exist, Bureau managers may assist local authorities as deemed necessary.

- A. **Coordination with Other Organizations.** Bureau personnel must, to the maximum extent feasible, cooperate and coordinate with local, state, and other Federal agencies within their areas of responsibility. Examples of areas of cooperation include interagency radio communications, shared patrol responsibilities, cooperative search and rescue planning and implementation, cooperation with local law-enforcement agencies, and cooperative management agreements.
- B. **Skills and Training to Participate in Search and Rescue.** Bureau employees who will be providing rescue services need to have appropriate skills acquired through training, such as climbing, diving, water vessel, etc. Bureau ground personnel who participate in SAR should maintain a standard first-aid certificate. Personnel who participate in SAR should be in good physical condition commensurate with a wide range of environmental conditions.

- 18.3 **Search and Rescue Assistance.** Local and state authorities have the primary responsibility for locating persons lost on public lands. Bureau personnel are authorized to assist them in searching for persons lost on or near the public lands. The extent of such assistance depends on local agency capabilities, USGS training and equipment, and the nature of the emergency.
- A. **USGS's Involvement in SAR. Appropriate search involvement may include the following:**
1. Monitoring a search effort and completing required reports.
 2. Providing local agencies with information regarding topography, visitor use areas, water sources, mine shafts, structures, etc.
 3. Supplying maps, vehicles, radios, search equipment, or aircraft.
 4. Utilizing employees to manage or participate in searches.
- B. **Response to Search Requests.** Whenever a request for a search is received, USGS employees must relay the nature of the situation to local authorities through the appropriate manager.
1. When encountering a search situation on public lands, USGS employees may take charge of the situation when no local authorities are present on the scene.
 2. Whenever local authorities are on the scene of a search incident on or near public lands, Bureau managers may offer available USGS assistance.

18.4 Specialized Search and Rescues

- A. Search Procedures for Lost, Overdue, or Missing Employees.
 1. **Determine whether a search needs to be implemented for the employee or employees. This can be done by:**
 - a. Attempting contact with the missing individual(s) by radio or phone.
 - b. Checking with supervisor and co-workers as to their whereabouts.
 - c. Checking the compound, parking lots, and surrounding area for the missing person's private and work vehicles.
 - d. Contacting by phone the family and/or friends of the missing individuals for information as to their whereabouts.
 - e. Dispatching a USGS employee to the employee's residence and/or contacting the local law-enforcement office to request that they do so.
 2. **If contact with the missing employee cannot be made, then:**
 - a. Notify the appropriate manager.
 - b. Notify the appropriate primary search and rescue agency.
 - c. Notify the appropriate Logistics Center and/or Dispatch Center.
 3. **Once it has been determined that there is a lost, overdue, or missing employee or**

employees, it is necessary to gather additional information.

a. WHO?

1. Names.
2. Number of persons missing.
3. Descriptions of person(s): gender, nationality, height, weight, hair color, eye color, and attire.

b. WHAT?

1. Missing person's travel plan and proposed schedule.
2. Mode of transportation.
3. Person's work assignment.
4. Type of communications equipment missing person(s) took on assignment.

c. WHEN?

1. Time persons were last seen or contacted.
2. Time persons were to complete work assignment.
3. Time persons were to return to base.

d. WHERE?

1. Determine the person's planned destination.

2. Determine the person's departure point.
3. Determine travel routes and any stops.
4. Once appropriate information has been gathered, provide the information to the primary search and rescue coordinator.

18.5 **Planning.** Districts, Resource Areas, and other detached facilities will write Search and Rescue Plans or Emergency Action Plans that include search procedures for lost, overdue, or missing employees. The purpose of the plans are to expedite emergency actions by various individuals to determine status, effective rescue, facilitate medical treatment, and handle security measures involved in a successful search and survival mission.



TOPIC 19
**CONTRACTOR SAFETY
AND HEALTH**

19.1 References

- A. Federal Acquisition Standards (FAR) 48 CFR, Chapter 1
- B. Department of the Interior Acquisition Regulations (DIAR)
- C. SM 445-2-H, Chapter 33 Contractor Safety

19.2 Procedures

- A. **The Contracting Officer (CO) is responsible for, but may delegate these responsibilities to, the Contracting Officer's Representative (COR):**
 - 1. **Advise of Potential Hazards.** USGS will provide information regarding hazardous substances to contractor employees as required by OSHA 29 CFR 1910.1200 Hazard Communication Standard. The CO shall advise the contractor of all potential unsafe or unhealthful working conditions that have been determined to exist or have the potential to occur on the job site.
 - 2. **Provide Material Safety Data Sheets (MSDS).** Provide Material Safety Data Sheets (MSDS) to the contractor for all hazardous materials provided by the Bureau for use by the contractor. If the contractor is to acquire, control, and use hazardous materials, the contractor is required to acquire MSDS for the hazardous products used.
- B. **The Contracting Officer's Representative (COR) is responsible for:**
 - 1. **Inspecting Work Site.** The COR shall inspect the work site or have a Project Inspector do so at reasonable intervals to ensure that the contractor and the contractor's employees are

complying with safety and health standards applicable to the work being performed.

19.3 **Contracts.** All contracts shall have Occupational Safety and Health clauses wherein the contractor is required to comply with all applicable safety and health standards as directed by Federal and/or state OSHA. The clause shall advise the contractor that failure to comply with safety and health standards shall result in a stop order being issued. All costs related to a stop order for failure to comply with safety and health standards will be borne by the contractor.

19.4 **Records**

- A. All safety and health deficiencies noted during inspections will be recorded and maintained in the project contract files. Actions taken by the CO, COR, or Project Inspector to obtain compliance by the contractor shall be recorded and will be considered as limiting factors in future contract awards.

- B. Accidents will be reported to the COR, reported online through the DOI Safety Management Information System.



TOPIC 20
**CONCESSIONAIRE SAFETY
AND HEALTH**

20.1 References

- A. 29 CFR 1910 OSHA General Industry Standards
- B. 29 CFR 1926, OSHA Construction Standards
- C. 29 CFR 1910.1200 Hazard Communication
- D. SM 445-2-H, Chapter 32 Concessionaire Safety Program
- F. 43 CFR 2920.7 Terms and Conditions

20.2 **Procedures.** Any USGS office establishing contracts with concessionaires will include applicable safety and health requirements for protecting concession employees, the public, and Bureau personnel.

- A. **Concessionaires' Safety Program.** The degree, scope, and complexity of the concessionaires' Safety Program will be determined by the products handled, the extent of equipment operations, and the amount of visitor services provided. Any program regardless of size should address the following concerns:
 - 1. Procedures to identify and correct safety deficiencies.
 - 2. Steps to ensure that safety awareness, hazard recognition, and accident prevention are being communicated to all affected groups.
 - 3. Steps to ensure compliance with the Hazard Communication Standard.
 - 4. Specific hazards directly associated with a particular concessionaire are identified in the Safety and Health Program.

5. Accident/incident and emergency procedures to be established and posted.

B. **Review of Concessionaires' Safety Program.** Offices, when appropriate, will monitor training, conduct and review safety inspections, and review safety promotion efforts conducted by concessionaires for the safety of their employees and the public.



TOPIC 21

RADIATION SAFETY

21.1 References.

- A. 10 CFR Nuclear Regulatory Commission
- B. SM 445-2-H, Chapter 30, Radiation Safety

21.2 **Radioactive Decay.** Radioactive materials have an associated half-life, or decay time characteristic of that isotope. As radiation is emitted, the material becomes less radioactive over time, decaying exponentially. Since it is impossible or impractical to measure how long one atom takes to decay, the amount of time it takes for half of the total amount of radioactive material to decay is used to calculate half-life. Some radioisotopes have long half-lives; for example, ^{14}C takes 5,730 years for any given quantity to decay to half of the original amount of radioactivity. Other radioactive materials have short half-lives; ^{32}P has a two-week half-life, and ^{99}Tcm (used in human and animal nuclear medicine diagnostic procedures) has a half-life of six hours.

This is important for many reasons. When deposited in the human body, the half-life of the radioactive material present in the body affects the amount of the exposure. If the radioactive material contaminates a workbench or equipment, and is not removable, the amount of time before the contaminated items may be used again is determined by the radioactive half-life. Radioisotope decay using half-life minimizes costs and concerns in radioactive waste management.

21.3 **Radiation Units.** Two types of units are used for radiation, units of activity and units of exposure (dose). Units of activity quantify the amount of radiation emitted by a given radiation source. Units of exposure quantify the amount of radiation absorbed or deposited in a specific material by a radiation source.

- A. **Units of Activity.** The unit of activity for radiation is the Curie, abbreviated Ci. Most laboratory facilities

use only millicurie (mCi, 0.001 Ci) or microcurie (uCi, 0.000001 Ci) amounts of radioactive materials, since reliable data can only be obtained using low levels of activity for a given isotope.

- B. **Units of Exposure.** The Roentgen, abbreviated as "R", is the unit for measuring the quantity of x-ray or gamma radiation by measuring the amount of ionization produced in air. One Roentgen is equal to the quantity of gamma or x-radiation that will produce ions carrying a charge of 2.58×10^{-4} coulombs per kilogram of air.
- C. **Rad and the Rem.** The rad and the rem are the two main radiation units used when assessing radiation exposure. The rad (radiation absorbed dose), is the unit of absorbed dose, and refers to the energy deposition by any type of radiation in any type of material. The rem (radiation equivalent man) is the unit of human exposure and is a dose equivalent (DE).

21.4 Tissue and Cell Sensitivity

- A. Various degrees of sensitivity to radiation exist due to the type of tissue which receives the exposure, and are shown on the following page.

Radiosensitive	Radioresistent
Breast tissue	Heart tissue
Bone marrow cells	Large arteries
Mucosa lining of small intestines	Large veins
Sebaceous (fat) glands of skin	Mature bloodcells
Immune response cells	Neurons
All stem cell populations	Muscle cells

Lymphocytes

It is important, when considering the real versus the perceived risk of radiation exposures, to be aware of the acute effects of large radiation exposures. Without this information, one has no comparison to determine whether the radiation one is handling presents an actual risk, or does not. Often, fears exist that because the radiation is present and is measurable, a serious risk is present. The fact that we cannot see, smell, hear or feel the radiation sometimes magnifies the fears. The table below shows the effects of various types of high radiation exposures.

B. Effects of Acute Radiation Exposures in Humans
 (See Figure Below).

Radiation Exposure	Effects
10000 R; single dose, whole body	Death occurs within hours from apparent neurological and cardiovascular breakdown (Cerebrovascular syndrome)
500 - 1200 R; single dose, whole body	Death occurs within days and is associated with bloody diarrhea and destruction of the intestinal mucosa. (Gastrointestinal syndrome)
250 - 500 R; single dose, whole body 50% death rate	Death occurs several weeks after exposure due to damage to bone marrow (Hematopoietic syndrome)
50 - 350 R and higher; single dose, whole body	Can produce various degrees of nausea, vomiting, diarrhea, red-denning of skin, loss of hair, bliters, depression of immune system

Radiation Exposure	Effects
100 R; Single dose, whole body	Mild radiation sickness, depressed white blood cell count
400 - 500 R; local, low energy x-ray	Temporary hair loss
600 - 900 R; local to the eye	Cataracts
500 - 600 R to skin; local single dose, 200 keV	Threshold erythema in 7 - 10 days, followed by gradual repair and dull tanning
1500 - 2000 R to skin; local single dose, 200 keV	Erythema, blistering, residual smooth soft depressed scar
25 R; single dose, whole body	Lymphocytes temporarily disappear from circulating blood
10 R; single dose, whole body	Elevated number of chromosomal aberrations in peripheral blood; no other detectable injury or symptoms

21.5 External Radiation Exposures. External hazards arise when radiation from a source external to the body penetrates the body and causes a dose of ionizing radiation. These exposures can be from gamma or x-rays, neutrons, alpha particles or beta particles; they are dependent upon both the type and energy of the radiation.

Most beta particles do not normally penetrate beyond the skin, but when sufficiently intense, can cause skin and/or eye damage. Very energetic beta particles, such as those emitted by ^{32}P , can penetrate several millimeters into the skin. Shielding is needed in order to reduce the external radiation exposure. Typically, a maximum of 1/2 inch thick sheet of Plexiglas is an effective shield for most beta particles.

Alpha particles, because of higher mass, slower velocity, and greater electrical charge compared to beta particles, are capable of traveling a few inches in air and rarely penetrate the outer dead skin layer of the body. Therefore, alpha particles typically are not an external radiation hazard.

X and gamma rays, along with neutron radiation, are very penetrating, and are of primary importance when evaluating external radiation exposure and usually must be shielded. The onset of first observable effects of acute radiation exposure, diminished red blood cell count, may occur at a dose of approximately 100 rads of acute whole body radiation exposure. The LD50 for humans (lethaldose where 50% of the exposed population may die from a one time exposure of the whole body) is about 500 rads, assuming no medical intervention.

Exposure to external radiation may be controlled by limiting the working time in the radiation field, working at a distance from the source of radiation, inserting shielding between the worker and the source, and by using no more radioactive material than necessary.

- 21.6 **Internal Radiation Exposures.** Radioactive materials may be internally deposited in the body when an uptake occurs through one of the three routes of entry: inhalation, ingestion and skin contact. These exposures can occur when radioactive material is airborne; is inhaled and absorbed by the lungs and deposited in the body; is present in contaminated food, drink or other consumable items and is ingested; or is spilled or aerosolizes onto the skin and absorbed or enters through cuts or scratches. Internal deposition may also result from contaminated hands, with subsequent eating or rubbing of eyes.

Internal exposures arise when radiation is emitted from radioactive materials present within the body. Although external hazards are primarily caused by x-rays,

gamma rays, high energy betas and neutrons, all forms of radiation (including low energy betas, gammas and alphas) can cause internal radiation exposures. Alpha particles create a high concentration of ions along their path, and can cause severe damage to internal organs and tissues when they are inhaled, ingested or are present on the skin. Once these particles get into the body, damage can occur since there is no protective dead skin layer to shield the organs and tissues. Internal exposures are not limited to the intake of large amounts at one time (acute exposure). Chronic exposure may arise from an accumulation of small amounts of radioactive materials over a long period of time.

- 21.7 **Routes of Exposure.** Minimizing the amounts of radioactive materials handled in all cases will reduce exposure potential, since exposure is directly related to the amount used and how it is handled. The three routes of entry into the body for radioactive materials are inhalation, ingestion and skin contact (absorption/injection). Precautions should be taken to avoid each of these means of internal exposure to radiation. External radiation exposure is possible with certain kinds of radiation. Methods of minimizing this potential are time, distance, shielding and minimizing the amount used.
- 21.8 **Monitoring Operations Involving Radioactive Materials.** Due to the potential for contamination of work areas during use of radioactive materials, it is necessary to monitor as much as possible the operations performed. Work areas should be checked before use to determine background or prior contamination. The survey instrument should be turned on and placed proximal to the work area in order to check radiation levels, and to alarm the worker if radiation levels rise significantly. Hands should be checked frequently for presence of contamination due to splashing or aerosols. At the end of the use of the work area, or each day, work areas should be monitored to determine the presence of contamination.

Note that worker clothing and shoes should also be monitored. If contamination is found, the area or equipment must be decontaminated.

21.9 Time, Distance and Shielding

- A. **Time.** Minimize the time that radioactive materials are handled. Since the amount of exposure occurs as a function of duration of exposure, less time means less exposure. This may be achieved by conducting "dry runs" (practicing the procedures to be performed, with all of the steps and manipulations performed without the hazardous materials). Conduct the work quickly and efficiently, but do not rush.
- B. **Distance.** Maximize the distance from the radioactive materials. Dose is inversely proportional to distance, therefore, greater distance means less dose. Do not increase the distance to the point wherein dexterity or control of the materials is jeopardized.
- C. **Shielding.** Use shielding wherever it is necessary to reduce or eliminate exposure. By placing an appropriate shield between the radioactive source and the worker, radiation is attenuated and exposure may be completely eliminated or reduced to an acceptable level. The type and amount of shielding needed to achieve a safe working level varies with the type and quantity of radioactive material used.

The HVL (half-value layer) may be used as a guide to the thickness of the shielding necessary to block the radiation. The HVL is the thickness of the shielding necessary to reduce the radiation dose rate to half of the original or unshielded dose rate. Refer to the HVL information in the appendices on specific nuclides.

21.10 Protective Equipment. In order to prevent contamination of skin, eyes or personal apparel, protective equipment should be utilized during use of radioactive material. The specific types of protective equipment needed are dictated by the nuclide, level of activity, chemical form and experimental procedures. Two main categories of protective equipment are personal protective equipment and engineering controls. Personal protective equipment is protective equipment worn by the worker. Examples are gloves, laboratory coats and safety glasses. Engineering controls are external equipment designed to protect the worker, or are a part of the design of the work area. Examples are fume hoods, biological safety cabinets, building ventilation systems and shields.

Individuals using radioactive materials must wear laboratory coats, gloves and eye protection. Additional protective equipment may be necessary or prudent. Contact a Health Physicist if you have questions about protective equipment.

21.11 General Rules for Radiation Safety

1. Do not eat, drink or smoke in radiation use, storage or disposal areas. "Eating" includes gum, candy, beverages and chewing tobacco. Do not apply cosmetics in the laboratory. Do not consume medication in radioisotope laboratories. Do not dispose of food, empty food wrappers or containers anywhere in the laboratories.
2. Laboratories must not be used for food storage, particularly refrigerators.
3. Gloves should be worn during any and all operations in which contamination of the hands is possible.
4. Never pipette radioactive liquids by mouth.

5. Store and transport radioactive materials in containers which will prevent breakage and spillage. Secondary containment is important; when transporting radioactive materials, use trays and carts.
6. Use ventilation hoods or glove boxes if the radioactivity may become airborne and for high activity uses, such as stock solutions.
7. The individual(s) responsible for any contamination will be required to decontaminate the area of concern.
8. Regularly check your hands, clothing and shoes for contamination prior to leaving the work area after working with radioactive material.
9. Always dispose of radioactive waste in a radioactive waste container.
10. Always wear your assigned radiation detection badge(s) when working with radioactive materials.
11. Wear laboratory coats when working with radioactive materials. Lab coats should be buttoned up, not worn open.
12. Users of high energy beta or gamma nuclides should wear eye protection, such as safety glasses or eye glasses.



TOPIC 22
INSPECTIONS AND
ABATEMENT

22.1 References

- A. 29 CFR 1960 Subpart D Inspection and Abatement
- B. 29 CFR 1960 Subpart H Training
- C. 485 DM Chapter 6
- D. SM 445-2-H, Chapter 6 Inspection and Abatement

22.2 Procedures

- A. **Routine Inspections.** The routine inspection of all operations, workplaces, and facilities is a continuous part of every supervisor's responsibility.

22.3 **Formal Inspections.** Procedures for conducting formal inspections can be found in SM 445-2-H, Chapter 6. Personnel sufficiently trained to recognize unsafe or unhealthful working conditions and occupational hazards shall conduct formal annual inspections of workplaces and facilities. Annual inspections should be scheduled with management at the facility to be inspected.

22.4 **Inspection Checklists.** Inspection checklists are an excellent tool for conducting routine inspections. While checklists are helpful, they are not all-encompassing. Hazards identified that are not included on checklists should be added as appropriate. The Appendix contains a sample inspection checklist.

22.5 **Collateral Duty Safety Officer Responsibility.** Coordinate the establishment of a workplace inspection program to effectively identify, document, and track safety, health, and environmental deficiencies until corrective action is taken either to eliminate or reduce the hazard to an acceptable level. High hazard workplaces or locations where there is an increased risk of accident or injury due to the nature of the operations should be surveyed more frequently.



TOPIC 23
**EMPLOYEE RECORDS OF
UNSAFE/UNHEALTHFUL
WORKING CONDITIONS**

23.1 References

- A. 29 CFR 1960.26-28 Inspection and Abatement
- B. 485 DM Chapter 8
- C. Public Law 91-596, Section 8 (f)(1)
- D. 29 CFR 1960.46 Agency Responsibility
- E. 29 CFR 1960.8(a) General Duty Clause
- F. SM 445-2-H, Chapter 8 Employee Reports of Unsafe Conditions and Allegations of Reprisal

23.2 **Procedures.** Employees are responsible for identifying potentially hazardous conditions and correcting them when they have the ability and knowledge to do so.

- A. **Supervisor Responsibilities.** Supervisors are the key to ensuring that employee reports of unsafe conditions are followed up. This responsibility cannot be delegated to the safety manager/ coordinator or to the employee. Supervisors to whom reports are made are responsible for investigating employee reports and implementing controls to protect employees from the hazard. Examples of such controls are the following:
 - 1. Discontinue the operation or process until corrective action is completed.
 - 2. Remove all employees from the hazardous condition, operation, or process.
 - 3. Place barriers and signs in the hazardous area to prevent employee entry until corrective actions are completed.
 - 4. Provide employees with appropriate clothing or personal protective equipment (PPE) or tools to allow them to continue the task safely.

5. Advise employees concerning corrective actions completed or planned.
6. Forward the report to the safety manager, or to a higher authority if the safety manager does not have the expertise, authority, or resources to accomplish corrective action.
7. Follow up to ensure corrective actions have been taken.

B. **Safety Manager Responsibilities.** The safety manager is responsible for providing technical assistance to supervisors and managers for proper identification of hazards and appropriate corrective actions.

C. **Management Responsibilities.** Management officials are responsible for implementing and supporting the reporting process by doing the following:

1. Training employees in proper reporting of unsafe or unhealthful working conditions.
2. Providing supervisors with the resources to ensure that employees are protected from the potential hazard(s) reported.
3. Ensuring that no employee is subjected to restraint, interference, coercion, discrimination, or reprisal by virtue of submitting a report either orally or formally within the organization or to higher levels of authority.

23.3 **Employee Rights.** The employee has the right to decline a task because of a reasonable belief that there is an imminent risk of death or serious injury and there is insufficient time for hazard reporting and abatement actions. See 29 CFR 1960.46. Employees have the right to make reports and to remain anonymous without fear of reprisal.

23.4 Reports to OSHA. Employees may also submit formal complaints alleging workplace hazards directly to the Department of Labor (OSHA); however, the Secretary of Labor encourages employees to use the Bureau inhouse hazard-reporting procedure as the most expeditious means to achieve abatement. Complaints outside the Bureau may serve as the basis for investigations or inspections by OSHA officials; therefore, employees should not contemplate such actions until in-house efforts prove to be ineffective.

23.5 Workplace Violence. Bureau offices shall implement a zero-tolerance policy on workplace violence. The policy shall be disseminated to all employees. Procedures for reporting workplace violence shall be established, and employees will be notified of the proper reporting procedure. Employees should receive training on prevention of workplace violence and proper reporting procedures. Employees who have potential exposure to conflict in the performance of duties shall receive training in conflict resolution or the equivalent.

Illustration 23.1 USGS REPORT OF UNSAFE OR UNHEALTHFUL CONDITION

FORM 9-3074 USGS REPORT OF UNSAFE OR UNHEALTHFUL CONDITION

USGS REPORT OF UNSAFE OR UNHEALTHFUL CONDITION	FILE NUMBER:
PART I: ORIGINATOR HAZARD DESCRIPTION	
DATE REPORTED: _____ LOCATION: _____ ROOM NUMBER: _____	
HAZARD DESCRIPTION: _____ _____	
PROPOSED CORRECTIVE ACTIONS: DATE: _____	
NAME(optional): _____ PHONE: _____ ORG: _____	
PART II: SAFETY OFFICIAL EVALUATION:	
RISK EVAL. (MARK ONE): IMMINENT DANGER: _____ SERIOUS: _____ NONSERIOUS: _____	
HAZARD CLASSIFICATION (MARK ONE) ENVIRONMENTAL: _____ FIRE: _____ SAFETY: _____	
SAFETY ASSESSMENT: _____ _____	
SAFETY RECOMMENDATIONS: DATE: _____	
NAME(optional): _____ PHONE: _____ ORG: _____	

PART III: SUPERVISOR CORRECTIVE ACTION

HAZARD PLANNED OR ACTUAL CORRECTIVE ACTION(S)

ESTIMATED COMPLETION DATE: _____ ACTUAL COMPLETION DATE: _____

NAME, PHONE, ORG: DATE: _____ SUPERVISOR SIGNATURE: _____

PART IV: SAFETY OFFICIAL CERTIFICATION

SAFETY OFFICIAL: _____ CLOSURE DATE: _____

DATE TRANSFERRED TO HAZARD ABATEMENT LOG/MANAGEMENT ACTION PLAN, AS APPLICABLE:

** Note: Any questions, please call the Safety Management Office, x7556. Return form to MS 246.
 (This form can be found by using the USGS Computer software package "Informs" or the USGS Safety
 Web site, <http://swwww.usgs.gov:8888/ops/safetynet/accfrm.html>)*

Instructions for Filing Employee Reports of Unsafe Conditions (Form 9-3074)

Any USGS employee has the right and is encouraged to report unsafe or unhealthful conditions that exists in any work place or work environment (refer to the Occupational Safety and Health Handbook, Chapter 3, 445-2-H for more information).

USGS employees are encouraged to verbally report unsafe or unhealthful conditions to their supervisors as soon as the condition is identified.

Reports that are submitted in writing shall be filed on **Form 9-3074** describing the hazard and the proposed corrective action suggested. In the case of imminent danger (i.e., the condition immediately threatens serious physical harm), the report should be made by the most expeditious means available to your supervisor or safety representative.

If requested by the employee, the safety and health manager, or the designee, will not disclose the name of any such person, or the names of the individual employees referred to in the report to anyone other than an authorized representative of the Secretary of Labor.

All USGS employees are protected from restraint, interference, coercion, discrimination or reprisal for exercising any of their rights under the DOI and USGS occupational safety, health, and environmental programs.

The Safety Official reserves the right to disclose the corrective action with the originator. Each hazard will be at the discretion of the circumstances that surround the condition or hazard. It is the policy of the USGS not to find fault or blame rather to correct the hazardous condition and prevent future occurrences.

File number: Safety Official should identify

Part 1: Originator Hazard Description

Date Reported: Enter today's date

Location: Enter the building and area where the condition exists

Room number: Enter the room number or nearest identifiable room number

Hazard Description: Enter the act, condition, and/or practice you observed. Give as much detail as possible. Name people to contact for further information who may have observed the hazard, or who committed the unsafe act.

Proposed Corrective Action(s): Enter your recommendations on how to correct the hazard.

Name (optional): Enter your name. If you wish to not enter your name you will not receive a written reply to your report.

Phone: Enter a telephone number where you can be contacted for further information, to discuss the report or to provide you with status reports on abatement actions.

Once the supervisors have taken actions to correct the hazard, they are to give a copy of the report to the employees reporting the hazard, and forward the original to the Safety Official.



TOPIC 24
ACCIDENT/INCIDENT
INVESTIGATIONS

24.1 References

- A. SM 445-2-H, Chapter 7, Incident/Accident Reporting/Serious Accident Investigation
- B. 29 CFR 1960, Subpart I, Recordkeeping and Reporting Requirements
- C. DM 485, Chapter 7, Incident/Accident Reporting/Serious Accident Investigation

24.2 **Procedures.** The following information is provided to assist you in identifying the type of forms and routing required in the event of an accident. Should you have any specific questions regarding completion of these forms, please contact your Regional Safety Manager for clarification. Include photographic evidence of all accidents when possible. **KEEP COPIES OF ALL DOCUMENTS SUBMITTED.**

- A. **ACCIDENT REPORT FORMS AND DESCRIPTIONS (Complete SMIS accident report and other required forms within five days whenever possible):**
 - 1. SMIS: Report of Accident / Injury / Incident. Make a copy (Incident Report in SMIS) prior to submission. The DI-134 is obsolete and should not be used.
 - 2. SF-91: Investigation of Motor Vehicle Accident.*
 - 3. SF-92: Supervisors report of Accident – Other than Motor Vehicle.
 - 4. SF-94: Statement of Witness.
 - 5. SF-95: Claim for Damage, Injury, and Death. (see Tort Claims below)

6. DI-103: Report of Survey.
7. Aviation Accident- Call OAS Accident Reporting Hotline 888 464-7427.
8. CG-3865: U.S. Coast Guard, Boating Accident Form

* As of 2/93 the SF-91 has incorporated the following forms: SF-91, SF-91A, OF-26, and should be completed along with the SF-94 if applicable.

ACCIDENTS INVOLVING DAMAGE TO INTERIOR-OWNED PROPERTY VALUED OVER \$5000 - OR-ACCIDENTS INVOLVING PROPERTY DAMAGE CAUSED BY GOVERNMENT ACTIONS:

DI-103 / SF-91 / SF94 original forms with any supporting documentation should be forwarded to the Property Management Branch. (Use SF-92 in lieu of SF-91 if non-motor vehicle property damage is involved). Collect photos taken at scene.

ACCIDENTS INVOLVING GSA-LEASED VEHICLES AND PROPERTY DAMAGE :

The original SF-91 / SF-94 should be forwarded to the GSA motor pool where the vehicle was obtained as soon as possible. The address should be listed within the package contained in the glove box. Submit SMIS accident report within 5 days.

If government liability is involved, a DI-103 should also be completed for GSA-Leased property damage, and forwarded to Property Management. The issuing office should maintain copies of all forms. Collect photos taken at scene.

ACCIDENTS INVOLVING DAMAGE TO NON-GOV-ERNMENT PROPERTY OR INJURIES TO NON-GOVERNMENT PERSONS:

(SF-91 / SF-92 / SF-94 / SF-95)

See TORT CLAIMS on the next page:

ACCIDENTS INVOLVING AIRCRAFT :

Call OAS to report the accident and receive further instructions. Call the OAS 24 hour Aircraft Accident Reporting Hotline 888 464-7427 or during business hours you can call the OAS Aviation Safety Office at 208 387-5800. If employee injuries are involved, a workers compensation claim (CA-1 form) should be completed. A SMIS accident report should be submitted within 5 days. Collect photographs taken at scene. When non-government injury/property damage is involved, a SF-95 should be issued to each injured person (See TORT CLAIMS below). Contact a Regional Safety Officer and Bureau Safety Manager.

ACCIDENTS INVOLVING WATERCRAFT:

The original CG-3685 should be sent to the State Boating Authority (US Coast Guard Auxiliary in most states) where the accident occurred within 48 hours if death or serious injury is involved; 10 days if the accident was non-serious involving property damage only. A SMIS accident report and DI-103 / SF92 should be completed. Collect photographs taken at scene.

If other than USGS injury or property damage is involved, a SF-95 should be issued to each injured party or owner of the non-government property, who completes the form and returns it to the issuing office for appropriate routing (See TORT CLAIMS on the next page).

- A. **SMIS** report should be completed for any watercraft accident along with SF-92.

- B. **WORKERS COMPENSATION PROGRAM:**
Procedures to report Workers Compensation

Claims vary from office to office. Please check with your administrative section for guidelines. The following information is intended for informational purposes only.

1. CA-1: Federal Employee Notice of Injury, Claim for Continuation of pay. The Administrative Group should forward CA-1 to Employee Relations with copy of SMIS and additional forms).
2. CA-2: Federal Employee Notice of Occupational Disease / Claim for Compensation.
3. CA-20: Physicians Report (when more than first-aid was required).

CA-1 is now electronically generated with the SMIS accident report. Make a hard copy of the CA-1 before electronically submitting the SMIS accident report for review. CA-2 and CA-20 original forms should be submitted to Personnel Office of Workers Compensation Program Manager within 30 days: a copy maintained by the reporting office.

- C. **TORT CLAIMS.** Procedures to report Tort Claims vary from office to office. Please check with your administrative section for guidelines. The following information is intended for informational purposes only.

Any accident involving private property damage or injury to non-government persons can result in Tort Claims. Tort Claims are filed using a SF- 95. Be complete in data collection, which include forms submitted by property owners. Incomplete SF-95 forms submitted by private citizens will delay the process. ALL SF-95 FORMS SHOULD BE ISSUED TO THE CLAIMANT, WHO SHOULD RETURN THE FORM TO THE LOCAL ORGANIZATION.

WHO WILL THEN FORWARD TO APPROPRIATE TORT CLAIMS PERSONNEL.

**ACCIDENTS INVOLVING DAMAGE TO NON-GOVERNMENT PROPERTY:
(SF-91 / SF-92 / SF-94 / SF-95)**

The original SF-91 / SF-94 and any other back-up documentation, i.e. police reports, etc, should be forwarded to your Tort Claims Officer within 20 days for a non-serious accident, within 7 days if serious injury is involved. The reporting office should maintain a copy. The Tort Claims Officer is responsible for review, and forwarding original forms and additional documentation to the Solicitors Office within 30 days of non-serious accident and 10 days from any occurrence of a serious accident. Collect photos taken at scene.

NOTE: IF PROPERTY DAMAGE IS OTHER THAN MOTOR VEHICLE, A SF-92 MUST BE COMPLETED. A SF-95 is issued to the private property owner, who returns it to the reporting office. The reporting office forwards the completed SF-95 to the Tort Claims Officer.

Tort Claims Officers are responsible for form review and sending all applicable forms to the Solicitors Office. All Solicitors Office correspondence should contain a cover letter, which includes points of contact related to the report.

D. SUMMARY OF REQUIRED ACCIDENT FORMS

ACCIDENT TYPE:

FORM NEEDED:

INJURY/ILLNESS:

GOV employee injury

SMIS, CA-1, CA-20,

Non-GOV employee injury

SMIS, SF94, SF-95

GOV employee illness

SMIS, CA-2, CA-20,

MOTOR VEHICLE PROPERTY DAMAGE/INJURY:

Interior vehicle & no injury

SMIS, DI-103, SF-91, SF-94

Interior vehicle & GOV employee injury

SMIS, CA-1, CA-16, CA-20, SF-91/94/95

Interior vehicle & non-GOV injury

SMIS, DI-103, SF-91/94/95

Interior vehicle & GOV+ non-GOV injury

SMIS, DI-103, CA-1/16/20, SF- 91/94/95

GSA VEHICLE:

GSA vehicle

SMIS, DI-103, SF91/94

GSA vehicle & GOV

Employee injury

SMIS, DI-103, SF91/94

GSA VEHICLE & NON-GOV INJURY

SMIS, DI-103, SF-91/94/95

GSA VEHICLE & GOV+ non-GOV injury

SMIS, DI-103, CA-1/16/20, SF-91/94/95

NON-VEHICULAR PROPERTY DAMAGE/INJURY:

GOV property

SMIS, DI-134, SF-92/94

Non-GOV property

SMIS, DI-103, SF-92/94/95

GOV property & GOV employee injury

SMIS, DI-103, CA-1/16/20, SF-92/94

GOV property &

non-GOV injury

SMIS, DI-103, SF-92/94/95

Non-GOV property & GOV+non-GOV INJURY

SMIS, DI-103, CA-1/16/20, SF-92/94/95

Aircraft accidents

SMIS. Call Accident hotline 888 464-7427

Watercraft accidents (no injuries)

SMIS, DI103, SF-94, CG3685

COMPLETION OF THE SF-94 IS DEPENDENT UPON AVAILABILITY OF WITNESSES. ALL SF-95 FORMS SHOULD BE ISSUED TO THE CLAIMANT, WHO SHOULD RETURN THE FORM TO THE LOCAL ORGANIZATION WHO WILL THEN FORWARDED TO APPROPRIATE TORT CLAIMS PERSONNEL (see TORT CLAIMS above).



TOPIC 25
CONFINED SPACE

25.1 **References**

- A. 29 CFR 1910.146 Confined Space
- B. SM 445-2-H, Chapter 40
- C. Federal Cave Resources Protection Act 1988
- D. 43 CFR Part 37 Cave Management Regulations

25.2 **Procedures.** The USGS has established procedures and policy for identifying permit-required confined space and associated hazards and controlling such hazards to allow safe entry. The USGS has established stiling well safety standards and mine entry requirements, within the Confined Space Entry Policy, for USGS employees. These standards consist of safety guidelines, job hazard analyses (JHAs), and search and rescue (SAR) procedures. Employees will have appropriate training prior to entry of such spaces.

25.3 **Program Elements for Confined Space Entry**

- A. Identification of Confined Spaces
- B. Hazard Identification/Risk Assessment
- C. Hazard Control
- D. Permit-System
- E. Employee Information and Training
- F. Site Control
- G. Authorized and Unauthorized Entry
- H. Equipment
- I. Rescue

J. Protection from Internal Hazards

K. Duty to Other Employees

25.4 **Stilling Wells**

A. **General Guidelines to enter stilling wells.**

1. Provide engineering solutions to reduce the need to enter the stilling well. For example, an electric tape can be used to measure water levels in the stilling well rather than entering the well to read a staff gage.
2. Place a sign at every entry to the stilling well: "Safety Hazard Unauthorized Personnel DO NOT ENTER". Cooperators or other non-USGS personnel visit many USGS gaging stations. The purpose of the sign is to warn everyone who may have access to the stilling well that there is a hazard and they should not enter.
3. Conduct a safety evaluation of the gaging station stilling well. Safety evaluations should be conducted either annually or just prior to entry. Personnel who conduct the safety evaluation for both physical and electrical safety hazards must have the necessary experience and skills needed to complete the evaluation. Personnel who conduct the atmospheric tests need to be trained to calibrate and use the instrumentation. Safety evaluation guidelines are described on the following page:
 - A. Document the number of years the stilling well has been safely entered. Review historic safety evaluations/incidents to help identify potential safety concerns.

- B. Evaluate and eliminate all identified physical hazards.
 - 1. Are ladders safe? Is fall protection needed? Fixed ladders require a safety device if they are more than 20 feet high (29 CFR 1917.118).
 - 2. Objects such as tools, shovels, sounding weights, nitrogen tanks, etc. that could fall into the stilling well should be secured or removed. Personal protective gear (hard hat, rubber gloves, eye protection, etc.) must be available and used as appropriate.
- C. Evaluate and eliminate all identified electrical hazards.
 - 1. All AC electrical circuits in gaging stations and stilling wells must be protected by a Ground Fault Circuit Interrupter (GFCI) device.
 - 2. Electric power tools used in stilling wells must be double-insulated or connected to a GFCI circuit.
- D. Evaluate and eliminate all identified biological hazards such as sanitary concerns, snakes, wasps, mice (hantavirus), bats (histoplasmosis), etc.
- E. Measure and verify that oxygen and carbon monoxide concentrations in the stilling well are safe (before mechanical ventilation).
 - 1. Before entry into any stilling well, open all doors and vents for a minimum of five minutes. Doors should always be secured in the open position to prevent inadvertent entrapment.
 - 2. Measure the atmosphere in the stilling well near the expected breathing zone of an entrant. Oxygen concentration is acceptable if

it is between 19.5% and 23.5%. Carbon monoxide concentration is acceptable if it is 0 to 35 PPM.

- F. Determine if there are other potential atmospheric concerns in the stilling well in addition to carbon monoxide and oxygen. All potentially hazardous atmospheric conditions must be evaluated and determined to be safe (before mechanical ventilation). For example:
1. Propane heaters in stilling wells can create very dangerous confined space hazards. The propane may leak, displacing oxygen, or creating an explosive hazard. The propane heater may burn inefficiently, creating carbon monoxide. The propane heater may consume the oxygen in the stilling well. If propane heaters are used, the entry procedures for stilling wells that fail any atmospheric test, described later, must be used.
 2. If there is considerable organic debris in the bottom of the stilling well, carbon dioxide may be displacing oxygen.
 3. The results of the stilling well safety evaluation for physical, electrical, biological, and atmospheric hazards must be documented.
 4. A Job Hazard Analysis (JHA) that describes the hazards and the required safe entry procedures for working in stilling wells must be completed. The JHA should include a plan for emergency help such as phone numbers for rescue and medical help. Supervisors will discuss the JHA and safe entry procedures with every employee who may enter a stilling well. The JHA should be placed in the field folder for that gage.
 5. After steps A-E have been completed, provide

mechanical ventilation, such as a portable blower, to supply fresh outside air into the stilling well during every entry. The blower should be able to supply enough fresh air to replace the total volume of air within the stilling well three times each minute. The fresh air exhaust duct from the blower should be placed near the water surface in the stilling well. Exhaust from gasoline or propane powered sources must be vented downwind and down gradient from the stilling well and the mechanical blower, to prevent accidental introduction of contaminated air in the stilling well.

- B. Guidelines for stilling wells that fail any atmospheric test. If any atmospheric test is unacceptable, it is recommended that the use of the stilling well be discontinued and alternate methods to measure stage be used.

If entry into a stilling well that has failed any atmospheric test is needed, significantly more restrictive entry procedures must be used. These entry requirements must be used every time the stilling well is entered during the life of the stilling well:

1. Use the General Guidelines for Entering Stilling Wells outlined in steps A – E above. In addition:
2. Require a minimum of two people, an entrant and an attendant, every time the stilling well is entered.
3. Provide mechanical ventilation, such as a portable blower, to supply fresh outside air into the stilling well during entry. The blower should be able to supply enough fresh air to replace the total volume of air within the stilling well

three times each minute. The fresh air exhaust duct from the blower should be placed near the water surface in the stilling well. Exhaust from gasoline or propane powered sources must be vented downwind and down gradient from the stilling well and the mechanical blower, to prevent accidental contamination of air in the stilling well.

4. Measure the stilling well atmosphere near the expected breathing zone of the entrant during mechanical ventilation for oxygen, carbon monoxide and any other atmosphere hazards identified as part of the safety evaluation. Oxygen concentration is acceptable if between 19.5% and 23.5%. Carbon monoxide concentration is acceptable if between 0 to 35 ppm. If propane is used to heat the stilling well during the winter:
 - a. The propane must be turned off prior to entry.
 - b. The first atmospheric test must be for oxygen concentration (most combustible gas meters will not provide reliable readings in an oxygen-deficient atmosphere).
 - c. The next atmospheric test must be for combustible gas. Combustible gas is acceptable if below 10% of Lower Explosive Limit.
 - d. The next atmospheric test should be for carbon monoxide concentration.

If any atmospheric measurement is unacceptable, even with mechanical ventilation, do not enter. This stilling well must be treated as a "Permit-Required Confined Space." Contact your Regional Safety Officer for further instructions.

5. If all atmospheric measurements are acceptable, continue to mechanically ventilate the stilling well and enter the well. The attendant will continuously monitor the stilling well atmosphere, near the breathing zone of the entrant, from outside the stilling well. If atmospheric monitoring indicates unsafe conditions, the entrant must exit the stilling well immediately.

25.5 **Caves.** Cave management responsibilities include consideration for employee and public health and safety while in a cave. A safety orientation based on the following guidelines and JHAs is required for USGS employees who enter caves as a part of their duties.

Inactive/Abandoned Mines. Confined space entry requirements within the USGS have been expanded to include entry into inactive/abandoned mines. Due to the high potential of exposure to hazardous conditions during mine entry and examination, it is recommended that the entry requirements outlined under the Confined Space Policy be followed to ensure the safety of those employees required to enter mines to perform their duties. Pre-evaluation for hazards shall be done until it is determined that no hazardous conditions exist. Continuous monitoring for hazards (i.e., lower explosive limits, oxygen deficiency, toxic gases) is still recommended when in the mine. Use the JHA evaluation process for all entry situations.



TOPIC 26
HYDROGEN SULFIDE (H₂S)
PROTECTION

26.1 References

- A. American National Standard for Respiratory Protection, Respirator Use, Physical Qualifications for Personnel, ANSI Z88.6-1984
- B. Accepted Practices for Hydrogen Sulfide (H₂S) Safety Training Programs, ANSI Z390.1-1995
- C. Respiratory Protection, ANSI Z88.2-1992
- D. 29 CFR 1910.134 Respiratory Protection
- E. SM 445-2-H, Chapter 18 Respiratory Protection

26.2 **Procedures.** H₂S is a highly toxic, colorless, heavier than air, and highly flammable gas. Employees who work in an H₂S environment must follow standard safety practices to protect themselves against potential H₂S hazards and exposure. Safe work practices include the required use and maintenance of personal protective equipment (PPE), safety training for working in an H₂S environment, and following established safety procedures.

- A. **Buddy System Procedure.** Ambient air H₂S concentration of 100 ppm or greater is considered Immediately Dangerous to Life and Health (IDLH) and requires that buddy-system procedures be implemented. The buddy or safety backup must be an individual trained in H₂S safety. The safety backup is responsible for maintaining contact with the petroleum engineering technician (PET) during an inspection and ensuring a safe rescue in the event the PET is overcome by H₂S.
 - 1. The safety backup will take the following measures:
 - a. Be in a safe zone (always upwind or cross wind).

- b. Establish radio contact with the office and advise them that PET is entering IDLH conditions and the expected duration of inspection. Office will be contacted upon completion of inspection.
- c. Maintain visual contact with the PET at all times.
- d. Be wearing a working monitor.
- e. Be wearing a self-contained breathing apparatus (SCBA) and be ready to mask-up immediately if the PET goes down.
- f. Be physically capable of moving the PET to a safe zone. If rescue is necessary, the safety backup will assess the situation to determine that it is safe to attempt rescue, inform the office, mask-up and check the SCBA, shut off source of H₂S, if possible, and proceed with rescue.

B. Tank-Gauging Inspections. If the H₂S concentration is known to be 20 ppm or greater, the PET will do the following:

1. Verify that the monitor is working.
2. Don SCBA and mask-up prior to ascending stairs.
3. Stand upwind from the hatch when opening it, allowing tank vapor pressure to equalize.
4. If tank vapor pressure does not equalize within 30 seconds, and if the monitor reading at shirt pocket level does not reach or exceed 100 ppm, the PET will leave the hatch open, get down from the tank, and perform other tasks. The PET will resume tank-gauging procedure

after 10 to 15 minutes if tank vapor pressure has equalized. If vapor pressure does not equalize and the monitor reaches or exceeds 100 ppm, the PET will close the hatch and leave the area until the buddy system can be implemented.

- C. **Meter-Calibration Inspections.** When witnessing a gas-meter calibration inside a meter house, and the H₂S concentration is known to be 20 ppm or greater, the PET will do the following:
1. Verify that the monitor is working.
 2. Open the meter house door and ventilate the area for three to five minutes.
 3. Don SCBA and mask-up prior to entering meter house.
 4. If the ambient air H₂S concentration is less than 20 ppm, the mask can be taken off. The SCBA, work unit, or escape pack must be used when performing inspections inside meter houses.
 5. The PET must mask up prior to witnessing the orifice plate inspection.
 6. If the ambient air H₂S levels reach or exceed 100 ppm at any time, the PET is to leave the area and initiate the buddy system before reentering the building.
- D. **Entering Buildings and Enclosed Structures.** The PET must follow the safety procedures described for meter calibration inspections prior to entering a building when H₂S concentrations are 20 ppm or greater.

- E. **Drilling Operations.** The PET must have an H2S monitor and escape pack ready for immediate use when performing drilling inspections.

- F. **Plugging and Abandonment, and All Other Oil and Gas Operations.** The PET must use an H2S monitor, and if H2S levels register greater than 20 ppm, the PET must leave the area, don an SCBA, and mask-up prior to continuing work.

- G. **Surface Compliance Inspections.** Surface Compliance Specialists working in an H2S environment of 20 ppm or greater must follow the same safety guidelines established for PETs.

- H. **All Other Field Activities or Inspections.** No person shall work at a site with known H2S concentrations without appropriate H2S training and personal protective equipment (PPE). Visiting personnel must have an escape pack and be trained in its use. A USGS employee who has received appropriate H2S training must also accompany them.

26.3 **Personal Protective Equipment.** Employees assigned PPE will be responsible for using and maintaining equipment according to the manufacturer's specifications and policy requirements.

A. **H2S Monitors:** H2S monitors are used to monitor levels in the air in ppm and to alert employees when H2S concentrations reach hazardous levels.

B. **Self-Contained Breathing Apparatus:**

1. **Type and Usage**

- a. **Thirty-minute (rescue) pack.** Thirty-minute pack will be rated and approved by NIOSH/MSHA as a 30-minute self-contained breathing apparatus (SCBA)

with a pressure demand Type C supplied-air respirator. It is used for rescue and to accomplish tasks of short duration.

- b. **Work unit.** Respirator is to be rated and approved by NIOSH/MSHA as a combination five-minute SCBA for escape and pressure demand Type C supplied-air respirator for work. This unit is designed to be attached to a breathing air supply hose from a large tank for longer periods of work.
 - c. **Escape Pack.** The escape pack is a five-minute light-weight, self-contained air supply pack with a bag-type cover to enclose head area. This is a one-piece unit designed to be used for escape only and is not to be used for any other purpose.
2. **Maintenance.** All equipment must be inspected to ensure equipment is in good working order before and after use. Equipment must also be cleaned after use. Fit tests are performed, using a nontoxic test agent, to ensure that employees are assigned a proper-fitting respirator. Fit checks must be performed every time a respirator is to be used to enter an H2S environment. All SCBAs shall be inspected before and after each use and at least monthly. Any equipment that does not pass a fit check will be replaced or repaired. On an annual basis, supervisors will inspect all breathing-air equipment and report to management on the condition of this equipment.

26.4 **Training.** PETs, safety backups, surface compliance specialists, and all other field personnel must receive training on the safety practices and procedures for working in an H2S environment.

- 26.5 **Medical Evaluation.** Employees should not be assigned to tasks requiring use of respirators unless a physician has determined that they are physically able to perform the work and use the equipment. The physician should determine which health and physical conditions are limiting. The respirator user's medical status should be reviewed annually by a physician.



TOPIC 27
**BREAKAWAY SOUNDING
REEL CABLE INSTALLATION**

27.1 Procedures. To help insure the safety of USGS employees, observers, and the public, the USGS requires the installation of Breakaway Sounding Reel Cable Kits to provide for the quick release of the cable from its reel. Installations shall be completed for all affected reels no later than April 1, 1999. A-reels not equipped with a drag brake retrofit and A-pack reels are exempt from this requirement. The drag brake retrofit for the A-reel is available and may be ordered from the Hydrologic Instrumentation Facility (HIF) warehouse. Use of this retrofit is highly recommended. Because not all A-reels will be equipped with the breakaway device, care should be taken in selecting the best reel for the task at hand. This issue relates to making discharge measurements during high flows. During periods of high flow, debris in a stream could be caught by the equipment attached at the end of the sounding-reel cable in the water. Even after complete payout of cable from the sounding reel, the debris caught on the end of the cable could pull the equipment and the streamgager into the dangerous flood-waters. Therefore, a modification to the cable has been devised to provide a quick release, or breakaway, of the end of the cable from the sounding reel in the event that the cable payout from the reel reaches the end.

The breakaway cable design for sounding reels was developed for situations when debris could lodge on the sounding weight (or other equipment) in the water and subject the cable to an unmanageable force. Transfer of such a force to the reel structure can cause damage, loss of equipment, and danger to anyone in close proximity to the equipment.

27.2 Parts Identification. The split-bolt connector located inside the sounding-reel drum will be reused in the breakaway cable installation. Other parts required: two Nicopress stop sleeves, two Nicopress tools, a ring-terminal, and heat-shrink protective tubing. All parts are available from the Hydrologic Instrumentation Facility (HIF). A pair of heavy-duty wire cutters is also required.

To apply the heat-shrink tubing, a heat source, such as a soldering iron or cigarette lighter can be used to shrink the tubing.

27.3 Calculating Breakaway Strength. Before performing the installation, determine the desired breakaway strength. The 0.084-inch diameter cable has eighteen 0.012-inch diameter outer strands and eighteen 0.008-inch diameter inner strands with a manufacturer rated strength of 500 pounds; the 0.100-inch diameter cable has thirty 0.014-inch strands with a manufacturer rated strength of 1,000 pounds; and the 0.125-inch diameter cable has thirty 0.017-inch diameter strands, with a manufacturer rated strength of 1,500 pounds.

Break-strength testing at the HIF produced average breaking strengths for three sizes of cable strands taken from three different size Ellsworth-type cables. The results are shown in the table below.

Table 1. Average breaking strength per strand for three size diameters

Strand Diameter (in inches)	Cable Diameter (in inches)	Average* breaking strength per strand (in pounds)
0.012	0.084	9
0.014	0.100	16
0.017	0.125	39

Table 2. Breaking strength tests of multiple untwisted strands (diameter 0.014 inches) taken from a 0.100-inch diameter Ellsworth-type cable

Number of Strands	Average breaking strength (in pounds)
5	213
6	258
7	279
8	284
30	1,000

Table 3. Breaking strength tests of multiple untwisted strands (diameter 0.017 inches) taken from a 0.125-inch diameter Ellsworth-type cable

Number of Strands	Average breaking strength (in pounds)
7	383
8	473
9	499
30	1,500

Table 4. Recommended number of twisted strands for the breakaway section for the breakaway limit for each size of Ellsworth-type cable.

Cable diameter (in inches)	Breakaway limit (in pounds)	Number of strands (remaining)
0.084	250	21
0.100	500	15
0.125	500	10

27.4 Installation.

(Refer to Steps 1-10 as illustrated.)

Step 1. Unspool all of the existing cable from the sounding reel. Unscrew the termination connection (ring terminal), and remove the split-bolt connector inside the reel drum.

Figure 1.

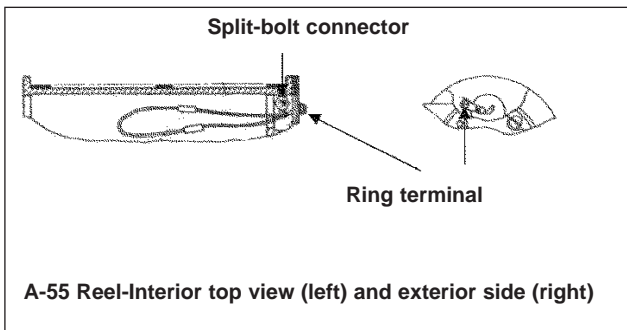


Figure 2.

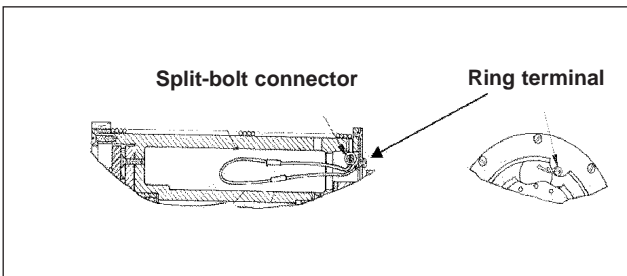
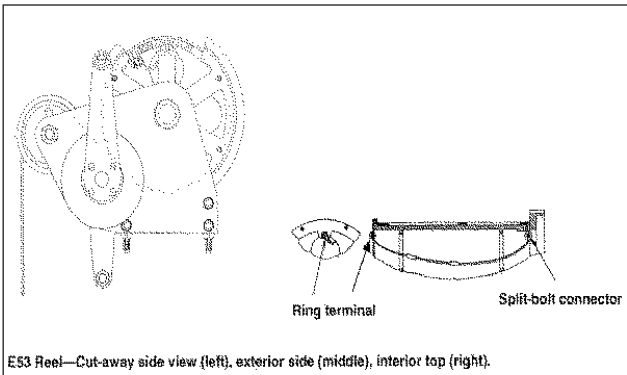
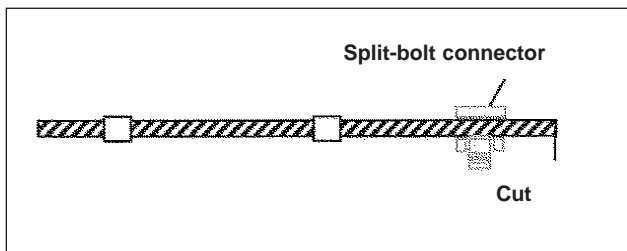


Figure 3.



Step 2. Cut cable above the existing crimp sleeve and split-bolt connector location. Pull the remaining cable from inside the drum, through the hole(s) in the reel drum, out of the drum.

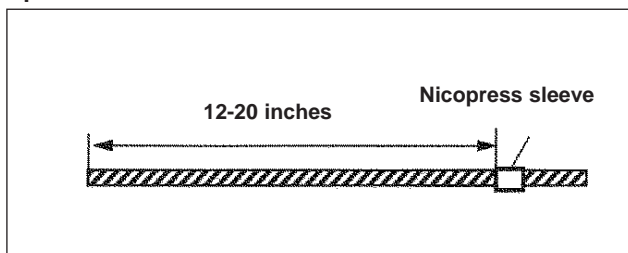
Step 2.



Step 3. For 0.084- and 0.100-inch diameter cables, slide a Nicopress No. 872-17-J stop sleeve ("For 3/32-inch steel cable") 12 inches from the cut end of the cable. (Note: For an E-53 reel, 20 inches from the cut end of the cable.) Using the "J" groove on a Nicopress tool, fully compress the sleeve on the cable.

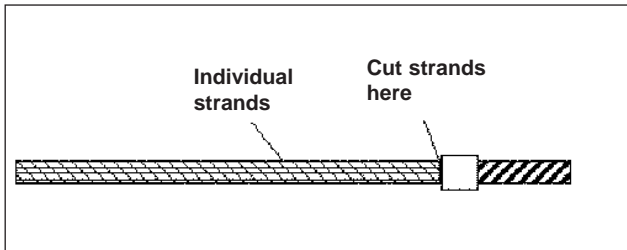
For 0.125-inch diameter cable, slide a Nicopress No. 872-18-J stop sleeve ("For 1/8-inch steel cable") 12 inches from the cut end of the cable. (Note: For an E-53 reel, 20 inches from the cut end of the cable.) Using the "J" groove on a Nicopress tool, fully compress the sleeve on the cable.

Step 3.



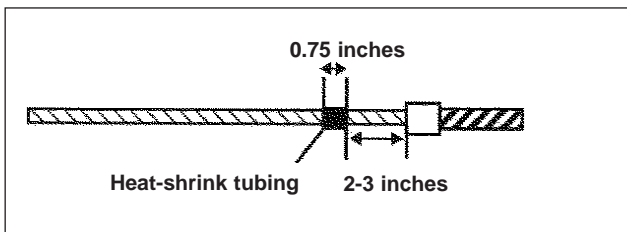
Step 4. Untwist and cut the number of strands from the cable to the end of the installed splice to achieve desired break-away strength. Leave the remaining strands twisted as manufactured.

Step 4.



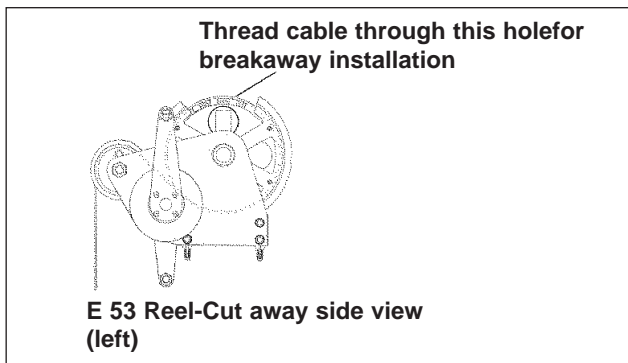
Step 5. Using a heat source, install a piece of heat-shrink protective tubing, approximately 3/4 inch in length, on the remaining twisted strands approximately 2 to 3 inches from the end of the first installed sleeve.

Step 5.



Step 6. Thread the end of the reduced section of cable through the hole in the reel drum to the inside of the drum. For the E-53 reel, thread the cable only through the hole as shown in the illustration below.

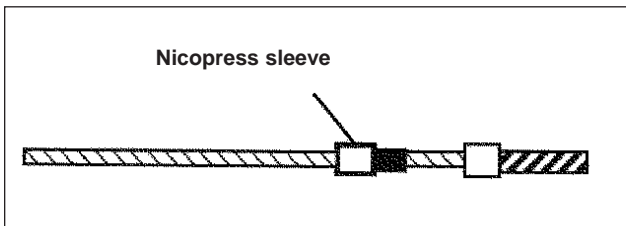
Step 6.



Step 7. For 0.084- and 0.100-inch diameter cables, slide a Nicopress No. 872-1-C stop sleeve ("For 1/16- inch steel cable") onto the remaining twisted strands to the end of the heat-shrink tubing. Note: Because of the tight fit of the stop sleeve on the 15-strand breakaway section of the 0.100-inch diameter cable, it may be necessary to apply some lubricant to that reduced section of cable prior to sliding the stop sleeve onto it. In addition, it may be necessary to use pliers and twist the sleeve as you slide it on the reduced section of cable. Using the "C" groove on a Nicopress tool, fully compress the sleeve on the cable.

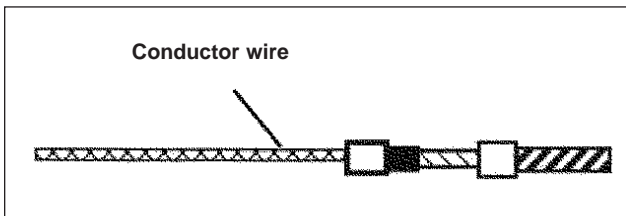
For 0.125-inch diameter cable, slide a Nicopress No. 872-17-J stop sleeve ("For 3/32-inch steel cable") onto the remaining twisted strands to the end of the heat-shrink tubing. Using the "J" groove on Nicopress tool, fully compress the sleeve on the cable. In addition, using the "C" groove on a Nicopress tool, (open the jaw of the tool fully) slightly overcompress the sleeve on the cable to assure a secure fit.

Step 7.



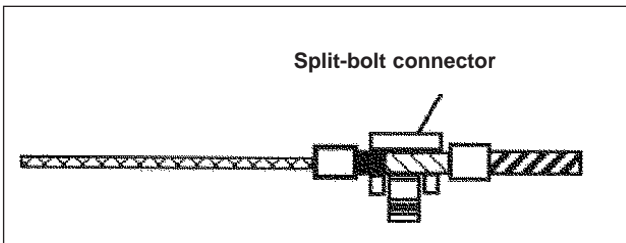
Step 8. Untwist and cut the strands remaining past the end of the second installed stop sleeve.

Step 8.



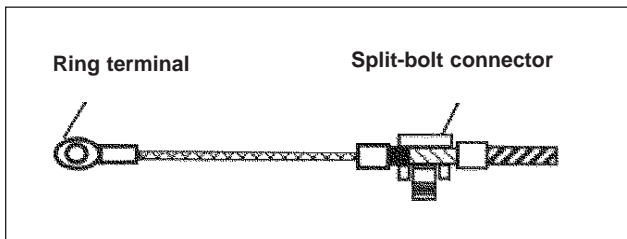
Step 9. Install the split-bolt connector on top of the heat-shrink tubing next to the second installed stop sleeve inside the drum. When fully tightened, the split-bolt connector may slide freely over the tubing.

Step 9.



Step 10.

For the A-55 and B-56 reels, install the ring terminal on the end of the conductor wire, and attach the terminal outside of the drum. For the E-53 reel, thread the conductor wire through the other two holes of the drum and into the drum. Install the ring terminal on the end of the conductor wire, and attach the terminal outside of the drum. On all reels, make sure the split-bolt connector does not come in contact with the ring terminal mounting flange.

Step 10.

27.5 Part Information and Procurement. The Breakaway Sounding Reel Cable Kit (stock number 2302075) and a technical information sheet is available for \$3.00 from the HIF. With the technical information sheet and the kit, USGS field personnel can modify the sounding reel cable so that the cable will break at the determined safe load.



TOPIC 28
TECHNICAL INFORMATION
FOR THE A-55 REEL
DRAG BRAKE

28.1 Procedures. This is a drag brake for use with the USGS-type A-55 reel. The brake is designed to eliminate sounding-line overload if a sounding weight is snagged by large debris carried in a fast-moving flow. It can also be manually slipped to control the descent of a suspended load, eliminating the work of cranking the reel to lower the suspended instruments.

The drag brake consists of a crank and ratchet wheel assembly (with a drag brake built into the ratchet wheel housing) and a new ratchet pawl (fig.1). It is a bolt-on replacement for the existing A-55 crank handle, ratchet wheel, and ratchet-pawl assembly. The operator turns a collar to select a line tension at which the brake will slip. If that tension is reached, the brake will slip, maintaining the set amount of tension while allowing the line to pay out from the reel drum.

The drag brake is of the multi-disc type (fig.2). Cranking force from the operator is transmitted through the crank to the ratchet housing. If the ratchet pawl is engaged, holding torque from the ratchet pawl is transmitted to the ratchet teeth on the housing. There are two “keyway” slots cut into the bore of the housing. Inside the housing there are several metal discs. Each metal disc has two tabs, or ‘keys’ that engage the keyway slots in the bore of the housing. Torque is transmitted by the “keys” and “keyways” from the housing to the internal metal discs. The crank arm, ratchet housing, and metal discs always turn together.

Alternating with the metal discs are discs made of a hard fibrous “brake-pad” friction material. Each fiber disc has a square hole in the center which engages the square portion of the hub. The hub attaches to the reel axle shaft.

The fiber discs, the hub, the reel-axle shaft, and the reel drum always turn together.

The collar, acting through a Belleville-type dished-spring washer, presses the metal discs and the fiber discs together. Torque is transmitted between the metal and fiber discs using the friction of the disc surfaces. When the applied torque (from cable tension) is greater than the friction between the discs, the metal and fiber discs will slip. This slippage appears to the operator as movement of the reel drum, cable, and axle relative to the crank handle and ratchet wheel.

Turning the adjustment collar adjusts the preload on the Belleville spring, and so adjusts the pressure that the spring applies to the discs, the friction between the discs, and the torque at which the brake slips. As the line tension is proportional to the torque, adjusting the slip torque also adjusts the line tension at which the disc slips.

Once the brake begins to slip, it holds a constant tension on the line while allowing the line to pay out.

Tightening the collar squeezes the discs against each other so that there is a friction resistance between the discs. The tighter the collar, the more clamping pressure and friction between the discs, and the more torque is needed to make the brake slip. This translates to more line tension before the brake slips.

Loosening the collar reduces the clamping pressure, which reduces the friction between the discs, and the line tension at which the brake will slip.

Completely loosening the adjusting collar eliminates the clamping pressure on the discs. With no clamping pressure, there is very little friction between the discs, and the hub and fiber discs are free to rotate within the housing. This allows the reel shaft and drum to rotate freely even though the crank and ratchet housing are stationary.

28.2 Initial Installation

A. Unpack and Identify Installation Kit Components

The kit to install the Drag Brake to the A-55 reel consists of: (The list numbers below correspond to the diagram numbers in Figure 3. Some items are shown in two views.)

1. Bearing-retainer plate
2. Crank-arm, ratchet-wheel housing and brake assembly
3. 5/16 in.diameter by 1-1/2 in. long coarse-thread wingbolt with nylon collar to retain the drag brake
4. Detachable crank handle
5. 1/2-in. coarse-thread wingnut to retain the crank handle
6. 3/8-in. diameter by 2 in. long fine-thread hex-head bolt (used as a levelwind pivot to retain plunger bracket)
7. Ball-plunger bracket assembly, (bracket, ball plunger, and locknut)
8. 3/8-in. fine-thread hex nut
9. Pawl anchor stud
10. Pawl return spring
11. Ratchet pawl
12. 5/16 in. by 1/2 in. long coarse-thread slotted-head screw, to retain the pawl

13. A small tube of “Loctite” retaining compound (not shown)
14. A small tube of grease for the threaded collar (not shown)

B. Remove the Existing Ratchet Assembly

1. Remove the existing crank from the reel axle, if installed.
2. Unbolt and remove the existing ratchet pawl (the brass “finger” that engages the teeth on the ratchet wheel) and pawl spring from the reel. Unhook the pawl spring from the brass stud that serves as the spring anchor, then remove the hex nut (inside the reel frame) from the pawl anchor stud and unscrew the pawl anchor stud from the threaded hole in the frame.
3. Loosen the set screw in the existing brass ratchet wheel and remove the ratchet wheel, shaft key, and shaft spacer from the reel axle shaft. Removing the brass ratchet wheel exposes the right-hand-side axle bearing retainer plate.

C. Replace the Bearing Retainer Plate

1. Remove the four flat-head screws that secure the bearing retainer plate, and remove the plate from the reel frame (fig.4).
2. Install the new bearing retainer plate to the reel, using the four flat-head screws from the old retainer plate. (The new retainer plate has a larger hole through its center than the old one.)

D. Replace the Spring Anchor and Anti- Backlash-Roller Pivot

1. Remove the hex nut, outside of the reel frame, from the brass stud that is used as the ratchet-pawl spring anchor.
2. Turn the reel upside down. You will see that the brass stud used for the spring anchor is also used as the pivot pin for one of the arms for the anti-backlash roller. Unscrew and remove the brass stud in the direction toward the center of the reel.
3. Install the 3/8 in. diameter by 2 in. long fine-thread hex-head bolt from the kit in place of the brass stud. Insert the bolt from the direction of the center of the reel, through the hole in the arm of the anti-backlash roller, through the roller torsion spring, and screw it into and through the threaded hole in the side of the reel housing until it extends about 1/2 in. beyond the outside of the reel housing.
4. Check that the anti-backlash roller pivots freely on the bolt.
5. Turn the reel right-side-up.

E. Install the New Ratchet Pawl Assembly (See fig. 4 and fig. 5.)

1. Place the ball-plunger bracket over the end of the 3/8-in. bolt that replaces the brass stud.
2. Install the threaded end of the pawl anchor stud through the ball-plunger bracket and into the 1/2-in. threaded hole in the reel housing from which the old pawl anchor bolt was removed.

3. Install the 3/8-in. fine thread hex nut to the end of the 3/8-in. bolt.
4. Tighten the pawl anchor stud and the 3/8 in. hex nut securely.
5. Install the new pawl and pawl spring to the pawl anchor (fig. 5).

When installed, the coils of the pawl spring go around the hex portion of the pawl anchor stud. The hook on the long end of the spring goes around the arm of the pawl, and the hook on the short end of the spring goes under the head of the small screw welded into the ball-plunger bracket (fig.5).

6. Check that the pawl can rotate freely within its range of movement on the pawl anchor. The spring should easily raise the pawl lever until the lever contacts the rim of the reel drum.
7. Install the 5/16-in. by 1/2-in. long coarse-thread slotted screw into the end of the pawl anchor to secure the pawl.
8. Check that the pawl can still rotate freely within its range of movement on the pawl anchor. If it does not rotate freely, remove the screw, remove the pawl, check for burrs on the mating surfaces, and smooth them with a fine-tooth file.
9. Reinstall the screw and check again to make sure that the pawl can rotate freely.
10. Remove the slotted screw from the pawl anchor. Apply a drop or two of Loctite to the threads of the screw. Reinstall the screw into the end of the pawl anchor stud and tighten securely.

F. Adjust the Pawl Disengagement Ball Plunger

1. Adjust the ball plunger (in the plunger bracket) that retains the pawl in the “disengaged” position. Loosen the 1/4-in. locknut on the ball plunger (fig. 6) slightly and insert a small straight-blade screwdriver into the slot on the end of the ball plunger, then turn the plunger to screw it in or out of the bracket until the spring-loaded ball in the end of the plunger contacts the lip of the pawl with enough force to hold the pawl in the disengaged position.
2. Adjust the plunger position for the desired amount of force needed to move the pawl between the “engaged” and “disengaged” positions.
3. Hold the plunger in position as you retighten the 1/4-in. hex nut on the threaded body of the plunger to lock the plunger in position.

G. Fit the Drag Brake Assembly to the Reel Axle Shaft

1. Inspect the reel axle shaft (fig.7) for any raised areas or burrs. Use a fine-tooth flat file to smooth down any raised areas or burrs that you find.
2. Latch the pawl in the “disengaged” position.
3. Check the fit of the brake assembly (the brake crank arm and ratchet wheel with its internal drag brake) on the reel axle shaft (without the key) by sliding the brake onto the axle. It should slide on easily, without excessive effort. If it does not slide on easily, carefully inspect the shaft for and remove any dirt, varnish, or additional raised areas or burrs.

4. Double-check that the brake assembly can easily slide on and off the reel axle shaft.
5. Make sure that the keyway on the shaft is clean, and that the shaft key is also clean and does not have any raised burrs.
6. Make sure the key will slide freely into the keyway in the bore of the brake hub. If it does not fit freely, check for raised areas or burrs on the key, and remove them with a fine-tooth flat file.
7. Check the fit of the shaft key into the reel axle shaft keyway (tight or loose), then install the key to the axle shaft using the appropriate procedure as follows:
 - a. Installing a Tight-Fitting Shaft Key to the Reel Axle Shaft (fig. 7)
 1. If the key is a tight fit in the keyway, (tight enough so that you have to press-fit it into place and it will not fall out during shipping and handling with the brake removed).
 2. Make sure the key is straight in the keyway, pad the key and the shaft with pieces of hard wood or hard plastic to avoid burring or distorting the shaft or the key, and press the the key all the way to the bottom of the groove with a large pair of visegrip pliers, a bench vise, C-clamp, or similar tool. An alternate method is to use a small hammer (and a piece of hard wood or hard plastic against the key as a driver to prevent distorting the key) to drive the key all the way down to the bottom of the keyway.

The end of the key should remain approximately flush with the end of the reel axle shaft. Check that the key is bottomed all the way into the keyway for its entire length.

- b. Installing and Retaining a Loose-Fitting Key to the Axle Shaft (fig. 7)
 1. If the key is a loose fit in the shaft keyway, such that the key may fall out during handling with the brake assembly removed, then remove the key from the axle keyway.
 2. Clean the keyway and key with solvent to remove any dirt, grit, varnish, or film of oil or grease.
 3. Apply Loctite to the shaft keyway, then rein stall the key to the reel shaft. Pad the shaft and key with a couple of pieces of wood, plastic, or wrap a cloth around the shaft and key, then use a C-clamp or a pair of Vise-Grip pliers to clamp the key completely down into the bottom of the keyway. Make sure that he key is bottomed completely in the keyway for its entire length. The end of the key should be approx imately flush with the end of the qreel axle shaft.
 4. Allow sufficient time for the Loctite down in the joint to completely cure (perhaps a couple of hours in warm weather, or overnight in cool weather) then remove the clamp and remove any excess Loctite from the key and keyway outside the joint. (Loctite will harden inside a close-fitting joint, but

will remain liquid when exposed to air.)

- c. Check the Fit of the Brake Assembly to the Axle Shaft Key
 1. Rotate the brake assembly so that the key way in the brake hub lines up with the key installed to the reel axle shaft. Check that the brake assembly can slide onto the shaft and key fairly easily, without excessive effort. As the brake has already been checked that it can fit freely onto the bare shaft, any problem installing the brake at this point should be due to interference between the brake and the shaft key. Carefully inspect the keyway in the brake hub and the key installed to the shaft for raised areas, burrs, or other causes of interference. Remove any raised areas or burrs with a fine-tooth file. After making sure that the brake slides easily on and off the reel axle shaft, remove the brake from the reel axle.
 2. Double check that the brake assembly will easily slide on and off the reel axle shaft.
 3. Check that the key is secure, and cannot fall out of the shaft keyway. (If the key falls out and is lost, the reel is out of service until you obtain a new one.)

H. Assembly for Service

Note: The Drag Brake Assembly has to be removed from the A-55 reel, and the handle has to be removed from the crank arm on the Drag Brake

Assembly, in order to fit all the parts into the steel A-55 shipping box.

1. Press the pawl handle down until the pawl latches in the “disengaged” position.
 2. Slide the brake assembly, consisting of the crank handle and ratchet housing with its internal parts onto the reel shaft all the way until it contacts the axle bearing.
 3. Install the 5/16-in. coarse-thread wingbolt with its nylon collar into the threaded hole in the end of the reel axle shaft, and tighten it firmly to secure the brake assembly onto the reel axle shaft.
 4. Install the crank handle to the end of the crank arm by inserting the threaded end of the handle pin into the arm until the square boss on the bushing engages the square hole in the arm.
 5. Install the 1/2-in. wingnut onto the protruding threaded part of the handle pin and tighten it against the arm to secure the handle to the crank arm.
- I. **Operation.** Normal operation of the A-55 reel with the drag brake is similar to using the reel without the drag brake, with the following changes:
1. Adjust the collar on the drag-brake until the brake slips at the approximate desired line tension. This can be easily varied from near zero to a tension of well over 100 lbs. line pull by turning the collar by hand. If the operator wants to set the slip tension at a greater value, the collar can be tightened further with a large pair of Channel-lock pliers; however, be sure to pad the collar with a rag so that you do not

put a burr on the knurled collar, and use care that you do not distort the collar.

2. Some users may wish to use the brake for a controlled descent of the sounding weight. To do this, tighten the collar by hand until the brake transmits just enough torque to pick up the sounding weight. Use the reel to pick up the weight, position the weight for descent, then loosen the collar enough for the brake to slip and the weight to descend. Tighten the collar to slow and stop the weight's fall.
3. The new pawl handle extends around to the back of the reel, so that the operator does not have to insert his/her fingers between the reel body and the crank arm to engage or disengage the ratchet.
4. Rotate the crank arm to raise the weight a bit and relieve the pressure on the pawl, then press the pawl lever down to disengage the ratchet. There is a ball-plunger to retain the ratchet pawl in the disengaged position. Push the handle down until you feel the pawl pop past the spring-loaded ball in the plunger, and the ratchet pawl should stay disengaged.
5. To re-engage the ratchet, lift the lever to pop the pawl past the spring-loaded ball on the plunger. From there, the pawl spring should raise the handle and keep the ratchet pawl engaged.
6. If the ball plunger does not properly hold or release the pawl, loosen the locking nut on the ball plunger and screw the plunger in or out to adjust the force needed to "pop" the edge of the pawl past the plunger ball.

J. Maintenance

IMPORTANT--Occasionally apply a thin film of grease to the screw threads where the collar attaches to the ratchet housing. Both parts are aluminum to save weight, and grease is needed to prevent the aluminum-on-aluminum threads from galling and seizing, which will ruin both parts. To do this,

1. Unscrew and remove the threaded collar from the housing,
2. Apply a thin film of regular No. 2 grease (the same type used in a typical grease gun) to the threads of the collar, making sure that the grease is applied all the way down into the threads, and
3. Carefully reassemble the collar to the housing.

PLEASE READ THE FOLLOWING NOTICE! The collar threads are a very fine pitch to give a large amount of clamping force (and braking action) for the degree of hand tightening on the collar.

The best way to start the threaded collar back into the housing is to gently hold it in position against the housing, then slowly turn it in the direction to loosen it until you feel a slight “pop” as the ends of the threads pass each other. Stop, then turn the collar gently in the direction to tighten it into the housing, and the threads should engage with no problem. Be careful that you do not get a “false start” as the end of the thread on the collar passes the two large “keyways” cut into the bore of the housing. If you cross-thread the collar in the housing, you can easily damage the threads, making it very difficult to reassemble.

Do not allow the grease to contaminate the brake disc friction surfaces inside the drag brake housing. Occasionally squirt a small amount of oil into the oil

hole (fig. 5) in the ratchet pawl to lubricate the pawl as it rotates on the anchor stud.

Figure 1. Drag Brake

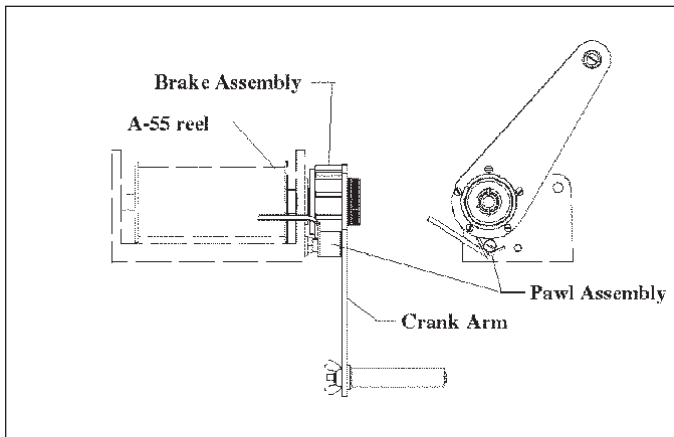


Figure 2. Brake Internal Parts

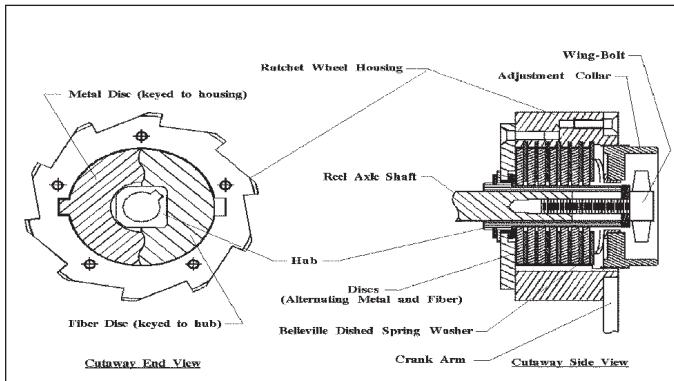


Figure 3. Kit Parts

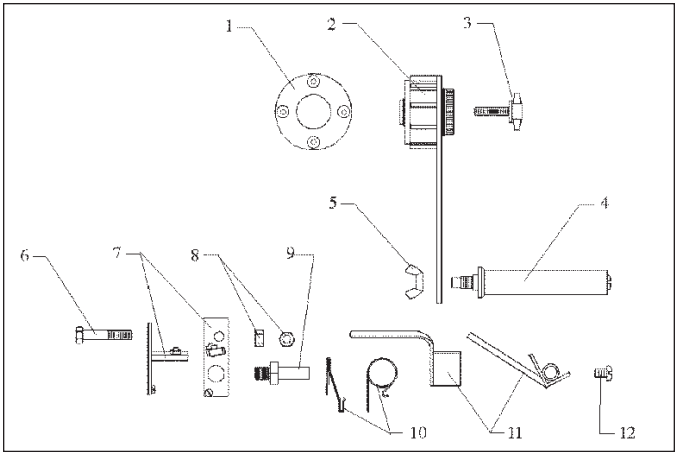


Figure 4. Pawl Assembly on Reel

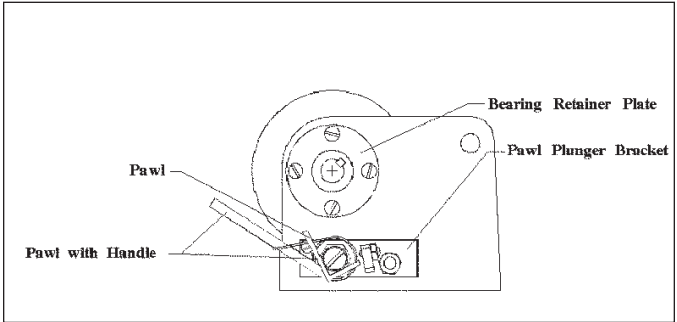


Figure 5. Pawl Assembly Details

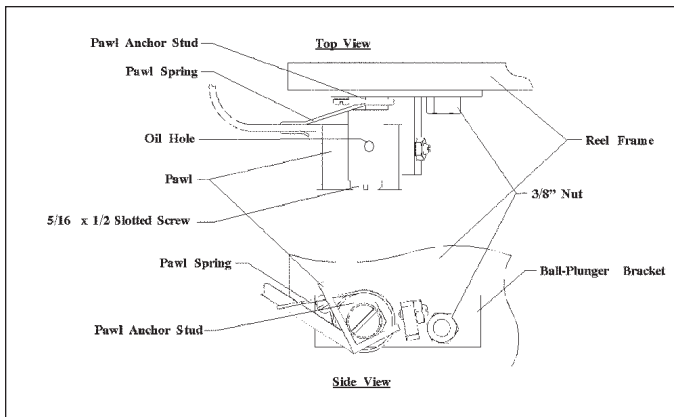


Figure 6. Adjusting the Ball Plunger

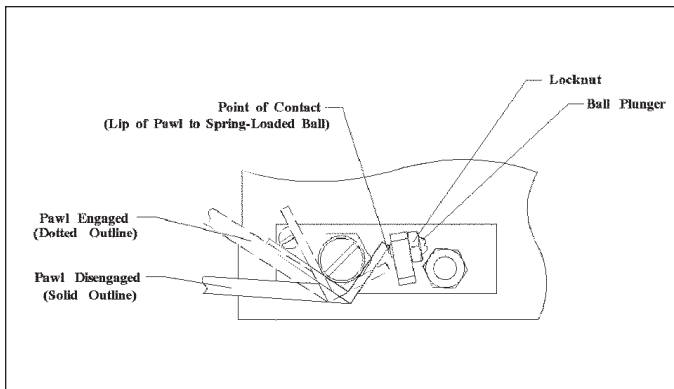


Figure 7. Reed Axle Shaft and Key

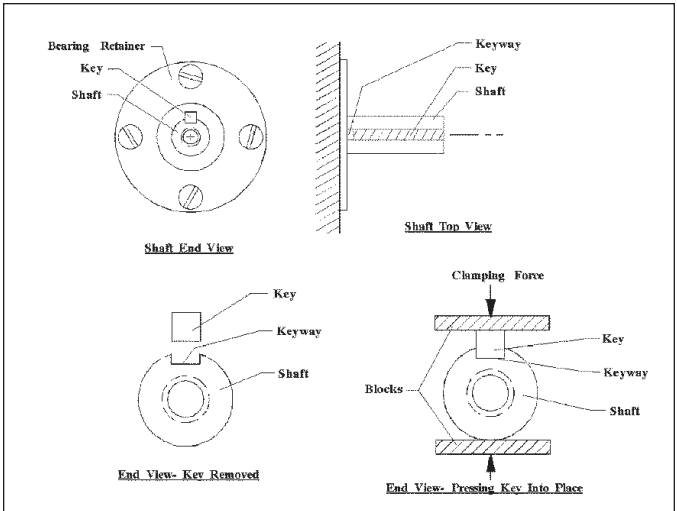
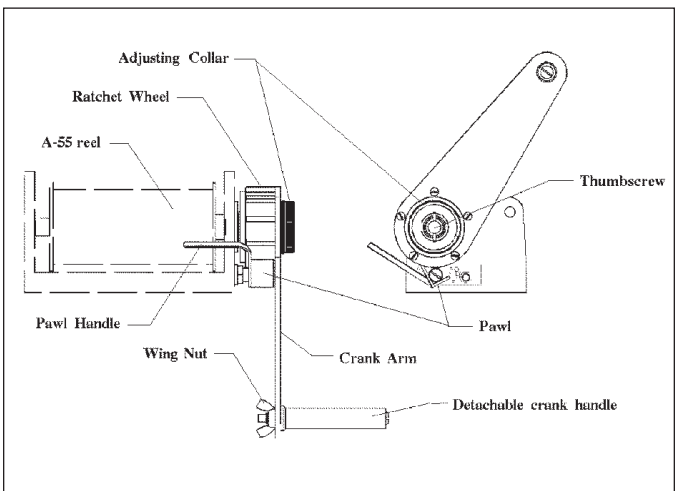


Figure 8. Drag Brake External Parts





TOPIC 29
**CABLEWAY AND GAGING
STATIONS**

29.1 References

- A. SM 445-2-H, Chapter 41, Cableway Safety
- B. Stream-gauging cableways,” Techniques of Water-Resources Investigations, Book 3, Chapter A21.
- C. Cableway Design Summary,” Appendix II, in “Stream-gauging cableways,” TWRI, Book 3, Chapter A21.

29.2 **Procedures.** Occasionally people are involved in accidents while operating cableways. Most of these accidents are relatively minor, like muscle strains, bruises, etc., but cableway use also can result in a major accident. Most accidents can be avoided if the safety of all cableways is assessed prior to use and if all safety rules are followed. Cableways are inspected annually by a trained inspector. This section describes how to inspect a cableway before it is used. The procedure described here should be followed prior to each use of any cableway.

29.3 Preplanning.

- A. Leave a trip plan with a designated person. This plan should include:
 - 1. A map with locations of places you will visit on your trip. Such as:
 - a. Gage stations
 - b. Cableways
 - c. Bridges
 - d. Overnight stops
 - 2. An itinerary of the stops you will make, along with estimated times you will be in these locations.

3. An estimated time by which you will call the designated person.
- B. If the designated person has not heard from you by the established time, that person should call the authorities and report the location you are believed to be at according to your itinerary.
- C. **Equipment Check.**
1. Inventory and inspect all specialized safety equipment you require for your trip. Below are some examples:
 - a. Personal flotation device (PFD)
 - b. Hard hat
 - c. Fluorescent vest
 - d. Flares
 - e. Traffic cones
 - f. Flashing lights
 - g. Road signs
 - h. Flags
 - i. Wire cutters
 2. Replace all defective equipment before you leave for the field.

29.4. **General.**

- A. When approaching gage houses, cableways, or bridges, watch for the following along footpaths:
1. Poisonous plants

2. Reptiles
 3. Animals
 4. Tripping hazards
 5. Unstable ground due to flooding
 6. Insects
- B. Before entering a gagehouse or ascending a cableway platform or bridge walkway be alert for:
1. Loose ladders
 2. Ladders with corroded rungs
 3. Unstable platforms and walkways
 4. Loose or weak handrails
- C. Much of the equipment used in measuring stream flow is heavy; always use proper lifting techniques.

29.5 **Wire Rope.**

- A. Below are some definitions to assist you with wire rope terminology.
1. **Abrasion** - Surface wear on the wires of a wire rope.
 2. **Backstay** - Guy line used to support an A- frame or tower.
 3. **Breaking Strength** - The measured load required to break wire rope in tension.
 4. **Cable** - A term applied to wire ropes, wire strands, and electrical conductors.

5. **Cableway** - Aerial conveying system for transporting single loads along a suspended track.
6. **Clip** -Fitting for clamping two parts of wire rope.
7. **Construction** - Design of wire rope including number of strands, number of wires per strand and arrangements of wires in each strand.
8. **Core** - Member of a wire rope about which the strands are laid. It may be fiber, a wire strand, or an independent wire rope.
9. **Corrosion** - Chemical decomposition of the wires of a rope by exposure to moisture, acids, alkalines, or other destructive agents.
10. **Cover Wires** - Outer layer of wires.
11. **Diameter** - Distance measured across the center of a circle circumscribing the wires of a strand or the strands of a wire rope.
12. **Eye or Eye Splice** - A loop with a thimble formed in the end of a wire rope.
13. **Fatigue** -Term commonly applied to progressive fracture of wires of a rope.
14. **Galvanize** - To coat with zinc to protect against corrosion.
15. **Grades, Wire Rope** - Classification of strand by its breaking strength. In order of increasing breaking strengths they are Iron, Traction, Mild Plow Steel, Plow Steel, Improved Plow Steel, Extra Improved Plow Steel.

16. **Guy Line** - Strand or wire rope, usually galvanized, for holding a structure in position.
17. **Regular Lay Rope** - Wire rope in which the wires in the strands and the strands in the rope are laid in opposite directions.
18. **Shackle** - A "U" shaped fitting with pin.
19. **Sheave** - A grooved pulley for use with wire rope.
20. **Strand** - An arrangement of wires helically laid about an axis, or another wire of fiber center to produce a symmetrical section.
21. **Thimble** - Grooved metal fitting to protect the eye of a wire rope.
22. **Turnbuckle** - Device attached to wire rope for making limited adjustments in length. It consists of a barrel and right and left hand threaded bolts.
23. **Wire (round)** - Single continuous length of metal cold drawn from a rod.
24. **Wire Rope** - A plurality of strands laid helically around an axis or a core.

B. When working with wire rope:

1. Always wear gloves.
2. Always wear safety glasses.
3. Use the proper size wrench for tightening clips. Do not use pliers or vise-grips.

29.6 Gage Stations.

- A. If there is a dam or power plant upstream, check with the operator to ensure that there will not be a discharge while you are in the stream.
- B. Look for down power lines before entering the stream.
- C. Always wear your personal flotation device.
- D. While in the stream, watch upstream for debris and ice drifting towards you.
- E. Always use your wading rod and feel for dropoffs and holes.
- F. Never wade directly upstream. Always angle across the stream. If your feet become lodged and you fall backwards while facing upstream, you may not be able to get up due to the water pressure.
- G. In areas of warm water discharge, there will be heavy algae growing on the stream bottoms. Algae is especially slippery.

29.7 Cableways.

- A. **Before using a cableway:**
 - 1. Inspect anchorages at both banks, when possible.
 - 2. Look for signs of excessive wear, vandalism, or accidental damage to:
 - a. Cable
 - b. Backstays
 - c. Anchors

- d. Cablecar
 - e. Turnbuckles and all other associated hardware
 - f. Footings
 - g. A-frames and towers
3. Look for downed power wire in the stream or on the cable.
 4. Carry wire cutters of sufficient strength to cut the sounding line, should it become entangled.
 - a. If possible, reel off sounding line until slack, before cutting wire.
 - b. Cut cable as close to reel as possible.
 - c. Hold on to cable car to steady yourself during rebound.
- B. Personal Flotation Device.
1. Your PFD should be worn anytime you are working above, beside, or in any body of water.
 2. Always use a PFD that is in good condition.

29.8 **Sample Checklists**

STREAMGAGING CABLEWAYS - Safety Checklist

Station Name: _____ Number: _____
 Type: _____
 Cable Diameter: _____ in Span: _____ ft Design Sag: _____ ft

Right Left Bank
(cable car side)

ANCHOR

Anchor Type: Concrete – Rock – Deadman – Tree –
 Other _____ U-bar: Y N
 Anchors clean of debris: Y N
 Soil – Weeds – Bushes – Trees Other
 Inspect for deterioration of:
 Concrete – Rock – Tree – Cable Connection:
 Signs of deterioration: Y N
 Fractures: Y N ; Movement: Y N ; Rust-Corrosion:
 Y N ; Items missing: Y N
 Other: _____

FOOTERS: A-Frames, etc.

Support footers clean of debris: Y N Soil – Weeds –
 Bushes – Trees Other: _____
 Inspect for deterioration of:
 Concrete – Rock – Tree – Other : _____
 Signs of deterioration: Y N
 Fractures: Y N ; Movement: Y N ; Rust-Corrosion: Y N
 Bolts/Nuts: Y N Tight – Loose – Missing –
 Other: _____

MAIN CABLE: _____ Marking: Y N

Sag: _____ ft
 U-bar to cable: Socket – Turnbuckle – Clevis – Direct –
 Other: _____
 Thimbles in place: Y N ; Cable clips: Y N Type: _____ ;
 Installed properly: Y N Number: _____ ; Tight: Y N
 Proper spacing: Y N 3, 5, 7, 9, Other _____ in
 Cable turnback: _____ in _____ ft
 Signs of deterioration to: Y N
 Cable – Socket – Turnbuckle – Clevis – Thimbles – Clips

Other: _____

If yes, what: Rust – Corrosion – Flaking – Broken strands –
Items missing – Cracks

Other: _____

BACKSTAY – GUYLINES: (CABLES) Same info. for all
cables in use

Cable(s) taut: Y N; Cable use: Backstay – Guyline

Cable size: _____

U-bar to cable: Turnbuckle – Clevis – Other: _____

Thimbles where required: Y N; Cable clips: Y N;

Clip type: _____; Number: _____

Installed properly: Y N; Tight: Y N; Proper spacing: Y
N;

Cable turnback: _____ in. _____ ft.

Signs of deterioration: Cable – Turnbuckle – Clevis –

Thimbles – Clips – Other: _____

Types of deterioration: Rust – Corrosion – Flaking – Broken
strands – Cracks – Items missing

Other: _____

AIRCRAFT WARNING CABLE –

Warning device in place: Y N

Thimbles: Y N Rust: Y N

Description: _____

CABLE SUPPORTS: A-frames, etc. Plumb (vertical) Y N

Support type: A-frame – Tower – Vert. beam – Tree Steel –
Wood – Pipe – H-beam

Other: _____ Ht. _____

Signs of: Fatigue – Rust – Corrosion – Wood decay;

Bolts: Rusted – Loose – Missing

Platform: Y N Steel – Wood – Other: _____

Height: _____ ft

Grated: Y N Handrails: Y N Kneerails: Y N

Secure: Y N Bolts/welds: VG G P

Climbing device: Ladder – Bolts – Steps –

Other: _____

Fall Protection needed: Y N

Saddleblock: Radius: _____ in

Sheave – Steel block – Wood block; Does size fit cable

dia: Y N
Deterioration of /at Saddleblock: Y N
Rust – Corrosion – Wood decay – Other: _____
Are all devices securely fastened: Y N;
Is support fenced: Y N; Locked: Y N
Other: _____

CABLE CAR

Type: Stand up – Sit down – Power – Aluminum – Wood – Steel
Other: _____ Appearance: VG G P
Hanger bars: G P Bent – Twisted – Cracked
Condition of floor: G P Aluminum – Wood – Other: _____
Seats: G P Bolts/Nuts: Rusted – Loose – Missing
Check aluminum pieces for: Swelling – Wear – Gunshots –
Other: _____

NOTE: Follow the requirements in the manual for
“Streamgaging Cableways”

Is measuring section cleared of brush, trees and other
obstructions: Y N
If no, what: _____
Is description of cableway system complete and accurate:
Y N Update as required.

Right Left Bank

ANCHOR

Anchor Type: Concrete – Rock – Deadman – Tree –
Other: _____ U-bar: Y N
Anchors clean of debris: Y N Soil – Weeds – Bushes –
Trees – Other: _____
Inspect for deterioration of: Concrete – Rock –
Tree - Cable Connection. Signs of deterioration: Y N
Fractures: Y N; Movement: Y N;
Rust-Corrosion: Y N; Items missing: Y N
Other: _____

FOOTERS: A-Frames, etc.

Support footers clean of debris: Y N Soil – Weeds –
Bushes – Trees Other: _____

Inspect for deterioration of: Concrete – Rock – Tree –
Other: _____ Signs of deterioration: Y N

Fractures: Y N ; Movement: Y N ; Rust-Corrosion: Y N ;
Bolts/Nuts: Y N Tight – Loose – Missing –
Other: _____

MAIN CABLE:

Marking: Y N Sag: _____ ft

U-bar to cable: Socket – Turnbuckle – Clevis – Direct –
Other: _____

Thimbles in place: Y N ; Cable clips: Y N ;

Type: _____ ; Installed properly: Y N ;

Number: _____ ; Tight: Y N ; Proper spacing: Y N ;
3, 5, 7, 9, Other: _____ in

Cable turnback _____ in _____ ft

Signs of deterioration to: Y N Cable – Socket –
Turnbuckle – Clevis – Thimbles – Clips

Other: _____

If yes, what: Rust – Corrosion – Flaking – Broken strands –
Items missing – Cracks

Other: _____

BACKSTAY – GUYLINES: (CABLES)

Same info. for all cables in use

Cable(s) taut: Y N Cable use: Backstay – Guyline

Cable size: _____

U-bar to cable: Turnbuckle – Clevis – Other: _____

Thimbles where required: Y N ; Cable clips: Y N ;

Clip type: _____ ; Number: _____

Installed properly: Y N Tight: Y N

Proper spacing: Y N Cable turnback: _____ in _____ ft

Signs of deterioration: Cable – Turnbuckle – Clevis –
Thimbles – Clips –

Other: _____

Types of deterioration: Rust – Corrosion – Flaking –

Broken strands – Cracks – Items missing

Other: _____

CABLE SUPPORTS:

A-frames, etc. Plumb (vertical) Y N
 Support type: A-frame - Tower - Vert. beam - Tree Steel -
 Wood - Pipe - H-beam Other: _____ Ht: _____
 Signs of: Fatigue - Rust - Corrosion - Wood decay;
 Bolts: Rusted - Loose - Missing Platform: Y N Steel -
 Wood - Other _____ Height: _____ ft
 Grated: Y N Handrails: Y N Kneerails: Y N
 Secure: Y N Bolts/welds: VG G P
 Climbing device: Ladder - Bolts - Steps - Other
 Fall Protection needed: Y N
 Saddleblock: Radius: _____ in Sheave - Steel block - Wood
 block; Does size fit cable dia: Y N
 Deterioration of/at Saddleblock: Y N: Rust - Corrosion -
 Wood decay - Other: _____
 Are all devices securely fastened: Y N; Is support fenced:
 Y N; Locked: Y N
 Other: _____

INSPECTION RESULTS:
THIS CABLEWAY IS SAFE TO USE: Y N

Explanation for any of the above items considered:
“UNSAFE”

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

I certify that the inspection was conducted on this date, all elements of the cableway were checked, and deficiencies found were noted on the hazard elimination log.

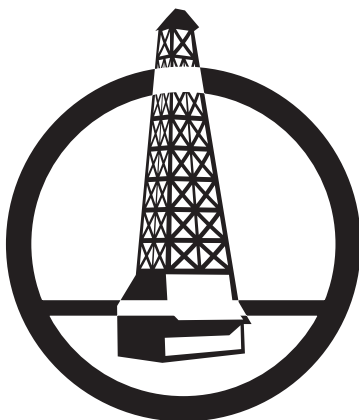
Inspected by _____

Title _____

Date _____

Reviewed by _____

Title _____



TOPIC 30
DRILLING SAFETY

30.1 Procedures. This plan establishes specific safety standards and safe work practices for all USGS drilling operations. It is intended to cover many of the safety and health issues and concerns that occur at a variety of drilling sites including rotary, core, and auger sites.

30.2 Responsibilities.

- A. **Project Chief.** Prior to starting work in an area, the project chief shall be responsible, either by inquiry, direct observation, or by instruments, whether any part of an electric power circuit, exposed or concealed, is so located that the performance of the work may bring any person, tool, or machine into physical contact with the circuit or within prescribed clearance distances set forth in this plan. Whenever possible, the circuit(s) shall be deenergized and grounded. The project chief shall advise the employees of the location of such lines. The project chief shall inform the site supervisor of known hazards.

The project chief will ensure that a list of addresses and phone numbers of emergency assistance units, such as medical care, hazardous material response, etc., is kept at the site and that all individuals know the location of the list.

The project chief is responsible for the development and enforcement of the Health and Safety Plan for hazardous waste drilling sites, and shall obtain proper authorization for drilling operations.

B. Site Supervisor.

1. The drill rig operator will be the site supervisor at each drill site unless other arrangements have been made to formally designate another crew member as site supervisor. The site supervisor maintains final authority to make and enforce all safety decisions related to the

drilling operations.

2. The site supervisor is responsible for ensuring that all site safety procedures are being followed, that all equipment is operating in a safe and proper manner, and that all personnel are using required personal protective equipment and are working in a safe manner. The site supervisor has the authority to make and enforce reasonable decisions concerning individual and site safety. Any conflicts concerning site or individual safety will be reported to the project chief or site supervisor as soon as possible.
3. The site supervisor shall protect the employees by isolation, insulation, warning signs, or other methods commensurate with electric power circuit hazards. The protection provided shall conform with national codes and this plan. The site supervisor advises of the hazards and protective measures to be taken.
4. The site supervisor shall not permit employees to work in such proximity to an electric circuit or within prescribed clearance distances that they may contact in the course of their work, unless the employees are protected against electric shock by de-energizing the circuit and grounding it, or by guarding it with effective insulation or other means.
5. The site supervisor is responsible for ensuring that every individual is knowledgeable and has the proper training for each task to which that person is assigned; and will make sure that each individual working at the site has a full understanding of safe operational and site practices and is fully aware of potential hazards to which that person may be exposed.

6. The site supervisor is responsible for ensuring that a copy of the JHA is readily available for employees performing their assigned tasks.
7. The site supervisor shall designate an individual to inspect equipment for potential malfunctions or hazards on a daily basis.
8. The site supervisor is responsible for ensuring that the drill site is kept reasonably clean and organized and that tools and equipment, that are not in use, are stored away from the immediate work area.
9. The site supervisor is responsible for ensuring that all emergency shutdown clutches and switches are in proper operating condition and that all members of the drilling crew are fully knowledgeable in emergency equipment shutdown procedures.
10. The site supervisor has the authority to dismiss from the drill site any individual whose mental or physical condition may endanger other employees or project equipment.
11. The site supervisor shall hold safety meetings to address any problems or concerns that may arise concerning site, equipment, or personal safety. Such meetings shall be held at the beginning of each workday, and as necessary.

C . Employee Responsibilities

1. General responsibilities. It is the responsibility of each employee to observe all safety and health regulations and comply with instructions and JHAs issued to them by the site supervisor. Employees shall promptly correct unsafe working conditions or report them to the site supervisor or other proper authority.

2. **Guidelines and standards for the use of personal protective equipment are presented in Section 4 of this plan.**

30.3 **Personal Protective Equipment**

- A. **Clothing.** Clothing worn at the drill site should not be loose-fitting or contain loose straps or belts. Chains, rings, and other jewelry should not be worn. All clothing shall be appropriate for the type of work being performed. Personal protective clothing and equipment, as required by the site health and safety plan, shall be worn at all times at sites where individuals may be exposed to hazardous materials.
- B. **Hardhats.** Hardhats shall be worn at the drill site by all individuals at all times during set up and drilling operations. Hardhats must meet the requirements of ANSI.
- C. **Safety-toed shoes.** All individuals working on or around the drilling equipment will wear steeltod shoes or boots that meet the requirements of ANSI.
- D. **Protective gloves.** All individuals shall wear protective gloves when appropriate. Gloves should be tight fitting without large cuffs or loose straps. Extreme caution should be taken when wearing gloves while working on or near rotational equipment or moving cables.
- E. **Protective eyewear.** All individuals shall wear protective eyewear that meets the requirements of ANSI Z87 when appropriate. Eyewear should always be worn when working with compressed air, power tools, such as grinders and drills, and hand tools or other similar equipment.
- F. **Hearing protection.** All individuals shall wear

hearing protection when drilling equipment is in operation. Hearing protection devices will be made available to all employees at the site at all times.

30.4 Site Selection and Working Platforms

- A. **Preparing the worksite.** Adequate clearing shall be done to accommodate the drilling rig and supplies. In preparing a worksite located on adverse topography, precautions against flooding, caving, slides, and loose boulders must be taken. The drilling rig shall be stabilized by outriggers or adequate timbering.

- B. **Underground utilities and overhead lines.** In the vicinity of overhead power transmission or distribution lines, drills shall be set with at least a 50-foot clearance between any part of the drill or mast and the power line. Further, the drill shall be adequately grounded in accordance with **Appendix A** of this plan. Prior to beginning drilling operations, underground utilities shall be located and marked so that appropriate clearances from drilling operations can be maintained.

- C. **Drilling rig design.** Drilling rigs shall be designed to provide adequate working space. Sills supporting the working deck shall be 4- by 4-inch nominal dimension or greater, spaced on 4-foot centers or less. Decking sills should be spaced so that there is no overhang. Deck boards shall be at least 2- by 10-inch nominal dimension and secured to the sills to prevent movement. Lumber used in constructing the drill platform shall be of good quality, straight grained, and free of unsound checks or knots.

- D. **Mud pits and drainage excavations.** Mud pits and drainage excavations should be safely sloped and located to provide minimum interference with work. Suitable barricades shall be provided to

reduce the possibility of injury to persons. Ladders shall be positioned in pits or excavations 5 feet or greater in depth. A drain shall be provided for the drill water to flow from the worksite. The drain shall be extended far enough from the worksite to prevent any under cutting of the foundation.

- E. **Lighting.** All electrical wiring for illumination purposes area shall be in accordance with National Electrical Code (ANSI/NFPA 70). All wiring shall be done by qualified personnel. Illumination of all working surfaces shall be a minimum of 5-foot-candles. Light bulbs shall be protected and shall be heavy duty, outdoor, non-shattering type. Lighting circuits shall be inspected periodically and defective wiring or fixtures removed from service.
- F. **Electrical.** Safe practices in accordance with Appendix A should be followed and, as applicable, 29 CFR 1926 Subpart K—Electrical.
- G. **Flammable liquids.** Flammable liquids shall be stored, dispensed and handled in accordance with Appendix B.2 and B.3 in this plan. The location of MSDS should be apparent to all employees.

30.5 Drilling Unit

- A. **General.** Platforms, steps, handholds, and guardrails shall be provided on the equipment to assure safe access and footing. The platform and decks shall be coated with nonskid surfaces. An effective preventive maintenance program providing for periodic inspection at such intervals as are necessary to ensure safe operation and adequate maintenance shall be carried out. The platform and decks shall be kept clean of oil and grease that may cause a hazard.
- B. **Operator.** The power unit shall be operated only by qualified persons instructed in the operation of the

particular equipment and certified by the site supervisor.

- C. **Safety shutoff.** An emergency safety power-shutoff device shall be installed within reach of the operator on all units. The device shall be clearly labeled or otherwise made readily identifiable and checked daily to ensure that it is operable. Truck-mounted drills shall be equipped with a "Safety Line" or with clearly marked and conspicuously-located emergency switches (panic buttons). The "Safety Line" emergency stop consists of a taut wire that runs around the back of the machine and connects to a special switch that turns off the power unit when the line is contacted. When emergency switches are used, in lieu of a "Safety Line" there shall be a minimum of two. One switch is to be located within easy reach of the operator and one located within easy reach of helpers at ground level near the drill or auger head.

- D. **Control levers.** Labels clearly indicating the function and direction of the control levers shall be posted on the power unit controls of all drills. Wherever practicable, operating unit controls shall be designed to return to neutral when the control levers are released.

- E. **Gears and moving parts.** Gears and moving parts, constituting a hazard to employees, shall be shielded to prevent accidental contact.

- F. **Refueling.** Where practicable, the fuel tank should be positioned or shielded to avoid accidental spillage of fuel on the engine or exhaust manifold during refueling operations.

- G. **Exhaust systems.** Engine exhaust systems shall be equipped with spark arrestors when operated in areas where sparks constitute a fire hazard.

- H. **Fire extinguishers.** A 2-A:40-B:C dry chemical fire extinguisher shall be carried on the unit and removed to a position within 25 feet of the worksite during drilling operations. Extinguishers shall be inspected at least once every month. Annual maintenance inspection and tagging shall be done by a qualified inspector.

- I. **First-aid kit.** A kit shall be properly mounted in a fixed location and all employees be made aware of the location. An inspection of the contents of the kit should be made prior to each new drilling location set up. At drilling site locations that are not conveniently accessible to a medical facility, supplemental first-aid supplies should be considered.

- J. **Raising and securing the mast.** Before raising the mast, the drilling rig must be level and personnel shall be cleared from the immediate area with the exception of the operator and a helper, when necessary. A check shall be made to ensure safe clearance from energized power lines or equipment. Drills shall be set with at least a 50-foot clearance between any part of the drill or mast and any adjacent power line. Unsecured equipment shall be removed from the mast before raising. Cables, mud lines, and cat line ropes must be adequately secured to the mast before raising. After raising, the mast shall be secured to the rig in an upright position with steel pins. The rig must NEVER be moved with the mast in the upright position. Always check for overhead power lines.

- K. **Truck movement.** Trucks shall NOT be moved backwards, unless the driver has personally inspected the area behind the truck. In restricted or congested areas or areas where workers are located, the assistance of a "spotter" is mandatory. Trucks shall be equipped with serviceable automatic backup alarms.

- L. **Traffic control regulations.** Use a State-approved traffic control plan when the drilling rig or other associated vehicles are positioned on or near bridges and highways as to interfere with normal traffic flow.
- M. **Moving drill equipment.** Prior to moving drill equipment, a thorough inspection shall be made to ensure that the mast, drill rods, tools, and other supplies and equipment are secured to prevent displacement while in transit. The inspection shall include the steering mechanism, brakes, lights, load limit and proper flagging or lighting of load extensions. Applicable traffic laws shall be observed in moving drill equipment over public roads.
- N. **Storms.** The drilling rig shall be shut down when oncoming electrical or violent wind storms approach. Employees must evacuate to a safe location.

30.6. **Surface Drilling Operations**

- A. **General.** Before starting the power unit, all gears shall be disengaged, cable drum brake set, and no rope shall be in contact with the cathead. No drilling, augering, or material excavating operation will be performed within 6 feet of underground line unless the lines have been deenergized.
- B. **Safety chains.** A safety chain and cable arrangement shall be used to prevent water swivel and mud line whip, and are required on air hoses and high-pressure flexible lines.
- C. **Water swivels and hoisting plugs.** All water swivels and hoisting plugs shall be checked for possible frozen bearings and shall be properly lubricated before use. A frozen bearing could cause mud line whip and injury to the operator.

- D. **Braking operation.** Only the drill operators shall brake or set the chucks to eliminate the possibility of engaging the transmission prior to removing the chuck wrench.

- E. **Chuck and pipe wrench jaws.** The chuck and pipe wrench jaws shall be periodically checked for wear and replaced as necessary.

- F. **String of drill rods.** A string of drill rods shall NOT be braked, during lowering into the hole, by the chuck jaws. A cat line or hoisting cable and plug should be used for braking prior to tightening of the chuck. Failure to follow this procedure could result in steel slivers on the rods, hand injuries, and loss of the rods down the hole.

- G. **Lowering drill rods.** Drill rods shall NOT be lowered into the hole with a pipe wrench. To avoid serious back and hand injuries use hoists or pulleys whenever possible, or get help from a fellow employee.

- H. **Drilling with air.** When drilling with air is required, the exhaust shall be directed into a dust collection system. The cuttings shall be directed away from employees.

- I. **Blow-out preventors.** When drilling in bedrock that is suspected or known to contain natural gas, hydrogen, sulfide, or other potentially explosive gases, blow-out preventors shall be required. The use of an LEL (lower explosive limit) meter for monitoring the appropriate gases is required.

- J. **Cleaning drill rods.** When using drilling fluids, a rubber or other suitable wiper shall be used to remove the material from the drill rods when removing them from the drill hole.

-
- K. **Hoisting of drill rod.** Care must be exercised by the operator to avoid a sudden hoist release of the drill rod while the rod is being carried from the hole.

 - L. **Hoist capacity.** The hoisting capacity and weight of the drill rod must be known to prevent collapse of the mast during drill string removal from the hole. The operating capacity of the mast and hoist shall NOT be exceeded.

 - M. **Draining of drill rods.** Drill rods should be allowed to drain completely following braking before removal from the working area.

 - N. **Cleaning of auger flights.** Cleaning of auger flights shall NOT be done while the auger is rotating. A special paddle should be designed for cleaning auger flights or, if available, water under pressure is recommended for jet cleaning.

 - O. **Auger sections.** The use of mismatched auger sections should be avoided. Different brands and different weights shall NOT be used in the same auger flight.

 - P. **Fitting pins.** Only tight-fitting pins designed for the auger shall be used. Some pins lose their temper after very little use and the spring or clip section fails to hold the pin securely.

 - Q. **Drill hole protection.** Unattended drill holes shall be adequately covered or protected to avoid the possibility of animals or people accidentally falling into them.

 - R. **Equipment inspection.** Daily inspections prior to using equipment shall be made. This inspection should include, but not limited to, a thorough check of the hydraulic hoses, cables, belts, shafts, connections, and valves. Deficiencies should be

corrected and safe-condition verified before starting the equipment.

30.7 Equipment Grounding and Bonding

- A. **Requirement.** All wiring, electrical circuits, and equipment, except portable tools and appliances protected by a UL-approved system of double insulation, shall be effectively grounded in accordance with the latest edition of the National Electrical Code (ANSI/NFPA 70), Article 250-Grounding. In addition to the safe practices listed in this Appendix, the employer should follow, as applicable, 29 CFR 1926 Subpart K--Electrical.

- B. **Portable and plug connected equipment.** The noncurrent-carrying metal parts of portable and/or plug connected equipment, not protected by a UL-approved system of double insulation, shall be grounded. Grounding shall be by a multi-conductor cord having a receptacle to proper polarity.

- C. **Fixed equipment.** Exposed, noncurrent-carrying metal parts of fixed electrical equipment, including motors, generators, frames and tracks of electrically operated cranes, electrically driven machinery, lighting standards, etc., shall be effectively grounded.

- D. **Portable and vehicle-or trailer-mounted generators.** Under the following conditions, portable and vehicle- or trailer-mounted generators are not required to be provided with a driven ground. The employer shall have a competent person certify that portable and vehicle- or trailer-mounted generators meet these requirements prior to using the generator, or the generator shall be effectively grounded with a driven ground rod.

- E. **Portable generators.** Under the following conditions, the frame of a portable generator shall

not be required to be grounded and shall be permitted to serve as the grounding electrode for a system supplied by the generator if:

1. The generator supplies only equipment mounted on the generator and/or cord and plug connected equipment through receptacles mounted on the generator.
2. The noncurrent-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are bonded to the generator frame.

F. **Vehicle-and trailer-mounted generators.** Under the following conditions, the frame of a vehicle or trailer shall be permitted to serve as the grounding electrode for a system supplied by a generator located on the vehicle or trailer if:

1. The frame of the generator is bonded to the frame of the vehicle or trailer.
2. The generator supplies only equipment located on the vehicle or trailer, and/or cord plug-connected equipment through receptacles mounted on the vehicle, trailer, or on the generator.
3. The noncurrent-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are bonded to the generator frame.

G. **Effective grounds.** The path from circuits, equipment, structures, and conduit or enclosures to ground shall be permanent and continuous, have ample carrying capacity for the current likely to be imposed on it, and have a resistance sufficiently low to permit sufficient current flow to operate circuit breakers and similar over current devices in the circuit.

- H. **Ground resistance.** Driven ground rod electrodes shall have a resistance to ground not exceeding 25 ohms. When it is not possible to obtain a resistance of 25 ohms or less with a single electrode, two or more electrodes connected in parallel shall be used to obtain a resistance of 25 ohms or less. Ground resistance shall be tested upon installation and the record shall be available for review.

- I. **Testing grounds.** Following installation, the grounding conductor shall be checked for size and continuity.

- J. **Bonding.** Conductors used for bonding and grounding circuits and equipment shall be of sufficient size to safely carry the anticipated current. When attaching bonding and grounding clamps or clips, a secure and positive metal-to-metal contact shall be made. The ground end shall be attached first and the other end attached by using insulated tools or other suitable safety devices. When removing grounds, the grounding device shall be removed first from the conductor or equipment using insulated tools or other suitable safety devices. Such bonding and grounding attachments shall be made immediately after the circuit has been de-energized and before any work is started. Grounds shall not be removed until all work has been completed.

30.8 Flammable and Combustible Liquids

- A. **General.** Unless defined herein, terms used throughout this subsection shall convey the meaning specified in the flammable and combustible liquids code, NFPA 30, or 29 CFR 1910.106. For the purpose of this standard, flammable and combustible liquids are classified as follows:

1. **Flammable liquids (Class I liquids):**

Class I-Liquids having a flashpoint below 1000F (380C)

Class IA-Flashpoint below 730F (230C) and boiling point below 1000F(380C)

Class IB-Flashpoint below 730F (230C) and boiling point at or above 1000F (380C)

Class IC - Flashpoint at or above 730F (230C) but below 1000F (380C)

2. **Combustible liquids (Class II and III liquids):** Class II-Liquids having a flashpoint at or above 1000F (380C) and below 1400F (600C)

Class III- Flashpoint at or above 1400F (600C)

Some common flammable and combustible liquids:

Ether	Class IA
Gasoline	Class IB
Acetone	Class IB
Diesel oil	Class II
Lube oil	Class III

3. **Class IA flammable liquids:**

- a. **Restricted use.** Due to extreme explosion hazard of Class IA liquids, they shall not be purchased until storage, dispensing, and use procedures have been approved. Submittals for approval shall state the name and description of the liquid, its characteristics, and a detailed description of its intended use, together with the health and safety precautions to be used. This requirement shall not apply to small quantities of starter fluid.

- b. **Substitute product.** Wherever practical, a less hazardous product shall be used.
- c. **Controlled use.** Storage, dispensing, and use of Class IA liquids, including design of the storage and dispensing system under the supervision of a competent person.

4. **Toxicity of flammable and combustible liquids.** Most flammable and combustible liquids are highly toxic and should not be used until their toxic characteristics have been determined. The appropriate health and safety requirements shall be followed in handling toxic liquids.

5. **Closed tanks and containers.**

- a. **Approved types.** Only the following type, approved and labeled, closed tanks and containers shall be used for storage, handling, and dispensing of flammable and combustible liquids.

1. **Original container.** Flammable and combustible liquids may be stored and used in the original DOT shipping containers, as shown in table B-1. However, the quantity in the work area shall not exceed 1-days usage, up to a maximum of 25 gallons of a Class IA liquid or a maximum of 120 gallons of any other class of liquid. If flammable and combustible liquids are dispensed and used in smaller quantities, they shall be dispensed into properly labeled approved safety containers. Exception: liquids which are highly viscous (extremely hard to pour) may be stored and handled in any size original container; and

liquids which are transferred from labeled containers to portable containers and are Intended only for the immediate use by the employee who performs the transfer are exempt from labeling.

Table B-1. Maximum allowable size of containers and portable tanks

Container type	Flammable liquids				
	Class IA	Class IB	Class IC	Class II	Class III
Glass	1 pt	1 qt	1 gal	1 gal	15 gal
Metal (other than approved DOT drums) or approved plastic	1 gal	5 gal	5 gal	5 gal	5 gal
Safety Cans	2 gal	5 gal	5 gal	5 gal	5 gal
Metal Drums (DOT Spec.)	60 gal	60 gal	60 gal	60 gal	60 gal
Approved Portable Tanks	660 gal	660 gal	660 gal	660 gal	660 gal
Polyethylene DOT Spec. 34 or as authorized by DOT exemption	1 gal	5 gal	5 gal	60 gal	60 gal
	Class IA refer to 7.1c.(1)				

6. Approved storage cabinets.

a. General design and construction.

Storage cabinets shall be designed and constructed to limit the internal temperature at the center, 1 inch from the top, to not more than 325oF(162.8oC) when subjected to a 10-minute fire test with burners simulating a room fire exposure using the standard time-temperature curve as given in ASTM E152-81 a. All joints and seams shall remain tight and the door shall remain securely closed during the fire test. All cabinets shall be labeled in conspicuous

lettering "FLAMMABLE--KEEP FIRE AWAY".

b. **Approved cabinets.**

1. **Metal cabinets.** The bottom, sides, and top shall be at least No. 18 gauge sheet steel and double walled with 1-1/2 inch air space. Joints shall be riveted, welded, or made tight by some equally effective means. The door shall be provided with a three-point latch arrangement and the door sill shall be raised at least 2 inches above the bottom of the cabinet to retain spilled liquid within the cabinet.

2. **Wooden cabinets.** The bottom, sides, and top shall be constructed of exterior grade plywood at least 1 inch in thickness, which shall not break down or delaminate under fire conditions. All joints shall be rabbeted and shall be fastened in two directions with wood screws. When more than one door is used, there shall be a rabbeted overlap of not less than one inch. Doors shall be equipped with a means of latching, and hinges shall be constructed and mounted in such a manner as to not lose their holding capacity when subjected to fire exposure. A raised sill or pan capable of containing a 2-inch depth of liquid shall be provided at the bottom of the cabinet to retain spilled liquid within the cabinet.

7. **Storage**

- a. **Indoor storage.** Flammable and comustible liquids will not be stored

indoors except as follows:

1. No more than 25 gallons may be stored outside of approved cabinets in a single fire area; and no more than 10 gallons of Class I and Class II liquids combined shall be stored in a single fire area.
2. No more than 60 gallons of Class I or II liquids, nor more than 120 gallons of Class III liquids, may be stored in an approved cabinet. No more than three such cabinets may be located in a single fire area.
3. Larger quantities may be stored in separated indoor storage areas when such storage is certified by a competent person to meet the requirements of NFPA 30, Section 4-4, Design, Construction, and Operation of Separate Inside Storage Areas.
4. At least one 2-A:40-B:C fire extinguisher shall be located not less than 10 feet nor more than 25 feet from the stored material, cabinet, or entrance to the inside storage area.

B. Outdoor storage.

1. Flammable and combustible liquids will not be stored outdoors except as follows:
 - a. Above ground in approved containers not exceeding 60-gallon capacity subject to the following restrictions:
2. Any one group of containers stored together

shall not exceed 1,100 gallons. Each group of containers shall be separated by at least 5 feet and no group shall be within 25 feet of any building or other combustibles.

3. Each group of containers shall be located adjacent to an access way at least 12-feet wide to facilitate the use of firefighting equipment.
 - b. Stored above ground in approved portable tanks not exceeding 660-gallon capacity providing:
 1. That groups of two or more tanks having a combined capacity over 2,200 gallons are separated by a 5-foot clear area.
 2. Portable tanks are not located within 25 feet of a building or combustible material.
 3. Portable tanks are equipped with emergency venting and other devices as required in NFPA 30.
 4. Each tank is located adjacent to an access way at least 12 feet wide to facilitate use of firefighting equipment.
 - c. Above ground in approved tanks installed in accordance with NFPA Section 2-2, "Installation of Outside Above Ground Tanks."
4. Storage areas shall be diked at least 12 inches high, or graded and sloped, and sealed with a 50 mil plastic or equivalent liner to permit containment of leaks and spills equal to the capacity of all tanks and/or containers located

in each area. Further, the area shall be maintained free of weeds or combustible material to a distance 10 feet out from the storage area perimeter.

5. At least one portable fire extinguisher rated not less than 2-A:40- B:C unit shall be located not less than 25 feet nor more than 75 feet from each portable tank or group of tanks or containers located outside.

C. **Handling and dispensing flammable or combustible liquids**

1. **Dispensing area.** Areas in which flammable or combustible liquids are transferred in quantities greater than 5 gallons at a time shall be separated from other operations by at least 25 feet, or by a partition having a minimum 1-hour fire rating. Drainage or an equally effective method shall be used to contain spills.
2. **Ventilation.** Adequate natural or mechanical ventilation shall be provided in order to maintain the concentrations of flammable vapor at below 10 percent of the lower flammable limit.
3. **Grounding.** The transfer of Class I flammable liquids from one container to another shall require bonding of the containers and the transfer system. All dispensing systems shall be electrically grounded and bonded.
4. **Dispensing.** Flammable and combustible liquids shall be drawn from or transferred into vessels, containers, or tanks, only (1) through a dosed piping system, (2) from safety cans, (3) by means of a device drawing through the top, or (4) from containers or tanks by gravity

or pump through a self-closing valve.
Transferring by injecting pressurized air into a tank or container is prohibited.

5. **Lighting and electrical equipment.** Electrical lighting shall be the only means used to provide artificial illumination in areas where Class I flammable liquids are handled or dispensed, or where flammable vapor may be present. The wiring and all electrical equipment shall meet the requirements of NFPA designation: Class I, Division 2, of the National Electrical Code.
6. **Covered containers.** Class I and II liquids shall be kept in covered containers when not in use.
7. **Flame and ignition.** Open flame, smoking, or other sources of ignition shall not be permitted within a distance of 50 feet from areas where Class I flammable liquids are dispensed or used. Greater distance may be necessary under some conditions. Approved "No Smoking" signs shall be posted in such areas.
8. **Leakage or spillage.** Leakage or spillage of flammable or combustible liquids shall be cleaned up promptly and disposed of safely.
9. **Refuse containers.** Self-closing metal refuse containers shall be available in all areas where flammable or combustible liquids are dispensed or used.

D. Refueling

1. **Equipment.** Tanks and equipment used for refueling vehicles and equipment, fueled with flammable or combustible liquids shall be designed and installed in accordance with the applicable provisions of the NFPA Standards, Underwriters Laboratories, Inc., or Factory Mutual Standards, or have the approval of the Government agency having jurisdiction.

2. **Tank truck.** Tank trucks shall comply with the requirements published in NFPA 385, "Standard for Flammable and Combustible Liquid Tank Vehicles."
3. **Dispensing hose.** Hoses used to dispense flammable and combustible liquids shall be an approved-type with an automatic self-closing valve or nozzle without a latch-open device. A hanger or hose retracting system will be provided to protect the hose from traffic abuse.
4. **Electrical equipment.** Electrical wiring, pumps, and equipment shall meet the appropriate requirements of NFPA designation: Class I of the National Electrical Code. Clearly identified and accessible switched shall be provided at a location remote from dispensing devices to shut off all power to devices in an emergency.
5. **Refueling equipment.** Vehicles or equipment using gasoline, LPG, or other flammable or combustible liquid fuels shall be shut down during refueling. Diesel equipment is excepted when fueled in accordance with manufacturer's recommendations. Stationary refueling tanks and/or dispensing islands and pumps shall be protected against vehicular damage by guardrails or posts.
6. **Smoking.** A standard "No Smoking" sign shall be posted on all mobile refueling equipment and in established refueling areas.

30.9 Basic Sanitation

- A. **Key requirement.** Employers shall establish and maintain basic sanitation provisions for all employees in all places of employment. This includes, but is not limited to, potable water, toilet,

and waste collection and removal system. Washroom, showers, and separate eating facilities should be provided as appropriate.

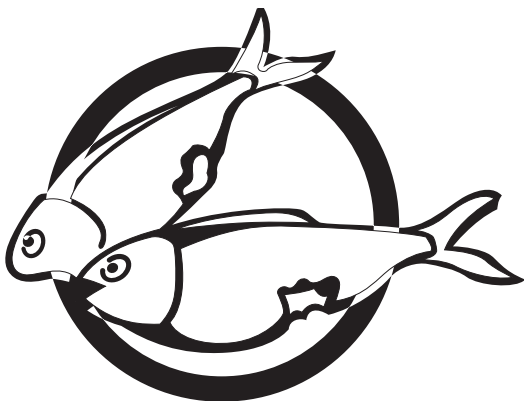
- B. **Potable water.** An adequate supply of potable water shall be provided in all places of employment. Portable containers used to dispense drinking water shall be kept tightly closed, equipped with a dispensing tap, labeled as "DRINKING WATER," and maintained in a sanitary condition. Water shall not be dipped from any potable water container. Drinking directly from the container is prohibited unless a properly installed drinking fountain with guarded orifice is provided. Containers used to dispense or distribute drinking water shall not be used for any other purpose. Use of breakable cups or glasses is prohibited. Fountain-type dispensers or one-use cups shall be provided at each dispenser; a waste receptacle shall also be provided. Outlets dispensing non-potable water shall be conspicuously posted "WATER UNSAFE FOR DRINKING PURPOSES" on a caution sign.

- C. **Toilet facilities.** Toilet facilities shall be provided at each job site in the following ratios:

1. Number of Employees	Minimum Number of Units
0 to 20	1 toilet 1 urinal
21 to 199	1 additional toilet and urinal for each additional 40 employees

Toilets will be within easy access to the worksite unless they are for a mobile crew and transportation is readily available.

2. **Portable toilet facilities.** When sewage disposal systems are not available, the



TOPIC 31
**Policy for Collecting,
Shipping, and Analyzing
Samples that may Contain
Pfiesteria**

following type toilet facilities shall be provided unless prohibited by local codes:

- a. Chemical toilets,
 - b. Recirculating toilets, or
 - c. Combustion toilets.
3. **Design of portable toilets.** Toilets shall be designed to provide privacy and protection from weather and falling objects. Cracks shall be sealed and the door tight-fitting and self-closing. Toilets shall have adequate ventilation and light, and all windows and vents shall be screened.
 4. **Chemical toilets.** Provision shall be made for routinely servicing and disposing of the sewage in accordance with Federal, State, and local health regulations.
 5. **Sanitation.** Toilets shall be maintained in a clean and sanitary condition with adequate supply of toilet paper with holder for each stool. Provision shall be made for frequent inspection and maintenance of all toilet facilities.
- D. **Garbage facilities.** Garbage shall be kept in substantial closed insect and rodent-tight containers and collected not less than weekly. Garbage and similar refuse shall be disposed of in designated areas according to local ordinance.
 - E. **Environmental contamination.** Garbage, refuse, waste materials shall not be discharged to streams, ditches, or natural drainage.
 - F. **Eating facilities.** Food service facilities and operations shall comply with the codes and

regulations of the jurisdiction in which they are located. Cafeterias, restaurants, mess facilities, and related operations located on construction sites shall be established, operated, and maintained in compliance with the health and sanitation recommendations of the U.S. Public Health Service and applicable State and local regulations.

Employees preparing or handling food shall undergo regular medical examinations and possess a food handler's certificate issued by the State or local government authority having jurisdiction. Such employees shall wear clean clothes and show evidence of cleanliness.

- G. **Sleeping facilities.** Sleeping quarters shall comply with all applicable Federal, State and local sanitation and fire protection codes. Sleeping quarters constructed on the job site shall comply with the NFPA Life Safety Code 101.

- H. **Washing facilities.** Adequate washing facilities shall be provided for all employees. Such facilities shall be near the worksite and furnished with cleaning materials which will remove the specific type of contaminant.

- 31.1 **General.** Pfiesteria are microscopic marine dinoflagellates which produce toxins that have caused fish kills and lesions on fish in coastal waters along the eastern United States. Human health effects from exposure to Pfiesteria toxins include flu-like symptoms, skin disorders, respiratory infections, and memory loss. Human health effects result from two primary pathways-
-inhaling chemical toxins produced by certain life stages of the organism, and direct contact with water, bottom sediments, or fish affected by Pfiesteria. The effects on humans can be treated medically. If you have been exposed to Pfiesteria toxins and begin to show any of the symptoms listed above, promptly consult a physician.
- 31.2 **Procedures.** The following procedures will be followed to safeguard USGS employees:
- A. **Sample Collection.** Personnel will consult with their State or local department of health or other agencies with Pfiesteria expertise before working in or around waters where Pfiesteria are suspected. UNDER NO CONDITIONS WILL SAFETY PROCEDURES BE LESS STRINGENT THAN PROTOCOLS DETERMINED BY LOCAL AGENCIES.

The following guidelines adapted from the State of Maryland, Department of Health and Mental Hygiene, will be followed, as a minimum, when collecting samples in an area where exposure to toxins is likely to occur:

1. A job hazard analysis will be developed specifically for the work to be performed.
2. Wear heavy waterproof gloves and protective clothing, and eye and face protection.
3. If personal contact with Pfiesteria-contaminated water should occur, immediately

wash affected area with soap and water. Wash hands and any exposed areas thoroughly with soap and water after sampling. After returning home, a full shower is recommended.

4. Avoid contamination of shipping coolers. If contamination of coolers should occur, immediately wash the coolers with soap and water.
 5. Respirators with HEPA and organic filters must be available for use. The need to wear a respirator will be determined by project personnel and supervisors, in conjunction with guidance from the State and local health department and your Regional Safety Officer.
 6. Contaminated protective clothing and equipment should be placed in a plastic bag and sealed until it can be washed with soap and water.
- B. **Sample Shipment.** Prior to shipping samples to any USGS or non-USGS laboratory, field personnel must contact the laboratory and determine if they are prepared to handle potentially contaminated samples. Under no circumstances will water from potentially contaminated locations be sent to any laboratory without prior notification.

It is the responsibility of those shipping samples to ensure that all sample labels, laboratory request forms, and shipping logs clearly state that "Pfiesteria toxins may be present."

- C. **Sample Analysis.** Processing water samples that potentially contain Pfiesteria for chemical analysis can be safely done only with special precautions in the laboratory. Each laboratory has the responsibility to ensure that safety measures are in place before they will accept potentially



TOPIC 32
FORMALDEHYDE

contaminated samples for processing. USGS laboratories will ensure that engineering controls are in place and personal protective equipment is available, prior to analysis of samples collected in areas where Pfiesteria toxins are suspected. The following guidelines will be followed:

1. A job hazard analysis will be developed specifically for the work to be performed.
2. Personal protective equipment (waterproof gloves, protective clothing, and eye and face protection) will be worn by all laboratory personnel at risk of coming in direct contact with the samples. In the event direct contact with the sample should occur, immediately wash affected area with soap and water.
3. The samples will be analyzed under a fume hood, if possible. If analytical procedures require oven drying, the laboratory ovens used must be vented to the outside.
4. For processes that cannot be performed under a fume hood, all laboratory personnel at risk of breathing the chemical toxins must wear a respirator with a HEPA and organic filter, in addition to wearing the personal protective equipment listed in paragraph (3)(b) above, until the stage of analysis when samples are dry. All requirements of the USGS Respiratory Protection Program, SM 445-2-H, Chapter 18.
5. Contaminated protective clothing and equipment will be placed in a plastic bag and sealed until it can be washed with soap and water.

32.1 References.

- A. 29 CFR 1910.1048 OSHA Formaldehyde Standard
- B. 29 CFR 1910.1048 Appendix A - Substance technical guidelines for Formaldehyde
- C. 29 CFR 1910.1048 App C - Medical surveillance – Formaldehyde
- D. SM 445-2-H, Chapter 22, Formaldehyde

32.2 **Procedures.** Formaldehyde is commonly used as a preservative in medical and research laboratories and can also be used as a sterilizer. Formaldehyde is used in foam insulations, as adhesives in the production of particle board and plywood, and in the treating of textiles. It is also a common ingredient in many household products such as carpet, draperies and furniture. Exposure is most common through inhalation but formaldehyde can also be absorbed through the skin. Safe work practices include the required use and maintenance of personal protective equipment (PPE), safety training for employees, and following established safety procedures.

- A. **Health Effects.** Short-term exposure to formaldehyde at high levels can be fatal (NIOSH, the National Institute of Occupational Safety and Health considers 20 parts per million (ppm) to be immediately dangerous to life and health); however, the odor threshold is low enough that irritation of the eyes and mucous membranes will occur long before these levels are achieved (0.1ppm). Long-term exposure to low levels of formaldehyde may cause respiratory difficulty, eczema, and sensitization. Formaldehyde is classified as a suspected human carcinogen and has been linked to nasal and lung cancer, and with possible links to brain cancer and leukemia.

B. Exposure Limits. The permissible exposure limit for formaldehyde is 0.75 ppm measured as an 8-hour time-weighted average. There is also a 2 ppm short term exposure limit (STEL), which is the maximum exposure allowed during any 15 minute sampling period. The action level is at 0.5 ppm. It is at this level that certain actions must occur and they are as follows:

- 1. Periodic monitoring,** (every six months)
Periodic monitoring may be discontinued when you can show that the results of two consecutive sampling periods, more than 7 days apart demonstrate employee exposure to be below the action level. The sampling must be statistically representative of the work operation and must be accurate within the confidence levels outlined in the standard 1910.1048 (d) (5).
- 2. Medical Surveillance.** Medical surveillance will be conducted as stated in the standard for all individuals exposed to formaldehyde at or above the action level. Records of this surveillance (Physicians Written Opinion) along with exposure monitoring results should be maintained for the period of employment plus 30 years.
- 3. When monitoring results** exceed either the 8-hour TWA or the STEL, either engineering controls or work practice controls must be implemented. Only when these controls cannot feasibly reduce the exposures may respiratory protection be provided to satisfy this standard. Provision of respiratory protection must comply with 29 CFR 1910.134.

32.3 Hazard Communication. Training must be provided to all individuals exposed to formaldehyde gas, using mixtures containing 0.1% or greater formaldehyde or materials that might under foreseeable conditions release formaldehyde at concentration at or above 0.1ppm. This training will be conducted at the time of initial assignment and whenever a change to the operation occurs. The training will be repeated annually at a minimum. Training must include:

- A. A review of the contents of the regulation (29 CFR 1910.1048) and the contents of the Material Data Sheet.
- B. The reason for medical surveillance and a description of the medical assessments required by this standard.
- C. A description of the potential health effects from long term exposure to formaldehyde and the signs and symptoms of exposure.
- D. Instructions to immediately report exposure to your supervisor.
- E. A description of processes that involve the use of formaldehyde and the methods of limiting exposure (safe work practices, personal protective equipment).
- F. The purpose for any provided PPE and their limitations.
- G. Instructions as to what to do in case of a spill or other emergency.

32.4 Regulated Areas. Areas which have airborne concentrations that exceed either the 8-hour TWA of 0.75 ppm or the STEL of 2 ppm will be posted with signs at each entrance. The signs will say:

DANGER
FORMALDHYDE
Irritant and Potential Cancer Hazard
AUTHORIZED PERSONNEL ONLY

32.5 Respiratory Protection.

- A. In areas that require respiratory protection, respirators must be provided at no cost to employees and employers must assure they are properly used to reduce exposure below the PEL and STEL. Respirators should only be used in the interval necessary to install engineering or work practice controls, or operations in which controls are not feasible such as maintenance, repair or emergencies.
- B. Employers must use NIOSH/MSHA-approved respirators and establish a written respiratory protection program in accordance to 29 CFR 1910.134. Minimum requirements for respiratory protection are shown in the chart below, which illustrates the type of protection required under specific concentrations of formaldehyde. Note: Half-mask respirators with formaldehyde cartridges are permitted if gas-proof goggles are used with the mask.



TOPIC 33
HANTAVIRUS INFECTION
PREVENTION PLAN

Formaldehyde Concentration	Minimum respirator concentration Required
Up to 7.5 ppm	Full facepiece with cartridges or canisters specific for formaldehyde.
Up to 75 ppm	Full facepiece with chin, back, or chest style industrial sized canisters specific for formaldehyde. Type C supplied-air respirator (continuous flow or pressure-demand) with hood, helmet, or full facepiece.
Above 75 ppm	Self-contained breathing apparatus with positive or unknown pressure full face piece. Combination supplied-air, full facepiece, positive-pressure, with auxiliary self-contained air supply.
Firefighting	SCBA, positive-pressure, full-face piece.
Escape SCBA	Demand or pressure demand mode. Full face mask with chin, back, or chest style industrial sized canisters specific for formaldehyde.

33.1 General Information. The first outbreak of Hantavirus infection occurred in the four corners geographical area where Arizona, New Mexico, Colorado, and Utah meet. The first known Hantavirus-related death was in May 1993.

The principal host and carrier of the virus is the common deer mouse, although other rodents also may be carriers. Human infection can occur when infected saliva or excreta are introduced into the body through principal routes of exposure, including inhalation, ingestion, or introduction into the eyes or through broken skin. A virus cannot survive without a host; however, it is uncertain how long the Hantavirus remains infectious once it is shed from an infected rodent.

The USGS currently operates a number of gage houses that have been determined to be infested with mice. There are no certain treatments if contracted, and the current death rate, if contracted, is more than 50 percent. These conditions place personnel that routinely operate the gaging stations at risk for exposure to a virus that is best completely avoided. Although it may be impossible to completely eliminate exposure to mice, the district is issuing this plan in an effort to reduce the threat of infection by minimizing exposure to mice in gage houses. This plan outlines the procedures all district personnel should follow when disinfecting, cleaning, and sealing gage houses, which if infested, will be assumed infected.

Gage houses are to be cleaned by teams of at least two people. Personnel should be medically able to engage in work activities described in this plan while wearing personal protective equipment. Personnel assigned to disinfect and clean gage houses must have necessary medical examinations, including a blood screen for Hantavirus antibodies. In addition to this plan, an orientation meeting will be held prior to its implementation to discuss the procedures outlined in the plan, to brief personnel about the hazards and the

protection to be provided, and to address questions and concerns. This plan shall become effective when approval and signature are made by the district chief.

- 33.2 **Equipment and Supplies.** The following equipment and supplies are needed and should be obtained before gage houses can be effectively disinfected, cleaned, and sealed. In addition, it is recommended that all solutions and their containers be clearly labeled identifying their names, expiration dates, and directions for use.
- A. Respirator protection, including half-face air-purifying respirators equipped with a filter/cartridge combination (HEPA filters (purple) and organic vapor/acid gas cartridges (yellow)), as outlined in a separate District Respiratory Protection Program.
 - B. Personal protective clothing
 - a. Coveralls (disposable, water-resistant Tyvek).
 - b. Boots (waterproof).
 - c. Goggles.
 - d. Gloves (disposable, waterproof).
 - C. Disinfectant (bleach) for use in sprayers, wash basins, and tubs (including measuring cups or other means of ensuring an effective ratio to prevent use of an unnecessary amount of bleach).
 - D. Sprayers (hand-pressurized and pumped, 1-3 gallon capacity) for saturating inside of gage houses and any waste that will be buried, and for rinsing and disinfecting boots.
 - E. Dust pans (or shovels) that can be disinfected easily for removing dead rodents, droppings, nests, or other waste that will be buried.

- F. Water jugs (5 gallon size) filled with potable water for personal wash water for hands and face and for additional water for mixing bleach solutions.
- G. Water jug spigot (at least one per work crew) for jug to be used as personal wash station.
- H. Washbasins (Rubbermaid dishpan type or pails, two per work crew) for disinfecting gloves and for soaking coveralls and spent filters with bleach solution before disposing.
- I. Mild dish soap or Liquinox for washing hands, face, respirator facepiece, and goggles.
- J. Paper towels for wiping areas that cannot be sprayed and for drying hands and face.
- K. Ziplock-type reclosable plastic bags (1 gallon size) for storage of filters and disposal of spent filters.
- L. Garbage bags for disposal of gloves, coveralls, and spent filters (after soaking in bleach solution), and for disposing general trash that does not require burial.
- M. Hardware for sealing houses (to be determined by technicians).
- N. Decon or other mouse poison.

33.3. **Killing the Virus and Cleaning the Gage House.**

A. **Preparations**

1. **Establish Zones.** The following zones should be established by using flagging, traffic cones, rocks, or other markers, to minimize transfer of potential contamination into clean areas such as vehicles and personal belongings, and to facilitate the work efforts.

- a. The Work Zone should include gage house, immediate surrounding area, and burial site. The burial site should be downwind from the gage house and removed enough from the river or stream that potential flooding will not be a concern. Personal protective equipment should be worn at all times in the Work Zone.

- b. THE WASH ZONE SHOULD ALWAYS BE LOCATED UPWIND FROM THE WORK ZONE. If this is impossible (i.e., directly upwind would put you in the middle of the river), remember that any location is better than directly down wind. The Wash Zone should provide a corridor for personnel to move from the Work Zone to the Clean Zone. If you progressed from the Work Zone to the Clean Zone, the Wash Zone should include,
 1. Wash basin or pail with bleach solution,
 2. Space for removing personal protective equipment,
 3. Wash tub with bleach solution,
 4. Garbage bag,
 5. Clean garbage bag laid flat on ground, table, or other surface for setting disinfected personal protective equipment that will be reused,
 6. Water jug with spigot and accessible soap and paper towels,
 7. Drinking water,

8. Extras, such as potable water, more bleach, or filters that you might need while working.
 - ii. The Clean Zone also should be located UPWIND from the Work and Wash Zones. The Clean Zone should be removed enough that there is no chance that work activities will cross over into areas designated as "clean," such as vehicles.
 - c. **Prepare A Burial Site.** All rodent refuse must be disposed by burying; never discard in stream or as general trash. A hole, 2-3 feet deep, should be dug BEFORE personal protective equipment is donned. (Note: Work in personal protective equipment will be heavy, hot, and likely uncomfortable. Taking the time to make needed preparation before personal protective equipment is donned will greatly facilitate the cleaning process.)
 - d. **Dress For The Occasion.** Respiratory protection and personal protective clothing must be worn while miceinfested gage houses are disinfected and cleaned.
1. **Respiratory Protection**
 - a. Respiratory protection needed for the protection of Hantavirus infection includes air-purifying respirators equipped with HEPA filters (purple). A combination of HEPA filters with organic vapor/acid gas cartridges (yellow) will provide respiratory

protection from chlorine gas, which is liberated from bleach, and must be used while disinfecting and cleaning gage houses.

- b. Respiratory protection operating procedures are outlined in the District Respiratory Protection Program and should be followed. For instance, it is easier to do negative and positive test fits first and then adjust the facepiece to have a comfortable but sealed fit. Adjusting the respirator is easier before having gloves on. Filters should be replaced any time during the cleaning effort when breathing becomes difficult or when chemicals such as disinfectants can be smelled. Spent filters should be disposed in plastic bags only after they have been soaked in bleach solution (discussed below).

2. **Personal Protective Clothing.** Personal protective clothing including coveralls, boots, goggles, hoods, gloves, and others, must be used during implementation of this plan. Coverall leg should be worn over the outside of the boots if possible. Only a small part of the boots will be exposed by wearing the coverall leg over the boot requiring minimal disinfection. Hoods on coveralls should be worn at least until gage house is saturated with bleach solution and obvious mice refuse removed.
3. **Prepare Disinfectant.** CDC has determined that the Hantavirus is easily killed by saturating contaminated areas with common household disinfectants. A solution of 2 cups of bleach to 1 gallon of water (1:8) is recommended in the March 17, 1994, USGS Memorandum and is to be the disinfectant used by the district. This bleach solution will be used in the wash zone

discussed above to disinfect personal protective equipment and in sprayers to disinfect gage houses by saturating dead mice, excreta, nests, etc.

Diluted bleach deteriorates more rapidly than concentrated bleach, and, therefore, may not be as effective a disinfectant (D.W. Stephens, U.S. Geological Survey, written commun., 1995). Solutions should be mixed at the beginning of each day and discarded at the end of each day. Solutions should be replenished during the day when they get low and should be replaced if used to soak filters or coveralls.

Never store diluted bleach in anything other than a tightly capped bottle (as opposed to a spray bottle), and never reuse the previous day's bleach solution that was used for washing personal protective equipment.

NEVER MIX ANOTHER DISINFECTANT SPECIFICALLY AMMONIA, WITH BLEACH! THIS MIXTURE WILL RESULT IN THE LIBERATION OF TOXIC GASES!

- 4. Disinfecting and Cleaning.** Disinfect any obvious areas of mouse habitation first. Saturate dead rodents, excreta, nests, and any other obvious remnants thoroughly. Carefully remove any waste from gage house and deposit in hole for burial. Continue to saturate waste material in hole if needed. When all refuse has been deposited in the hole, refill the hole with the dirt that was removed. Continue disinfecting the gage house, by saturating all surfaces with bleach solution using the sprayer, if possible otherwise, wipe surfaces with paper towels dampened with bleach solution. Ventilate gage house before reentering to seal, to ensure that the chlorine gas liberated from the bleach has sufficiently

dissipated.

- B. Stopping Work.** It should always be assumed that the clothes and protective equipment you are wearing while disinfecting and cleaning the gage houses are contaminated. Care should be taken when you stop work, at any time for any reason, to appropriately disinfect protective equipment to prevent transfer of potential contamination to clean areas and personal clothing. **NEVER REMOVE YOUR RESPIRATOR IN A POTENTIALLY CONTAMINATED AREA; ALWAYS LEAVE THE WORK ZONE FIRST.** Remember the routes of exposure. Stopping for a drink of water without disinfecting your gloves makes the risk for ingesting contaminants high. Only under emergency conditions should protective equipment be removed before disinfecting.
1. **Leaving The Work Zone.** The following steps should be followed when you leave the Work Zone for any reason, even if it is only for a short period of time, such as getting a drink of water.

ALWAYS EXIT THE WORK ZONE THROUGH THE WASH ZONE

- a. Disinfect gloves by dipping hands in dishpan with bleach solution
- b. Remove coveralls and place in washtub with bleach solution
- c. Disinfect gloves, as above
- d. Spray boots with bleach solution
- e. Remove goggles and wipe off EXTERIOR with paper towels dampened with bleach solution

- f. Disinfect gloves, as above

- g. Remove respirator and wipe off EXTERIOR with paper towels dampened with bleach solution, being very careful not to introduce any water into the filters (covers, however, should be wiped)
 - h. Disinfect gloves, as above
 - i. Remove gloves, and wash hands and face
- 2. **Day's End or Completion of Job.** The steps outlined below should also be followed at the day's end or upon completion of a job.
 - a. Spray and wipe off any equipment that is used in the cleaning process, such as sprayers, with bleach solution, BEFORE removing any personal protective equipment.
 - b. Break down wash line, disposing of bleach solution along exterior perimeter of gage house.
 - c. Clean goggles and respirator facepiece thoroughly with soap and water. Follow the guidelines in the District Respiratory Protection Program, or in the manufacturer's instruction manual for cleaning the respirator. This could be done at the work site or at a more convenient place such as your home or motel room. Waiting until the next morning is not advisable as it may not be completely dry by the time you need to wear it.

C. Associated Hazards

- 1. **Hantavirus Infection.** If infected, symptoms typically develop within 2 to 4 weeks after



TOPIC 34
**Working on Ice-Covered
Rivers**

exposure, although it may take up to 6 weeks. Early symptoms are similar to the flu and include high fever, muscle aches, chills, cough, and headache. As the disease progresses, the victim experiences severe pneumonia (hantavirus pulmonary syndrome) and respiratory distress. The lungs may swell and fill with fluid.

If personnel involved in disinfecting and cleaning gage houses develop any of these symptoms described, at any time during or after the job, immediate medical attention should be sought and appropriate USGS personnel notified.

2. **Bleach.** The dangerous part of common household bleach ($\text{Ca}(\text{ClO})_2$) is the chlorine (Cl_2) that is liberated as a gas when bleach is exposed to air. The Handbook of Toxic and Hazardous Chemicals and Carcinogens (Sittig, 1985) describes chlorine (Cl_2) as "a greenish-yellow gas with a pungent odor. It is the most common of the four halogens which are among the most chemically reactive of all the elements. Chlorine reacts with body moisture to form acids. It is itself extremely irritating to skin, eyes, and mucous membranes." The greatest risk of exposure to chlorine gas is through inhalation and eye and skin contact.

The concentration recommended by USGS of 2 cups of bleach to 1 gallon of water is a fairly concentrated solution. The solution should be used with care. The filter/cartridge combination (HEPA/organic vapors/acid gases (purple/yellow)) that will be issued for use with the half-face, air-purifying respirator facepiece will provide the respiratory protection needed for any liberation of chlorine gas while using

the bleach solution. Contact with skin and eyes should not be a problem if personal protective clothing is worn. It is important to keep these hazards in mind, particularly when personal protective equipment is not being worn, for example when the wash line is disassembled.

First aid for accidental contact should be administered and includes the following:

- a. Inhalation Immediately move victim to fresh air. Administer artificial respiration, if needed. Seek immediate medical attention.
- b. Eye or skin contact Irrigate eyes or skin with copious amounts of water. Seek immediate medical attention.

3. **Dehydration, heat exhaustion, heat stroke, and other physical hazards.** Personal protective equipment can be hot and cumbersome to work in. Personnel should be alert and aware of associated hazards such as, dehydration, heat exhaustion, and heat stroke, particularly when working during hot days. Although it may be time consuming and somewhat of a bother, personnel should make sure they pace themselves and take breaks as frequently as necessary. Personnel should be aware of other physical hazards inherent to the work environment, which may include cuts and snake and insect bites.

- 33.4. **SEALING THE GAGE HOUSE.** Gage house and immediate surrounding area should be sufficiently disinfected, cleaned, and aired BEFORE sealing begins, such that sealing the gage house can progress without use of personal protective equipment. Procedure for sealing gage houses should be determined individually by technicians that operate

them. Decon or other mouse poison should be placed inside cleaned and sealed gage houses. Use of mouse poison may become routine if it is determined to be a fairly effective deterrent, at least for nesting.

34.1 General Information. Working on ice-covered rivers can be very hazardous. If you break through the ice into several feet of flowing water, it will be very difficult for you to get out and very hazardous for a co-worker to try to rescue you. The risk involved with working on each ice-covered river should be weighed against the value of the data collected. Use extreme caution and good judgment to carefully evaluate site conditions including ice strength. Do not continue if the risk is too great. The following safety policy associated with working on ice-covered rivers is provided:

34.2 Measurements Through Ice. Do not attempt an ice measurement if there is any doubt that the ice will support the weight of the workers and equipment.

- A. Ice is a continually changing medium and therefore must be monitored and tested often.
- B. Before going on the ice determine whether:
 - 1. The temperature has been or will be above freezing. Snow melt increases the stage and the pressure on the ice sheet which may cause it to break up rapidly (sometimes in a matter of minutes).
 - 2. The temperature has been cold enough for the ice sheet to form.
 - a. Early season ice may have spots of open water.
 - b. Thickness of ice may vary.
 - c. Ice sheet may not be frozen to either bank.
 - 3. The river stage is rising or falling. A dropping river stage may cause an ice bridge and may



TOPIC 35
LABORATORY SAFETY

not support additional weight without the support of the water underneath.

4. The ice is covered with snow.
 - a. Snow insulates the ice and slows development.
 - b. Blowing snow may blanket spots of open water.
 - c. Snow covers cracks and deformations.

C. Working on ice.

1. Ice at the bank may be thin and weak in areas. Also, it may be deformed and tilted making traction difficult.
2. Ice may feel "rubbery." This means ice is flexing and is weak.
3. Piers, rocks and trees.
 - a. Ice may not build up around piers, rocks, and trees.
 - b. Open water may be around ice, rocks, and trees.
4. Ice color.
 - a. Black or blue ice is usually strong.
 - b. White ice is weaker due to trapped air.

D. Testing ice.

1. Test ice with a sharp blow from your ice chisel.
 - a. Hard ice resounding ring.
 - b. Soft ice a dull thud. (Drill a test hole to determine if ice is safe to work on.)

- c. Dangerous ice chisel penetrates ice. (Do not work on ice.)

E. Drilling holes.

1. Holes overflow or gush water river stage has risen and is applying pressure to the ice and may cause it to breakup rapidly.
2. Power augers should have a dead man switch installed to stop the auger when the operator lets go.
3. Keep auger blade covered when not in use. This helps keep them sharp and helps prevent cuts.

- F. **There is no substitute for experience.** When possible, work with someone who has experience working on ice.

- 34.3 **Personal Flotation Devices.** (PFD's) are required and must be worn in all ice measurement operations, except in those cases where an approved site-specific Job Hazard Analysis (JHA) defines the conditions for an exemption. U.S. Coast Guard-approved Type III or Type V anti-exposure worksuit or thermal system float coat PFD's help protect against hypothermia. Suspender type self-inflating PFD's may be worn over winter clothing.
- 34.4 **Job Hazard Analysis (JHA).** At least two workers must be present except in those cases where an approved site-specific (JHA) defines the conditions for an exemption. One of the two employees present at an ice measurement must be experienced in working on ice-covered rivers. Under no conditions should an employee, inexperienced in making ice measurements and/or unfamiliar with the measurement site, attempt an ice measurement alone.

- A. **A site-specific JHA** must be developed for each site where work on an ice-covered river is to be conducted. The JHA will identify, for each job step, the potential hazards and recommended procedures to be followed. The JHA must also contain:
1. A section describing unsafe conditions under which no measurements or sampling operations will be attempted.
 2. The conditions, if any, for which the wearing of a PFD is not required.
 3. The conditions, if any, when only one employee may make measurements or collect samples.
 4. A rescue plan if it is possible for someone to break through the ice and drown. This rescue plan must be formulated and documented in the JHA before beginning work on an ice-covered river. Examples of a few general rescue techniques are provided in Appendix A (a generic JHA for working on ice-covered rivers).
 5. The location and telephone number of emergency medical and rescue facilities.
- B. JHA's must be approved by the first line supervisor and reviewed by a supervisor or manager that is senior to the approving official. The JHA will be placed in the station field folder. The JHA's will be evaluated during the discipline and safety reviews.

34.5 **Communication.** A cell phone, satellite phone or two-way radio is recommended for working at remote sites.

35.1 **References.**

- A. 29 CFR 1910.1450 - Occupational Exposures to Hazardous Chemicals in Laboratories
- B. 29 CFR 1910.1200 - Hazard Communication
- C. SM 445-2-H, Chapter 20, Industrial Hygiene – Hazard Communication Program
- D. SM 445-2-H, Chapter 21, Industrial Hygiene – Laboratory Protection Program

35.2 **Procedures.** A Chemical Hygiene Plan (CHP) is required (29 CFR 1910.1450) by the Occupational Safety and Health Administration (OSHA) for every laboratory. One CHP may cover more than one laboratory if activities and types of chemicals used in the laboratories are similar. Photo development laboratories are an example of where a single CHP could cover many areas.

35.3 **General Safety Principles.** The following guidelines have been established to minimize hazards and to maintain basic safety in the laboratory.

- A. Examine the known hazards associated with the materials being used. Never assume all hazards have been identified. Carefully read the label before using an unfamiliar chemical. When appropriate, review the Material Safety Data Sheet (MSDS) for special handling information. Determine the potential hazards and use appropriate safety precautions before beginning any new operation.
- B. Be familiar with the location of emergency equipment – fire alarms, fire extinguishers, emergency eyewash and shower stations and know the appropriate emergency response procedures.

- C. Avoid distracting or startling other workers when they are handling hazardous chemicals.
- D. Use equipment and hazardous chemicals only for their intended purposes.
- E. Always be on the alert for unsafe conditions and actions. Call attention to them so that corrective action can be taken as quickly as possible.
- F. Wear eye and face protection when appropriate.
- G. Always inspect equipment for leaks, tears and other damage before handling a hazardous chemical. This includes fume hoods, gloves, goggles, etc.
- H. Avoid tasting or smelling hazardous chemicals.

35.4 **Health and Hygiene.** The following practices have been established to protect laboratory employees from health risks associated with the use of hazardous chemicals:

- A. Avoid direct contact with any hazardous chemical. Know the types of protective equipment available and use the proper type for each job.
- B. Confine long hair and loose clothing and always wear footwear that fully covers the feet.
- C. Do not mouth pipette.
- D. When exposure to gases, vapors or aerosols is suspected, use appropriate safety and ensure exhaust facilities are working properly.
- E. Wash thoroughly with soap and water after handling chemicals, before leaving the laboratory and before eating or drinking.

- F. Contact lenses are prohibited when using hazardous chemicals.
- G. Replace personal protective equipment as appropriate.
- H. Laboratory employees shall be familiar with the symptoms of exposure for the chemicals with which they work and the precautions necessary to prevent exposure.

35. 5 **Food and Drink in the Laboratory.** The following statement is the accepted practice on food and drink in laboratories and should be followed at all times:

"There shall be no food, drink, smoking or applying cosmetics in laboratories that have radioactive materials, biohazardous materials or hazardous chemicals present. There shall be no storage, use or disposal of these 'consumable' items in laboratories (including refrigerators within laboratories). Rooms that are adjacent, but separated by floor to ceiling walls and do not have any chemical, radioactive or biohazardous agents present, may be used for food consumption, preparation or applying cosmetics at the discretion of the project director responsible for the areas."

35. 6 **Housekeeping.** Safety follows from good housekeeping practices. Use the following guidelines to maintain an orderly laboratory:

- A. Keep work areas clean and uncluttered with chemicals and equipment. Clean up work areas upon completion of an operation or at the end of each work day, including floors.
- B. Dispose of waste as per local requirements.
- C. Clean spills immediately and thoroughly. Ensure a chemical spill kit is available and that employees

know how to use it.

- E. Do not block exits, emergency equipment or controls. Do not use hallways and stairways as storage areas.
- F. Assure hazardous chemicals are properly segregated into compatible categories.

35.7 Transferring of Chemicals. When transporting chemicals outside the laboratory, precautions should be taken to avoid dropping or spilling chemicals.

- A. Carry glass containers in specially designed bottle carriers or a leak resistant, unbreakable secondary container.
- B. When transporting chemicals on a cart, use a cart that is suitable for the load has high edges to contain leaks or spills.
- C. When possible, transport chemicals in freight elevators to avoid the possibility of exposing people on passenger elevators.

35.8 Compressed Gases. Special systems are needed for handling materials under pressure. Cylinders pose mechanical, physical and/or health hazards, depending on the compressed gas in the cylinder.

- A. Cylinders with regulators must be individually secured. Only cylinders with valve protection caps securely in place may be safely gangchained (chained in groups).
- B. When storing or moving a cylinder, ensure the valve protection cap is securely in place to protect the stem.
- C. Cylinders must be secured in an upright position at all times. Use suitable racks, straps, chains or stands to support cylinders against

an immovable object, such as a bench or a wall, during use and storage. Do not allow cylinders to fall or lean against one another.

- D. Use an appropriate cart to move cylinders.
- E. Never bleed a cylinder completely empty. Leave a slight pressure to keep contaminants out.
- F. Oil or grease on the high pressure side of an oxygen cylinder can cause an explosion. Do not lubricate an oxygen regulator or use a fuel gas regulator on an oxygen cylinder. Use an oxygen approved regulator.
- G. Always wear goggles or safety glasses with side shields when handling compressed gases.
- H. Always use appropriate gauges, fittings, and materials compatible with the particular gas being handled.

35.9 **Personal Protective Equipment.**

- A. Match the protection to the hazards.
- B. As a minimum, eyeglasses should be worn when working with hazardous chemicals.
- C. Splash goggles and full-face shields should be worn when there is a chance of liquid being splashed or an uncontrolled release of energy is possible.
- D. Gloves should be worn when handling corrosive or toxic chemicals.
- E. The information below gives compatible glove material for the chemical class shown.

1. Acids, carboxylic aliphatic and alicyclic

- unsubstituted with neoprene, nitrile, polyvinylchloride (PVC).
 - polybasic with natural rubber, neoprene, nitrile, or PVC.
2. **Aldehydes, aliphatic with butyl aromatic and heterocyclic**
 - no material shown to be effective for more than 1 hour.
 3. **Amines aliphatic and alicyclic**
 - primary with nitrile.
 - secondary - no material shown to be effective for more than 1 hour.
 - tertiary with nitrile and PVC.
 4. **Esters, carboxylic aliphatic**
 - acetates with PVA (polyvinyl alcohol)
 - higher monobasic - no material shown to be effective for more than 1 hour. **aromatic** with neoprene or nitrile.
 5. **Esters, aliphatic**
 - with nitrile or PVA.
 6. **Halogen compounds aliphatic**
 - unsubstituted with viton.
 - substituted – no material shown to be effective for more than 1 hour.

aromatic

 - unsubstituted – no material shown to be effective for more than 1 hour.
 - substituted with neoprene.
 - polynuclear with PVA.
 7. **Heterocyclic compounds, epoxy compounds and furan derivatives**
 - no materials shown to be effective for more than 1 hour.
 8. **Hydrocarbons aliphatic and alicyclic**
 - with neoprene, nitrile, viton, or PVA. **aromatic**

with viton or PVA.

9. **Hydroxyl compounds aliphatic and alicyclic**
 - primary with butyl, neoprene or nitrile.
 - secondary with natural rubber, neoprene, nitrile, PVA or PVC.
 - polyols with nitrile or PVA. **aromatics** with neoprene.

10. **Inorganic gas**
 - with neoprene.

11. **Inorganic acids**
 - with viton.

12. **Inorganic bases**
 - with natural rubber, neoprene, nitrile or PVC.

13. **Ketones, aliphatic**
 - no material shown to be effective for more than 1 hour.

14. **Nitriles, aliphatic**
 - with natural rubber.

35.10 Gases.

- A. There are three major groups of gases based on their physical state when contained.
 1. Non-liquified gases or cryogenic fluids are elements or compounds that have relatively low boiling points, less than -150o F. Carbon monoxide is an example.

 2. Liquified gases are elements or compounds that have boiling points near atmospheric temperature, -130o F to 30o F. Sulfur dioxide is an example.

 3. A dissolved gas is packed with an inert porous material. Acetylene is an example.

- B. Acetylene will decompose violently if handled at pressure greater than 15 psig.
- C. When storing compressed gases, they should be segregated according to whether they are an inert, an oxidizer or a fuel.
- D. Firmly secure all gas cylinders during transport or when used or stored in the work area.
- E. Do not transport a cylinder unless the valve protector cap is in place. Otherwise the valve could be sheared off if the cylinder is dropped, resulting in an uncontrollable rocket.
- F. A cylinder valve should never be opened unless a regulator designed for the cylinder and the gas within the cylinder is properly attached.
- G. Do not allow oil or grease to contact valves, regulators or hoses of cylinders containing oxidizing gases; (i.e., oxygen).

35.11 Physical Hazards.

- A. Glass vessels under extreme pressure or vacuum should be shielded to prevent flying glass if an explosion or implosion occurs.
- B. Wear appropriate gloves and goggles when pouring cryogenic gases.
- C. Remember that high heat sources (i.e., ovens) generate non-ionizing radiation that can lead to both skin and eye damage. Wear appropriate protective equipment if long exposure is anticipated.

35.12 Hazardous Waste Disposal.

- A. All hazardous waste must be disposed of in accordance with federal, state or local regulations.

- B. Generally, a liquid material may be disposed of by way of the sanitary sewer if the following two conditions are met:
 - 1. The liquid material has a pH greater than 5.5 and less than 10.0.
 - 2. The liquid does not demonstrate any of the following characteristics: ignitability, corrosivity, toxicity, and reactivity.
- C. Generally, a solid material may be disposed of by way of the common trash if the material does not demonstrate any of the following characteristics: ignitability, corrosivity, toxicity, and reactivity.
- D. Every effort should be made to limit hazardous waste. The following are examples:
 - 1. Substitute, where possible, non-hazardous materials for hazardous materials in operations or experiments.
 - 2. Convert the hazardous waste to a non-hazardous material through either evaporation, neutralization, precipitation and filtering off of toxic metals, or other chemical treatment.
 - 3. Order only the amount of material needed for the job, thereby eliminating excess. Ordering a 20-pound bottle of a material when only a 1-pound bottle is needed will result in considerable dollars being spent to dispose of the excess material.
 - 4. When possible share common materials, eliminating doubling or tripling of orders for the same material.
- E. All hazardous waste must be properly labeled and stored in a properly designed storage area during the time the material is on a USGS facility.

F. All hazardous waste must be transported by EPA-licensed haulers and disposed of in EPA- licensed treatment, storage and disposal facilities.

SAMPLE CHEMICAL SAFETY LABORATORY CHECKLIST

Room: _____ Building: _____
 Safety Rep: _____
 PI: _____
 Inspection Date: _____
 Dept: _____
 Inspected By: _____

GENERAL

YES

NO

N/A

- | | | | | |
|-----|--|-------|-------|-------|
| 1. | Emergency phone numbers are posted on the laboratory door laboratory door. | _____ | _____ | _____ |
| 2. | Warning signs are posted on doors. | _____ | _____ | _____ |
| 3. | Right-to-Know law bulletin is posted within department. | _____ | _____ | _____ |
| 4. | All personnel know how to obtain MSDS's. | _____ | _____ | _____ |
| 5. | All personnel have received Lab Specific Training. | _____ | _____ | _____ |
| 6. | All personnel have received CHP Training. | _____ | _____ | _____ |
| 7. | Lab coats are available. | _____ | _____ | _____ |
| 8. | Chemical protective gloves are available. | _____ | _____ | _____ |
| 9. | Safety glasses/goggles are available. | _____ | _____ | _____ |
| 10. | An eyewash fountain | _____ | _____ | _____ |



TOPIC 36
**Medical Surveillance and
Immunizations**

- | | | | | |
|-----|---|-------|-------|-------|
| | is present. | _____ | _____ | _____ |
| 11. | An emergency shower is present. | _____ | _____ | _____ |
| 12. | Food and beverages are not stored or used in lab. | _____ | _____ | _____ |
| 13. | Aisles are uncluttered and without a tripping hazard. | _____ | _____ | _____ |
| 14. | Chemical spill kits are available. | _____ | _____ | _____ |
| 15. | Non-contaminated sharp objects are in labeled, puncture-proof containers. | _____ | _____ | _____ |
| 16. | Fume hoods have current inspection sticker. | _____ | _____ | _____ |
| 17. | All exit ways are free and unobstructed. | _____ | _____ | _____ |
| 18. | Fire extinguishers are available and unobstructed. | _____ | _____ | _____ |
| 19. | Fire extinguishers are inspected. | _____ | _____ | _____ |
| 20. | Current inventory of chemicals is available. | _____ | _____ | _____ |

CHEMICAL STORAGE AND HANDLING

- | | | | | |
|----|-------------------------------------|-------|-------|-------|
| 1. | Gas cylinders are properly secured. | _____ | _____ | _____ |
|----|-------------------------------------|-------|-------|-------|

-
- | | | | | |
|-----|---|-------|-------|-------|
| 2. | No leaking containers are present. | _____ | _____ | _____ |
| 3. | All chemical containers are properly labeled. | _____ | _____ | _____ |
| 4. | Chemicals are stored according to compatibility. | _____ | _____ | _____ |
| 5. | Peroxide forming reagents are dated when opened. | _____ | _____ | _____ |
| 6. | Peroxide forming reagents are disposed of or tested after exp. date. | _____ | _____ | _____ |
| 7. | Flammable storage areas are labeled. | _____ | _____ | _____ |
| 8. | Flammables are kept away from sources of heat, ignition, flames, etc. | _____ | _____ | _____ |
| 9. | Corrosive chemical storage areas are labeled. | _____ | _____ | _____ |
| 10. | Corrosive materials are stored low to the ground. | _____ | _____ | _____ |
| 11. | Carcinogen storage area(s) is labeled. | _____ | _____ | _____ |
| 12. | Chemicals in the open are kept to a minimum. | _____ | _____ | _____ |
| 13. | Flammable/Combustible liquids do not exceed NFPA storage limits. | _____ | _____ | _____ |

35.13

Chemical Storage Guidelines

Chemical Class											
1	Inorganic Acids	1									
2	Organic Acids	2									
3	Caustics	3									
4	Amines, Alcoholamines	X 4									
5	Halogenated Compounds	X	5								
6	Alcohols, Glycols, Glycol Ethers	X ^b	X	X	X	6					
7	Aldehydes									X	7
8	Ketones	X	X	X	8						
9	Saturated Hydrocarbons	X	X	X	X	X	X	X	X	9	
10	Aromatic Hydrocarbons	X	X	X	X	X	X	X	X	10	
11	Olefins	X	X	X	X	X	X	X	X	11	
12	Esters	X	X	X	X	X	X	X	X	12	
13	Halogens	X ^a	X	X ^c	X	13					
14	Ethers	X	X	X	X	X	X	X	X	X	14
15	Acid Anhydrides	X	X	X	X	X	X	X	X	15	
16	Oxidizers										16

NOTE:

- Identify class to which a specific chemical belongs, read safe combinations (X = safe combinations) with other classes both horizontally and vertically.
- Store flammables in a storage cabinet for flammable liquids or in safety cans.
- Do not store chemicals alphabetically as a general groups. This may result in incompatibles appearing together on a shelf. Rather, store alphabetically within compatible groups.
- This listing is only a suggested method of arranging chemical materials for storage and is not intended to be complete.

a = Halogens (X2) are oxidizing agents

b = Esters produced

c = Haloamines produced



TOPIC 37

OFFICE SAFETY

36.1. References

- A. SM 445-2-H, Chapter 23, Medical Monitoring Protection Program
- B. DM 485, Occupational Medicine Program

36.2 **Medical Surveillance.** USGS policy is to monitor work place exposures for chemical, physical, and biological hazards, and perform follow-up medical surveillance for personnel who are or may be occupationally exposed to hazards above established exposure levels. Medical monitoring is required for those with occupational exposure to toxic chemicals, physical agents, or biological hazards above established Permissible Exposure Limits (PEL) and Threshold Limit Values (TLV) without respect to the use of personal protective equipment. Medical surveillance is a legal requirement enforceable by OSHA and employees must participate as a condition of employment. Examples of USGS activities that may require medical surveillance include, but are not limited to: pesticide handlers, inspectors, laboratory personnel, chemical spill clean-up personnel, individuals working with power tools, respirator wearers, field personnel and staff working with hazardous waste site activities. Volunteers under the age of 18 are excluded from activities that require medical surveillance.

- A. **Pre-placement or baseline examinations.** Pre-placement or baseline medical examinations will be performed on any USGS employee that by job description or assignment may have exposures to hazardous conditions in their work environment. These exams are designed to assess physical capabilities and limitations in relation to job requirements, and to document the employee's current health status for future use in the evaluation of potential exposures of USGS personnel.

- B. **Periodic exams.** Special purpose periodic examinations are conducted at pre-determined intervals either based on OSHA regulation or Bureau policy to evaluate and document the health effects of occupational exposures. The frequency of many of these exams is set by regulation. These exams are designed to identify health conditions that have arisen since the previous exam. Early identification of medical conditions that are work related allows both supervisory and safety personnel to investigate and intervene so that further occupational exposures do not occur. In some cases overexposures to certain agents require temporary medical removal from the job until the substance is cleared from the body. In other cases, it may require the use of personal protective equipment or the re-engineering of the process so that further exposure and permanent injury does not occur.
- C. **Termination examinations.** Termination of employment physical examinations are conducted whenever a worker leaves the position in which he or she has had an occupational exposure. It need not mean that the individual is leaving government service, as might be the case if he or she is retiring or resigning. It can also be used to establish current medical condition if the person is changing jobs or transferring to another organization.

The termination exam will determine the relationship between any future medical problems, which may be related to a previous occupational exposure.

- 36.3 **Immunizations.** Immunizations will be provided to employees that by job hazard analysis have the potential to be exposed to the agents which the immunizations protect against. The USGS provides two immunizations as part of their occupational

health program, Hepatitis B and Td (diphtheria/tetanus). Other vaccines may be provided on an as needed basis in unusual situations or for overseas travel.

- A. **Hepatitis B.** Individuals with routine exposure to Blood borne Pathogens will be offered the three series Hepatitis B vaccine. Employees will either complete a consent to be vaccinated or will sign a declination form if they decide not to be vaccinated. These forms will become part of their official employee medical records. Initial declination of either does not prevent employees from changing their minds and receiving the vaccination at a later date. Since first responders may never have the occasion to provide first aid, it is up to the local organization to determine whether or not they wish to immunize first responders prior to the first incident of first aid response. If the decision not to automatically immunize (collateral duty) first responders is made, then a procedure must be put in place to report when first aid is performed and the names of those involved in the incident (regardless of whether or not they were actually exposed to human body fluids). The incident must be reported by the end of the work shift to the appropriate authority as identified in the local exposure control plan. The full vaccination series must then be offered to all first responders involved in the first aid incident within 24 hrs of the incident.
- B. **Diphtheria/Tetanus (Td).** A DPT booster will be offered every ten years to those that are at risk of field work related cuts, scrapes or other open injuries. Also those that may come into contact with unsanitary water such as those doing wildlife research or collecting water samples should be immunized.
- C. **Immunization for Overseas Travel.** Employees scheduled for travel to foreign countries should

determine the requirements for entry into that country as far in advance as possible. Certain immunizations, such as typhoid or yellow fever vaccines, may be either recommended or required for entry into certain countries. Information concerning the requirements for entry into these countries can be obtained through the State Department or through the embassy of the country you are planning to visit.

37.1 References

OSHA General Duty Clause

37.2 Procedures.

A. General Housekeeping.

1. Always keep your work station as orderly as possible.
2. File papers regularly to reduce the possibility of a fire hazard.
3. If you eat or drink at your work station, always clean up crumbs and/or spills. Trash from eating or drinking should be disposed of daily and preferably put in covered waste containers.
4. Community coffee areas must be kept clean to prevent attracting insects.
5. Never hang plants from the ceiling, especially from the gridwork of dropped ceilings.

B. Tripping Hazards.

1. Never string extension or electrical cords across walkways. Rearrange furniture to avoid this situation.
2. Keep walkways clear of objects such as boxes, wastebaskets, books, files, etc.
3. Wipe up coffee or other liquid spills immediately.
4. Pick up small objects such as pens, pencils, paper clips, etc.

5. Report frayed, torn, or loose carpeting.
6. Never read or carry objects which obstruct your vision while walking.

C. Furniture.

1. Never stand on furniture, use a stepstool.
2. Never lean back in chairs such that the front legs lift off of the floor.
3. Examine furniture periodically for weakened or broken parts, and repair or remove from service as necessary.
4. Always request moving crews to move heavy furniture. Do not attempt to move it yourself.
5. Always close desk drawers immediately after use.
6. Arrange furniture and equipment to prevent eye strain from reflected light and glare on work surfaces.
7. Never lean on room dividers or partitions.

D. File Cabinets/Shelves.

1. Never place cabinets/shelves close to door ways, corners, or in walkways or corridors.
2. Cabinets/shelves should be fastened to the wall, especially when the shelves or cabinets are taller than 5 feet.
3. When filling the cabinet/shelf always start at the bottom to avoid tipping.
4. Store heaviest items on bottom.



TOPIC 38
**Prevention of Arthropod
(Insect) Borne Diseases**

5. Never stack or store items on top of cabinets/shelves.
6. Always close cabinet drawers and shelf door immediately after use.
7. Open only one cabinet drawer at a time.
8. When emptying cabinets/shelves, start from the top.

E. Office Machinery/Tools.

1. Keep electric fans, paper cutters, and other hazardous equipment in a safe area.
2. Guards should always be left in place.
3. Always disconnect machines being cleaned, adjusted, or repaired.
4. Keep hands away from cutting edge of fax machines.
5. When using a photocopier and removing jammed paper, never reach into the machine until it has cooled.
6. When handling photocopier toner, keep it away from your face and eyes, and wash your hands afterwards.
7. Never remove the guard from a paper cutter.

F. Electrical Hazards.

1. Never overload electrical outlets by using adapters to increase the number of items that can be plugged in.

2. All electrical equipment and tools should be properly grounded.
3. Never use a cord which is frayed or broken.
4. Never use receptacles which show signs of sparking or are not covered.

G. Extension Cords.

1. Never use extension cords in lieu of permanent wiring circuits.
2. Never connect multiple extension cords together.
3. If an extension cord is absolutely necessary, use a properly rated cord.
4. Never use extension cords to add electrical equipment to receptacles.
5. Never run extension cords across walkways, or under carpeting or areas where it can be squeezed, compressed, or damaged.

H. Visual Display Terminals (VDTs).

1. Position the keyboard so that wrists are fairly straight while you work.
2. Arms should be at a comfortable angle to minimize back strain.
3. Adjust your chair so that your feet touch the floor comfortably. Use a footrest if necessary.
4. Adjust the back of your chair so that the small of your back is firmly supported.

5. The top of the screen should be just below eye level.
6. The screen should be tilted backwards slightly (10-20 degrees) unless this increases glare.
7. The screen should be approximately 18 inches from your eyes.
8. If you use bi-focals, choose monofocal or full-width bi-focals so that you do not have to tilt your head back to see the screen.
9. Stretch occasionally and look away from the screen.
10. Whenever possible get up from the VDT several times a day and do other types of work.

I. Fire Protection.

1. Never smoke at a desk cluttered with papers or other combustibles.
2. Never use a wastebasket as an ashtray.
3. Stacked paper burns more slowly than loosely laid paper. Concentrated, well organized storage reduces the spread of fire.
4. Never cover heater registers or other heat sources with papers or combustibles.
5. Office appliances, such as space heaters, coffee pots, hot plates, refrigerators microwave ovens, etc., must be authorized by the appropriate building manager.
6. Never place space heaters under desks.

7. Always turn off space heaters when leaving the area.
8. Keep heat sources, i.e., heaters, coffee pots, hot plates, smoking material out of combustible material storage areas.
9. Always place coffee pots, hot plates, etc., on heat resistant surfaces and unplug after use.
10. Flammable liquids of any kind must be stored in special containers and/or cabinets.



APPENDIX

**FACILITIES SAFETY
INSPECTION CHECKLIST**

38.1 General. In the United States, a number of insects carry diseases that can affect humans. Depending on the area that you live in you can encounter different species of mosquitoes and ticks, which at a minimum, can make you sick and in some cases cause diseases that may have more lasting effects or more serious consequences. Overseas travel or assignment presents even more challenges since many diseases that have been eradicated in this country are still serious health threats due to the climates and poorly administered public health programs in these less developed countries. Careful research should be conducted to determine the health threat prior to traveling to these locations.

38.2 Reducing Exposure.

- A. Probably the best and the first line of defense against all arthropod borne disease would be through the use of repellents. There are products on the market that you can use to treat your clothing and others that you can apply to your skin, which are very effective in repelling biting insects. Products containing DEET (n,n-diethylm-toluamide) can be safely used on the skin and Permethrin can be used to treat clothing. Other products using oil of citronella or other ingredients are ineffective or effective for very limited time periods. Common sense will tell you that if you don't get bitten, you will never contract the disease, so the use of products containing DEET or Permethrin is very effective in preventing the transmission of disease. **WARNING. DEET should NOT be applied to the face as it can get into the eyes and other mucous membranes. Permethrin should NOT be applied to clothing while it is being worn. It should be applied to the clothing and allowed to dry before dressing.**
- B. Another good way of reducing exposure is to eliminate the habitats that support these insects.

Mosquitoes can breed in limited amounts of standing water. Eliminating this water, when possible will prevent them from breeding and will keep the populations controlled. Keeping grass cut short will go a long way to reducing populations of ticks in areas frequented by people since the ticks are usually carried by small mammals (mice, rabbits, etc.) and small animals are usually found in these types of areas where they can hide from predators. Elimination of habitat is obviously not an option for remote or natural locations but can be used in populated areas.

38.3. **Mosquitoes.** Mosquitoes carry a number of diseases in this country, from West Nile Virus which has been spreading rapidly since its discovery to a number of types of encephalitis.

38.4 **Ticks.** When working in areas infested with ticks:

1. Tuck your pants legs into your socks.
2. Tuck your shirt into your pants.
3. Use a tick repellent (Permethrin) on your clothes.
4. Do a body check at the end of each work day, paying particular attention to armpits, navel, behind the ears, and the groin area.
5. At night, place clothing where ticks, spiders, or scorpions cannot get in them. Arrange bedding so insects cannot crawl into it during the day and night.
6. **Tick Removal.** The sooner ticks are removed, the better.
 - a. Tweezers work best at removing ticks. If fingers are used, shield them with a piece of paper.

- b. Grasp the tick as close to the skin surface as possible and pull outward with a steady, even pressure. **DO NOT** jerk or twist, as this may cause the head of the tick to break off in the skin.
 - c. Take care not to squeeze, crush, or puncture the body of the tick, as this may cause the injection of fluids from the tick to enter the wound.
 - d. After removing the tick, disinfect the area with alcohol or soap and water. You may want to keep the tick in a small jar for later identification in case you become sick with Lyme disease or another illness.
 - e. Folklore methods of tick removal, such as painting the tick with Vaseline, fingernail polish or alcohol or applying a hot match head, **DO NOT WORK.**
7. **Lyme Disease.** Ticks carrying Lyme disease can be found in many parts of the United States. The carriers are the deer tick and to a lesser extent the lonestar tick. Lyme disease is one of the most prevalent tick-borne diseases and thus is well known though it is only one of many diseases that can be transmitted via ticks in this country.
- a. Currently it is felt that ticks must be attached to the skin for 12 to 24 hours in order to transmit the spirochete that causes Lyme disease (*Borrelia burgdorferi*), so prompt removal is a safeguard against disease.
 - b. **Symptoms of Lyme Disease.** Lyme disease can cause severe health problems if left untreated. Prompt and

accurate diagnosis is essential. Symptoms usually develop within a few days to a few weeks after the bite of an infected tick. Symptoms include headache, stiff neck, fever, muscle ache, flu-like symptoms, and general malaise. In 60-80% of Lyme disease cases, a “bull’s eye” rash or lesion is exhibited. If these symptoms occur following tick exposure, seek medical attention.

OK ACTION
NEEDED

GENERAL

- | | | | |
|-----|-----|----|---|
| () | () | 1. | Is the required OSHA workplace poster prominently displayed? |
| () | () | 2. | Has the office head demonstrated an active interest in safety and health matters by defining a policy for the workplace and communicating it to all employees? |
| () | () | 3. | Are the required forms, Report of Accident/Incident, prepared for all employee and visitor accidents/incidents and promptly forwarded to the safety manager? |
| () | () | 4. | Has the safety coordinator/manager received the required training? |
| () | () | 5. | Is there an active safety committee or group that allows and encourages participation of employees in safety and health activities? |
| () | () | 6. | Does the safety committee or group meet regularly and prepare written reports of its activities? Are copies of the minutes promptly sent to the safety manager? |
| () | () | 7. | Is there an established procedure for handling employee concerns regarding safety and health issues without fear of reprisal? |
| () | () | 8. | Are workplace emergency plans current? Do they cover all types of natural disasters that might be anticipated to affect the work place? |

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- () () 9. Are emergency telephone numbers posted where they can be easily seen in the event of an emergency?
- () () 10. Are the workplace emergency plans readily available for quick reference during working hours?
- () () 11. Are the workplace emergency plans readily available for quick reference before and after working hours and on weekends? Are appropriate after-hours telephone numbers included in the emergency plans?
- () () 12. Does the workplace emergency plan list the name and extension of employees currently certified in CPR and first aid?
- () () 13. Have copies of the current emergency work place plans been sent to the safety manager ?
- () () 14. Have all employees who drive either a Government vehicle or a private or rental vehicle on Government business attended a defensive driving course within the last three years? Has the training been documented? Are employees notified of the need for required defensive driving refresher training at least six months before their defensive driving certificate expires? Do the employees have valid state driver licenses?
- () () 15. Have all aircraft users had a minimum of eight hours of aviation safety training within the last three years? Has the training been documented?
- () () 16. Have all employees who operate all-terrain vehicles or other large or unique vehicles

been properly trained in the operation of such vehicles? Has the training been documented? When appropriate, do the employees have valid state driver's licenses to operate such vehicles?

- () () 17. Have appropriate employees been trained in CPR and first aid? Has the training been documented? Are employees notified of available refresher training before their CPR and/or first-aid certificates expire?
- () () 18. Has other suitable safety and health training been provided for appropriate employees? Has such training been documented?

ELECTRICAL WIRING, FIXTURES, AND CONTROLS **29 CFR 1910.301**

- () () 1. Are fuses and circuit breakers the right type and size for the load on each circuit?
- () () 2. Are all fuses free of "jumping" with pennies or metal strips?
- () () 3. Are all switches properly identified to show their purpose?
- () () 4. Do switches or circuit breakers show evidence of overheating?
- () () 5. Are switches mounted in clean, tightly closed metal boxes?
- () () 6. Are all outlets covered by face plates?
- () () 7. Are all plugs safe to use?
- () () 8. Are metallic cable and conduit systems properly grounded?

- () () 9. Are outlets tested for proper grounding?
- () () 10. Are ground-fault circuit interrupter outlets provided in restrooms or at other locations within six feet of a water source?
- () () 11. Are portable electric tools and appliances grounded or double-insulated?
- () () 12. Is any cord temporarily placed in a walkway covered by a runner?
- () () 13. Are all electrical cords three-pronged and free from fraying or other defects?
- () () 14. Are all telephone cords and any temporary extension cords secured under desks or alongside baseboards?
- () () 15. Do all electrical installations in locations classified as hazardous — due to the possible presence of flammable vapors, liquids or gasses, or combustible dusts or fibers — meet the OSHA requirements of 29 CFR 1910.307 for such locations?
- () () 16. Are electric motors clean and kept free of excessive grease and oil?
- () () 17. Are electric motors properly maintained and provided with adequate over-current protection?
- () () 18. Are portable lights equipped with proper guards?
- () () 19. Are all lamps kept free of combustible material?

EXITS AND ACCESS
29 CFR 1910.35

- () () 1. Are all exits visible and unobstructed?
- () () 2. Are all exits marked with a readily visible sign that is properly illuminated?
- () () 3. Are there sufficient exits to ensure prompt escape in cases of emergency?
- () () 4. Are adequate controls established and posted for areas requiring limited occupancy?
- () () 5. Is the exterior egress from the emergency exit to designated safe areas smooth, solid, and substantially level?
- () () 6. Are special precautions taken to provide employees with adequate exits during construction and rehabilitation work?
- () () 7. Are latches or other fastening devices on exit doors provided with a panic bar for easy exit?

FIRE PROTECTION
29 CFR 1910.155

- () () 1. Is there an adequate number of the appropriate type of portable fire extinguishers? (total travel distance does not exceed 75 feet for a Class A fire or 50 feet for a Class B fire)?
- () () 2. Are fire extinguishers serviced annually and such service properly noted on the inspection tag?
- () () 3. Are fire extinguishers mounted in readily accessible locations?

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- () () 4. Are fire extinguisher locations marked with a readily visible sign?
 - () () 5. Are fire extinguishers inspected monthly for general condition and operability? Is the monthly inspection recorded on a tag attached to the extinguisher?
 - () () 6. Is the fire alarm system tested at least once a year?
 - () () 5. Are there tripping hazards in halls, walkways, or work areas?
 - () () 6. Are carpets well secured to the floor and free of worn or frayed seams?
 - () () 7. Is smoking permitted in designated smoking areas only?
 - () () 8. Are "no smoking" signs prominently posted for areas containing combustibles and flammables?
 - () () 9. Do toilet facilities meet the requirements of applicable sanitary codes?
 - () () 10. Are adequate washing facilities provided?
 - () () 11. Are all areas of the facility adequately illuminated?
 - () () 12. Are the building ventilation systems regularly checked for their performance and balanced when necessary?
 - () () 13. Are stairways in good condition, with standard risers provided for every flight having four or more risers? Are nonslip treads provided?

- () () 14. Have weeds or other combustible material been removed from within 20 feet of any building?
- () () 15. Are portable ladders adequate for their purpose, in good condition, and provided with secure footing?
- () () 16. Are fixed ladders adequate, in good condition, and equipped with side rails or cages or special climbing devices, if required?
- () () 17. Are all areas below seven feet in height free from nails, hooks, screws, and any other sharp protruding object.

MEDICAL AND FIRST AID
29 CFR 1910.151

- () () 1. If a hospital or medical clinic is not located near your facility, are one or more employees trained in first aid?
- () () 2. Are the first-aid supplies adequate for the type of potential injuries in the workplace?
- () () 3. Are there quick water-flush facilities available where employees are exposed to corrosive materials?

MACHINES AND EQUIPMENT
29 CFR 1910.212

- () () 1. Are all machines or operations that expose operators or other employees to rotating parts, pinch points, flying chips, particles, or sparks adequately guarded?
- () () 2. Are mechanical power transmission belts and pinch points guarded?

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- () () 3. Are hand tools and other equipment regularly inspected for safe condition?
 - () () 4. Whenever compressed air is used for cleaning, is the pressure reduced to 30 psi or less?
 - () () 5. Are power saws and similar equipment provided with safety guards?
 - () () 6. Are grinding wheel tool rests set to within one-eighth inch or less of the wheel?
 - () () 7. Are grinding wheels worn or cracked?
 - () () 8. Are all machinery and equipment kept clean and properly maintained?
 - () () 9. Are power saws and similar equipment provided with proper safety guards?
 - () () 10. Are radial arm saws equipped with an automatic return?
 - () () 11. Are table saws equipped with anti-kickback devices?
 - () () 12. Are eye guards and other protective equipment located near the machine area?

COMPRESSED GASES
29 CFR 1910.101

- () () 1. Are compressed gas cylinders examined regularly for obvious signs of defects, deep rusting, or leakage?
- () () 2. Are compressed gas cylinders securely fastened and capped at all times when not in actual use?