



**The National Science Foundation  
Office of Polar Programs  
Polar Environment, Safety & Health**

PESH-POL\_2000.10  
Safety and Occupational Health Policy

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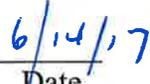
**Consult the USAP Master List for the most current version.**

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## Signature Approval

Approved by:

  
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Susanne M. LaFratta  
Section Head, Polar Environment, Safety and Health

  
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Date

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**Note** This policy becomes effective on the date of signing.

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## 1. Purpose

The purpose of this policy is twofold: to establish a comprehensive accident and illness prevention program for the National Science Foundation's Office of Polar Programs (OPP) that identifies responsibilities for implementation, and to provide guidance and procedures for policy compliance and implementation.

This policy does not address funding. Funding is dictated in contracts or negotiated through the proposal or the MOA (Memorandum of Agreement) processes. There should be no expectation that any additional funding will be provided than what has been provided in the past for personal protective equipment (PPE), safety training, or any other safety equipment or item. This document provides the *minimum* safety standards that OPP expects which help ensure that workers, researchers, and other stakeholders are protected from hazards, and that risk is managed to the lowest achievable level, while still allowing the science mission to be accomplished.

## 2. Applicability and Compliance

The policies and procedures herein are applicable to all OPP stakeholders, to include grantees. Research stations and other offices are responsible for supplementing this regulation with standard operating procedures (SOPs) if deemed necessary. This policy supersedes any past safety policy or contractor safety policy and compliance is required with the latest version.

## 3. References

- Parts 1910, 1926, and 1960, Title 29, Code of Federal Regulations (OSHA).
- NFPA Life Safety Code
- National Electric Code
- International Building Codes (ICC)
- EM 385-1-1, U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual

## 4. Objective

The objective of this policy is to minimize losses of manpower and material resources due to accidents, which would affect the science mission of the OPP, by:

- Integrating appropriate safety standards into all engineering, construction, operating, administrative, research, and maintenance activities;
- Requiring safe performance of all OPP contractor activities;
- Creating and maintaining safe working conditions for all personnel involved in OPP-supported operations and research, as well as any others who might visit OPP-supported sites; and
- Producing finished facilities and projects that provide an inherently safe environment for years to come.

## **5. General Safety Policy**

OPP believes there is no operation, activity, or research worth the loss of a life, no matter how important the future discovery may be, and all proactive safety measures shall be taken to ensure protection of this most valuable resource. With that, no individual shall be required or allowed to expose himself or herself to unsafe conditions in the performance of his or her work, beyond the typical hazards and risk associated with working in the extreme environment at many locations. It shall be the responsibility of individuals to perform in a safe manner, given they have available to them all the safety and occupational health (SOH) training, correct and appropriate tools, PPE, and protection from hazards.

SOH considerations shall be included in all OPP project plans, the grant process, and in the delivery of quality projects and services to all of our customers. All stakeholders will ensure that a risk assessment is executed for all projects or research for which they have authority or responsibility, and that for any project or research that is found to have a medium to high risk level based on probability of a safety incident occurring and the severity of loss if one does occur, a safety professional is consulted to ensure risk is mitigated to acceptable levels (certain risk is inherent in the environments in which Polar Programs operate, but no more than what is necessary to accomplish research shall be accepted) and that an accident prevention plan is developed and implemented. This plan shall be documented and available for OPP review.

### **5.1. Responsibilities of Personnel**

All participants will be required to comply with all applicable OPP safety requirements, including those in the contractor's site-specific accident prevention plan.

Leaders are responsible for the safe conduct of any and all work under their control. They shall be familiar with all recognized codes, standards, and regulations relevant to their work and ensure that such requirements are strictly enforced. These include all applicable OSHA standards and applicable host nation requirements.

Supervisors will ensure all employees receive a safety orientation covering hazards in the environment, as well as other general safety information, such as what to do in case of emergency, before starting work or research. A safety briefing shall be provided to all visitors and researchers when possible, and the briefing shall be documented.

Employees will report any workplace accident or injury to their supervisor. Guidance for reporting accidents and mishaps is found in Appendix 3 of this policy.

### **5.2. Accident prevention**

Integrating accident prevention measures in all activities and operational procedures is the basic concept of the OPP's accident prevention program. This program shall be applied to all OPP-supported activities.

### **5.3. Risk Management**

Composite risk management will be integrated into all aspects of the OPP mission. The five basic steps of composite risk management are: (1) identify the hazards, (2) assess the hazards to determine risks, (3) develop controls, (4) implement the controls to eliminate or reduce the hazards, and (5) supervise the implementation and evaluate the effectiveness.

## 5.4. Suspend Operations

It is the policy of OPP that anybody in the vicinity of any activity or operation who observes somebody about to be fatally injured can temporarily stop that activity until the safety issue is corrected. After that, a supervisor needs to intervene and for contractor operations, the CO notified immediately. Only that activity or operation posing the imminent risk to life should be stopped.

It is the policy of OPP to suspend operations when all attempts to secure compliance have failed for any activity funded by OPP. A suspend operations order will be issued only after noncompliance has been discussed with the representative on the project, and it is evident that suspension of work is the only means through which compliance can be secured. For contractor operations, the Contracting Officer (CO) has the authority to issue an official stop-work order, to withhold payment, or to assign an unsatisfactory safety evaluation to contractors who fail to comply with safety requirements.

## 5.5. Smoking

Smoking is prohibited inside of all OPP facilities. For the purpose of this policy, smoking shall refer to the use of any of the following tobacco products: A.) Tobacco products: Any smoke or vapor emitting product including, but not limited to, cigarettes, cigars, cigarillos, and pipes; B.) Non-Tobacco Products: Any smoke or vapor emitting product or device designed or intended to simulate a tobacco product, including, but not limited to, e-cigarettes but excluding gum and prescription medications. Employees and visitors who wish to smoke must go outside the building to a spot at least 25 feet from the door, unless smoking designated areas are available. The following smoking requirements shall be complied with:

1. Smoking is prohibited inside any vehicle or heavy equipment.
2. Smoking is allowed outdoors, except adjacent to building entrances and air intake ducts, and except where it presents a safety hazard, such as near fuel, explosives, and vehicle, aircraft, and small boat operations.
3. Smoking near building entrances may be further restricted by station management to protect workers and visitors from environmental tobacco smoke in the workplace.
4. All materials used for smoking , including cigarette butts and matches, must be fully extinguished and disposed of in appropriate containers.
5. For the U.S. Antarctic Program (USAP) only, designated indoor smoking spaces are as follows:
  - A. McMurdo Station: Smoking Shelters
  - B. South Pole Station: Smoking Shelters
  - C. Palmer Station: There are no indoor smoking areas at Palmer Station.
  - D. R/V Nathaniel B. Palmer: There are no indoor smoking areas on the vessel. The following exterior areas are designated for smoking:

5.5.1.1.5.D.1. 01 Level-Exterior area adjacent to waterfall winch (outside of Incinerator Room)

5.5.1.1.5.D.2. 05 Level-Exterior Bridge deck aft

E. R/V Laurence M. Gould: There are no indoor smoking areas on the vessel. The following exterior areas are designated for smoking:

5.5.1.1.5.E.1. 02 Level-Trawl winch area outside of Lounge/Conference Room

5.5.1.1.5.E.2. 04 Level- Exterior Bridge wings

6. There are no indoor smoking areas at any field camp.

7. Smoking is prohibited in any aircraft.

## 6. Procedures

### 6.1. Reviews

All research plans, specifications, designs, technical publications, and operating procedures will be reviewed for conformance with established safety codes and standards. The OPP Polar Environment, Safety and Health (PESH) section will provide assistance in the review process where needed, and when it comes to SOH requirement compliance questions, PESH shall be the final authority on determinations.

### 6.2. Occupational Safety and Health (OSH) Act Standards

OPP recognizes that OSH Act standards came about because fatalities and serious injuries occurred during certain types of work activities. Even though the Occupational Safety and Health Administration (OSHA) does not have jurisdiction in certain regions, compliance is required with these standards, as well as any local standards and NFPA, NEC, and International Building Codes, among others, with the most stringent requirement applying.

If compliance with a specific requirement cannot be met due to conflicting circumstances, practices, laws, regulations, or the unavailability of equipment, a request shall be made to the OPP Safety Officer, who is the Authority Having Jurisdiction (AHJ), for a variance or waiver, using the OPP waiver/variance form (PESH-FORM\_2000.10-4) (see Appendix 17). The OPP AHJ will provide a response within 14 days however failure to respond within 14 days does not constitute approval.

For waivers or variances required in an expedited timeframe due to immediate life safety reasons, and the OPP AHJ is not available, the NSF representative or NSF station manager on-site (if there is one), Contracting Officer's Representative (COR), or OPP activity based manager (ABM) for the specific activity shall request that an activity hazard analysis (AHA) is conducted and approved by the prime contractor's safety lead. The AHA shall provide for risk mitigation, using the proposed alternate means, process, or equipment, equivalent to whatever the initial code or requirement would have provided, BEFORE implementing that alternate means. A completed waiver/variance form shall be provided to the AHJ, along with the AHA, no later than five days after implementation.

### **6.3. Radiological Safety.**

Radiological safety matters will be executed in strict compliance with Environmental Protection Agency (EPA) and Nuclear Regulatory Commission (NRC) regulations and agreements. Deviations from these requirements are prohibited without prior approval of the designated radiation safety officer and PESH. PESH will be kept informed of all matters involving radioactive materials.

### **6.4. Explosives and Other Dangerous Articles.**

Fifteen days before beginning operations that use explosives, the prime contractor's safety office or explosives subject matter expert (SME) will develop and review an explosives safety plan. This safety plan shall be developed by a qualified and experienced explosive expert, and it shall outline the method of operation and precautions taken to control all hazards. A copy of the plan shall be kept on file and available for review if requested by the OPP.

### **6.5. Health Hazards.**

Potential health hazards from highly toxic materials, noise, waste disposal, or the work environment will be thoroughly evaluated prior to procurement or shipment to area of use, and preventative measures, surveys, and inspections shall be required for control of such hazards. Plans, designs, operations, research, or use of new materials that involve serious life threatening health hazards will be brought to the attention of the OPP prior to deployment.

### **6.6. Safety Surveys and Inspections.**

At a minimum, all areas of operation at a research station (and other locations, when possible) shall be surveyed and inspected weekly for safety, and daily for operations and maintenance (O&M) and construction when work is ongoing. All findings not in compliance with safety requirements, codes, and standards shall be identified, tracked, prioritized, and corrected as soon as possible. The prime contractor's safety office shall have anticipated and estimated the funding required for these tasks and shall have provided this information to the COR (or ABM, if applicable) before the start of any operation, or during the change request (CR) process, if a CR is necessary. The funding should be available for implementing safety and health requirements, if approved by the applicable COR. If the safety finding is one that could not have been anticipated or arose due to changing conditions (and funding is not already secured), a cost estimate shall be provided, along with a clearly identified priority, so OPP can evaluate it and make a funding decision. Imminently Dangerous to Life and Health (IDLH) findings require immediate removal of personnel and/or property and a halt to work until corrections can be made to reduce risk to acceptable levels, as defined by contractor's safety lead and PESH.

## **7. OSH Programs for U.S. Federal Employees**

Executive Order 12196, Occupational Safety and Health Programs for Federal Employees, made each Federal agency head responsible for establishing and maintaining an effective and

comprehensive Occupational Safety and Health Program. The OSH Act is therefore applicable to all OPP employees and will be complied with in applicable workplaces. The rights and responsibilities of employees, as delineated in Title 29 CFR, Part 1960, Federal Employee Safety and Occupational Health, will be implemented. All Federal Employees on-site shall comply with the contractor's site-specific accident prevention plan at all times.

## 8. Policy Review

This policy is valid until rescinded. It will be reviewed at an interval of not more than 5 years.

## 9. Distribution

All OPP stakeholders.

## 10. List of Acronyms

Acronym Definitions	
AAUS	American Academy of Underwater Sciences
ABM	Activity Based Manager
ACO	Administrative Contracting Officer
AHA	Activity Hazard Analysis
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
ATV	All-Terrain Vehicle
BOI	Board of Investigation
CAGE	Cerebral Arterial Gas Embolism
CE	A mark indicating a product complies with the requirements of the relevant European legislation regarding the environment, safety, and health; literally "Conformité Européene"
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CO <sub>2</sub>	Carbon Dioxide
CO	Contracting Officer
COR	Contracting Officer's Representative
CPR	Cardiopulmonary Resuscitation
CR	Change Request
dBA	A-weighted decibels (an expression of the relative loudness of sounds, as perceived by the human ear)
DCS	Decompression Sickness
DHHS	Department of Health and Human Services
DOD	Department of Defense
DOT	Department of Transportation
DSO	Diving Safety Officer
EPA	Environmental Protection Agency
FAR	Federal Acquisition Regulations
FOIA	Freedom of Information Act
FOPS	Falling Object Protective Structures

<b>Acronym Definitions</b>	
GFCI	Ground Fault Circuit Interrupter
GPS	Global Positioning System
IBC	International Building Code
ICC	International Code Council
IDLH	Imminently Dangerous to Life and Health
IFC	International Fire Code
LEL	Lower Explosive Limit
LFL	Lower Flammable Limit
NEC	National Electrical Code
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NRC	Nuclear Regulatory Commission
NSF	National Science Foundation
O&M	Operations and Maintenance
OPP	Office of Polar Programs
OSH	Occupational Safety & Health
OSHA	Occupational Safety & Health Administration
PEL	Permissible Exposure Limit
PESH	Polar Environment, Safety & Health
PFD	Personal Flotation Device
PI	Principal Investigator
PPE	Personal Protective Equipment
ppm	Parts per million
RAC	Risk Assessment Code
SAE	Society of Automotive Engineers
SDCB	Scientific Diving Control Board
SDS	Safety Data Sheet
SME	Subject Matter Expert
SOH	Safety & Occupational Health
SOHO	Safety & Occupational Health Officer
SOP	Standard Operating Procedure
STS	Standard Threshold Shift
TLV	Threshold Limit Values
USACE	U.S. Army Corps of Engineers
USAP	United States Antarctic Program
UL	Underwriters Laboratories (an independent, not-for-profit testing laboratory)
UV	Ultraviolet (in referring to radiation)

## **Appendix 1: Organizational Responsibilities**

In order to ensure an effective accident prevention program is in place and functioning, all elements within the organization must be held accountable for safety and health performance. Safety performance should be included in all individual performance reviews and as part of the formal contract performance evaluation.

### **Purpose**

The purpose of this appendix is to define the specific SOH responsibilities of OPP participants and stakeholders.

## **Safety Responsibilities and Authorities**

### **OPP Director**

The ultimate responsibility for safety and health performance in the OPP rests with the director. The director has delegated responsibility for establishing SOH policy to the PESH Section Head. The PESH Section Head is also responsible for acting on safety and occupational health issues requiring specific actions, interpretations, or directives.

### **Contracting Officer Representatives (CORs)**

The COR is designated by the CO to ensure contract specifications are complied with, which includes any relevant safety and health requirements or standards. The COR is ultimately authorized to approve funding in support of the contract specifications. Due to the size and complexity of the USAP, the COR has authorized ABMs to recommend funding approval for specific programs.

### **PESH Section**

The Polar Environment, Safety and Health section:

- PESH Safety reports directly to the PESH Section Head who reports to the Director. The purpose is so that PESH can operate independently and not be subject to conflicts of interest with others subject matter areas within OPP..
- As a representative of the PESH Section Head and OPP Director, PESH Safety has the authority to intervene in any activity where risk to human life is present and where feasible (and within funding constraints) should have access to sites/research stations and contractor safety personnel (among others) freely.
- Develops SOH policy;
- Develops specific procedures to protect personnel, property, and environment from loss in cases where OPP feels it needs to be more direct in ensuring risk mitigation in order to avoid interruptions to the OPP science mission;
- Ensures that contractor safety and health requirements, standards, best business practices, and this policy are being complied with across all OPP-supported activities and sites so that work risk is mitigated to acceptable levels;

- Tracks accident trends across OPP activities and passes along lessons-learned to ensure prevention of future, similar incidents;
- Makes determinations on waivers and variances to SOH requirements and standards, as proposed by the contractor (specifically the contractor's safety lead);
- Ensures proper investigation of all recordable accidents throughout the OPP and ensures that corrective actions are implemented;
- Performs risk analysis and provides risk-mitigation recommendations to others in OPP on SOH matters, as requested; and
- Ensures that funding is available so that the contractor can comply with OSHA requirements, based on the most cost-effective approach to implementation, as provided by the contractor during the budget process.

## **OPPABMs**

Activity based managers:

- Ensure safety and occupational health requirements are complied with in any activity or research under their supervision, which may entail a request to PESH for SOH support;
- Ensure that safety and health planning activities, such as design reviews, specification development, O&M work, and research proposals have all been reviewed for safety and health requirement inclusion and compliance; this may mean consulting with PESH for risk-mitigated solution recommendations;
- Ensure designers use methods and techniques that prevent or reduce hazards associated with use of proposed equipment, processes, or facilities; and
- Take action immediately, in consultation with PESH, when SOH non-compliance is identified to ensure corrections are made to prevent injury or property damage; for IDLH safety items, work and/or research must be stopped until these can be corrected.

## **OPP Science Program Managers**

Science program managers:

- Ensure safety and occupational health requirements and expectations for safety performance are communicated to the respective university or institutions before research teams deploy;
- Ensure proposals address risk management and provide the level of detail needed for OPP safety reviews;
- Partner with university or institution research team leaders to ensure safety integration into science comes from the top down; and
- Take action immediately, in consultation with PESH, when SOH non-compliance is identified to ensure corrections are made to prevent injury or property damage; for IDLH safety items, work and/or research must be suspended until corrected.

## **Contractor Safety Responsibilities and Authorities**

### **Prime Contractor's Leadership**

Safety starts with senior leadership. It should be clearly evident to OPP that senior leadership for the prime contractor supports and values the OPP safety policy described in this document through behaviors, decisions, and actions. The leadership:

- Shall ensure compliance with this regulation, 29 CFR 1910, 1926, the National Fire Protection Association (NFPA), the National Electrical Code (NEC), and the International Building Code (IBC) (2015), among other U.S. standards, during all operations and activities under their control and authority;
- Shall ensure the organization has an established and documented safety and health program that emphasizes proactive safety measures, and that has a clearly evident process for accountability;
- Shall ensure the contractor safety office is staffed appropriately to meet OPP mission support requirements, as identified by OPP; and
- Shall recognize exceptional safety performance by teams in the field, thus fostering a safety culture in which hazards are reported openly and employees protect one another. There shall be no retribution for any subcontractor or employee reporting a safety hazard or incident to either the OPP or contractor management, except where a blatant disregard for safety was identified or, in the case of a repeat offender, where the individual had all of the proper (and documented) safety training, PPE, and supervision required yet still committed the safety infraction, even after being counseled for a previous, similar issue.

### **Contractor's Safety and Health Team**

The prime contractor shall ensure all subcontractors comply with this policy. The prime contractor is responsible for each subcontractor's safety performance. The prime contractor's safety and health team shall:

- Ensure continuing inspection of job sites for compliance with contractual requirements;
- Ensure work meets the requirements of the Code of Federal Regulations (CFR) 1910 and 1926 or other SOH standards and requirements, where applicable;
- Develop and submit accident prevention plans and activity hazard analyses for all projects before physical work in the field begins. Accident prevention plans and activity hazard analyses shall be forwarded to PESH for review and acceptance when the project or research risk assessment code (RAC) is medium or high, as identified during the risk management process;
- Provide preliminary accident notification information to PESH within 24 hours and a completed Polar Accident and Investigation Form to the safety office within five days for all recordable accidents or injuries.
- Review all accident reports to ensure they are complete;
- Ensure action is taken to prevent a reoccurrence;
- Ensure a weekly toolbox safety meeting is executed at all sites;

- Require field personnel to include all safety findings in reports, whether negative or positive, track these on a log, and ensure correction based on priority (and approved funding, when needed);
- Ensure that adequate fire prevention and protection programs, as well as emergency response plans, are established for all sites and that exercises and drills are performed and documented as required;
- Ensure personnel receive relevant safety training on a regular basis, or as required by the Code of Federal Regulations, specifically 1910 and 1926;
- Ensure all new field personnel receive a safety orientation;
- Ensure all employees with potential exposure to noise levels exceeding OSHA's time-weighted average of 85dba (29 CFR 1910.95) or exposure to hazardous chemicals or toxic wastes (29 CFR 1910 Subpart Z) are placed in a medical surveillance program to ensure their safety and health (Note, the contractor should have this as part of their safety program and should expect no additional funding for these OSHA required protective measures);
- Provide the necessary personal protective equipment (PPE) for each employee, and ensure training is provided on the proper use of PPE;
- Provide safety briefings for visitors;
- Evaluate safety performance and reward it, as necessary and appropriate;
- Keep OPP advised as to findings and make recommendations for changes or improvements where conditions warrant;
- Act as technical advisor to Boards of Investigation and other committees (see Appendix 3 for Accident Investigation and Reporting) convened by OPP;
- Ensure all accidents are investigated and corrections identified and implemented in a timely matter;
- Ensure designers use methods and techniques that prevent or reduce hazards associated with use of proposed equipment, processes, or facilities;
- Ensure direct SOH oversight for any activities that have the below hazards:
  - excavations deeper than five meters
  - potential falls from heights greater than seven meters
  - exposures to hazardous chemical or biological substances
  - work less than five meters from high voltage lines
  - underground earth work or snow tunnels
  - potential danger of drowning
  - use of compressed air
  - work with ionizing radiation or explosives
  - work involving assembling or dismantling heavy prefabricated components (10 tons or greater)
  - projects with a potential of blasting, or
  - ANY permitted confined space work

## Researcher Safety Responsibilities and Authorities

### Grantees and Principal Investigators (PIs)

Grantees are responsible for safety and health in their respective activities, and they are responsible and accountable to their OPP science program manager. PIs are responsible for the safety and health of their teams. PIs:

- Shall ensure that each person working under their grant has reviewed and is knowledgeable of the safety and health requirements related to the research project;
- Shall comply with, implement, and enforce all safety and health requirements for research personnel and their associated operations (including any specific requirements in their grant);
- Shall report all accidents and incidents to the contractor camp manager or the contractor's on-site safety office as well as the NSF Safety Officer (Jon Fentress, [jfentres@nsf.gov](mailto:jfentres@nsf.gov)). Reporting is to ensure the safety and health of all personnel and will not be utilized for punitive actions but for sharing lessons-learned with others.
- Shall identify and assess the relative safety and health risks of each grant-related activity and ensure that written procedures are in place to minimize risk to research teams and others that may work in the vicinity;
- Shall ensure that safety and health issues are addressed early in the planning and proposal stages and are integrated throughout the project life cycle;
- Shall provide safety and health training for research personnel before they deploy;

## **Appendix 2: Accident Prevention Plans for Contractors**

### **Purpose**

The purpose of this appendix is to prescribe guidelines and requirements for implementing accident prevention provisions for contractors.

### **Policy and Scope**

It is mandatory that prime contractors comply with the safety expectations and requirements outlined in this policy and in the Code of Federal Regulations, and assume responsibility for all sub-contractors. This policy is applicable to all activities performed by all OPP contractors. Accident prevention provisions for contractors are as much a part of the contract as any other provision set forth in the contract for control of work. After signing the contract, it is mandatory that the contractor vigorously comply with all 29 CFR standards, NFPA, NEC, IBC, and any local safety requirement or standard during the duration of the contract. As always, the most stringent requirement applies.

### **General Requirements**

Safety and accident prevention plans are necessary to ensure personnel performing OPP-supported activities are provided controls for protecting their life and health and the life and health of any other personnel in the vicinity of operations, preventing property damage, and avoiding interruptions in the performance of their work.

### **Contract Specifications**

In addition to complying with 29 CFR 1910 and 1926, the specifications for all OPP activities and contract work shall include such additional requirements as are necessary to insure a high standard of physical protection and safety performance by those individuals performing these activities. Operations and maintenance, construction, engineering, planning, research, and any other offices involved in field activities will take note of all hazards inherent in the location or terrain and will implement precautionary measures.

### **Contractor's Accident Prevention Plan and Pre-Construction Conference**

1. After award of a contract, the contractor shall develop an Accident Prevention Plan (APP) demonstrating they are complying with the contract to develop, establish, and manage a safety program that meets federal law (OSHA).
2. A copy of the Accident Prevention Plan will be kept on file for review by OPP if needed. Only one plan is required for operations and maintenance contracts and one for major construction beyond that deemed to be operations and maintenance activities. Within this risk mitigating plan, the activity hazard analysis (AHA) for the initial work phase will be included with the others to be developed as construction continues through the next phases. Before work is initiated, the contractor shall meet in conference with the OPP program managers responsible for the work activity, in order to discuss the accident

prevention plan, inherent and specific hazards of the contemplated operations, and other aspects of the contracted work, as necessary. Written minutes containing the understanding reached at this pre-work conference will be furnished to the contractor and kept on file. There shall be no field work initiated until this step is accomplished.

3. PESH shall be informed of the pre-work meeting for large operations or construction in sufficient time to permit attendance.
4. The pre-work meeting agenda should be developed to meet the specific risk challenges and unusual features of the job. Consideration should be given to any previous experience of the contractor on OPP-supported work. The following safety topics are suggested for the agenda, where applicable:
  - A. Identification and accountability of contractor personnel responsible for accident prevention.
  - B. Site safety officers shall have completed, at a minimum, the OSHA 30-hour construction safety course or equivalent.
  - C. The anticipated level of medical support shall be identified for each location/project/field camp/traverse/vessel/research site.
  - D. The establishment of a mutual understanding regarding the purpose and function of an AHA process.
  - E. A review and discussion of the hazards and remedies submitted by the contractor, leading to an agreement upon the methods used to recognize, evaluate, and control the hazards.
  - F. Purpose and advantages of an effective safety program.
  - G. A review of the accident prevention clause of the contract and the general and special conditions of the specifications, with emphasis on the contractor's regular safety inspections and records.
  - H. A list of local, site-specific requirements that must be complied with (e.g., blasting, respiratory protection).
  - I. How the contractor proposes controlling and coordinating the work of subcontractors.
  - J. Discussion of key items in the contractor's proposed plan. Where not clearly indicated in the proposed plan, the following items, at a minimum, should be developed:
    - i. Method(s) by which the contractor will enforce safety.
    - ii. Plans for dealing with snow drifting and for runway construction and/or maintenance.
    - iii. Methods that the contractor will use to control and coordinate work with others having operations at the same location.
    - iv. Plans for laying out temporary construction buildings and facilities.
    - v. Plans for initial indoctrination and continued safety education for all employees.
    - vi. Plans for controlling traffic and marking hazards on roads, utilities (both below ground and overhead), bridges, and restricted areas.

- vii. Plans for job cleanup.
- viii. Plans for fire protection, hot-work permits, and dealing with emergencies (e.g., medical emergencies, fires).
- ix. Arrangements for providing adequate lighting, ventilation, personal protective equipment, and medical care (to include safe transport).
- x. Plans for inspecting the job site by competent persons, to include reports to be kept, results of inspections, and corrective actions taken.
- xi. Plans for prompt action by the contractor to correct deficiencies reported by OPP or other OPP-authorized representatives.

### **Contractor Activity/Job Hazard Analysis (AHA).**

An activity or job hazard analysis (see Appendix 17 for an example) shall be developed at the beginning of any "major phase" of O&M work and construction. At a minimum, any definable feature of work shall have an AHA. The purpose of the activity hazard analysis will be to review the specific hazards anticipated and the specific measures planned to eliminate them.

"Major phase" pertains to significant items of work, such as renovation, demolition, drilling, land clearing, excavation, road relocation, pile driving, concrete placement, building construction, installation of equipment, steel erection, use of hazardous materials, electrical work, installation of heating, and ventilating and air conditioning.

### **Inspection and Approval of Plant and Equipment**

The contractor shall have available onsite for review if needed the required inspection records and tests indicating compliance with manufacturer and OSHA requirements. Equipment failing to meet the requirements will not be used, pending compliance therewith. Whenever defects are noted that will render the equipment unsafe, the contractor will be promptly notified of the specific corrective action required and directed to withhold equipment operation until corrective action has been taken and the COR advised of the completed action.

### **Use of "Stop Work Order"**

If all attempts to secure voluntary compliance with safety requirements are not successful, the ACO or COR may issue a "stop work order." It is important that the order applies only to that portion of the work that is affected by the actions or inactions of the contractor, and that all of the facts of the proceedings are documented in writing, including noting uncorrected safety violations. The contractor shall be informed in writing of the extent of the work stoppage, the date and hour work has stopped, the reason for the action, and the conditions under which work may proceed again. PESH shall be notified immediately of such action.

## **Responsibility for Enforcement**

Full and complete responsibility for enforcing the safety provisions of all contracts rests with the ACO and COR. Prompt and positive action at the field level will be taken to correct deficiencies.

## **Responsibility of Inspectors in Cases of Immediate Hazard**

Whenever OPP or the prime contractor's safety professional observes an activity or situation that constitutes a risk to life or limb, the inspector will immediately take the following measures:

- The safety inspector will require the contractor's representative to remove workers immediately from the area of danger and refrain from the dangerous practice.
- If the contractor's representative is not at the location of the dangerous condition, the inspector will direct the workers to remove themselves from the site and cease the hazardous operation.
- The inspector will ensure that work is not resumed in the area of danger and the defective methods, SOPs, equipment, tools, scaffolds, etc. not used again until the recommended corrective action is taken.

The safety professional will immediately report any of the above actions and any noncompliance, along with his or her recommendations, to an immediate supervisor, and the inspector will document observations.

## **Reckless Employees**

When a contractor employee endangers his or her own well-being or the well-being of others by flagrant disregard of safety regulations, the contractor will be requested to discharge the offender or place the employee on work where his or her actions will not constitute a hazard (For USAP, this is IAW with the contract clause H.2, Replacement of Personnel).

When a grantee is engaging in this type of behavior the contractor will immediately notify the PESH safety officer, who will work directly with the OPP science program manager and the researcher's university to rectify the situation immediately.

## Appendix 3: Accident Investigation and Injury Reporting

### Purpose

The purpose of this policy and these procedures is to: 1) establish the requirement for accident reporting and investigation within OPP programs; 2) standardize the process to improve efficiency; and 3) ensure that all accidents are reported but that resources are focused on recordable incidents, in accordance with 29 CFR Part 1904, "Recording and Reporting Occupational Injuries and Illness."

### Applicability

This appendix applies to all OPP personnel and contractors. Compliance is requested by grantees, Department of Defense (DoD) personnel (who have their own reporting process), and other visitors to OPP-owned and operated facilities and sites so that safety can be enhanced for all stakeholders.

### Reporting Requirements

The following reporting requirements apply to all contractor personnel, whether on duty or off, and all contractor activities performed on OPP-supported research stations, research vessels, projects, or activities.

#### Serious Accidents

For any accident that results in (or could result in):

1. Injuries to ANY personnel with the following consequences:
  - A. Fatality;
  - B. Permanent total disability: The complete loss of any member or part of a member of the body, or any permanent impairment of functions of the body or part thereof, to the extent that the individual cannot follow gainful employment;
  - C. Temporary total disability: An injury that does not result in death, permanent total, permanent partial disability, but which does result in one or more days of disability (other than the day of the injury);
  - D. Permanent partial disability: The complete loss of any member or part of a member of the body, or any permanent impairment of the functions of the body or part thereof;
  - E. Three or more persons hospitalized; or
  - F. A worker's compensation claim
2. Damage of \$100,000 or more to OPP-supported property and/or equipment; or
3. Significant adverse publicity,

the worksite supervisor shall immediately notify the prime contractor's safety office and contractor management by telephone and email. If there is an OPP representative or station manager on site, that individual shall also be immediately notified in the same manner, by

either contractor management (if on site) or by the worksite supervisor. Upon being notified by the worksite supervisor, the contractor's safety office shall immediately notify by email the OPP representative or station manager (if not on-site), PESH, and the responsible OPP program managers.

This immediate notification shall include, but not be limited to, the following (as applicable to the incident):

- Name of the participant(s) killed or injured, job, and specific location;
- Identification of property (ownership) and/or equipment damaged and dollar estimate of damage;
- Date and time of accident;
- Location of accident, to include research station or project name;
- Contract number and the name of contractor (and/or sub);
- Description, (who, when, what, why, and how) in as much detail as possible;
- Immediate actions taken to control the hazard to prevent further injuries; and
- Any other information considered pertinent.

The PESH safety officer, and possibly the relevant OPP program manager, shall travel as soon as possible and where practical to all accidents that result in a fatality, taking into consideration travel conditions and environmental hazards.

All accidents of the above listed severity will be investigated by a Board of Investigation (BOI) appointed by the PESH Safety Officer (see Appendix 3-1). Members to serve on the BOI will be composed of technical and management specialists. The PESH safety officer will manage this process and ensure the accuracy of the investigation.

The BOI report will include photos, sketches, diagrams, and other exhibits essential to presenting a clear picture of the incident. The original BOI report and three copies will be submitted to the PESH safety officer as soon as practicable, but in no event later than 30 days after the day of the accident.

The following signature chain is to be used on the BOI report to ensure review at all appropriate levels.

- All BOI members
- Contractor safety officer
- Contractor management (on-site)
- OPP program manager
- PESH safety officer
- PESH section head

## **Less Serious Accidents**

For any accidents not meeting the criteria above for serious accidents but still involving:

1. Any injury requiring medical care beyond First Aid;

2. The operation of a vehicle (whether moving or halted) that results in injury, damage to the vehicle beyond \$2000, or damage to any other property beyond \$2000 but less than \$100,000;
3. Damage beyond \$2000 but less than \$100,000 to any property, equipment, or material incident to an OPP-supported facility; or
4. Explosions; fires involving ammunition and other explosives; exposure to microwave or ionizing radiation; chemical exposures; contamination or damage of property from biological, radiological, or chemical agents; crane accidents (no matter how minor); and confined space incidents (no matter how minor),

the contractor's safety office shall notify the OPP representative or station manager (whether on or off site), PESH, and the responsible OPP program managers within 24 hours of the accident. The email shall contain the same information as listed above (as applicable to the incident).

These accidents do not require a BOI. However, a formal investigation must still be undertaken and a formal accident report submitted to OPP within 14 calendar days. This formal report shall also contain a root-cause analysis (covering both direct and indirect causes), corrective actions to mitigate the risk of similar future accidents (and cost estimates), and a proposed timeline for corrective action implementation.

The following signature chain is to be used on the accident report to ensure review at all appropriate levels.

- Lead investigator (if other than the contractor safety officer)
- Contractor safety officer
- Contractor management (on-site)
- OPP program manager
- PESH safety officer
- PESH section head

## **Near Misses**

Though it is recognized that best practices dictate that all near misses be investigated to various extents depending on the incident and resulting risk, contractor safety teams shall focus efforts on recordable incidents and screen near misses for those that are deemed to be serious enough to demand resources (labor). Proactive safety efforts to prevent incidents should be the focus and that is the expectation of OPP.

## **Safeguarding Accident Information**

Completed accident investigation reports and any attachments, copies, or extracts will not be appended to or enclosed with any other report or document, unless the sole purpose of the other report or document is to aid in accident prevention. Requests for copies of accident reports from outside OPP will be in writing and forwarded to PESH and subjected to FOIA restrictions.

## **Accident Reporting Integrity**

It shall be the responsibility of on-site managers to take reasonable steps to ensure that all accidents are properly reported. If injuries are mentioned through unofficial discussions, or if local medical clinics receive injuries, they should be reported to the prime contractor's safety office (while protecting personal information) to investigate whether the injury was work-related.

## Appendix 3-1: Board of Investigation (BOI) Procedures

At a minimum, a BOI will be appointed by the PESH safety officer, with recommendations provided by the prime contractor or other assets, for:

- Any accident involving a fatality or permanent total disability to government, contractor, or military personnel, or damage of \$100,000 or more.
- Any accident for which OPP leadership determines a BOI is warranted.

### BOI Structure

The BOI will consist of at least three voting members. In addition, non-voting technical advisors may be appointed to facilitate the investigation.

1. The president of the board should be the most experienced and qualified individual, in regard to the type of incident, and he or she may not be the supervisor of the team or work area that sustained the incident.
2. The selection of board members will be based on their ability to analyze accident circumstances and causes, and develop corrective measures to prevent future similar accidents.
3. Board members will not be selected from the element incurring the accident (when at all possible), and members will be screened to ensure no member of the board has an interest in the investigation. However, members from the element may be designated as non-voting advisors to facilitate the investigation of the accident.
4. The PESH Safety Officer shall have authority over the board and investigation process and function as a direct advisor to the board president.
5. Both members and advisors will be appointed by a directive that specifies:
  - A. Board members are to be relieved of their regular duties so they may give first priority to the accident investigation, until such time as the board report is submitted to and approved by PESH.
  - B. Board members and advisors are responsible for following all privacy laws protecting personal information.
6. Investigation, analysis, and preparation of board reports will involve only those members and advisors, including their clerical support, specified in the appointment orders. The board report will not be prepared by or reviewed by anybody who doesn't have a need to know.
7. Appointment of the board shall be immediate (as able), and the PESH Safety Officer will provide the board a list of objectives to accomplish.

### BOI Equipment

BOI members will need appropriate equipment to conduct the investigation, and this equipment should be included in the annual funding request/estimate. The BOI accident investigation kit should contain the following, at a minimum:

- Digital Camera

- GPS locator
- 30-meter tape measure
- Pavement spray paint (environmentally friendly and approved by PESH)
- Tags (adhesive and tie-on type)
- Zip-lock® bags
- Engineering tape (to mark off area)
- Writing supplies (pens, pencils, and paper)
- Flashlight (spare batteries and bulb)
- Appropriate personal protective equipment (PPE)

### **Instructions for a BOI**

Essential steps to be taken and reported on in the investigation will include, but not be limited to, the following. At a minimum, the board will:

1. Visit the scene of the accident as soon as possible after the accident occurs. A reconstruction of the circumstances is highly desirable if the scene cannot be kept intact from the time of the accident.
2. Illustrate clearly on drawings or charts all pertinent information of the vicinity.
3. Take photographs and accompany each with an accurate description.
4. Take statements from witnesses and supervisors. The statements should include:
  - A. Where the witness was at the time of the accident;
  - B. What action or operation was taking place immediately before the accident; and
  - C. How, in their estimation, the accident happened.

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**Note** Written statements should be signed by the witness.

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5. Establish the following facts about the accident (at a minimum):
  - A. How long the employee(s) involved had been employed on the job
  - B. Was/were the employee(s) qualified to perform his/her/their assigned duties?
  - C. Did employee(s) have any known physical impairments?
  - D. Was/were employee(s) familiar with safety requirements covering the work? If so, were safety requirements violated?
  - E. What unsafe act or condition caused the accident?
  - F. What safety instructions had been given by the supervisor?
  - G. Had the hazard or safety violation been called to the attention of the supervisor? If so, by whom and when?

- H. Was the equipment involved in a safe operating condition? If not, by and to whom had this condition been reported and what action was taken?
  - I. How could the accident have been prevented? (Include systematic weaknesses that contributed to the mishap).
  - J. What were the direct and indirect causes? (These should be described.)
  - K. Had a hazard analysis been completed and accepted for this particular operation or activity?
6. If conflicting evidence is obtained, secure enough additional evidence from reliable sources to resolve the conflict.

### **Instructions for Preparing a BOI Report.**

- 1. Summarize testimony of witness in the discussion and do not include verbatim statements.
- 2. Resolve conflicts in testimony based on the best available evidence.
- 3. Identify witnesses only by job title or assignment, such as engineer or carpenter.
- 4. Print conclusions and recommendations on separate pages to facilitate their removal in the event the report is released.
- 5. Include the following information (as applicable to the particular type of accident investigated):
  - A. BOI authorization and members.
  - B. Accident classification; name, age, and occupation of deceased (if any); equipment involved; date of accident; name of employer; name and location of project.
  - C. Accident description. Provide the scenario of the accident, describing the factual details.
  - D. Findings. List all relevant factual findings of the investigation.
  - E. Conclusions. List the board's conclusions as to the causes, direct and indirect, of the accident. Reports will identify whether any of the following apply:
    - i. Standards or procedures were incomplete, unclear, impractical, or did not exist.
    - ii. Standards or procedures exist but were not known or ways to achieve them were not known.
    - iii. Standards or procedures were known but were not enforced, and, if so, the reason(s) they were not enforced.
    - iv. Standards or procedures were known but were not followed, and, if so, the reason(s) they were not followed.
  - F. Recommendations. For each causal factor, direct or indirect, the board will recommend actions to preclude their future occurrence. As appropriate, recommendations will target all levels of

involvement, e.g., employee, supervisor, manager. The board will attach a separate implementation plan at the end of the report capturing this information and attaching timelines for implementation (along with cost estimates, if needed) for PESH to review. Upon full implementation of the corrective actions, an email notification shall be made to the PESH safety officer summarizing the corrections.

- G. Signatures (from all members of the Board).
  - H. Report abstract. This is used for lessons learned and to notify other locations of similar hazards. The abstract should contain factual information only (no interpretations, opinions, or rumors), and it should be in the following format:
    - i. Type of location.
    - ii. Date and time.
    - iii. Agent directly causing the accident.
    - iv. Personnel and equipment categories.
    - v. Details of occurrence (no names).
    - vi. Nature and number of injuries and property damage.
    - vii. Causes, direct and indirect.
    - viii. Remarks.
    - ix. Recommendations for corrective actions to preclude future occurrences of similar accidents (one for each direct and indirect cause identified above).
  - I. Appendices. The report should include photographs, sketches, diagrams and other exhibits, such as inspection reports, accident prevention programs, and training documents, as necessary to present a clear picture.
6. The board president will send all BOI reports to the prime contractor's safety office for review and concurrence before they are sent on to the PESH safety officer.

### **Recommendations and Findings.**

The PESH Safety Officer will ensure the report is thorough and addresses the below items before forwarding it to the PESH Section Head:

- 1. Was the true cause of the accident identified?
- 2. Were the necessary, significant engineering factors and system errors brought to light?
- 3. Was realistic corrective action recommended?
- 4. Has recommended corrective action been taken by the responsible personnel?
- 5. If the major reason/cause of the accident was human error, were the following identified?

- A. Required safety or health standards were not clear or practical, or did not exist.
- B. Standards exist but were not known, or ways to achieve them were not known.
- C. Standards were known but not enforced.
- D. Standards were known but not followed.

### **Instructions to Witnesses**

Those who witness or immediately respond to an accident resulting in a fatality, \$100,000 or greater property damage, injuries sustained by three or more persons, should (or as otherwise directed by the senior leader on the ground):

1. Attend to the injured and notify emergency response personnel.
2. Perform necessary action required to prevent further injury or damage.
3. Do not alter accident scene. Take photos of the scene as soon as possible.
4. Immediately notify element supervisor and safety office.
5. Identify all principal witnesses.
6. Advise witnesses not to discuss the accident amongst themselves.
7. Await further instructions.

### **Sharing of Lessons Learned Post-Investigation**

PESH believes in transparency when managing accident cause and lessons-learned information and recognizes that there may be a need to withhold report information but otherwise when approved by PESH a copy of the report with the victim's personally identifiable information removed should be shared to ensure the widest distribution possible, in an effort to prevent a similar incident from occurring anywhere in OPP-funded research or operations.

## Appendix 4: Fire Prevention and Protection

### Purpose

This appendix defines the policy for maintaining and administering a fire prevention and protection program. Included is guidance for all OPP facilities to develop their own site-specific plans. Each facility shall have written emergency evacuation and fire prevention plans to minimize the risks of fire and other emergencies.

Basic fire prevention and protection for construction activities shall comply with International Code Council (ICC) codes, to include the International Fire Code, referenced National Fire Protection Association (NFPA) codes, applicable International Building Code (IBC) codes, and local codes and requirements, with the most stringent applying. If in a location where OSHA has no jurisdiction, and compliance with a requirement is not feasible due to the environment, unavailability of equipment, or other identified reason, then a waiver or variance may be requested using the Authority Having Jurisdiction (AHJ) process (as described in section 6.2 of the SOH policy, above). Coordination shall be made with local emergency response units and/or fire stations in the vicinity when possible.

### References

- 29 CFR 1910.38
- NFPA Codes
- IBC (2015)

### Policy

1. Inspections that address life safety and fire protection shall be conducted monthly for all OPP facilities. See Appendix 17 for the inspection form.
2. The only building fires that should be fought by OPP participants are small, incipient fires which can be readily put out by fire extinguishers (and only if personnel are so trained), unless a trained fire brigade is available on-site.
3. Managers of facilities in remote locations shall establish, if possible and if needed, memoranda of understanding with local fire departments for fighting fires. The fire department shall be provided inventories of all hazardous material in the facility and a map showing storage locations, and fire department personnel shall be walked through the facility so they understand the layout and dangers should a fire occur.  

If there is no fire department at a research station, project site, field camp or other location where serious fire hazards exist consideration of a fire brigade shall be proposed to the OPP program manager responsible for that location's research or operational support.
4. Evacuation plans and fire prevention plans shall be reviewed annually and updated as needed.
5. Facilities that do not meet safety and fire requirements shall be expeditiously corrected. All deficiencies shall be reviewed quarterly until corrected.

6. Electrical devices and power strips shall be in compliance with any nationally recognized testing laboratory and identified as such (e.g., UL or CE).

## **General Building Operational and Basic Structure Requirements (Minimums)**

1. In every building or structure, exits shall be so arranged and maintained as to provide free and unobstructed egress from all parts of the building or structure at all times of occupancy. No lock or fastener shall be installed to prevent free escape from the inside of any building.
2. Every exit shall be clearly visible, or the route to it shall be conspicuously marked in such a manner that every occupant of every building or structure who is physically and mentally capable will readily know the direction of escape from any point. Any doorway or passageway that is not an exit, but could possibly be thought of as an exit, shall be so arranged or marked to prevent occupant confusion with actual fire exits. Every effort shall be taken to avoid occupants mistakenly traveling into dead-end spaces during a fire.
3. Two means of egress, as a minimum, shall be provided (and maintained) in every building or structure, section, or area where the size, occupancy, and arrangement endangers occupants attempting to use a single means of egress that is blocked by fire or smoke. The two means of egress shall be arranged to minimize the possibility that both may be impassable by the same fire or emergency condition.
4. Where hazardous processes or storage are of such character as to introduce the potential for an explosion, explosion venting or an explosion suppression system specifically designed for the hazard involved shall be provided.
5. Clearance of at least 45 cm (18 inches) shall be maintained between the top of stored material and sprinkler deflectors (if present).
6. Clearance shall be maintained around lights and heating units to prevent ignition of combustible materials.

## **Housekeeping Requirements**

1. Excess stacks of paper, crating materials, paper packing boxes, and combustibles shall be cleared from buildings daily and work areas shall be maintained free from the accumulation of combustible debris.
2. All entrances, fire exits, stairs, halls, and passageways shall allow free, unrestricted passage at all times. No material or equipment of any type shall ever be placed or stored to block or restrict free access and egress (and at no time shall space for emergency egress be less than 28 inches).
3. Combustible cleaning materials shall be stored in closed metal containers. No combustible materials shall be stored beneath or stacked within three meters (10 feet) of buildings.
4. All rags, waste, and other items soiled by flammable or combustible materials shall be placed in tight or closed metal containers for daily disposal, when a flammable locker for storage of these is not available.

5. Incinerators used must allow for no visible paper ash to escape during use. Incinerators will only be utilized by personnel who have received training and have a certificate of training on file with the employee's supervisor. PPE, such as gloves and safety glasses, will be worn when placing documents into incinerators and when removing ash with shovels. Incinerators should not be placed within 50 feet of ignition sources or buildings. The manufacturer's recommended operating instructions should be readily available to operators.

## Other Requirements

1. Smoking is permitted only in approved locations.
2. All electrical installations shall be accomplished in accordance with the current edition of the National Electrical Codes (up to one year after publication) unless the AHJ has otherwise approved a waiver. A GFCI that trips at 10mA or lower will be utilized during electrical installations.
3. Emergency telephone numbers and reporting instructions shall be conspicuously posted.

## Fire Protection

1. In accordance with International Fire Code (IFC) Section 906 and NFPA 10, portable fire extinguishers will be recharged and serviced as indicated by the manufacturer for the specific type of fire extinguisher. Record tags will be attached to all extinguishers and the dates they were inspected and weighed or recharged will be indicated thereon.
2. All participants will be trained on the proper handling and operation of fire extinguishers if they are in a high-risk fire location (e.g., laundry facility, fueling station).
3. Adequate firefighting equipment will be provided at temporary buildings and places where combustible materials are stored, as follows:
  - A. Class A fire (wood, paper, textiles, rubbish): water or foam extinguisher.
  - B. Class B fire (oil, grease, gasoline, and similar flammable materials): foam, carbon dioxide, or dry-chemical extinguishers.
  - C. Class C fire (electrical): carbon dioxide or dry-chemical extinguisher.
4. Using carbon tetrachloride or chlorobromomethane as fire extinguishing agents is prohibited.
5. Where unusual fire hazards exist or emergencies develop, additional fire-fighting facilities, such as larger portable chemical units, fire pumps, fire hoses, and outside assistance shall be developed as necessary to ensure reasonable protection.

## Evacuation Plan

The evacuation plan shall include the following:

1. Responses to alarms.
2. Notification procedures - fire department, supervisors, visitors. Include phone numbers.

3. Evacuation routes, to include designation of safe locations outside of facility where employees would wait for further instructions.
4. Fire extinguishing activities, if required to egress safely (locations, training).
5. Emergency escape procedures and escape route assignments.
6. Procedures to account for all employees after evacuations have taken place.
7. Drill requirements, to include evacuation and rescue operations.
8. Responsible employees, such as fire marshals and coordinators, who can provide further information or explanation of duties under the plan.
9. Fire reporting procedures, accident investigation procedures.

## **Fire Prevention Plans**

A written fire prevention plan shall be available for each location. The plan shall include:

1. A list of major work-place fire hazards.
2. Storage and handling procedures for fire hazards, to include general housekeeping and procedures for the control of flammables and combustibles.
3. Potential ignition sources and control procedures, to include smoking, cutting, grinding, and welding.
4. A list of fire protection equipment and written procedures for its use.
5. Standard operating procedures (SOPs) for specific maintenance operations that present unique fire hazards, such as hot work and confined space work.
6. Names and job title of personnel responsible for maintaining fire equipment and those responsible for fire hazards.
7. Required maintenance and testing procedures -- and required frequency of maintenance and testing -- for all fire equipment and systems, e.g. CO2 systems, detectors, alarm systems.
8. Designated parking spaces for emergency vehicles and firefighting equipment.
9. A report of all fires experienced by the facility.

All employees shall be informed of the fire hazards of materials and processes to which they are exposed.

## Appendix 5: Personal Protective Equipment (PPE)

### Purpose and Scope

This appendix prescribes requirements, procedures, and policies for providing personal protective equipment and the apparel necessary to protect the health and safety of all personnel from occupational hazards.

### References

- 29 CFR 1910, Subpart I
- ANSI (American National Standards Institute), Z87.1, (Eye and Face Protection).
- ANSI, Z41 1983, (Safety Toe Footwear).
- ANSI, Z88.2, (Respiratory Protection).
- ANSI, Z89.1, Z89.2 (Protective Headgear)

### General Conditions

Personal protective equipment is the last choice for the control of workplace hazards. Engineering and administrative controls shall be initiated to reduce or eliminate the hazard before personal protective equipment is required.

When engineering and administrative controls do not eliminate or reduce the hazard, adequate protective equipment and apparel shall be provided to prevent or minimize injury or occupational disease.

### Responsibilities

1. It is the responsibility of supervisors to ensure that the proper protective equipment, such as hard hats, respirators, safety eyewear (plain or prescription), protective footwear, and gloves are provided to their employees and are worn when necessary. Supervisors or on-site managers will inform all visitors to a research station, project, field camp, or other OPP-supported site of the need to wear specific PPE in certain areas and ensure such equipment is available.
2. It is the responsibility of employees to wear their personal protective equipment when in a hazardous work area and of all visitors to such areas when so instructed.

### Protective Eyewear Policy

All employees working in eye-hazard areas are required to wear eye protection specific to the hazard encountered.

1. Supervisors are responsible for ensuring that eye-hazard operations and hazard areas are identified and that employees are provided adequate PPE, to include corrective lenses if needed. Examples of eye-hazard operations are welding, grinding, abrasive blasting, using acids or corrosives, chipping, and bright sunlight. Eye-hazard areas are those areas immediately surrounding operations in which light, chemicals, projectiles,

- particles, or dust would be reasonably expected to cause eye damage if an unplanned event occurs.
- Supervisors are also responsible for ensuring that all PPE and eye tests provided to employees are essential for performing their work. For employees who are only intermittently exposed to eye hazards, using goggles over their glasses may be a suitable alternative to the purchase of safety glasses.
  - Eye hazards and protective equipment requirements shall be reviewed with employees during orientation and periodically thereafter. All personnel shall be informed of eye hazards and required to wear safety glasses or equivalent while conducting eye-hazardous operations or while in eye-hazardous areas in OPP facilities or on OPP-funded projects or research.
  - All industrial safety glasses shall meet the requirements of American National Standards Institute (ANSI) Z87.1.
  - Contact lenses are not considered appropriate substitutes for eye protection.
  - For chemical, eye-hazardous operations, emergency eyewashes shall be readily available.

## Protective Footwear Policy

All employees conducting foot-hazard operations or working in foot-hazard areas (extreme cold, snow, around heavy equipment) are required to wear protective footwear.

- Supervisors are responsible for ensuring that foot-hazard areas are identified and that employees have the appropriate protective footwear for the hazards associated with the specific job. Foot-hazard operations are those operations that have a high potential for foot injuries, such as snow or ice exposure, material handling, construction, or field operations.
- Foot hazards and protective equipment requirements shall be reviewed with employees during orientation and periodically thereafter.
- All safety boots shall meet the requirements of ANSI Z41.1.
- Waterproof boots will be considered protective footwear. If a compression hazard exists along with the hazard of excessive moisture, then the waterproof boots will be the type that have a safety toe built in.
- Protective footwear shall be properly maintained by the employee while it is in the employee's possession.

## Respiratory Protection

- When respiratory protective equipment is required, a respiratory protection program shall be developed and implemented. The program shall include, but not be limited to, training, fit testing, equipment selection, maintenance, and medical surveillance, in accordance with 29 CFR 1910.134.
- The medical status of individuals who are to wear respirators shall be evaluated and a statement from a qualified physician shall be provided that indicates the individual is qualified to wear the specified type of respirator.

3. Only approved respiratory protective devices shall be provided and used. "Approved" means that the respirator and its component parts have been tested and listed as satisfactory by the National Institute for Occupational Safety and Health (NIOSH), or applicable host nation requirements, where available.
4. A competent person knowledgeable of inhalation hazards and respiratory protective equipment shall conduct a step by step evaluation to insure only appropriate respiratory protection for the conditions of exposure (including high altitude) is utilized.

## Protective Headgear

(See also Appendix 16, Helmet Policy)

1. All employees shall wear hard hats when working in or visiting a hard hat area.
2. Hard hat areas shall be identified, and all points of entry to a hard hat area shall have a hard hat caution sign posted.
3. Hard hat areas shall be general areas, such as construction, alteration, or demolition sites rather than specific portions of a building or project.
4. All protective headgear shall meet the requirements of ANSI Z89.1, Class A. or ANSI Z89.2., Class B.
5. Protective headgear worn near electric lines and equipment shall be Class B (ANSI Z89.2).

## Hearing Protection

1. All employees that are exposed to excessive noise shall be considered for inclusion in a medical surveillance program for hearing conservation, in accordance with 29 CFR 1910.95.
2. Noise monitoring shall be coordinated by the contractor's safety office.
3. Results of the noise monitoring shall be used to determine the appropriate type of hearing protection.
4. All employees working in a noise-hazardous area shall wear hearing protection.
5. Supervisors are responsible for identifying potential hazards, training employees in the proper use of hearing protection, and enforcing the use of hearing protection. The need for hearing protection is suspected when any one of the following three conditions exist:
  - A. Employees have difficulty communicating with each other by voice when in the presence of noise.
  - B. Employees report head noises or ringing in the ears (tinnitus) after working for several hours in the noise.
  - C. Employees sustain a temporary hearing loss which has the effect of muffling speech and other sounds following several hours of noise exposure.

## Miscellaneous PPE

A number of chemical, physical, and environmental hazards can be controlled with miscellaneous PPE.

- Clothing, such as coats, parkas, pants, or coveralls made of special materials designed to protect against specific or general exposures to irritant, toxic, or corrosive materials may be reusable or disposable. In most cases, protective clothing is made of special impervious materials, which can withstand repeated or prolonged contact with solvents, acids, alkalis, or other chemical or physical agents.
- Special foot protection, such as slip-on toe protectors, metatarsal protectors, hip boots, oil or chemical resistant boots, waterproof boots, or insulated boots.
- Personal flotation devices (PFDs).
- Insect bite kits, for protecting employees who are sensitive to or allergic to insect bites.
- Chaps, for protection when using chain saws.
- Safety harnesses and lanyards for fall protection.
- Insect repellent in areas infested with chiggers, mosquitoes, and ticks.

## Appendix 6: Confined Space Entry Procedures

### Purpose

This appendix contains requirements for practices and procedures to protect personnel from the hazards associated with entry into permitted confined spaces.

### Scope

This appendix applies to all operations and research activities performed under OPP auspices.

### References

- 29 CFR 1910.146
- DHHS (NIOSH) Publication No. 87-113; "A Guide to Safety in Confined Spaces"  
<http://www.cdc.gov/niosh/docs/87-113/default.html>

### Definitions

**Acceptable entry conditions:** The conditions that must exist in a permit space to allow safe entry by personnel.

**Attendant:** The individual stationed outside a permit space who monitors the authorized entrants and performs assigned duties.

**Authorized entrant:** Person who is authorized to enter a permit space.

**Confined space:** A space that:

- Is large enough and so configured that an employee can bodily enter and perform work;
- Has limited or restricted means of entry and exit; and
- Is not designed for continuous employee occupancy.

**Entry:** The action by which an employee passes through an opening into a permit-required confined space. Entry is assumed to be as soon as the employee's body breaks the plane of the opening.

**Entry permit:** The written document that is provided to allow and control entry into a permit-required confined space.

**Entry supervisor:** The person responsible for determining acceptable conditions prior to entry into a permit-required confined space and for terminating entry.

**Designated official:** The person responsible for evaluating permit-required confined spaces and ensuring program elements are enforced.

**Hazardous atmosphere:** An atmosphere that may expose employees to risk of death or injury from one or more of the following causes:

- Flammable gases or vapors in excess of 10 percent of the lower flammable limit (LFL).
- Airborne combustible dust in concentration equal to or greater than its LFL.

- Atmospheric oxygen less than 19.5% or greater than 23.5%.
- Atmospheric concentration of any substance that has a permissible exposure limit (PEL).
- Any other atmospheric condition that is immediately dangerous to life and health.

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

**Permit-required confined space:** A confined space that has one or more of the following characteristics:

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

**Permit system:** The written procedures for preparing and issuing permits for entry and for returning the permit space to service upon termination of entry.

**Rescue service:** The personnel designated to perform rescue functions in permit-required spaces.

**Retrieval system:** The equipment used for non-entry rescue of a person from permit-required spaces.

**Testing:** The process by which hazards are identified and evaluated for entry into permit-required spaces.

## General Requirements

1. At each activity, personnel shall evaluate, or designate a competent person to evaluate, whether there is a potential for permit-required confined spaces.
2. The evaluation shall use the definitions presented above to determine the presence of confined spaces.
3. A list of confined spaces (both permit-required and non-permit-required) shall be maintained on site.
4. All permit-required confined spaces shall be identified with a sign to inform personnel of the existence, location of, and danger posed by the permit-required confined space. The sign will be written in English and the host nation language and will read as follows:

**DANGER - PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER**

## Responsibilities

### Authorized Entrants

Authorized entrants shall:

1. Communicate with the attendant as necessary so the attendant can monitor entrant status and alert entrants of any need to re-evaluate the permit-required confined space.
2. Evacuate the permit-required confined space and alert the attendant whenever they recognize any warning signs or symptoms of exposure to a dangerous situation, or if they detect a prohibited condition, or whenever the attendant or entry supervisor orders evacuation, or whenever an evacuation alarm is activated.

### Attendants

Attendants shall:

1. Remain outside the permit-required confined space during entry operations until relieved by another attendant.
2. Take action when conditions warrant evacuation of the permit-required confined space, inform the entry supervisor of conditions, and warn persons approaching the permit-required confined space.
3. Maintain an accurate list of personnel within the permit-required confined space and a means to identify the personnel.
4. Communicate with entrants as necessary to monitor them and alert them of the need to evacuate.
5. Immediately order evacuation of the permit-required confined space if conditions change to pose a hazardous condition.
6. Perform non-entry rescue as specified in the permit and summon rescue or other emergency services as necessary.
7. Not perform any other duty other than that of attendant during permit-required confined space entry.

### Entry supervisors

Entry supervisors shall:

1. Verify that all tests specified by the permit have been conducted and that all necessary equipment and procedures are in place before entry.
2. Terminate the entry when assigned work is completed or when conditions warrant evacuation.
3. Verify that rescue services are available and that means of summoning them are operable.
4. Ensure that entry operations are consistent with the terms of the entry permit and that acceptable conditions are maintained.

## Permit-Required Confined Space Entry Procedures

1. The designated official shall develop and implement a system for preparing, issuing, and canceling permit-required confined space entry permits. At a minimum, these permits must have the information listed in the sample permit in Appendix 17, in whatever format is desired. Additional information may be included if necessary or desired.
  - A. Before entry begins, the entry supervisor identified on the permit shall sign the permit to authorize entry.
  - B. The completed permit shall be posted at the entry portal so that entrants can confirm the pre-entry preparations have been completed.
  - C. The permits shall be kept in a log book on-site for review by OPP.
  - D. The duration of the permit shall not exceed the time required to complete the task identified on the permit.
2. Plans and procedures shall be developed for summoning rescue personnel and for preventing unauthorized personnel from attempting a rescue.
3. The entry supervisor shall designate at least one attendant who will remain outside the permit-required confined space for the duration of the activity.
4. The designated official shall develop procedures to ensure that when more than one crew is authorized entry, the activities of one crew will not interfere with the work of the other crew.
5. The designated official shall review the entry program periodically to ensure the measures contained in the program are still adequate.

## Training Requirements

1. All employees shall be instructed not to enter permit-required confined spaces without the proper permit that describes procedures and practices for the space.
2. Employees who are required to enter permit-required confined spaces or act as attendant or entry supervisor shall be trained in the knowledge and skills necessary for the safe performance of their work. The employees must also be familiar with the hazards associated with the entry and the measures used to ensure safe conditions.
3. Training shall conform to the requirements of the references above.
4. All training shall be certified by the instructor upon successful completion by participants.
5. Evidence of training shall be available onsite where the entry is occurring for government review if needed.

## On-Site Rescue Teams

1. Each member of the rescue team shall be trained in the use of personal protective equipment and other equipment necessary to perform a rescue.
2. Each member of the rescue team shall practice making a rescue at least once every 12 months. The practice drill shall simulate actual conditions within the permit-required confined space.

3. Each member of the rescue team shall receive the same level of training as authorized entrants and shall be trained in basic first aid and cardiopulmonary resuscitation (CPR).

## Off-Site Rescue and Emergency Services

1. To ensure availability in case of need, contact must be made with emergency services before entry into a permit-required confined space. If there are no emergency services, a rescue team must be established and trained in permit-required confined space rescue procedures, with all necessary emergency equipment.
2. The rescue service shall be informed of the associated hazards that may be present during a rescue.
3. A rescue team shall be provided access to all permit-required confined spaces for which rescue may be necessary so the service can develop appropriate plans. The team shall be trained in permit-required confined space rescue procedures, with all necessary emergency equipment at the work site.

## Retrieval Systems

1. Each authorized entrant shall use a chest or full body harness, with a retrieval line attached at the center of the entrant's back near the shoulder level or above the entrant's head.
2. Retrieval lines shall be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware of the need for rescue.
3. A mechanical device shall be available to retrieve personnel from vertical permit-required confined spaces more than 1.5 meters (5 feet) deep.

## Recordkeeping

Records shall be maintained at each facility by the supervisor documenting the training. Records shall include safety drills, inspections, tests and maintenance, and any atmospheric tests made, to include time, date, atmospheric concentrations of substances for which there is a permissible exposure limit, PPE used, and employees' names.

## Sample Activity Hazard Analysis, Confined Space Entry

Listed below are hazards associated with entering a confined space and possible means of controlling those hazards.

### Hazard: Toxicity

#### *Causes:*

- *Toxic levels of substances in confined space*
- *Decomposition of organic material in confined space*
- *Toxic mixture of substances in confined space*
- *Substances being used in confined space, e.g., cleaning solvents*
- *Residual vapors from previous contents of confined space*

- *Welding fumes or vapors*

*Controls:*

- *Evaluate previous history of the confined space to avoid reactions with residual chemicals, wall scale, and/or sludge, which can be highly reactive.*
- *Check for compatibility of materials when structural members and/or equipment are introduced e.g., aluminum ladder, cleaning solvents.*
- *Utilize proper respiratory equipment based on air monitoring.*

## **Hazard: Insufficient Oxygen**

*Causes:*

- *Rust*
- *Use of other gases, e.g., nitrogen, carbon dioxide.*
- *Welding*

*Controls:*

- *Maintain atmospheric oxygen level of 21% by volume through ventilation and/or exhaust.*
- *Provide and maintain adequate ventilation and exhaust, as per specific conditions in the confined space.*
- *Self-contained breathing apparatus.*

## **Hazard: Explosion/Fire in Confined Space**

*Causes:*

- *Combination of combustible gases and a spark from activity of an employee in confined space (dip testing tank, welding, electric tools, light bulbs, matches).*

*Controls:*

- *No matches, lighters, or other flame-producing sources allowed in confined space.*
- *Explosion proof bulbs.*
- *Provide adequate ventilation to prevent an enriched oxygen atmosphere or to eliminate the explosive or flammable atmosphere.*

## **Hazard: Explosion/Fire at Point of Entry.**

*Causes:*

- *Employee welding, using power tool, or engaging in other spark-generating activity at point of entry.*
- *Driving automobile near confined space containing combustible materials.*

*Controls:*

- *Use non-sparking tools.*
- *Barricade entry point at a reasonable distance.*

- *Prohibit vehicles within immediate area.*

### **Hazard: Electrocution/Electric Shock**

*Cause:*

- *Conductive walls of confined space picking up an electrically "hot" source in confined space.*

*Control:*

- *Ensure all electrical apparatus used comply with National Electrical Code (NEC) standards.*
- *Lock out electric sources.*

### **Hazard: Caught In/Crushing**

*Cause:*

- *Entering a machine or area that has not been locked out, then having it activated.*

*Control:*

- *Manually isolating each piece of equipment before workers enter or while they work in a confined space (Locking out).*
- *Follow specific procedures for mechanical lockout.*

### **Hazard: Struck by Falling Objects in Confined Space**

*Cause:*

- *Falling objects from walls of confined space.*
- *Objects falling through point of entry.*

*Control:*

- *Barricade entry of confined space.*
- *Wear appropriate personal protective equipment, i.e., hard-hat.*
- *Assess hazards before entry.*

### **Hazard: Falls While in Confined Space**

*Causes:*

- *Wet, oily floors*
- *Configuration of internal surfaces.*
- *Holes/breaking through part of confined space.*
- *Falls over object or /tools.*
- *Poor lighting.*
- *Uneven surfaces.*

*Controls:*

- *Ensure floor or base is clean and dry.*

- *Wear proper foot protection.*
- *Locate, identify, and barricade existing holes*
- *Provide adequate illumination.*
- *Practice good work habits (housekeeping).*
- *Use guardrails and scaffolding properly.*

## **Hazard: Bodily Reactions, Strains, Abrasions**

### *Causes:*

- *Entering or leaving a cramped, sharp edged, high-level, or hazardous point of entry to a confined space.*
- *Maneuvering within a confined space.*
- *Low head room/striking head.*

### *Controls:*

- *Wear personal protective equipment.*
- *Training to ensure awareness.*
- *Reduce "bulkiness" of clothing and equipment.*
- *Engineering controls to eliminate condition.*

## **Hazard: Eye Injuries**

### *Causes:*

- *Falling dust*
- *Grinding, chipping, other operations that cause flying debris.*

### *Control:*

- *Wear proper eye protection at all times.*

## **Hazard: Contact with Temperature Extremes**

### *Causes:*

- *Steam discharge*
- *Welding surfaces*
- *Weather conditions*
- *Compressed gases, e.g., nitrogen.*

### *Controls:*

- *Wear appropriate clothing and PPE.*
- *Limit time of exposure.*
- *Know symptoms of excessive exposure.*
- *Frequent breaks to ensure high fluid intake to compensate for hot climates and for hot conditions inside PPE.*

## Appendix 7: Hazardous Energy Control (Lockout/Tag-Out)

### Purpose

This appendix defines the minimum requirements for establishing a program and utilizing procedures for affixing the appropriate lockout or tag-out device to energy isolating devices and to otherwise disable machines or equipment to prevent unexpected energizing, start-up, or release of stored energy, in order to prevent injuries to personnel.

### Applicability

This appendix applies to the control of energy during servicing and/or maintenance of equipment. This includes contractors performing renovation, remodeling, demolition, O&M, and construction activities.

### References

- 29 CFR 1910.147

### Definitions

**Energy isolating device:** A mechanical device that physically prevents the transmission or release of energy.

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

**Lockout:** The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

**Lockout device:** A device that utilizes a positive means, such as a lock (key or combination) to hold an energy isolating device in a safe position and prevent the energizing of equipment.

**Tag-out:** The placement of a tag-out device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tag-out device is removed.

**Tag-out device:** A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and equipment being controlled may not be operated until the tag-out device is removed.

**Zero-energy state:** This means no energy is coming into or is inside the equipment. Equipment that is just turned off is not at a zero-energy state because it could easily be turned on again. Isolating the energy source and using locks and tags ensures the equipment reaches and stays at a zero-energy state.

## General Requirements

### Lockout/Tag-Out Requirements

1. If an energy isolating device is not capable of being locked out, the energy control program shall utilize a tag-out system.
2. If an energy isolating device is capable of being locked out, the energy control program shall utilize lockout, unless it can be demonstrated that the use of a tag-out system will provide a level of safety equivalent to that obtained by using a lockout system.
3. As of January 2, 1990, whenever replacement, major repair, renovation, or modification of equipment is performed, and whenever new equipment is installed, energy isolating devices for such equipment shall be designed to accept a lockout device.

### Equipment Power Requirements

Before any piece of equipment can be serviced or worked on in any way, it must be in a zero energy state.

Equipment may be powered by different types and/or combinations of energy sources, such as:

- Electrical energy (the flow of currents through wires and circuits)
- Hydraulic energy (any type of liquid, including water, under pressure)
- Pneumatic energy (gas, including air, under pressure)
- Mechanical energy (potential or "built-up" energy, such as spring energy, that may cause equipment parts to move without warning)

### Protective Material and Hardware Requirements

1. Locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware shall be provided for isolating, securing, or blocking equipment from energy sources.
2. Lockout and tag-out devices shall be singularly identified, shall be the only devices used for controlling energy, shall not be used for other purposes, and shall meet the following requirements:
  - A. Lockout devices and tag-out devices shall be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.
  - B. Tag-out devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.
  - C. Tags shall not deteriorate when used in corrosive environments, such as areas where acid and alkali chemicals are handled and stored.

3. Lockout and tag-out devices shall be standardized within the facility according to at least one of the following criteria: color, shape, or size. Additionally, tag-out devices should be standardized in print and format.
4. Lockout and tag-out devices shall be substantial:
  - A. Lockout devices shall be substantial enough to prevent their removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting tools.
  - B. Tag-out devices, including their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal.
5. Lockout and tag-out devices shall be identifiable:
  - A. Lockout and tag-out devices shall indicate the identity of employee applying the device.
  - B. Tag-out devices shall warn against the hazardous condition if the machine or equipment is energized, and they shall include a legend, such as the following:

**DO NOT START – DO NOT OPEN – DO NOT CLOSE  
DO NOT ENERGIZE – DO NOT OPERATE**

6. No lockout or tag-out device shall be removed by anyone other than the individual who placed it.

## Inspection Requirements

1. A qualified individual shall conduct an inspection of the energy control procedures at least annually to ensure that established procedures and requirements are being followed.
2. Periodic inspections shall be performed by an authorized person other than the one(s) utilizing the energy control procedures being inspected.
3. Periodic inspections shall be conducted to correct any deviations or inadequacies identified.
4. Periodic inspections shall include a review between the inspector and each authorized and affected employee regarding the procedures and responsibilities being used.
5. Periodic inspections will be documented for each piece of machinery or equipment. This certification shall identify the machine or equipment on which the energy control procedure was being used, the date of the inspection, the employees included in the inspection, and the person performing inspection.

## Responsibilities

Supervisors will establish programs and utilize procedures (lockout/tag-out) for controlling hazardous energy for their facilities. Supervisors will also ensure that all necessary personnel receive required training regarding the control of hazardous energy.

## **Training**

Employers shall provide training to ensure that the knowledge and skills required for the safe application, use, and removal of energy controls are acquired by employees.

1. All authorized employees will receive initial and periodic (annual) training in the recognition of hazardous energy sources, the types and magnitude of the energy present in the workplace, and the methods and means necessary for energy isolation and control.
2. All affected employees shall be instructed in the purpose and use of the energy control procedures.
3. All other employees whose work operations are or may be in an area where energy control procedures may be used shall be instructed about the procedure and about the prohibition against attempting to restart or re-energize machines or equipment that are locked out or tagged out. This training may be accomplished during regularly scheduled safety meetings.
4. Employees shall be made aware that lockout or tag-out are to be performed only by the authorized employees performing the servicing or maintenance.
5. Training will be documented. Certification shall contain each employee's name, dates of training, name of person(s) conducted the training, where the training was performed, and the subjects covered.

## **Personal Protection Equipment**

All appropriate personnel protective equipment will be used when applying lockout and tag-out procedures.

## **Appendix 8: Respirator Program Guidelines**

### **Purpose**

The purpose of this appendix is to prescribe requirements and procedures for selecting, using, and maintaining respirators.

### **Applicability**

This appendix applies to all employees who may wear a respirator. Contractors are required to submit a standard operating procedure (SOP) on the proper use and handling of respirators.

### **References**

- 29 CFR 1910.134, OSHA Standard for Respiratory Protection
- ANSI Z88.2, Practice for Respiratory Protection

### **Policy**

It has long been recognized that the respiratory tract is the most important route by which toxic substances enter the body. Most industrial poisonings are caused by inhaling toxic substances. The primary effort to control such hazards should be in the form of engineering controls, such as specially designed ventilation systems. If engineering controls cannot be implemented, or are cost prohibitive, infeasible, or inadequate, respirators must be used to protect the individual whenever hazardous conditions exist. A respiratory protection program shall be established and implemented in accordance with ANSI Z88.2. This program shall encompass training, maintenance, and awareness of the limitations associated with various types of respirators.

### **Responsibilities**

#### **All Personnel**

All personnel who might wear a respirator shall become familiar with the respiratory protection program, as outlined in this appendix. A copy of the program shall be maintained in the local safety office.

#### **Supervisors**

All supervisors shall:

- Request assistance from the contractor's safety office in conducting atmospheric testing of the work area to determine if employees are exposed to contaminant levels in excess of the threshold limit values (TLV) and permissible exposure limits (PEL).
- Request assistance from the contractor's safety office for respirator fit-testing.
- Enforce the use of respirators by employees. Written documentation of an employee's failure to wear respirators shall be cause for disciplinary action and

shall be forwarded to the safety office for inclusion in the employee's medical records.

- Ensure all employees are trained in the proper use of respirators and report to their medical surveillance examinations.

## **Employees**

All employees shall:

- Wear and maintain respirators as required.
- Notify supervisors of any problems with respirators, or if they are having respiratory problems.
- Report for training and medical surveillance examinations.

## **Contractor's Safety Office**

The contractor's safety office shall:

- Ensure all respirators are approved by the National Institute for Occupational Safety and Health (NIOSH), or meet host nation requirements for local national employees.
- Provide oversight to ensure compliance with the respiratory protection program.

## **Program Requirements**

1. Respirators and canisters shall be selected according to the hazards to which the worker is exposed. Accordingly, project personnel must know which type of respirator or canister to use in each particular situation.
2. Supervisors shall be instructed in the proper use of respirators and their limitations (e.g., respirators designed for protection against one hazard may be totally ineffective against another).
3. Employees shall ensure respirators are regularly cleaned, disinfected, and stored in a convenient, clean, and sanitary location.
4. Employees shall be trained in the care of their respirator. Training shall include inspection for defects, cleaning and disinfection, repair, and storage.
5. Supervisors shall not assign personnel to tasks requiring the use of respirators unless it has been determined that they are medically able to wear respirators while performing their work (see "Medical Requirements" below).

## **Training Requirements and Respirator Use**

1. Supervisors as well as employees must know which respirators and cartridges are to be used in each situation. There must be written procedures in place that describe this. When new operations or projects develop, supervisors should contact the local safety office for assistance, as necessary.
2. An additional person must be present in areas where the failure of a respirator could result in the wearer being overcome by a toxic or an oxygen-deficient atmosphere.

- Effective communications (visual, voice, or signal line) will be maintained between both (or all) individuals present.
- Supervisors shall ensure that their employees have an opportunity to handle the respirator, have it fitted properly, test its seal, and familiarize themselves with the respirator by wearing it at periodic training sessions.
  - It must be stressed that respirators shall not be worn when a good fit cannot be achieved. A good fit cannot be achieved by anyone who has a beard, long sideburns, a long mustache, or stubble. Also, the absence of dentures can affect the fit of a face piece.
  - If air-line respirators are used, the supplied air source shall be inexhaustible and the hose length cannot exceed 300 feet from the source to the user.
  - The wearer of any type of respirator shall not be allowed to wear contact lenses. If a spectacle, goggle, face shield, or welding helmet must be worn with a face piece, it shall be worn so as not to adversely affect the seal of the face piece to the face.

## **Maintenance, Care, and Storage**

- Each respirator shall be inspected by the employee for defects before and after each use, and at least monthly, to assure it is in good working order. The inspections shall include a check of the tightness of the connections and a check of the face piece, valves, connecting tube, and cartridge. All rubber and elastic parts must be inspected for pliability and signs of deterioration.
- Each self-contained breathing apparatus shall be inspected by the employee monthly. Air cylinders shall be fully charged, according to the manufacturer's instructions.
- If respirators are used regularly, they may be assigned to individual workers for their exclusive use.
- Respirators shall be regularly cleaned and disinfected. Those issued for the exclusive use of one worker shall be cleaned after each day's use. Those used by more than one person shall be thoroughly cleaned and disinfected after each use. To clean and disinfect respirators, they should be washed with detergent in warm water using a soft brush, rinsed thoroughly in clean water, rinsed in a disinfectant solution, rinsed again in clean water (to prevent skin irritation), and air dried in a clean place. Cleaner and sanitizer solutions that clean effectively and contain bactericide are also available.
- After inspection, cleaning, and necessary repair, respirators shall be stored in sanitary locations to protect against dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals. It is useful to store non-emergency respirators in plastic bags after they have been cleaned and disinfected.
- Defective respirators shall be tagged and removed from service by the supervisor.
- Respirators shall not be stored in tool boxes and lockers unless they are in carrying cases or other protective containers.
- When stored, the face piece and exhalation valve must be in an upright or resting position. If stored in a bent, folded, or abnormal position, the face piece and exhalation valve can warp or become deformed and thereby void the NIOSH approval.

## Identification of Respirators and Cartridges

Most manufacturers use the following guidelines when designing their product. Therefore, while the identification information given below is necessary to know, it is usually not of major significance to the purchaser. Assistance in ordering specific respirator equipment may be obtained from the local safety office.

1. The primary means of identifying respirator cartridges should be via properly worded labels. Each cartridge shall have bold letters stating "Cartridge for (name of contaminant)." It shall also state "For respiratory protection in atmospheres containing not more than [X] percent by volume of (name of contaminant)."
2. Each cartridge shall have a label warning that gas masks should be used only in atmospheres with enough oxygen to support life (at least 16 percent by volume), since the cartridges are only intended to neutralize or remove contaminants from the air.
3. Each cartridge shall be painted a distinctive color for a particular contaminant. For example, an organic vapor cartridge is signified by the color black. A cartridge for use in ammonia gas atmospheres (limited to 300 ppm) is green.
4. The use of one manufacturer's cartridge with another manufacturer's respirator is unacceptable. The problem with interchanging brand names is that an airtight seal cannot be guaranteed. In addition, the interchanging of respirator components voids any approval granted by NIOSH.

## Medical Requirements

It is important that no employee be assigned to tasks requiring the use of respirators if, based upon their most recent medical examination, the examining physician determines the employee will be unable to function normally while wearing a respirator, or if the safety and health of the employee or other employees will be impaired by his or her use of a respirator. The focus of the medical examination should be on pulmonary and cardiovascular fitness.

Workers who have indications of coronary artery disease, myocardial infarction, angina pectoris, or progressive or severe hypertension should only wear a continuous-flow, air-line respirator, unless approval from their physicians is obtained.

Those whose duty it is to respond to emergencies should not wear any type of respirator if they have a cardiovascular deficiency. Other physical conditions, such as diabetes or grand mal epilepsy, may limit respirator use. The final decision regarding respirator use for any individual is the responsibility of the examining physician.

## Guide for Selecting Respirators

The contractor's safety office is responsible for advising supervisors on the type of respirator required. In selecting a respirator, safety and supervisory personnel should assemble the information needed by answering the following questions:

1. What is the measured or estimated contaminant concentration at the breathing zone of the worker?
2. What is the PEL and/or TLV of the contaminant? (Use the more stringent of the two.)
3. Is the workspace oxygen deficient (less than 19.5% oxygen)?

4. What is the lower explosive limit (LEL) of the contaminant?
5. Does an IDLH situation exist at contaminant concentration?
6. If the contaminant is a gas or vapor, is efficient sorbent available and is there adequate warning containing the contaminants dangers?
7. Will eye irritation occur at contaminant concentration?
8. Will skin absorption pose a problem?
9. Are there other circumstances or conditions that should be considered?

## **Appendix 9: Hearing Conservation**

### **Purpose**

The purpose of this appendix is to eliminate occupational, noise-related hearing loss among personnel.

### **Applicability**

This appendix applies to all personnel who may be exposed to noise greater than OSHA's PELs. The provisions of this appendix do not apply to deaf personnel, as defined in ANSI S3.20.

### **References**

- 29 CFR 1910.95, OSHA, Occupational Noise Exposure
- 29 CFR 1926.52, OSHA, Occupational Noise Exposure

### **Background**

Noise is unwanted sound transmitted, primarily, to the ear through air. It may injure the hearing mechanism. Noise-induced hearing loss may be temporary or permanent, depending on the frequency and intensity of the noise and the duration of exposure. Temporary hearing loss or temporary threshold shift results from auditory fatigue induced by exposure to intensive sound, and there is a return of the individual's pre exposure hearing level after a period of time away from intensive sound. Permanent hearing loss or permanent threshold shift results from damage to the end organ of the inner ear and it is not reversible by any known treatment.

### **Requirements**

Supervisors are responsible for becoming familiar and implementing the requirements established in this appendix. They are responsible for identifying those areas where employees are exposed to high noise levels, posting notices in noise hazardous areas, using engineering controls, and educating employees on preventing hearing loss and the use of personal protective equipment (PPE). Noise hazards will be included in the position hazard analysis.

Supervisors shall notify the contractor's safety office of suspected noise hazardous areas. The local safety office shall then coordinate noise surveys to determine the level of exposure. In areas where employees are subjected to continuous noise levels of 85 dBA or impulse levels of 140 dBA, regardless of duration, engineering and administrative controls (such as limiting the duration of exposure) will be implemented to reduce the noise hazard. In noise hazardous areas where engineering and administrative controls are not feasible, any employee exposed to 85 dBA or greater shall be provided hearing protection devices and will be entered in the medical surveillance program. Nobody should be exposed to impulse or impact noise above 140 dBA peak sound pressure level.

## Responsibilities

### Supervisors

Supervisors shall:

- Request that the contractor's safety office measure and analyze all areas and equipment suspected of being noise hazardous. An area where one has to shout to communicate is probably over 85 dBA.
- Post signs or sticker labels on equipment or areas where noise is a hazard.
- Enforce the use of hearing-protective equipment.
- Include noise exposure in employees' activity hazard analyses (AHAs).
- Ensure engineering controls are established to protect employees from noise hazards.
- Requisition hearing protection equipment that reduces ambient noise level to no more than 85 dBA at the wearer's ear.
- Ensure that only hearing-protective devices that meet requirements established by ANSI S3.19, are issued to employees exposed to noise-hazard areas.
- Ensure that the applicable job description contains the requirement that the employee must wear hearing protection in the performance of the job.
- Use disciplinary actions when necessary to enforce the proper use of hearing protection.
- Ensure that employees receive orientation and ongoing training on hearing conservation during safety meetings.
- Ensure that employees exposed to a noise-hazard work environment are considered for inclusion in the hearing conservation program.

### Employees

Employees shall:

- Wear the provided and proper hearing protection, when required.
- Report for audiometric testing when required.
- Attend and participate in periodic safety and occupational health training.

### Contractor's Safety and Occupational Health Office

The contractor's safety and occupational health office shall:

- Ensure that only calibrated equipment is used for measuring and analyzing noise.
- Notify supervisors of areas or equipment that produce hazardous noise.
- Maintain all noise survey records for 40 years.
- Make provisions to schedule personnel for audiometric testing and yearly follow-up hearing tests for all personnel included in the hearing conservation program (i.e., those who will potentially be exposed to 85 dBA for more than eight hours per day).

## **Occupational Health Nurses/Medical Testing Facility**

Occupational health nurses and/or the medical testing facility shall:

- Ensure audiometric testing is conducted by a physician, audiologist, otolaryngologist, or a certified technician under the supervision of one of the listed professionals.
- Ensure that the audiometric testing is conducted in an environment that allows 0 dBA hearing levels at test frequencies of 500, 1000, 2000, 3000, 4000, and 6000 Hz. Testing shall also include pure tone, air-conductive hearing threshold levels in each ear, with test frequencies of at least 500, 1000, 2000, 3000, 4000, and 6000 Hz.
- Notify employees of any validated standard threshold shift (STS) in hearing loss
- Maintain a roster of all personnel included in the hearing conservation program.

## Appendix 10: Hazard Communication Program

### Purpose

The purpose of this appendix is to establish a formal hazard communication program to inform and educate personnel on the occupational health hazards associated with the chemicals in their workplace.

### Applicability

This appendix is applicable to all personnel who are performing work or research within OPP funded and/or supported locations.

### References

- 29 CFR 1910.1200
- 29 CFR 1926.59

### General

The hazard communication program has been developed, in accordance with 29 CFR 1910.1200, to ensure that all chemical substances that are brought into the workplace have been evaluated for their physical and health hazards. Information concerning these hazards must be transmitted to those employees with potential exposure. Examples of such exposure would be employees subjected to the hazardous chemical in the course of employment, through any route of entry (inhalation, ingestion, and skin contact, or absorption), under normal conditions of use or in an emergency. Note that only those chemicals that have been classified as health or physical hazards, in accordance with 29 CFR 1910.1200, are required to be included in the hazard communication program. Employees should consult with the contractor's safety office if there is an uncertainty as to a chemical's inclusion.

### Major Elements

There are five major elements of the hazard communication program; 1) written hazard communication program; 2) chemical assessment and inventory; 3) hazardous chemical labeling system; 4) safety data sheets (SDSs); and 5) employee training. This appendix of the OPP SOH policy constitutes the written hazard communications program. The remaining elements are discussed below.

#### **Chemical Hazard Assessment and Inventory**

Every chemical funded by OPP (directly or indirectly) will be assessed for its chemical or physical hazards. Where applicable, substitute chemicals that are less hazardous shall be purchased for the assigned tasks. Chemical manufacturers or importers are required, by federal and international laws, to determine if the chemicals they sell or import are hazardous, and to provide this information via label, SDS, mark, or tag to the purchaser. Based on this information, the chemicals purchased shall be included in the hazardous chemicals and materials inventory, and the inventory will be continually updated.

As hazardous chemicals are purchased, they will be added to the inventory. As hazardous chemicals are disposed of, they will be removed from the list. However, data on their hazards will be maintained by the relevant supervisor and the contractor's safety office. Industrial hygiene and workplace inspections will include a check to ensure the accuracy of the inventory.

## **Hazardous Chemical Labeling System**

Chemical manufacturers, importers, and distributors are required by federal and international laws to label, mark, or tag each container of hazardous chemicals leaving their workplace with the following:

- The identity of the hazardous chemical(s) contained within;
- An appropriate hazard warning label; and
- The name, address, and telephone number of the chemical manufacturer or importer or other source that can provide additional information on the hazardous chemical(s) and appropriate emergency procedures.

Supervisors shall ensure that each container of hazardous chemicals in the workplace is labeled, tagged, or marked accordingly and that the label or other form of warning is legible, in English and in the host nation language, and is prominently displayed on the container. Supervisors shall also ensure the information is readily available during each work shift.

For the purpose of this requirement, container means any bag, barrel, bottle, box, can, cylinder, drum, storage tank, or similar enclosure that contains a hazardous chemical. Pipes and piping systems are not considered to be containers. However, pipe and piping systems will be labeled as specified above if substances that are transported within them are or will be contained in the hazardous material inventory.

Portable containers into which hazardous chemicals are transferred shall be marked to indicate the chemical, hazardous or non-hazardous, which they contain. Containers that both contain and process chemicals may have signs, placards, process sheets, batch tickets, operating procedures, or other such forms of identity to ensure employees are aware of the hazards involved with the chemical or process.

## **Safety Data Sheets (SDS)**

Federal law 29 CFR 1910, requires chemical manufacturers and importers to obtain or develop a Safety Data Sheet for each hazardous chemical they produce or import and employers to maintain a SDS for each hazardous chemical they procure and use. The inclusion of Federal Acquisition Regulation (FAR) clause 52.223-3 in purchase orders for chemical products will ensure that the manufacturer or distributor provides SDSs for those products. The contractor's procurement office will ensure that every purchase order will include FAR clause 52.223-3.

SDSs may take various forms (including operating procedures), and they may be designed to cover groups of hazardous chemicals if it is appropriate to address the hazard of the process rather than the individual chemicals. In these circumstances, the information contained in the SDS must be provided for each chemical in the process and be readily accessible during each work shift to all affected personnel.

When work center personnel receive a SDS, they shall forward a copy to the contractor's safety office and ensure the SDS is readily accessible to personnel in the work area, in a language understood by each worker. The new chemical will be included in the hazardous material inventory and added to the work area inventory. Information on the SDS will be used by the safety office to develop adequate hazard control and abatement procedures and establish training requirements for personnel exposed to the chemical.

## **Employee Information and Training**

Supervisors are responsible for providing their personnel with an orientation on the purpose and requirements of this program, and specific training on hazardous chemicals in their workplace. This training will be conducted during the first four weeks of a new employee's assignment, when a new chemical is introduced in the workplace, or whenever the need exists. Specific training shall include, as a minimum, the following:

- A description of those operations in the employee's work area where hazardous chemicals are present and in use.
- A chemical hazard evaluation. This will include a listing of those chemicals included in the hazardous material inventory for the work area, the work area labeling system, and the use of safety data sheets. Training in the use of the safety data sheets shall include the physical and chemical hazards of the chemical and the specific measures required to protect the employee from these hazards.
- Methods and observations that may be used to detect the presence or release of a hazardous chemical within the work area.

The supervisor will contact the contractor's safety office within the first four weeks of the new employee's assignment to schedule formal training for the employee in hazard communication. The training will be provided during the next site visit to the area.

## **Non-Routine Tasks**

Before undertaking a non-routine task, supervisors shall inform employees of any hazards associated with the non-routine work they have been assigned. Generally, these hazards will have been pre-determined and brought to the supervisor's attention.

If the hazards have not been pre-determined, the supervisor will notify the safety office and request a hazard evaluation. The employee will then be informed of the associated hazards.

## **Hazard Communication for Contract Activities**

All design plans and specifications for structures or activities will list any hazardous substances and materials incorporated in the design, including those used in the construction of the structure or performance of the activity. This list will serve as the primary notice to contractors of the hazardous materials and substances to which their employees may be exposed to while performing their work. It is also required that the contractor provide documentation of employee training in hazardous substances and chemicals used on every job site. It is required that the contractor develop an activity hazard analysis acceptable to the COR that identifies those hazards, including chemical hazards, anticipated during a particular phase of work, and proposes methods to control those hazards. Contractors shall utilize those sections of the activity hazard analysis and applicable SDSs to provide training to their employees.

## **Appendix 11: Report of Hazard, Unsafe Condition, or Unsafe Practice**

### **Purpose**

The purpose of this appendix is to provide all personnel with a practical means of reporting hazards, unsafe conditions, or unsafe practices encountered while on the job.

### **Applicability**

All personnel working on OPP-funded activities.

### **General Requirements**

If a hazard, unsafe condition, or practice is observed, the first course of action shall be to inform the supervisor. If the supervisor does not adequately address the safety concern, then the contractor's safety office shall be informed of the concern and details regarding any action or non-action taken to correct the issue. If there still is no action observed or the safety concern does not get addressed properly, the concern can then be passed by the concerned individual to the PESH Safety Officer directly (phone number 703-492-7477).

The contractor's safety office shall set up an anonymous reporting system for all stakeholders. The contractor shall follow-up on all reports and use discretion as to which reports demand labor and resources.

The Occupational Safety and Health Act of 1970 gives an employee assurance that no discriminatory or discharge action will be taken against any employee who exercises his or her rights under the Act. In other words, NO retribution shall be taken on any employee or researcher that reports an unmitigated hazard, unsafe condition, or unsafe practice. If OPP becomes aware of any such retribution, there shall be an investigation, with corrective actions identified and implemented, with any and all means available, by the CO or other OPP leader (such as the science program manager or the university or institution's risk manager).

## Appendix 12: Diving Standards (Antarctic Program Only)

### Purpose

Diving is an inherently dangerous activity. Diving in Antarctica carries additional risks associated with the environmental conditions and the often remote diving locations, where diving support, medical support, and life-support infrastructure are limited or absent. This policy and these standard operating procedures are intended to provide a framework by which underwater diving for both operations and maintenance (O&M) and scientific purposes can be conducted safely.

### Applicability

All personnel working under OPP auspices, to include O&M and scientific diving.

### References

- 29 CFR 1910.401-440 and Subpart T
- AAUS Standards for Scientific Diving

### Definitions

**American Academy of Underwater Sciences (AAUS):** The national association of scientific diving scientists, diving technicians, and diving safety officers that is generally responsible for setting standards for scientific diving.

**Bottom time:** The total elapsed time (measured in minutes) from when the diver leaves the surface until the diver resurfaces.

**Buddy diver:** Second member of the dive team.

**Certified diver:** A diver who holds a current certification from an AAUS scientific diving program or recognized certifying agency.

**Cylinder:** A pressure vessel for storage of gases.

**Decompression sickness (DCS):** A condition with a variety of symptoms that may result from gas and bubbles in the tissues of divers after pressure reduction. DCS can be caused by exceeding no-decompression limits or exceeding the prescribed rate of ascent.

**Depth:** The dive log should denote the maximum depth of the dive.

**Depth certification:** The depth to which a diver is certified to dive.

**Dive:** A descent into the water, an underwater activity utilizing compressed gas, an ascent, and return to the surface.

**Dive computer:** An electronic device for tracking depth and time and computing inert gas uptake and off-gassing.

**Dive site:** The physical location of a dive.

**Dive table:** A profile or set of profiles of depth-time relationships, including their ascent rates, for particular breathing mixtures, to be followed after a specific depth-time exposure or exposures. (Synonymous with Decompression Table.)

**Dive team:** Divers and support individuals who are exposed to or control the exposure of others to hyperbaric conditions.

**Diver:** An individual in the water who uses an apparatus that supplies breathing gas at ambient pressure.

**Diving mode:** A type of diving requiring specific equipment, procedures, and techniques; for example, scuba, surface-supplied air, or mixed gas.

**Diving safety officer (DSO):** Individual with scientific diving expertise responsible for advising the OPP on scientific diving matters, authorizing dive plans, and authorizing divers to dive under OPP auspices.

**Dry suit:** An exposure suit with airtight seals at the neck and wrists, which allows the introduction and exhaust of compressed air through valves and keeps the diver dry during the dive.

**Hyperbaric:** A condition defined by pressure greater than one atmosphere at sea level.

**Lead diver:** A certified scientific diver with the experience and training to lead the diving operation.

**Mixed-gas diving:** A diving mode in which the diver is supplied in the water with a breathing gas other than air.

**No-decompression limits:** The maximum depth and time parameters of a decompression algorithm for which staged decompression is not required.

**Open water:** Water not covered by a ceiling, ice or otherwise.

**Principal investigator (PI):** The scientist in charge of a science project, usually the senior scientist.

**Pressure-related injury:** An injury resulting from pressure disequilibrium within the body as the result of hyperbaric exposure. Examples include decompression sickness, pneumothorax, mediastinal emphysema, air embolism, subcutaneous emphysema, and barotrauma.

**Recompression chamber:** A pressure vessel for treating pressure-related dive accidents, such as cerebral arterial gas embolism (CAGE) and DCS. (Synonymous with Hyperbaric Chamber).

**Regulator:** A device for delivering air from high pressure to ambient pressure, usually for breathing purposes.

**Scientific Diving Control Board (SDCB):** The group of individuals that act as an appointed body of expertise to OPP in all matters relating to scientific diving operations.

**Scientific diving:** All diving performed by individuals necessary to and part of a scientific research or educational activity, in conjunction with a project or study under the jurisdiction of any public, private, or educational institution or similarly recognized organization, department, or group. To further clarify, OPP requires that:

- The underwater diving activity is an integral and essential part of the project;
- The project is a scientific, research, or educational activity consistent with OPP's mission to foster research and education in the sciences and engineering;
- The specific tasks that the diver performs under water are observational or involved in data gathering, rather than tasks usually associated with commercial diving; and;
- The work products of the diving activity are available to the public for review or examination.

**SCUBA diving (scuba):** A diving mode independent of surface supply in which the diver uses an open-circuit, self-contained, underwater breathing apparatus.

**Supervisor of diving services:** Individual with scientific diving expertise and logistical responsibilities, employed by the USAP Antarctic support contractor. He or she coordinates closely with the USAP DSO and safety and health officer to manage the USAP scientific diving program.

**Surface-supplied diving:** A diving mode in which the diver in the water is supplied from the surface with compressed gas for breathing, either from an air bank or from a compressor with volume cylinder.

**Tender:** A qualified person on the surface who is responsible for assisting and communicating with divers during a dive by various means, including a tether.

**Tether:** A line attached to a diver(s) to prevent their becoming lost underwater or under ice due to poor visibility or swift current. This is also a means of diver-to-surface communication.

**U.S. Antarctic Program (USAP):** An organization of the U.S. government made up of scientists and support personnel who carry out research that can only be done or best be done in Antarctica. The program comprises research by scientists selected from universities and other research institutions and operations and support by a contractor and other agencies of the U.S. Government. The National Science Foundation (the U.S. Government agency that promotes the progress of science) funds and manages the program through its Geosciences Directorate, Office of Polar Programs.

## Background

The Office of Polar Programs (OPP) of the Geosciences Directorate of the National Science Foundation (NSF) provides support for scientific diving associated with the research activities it funds. The OPP Standards for the Conduct of Scientific Diving have been developed to ensure that all scientific diving is conducted in a manner that will minimize scientific divers' exposure to risk for accidental injury or illness associated with diving, while optimizing the researchers' ability to conduct research. These Standards have been patterned after the American Academy of Underwater Sciences (AAUS) *Standards for Scientific Diving*, a document that has provided a template for scientific diving at most academic and research institutions in the United States over the last fifty years. The approach described in the AAUS standards has been recognized by the Occupational Safety and Health Administration (OSHA) as providing an effective means of protecting scientific divers (i.e., Code of Federal Regulations, 29.1910 Subpart T). Although OSHA does not have jurisdiction in Antarctica, the fact that the Scientific Diving Control Board

and these Standards for the Conduct of Scientific Diving meet OSHA requirements for scientific diving helps ensure the scientific diving program provides a framework of safety consistent with scientific diving in the United States.

There are inherent risks in diving and doing so in Polar Regions involves additional risks because of the environmental conditions and remoteness. These standards provide a structure within which to manage those risks and allow underwater diving in support of the scientific enterprise to proceed safely. Each scientific diver should acknowledge those risks and commit to conducting their underwater diving activities in accordance with this policy and directed procedures.

## **Scientific Diving Program Administration**

The OPP Scientific Diving Control Board falls under the administrative management of PESH and needs budget approval from PESH before initiating any travel or other actions (such as diving) that expend resources. The SDCB and diving safety officer (DSO) have been appointed to assist OPP by providing the technical expertise necessary to operate a scientific diving program in support of OPP's polar research mission. The SDCB members are primarily volunteers from other academic or research institutions, providing their expertise as "special government employees" during the period of their assignment.

## **Diving Eligibility**

OPP-funded or sanctioned research projects or related educational outreach activities can request underwater diving privileges under the auspices of the OPP scientific diving program. Diving may be authorized if the dive project meets the definition of scientific diving (see above), the dive plan follows this policy and directed SOPs, the participating divers are authorized to dive, and the operational requirements of the dive project can be met within the resources available. The OPP DSO will determine whether the dive plan and divers meet the requirements stipulated in this policy and SOP and can be authorized to dive. The PESH and programs, operations, and logistics managers will determine whether the overall operational support requirements of the specific research project (including the underwater component) can be met within current resource constraints.

## **Responsibilities**

Supervision and control of scientific diving operations shall be conducted as defined below.

### **Safety and Occupational Health Officer (SOHO)**

The SOHO is responsible for the safety of all USAP participants and is the administrative position to which the SDCB and the DSO report. The SOHO has ultimate responsibility over all phases of the dive program and its management. The DSO exercises responsibility over all technical components of the scientific diving program.

### **Scientific Diving Control Board (SDCB)**

The SDCB is a committee appointed by the OPP director to oversee the operational details of the scientific diving program. Members of the SDCB are selected based on their knowledge of and involvement in the scientific diving activities, preferably in Polar

Regions. The SOHO, DSO, and the support contractor supervisor of diving services serve as non-voting, ex-officio members of the Board. The SDCB has the responsibility to:

- Recommend changes to policy, changes in procedure, and amendments to this policy and SOP as the need arises;
- Establish and/or approve training programs through which applicants can satisfy the requirements of this policy and SOP;
- Develop guidance for safe diving activities (e.g., procedures, locations, conditions) in Antarctica;
- Recommend new equipment or techniques for polar use; and
- Perform other duties associated with USAP scientific diving, as listed in the SDCB charter.

### **OPP Diving Safety Officer**

The OPP DSO acts as a liaison between the SDCB and the research divers. The DSO has the authority to act on behalf of the SDCB in all diving matters, pending acceptance by the SDCB at their next meeting. The DSO typically represents OPP in technical matters concerning diving operations, diving safety, or projects utilizing diving as a tool in their research. The DSO has the responsibility to:

- Review and approve divers, diving plans, and diving locations submitted by the various research projects;
- Evaluate and recommend equipment for polar diving use;
- Recommend facilities to support scientific diving in polar regions; and;
- Recommend new diving techniques or procedures to further scientific diving as a research tool in Antarctica.

### **Home Institution Diving Safety Officer**

The home institution DSO oversees diving safety at the home institution, usually that of the principal investigator (PI), to which the scientific divers are affiliated. The home institution DSO acts in an advisory capacity to the OPP DSO, provides information on current scientific diver status under AAUS standards, and ensures that specialized training is provided to prepare individual divers for diving in Polar Regions. The home institution DSO certifies that the diver is current according to AAUS standards.

### **Contractor Supervisor of Diving Services**

The supervisor of diving services is responsible for maintaining the OPP-owned dive equipment provided on-site, conducting diving pre-season orientations, orienting new science teams to conditions on-site, providing supervision and instruction during local familiarization dives, and generally supporting all scientific diving activities. The supervisor of diving services has the authority to suspend diving operations if in his or her opinion they are unsafe or unwise, pending review by the DSO. Other oversight duties, authorities, and responsibilities may be assigned this individual by the OPP DSO or the SOHO.

## **Principal Investigator (PI)**

Generally, the PI acts as the lead diver, unless that authority is assigned to another more experienced diver in the project. The PI is responsible for ensuring all divers meet this policy's requirements and the operational requirements of the project.

The PI is responsible for ensuring maintenance of project-owned scuba equipment within 12 months for the following items (unless they are provided by the OPP):

- Regulator
- Buoyancy compensator
- Dry suit
- Dive computer and gauges

## **Lead Diver**

A project's lead diver is the person who has the diving experience, competency, responsibility, and reliability to conduct polar diving operations, and who has been designated responsible for managing the daily dive operations of the science team. The lead diver ensures that all divers in the team follow the procedures established in this policy and SOP.

## **Divers**

Divers are the individuals having the experience, training, and authorization necessary to dive under the auspices of the OPP.

## **Tenders**

Tenders are individuals who are trained to assist divers in their diving activities. They have no direct responsibility to intervene in diving operations. Tenders are assigned and trained by the supervisor of diving services and/or project's PI or lead diver.

# **Diving Control**

## **Diving Approval**

Upon the recommendation of the supervisor of diving services, the DSO determines whether a specific project's dive plan is consistent with the requirements of this policy and SOP, based on the information submitted by the PI, and if so, approves the dive plan. Likewise, the DSO reviews each diver's credentials and approves or disapproves the diver, as appropriate. All divers must meet the following criteria:

- Certification for one year
- 50 open water dives
- 15 dry suit dives
- 10 dry suit dives within twelve months of Antarctic dive operations, with at least one dry suit dive logged within the last six months

- Minimum depth certification of 100 feet of sea water (fsw) for the McMurdo area and 60 fsw for Palmer and research vessels, with at least one dive to the diver's maximum certification depth within the last twelve months
- Current certification in first aid, cardiopulmonary resuscitation (CPR), and oxygen administration

Divers may be required to perform checkout dives with a party designated by the OPP DSO before deployment. Diving approval may be revoked for any diver who does not demonstrate proficiency during the in-situ familiarization dives conducted by the OPP DSO or supervisor of diving services in the field.

## **Oversight of Diving Activities**

The SDS, the OPP DSO, and any member of the SDCB has the authority to suspend the diving privileges of any divers or dive team if, in his or her opinion, the divers are conducting themselves in a manner that is unsafe or inconsistent with this policy and SOP. Temporarily suspended diving privileges can be reinstated by the OPP DSO, subject to review by the SDCB and ultimate approval by the OPP SOHO.

## **Consequences of Violating Regulations**

Failure to comply with this policy and SOP may be cause for revocation or restriction of a diver's authorization to dive anywhere in the OPP's area of responsibility and authority.

# **Policies and Regulations**

## **Diver Qualifications**

In no case will individuals be allowed to dive under OPP auspices unless they are trained and proficient in the type of diving they plan to do and familiar with the equipment that they plan to use. Each diver shall have experience or training in the following:

- The use of instruments and equipment appropriate to the diving activity to be conducted;
- Dive planning and emergency procedures;
- CPR, diver rescue techniques, oxygen administration, and diving-related first aid;
- Diving-related physics and physiology and the recognition of pressure-related injuries; and
- Supplemental qualifications the SDCB may impose (e.g., the number of dry suit dives or other qualifications not required by AAUS).

## **Diver Health**

No dive team member shall be permitted to dive for the duration of any known condition likely to adversely affect the safety and health of the diver or other dive team members.

## **Solo Diving Prohibition**

All dives conducted under OPP auspices shall be executed in such a manner as to ensure that every diver involved maintains constant, effective communication with at least one

other comparably equipped, certified scientific diver in the water, except as permitted below. This buddy diver system is established to provide mutual assistance, especially in the case of an emergency. Dives should be planned around the competency of the least experienced diver. If effective communication is lost within a buddy team, then all divers shall surface and reestablish contact.

## **Diving Under Ceilings**

- The dive access hole must be clearly marked by deploying a secured downline with flags and strobe lights, and the opening must be maintained to allow a normal exit from the water. If additional holes are required, they must be similarly marked and maintained.
- Untethered diving is permitted, provided a downline is deployed and divers adhere to the buddy system, and provided diving is conducted in clear water with adequate visibility to permit clearly seeing the access hole or its downline from anywhere the divers will be during the course of the dive.
- The use of a tendered tether is required when visibility restricts the diver from clearly seeing the access hole or downline, when shallow water restricts the diver's ability to see the entry hole, or if a danger is present.
- Divers must carry with them two independent regulators: a primary and a backup. These regulators may be attached to the same or to separate air sources.
- A buoyancy compensator in conjunction with a dry suit is not required when diving with a downline that reaches the bottom at a diveable depth.
- All dives must be tended. Additionally, during periods of darkness, at least two lights powered by independent sources must be in the hole.

## **Dive Computers and Pressure Gauges**

All members of the diving team shall use an OPP-issued dive computer and a submersible, cylinder pressure gauge. Divers shall read and acknowledge understanding of the computer's manual, and all dives shall be planned and conducted within the computer's no-decompression limits.

## **Depth Limits**

- The diving certification issued by the diver's home institution will authorize the holder to dive to, but not exceed, his or her certification depth.
- Individuals are authorized to dive to either their depth certification from their home institution or to a depth specified by the OPPDSO, whichever is shallower. Minimum depth certification for the McMurdo area is 100 fsw and for Palmer and research vessels is 60 fsw. Dives that require staged decompression are not authorized.
- An OPP-authorized diver may only exceed his or her depth certification by one step under the following conditions:
  - If accompanied by a diver certified to a greater depth.
  - If an emergency situation makes this necessary.

## **Diver Recall**

A method of recalling the divers must be available at each dive site and understood by all divers and tenders.

## **Tended Diving with Communications**

Single divers using surface-supplied or tethered-scuba modes of diving may be deployed, provided the following requirements are met:

- A full-face mask or helmet is utilized;
- The system has a positive, two-way, voice-communication link;
- The system has a tether, air supply hose (if appropriate), and communication line;
- The diver has received a dive plan authorization number from the OPP DSO for this mode of diving to be used; and
- A fully equipped stand-by diver who is able to enter the water expeditiously is present.

## **Special Authorization**

Special authorization by the OPP DSO is required for:

- Surface-supplied diving.
- Blue-water diving.
- Rebreathers.
- Mixed gases/oxygen enriched air (Nitrox)

## **Diving Operations**

### **Pre-dive information**

Before conducting any diving operations, the PI must provide the following information in POLARICE or other communication option, as appropriate:

- The names of participating divers, their qualifications, and their depth certifications;
- The name, telephone number, and relationship of the person to be contacted for each diver, in the event of an emergency;
- The approximate number of proposed dives;
- The locations of proposed dives;
- The estimated depths and bottom times anticipated; and
- The proposed work, the equipment and/or boats to be employed, whether repetitive dives will be required, and details on any hazardous conditions anticipated.

## Lead diver

For each dive, one individual shall be designated as the lead diver. He or she shall be at the dive site during the diving operation. The lead diver shall be responsible for:

- Coordinating diving with other known activities in the vicinity that may interfere with the diving operation.
- Briefing the dive team members on:
  - Dive objectives;
  - Any unusual hazards or environmental conditions likely to affect the safety of the diving operation;
  - Any modifications to diving emergency procedures necessitated by the specific diving operation; and
  - The need to report immediately any physical problems or adverse physiological effects, particularly symptoms of pressure-related injuries.
- Planning the diving operation, which shall include considerations of the safety and health aspects of the following:
  - Diving mode;
  - Surface and underwater conditions and hazards;
  - Breathing gas supply;
  - Thermal protection;
  - Dive equipment ;
  - Dive team assignment;
  - Residual inert gas status of dive team members;
  - Decompression schedule and altitude corrections; and
  - Emergency procedures.

## Tenders

All dives conducted under the auspices of OPP shall be tended by personnel who shall remain on-site and at the surface during the course of the dive, and who are trained to tend that specific type of diving activity. At a minimum, tenders must be aware of emergency response procedures for the specific dive site, diver recall procedures, methods of extracting an unconscious diver from the water, and the location and use of the emergency oxygen kit.

## Pre-Dive Checks

Each diver shall conduct a pre-dive functional check of his or her diving equipment in the presence of the dive buddy or tender. This functional check shall include, but not be limited to, confirming:

- the cylinder valve positively opens and closes;
- the submersible pressure gauge works and registers the expected amount of air in the cylinder;
- the in-line shut-off valve on the primary regulator is in the open position;

- there is adequate air delivery and an absence of free flow (by inhaling but not exhaling on both primary and backup regulators);
- the dry suit inflator valve delivers air without free flow, and the dry suit exhaust valve vents air when open;
- the buoyancy compensator inflator valve delivers air without free flow, and the exhaust valve vents air when open;
- the integrity of mask and fin straps; and,
- any other gear operates according to specifications or expectations.

## Refusal to Dive

It is the diver's responsibility and duty to refuse to dive if in his or her judgment conditions are unfavorable, or if he or she would be violating the precepts of his or her training, USAP diving standards, or his or her home institution's diving manual.

## Agreement to Dive

No dive team member shall be required to be exposed to hyperbaric conditions against his or her will, except when necessary to prevent or treat a pressure-related injury.

## Terminating the Dive

A diver may terminate a dive at any time if he or she feels it would be unsafe to continue. Divers should begin terminating their dives by notifying their buddies of the termination, stopping work, and commencing ascent. Divers must be at their safety stops with no less than 20 cf of air (see Table 1) and must have exited the water with no less than 10 cf.

Examples of situations necessitating dive termination include:

- Environmental conditions that become unsafe.
- One or more divers becomes chilled.
- Cylinder gas volume approaches 20 cubic feet.
- Dive profiles approach required stage decompression.
- Equipment failure that immediately or potentially jeopardizes the safety of the diver.

**Table 1:** Minimum reserve pressures for selected cylinder configurations  
(cf = cubic feet; psig = pounds per square inch gauge)

Cylinder Type (cf)	Pressure at 20 cf (psig)	Pressure at 10 cf (psig)
Single Steel 95.1	600	300
Single Steel 110	500	250

## Equipment Requirements

- A functional oxygen kit shall be present at the dive site for every dive, and all participating divers and tenders shall be trained in its use.
- Each diver shall have a submersible pressure gauge that measures scuba cylinder pressure and can be monitored by the diver during the dive.

- Each diver shall have the capability of achieving and maintaining positive buoyancy.

## **Post-Dive Safety Checks**

After completing a dive, each diver shall report any physical problems, symptoms of decompression sickness, or equipment malfunctions to the lead diver, PI, and the SDS.

## **Emergencies - Deviation from Regulations**

Any diver may deviate from the requirements in this policy and SOP to the extent necessary to prevent or minimize a situation that is likely to cause death, serious physical harm, or major environmental damage. A written report of such actions must be submitted to the OPP SOHO, supervisor of diving services, and DSO explaining the circumstances and justifications for such action. Potentially dangerous diving incidents must be communicated to the on-site divers as soon as possible.

## **Dive Record Requirements**

### **Personal Diving Log**

Each diver shall log every dive. Completed log sheets shall be submitted to the supervisor of diving services or other approved representative, who will forward them to the DSO. If an emergency causes a diver to incur a staged decompression obligation, this shall be noted in the log. The log shall be in a form specified by OPP and shall include at least the following:

- Dive date;
- Names of diver and partner;
- Total dive time;
- Maximum depth attained;
- Location of dive;
- Dive computer used;
- Regulator used;
- Mixed gas composition and tables, if used;
- Mode of diving (scuba, surface supply);
- Safety stop depth and time; and,
- Any accidents, equipment failures, or dangerous incidents occurring during the dive.

### **Record Maintenance**

The supervisor of diving services and USAP shall maintain records for each authorized scientific diver, including these items for at least the specified period:

- Record of dive - one year, except five years if there has been a pressure-related injury;
- Pressure-related injury assessment - five years;

- Records of hospitalization - five years;
- Equipment inspection and testing records - current entry or tag, or until equipment is withdrawn from service.

## **Availability of Records**

Institutional DSO's are required by AAUS standards to maintain certain permanent records. Divers must agree to the release of that information deemed necessary for the DSO to make a reasonable safety and health judgement regarding the diver's qualifications to dive. Failure to provide sufficient information may result in the denial of the OPP diving authorization.

## **Dive Accident Reporting**

The diving program has an official and valid interest in all diving incidents and accidents. Analysis of incidents is important so that causes can be determined and corrected to prevent future occurrences and/or injuries that may impact diving readiness and authorizations.

The supervisor of diving services and/or McMurdo or Palmer Station medical personnel shall report to the DSO any diving-related injury or illness that requires any dive team member to be hospitalized for 24 hours or more, or any episode of unconsciousness related to diving activity. The circumstances of the incident and the extent of any injuries or illnesses shall be specified to the extent allowable by patient privacy regulations, taking into account the program's legitimate requirement to know the physical readiness of all divers to safely dive. The DSO shall maintain these records, which shall also contain:

- A description of symptoms - including depth and time of onset;
- A description and results of treatment;
- A printout of the relevant dive computer profile(s);
- A dive history for the previous seven days; and
- Any history of flying within those seven days.

The supervisor of diving services and the DSO shall prepare a report of any diving accident requiring recompression or resulting in a serious injury, e.g., decompression sickness or gas embolism, and shall notify the OPP SOHO and the diver's home institution DSO.

Incidents that do not involve injuries, e.g., free-flows and other equipment malfunctions, shall be recorded in the dive log.

## **Diving Equipment**

### **Equipment maintenance**

The USAP issues regulators and dive computers for use by scientific divers. This equipment shall be maintained according to manufacturer's specifications. The PI is responsible for ensuring that all grantee-owned scuba equipment has been provided regular maintenance within the past 12 months.

## Equipment inspection

All inspections, tests, maintenance, and record keeping referred to in this section must be performed by the supervisor of diving services or other approved individual.

## Equipment records

Each equipment modification, repair, test, calibration, or maintenance service shall be logged for the equipment listed below. The logs shall include the date and nature of work performed, serial number of the item, and the name of the person performing the work.

Compressors	Submersible pressure gauges
Regulators	Depth gauges
Scuba cylinders	Cylinder valves
Diving helmets	Dive computers
Gas control panels	Air storage cylinders
Air filtration systems	Dry suits

## Breathing masks and helmets

Breathing masks and helmets shall have:

- A non-return valve at the attachment point between helmet or mask hose, which shall close readily and positively;
- An exhaust valve; and
- A minimum ventilation rate capable of maintaining the diver at the diving depth.

## Scuba Air Cylinders

Scuba cylinders:

- Shall be designed, constructed and maintained in accordance with provisions of the applicable Unfired Pressure Vessel Safety Orders;
- Must be hydrostatically tested in accordance with Department of Transportation (DOT) standards; and
- Must have an internal visual inspection before they are issued for use, and thereafter at intervals not to exceed 12 months, or sooner if they are suspected of having internal moisture.

## Scuba cylinder valves

Cylinder valves shall be functionally tested at intervals not to exceed 12 months.

## Backpacks and weight systems

Backpacks and weight systems shall be regularly examined by the persons using them. When used in open water, all weight systems and scuba backpacks worn by the diver shall be equipped with quick release devices designed to permit jettisoning of the gear. The quick release device must operate easily with a single motion from either hand.

## **Pressure gauges**

Gauges shall be inspected and tested before the first use of the season, and thereafter as necessary.

## **First Aid Supplies**

Both oxygen and a first-aid kit adequate for the diving operation shall be available at the dive location. When used in a hyperbaric chamber or bell, the first-aid kit shall be suitable for use under hyperbaric conditions.

## **Underwater Tools**

Hand-held electrical tools and equipment used under water shall be specifically approved for this purpose, and they shall not be supplied with power until requested by the diver.

## **Auxiliary Equipment**

Any auxiliary equipment may be subject to approval by the SDCB.

## **Breathing Air Standards**

Breathing air for scuba shall meet Compressed Gas Association (CGA) Grade E air quality standards.

## **Compressor Systems**

- Low pressure compressors used to supply breathing air shall be equipped with a volume cylinder, with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.
- Compressed air systems over 500 psi shall have slow-opening shut-off valves.
- All air compressor intakes shall be located away from areas containing exhaust or other contaminants.

## **Compressor Operation and Test Records**

- Gas analysis and air tests shall be performed on breathing air compressors by the supervisor of diving services or other approved representative at regular intervals of not more than 100 hours of operation or 6 months, whichever occurs first. The results of these tests shall be entered in a formal log and be maintained by the supervisor of diving services.
- A log shall be maintained by the supervisor of diving services or other approved representative showing any operation, repair, overhaul, filter maintenance, or temperature adjustment for each compressor.

## **Oxygen Safety**

- Equipment used with oxygen or mixtures containing over forty percent (40%) oxygen by volume shall be designed and maintained for oxygen service.

- Components (except umbilical) exposed to oxygen or mixtures containing over forty percent (40%) oxygen by volume shall be cleaned of flammable materials before being placed in service.
- Oxygen systems over 125 psig shall have slow-opening shut-off valves.

## **Construction or O&M Diving**

### **Background**

Though not as frequently executed as scientific diving, there are occasions where O&M or even construction diving is required. This type of diving presents additional hazards as compared to scientific diving, such as underwater welding, crane hazards, electrical hazards, and pressure differentials that create sucking forces, among others. Many of these hazards require lockout/tag-out procedures.

### **Procedures**

- Compliance is required with all requirements in 29 CFR 1910.410.
- All administrative steps required for scientific diving shall also be complied with for O&M and construction diving, to include submission of a dive plan to the OPP for review and approval before the dive.
- An activity hazard analysis (AHA) shall be completed for each working dive and shall be reviewed by the dive supervisor on-site before the dive. All members of the dive team shall sign the AHA, indicating they understand the hazards and the controls that will be utilized to mitigate risk.
- Safety training, as required by OSHA for specific activities, such as welding and lockout/tag-out, shall be provided to dive team members as needed, and it shall be documented. In addition, the divers must have experience performing similar types of underwater work in the past, e.g., welding.

## Appendix 13: Fall Protection

### Purpose

This appendix provides the requirements for fall protection and applies to both contractors and researchers throughout the OPP. Falls are one of the leading causes of work fatalities and managing this risk is imperative to the success of the OPP science mission.

### References

- 29 CFR 1910, Subpart D Walking-Working Surfaces
- 29 CFR 1926 Subpart M Fall Protection

### Policy

All contractors are responsible for establishing, implementing, and managing a fall protection program that complies with this policy, 29 CFR 1910 Subpart D, and 1926 Subpart M, and they should supplement this policy appendix and these regulations with their own standard operating procedures.

1. The fall protection threshold height requirement is six feet (1.8 meters) for ALL work and research, unless specified differently below. This includes steel erection activities, systems-engineered activities, prefabricated metal building erection, residential construction, and scaffolding work.
2. Fall protection also applies to all OPP-owned or operated permanent facilities with open-sided floors, platforms or unprotected edges four feet (1.2 meters) or more above adjacent floor or ground level.
3. Workers or researchers exposed to fall hazards shall be protected from falling to a lower level by the use of standard guardrails, work platforms, temporary floors, safety nets, engineered fall protection systems, personal fall arrest systems, or the equivalent, in the following situations:
  - A. Whenever workers or researchers are exposed to falls from unprotected sides or edges, access ways, fixed ladders over 20 feet (6 meters) in height, unprotected roof edge or floor openings, holes and skylights, unstable surfaces, leading edge work, scaffolds, formwork, work platforms, re-bar assembly, steel erection and engineered metal buildings;
  - B. Whenever workers or researchers operate on access ways or work platforms over water or ice, machinery, or dangerous operations;
  - C. When workers are installing or removing sheet piles, h-piles, cofferdams, or other interlocking materials from which they may fall six feet (1.8 meter) or more;
  - D. Wherever there is a possibility of a fall from any height onto dangerous equipment, into a hazardous environment, or onto an impalement hazard;
  - E. Whenever connectors are working at the same connecting point (for steel erection activities), they shall connect one end of the structural member before going out to connect the other end. The connectors shall always be tied off 100%.

4. The order of control measures (the hierarchy of controls) to abate fall hazards or to select and use a fall protection method to protect workers and researchers performing work or science at heights shall be:
  - A. Elimination**

Remove the hazard from work areas; change the task, process, or controls; or use other means to eliminate the need to work at heights, with its subsequent exposure to fall hazards (i.e. build roof trusses on ground level and then lift into place, or design a change by placing a meter or valve at a lower level). This control measure is the most effective.
  - B. Prevention** (passive or same-level barrier)

Isolate and separate fall hazards from work or research areas by erecting same-level barriers, such as guardrails, walls, covers, or parapets.
  - C. Work platforms** (movable or stationary)

Use scaffolds, scissor lifts, work stands, or aerial lift equipment to facilitate access to work or research locations and to protect personnel from falling when performing work at high locations.
  - D. Personal Protective Systems and Equipment**

Use fall protection systems, including (in order of preference) restraint, positioning, or personal fall arrest. All systems require the use of full body harness, a means of connecting, and a safe anchorage system.
  - E. Administrative Controls**

Introduce new work practices that reduce the risk of falling from heights or warn people to avoid approaching a fall hazard (i.e. warning systems, warning lines, audible alarms, signs, or training for workers and/or researchers to recognize specific fall hazards).

## Appendix 14: Research Safety

### Purpose

The purpose of this appendix is to ensure risk is managed during research so that researchers and those in the vicinity of researchers (OPP personnel, contractors, and others) are not put at risk by research activities.

### Policy

OPP recognizes that universities and institutions are ultimately responsible for the safety of their research teams and the teams' activities. However, since research is funded by OPP, compliance with the below is required so that research teams do not put themselves, their research assistants, or any others in the vicinity of research activities (OPP contractors, DoD assets, OPP personnel, among others) at risk of fatality or serious injury which if was to occur, would require OPP to expend resources in order to assist with the emergency response following such an incident.

Bottom line, OPP expects safety to be a top priority during any government funded activity no matter what the activity and research is no different.

1. All grantees shall comply with the Code of Conduct for each program. Non-compliance could result in removal from the field and prohibition from future grants.
2. Research proposals shall be reviewed for safety integration by both the PESH office and the contractor safety office. Risk shall be identified and recommendations made to the university or institution from which the research proposal came (and preferably the institution's risk management or safety office) so that control measures can be implemented before the research teams deploy. This proactive approach to safety needs to be thorough and may require consultation with technical safety experts not commonly associated with the proposal process depending on the activity (e.g. radiation or drilling activities).

Before such deployment, OPP science program managers shall have teleconferences with the PIs and the university risk management office (or whoever at the university is responsible for the research team if available) to remind them of OPP's anonymous safety reporting process (phone call or email direct to the PESH Safety Officer with no name required- [jfentres@nsf.gov](mailto:jfentres@nsf.gov) or 703-407-0840) and to communicate clearly the OPP expectation for safety in the field. During this call, a *request* shall be made that accidents be reported so evaluation can occur and recommendations for hazard mitigation provided. The process of accident reporting will be reviewed during this teleconference. At the end of the season, this incident information shall be compiled by PESH (trend analysis) and shared among research universities and institutions so that lessons learned are shared.

3. Researchers should include in their proposals any need for a weapon or bear guard (Arctic only). For researchers who choose to bring their own weapons, they shall identify this to the OPP before they arrive on-site, and they shall have taken a recognized weapons training course specific to the weapon in question within the last three years. Weapons and ammunition shall be stored separately and in proper casing. Contractors shall write up SOPs covering specifics on this topic, and after OPP approval, they shall be considered an extension of this policy.

4. Diving risk shall be managed according to the diving section of this document.
5. Any researchers using radioactive materials need approval by a qualified Radiation Safety Officer. Both the OPP science program manager and PESH shall be made aware of this PRIOR to the arrival of the radioactive materials on-site.
6. Transporting hazardous materials shall be in accordance with DOT requirements, as able.
7. Lab safety will be in accordance with OSHA, EPA, NRC, DOT or any other federal safety standard unless a more stringent local requirement exists.
8. Remote field camps and expeditions shall prepare a preliminary hazard analysis before arrival to identify controls needed to mitigate risks, such as medical support, expert field guides, bear guards (Arctic only), and emergency equipment and planning.
  - a. All tents using heaters shall have a functioning carbon monoxide detector.
  - b. All tents using cooking equipment shall have a functioning carbon monoxide detector with proper ventilation of smoke or other fumes.
9. All accidents *should* be reported in accordance with the accident reporting section, so that incident trends can be tracked to improve the safety of future researchers.
10. When feasible, OPP field science managers and contractor safety (or contractor field safety) should visit field research sites (spot check) in order to ensure safety is being implemented as described in the proposal or other safety plan.

## Appendix 15: Vehicles, Machinery, and Equipment

### Purpose

The polar environment presents additional risk of injury or fatality when operating vehicles, machinery, and equipment, so risk must be managed effectively. The extreme cold can hamper equipment and machinery function and can present traction challenges (as well as the hazard of a vehicle falling through the ice). The purpose of this policy appendix is to reduce this serious risk.

### Applicability

This policy applies to all vehicles, machinery, and equipment owned by OPP or operated in support of OPP operations. Compliance with state and host nation laws is also required, with the most stringent requirements prevailing.

### Policy

#### General Requirements

Every person operating machinery and mechanized equipment, all-terrain vehicles (ATVs), unmanned vehicles (UVs), or other specialty (snow) vehicles shall be properly trained, qualified (by license, certificate, or permit), and designated by the employer in writing to operate such equipment. Proof of qualification and/or competence to operate equipment (such as a certificate or permit) shall be available for government review at the work location.

#### Inspections, Tests, Maintenance, and Repairs

- Inspections, tests, maintenance, and repairs shall be conducted by a qualified person, in accordance with the manufacturer's recommendations.
- Before initial use, vehicles not otherwise inspected by state or local authorities shall be inspected by a qualified mechanic and determined to be in safe operating condition and in compliance with all required vehicle safety standards. This one-time inspection shall be documented and available for review at the work site.
- All vehicles and equipment shall be inspected on a scheduled maintenance program.
- Before each use, but not more than daily, vehicles and equipment shall be checked by the operator to ensure the following parts, equipment, and accessories (as applicable) are in safe operating condition and free of apparent damage that could cause failure while in use:
  - Service brakes, including trailer brake connections
  - Parking system (hand brake)
  - Emergency stopping system (brakes)
  - Tires
  - Horns
  - Steering mechanism

- Coupling devices
- Seat belts
- Operating controls
- Safety devices (e.g. back up alarms and lights, fire extinguishers, first-aid kits, window punch, seatbelt cutter)
- Accessories, including lights, reflectors, windshield wipers, and defrosters, where such equipment is necessary

## **Guarding and Safety Devices.**

### **Lights**

When visibility is limited or when work is conducted in darkness, additional portable lighting shall be utilized where practicable, and all vehicles shall have functioning headlights and tail lights.

### **Reverse signal (back-up) alarm**

- All self-propelled construction and industrial equipment, dump trucks, and cargo trucks for which the trailer/body permanently blocks the view to the rear, whether moving alone or in combination, shall be equipped with a back-up alarm.
- Equipment designed and operated so that the operator is always facing the direction of motion does not require a back-up alarm.
- Back-up alarms shall be audible and sufficiently distinct to be heard above surrounding noise level.
- Alarms shall operate automatically upon commencement of backward motion and shall operate throughout the entire backward motion.
- Commercial cargo vehicles (such as pick-up trucks, utility cargo or tool trucks, and flatbed cargo trucks intended for roadway use) that have a normally clear view through the rear window are not required to have back-up alarms. If the view is temporarily obstructed by a load or permanently blocked by a utility or tool box or other modification, then a signal person may be used if the value outweighs the risk, as determined by an AHA. In lieu of a signal person, a backup alarm must be installed.
- Removing or disabling a back-up alarm is strictly prohibited.

### **Guarding**

- All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or moving parts of equipment shall be guarded when exposed to contact by persons or when they otherwise create a hazard.
- All hot surfaces of equipment, including exhaust pipes or other lines, shall be guarded or insulated to prevent injury and fire.

- Substantial overhead protection shall be provided for the operators of forklifts and similar material handling equipment.
- A safety tire rack, cage, or equivalent protection shall be provided and used when inflating, mounting, or dismounting tires on split rims or on rims equipped with locking rings or similar devices.
- No guard, safety appliance, or device shall be removed from machinery or equipment, or made ineffective, except for making immediate repairs, lubrications, or adjustments, and then only after the equipment has been de-energized and a hazardous energy control program (lockout/tag-out) implemented. All guards and devices shall be replaced immediately after repairs and adjustments are completed and before power is turned on.
- Seatbelts must be worn in all motor vehicles where the manufacturer has installed them. Seatbelts that have been damaged or removed shall be replaced immediately and meet the requirements of 49 CFR 571 and/or Society of Automotive Engineers (SAE) Standard J386.

#### **Falling Object Protective Structures (FOPS):**

- All bulldozers, tractors, or similar equipment used in clearing operations shall be provided with guards, canopies, or grills to protect the operator from falling and flying objects, as appropriate to the nature of the clearing operations.
- FOPs for other construction, industrial, and grounds-keeping equipment will be furnished when the operator is exposed to falling object hazards.
- FOPs will be certified by the manufacturer or licensed engineer as complying with the applicable recommended practices of SAE Standards J231 and J1043.

#### **Operating Rules**

- Only cellular phones with hands-free devices may be used in moving vehicles.
- Text messaging while operating a moving vehicle is strictly prohibited.
- Using portable headphones, earphones, or other listening devices (except for hands-free cell phones) while operating a motor vehicle is prohibited.
- Operators of motor vehicles shall not smoke or drink alcohol while the vehicle is in motion (nor should alcohol be consumed at any point during the workday).
- GPS or other personnel locating systems shall be considered (and vetted and approved by the responsible OPP program manager) for all moving vehicles, including snowmobiles, so that operators can find their way back in inclement weather or can be located in an emergency.
- Vehicles shall not be driven at speeds higher than necessary to accomplish the mission without increasing risk (such as impending severe weather, where increasing speed slightly might be life-saving, based on a risk assessment).

- No vehicle or combination of vehicles hauling unusually heavy loads or equipment shall be moved until the driver has been provided with the required permits (as applicable), the correct weights of the vehicles and load, and a designated route to be followed.
- When maneuvering or performing back-up operations, operators will take precaution. If a signal person or spotter is not used (or not available), operators will walk behind their vehicle to view the area for possible hazards or obstructions before performing back-up operations. All vehicle incidents that occur as a result of backing operations shall be tracked by the operator, and a process to improve operations will be established, documented in a SOP, and implemented, particularly for operators with repeat incidents.
- For snowmobiles, ATVs, or other types of specialty vehicle, a driver qualification and training program shall be established specific to the vehicle. In addition, a SOP that includes, at a minimum, safe operations, limits of operational work areas, required PPE (such as helmets, which are required for snowmobiles), and vehicle safety equipment requirements shall be established for all such vehicles.
- Personnel who are involved in vehicle incidents where there is damage more than what would be considered minor (such as a fender bender), shall be cleared by a medical professional (paramedic or nurse, at a minimum) before operating another motor vehicle and/or returning to duty. Vehicle incidents that occur in remote locations without medical support would be exempt from this policy, but operators should consider obtaining a medical evaluation upon returning to an area where medical support is available. The employee shall not be responsible for paying for this medical clearance, where payment is expected.

## **Appendix 16: Snowmobile/ATV Helmet and Training**

### **Purpose**

The purpose of this appendix is to establish a uniform policy on the use of snowmobile and all-terrain vehicle (ATV) helmets.

### **Applicability**

The policy applies to all OPP participants.

### **Policy**

All participants operating a snowmobile or ATV, or riding on a sled towed by a snowmobile or ATV, shall wear a helmet. The helmet must be approved by the Department of Transportation (DOT) or Snell Foundation for snowmobile or ATV use. Climbing and rigging helmets are permitted in limited circumstances for personnel in transit during tower inspection and maintenance.

All participants using a snowmobile or ATV shall be trained on the equipment used. Training shall take into account the terrain to be accessed (e.g. side of a mountain or volcano). Only personnel needing to use snowmobiles or ATVs for mission activities, and for which such use is approved by their supervisory chain, shall operate them. Speed shall be the minimum needed to accomplish the operation.

### **Enforcement**

Strategies for enforcement shall be written into SOPs to support this policy, and failure to comply will be handled proactively.

## **Appendix 17: PESH Forms**

The PESH forms on the following pages may be printed out and used. Contractor-developed forms may be used in lieu of the first three forms, provided the contractor forms contain the same information, at a minimum:

PESH-FORM_2000.10-1	Fire Prevention Checklist for Administrative Occupancies
PESH-FORM_2000.10-2	Confined Space Entry Permit
PESH-FORM_2000.10-3	Activity Hazard Analysis

The following form must be used as it is, with no substitution permitted:

PESH-FORM_2000.10-4	Safety Requirement Waiver/Variance Request Form
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## Fire Prevention Checklist for Administrative Occupancies

**Instructions:** An occupant appointed by the supervisor completes the checklist monthly for each building. Maintain in file for one year. Corrective actions should be noted on reverse side.

Section: \_\_\_\_\_ Date: \_\_\_\_\_

1. Are emergency phone numbers posted? \_\_\_\_\_
2. Are hallways and stairs free of obstructions? \_\_\_\_\_
3. Areas near heating appliances free of combustibles? \_\_\_\_\_
4. Are fire extinguishers visually inspected and operating instructions attached? \_\_\_\_\_
5. Do all electrical fixtures and appliances appear to be in a safe condition? \_\_\_\_\_
6. Are extension cords UL or CE listed? \_\_\_\_\_
7. Are extension cords overloaded? (No more than three items may be plugged into a non-circuit breaker protected extension cord.) \_\_\_\_\_
8. Are appliances located on a noncombustible base and unplugged if not in use? \_\_\_\_\_
9. Are exit lights and emergency illumination operational? \_\_\_\_\_
10. Are exits and exit doors free of obstructions and unlocked during hours of operation? \_\_\_\_\_
11. Is the building fire alarm system operational? \_\_\_\_\_
12. Are transformers unplugged if attached equipment is not in use? \_\_\_\_\_

\_\_\_\_\_  
Printed name of inspecting person

\_\_\_\_\_  
Signature of inspecting person



## Confined Space Entry Permit

**Instructions:** A confined space entry permit can be in whatever format desired, but the information listed on this form must be included, at a minimum. This permit may be used in lieu of a contractor-developed form.

Location of space \_\_\_\_\_

Description of space \_\_\_\_\_

Employee authorizing entry \_\_\_\_\_ Date \_\_\_\_\_

Purpose of authorization \_\_\_\_\_

Entry authorized from (time) \_\_\_\_\_ to \_\_\_\_\_ Date \_\_\_\_\_

Authorized entrants \_\_\_\_\_

Authorized attendant(s) \_\_\_\_\_

### SPACE HAZARDS AND CONTROLS

Asphyxiation: oxygen deficiency  chemical  engulfment

Flammable/explosive: dust  chemical  (specify) \_\_\_\_\_

Toxic: chemical  (specify) \_\_\_\_\_

Unauthorized activation: mechanical \_\_\_\_\_ electrical \_\_\_\_\_

**The confined space shall be isolated or potential hazards controlled by:**

Depressurization  Purging and cleaning pipe  Lockout/tagout

Blanking/capping pipe  Other  (specify) \_\_\_\_\_

Rescue services/equipment are available: on-site  outside

Communication equipment/procedures to be used:



The following personal protective equipment have been assigned to, and shall be worn by, entrants:

Hot work [may]/[shall not] be conducted in this space.

If hot work is permitted, the following controls shall be utilized:

### **TESTING AND MONITORING**

The space has an oxygen content of \_\_\_\_\_ and is [safe]/[unsafe]

The space has been monitored and contains the following concentration of toxic hazards:

carbon monoxide \_\_\_\_\_

hydrogen sulfide \_\_\_\_\_

other (specify) \_\_\_\_\_

The space has been tested and contains the following percentages of lower flammable limit of flammable/explosive chemicals (specify):

Monitoring will be conducted: continuously  or at intervals

**AUTHORIZATION:** All actions and conditions necessary for safe entry to, work in, and exit from the confined space have been performed. Entry is permitted on the date and time, and for the duration, specified above.

\_\_\_\_\_  
(Signature of individual authorizing entry)

**CANCELLATION:** All entrants have exited the confined space and this permit is canceled.

\_\_\_\_\_ Time \_\_\_\_\_  
(Signature of individual authorizing entry)



## Activity Hazard Analysis

**Instructions:** Contractors may develop and use their own Activity Hazard Analysis form, provided it contains the information listed below, at a minimum. Otherwise, this form may be used.

1. Contract No.	2. Project	3. Facility
4. Date	5. Location	6. Estimated Start Date
7. PRINCIPAL STEPS	8. POTENTIAL HAZARDS	9. RECOMMENDED CONTROLS
10. EQUIPMENT TO BE USED	11. INSPECTION REQUIREMENTS	12. TRAINING REQUIREMENTS
Risk assessment code (RAC) based on probability of an incident occurring and severity of loss if one occurs (Low-Med-High):		
13. Contractor (Signature & Date)		
14. If RAC medium or high, signature of NSF representative on site, or if none, appropriate NSF program manager/ABM remote:  _____		15. NSF ABM:  (Signature & Date)



# National Science Foundation/Office of Polar Programs Safety Requirement Waiver/Variance Request Form

## WAIVER INFORMATION

PROJECT: [Click here to enter text.](#) DATE: [Click here to enter a date.](#)

SUBJECT: [Click here to enter text.](#)

### 1. SAFETY REQUIREMENT AND/OR CODE REQUIREMENTS TO BE WAIVED:

[Click here to enter text.](#)

### 2. SAFETY REQUIREMENT/STANDARD/CODE REFERENCES:

[Click here to enter text.](#)

### 3. DEFINE WHETHER A TEMPORARY OR PERMANENT VARIANCE IS BEING REQUESTED:

- EXPLAIN WHAT LENGTH OF TIME IS REQUIRED AND WHY;
- IS THE REQUEST A WAIVER OF REQUIREMENT, A DELAY OF IMPLEMENTATION OR A SUGGESTION OF AN ALTERNATIVE SOLUTION?

[Click here to enter text.](#)

### 4. RATIONALE FOR WAIVING THE SAFETY REQUIREMENT/STANDARD/ CODE

#### A. GIVE A COMPLETE EXPLANATION DEFINING THE NECESSITY OF THE VARIANCE:

- AN EXPLANATION OF THE CURRENT OR PROPOSED CONDITION;
- WHY IT DOES NOT CONFORM WITH THE RULE;
- WHAT WOULD BE NECESSARY TO COMPLY WITH THE RULE;
- BACKGROUND INFORMATION ABOUT THE CONDITION;
- HOW IT HAS AFFECTED LIFE, HEALTH AND SAFETY

[Click here to enter text.](#)



B. PROVIDE DEFINITIVE INFORMATION AS TO WHY THE VARIANCE CAN BE GRANTED WITH NO ADDITIONAL OR UNDUE THREAT TO THE HEALTH AND SAFETY OF THE PUBLIC, SUCH AS:

- OPERATIONAL HISTORY;
- HISTORY OF SIMILAR CONDITIONS;
- EXPERT TESTIMONY; OR,
- AN ALTERNATIVE SOLUTION TO PROTECT THE PUBLIC.

[Click here to enter text.](#)

5. RECOMMENDED ALTERNATIVE MEANS TO ACHIEVE EQUIVALENT PROTECTION

- PROCESS, PROCEDURE, OR EQUIPMENT TO BE IMPLEMENTED;

[Click here to enter text.](#)

6. HAZARD ANALYSIS EVIDENCING RISK MITIGATION AND IDENTIFICATION OF RESIDUAL RISK :

- NEED IDENTIFY RISK IN CURRENT STATE;
- NEED TO IDENTIFY RISK AFTER IMPLEMENTATION;
- NEED TO IDENTIFY RESIDUAL RISK AFTER IMPLEMENTATION

[Click here to enter text.](#)

7. COST ESTIMATE

- INCLUDE ALL COSTS ASSOCIATED (PLANNING,PROCUREMENT, SHIPPING, INSTALLATION, O&M, OTHER)
- PLEASE ADD A NOTE ABOUT LIFE EXPECTANCY IF EQUIPMENT/REPAIR INCLUDED

[Click here to enter text.](#)



**PEER REVIEW AND RECOMMENDATION**

**PEER REVIEW COMMENTS:**

Click here to enter text.

Click here to enter text.

REVIEWER ELECTRONIC SIGNATURE

Click here to enter a date.

DATE

RECOMMENDATION:  CONCUR  DO NOT CONCUR

**NATIONAL SCIENCE FOUNDATION (NSF) APPROVAL**

**NSF COMMENTS:**

Click here to enter text.

Click here to enter text.

AUTHORITY HAVING JURISDICTION (AHJ) ELECTRONIC SIGNATURE

Click here to enter a date.

DATE

NAME: Click here to enter text. TITLE: Click here to enter text.

