



National Optical Astronomy Observatory

Kitt Peak National Observatory • Cerro Tololo Inter-American Observatory • NOAO Gemini Science Center

Doc #: 1000-AD-015-0031

Revision: -

NOAO-N Environmental, Health & Safety Manual

Author(s): Tammie Lavoie, Miranda Saucedo

950 North Cherry Avenue, Tucson, Arizona 85719 • P.O. Box 26732, Tucson, Arizona 85726
www.noao.edu • Phone: 520.318.8000

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REVISION HISTORY

Rev	Date Approved	Sections Affected	Reason for Change Remarks and/or Change Details	Name
--	03/08/18		Initial Release	T. Lavoie

Approved by:

 Name, Facilities Manager

 Name, Mountain Supervisor
Tammie Lavoie

Tammie Lavoie, Safety Manager

8 March 2018

Date

1.0 INTRODUCTION

The intent of this manual is to increase the work skills and safety knowledge of all employees, minimize loss due to accidents, and help the company operate in compliance with state and federal regulations.

2.0 PROGRAM DESCRIPTION

This manual has been developed from the experience of many people, through publications available from OSHA, other regulatory authorities, and other references. It is not all-inclusive and serves as a guide. You will find useful checklists throughout this manual to help you comply with company policy and regulatory requirements. Some topics may not apply to your work, after the introductory sections, specific topics are in alphabetical order to help you find topics that do apply.

This manual is available online at <http://www.noao.edu/noaolocal/safety/>. Employees are encouraged to become familiar with this manual and the work activities addressed therein. Questions, comments and suggestions concerning this manual should be directed to the Safety Manager's Office in Tucson at extension 8211, or 520-318- 8211.

3.0 INDUSTRIAL HYGIENE

Industrial Hygiene is a science and art devoted to the anticipation, recognition, evaluation, prevention, and control of those environmental factors or stresses arising in or from the workplace which may cause sickness, impaired health and well-being, or significant discomfort among workers or among citizens of the community. Industrial Hygiene is an essential component of the company's safety and health system. The goal is to prevent occupational disease or injury through the recognition, evaluation, and control of occupational health hazards. We are concerned about your health, as well as your physical safety at work. We must all share the responsibilities of maintaining a work place where the risks of occupational disease are controlled.

- 3.1 Each employee is responsible for contributing his or her part towards the success of the industrial hygiene program. This includes the following:
 - 3.1.1 To notify the supervisor immediately when conditions or practices can cause personal injury or property damage that you cannot correct due to lack of resources and/or training.
 - 3.1.2 To observe all safety and health rules and to make maximum use of all prescribed personal protective equipment, and to follow practices and procedures established to maintain health and safety.
 - 3.1.3 To report immediately an accidental exposure to harmful chemicals or materials.
 - 3.1.4 To practice good habits of personal hygiene and housekeeping.

- 3.2 Knowledge is the key in protecting your health and safety. Learn about the potential health risks in your work environment through formal and informal classes and meetings, job procedures and job hazard analysis. In addition, safety and health standards provide information directed toward maintaining a safe and healthy work place. The education and training will provide you with information on the following:
 - 3.2.1 Identification of the health risks - what is out there, how much, and how much exposure risk.
 - 3.2.2 Where to find additional information on hazardous substances, such as safety data sheets.
 - 3.2.3 What to do in the case of an emergency.
 - 3.2.4 Provides you the opportunity for discussion and questions.
 - 3.2.5 Describes what steps your employer is taking to protect your health.
 - 3.2.6 Describes what steps you can take to protect yourself, your fellow employee, and your family.

4.0 ENVIRONMENTAL, HEALTH & SAFETY (EHS) POLICY

We are committed to providing employees, contractors, visitors and observers with a safe and healthy work environment. In pursuit of this goal, managers and supervisors are tasked with ensuring that work conducted in their area does not pose a potential risk to the health and well-being of the assigned personnel.

Employees have a key role in this program by maintaining a safety conscious work attitude. Unsafe conditions or health and safety concerns should be reported to the supervisor or the Safety Manager immediately. Employees involved in any activity that could reasonably be considered to pose a serious threat to life or health have the right, under OSHA regulations, to cease work until the condition can be reviewed and abated.

- 4.1 To support the EHS Manual, the following are established and proven safe operating objectives:
 - 4.1.1 Safety is a value associated with every priority.
 - 4.1.2 Prevention is our focus.
 - 4.1.3 All accidents are preventable.
 - 4.1.4 Compliance without compromise to regulatory standards.
 - 4.1.5 Employee involvement is key to continuous improvement in safety performance.
 - 4.1.6 No job is so important that it will be done at the expense of your safety.
 - 4.1.7 Make safety communication a part of our daily activities.
 - 4.1.8 To create a partnership with our employee, contractors, visitors and observers in safety and health management

- 4.2 The purpose of this policy statement is to highlight the importance we attach to ensuring that proper environmental, health & safety conditions are maintained throughout the National Optical Astronomy Observatory (NOAO).

5.0 SAFETY & HEALTH LEGISLATION AND REGULATIONS

OSHA's Mission: With the Occupational Safety and Health Act of 1970, Congress created the Occupational Safety and Health Administration (OSHA) to assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance. OSHA, works with companies to assure a safe and healthy work environment for employees. They set safety standards and procedures for employees to follow to make the company a safer organization.

- 5.1 NOAO acknowledges that both Federal and State legislation and regulations are designed to ensure that employers provide a safe and healthy workplace and that employees use the safety devices provided and follow the safety rules and procedures. In summary, safety laws are for your protection.

As an employee of the company, it is your responsibility to learn and follow these standards and procedures.

- 5.2 SAFE WORK - NOAO management is committed to improve the safety and health of all employees. Safety standards, rules and regulations apply to all employees, contractors and visitors. Everyone shares the responsibility to work safely by following rules, procedures and standards. Everyone shares the responsibility to prevent accidents.

We are committed, and are constantly striving to provide a safe and healthy work environment for all. Safety is a value, linked with every priority and we have safety systems in place to make this a reality. You are the key to making our safety system a success and your involvement, participation and support are vital to this success.

- 5.3 Contractors, collaborators and visitors on Observatory property are expected to take all reasonable precautions in the performance of the work under his/her contract to protect the health and safety of employees and of the public and to minimize danger from all hazards to life and property and will comply with all health, safety and fire protection regulations and requirements (including reporting requirements) required by Federal, State or local authorities.

6.0 GENERAL SAFETY

NOAO EHS policies and procedures outlined in this manual can be found on the NOAO website and comprise the health and safety program.
<http://www.noao.edu/ets/Mechanical/>

6.1 STANDARDS:

Hazards must be recognized before you can do anything about managing them. One way that you can do this is by always thinking about what could go wrong, so you can predict what could happen under slightly different circumstances. The key to proactive safety is not what happened, but what COULD happen! You have the legal right and responsibility to have hazardous conditions corrected.

6.1.1 Occupational Safety and Health Administration 29 CFR 1910.

6.1.2 NFPA Volume 1 through 12 (Includes National Electric Code, Sprinkler System Code, Life Safety Code and other parts of the National Codes)

6.1.3 National Fire Prevention Code

6.2 ALL EMPLOYEES:

Each individual is responsible for performing assignments in a manner that will not endanger themselves or their fellow employees. Each employee is responsible for:

6.2.1 Following all of the safety policies, programs, and procedures.

6.2.2 Utilizing all safety equipment in the proper manner.

6.2.3 Promptly reporting all unsafe conditions to their supervisor.

6.2.4 Promptly reporting all work related injuries, illnesses, and near misses to their supervisor.

6.2.5 Promptly seeking appropriate medical attention when injured on the job.

6.2.6 Always practice good housekeeping habits.

6.3 NOAO/Kitt Peak Supervisor and the Safety Manager will:

6.3.1 Provide information about the risks that you may encounter on the job.

6.3.2 Identify potential causes of job-related injury, disease or illness.

6.3.3 Provide safety training, when necessary.

6.3.4 Explain procedures, equipment and actions that you should take to reduce hazards and risks so that you can perform jobs safely.

6.3.5 Provide and (in some instances) maintain personal protective equipment (PPE).

6.3.6 Ensure emergency and first aid plans are in place and available.

6.3.7 Allow sufficient opportunity for safety meetings and discussions.

6.3.8 Make the necessary safety data sheets (SDS's) and written safe work procedures readily available.

6.3.9 Value safety and health in everything that we do.

6.3.10 Have management staff that can assist you in being safe at work by guiding, educating, training and inspiring you in all aspects of managing risks.

6.3.11 Provide leadership to ensure your safety at work.

6.4 Stop Work Authority – (SOP#: 1000-AD-015-0012)

Anyone has the authority to stop any work activity if, in his or her judgment, continuation of such activity constitutes an imminent threat to personnel, site equipment, or property.

6.5 CARDINAL RULES:

No safety standard, procedures or rule should ever be broken, because they represent our commitment to the safety and health of our employees. Standards, procedures or rules that are broken may have more severe consequences than others. Employees may be reprimanded, given disciplinary time off or discharged as the circumstances warrant.

The following rules are called the CARDINAL SAFETY RULES and a breach of any of these nine rules will lead to severe disciplinary action up to and including dismissal irrespective of whether the breach led to an injury or not:

- 6.5.1 Fighting for any reason. It is not tolerated.
- 6.5.2 Working while intoxicated, being at work under the influence of intoxicating liquor or drugs.
- 6.5.3 Removing a lock-out lock or tag without authorization.
- 6.5.4 Failing to lock, tag and try out (test) energy systems when required by policy.
- 6.5.5 Committing an intentional act or situation that demonstrates reckless disregard for your safety and/or the safety of others.
- 6.5.6 Repeated failure or unwillingness to abide safety rules and regulations.
- 6.5.7 Making false statements in the course of an accident investigation or while undergoing a physical examination.
- 6.5.8 Removing, interfering with, defacing or destroying any safety device.
- 6.5.9 Possession of firearms or explosives while on company property without permission.

Remember that some prescription drugs may make you feel drowsy or affect your reaction time. This may create a hazardous situation if you operate machinery or vehicles. If you are on prescription medication, get medical advice as to whether or not you can come to work if the medication has such side effects. Confidential assistance can be arranged for employees with alcohol or drug related problems.

6.6 SAFETY MEETINGS:

Safety meetings should be conducted regularly in each department to keep everyone informed and aware of current safety issues, and for providing ongoing safety training. Formal meetings and training are sometimes required by law. These meetings provide the time for all to focus on safety and to discuss any safety concerns that have not been previously addressed.

We expect all to attend and to participate in these meetings. These meetings are opportunities to discuss safety issues and problems, as well as to propose possible solutions.

A safety meeting is an ideal opportunity to ask for clarity on issues of safety. Recall safety incidents and near misses at these meeting so that others can learn about what happened, or could have happened. Supervisors can use the topics in this manual for safety meetings and make sure that there is a sign in sheet.

7.0 DEFINITIONS

These are a few of the different terms used in our safety system, please familiarize yourself with them:

- 7.1 **Safety:** The condition of being safe; freedom from danger, risk, or injury.
- 7.2 **Accident:** An accident is an undesired event that causes injury and/or property damage and/or business interruption.
- 7.3 **Incident/ Near Miss:** An incident is an undesired event, which, under slightly different circumstances, could have caused injury to people, damage to property, or business interruption.
- 7.4 **Injury:** Damage to the body caused by external force. This may be caused by accidents, falls, hits, weapons, and other causes.
- 7.5 **Occupational Disease:** An occupational disease is any chronic ailment that occurs as a result of work or occupational activity. It is an aspect of occupational safety and health.
- 7.6 **Recordable Injury:** Generally, a recordable injury or illness under OSHA is one that requires medical treatment beyond first aid, as well as one that causes death, days away from work, restricted work or transfer to another job, or loss of consciousness.
- 7.7 **Reportable Injury:** If someone has died or has been injured because of a work-related accident this may have to be reported. Not all accidents need to be reported. The employee and the supervisor have the responsibility to report the injury to the Safety Department. The Safety Manager will report the injury to OSHA if required.

8.0 ACCIDENT, INCIDENT REPORTING AND INVESTIGATING

Injuries caused by accidents in the workplace are a major source of pain, suffering and expense. We do not want you to be injured while at work and we will do all we can to create a safe work environment.

- 8.1 If you are involved in an accident at work and are injured, you are required to do the following:

- 8.1.1 Notify your manager or supervisor immediately.
- 8.1.2 Seek medical attention as directed.
- 8.1.3 Follow all the instructions issued by the medical attendant concerning ongoing treatment. Even if you feel that the injury is insignificant, report it nevertheless. Sprains and strains are sometimes worse on the day following the event.
- 8.1.4 Participate in the investigation of the accident so those steps to prevent a recurrence can be taken.

Should you be involved in an accident that causes any form of loss or injury, report it so that it can be investigated and a recurrence of the same type of accident can be prevented. Should you witness a near miss (incident) report it as well. Under slightly different circumstances, it may have caused injury.

8.2 Things to remember about accident and incident reporting:

- 8.2.1 Accident reporting forms are available from management, administrative assistant or immediate supervisor. Also on the intranet on the website- safety section.
- 8.2.2 To report a near miss, at risk behavior, unsafe conditions, names and identities of the reporter or people involved are not required.
- 8.2.3 Report all near misses to your manager or immediate supervisor.
- 8.2.4 Remember that the only difference between an accident and a near miss is the consequence.
- 8.2.5 All property damage, business interruption and injury causing accidents must be reported immediately.
- 8.2.6 Accidents can only be prevented if they are reported.
- 8.2.7 Report all personal injuries as soon as possible; even if you think it is not serious, it may worsen with time.

You may be asked to participate in an accident investigation, if so remember that accident investigation is Fact Finding and not Fault Finding.

9.0 ASBESTOS: (SOP#: 1000-AD-015-0024)

- 9.1 NOAO maintains records of all information required by 29 CFR1910.1001 and information otherwise known concerning the presence, location and quantity of asbestos containing material, ACM, in all facilities.
- 9.2 Warning labels must be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers. Labels are placed in areas noticed by employees who are likely to be exposed, such as at the entrance to mechanical room/areas. Signs may be posted instead of labels.

- 9.3 Provide and display warning signs at each regulated area and approaches to regulated areas so that an employee may read the signs and take necessary protective steps before entering the area.
- 9.4 The most effective way to protect workers exposed beyond the permissible exposure limit is to minimize exposure using engineering controls and good work practices.
- 9.5 An Asbestos Regulated Area is an area where employees may be exposed to airborne concentrations of fibers of asbestos. Each person entering a Regulated Area must be supplied with and required to use a respirator.
- 9.6 If an employee discovers a new deposit of something that could be asbestos and it is not on the existing records, he or she shall notify his or her supervisor, who in turn will call CFO and Safety to examine the site. CFO/Safety will determine the best course of action which may be to call a professional firm to handle the situation, or may be to follow certain guidelines and abate the problem.

Refer to the NOAO SOP 1000-AD-015-0024 for more details.

10.0 BLOODBORNE PATHOGENS: (SOP#: 1000-AD-015-0016)

- 10.1 A Bloodborne pathogens program has been developed in accordance with 29 CFR 1910.1030. All personnel who may come in contact with blood or other body fluids as part of their duties shall be familiar with and shall at all times practice - Standard or Universal Precautions.
- 10.2 All human blood and certain human body fluids are treated as if known to be infectious for the human immunodeficiency virus, the Hepatitis B and C Viruses, and other blood borne pathogens.;
- 10.3 Training and annual refresher training on the Bloodborne Pathogen Standard shall be furnished to all employees who have been determined to be covered by this standard.
- 10.4 Personal protective equipment shall be provided to affected employees at no cost to the employee as required. Personal protective equipment provided to these employees shall be worn in all situations where there is a possibility exposure to human blood and/or body fluids.

Refer to the NOAO SOP 1000-AD-015-0016 for more details.

11.0 CHEMICAL SAFETY

- 11.1 Every employer who uses hazardous chemicals is required to have an effective program to control use, access, storage and disposal of chemicals. Information about the risks of using or misusing chemicals is available from manufacturers and suppliers through Safety Data Sheets (SDS), formerly known as Material Safety Data Sheets

(MSDS). This information can be used to provide the engineering, protective equipment and procedures needed to safeguard employees.

11.2 A material is generally defined as *hazardous* when it has one or more of the following characteristics: (Here are the physical and health hazards that EPA is adopting-2012)

Physical hazards	Health hazards
Flammable (gases, aerosols, liquids, or solids)	Carcinogenicity.
Gas under pressure	Acute toxicity (any route of exposure).
Explosive	Reproductive toxicity.
Self-heating	Skin Corrosion or Irritation.
Physical hazards	Health hazards
Pyrophoric (liquid or solid)	Respiratory or Skin Sensitization.
Oxidizer (liquid, solid or gas)	Serious eye damage or eye irritation.
Organic peroxide	Specific target organ toxicity (single or repeated exposure).
Self-reactive	Aspiration Hazard.
Pyrophoric gas	Germ cell mutagenicity.
Corrosive to metal	Simple Asphyxiant.
In contact with water emits flammable gas	Hazard Not Otherwise Classified (HNOC).
Combustible Dust	
Hazard Not Otherwise Classified (HNOC)	

11.3 Safety Data Sheets:

Users of the chemicals shall obtain Safety Data Sheets (SDS) from the suppliers. These sheets tell how to protect employees, property and the environment through proper use, storage and disposal of chemicals. Manufacturers provide safety data sheets to inform users about products, and encourage controls that will protect manufacturer and user against financial loss due to a preventable accident. Strict observation of the following general guidelines greatly reduces the probability of accidents during the transportation, storage and use of hazardous chemicals:

11.3.1 Smoking, eating and drinking in areas where chemicals are stored or used is prohibited.

11.3.2 Keep all containers closed and drums sealed.

11.3.3 If a container leaks, prevent the spread of the material leaking, inform management and the Safety Office and clean up the spill per the SDS and other guidance.

- 11.3.4 Label containers properly and keep chemicals in their original containers.
- 11.3.5 Dispose of chemical containers by following written procedures consistent with municipal, county, state and federal regulations.
- 11.3.6 Keep incompatible chemicals physically apart.

11.4 Transporting Hazardous Materials:

The transportation of hazardous materials in the United States is regulated by the Department of Transportation. The movement of such hazardous items in any quantity requires the driver to have a Hazardous Materials Endorsement on his/her license and must be accompanied by the proper shipping documents.

In order to produce the proper shipping documents, Shipping and Receiving department must have a Safety Data Sheet (SDS) for each hazardous material to be transported and ensure that that document is transmitted to and registered with a national SDS clearing house. Registering the SDS document with the clearinghouse may take up to 4 days. Once the SDS is registered; there is no need to repeat the 4-day registration process for following shipments of the same hazardous material, proper shipping methods would still apply.

Hazardous materials as defined by the Department of Transportation include, but are not limited to, all aerosols, bottled gasses, cryogenes, adhesives and non-latex paints and coatings. All flammable, corrosive, toxic and explosive liquids are considered hazardous materials without regard to the quantities shipped. Applicable packing groups for the hazard classes is as follows:

- 11.4.1 Explosives (classes 1.1, 1.2, 1.3, 1.4, 1.5, 1.6)
- 11.4.2 Gases (class 2.1, 2.2, 2.3)
- 11.4.3 Flammable Liquids/Combustible Liquids
- 11.4.4 Flammable solids; Spontaneously combustible; Dangerous when Wet (4.1, 4.2, 4.3)
- 11.4.5 Oxidizers and Organic Peroxides (5.1, 5.2)
- 11.4.6 Toxic Material and Infectious Substance (6.1, 6.2)
- 11.4.7 Radioactive Materials requiring a Yellow III label (class 7)
- 11.4.8 Corrosive Materials
- 11.4.9 Miscellaneous Dangerous Goods-materials that present a hazard during transport but otherwise do not meet other hazard classifications.

If you intend to or know of any visitor that intends to use any of the above classifications of hazardous materials, contact the Shipping and Receiving Department or the Safety Manager before ordering or having the items shipped.

12.0 COMPRESSED GASES: (SOP#: 1000-AD-015-0029)

Compressed gases are dealt with under the OSHA Standard (29CFR1910.101)

12.1 Inspection of compressed gas cylinders:

Each employer shall determine that compressed gas cylinders under his control are in a safe condition to the extent that this can be determined by visual inspection. Visual and other inspections shall be conducted as prescribed in the Hazardous Materials Regulations of the Department of Transportation (49 CFR parts 171-179 and 14 CFR part 103). Where those regulations are not applicable, visual and other inspections shall be conducted in accordance with Compressed Gas Association Pamphlets C-6-1968 and C-8-1962, which is incorporated by reference as specified in Sec. 1910.6.

The in-plant handling, storage, and utilization of all compressed gases in cylinders, portable tanks or motor vehicle cargo tanks shall be in accordance with Compressed Gas Association Pamphlet P-1-1965, which is incorporated by reference as specified in Sec. 1910.6.

Further, if you will be involved in the transportation of larger quantities of compressed gases you must read the training requirements under the Hazardous Materials Regulations. It is entitled Code of Federal Regulations, Title 49, Subpart H, 172.700-172.704 from PHMSA (Pipeline and Hazardous Materials Safety Administration at website: <http://hazmat.dot.gov/regs/rules.htm>)

12.2 Cylinder Storage:

Cylinder storage has safety implications. Remember these guidelines when storing cylinders:

12.2.1 Store cylinders upright.

12.2.2 Group cylinders by compatibilities of gas.

12.2.3 Store full and empty cylinders apart and have them tagged or labeled.

12.2.4 Store gases so that old stock is used first.

12.2.5 Secure cylinders with chains or cables or special holders designed for that purpose such as cylinder carts or wall holders. Never secure cylinders to conduit carrying electrical current.

12.2.6 Make sure that fire extinguishers near cylinder storage area are appropriate for the types of gases being stored.

12.2.7 Store oxygen cylinders at least 20 feet from flammables or combustibles or separate them by a 5-foot high, fire resistant barrier in accordance with NFPA requirements.

12.2.8 Keep oil and grease away from oxygen cylinders, valves, and hoses.

12.2.9 If your hands, gloves or clothing are oily, do not handle oxygen cylinders.

12.2.10 Oxygen and compressed air are not the same thing. Do not use them interchangeably.

12.3 Cylinder Handling and Transportation:

- 12.3.1 Always transport cylinders with the regulator removed and the safety cap installed.
- 12.3.2 Utilize a cylinder cart whenever possible. Do not roll them on their side by hand along the floor or transport them laying across the forks on the forklifts. All cylinders should be treated as full and handled accordingly.
- 12.3.3 Always use the correct pressure regulator for the specific gas.
- 12.3.4 CGA fittings differ for inert gases (e.g., He, Ar, N₂), flammable gases (e.g., H₂) and oxidizers (e.g., O₂, N₂O). The modification or retrofitting of CGA fittings or relief valves is *not* allowed.
- 12.3.5 All compressed gas cylinders must be clearly marked with the correct chemical name. Shoulder labels must clearly identify the contents of a cylinder. DO NOT rely on cylinder color to identify the gas.
- 12.3.6 If more than 1,000 lbs. of cylinders are carried in a truck, the vehicle must be appropriately placarded and the driver needs a Commercial Driver's License and Hazmat Endorsement.
- 12.3.7 Never open valves until regulators are drained of gas and pressure-adjusting devices are released. When opening cylinders, point outlets away from people and sources of ignition, such as sparks or flames. Open valves slowly. On valves without hand wheels, use only supplier recommended wrenches. On valves with hand wheels never use wrenches. Never hammer a hand wheel to open or close a valve.
- 12.3.8 Never put any gas cylinder in an enclosed environment such as a car trunk or a station wagon because if the valve has even a small leak, it could present an exposure, asphyxiation, fire and/or explosion risk.
- 12.3.9 Cylinders should be carried in the back of an open truck in a standing position and chained to a rack. If they must be transported laying down, they should be blocked in a manner to keep them from rolling around or banging against each other, and they must not be used until they have been in a standing position for several hours.
- 12.3.10 The transportation of cylinders and compressed or liquid gases is largely controlled by the U.S. Department of Transportation, and its affiliate which can be explored further at: <http://www.fmcsa.dot.gov/safety-security/safety-security.htm>

See Appendix A for Checklists.

12.4 Training

All employees using or handling compressed gases must be trained in the safe use of the material and pressurized systems, and permanent records/logs must be kept on all persons who have completed such training. Refer to the NOAO SOP 1000-AD-015-0029 for more details.

13.0 CONFINED SPACE (SOP#: 1000-AD-015-0005)

Confined spaces may have limited openings for entry and exit, unfavorable natural ventilation and not designed for continuous worker occupancy. General examples include: pits, septic tanks, storage tanks, telescope cells, vessels, vaults, and furnaces.

13.1 The Maintenance Manager and/or Safety Manager will:

- 13.1.1 Ensure that all potential confined spaces at each telescope or laboratory are evaluated in accordance with the OSHA regulation, 29 CFR1010.146.
- 13.1.2 A Confined Space Program will be implemented for all areas where there is a need to perform any activity within a Confined Space as defined by the OSHA standard. The Confined Space Program will be reviewed annually and as regulations require.
- 13.1.3 Inform employees of the existence and danger posed by the permit-required confined space by posting danger signs, conducting awareness training, or by other means. Areas are required to be posted with a sign that reads, "DANGER – PERMIT REQUIRED CONFINED SPACE – DO NOT ENTER."

13.2 All Confined Space authorized personnel are expected:

- 13.2.1 To take an active role in maintaining a safe Confined Space Program.
- 13.2.2 Each individual entering or attending a Confined Space shall be trained regarding the hazards associated with Confined Space entry.

13.3 Those spaces meeting the criteria of a Confined Space and having a known potential to contain hazardous atmospheres will be designated as a permit-required confined space. Procedures for entry without the need for a written permit or attendant into certain confined spaces are detailed in the Confined Space Program.

13.4 Training shall be provided prior to performing assigned duties that require a Confined Space entry, or prior to a change in duties.

- 13.4.1 Untrained personnel are not permitted entry into areas meeting OSHA criteria for confined spaces until pre- entry procedures demonstrate that special training is not required.
- 13.4.2 Untrained employees will be prevented from entering.

13.5 In the event of a need for Confined Space rescue, only appropriately trained and authorized personnel may enter a confined space for rescue purposes. Training for rescue and emergency services must be in accordance with 1910.146(k). This section requires annual rescue simulation exercises, CPR, and first-aid certification.

See Appendix B

Refer to the NOAO SOP 1000-AD-015-0005 for more details.

14.0 CRANE SAFETY: (SOP#: 1000-AD-015-0010)

Crane Safety is a major area of concern to OSHA 29 CFR 1910.179 and as a result there are many references to crane safety in OSHA documents. Also crane safety is a major area of concern to NOAO/Kitt Peak as there are many cranes of different types in the Observatory and in the Tucson buildings.

All cranes are to be professionally inspected on an annual basis, and fixed immediately if not certified, or locked out, if not fixed immediately. Cranes should be visually inspected before each use to determine that the cables are not frayed, the hand controls work properly, and that proper safety hooks are in use.

Refer to the NOAO SOP 1000-AD-015-0010 for more details.

15.0 CRITICAL LIFTS:

15.1 The purpose is to provide guidelines and a method to establish a safe and intelligent way of moving materials. The main directive is to get more help when you need it whether it involves something as simple as asking another person to check the rigging or as complex as a written and controlled procedure.

15.2 Definition of a Critical Lift: is defined as any non-routine crane lift requiring detailed planning and additional or unusual safety precautions.

15.2.1 Critical lifts include: lifts made where the load is greater than 75% of the rated capacity of the crane;

15.2.2 Lifts which require load to be lifted, swung or placed out of operator's view;

15.2.3 Lifts made with more than one crane;

15.2.4 Lifts involving non-routine/technically difficult rigging arrangement;

15.2.5 Hoisting personnel with a crane or derrick;

15.2.6 Or any lift which the crane operator believes should be critical.

15.3 Critical lifts are lifts in which you need to get as much information or experience involved to ensure that it goes safely. These include but are not limited to the following considerations:

15.3.1 If you are unsure or do not know for sure that the lift is safe then it is a critical lift and you need to seek help. ASKING is always correct.

15.3.2 When the action is infrequent or complex. The handling of a 5000 lb. spreader bar may be routine but a 500 lb. special device may be a critical lift since it has not been done before.

15.3.3 The weight is large. This is again a relative term and depends on what you are doing.

15.4 Special considerations should be given to the following:

15.4.1 Relative capacity of the device. Lifting 4 tons with a 5 ton crane is more of a critical lift than 10 tons with a 50 ton crane. If you are over 50% of the rated capacity of the device then unless this is a very repetitive lift it is a critical lift.

15.4.2 When the absolute weight of the lift exceeds 10 tons, it is a critical lift, even if it is usual.

15.4.3 When hand lifting something which weighs over 150 lbs. requiring several people to share the load, it is a critical lift and needs consideration and planning.

15.5 When the clearance is small or the size is large:

15.5.1 Proximity of people is an important consideration. No one is allowed under a load.

15.5.2 The clearance around an object could make a critical lift. When a little swing could damage something there needs to be consideration given.

15.6 The stability of the move is another important consideration that would make it a critical lift:

15.6.1 If you are turning a load over and it may flop.

15.6.2 When a load may topple when released.

15.6.3 When you use more than one device to lift, such as a crane on one side and a forklift on the other.

15.6.4 When you know the load will swing or slide when lifted.

15.7 When the load is fragile or very costly increased vigilance is demanded:

15.7.1 Mirrors are always a critical lift.

15.7.2 Mirrors over 3 meters in size are required to have mountain supervisor and engineering support.

15.7.3 Mirrors over 6 meters in size are required to have a written and approved procedure in place and have a senior engineer or scientist present before the lift is made.

15.8 Complex or special rigging: only qualified riggers may perform the work.

15.8.1 Rigging to more than 3 points.

15.8.2 Rigging where you use more than 50% of the rated rigging capacity.

15.8.3 An unusual shaped object where the center of gravity is unknown.

15.9 Methods of handling a critical lift:

15.9.1 Discuss the lift and gain the information required.

15.9.2 Find a supervisor/engineer/coworker with more knowledge or experience to assist with the lift.

15.9.3 Have a written, reviewed and approved procedure for the lift.

16.0 CRYOGENIC LIQUIDS: (SOP#: 1000-AD-015-0002)

Cryogenic Liquids are extremely cold and can produce a severe burn comparable to frostbite, or worse. Exposure to cryogenic liquids in the eyes can cause blindness if the cornea becomes frozen. Bare skin can instantly bond with unprotected supply lines or un-insulated equipment and may tear when pulled away, causing skin lesions.

Further, very small amounts of liquid are converted to large volumes of gas that can create asphyxiation and/or pressure hazards. Cryogenic liquids may only be used by persons trained in the safe use of gases.

16.1 When handling cryogenic liquids, the following precautions must be taken:

- 16.1.1 Wear a face shield and safety goggles. Safety glasses with side shields, or without, do not give adequate protection and a face shield alone does not provide adequate protection.
- 16.1.2 Wear a long sleeve garment such as a lab smock.
- 16.1.3 Cryo-thermal gloves or loose-fitting gloves are required as they allow the filler to remove them quickly to avoid a burn.
- 16.1.4 When handling large volumes, it is recommended that high top shoes be worn.
- 16.1.5 Where the volume of the expanded gas from a cryogenic liquid has the potential to displace significant amounts of oxygen in the work area, a survey must be done by the user. The survey is to describe the extent of the potential hazard and the controls necessary to eliminate or control the hazard. For example, when carrying liquid nitrogen in an elevator it may be wise to send the Dewar up by itself and walk up rather than chance being caught in the elevator if the power goes out.
- 16.1.6 Transportation of liquefied gases must be accomplished in a manner such that no occupant of the vehicle, or bystander could possibly be exposed to a liquid spill or to a reduced oxygen atmosphere as a result of a liquid spill or boil off. All liquefied gas containers will be securely fastened to the vehicle in which they are being transported.

16.2 Special Considerations for our most frequently used cryogenic liquids:

- 16.2.1 Liquid helium must be transferred via helium pressurization in properly designed transfer lines. A safety hazard may occur if liquid helium encounters air. Air solidifies in contact with liquid helium, and precautions must be taken when transferring liquid helium from one vessel to another or when venting. Over pressurization and rupture of the container may result.
- 16.2.2 All liquid helium containers must be equipped with a pressure-relief device.
- 16.2.3 The latent heat of vaporization of liquid helium is extremely low (20.5J/gm). Therefore, heat leaks can cause rapid pressure rises.

16.2.4 The boiling point of liquid nitrogen is below that of liquid oxygen, it is possible for oxygen to condense on any surface cooled by liquid nitrogen. If the system is subsequently closed and the liquid nitrogen removed, the evaporation of the condensed oxygen may over-pressurize the equipment or cause a chemical explosion if exposed to combustible materials like oil.

16.3 Safe handling considerations when working with cryogenic gases and liquids:

16.3.1 Wear appropriate protective clothing including face shield and goggles, non-absorbent insulated gloves, non-woven fabric apron and clothing free of pockets or turned-up edges.

16.3.2 Do not wear open-toed shoes, sandals, or other footwear that would allow liquid nitrogen to come in contact with your feet. Refrain from wearing sweaters, mufflers, scarves, or bulky socks worn outside of boot tops.

16.3.3 Always handle cryogenic liquids in well-ventilated areas to prevent possible gas or vapor accumulation that may produce an oxygen-deficient atmosphere and lead to asphyxiation.

16.3.4 Remain at the fill station until the liquid transfer is complete.

16.3.5 Know the properties, hazards and procedures associated with cryogenic liquids, refer to manufacturers Safety Data Sheets (SDS) for proper handling and use.

16.3.6 Stand clear of cold gases and liquids that are boiling or splashing.

16.3.7 Use only containers specifically designed for holding cryogenic liquids.

16.3.8 Store small, empty containers indoors or in areas free from rain or excessive moisture.

16.3.9 Fill containers slowly to minimize thermal shock to the container.

16.3.10 Cover Dewars when the liquid is not being transferred to prevent buildup of oxygen and subsequent explosion.

16.3.11 When transferring cryogenic fluids from open containers, pour below your chest level.

16.3.12 Consider transportation and handling procedures so that you do not endanger yourself or other people in the area.

Refer to the NOAO SOP 1000-AD-015-0002 for more details.

17.0 ELECTRICAL SAFETY: (SOP#: 1000-AD-015-0015)

17.1 Safety-related work practices shall be employed at NOAO-North to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts, when work is performed near or on equipment or circuits which are or may become energized. The specific safety-related work practices shall be consistent with the nature and extent of the associated electrical hazards.

17.2 OSHA guidelines Subpart S – 29 CFR 1910.331 -336 regarding electrical safety have been developed, for the protection of all employees. An electrical safety program must be implemented, for workplace safety when dealing with electrical safety.

17.3 Listed below are some of the general work rules established:

- 17.3.1 Employees are not permitted to work near any part of an electric power circuit that the employee could contact in the course of work unless the employee is protected against electric shock by de-energizing the circuit, by grounding it, or by effectively guarding it. (Lockout-Tagout SOP 1000-AD-015-0001).
- 17.3.2 In areas where the exact location of underground electric power lines is unknown, employees using tools which could come in contact with an underground power line shall be provided with insulated gloves. If possible, an expert from the power company will be called to assure no lines are present.
- 17.3.3 Working spaces, walkways and similar locations must be kept clear of electrical cords to eliminate hazards.
- 17.3.4 Worn or frayed electric cords shall not be used. Additionally, cords shall not be fastened with staples, hung from nails, or suspended by wires.
- 17.3.5 Plugs equipped with grounding prongs must have the prong in place.
- 17.3.6 Only trained persons shall perform work incidental to their area of expertise on circuits of 30 volts AC or 50 volts DC or greater. By definition a Qualified Person is someone familiar with the construction and operation of the equipment and the hazards involved, and who can demonstrate knowledge of the technical and safety issues in the use and maintenance of the equipment involved.
- 17.3.7 The two-person rule shall be in effect for work on these circuits and Lockout-Tagout procedures used.
- 17.3.8 On call-ins, the two-person rule will be in effect. If the call-in pertains to power loss to any portion of a building or site, a site electrician must be present in order to restore power to the site, especially if entrance to a high-voltage area is required.
- 17.3.9 Non-grounding adapters are not to be used without approval from the site electrician.
- 17.3.10 When high voltage equipment is being operated or is present, "High Voltage" signs must be displayed. High voltage is defined for this purpose as voltage above 240 volts AC.
- 17.3.11 Do not open or close an electrical switch unless you are familiar with its purpose.
- 17.3.12 All new wiring installations must be made or reviewed by a qualified electrician.
- 17.3.13 Ground Fault Circuit Interrupts (GFCI) must be utilized with power equipment such as pumps and power tools if they are to be utilized when working around water or on outdoor applications.
- 17.3.14 No employee should attempt to repair or use defective electrical fittings. Users should inspect all electrical equipment for hazards which could cause serious harm or death before use.
- 17.3.15 Each telescope operation or department is responsible for properly training and appointing their Qualified Persons who are able to perform electrical work.

17.3.16 All new electrical wiring and equipment shall comply with the National Electric Code (NEC).

Refer to the NOAO SOP 1000-AD-015-0015 for more details.

See Appendix C

To view the OSHA website related to electrical standards please go to:

<http://www.osha.gov/SLTC/electrical/standards.html>

18.0 EMERGENCY RESPONSE PLAN:

18.1 NOAOs emergency response/action plan addresses emergencies that may reasonably be expected in the workplace, fulfills the requirements listed in OSHA1910.38 and provides the following kinds of information:

18.1.1 A site map of each building or facility showing exits and safety equipment;

18.1.2 Escape procedures and emergency escape route assignments;

18.1.3 The preferred means of reporting fires and other emergencies; and

18.1.4 Names or regular job titles of persons or departments who can be contacted for further information or explanation of duties under the plan.

18.2 NOAO will ensure that all of its facilities have an employee alarm system which complies with OSHA 1910.165, and before implementing the emergency action plan, NOAO will designate and train a sufficient number of employees to assist in the safe and orderly evacuation of employees.

18.3 In addition, NOAO will have a Fire Prevention Plan which includes the following: OSHA's Fire Prevention Plan (FPP) regulation found at 29 CFR 1910.38 and Subpart L requires specific program elements. The plan addresses the following:

18.3.1 Workplace fire hazards and their proper handling and storage procedures.

18.3.2 Potential ignition sources for fires and their control procedures.

18.3.3 Type of fire protection equipment or systems.

18.3.4 Personnel responsible for maintenance of equipment and systems installed to prevent or control ignition of fires and for control of fuel-source hazards.

18.3.5 Emergency evacuation plans for orderly egress.

18.4 Under this plan, our employees will be informed of the plan's purpose, preferred means of reporting fires and other emergencies, types of evacuations to be used in various emergency situations, and the alarm system. The plan is closely tied to our Emergency Action Plan where procedures are described for emergency escape procedures, procedures to account for all employees after emergency evacuation has been completed, and rescue and medical procedures.

18.4.1 These items will be reviewed in a safety meeting with a Supervisor.

- 18.5 Flammable or combustible materials may not ignite on their own without an external source of ignition. The following procedures are used to control known ignition sources:
- 18.5.1 Flammable materials are kept separate from any possible heat sources.
 - 18.5.2 Welding activities are confined to the outside when possible, and to the welding shop.
 - 18.5.3 When welding is required, a proper fire watch or fire detection system is established along with the necessary extinguishing material.
 - 18.5.4 Fuel, oil and other stored flammable products are kept in bulk storage containers designed to minimize the hazard of fire, and are controlled.
- 18.6 Once hazards are evaluated and equipment is installed to control them, that equipment must be monitored on a regular basis to ensure it continues to function properly. Strict guidelines for maintaining the equipment are followed, as set forth by National Fire Protection Association and OSHA.
- 18.7 Training will be provided for each employee who volunteers to use fire prevention equipment. Employees shall not use fire-prevention equipment without appropriate training. Employees must demonstrate an understanding of the training and the ability to use the equipment properly before they are allowed use of the equipment. All untrained personnel are expected to immediately evacuate the building upon the alarm.
- 18.8 In anticipation of the discovery of an uncontrolled fire, all employees should become familiar with the layout of the site, exit pathways, and the location of fire extinguishers.
- 18.8.1 Emergency lighting should be installed in all buildings to illuminate exits and means of egress.
 - 18.8.2 Fire extinguishers need to be checked and tested annually in accordance with an established schedule.
 - 18.8.3 All fire extinguishers at each site shall be appropriate for the type of fire anticipated guidelines for maintaining the equipment are followed, as set forth by National Fire Protection Association and OSHA.

19.0 ENVIRONMENTAL COMPLIANCE: (SOP#: 1000-AD-015-0023)

- 19.1 NOAO-N will operate our facilities in an environmentally responsible manner that promotes pollution prevention and places the highest priority on health and safety. We will operate facilities that meet all applicable federal, state and local environmental, health and safety rules, regulations, ordinances and statutes as well as recognized industry guidelines and standards.
- 19.2 NOAO will follow OSHA 1910 Subpart G – Occupational Health and Environmental Control and Subpart J General Environmental Controls.

19.3 NOAO will follow Title 40: Protection of Environment - the section of the CFR that deals with EPA's mission of protecting human health and the environment that may apply.

19.4 The employer shall provide training to make sure all employees, contractors and visitors are aware of and understand their environmental, health and safety obligations while working at NOAO-N. Retraining will take place when there is a change in job assignment or a regulatory change has taken place.

Refer to the NOAO SOP 1000-AD-015-0023 for more details.

20.0 ERGONOMICS: (SOP#: 1000-AD-015-0022)

20.1 Ergonomics is the science of fitting the job to the worker. Designing work stations and tools to reduce work-related musculoskeletal disorders (MSDs) can help workers stay healthy and companies to reduce or eliminate the high costs associated with MSDs.

20.2 Various types of ergonomic concerns:

20.2.1 Office Ergonomics: A computer workstation should be designed to accommodate the user.

20.2.2 Lab Ergonomics: Laboratory tasks can include awkward posture, precision work with hands, reaching, and bending forward.

20.2.3 Industrial Ergonomics: When ergonomics is applied at an industrial work area (e.g., telescope chamber, workshop, hand-tool use, material handling and process areas), and can include lifting and carrying, awkward posture, reaching for loads, and passing loads from hand to hand.

20.3 JHA's will be utilized to identify any ergonomic issues and will be analyzed for risk mitigation.

Refer to the NOAO SOP 1000-AD-015-0022 for more details.

21.0 FALL PROTECTION (SOP#: 1000-AD-015-0003)

21.1 This procedure will pertain to all NOAO-North employees and contractor personnel who may be exposed to a variety of fall hazards while performing inspections, service, maintenance, repair, telescope support, experiment support, and building remodeling projects. Under these instances, OSHA requires workers to use fall protection at elevations of four feet, or higher.

21.2 It is the intent of NOAO that all of its employees who are engaged in construction/maintenance activities where fall protection is required under OSHA 29 CFR 1926.501 or 29 CFR 1910.23 adhere to the policy.

21.3 Responsibilities: Supervisors and Employees

- 21.3.1 No one is to be on any telescope or platform/structure unless necessary and authorized by his/her supervisor. Only those trained and with a reason to climb will be permitted to do so.
- 21.3.2 Climbers should restrict themselves to stairs, walkways, or platforms whenever possible.
- 21.3.3 Exercise good judgment when climbing. Do not climb when tired or ill.
- 21.3.4 See the Safety Manager or Maintenance Manager for guidance in the use of harnesses, lanyards, and tie-offs.

21.4 Training:

- 21.4.1 The employer shall provide training to ensure that the purpose and function of the fall protection program is understood by workers and that the knowledge and skills required for the safe wear, inspection, storage, and maintenance of fall protection equipment are acquired by workers.
- 21.4.2 Retraining must be provided when there is a change in job assignments, fall protection equipment, processes that present a new hazard, or when there is a change in fall protection procedures.
- 21.4.3 Supervisors must also review the related Rescue Plan (1000-AD-015-0004) with workers, as it provides additional information on how to handle rescues, in the event that it is necessary.

Refer to the NOAO SOP 1000-AD-015-0003 for more details.

22.0 FLAMMABLE AND COMBUSTIBLE MATERIALS

- 22.1 Flammable and combustible liquids are liquids that can burn. They are classified, or grouped, as either flammable or combustible by their flashpoints. Generally speaking, flammable liquids will ignite (catch on fire) and burn easily at normal working temperatures.
- 22.2 Flammable liquids have a flash point of less than 100°F. Liquids with lower flash points ignite easier. Combustible liquids have a flashpoint at or above 100°F.
- 22.3 There will be no individual flammable or combustible liquid containers larger than 60 gallons. Only approved containers may be used.
- 22.4 Aggregate volumes of flammable liquids greater than 10 gallons must be kept in an approved flammable liquid storage cabinet.
- 22.5 Open flame and smoking are not permitted in flammable or combustible liquid use or storage areas.
- 22.6 Combustible liquids are not to be poured into a drain due to the potential for formation of gas pockets in the trap.

22.7 All containers are to meet NFPA requirements

23.0 HAZARD COMMUNICATION (SOP#: 1000-AD-015-0028)

The Occupational Safety and Health Administration (OSHA standard 29 CFR 1910.1200) established programs to protect employees who work with hazardous chemicals. OSHA Hazard Communication Standard (or Worker Right-to-Know) applies to all employees who work with hazardous chemicals. In addition, hazardous materials are classified by no less than three Federal agencies: the Environmental Protection Agency (EPA), the Department of Transportation (DOT), and OSHA. Hazardous waste is regulated under OSHA and EPA.

New changes to the Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard are bringing the United States into alignment with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS), further improving safety and health protections for America's workers. Building on the success of OSHA's current Hazard Communication Standard, the GHS is expected to prevent injuries and illnesses, save lives and improve trade conditions for chemical manufacturers. The Hazard Communication Standard in 1983 gave the workers the 'right to know,' but the new Globally Harmonized System gives workers the 'right to understand.'

OSHA Reference: <https://www.osha.gov/dsg/hazcom/ghs.html>

Refer to the NOAO SOP 1000-AD-015-0028 for more details.

24.0 HEARING PROTECTION

The Occupational Noise Exposure Standard (OSHA 191.95) which requires hearing protection be provided to all general industry employees exposed to an 8-hour TWA of 85 decibels or more. The Safety Manager and/or Maintenance Supervisor will conduct a hazard assessment to determine what types of noise control measures are needed. The wearing of hearing protection is mandatory when working in a designated area. Employees are also encouraged to use hearing protection in other noisy areas.

At this point in time, there are no designated areas requiring hearing protection.

25.0 HOUSEKEEPING: (SOP#: 1000-AD-015-0025)

25.1 The revised OSHA general industry workplace housekeeping requirements are referenced in 29 CFR 1910.22. Employers must ensure that:

25.1.1 Provide sufficient or required safe clearances and access to any and all work stations, exit corridors, fire extinguishers, fire blankets, electrical disconnects, safety showers, other emergency aids, doors, and access to stairways.

25.1.2 All places of employment, passageways, storerooms, service rooms, and walking working surfaces are kept in a clean, orderly, and sanitary condition.

- 25.1.3 Keep aisles and walkways free of physical obstructions that would prevent access and do not block exit signs.
 - 25.1.4 Keep floors clean; dry as possible; slip resistant; and free of waste, unnecessary material, oil and grease, protruding nails, holes or loose boards.
 - 25.1.5 Workers need to return tools and other materials to storage after using them, and dispose of materials that are no longer needed.
 - 25.1.6 Keep aisles, stairways, emergency exits, electrical panels and doors clear of clutter, and purge untidy areas.
 - 25.1.7 Clean up spills immediately after they occur
- 25.2 Every employee, contractor and visitor plays a part for effective workplace housekeeping. Each worker needs to understand that workplace housekeeping is an integral part of his/her job and not merely a supplement to work he/she already performs. And, as workplace housekeeping becomes a standard part of operations, less time and effort are needed to maintain it at an appropriate level.
- 25.3 Training will follow the housekeeping standards that fall under 29CFR1910, with emphasis on 1910.22, Walking-working surfaces.
- Refer to the NOAO SOP 1000-AD-015-0025 for more details.

26.0 LASER SAFETY: (SOP#: 1000-AD-015-0030)

Lasers are now utilized in many parts of NOAO. If you are going to be involved with the operation or installation of lasers, you need to be aware of the hazards. Although these are not OSHA regulations, *Z136.1-2014*, American National Standard for Safe Use of Lasers, they do provide guidance for worker protection.

OSHA 1926.102(c)(2) Laser protection, 1926.102(c)(2)(i) states employees whose occupation or assignment requires exposure to laser beams shall be furnished suitable laser safety goggles which will protect for the specific wavelength of the laser and be of optical density (O.D.) adequate for the energy involved.

26.1 Who has primary responsibility for the laser safety any time a laser is operated? The person operating the laser always has the primary responsibility for all hazards associated with laser use.

26.2 Any laser above 5mW in power is not allowed.

26.3 Laser use in the domes needs pre-approval by the Kitt Peak Director.

26.4 Lasers are classified based on their hazard potential. Laser manufacturers are required to clearly label this classification on the laser casing.

26.4.1 Class I, II, and IIA lasers called low power lasers pose little risk to users. The beam of this type of laser is so bright that an individual's natural blink reflex prevents one from staring at the beam long enough for injury to occur.

26.4.2 Class IIIA, IIIB and IV lasers are known as medium and high-powered lasers respectively and potentially pose a greater risk.

26.4.3 Because lasers focus energy into a very small area, the skin and eyes are most vulnerable. Thermal burns are the most common type of damage caused by exposure to lasers.

26.5 Hazards Associated with Lasers:

26.5.1 Directly viewing laser light is particularly hazardous. The normal function of the human eye is to collect light and focus it onto the retina, the vision cells on the back of the eye. Similar to how a magnifying glass can focus intense sunlight and burn paper, the eye focuses laser energy onto the retina (by as much as 100,000 times). Looking at high-powered laser beams without proper eye protection, even for brief periods, will cause permanent damage or burns the vision cells of the eye. Extensive damage will result in irreversible blindness.

26.5.2 Some high-powered lasers are particularly hazardous because their beams may be invisible. High-powered laser systems also pose an electrical hazard. Several fatalities have been documented associated with electrocution or explosions resulting from the misuse of high-powered lasers around flammable materials.

26.6 Laser Safety and Control:

To assure the safe use and operation of lasers, be sure you are aware of the following guidelines:

26.6.1 Never look directly into the beam of a laser regardless of its classification or your exposure duration.

26.6.2 Wear laser eye protection appropriate for the laser being used.

26.6.3 Check goggles periodically to ensure that the protective characteristics are intact.

26.6.4 Normal eye wear or safety glasses will not be sufficient.

26.6.5 Be aware of where lasers are used in your work area. Signs and placards are posted for your protection.

26.6.6 Know the class of lasers you work with. Always use the laser with the lowest classification possible. That is never use a high power laser when a low power laser will do.

26.6.7 Never attempt to open, repair or relocate a laser. Leave this job to properly trained technicians.

26.6.8 For high-powered lasers, be familiar with and follow written operating procedures.

26.6.9 Lasers can be reflected off metal surfaces or mirrors often with little loss of intensity, therefore study the intended path before energizing the laser.

- 26.6.10 Be aware of toxic fumes or flying particles that might be produced from target area.
 - 26.6.11 Contain the laser beam as much as possible by using light traps, fireproof for the energy density involved.
 - 26.6.12 Work in well-lighted areas to constrict your eye pupils.
 - 26.6.13 Do not use lasers at eye level (4 to 6 ft. from floor).
- 26.7 Class 3R lasers are “Marginally Unsafe.” This means that the aversion response is not adequate protection for a direct exposure of the eye to the laser beam, but the actual hazard level is low, and minimum precautions will result in safe use.
- 26.8 The ANSI Standard has the same limits for visible class 3R lasers. It also allows invisible lasers in this class. An invisible laser with 1 to 5 times the class 1 limit is a class 3R invisible laser under the ANSI Standard. The only precautions required for safe use of a class 3R laser are that the laser user must recognize the level of hazard and avoid direct eye exposure.

See Appendix D for Laser Hazard Classes

27.0 LOCKOUT-TAGOUT: (SOP#: 1000-AD-015-001)

The Lockout-Tagout Program is designed to comply with OSHA 1910.147 and covers servicing and maintenance of telescopes, antennas, machines, and other equipment in which unexpected energizing or release of stored energy could cause an injury. The Program establishes the minimum procedures for the control of electrical, mechanical, pneumatic, hydraulic, chemical, or other energy during construction, servicing, and maintenance.

- 27.1 The program consists of energy control procedures, employee training and periodic inspections to ensure the equipment is isolated from the energy source and rendered inoperative. The Lockout-Tagout procedures outline the scope, purpose, authorization, rules, and techniques utilized to control energy. The procedures include the following:
- 27.1.1 Notify the telescope operator or machine operator and any other affected employees in the area of the lockout.
 - 27.1.2 Be aware that there may be more than one energy source.
 - 27.1.3 Be aware that stored energy must be dissipated or restrained to prevent possible injury. After the lock is in place, verify the isolation of energy by attempting to operate the device or otherwise test for the presence of energy.
 - 27.1.4 When repair or service is complete, verify that the area is clear before restarting the equipment.
 - 27.1.5 Place the equipment back in service in accordance with the Lockout-Tagout procedures.

- 27.1.6 If more than one employee is working on a locked-out piece of equipment, then each affected employee shall place a lock on the equipment to prevent startup.
- 27.1.7 If a piece of equipment has been locked out and the employee whose lock is on the equipment has left the site, then every attempt shall be made to verify that the lockout was not inadvertently left in place. This must be accomplished before the lock is removed by someone other than the employee that placed the lock.
- 27.1.8 If no contact can be made with the individual, the supervisor, a qualified engineer and the safety manager must be contacted and the situation reviewed before the lock can be removed.

Refer to the NOAO SOP 1000-AD-015-0001 for more details.

28.0 MACHINE GUARDS

28.1 The following types of dangerous moving parts need guarding:

- 28.1.1 The Point of Operation-the point where work is performed on the material, such as cutting, shaping, boring or forming of stock.
- 28.1.2 Power Transmission Apparatus-the components of the mechanical system that transmit energy to the part of the machine performing the work. These components include flywheels, pulleys, belts, connections, couplings, cams, spindles, chains, cranks and gears.
- 28.1.3 Other Moving Parts-parts of the machine which move while the machine is working, can include reciprocating, rotating and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

28.2 Guards must meet these minimum general requirements:

- 28.2.1 Prevent Contact-the guard must prevent hands, arms or any part of your body or clothing from making contact with dangerous moving parts.
- 28.2.2 Secure-guards should not be easy to remove or alter; a guard that can easily be made ineffective is no guard at all. Guards and safety devices should be made of durable material that will withstand the conditions of normal use. They must be firmly secured to the machine.
- 28.2.3 Protect from Falling Objects-the guard should ensure that no objects could fall into moving parts. A small tool that is dropped into a cycling machine could easily become a projectile that could injure someone.
- 28.2.4 Create No New Hazards-a guard defeats its own purpose if it creates a hazard of its own such as a shear point, a jagged edge, or an unfinished surface which can cause a laceration. The edges of guards should be rolled or bolted in such a way that they eliminate sharp edges.
- 28.2.5 Create No Interference-guards should be designed so that equipment can be maintained and lubricated without having to remove them.

29.0 MACHINE /TOOLS SAFETY REQUIREMENTS

- 29.1 General safety rules apply to both stationary and portable equipment. The following rules apply to every machine or power tool you may use:
- 29.1.1 Keep your work area well lighted and dry.
 - 29.1.2 Keep tools sharp, oiled and stored in a safe, dry place. Regularly inspect all tools, cords and accessories. Repair or replace problem equipment immediately.
 - 29.1.3 Keep your work area clean. Sawdust, paper and oily rags are a fire hazard and can damage tools.
 - 29.1.4 Use safety features like three-prong plugs, double insulated tools and safety switches. Make sure all machine guards are in place before using any equipment.
 - 29.1.5 Use personal protective equipment when necessary. This might include safety glasses, safety shoes, gloves, hearing protection, or respiratory protection.
 - 29.1.6 Dress correctly. Never wear clothing or jewelry that could become entangled in power tools.
 - 29.1.7 Install or repair equipment only if you are qualified to do so.
 - 29.1.8 Use the right tool for the job. Do not force a small tool to do heavy work.
 - 29.1.9 Keep electric cables and cords clean and free from kinks. Never carry a tool by its cord, or pull a plug from the wall by the cord.
 - 29.1.10 All visitors to machine shops are required to have safety glasses if equipment is in operation.
 - 29.1.11 Never leave loose tools on other equipment, telescopes, antennas, or vehicles.
 - 29.1.12 All stationary equipment in labs, shops or other work areas is to be secured to the floor or bench surface.
- 29.2 Grinding Wheels: It is important for all employees who use a grinder to be familiar with the mounting operation, speed, and use of the grinder and different wheels. The following guidelines represent minimum acceptable safety practices for grinder use:
- 29.2.1 Inspect the grinding wheel before installation.
 - 29.2.2 Never alter the mount hole or force a wheel on the spindle.
 - 29.2.3 Make sure the safety flanges are used to mount the wheel.
 - 29.2.4 Adjust the wheel guards and put on PPE before grinding.
 - 29.2.5 Make grinding contact without bumping the wheel.
 - 29.2.6 Grind only using the face of the straight wheel.
 - 29.2.7 Use a disk wheel for side grinding.
 - 29.2.8 Never grind aluminum on a standard wheel.

30.0 MOTOR VEHICLE SAFETY

Owned and AURA rented Vehicles:

- 30.1 Employees driving company or government vehicles must possess a valid driver's license and, if applicable, a valid international driver's license. Government vehicles are for only official duties connected with the Center, and in accordance with guidelines of the NSF where specified in the contract.
- 30.2 A U.S. Government Motor Vehicle Operators ID card (GSA card) must be obtained from the local Center facilities office. Unauthorized persons may not be transported. Drivers are personally responsible for citations, fines or confinement resulting from violations of traffic laws while driving official vehicles. They are also responsible for conformance to local laws in case of accident and must file an accident report with the local Facilities office as soon as possible.
- 30.3 Failure to follow policies and/or violation of existing laws, by an employee or authorized visitor driving a government vehicle may result in withdrawal of driving privileges by the organization. No staff member may permit a government vehicle to be driven by a person who does not have a valid GSA operators permit. Continued eligibility to drive government or company vehicles depends on a safe driving record and following policies and procedures.
- Refer to <http://www.noao.edu/cfo/vehicle.html> for Vehicle Usage Policies and Procedures.
- 30.4 For your safety and in the event of an emergency, shuttle vehicles are equipped with a radio, accident reporting packet located in the glove box and insurance identification card.
- 30.4.1 Radio communication-Within Tucson, tune communications radio to Channel 2.
(Switch to channel 1 when ½ way to Kitt Peak area)
- 30.4.2 Within Kitt Peak area, tune communications radio to Channel 1 (Switch to channel 2 when ½ way to Tucson area)
- 30.5 Any citations, fines, or confinement resulting from violation of existing laws/statutes by an employee or an authorized visitor operating a company vehicle, or a personal or rental vehicle when connected with NOAO/NSO business, shall be the personal responsibility of the individual, and may result in the loss of driving privileges and other actions.
- 30.6 Report all motor vehicle accidents and or property damage that involve a NOAO/NSO vehicle or rental, no matter how minor. The driver must fill out the accident report form located in the glove box and/or a NOAO/NSO incident report form.

31.0 MOUNTAIN TRAVEL AND HABITAT

Kitt Peak has the potential for hazardous weather conditions year around including heavy rain, flash floods, very high winds, and ice and snow, particularly in the winter months.

31.1 Employees and visitors that drive shuttles to the mountain are required to carry and monitor a two-way radio when travelling to and from the mountain.

31.2 It is required that all employees and visitors adhere to posted speed limits, or travel at slower than posted limits if conditions require slower travel.

31.3 It is not unusual to have rocks/boulders in the road that need to be avoided and at times could stop traffic until they can be removed. Be aware that rocks could fall at any time.

31.4 There are other concerns for employees and visitors to the telescopes and labs on the mountain sites. Some of these concerns are the prevalence of poisonous animals/bugs such as snakes and scorpions.

31.5 On Kitt Peak it is not unusual to find cattle roaming across the highway and if it is dusk or nighttime, one may not have a lot of time to react and apply the brakes, but be sure to drive safely and not too fast.

31.6 Also lightning is a major concern on mountaintops and no one should be standing near corded telephones, electrical appliances, electric sockets or plumbing. Avoid water activities like taking a shower and try to get into a large, fully enclosed, substantially constructed building. Next best is an all-steel vehicle with closed windows and don't touch anything but the seat.

31.6.1 To determine the danger, use the National Lightning Safety Institute, NSSI, 30/30 Rule. When you see lightning, count the time until you hear thunder. If the time is 30 seconds or less (9.66 km), go immediately to a safe place.

31.7 Snow which accumulates on the roads and telescope domes will often melt during the day, but refreeze at night. This can result in the roads being coated with clear ice which poses a slip hazard for both walking and driving, particularly on the hills leading to WIYN and the 4-meter telescopes.

31.8 In addition, snow and ice accumulating on the 4-m telescope dome and catwalk can break off and fall, posing a significant hazard to those walking in the vicinity of the building. Large ice chunks have been known to fly off the dome and land at the edge of the parking lot, 30 feet or more away from the building itself. Under these conditions, the 4-meter telescope may be closed to the public, and staff should park under the protective overhang by the large roll-up door on the north side of the building and enter using the nearby doorway.

32.0 OFFICE SAFETY (SOP#: 1000-AD-015-0026)

The purpose of this procedure is to provide general office safety procedures for NOAO-N office personnel. This applies to all employees working in administrative and office areas throughout the facility, both in Tucson and Kitt Peak.

32.1 Every employee should endeavor to keep his or her office clean and neat. Excess accumulation of paper products should be avoided to minimize the potential for fire and to eliminate tripping hazards.

32.2 Electrical outlets must not be overloaded, and extension cords are not to be used in place of permanent wiring.

32.3 Wiring should be routed so as not to present a tripping hazard, even if low profile cable protectors are required.

32.4 All electrical power strips or bars must be UL approved and have a resettable circuit breaker on the strip, and they should be kept off the floor and secured.

32.5 Freestanding bookcases should be stable and/or secured to the wall to prevent tipping. Heavy books should be on the bottom shelves.

32.6 File cabinets should be opened one drawer at a time to prevent tipping. Whenever possible, cabinets should be loaded from the bottom-up, with the heaviest accumulation in lower drawers.

32.7 Ergonomics is the study of fitting the work/job to the individual. Office furniture and equipment must accommodate various body types.

Refer to the NOAO SOP 1000-AD-015-0026 for more details.

33.0 PERSONAL PROTECTIVE EQUIPMENT-(PPE) (SOP#: 1000-AD-015-0008)

33.1 Protective equipment shall be provided and used as required, and shall be maintained in a sanitary and reliable condition.

33.2 Each Department shall specify and provide employees with personal protective equipment as required to safely perform their assigned tasks. Each Department is also responsible for training employees in the proper use of any of the provided equipment. Specific requirements and related standards are found in OSHA 29CFR 1910.132-140.

33.3 Engineering and administrative controls are the installation of equipment or other physical facilities and procedures and work practices designed to minimize or eliminate the potential for an adverse exposure to hazards. Whenever engineering controls are not available or in conjunction with administrative controls are not fully

capable of individual protection, the employee must wear protective clothing or personal protective equipment (PPE).

Refer to the NOAO SOP 1000-AD-015-0008 for more details.

34.0 POWERED INDUSTRIAL TRUCKS (SOP#: 1000-ADD-015-0013)

Powered Industrial Truck Safety Training Program in accordance with OSHA 29 CFR 1910.178. The following information provides the highlights of the safety requirements of the program.

- 34.1 Supervisors will make every effort to follow-up on safe driving practices. NOAO-North will also do everything necessary to maintain our trucks and facilities in the safest condition and expect everyone to cooperate in keeping them that way. By matching safe driving with safe equipment, we will keep truck accidents and injuries to a minimum. NOAO-North wants to do everything we can to prevent our employees from getting injured.
- 34.2 A list of safety rules has been set up to ensure that all powered industrial truck operators have a uniform understanding of safe and efficient operations and safety rules.
 - 34.2.1 Only trained authorized operators will be permitted to operate powered industrial trucks.
 - 34.2.2 Passengers are not allowed to ride on the truck.
 - 34.2.3 When a powered industrial truck is left unattended, forks will be fully lowered, controls will be in neutral, power will be shut off and the brakes set. A powered industrial truck is considered unattended when the operator is 25 feet away from the vehicle which is in view or whenever the operator cannot see the vehicle.
 - 34.2.4 If the load being carried obstructs forward view, the driver will be required to travel in reverse.
 - 34.2.5 Under all conditions the truck will be operated at a speed that will permit it to be brought to a stop in a safe manner.
 - 34.2.6 Do not lift personnel with lift trucks, they are not an elevator.
 - 34.2.7 All accidents must be reported to your supervisor immediately.
 - 34.2.8 Keep loads as low to the ground as possible. Keep forks down when traveling empty.
- 34.3 Not only is it important to know how to professionally operate a forklift, it is vital to know all safety rules of operation.
 - 34.3.1 If, at any time, a forklift is found to be in need of repair, defective, or in any way unsafe, the truck must be taken out of service until it is safe to operate.
 - 34.3.2 Only a trained and authorized operator is permitted to drive a forklift.
 - 34.3.3 A qualified operator is one who has been fully trained, knows the general vehicle design and who has learned safety inspections and safe driving rules.

34.4 The following “rules of the road” list general guidelines for safe forklift operations.

34.4.1 Always keep arms and legs inside the vehicle.

34.4.2 Wear protective equipment, when required, such as safety glasses and ear protection.

34.4.3 Face direction of travel, keep your mind on what you are doing and never travel forward with the load blocking your view.

34.4.4 Pedestrians always have the right of way.

34.4.5 Never allow anyone to ride on your forklift. Forks may be used as a lift only with an approved safety platform. An appropriate safety harness and lanyard must be used.

34.4.6 Know the position of your forks at all times.

34.4.7 Obey speed limits. Avoid sudden braking.

34.4.8 Slow at all intersections and always sound the horn at blind ones.

34.4.9 Always drive up and back down ramps and inclines. The center of gravity of the forklift is in a more stable position when operated in this fashion.

34.4.10 Lift or lower the load only when completely stopped, never when traveling.

34.4.11 Cross railroad tracks at an angle, never a right angle.

34.4.12 No horseplay is allowed.

34.4.13 Keep aware of overhead clearances.

34.4.14 Know the load limits of the vehicle.

34.4.15 Watch for obstructions or spills which may cause an accident.

34.4.16 Make sure the load is balanced.

34.4.17 No towing or pushing is allowed with a forklift.

34.5 Examine the powered industrial truck prior to use. At a minimum, check the fork pins and stops, all cowling, body parts, and tires for wear. Check fuel, oil, and water levels and report any leaks.

Refer to the NOAO SOP 1000-AD-015-0013 for more details.

35.0 RESPIRATOR PROGRAM

OSHA Respiratory Protection Standard 29 CFR 1910.134 Appendix D – Information for Employees using respirators when not required under the Standard.

35.1 Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards.

35.2 If your employer provides respirators for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard. The following are safety precautions for utilizing a respirator:

- 35.2.1 Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
- 35.2.2 Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how well it will protect you.
- 35.2.3 Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.
- 35.2.4 Keep track of your respirator so that you do not mistakenly use someone else's respirator.

36.0 SAFETY INSPECTION GUIDELINES

Safety inspections should be conducted at least once per year, and more often if there are safety concerns. The inspections should be conducted by at least one authorized Safety Representative, preferably with a member of management.

36.1 Pre-inspection discussion:

- 36.1.1 Safety concerns...what is the most unsafe job?
- 36.1.2 How is the department attitude towards safety, in general?
- 36.1.3 Is there a lock-out/tag-out program and is it used?
- 36.1.4 Are training records and accident records kept in the department?
- 36.1.5 Are there confined space issues, hazmat issues, etc.?

36.2 Telescope Inspection:

- 36.2.1 Look for, loose wires, possible pinch points, lock-out tag-out devices, oil leaks, cryogenic safety (proper connectors, gloves, long sleeves, face masks, etc.), telescope movement lights or sirens, fall protection devices, including tie off points, guard rails.
- 36.2.2 Also look or listen for extended loud noise levels, flammable liquids exposed, unsafe ladders, access issues, control issues, sharp points or corners, unguarded belts or pulleys, etc.

36.3 Machine Shop Inspection:

36.3.1 Look for unguarded belts and pulleys, loose wires, machines too close to each other, bad oil leaks, housekeeping, fluid disposal, two hand control buttons, emergency shut off switches.

36.3.2 Safety glass availability and use by operators and visitors, access to electrical panels, evidence of lock-out/tag-out, air nozzles over 35 lbs. for cleaning, slippery conditions, availability of first aid kit and telephone.

36.3.3 Check steel storage racks, parts bins and general condition of machines and equipment. Are hazardous metals being machined, if so are there proper precautions.

36.3.4 Check grinding wheels for aluminum build up, and proper spacing of tool rests and eye shields.

36.4 Vehicle Inspection:

36.4.1 Includes cars, trucks, fork lifts, cranes, snow plows, tractors, etc.

36.4.2 Check overall appearance and condition, check brakes, lights, turn signals, horns and back up warning systems.

36.4.3 Look for worn tires, missing parts, crane inspection certificates, worn, leaking, or gashed hydraulic hoses.

36.4.4 Be sure that chains and lifters are in good shape on the cranes. Do all vehicles have fire extinguishers, and small safety kits with first aid items?

36.5 Fall Protection:

36.5.1 Are there proper tie off points for employees working at heights?

36.5.2 Does each employee have his or her own full body harness and is there a record of each inspection of each harness.

36.5.3 Are there records of inspections of other fall protection equipment?

36.5.4 Have employees taken training and is there a record?

36.6 Housekeeping:

36.6.1 Are floors maintained in a clean, safe dry manner with no holes or protrusions such as nails, and no slippery areas, and no tripping hazards such as extension cords?

36.6.2 Is equipment stored properly, at least 18 inches from the ceiling in sprinkler system areas and not in aisles?

36.6.3 Are eating areas and bathrooms cleaned and sanitized on a regular basis?

36.7 Electrical:

36.7.1 Look for blocked electrical panels and shut offs, extension cords being used in place of permanent wiring, flexible electric cords without strain relief.

36.7.2 Are all boxes, feeder and branch circuits identified at the outlet and in the panel box?

36.7.3 Are boxes and/or breakers equipped with lock holders for lockout/tagout?

36.7.4 Are cords or wires run through walls without approved conduit?

36.8 Compressed Gas:

36.8.1 Look for cylinders to be chained to walls or in approved standing containers.

36.8.2 Are cylinders marked properly and do they have safety relief valves.

36.8.3 Cylinders should not be stored in hallways or corridors or near flammables or combustibles.

36.8.4 Is hydrogen being used and if so is it in a well-ventilated area and being kept at a safe distance from flammable gases and people?

36.8.5 Are rules concerning transportation of gases being followed?

36.9 Welding Areas:

36.9.1 Welding should only be done in a well-ventilated area, away from flammables.

36.9.2 Only approved welding equipment, in good condition should be used and it should have anti-flash back valves installed.

36.9.3 All welders should have been trained and records kept.

36.9.4 Cylinders must be kept in approved carts or containers.

36.9.5 Acetylene cylinders shall be stored with the valve end up and all cylinders that are not in use shall have valve protection caps in place, especially when being moved.

36.9.6 All cylinder valves should be closed when moving cylinders and when work is finished and the welder has left the area.

36.9.7 Proper safety equipment including gloves and welding glasses or helmets must be used and in good, safe condition.

36.9.8 Precaution must be taken to assure that visitors to a welding area cannot look at the flash or be exposed to it without proper equipment.

36.10 Signs and Labels:

36.10.1 Are there proper exit signs, equipment warning signs, chemical labels and in use signs, fire extinguisher location signs, Safety eyewear warning signs, etc.

36.11 Fire Safety:

36.11.1 Look for current inspection stickers on fire extinguishers.

36.11.2 Check for accumulations of trash and flammable materials, weeds and debris.

36.11.3 Is there a fire alarm system, smoke detectors, and, if there is a furnace, are there carbon monoxide detectors?

36.11.4 Are routine tests for fire apparatus and fire drills performed and documented? Is there training on fire extinguishers and lists of approved persons to handle extinguishers.

36.12 Fork Lift and Crane Safety:

- 36.12.1 Check equipment, approved certifications, approved operator lists, and look for leaking hydraulic hoses or cylinders.
- 36.12.2 Is there an approved man lift or safety platform with guard rails and can it be secured to the fork lift mast.
- 36.12.3 Check the fork pins and stops, cowling, body cage, and tires for wear.
- 36.12.4 Are the forks in the lowest position when the fork lift is parked and not in use?

36.13 Security:

- 36.13.1 Check for fences, locks on doors, windows etc. Are there after-hours workers, and good parking lot lights?
- 36.13.2 Is there an alarm system and does it go to security?

36.14 Stairs and Handrails:

- 36.14.1 Are the stairs painted to indicate a level change? Are handrails located at the right height?

36.15 Ladders:

- 36.15.1 Check all ladders for proper feet, damage, OSHA approval in electrical shop, etc.
- 36.15.2 In general, wood ladders should not be painted because paint can mask problems.

36.16 Portable Hoists and Winches:

- 36.16.1 Look for current certification, wire rope connected properly, cable spooling properly, and see if there are weight limits marked.
- 36.16.2 There should be an inspection log for the hoist.
- 36.16.3 Check that associated slings, chains and web straps are in good condition and have regular inspection.

36.17 Fuel Tanks:

- 36.17.1 Are there barricades, proper signage, vents, and emergency shut off valves?
- 36.17.2 If it is underground is it due for removal, or is it a double tank?
- 36.17.3 If it is above ground, is it a double tank or is it located in a spill proof container?
- 36.17.4 Are there leak test valves, and if so do a leak test?

36.18 Used Oil Management:

- 36.18.1 All telescopes use oil and grease in big quantities and the used oils must be disposed of properly.
- 36.18.2 Look for a plan and good records for doing this.
- 36.18.3 Also check that new oil and greases are stored properly as are old oils in drums in spill- proof containers.

36.19 Chemicals:

- 36.19.1 Look for proper storage of chemicals and other flammable compounds.
- 36.19.2 There should be specially made flammable liquid storage cabinets for oil based paints, thinners and solvents.
- 36.19.3 Are there persons trained to handle chemicals?
- 36.19.4 Is there an SDS book in the vicinity of chemical usage and is there a policy to get current SDS from the vendor selling the product to the person using it and finally into the book located in the vicinity of use?

36.20 Respiratory Protection:

- 36.20.1 Look for areas that might require respiratory protection and check to see that respirators are available and being fitted and used properly.

36.21 Lasers:

- 36.21.1 Are lasers being used and if so what class are the lasers and are there proper protections in place for the class of laser?
- 36.21.2 Check for a laser safety program, that deals with who is authorized to use lasers and where.

36.22 General:

- 36.22.1 Is asbestos or lead-based paint an issue and is there a management plan for dealing with it?
- 36.22.2 Are there workers who must go in confined spaces and if so is there a program for safety?
- 36.22.3 If it is in a remote place, are there persons always available who are trained in first aid, or are EMT's.
- 36.22.4 Check for first aid cabinets in all areas where there are likely to be cuts and injuries, such as machine shops, shipping areas, or repair facilities.

37.0 SAFETY SIGNS

All employees need to understand the meaning of the warning signs at the entrances to work areas and the specific location of the hazard.

37.1 The Safety Manager and Maintenance Supervisor shall be responsible for identifying areas of work where special hazards exist. The Safety/Maintenance Supervisor are responsible for obtaining, placing, and maintaining appropriate warning signs, labels, or placards at the entrances to the work areas and at the specific location of the hazard.

37.2 As part of the communication responsibility, signs are posted throughout each work area indicating the proper procedures to follow when working on or around potential

hazards. This includes, but is not limited to, speed limit signs, safety glasses signage, as well as indicators of hard hat areas. All safety signs must be observed.

37.3 Signs are classified according to use. There are five classifications, which are:

37.3.1 Danger - indicates an immediate danger that could result in death or injury. Danger signs use black, red and white colors.

37.3.2 Warning - indicates a potentially hazardous situation which, if not avoided, could result in death or injury. Yellow conveys a general warning sign.

37.3.3 Caution - warns against potential hazards or unsafe practices and represents the potential for moderate or minor injury. Caution signs have a yellow background, a black panel and yellow letters.

37.3.4 Notice - indicates general safety policies and should not be associated directly with a hazardous situation. Typically blue and white signs.

37.3.5 Safety Instruction Signs - convey general instructions relative to safety measures. These signs are white, with green panel and white letters.

37.4 Uses of labels are for identifying potential hazards of chemicals in the workplace. Along with signs, they help ensure all workers understand the hazards around them.

37.5 Tags are sometimes used as signs to prevent accidental injury or illness to employees exposed to potential hazardous conditions, equipment or operations. Tags are used until the identified hazard is eliminated or the hazardous operation is completed.

38.0 SMOKING POLICY

We have an established smoking policy to comply with State and Federal guidelines, as well as, to encourage consideration for our non-smokers. Smoking is not permitted in company buildings in the United States.

38.1 Smoking and use of other tobacco products is strictly prohibited on all AURA premises (except in designated areas) and in AURA buildings and vehicles at all times.

38.2 Vapor pipes are also prohibited.

38.3 Smoking is not permitted at any AURA business or social function held at other locations except in authorized and designated areas.

38.4 Hawaii and Arizona State Ordinances requires that employees smoke outside the building, at least 20 feet away from the building windows, doors and ventilation intakes. In New Mexico, employees must be at least 50 feet away from entrances, windows and ventilation intakes.

38.5 All smoking materials must be properly extinguished and disposed of in an approved container.

39.0 TELESCOPE/ANTENNAE SAFETY

- 39.1 All personnel whose work requires them to be on or under any elevated structure such as a telescope, antenna, wind tower, water tank or other similar structure are required to wear hard hats or other approved head protection if there is someone working above. All contractors and visitors are to conform to this rule or remove themselves from the hazard.
- 39.2 During maintenance/construction/renovation work no unauthorized personnel is to be at or on a telescope unless they have permission from the Maintenance Supervisor or Safety Manager.
- 39.3 Special precautions must be observed if it is necessary to move the telescope when someone is on or near it.
- 39.4 No one shall work on the telescope drives or control systems where dangerous voltages exist, or on electronic gear or drive gears without having appropriate lock-out tag-out locks in place.
- 39.5 No one is to be on a telescope or dome in adverse weather conditions (rain, snow, sleet, high winds, etc.).
- 39.3.1 There must be a qualified operator at the controls at all times the telescope is in motion.
- 39.3.2 The person on the telescope must be provided with communications to the operator at all times.
- 39.3.3 If the telescope is remotely operated, the operator shall communicate orally with other persons on the structure before starting the movement of the telescope.
- 39.3.4 In Addition at least one person shall be a designated safety monitor. This person must watch the telescope relative to the worker(s) and call for work to be stopped or moved if necessary.
- 39.3.5 The safety monitor must not be assigned to any other tasks while work continues on the moving telescope.
- 39.3.6 More than one safety observer is required if all of the workers on the telescope cannot be seen at the same time by one person.
- 39.3.7 Anyone planning to be on the telescope structure when it is in motion, as well as the safety monitor, shall be advised before climbing as to the danger areas around the drives, and should know the location of all emergency stop switches.
- 39.3.8 They shall also follow all safety rules such as wearing proper safety harnesses with appropriate tie-off points, and utilization of other personal protective equipment that may be called for.

- 39.5.1 Steel and aluminum structures are slippery when wet, and care should be taken when climbing in these conditions.
- 39.6 In the event that any personnel are injured on a telescope, antenna or other structure, immediately call for emergency help.
- 39.7 No loose materials, tools or equipment are to be left on any telescope or other structures at any time for any reason.
- 39.8 If there is any doubt as to the safety of any activity, anyone can stop that activity and then consult with the Maintenance Manager or Safety Manager.

40.0 TWO PERSON WORK RULE

- 40.1 NOAO has telescopes and equipment in remote and isolated sites. In addition it has facilities that include complicated, large moving equipment and it has processes that require the presence of hazardous chemicals. Because of these facts and the nature of our research, it is often advisable that some tasks which could be completed by one person, be performed by two persons in order to increase safety.
- 40.2 No employee should perform any task alone if that individual feels that the job cannot be completed safely without assistance or the presence of a second person.
- 40.3 In general, the Two-Person Work Rule shall be in effect under at least the following conditions:
- 40.3.1 Working from any external platform, scaffolding, or building roof. This would include scissor lifts and the like.
 - 40.3.2 Working with any energized electrical circuits above 408 volts AC. (The second person does not need to be qualified, as long as he is not working on the electrical components).
 - 40.3.3 Accessing any parts of the telescope under hazardous weather conditions.
 - 40.3.4 Working on or near moving telescopes or antennas.
 - 40.3.5 Working with hazardous chemicals or in areas of very high temperatures.
 - 40.3.6 Working in manholes or confined spaces.
- 40.4 There may be emergency or unplanned circumstances where it seems to be important to work alone, despite the above rules and guidelines. If that happens, and the person who feels that he or she must perform (and is willing to perform) a task without benefit of a second person in attendance, then that person should:
- 40.4.1 Contact his or her supervisor and advise the supervisor of the circumstances.
 - 40.4.2 The supervisor may give approval to perform the task if both persons feel confident that the task can be performed safely.
 - 40.4.3 If this happens there will be a direct, hand-held two-way radio or cell phone on an open line between the worker and someone who is in a place close enough to respond quickly, if needed.

40.4.4 Video monitoring of some work situations might also be considered in some circumstances.

41.0 USED-OIL MANAGEMENT AND FLOURESCENT LAMP DISPOSAL

41.1 Used-Oil

NOAO follows the requirements with Environmental Protection Agency (EPA) 40 CFR 279 for used oil generators. The plan outlines a written description of used oil management procedures, disposal methods, and transportation requirements.

- 41.1.1 Never dump or dispose of used oil in the trash, in sewers, or on the ground.
- 41.1.2 Make sure collection and storage set-up is leak-proof, spill proof, and that tanks have lids or are covered to prevent water from entering.
- 41.1.3 Maintain collection containers regularly, comply with local fire and safety regulations, and avoid leaks and spills.
- 41.1.4 Label storage tanks "Used Oil."
- 41.1.5 Keep records of used oil sent to recycling.
- 41.1.6 Never mix used oil with any other material. Keep gasoline, solvents, degreasers, paints, and so on, separate to prevent contamination or the mixing of incompatible wastes.
- 41.1.7 Keep the area near the storage devices neat and clean.
- 41.1.8 If there are areas where oil could possibly be spilled, keep a supply of clean up and absorbent materials on hand.

41.2 Fluorescent Bulbs

NOAO follows ADEQ guidelines when disposing of fluorescent & high intensity discharge lamps as they should not be disposed of as regular trash. Most fluorescent lamps contain Mercury (a highly toxic, heavy metal) and HID lamps contain elemental Sodium (which is water reactive).

- 41.2.1 For disposal of these lamps, please call CFO/Safety to set up a pick-up date.
- 41.2.2 When storing these lamps while awaiting pick up by Facilities, you should store the lamps in a closed container that has a label identifying the box as universal waste (labels are available from Facilities department).
- 41.2.3 Labels should be marked with the first date a lamp was placed in the storage container.
- 41.2.4 Care should be taken so that lamps will not be crushed.

42.0 VISITORS (SOP#: 1000-AD-015-0019)

The safety of contractors/visitors/observers to any NOAO facility /Kitt Peak Observatory is the responsibility of each visitor's Observatory host. It is the responsibility of the host to be sure that each visitor complies with all Safety Rules and Procedures. If you are the host, be sure you know the Safety Rules and Procedures well, and this may include procedures such as Lockout/Tagout. Be sure to inform the Telescope Operator or Site/Operations Manager that you will be escorting visitors into the area, prior to the visit.

Refer to the NOAO SOP 1000-AD-015-0019 for more details.

43.0 WORKING SURFACES/LADDERS/SCAFFOLDS (SOP#: 1000-AD-015-0027)

In accordance with OSHA 29 CFR 1910.21-32, workplaces are to be maintained and kept accessible.

43.1 The following details some of the general safety requirements:

- 43.1.1 All places of employment, passageways, storerooms, and service rooms shall be kept clean, orderly, and in a sanitary condition.
- 43.1.2 Floors will be maintained, cleaned, dried and in good condition.
- 43.1.3 There will be no obstructions or protrusions from the surface.
- 43.1.4 All floor and wall openings or any place where there is a falling object hazard will be appropriately guarded and signed.
- 43.1.5 All portable ladders will meet ANSI standards and be maintained in good condition.
- 43.1.6 Damaged ladders will be properly repaired before use or destroyed to prevent use

43.2 LADDERS - The following points summarize many of OSHA'S regulations for ladders and can serve as guidelines for ladder use:

- 43.2.1 Do not build makeshift ladders out of chairs, benches or boxes. If the job calls for a ladder take time to find one.
- 43.2.2 Make sure there is only one person on a ladder at a time, unless the ladder is designed for two.
- 43.2.3 Check the condition of the ladder before use. Do not use a ladder with broken or cracked rails or rungs or rungs made slippery by grease or oil. The ladder should have good safety feet.
- 43.2.4 Do not place a ladder on boxes or blocks to make it taller.
- 43.2.5 Face front and use both hands as you climb.
- 43.2.6 Do not overreach from a ladder. If your waist reaches past the uprights you have gone too far.

- 43.2.7 Set ladders up properly by using the 4 to 1 rule. The distance from the wall to the base of the ladder should be one-fourth the distance from the base of the ladder to where it touches the wall.
- 43.2.8 Hoist tools or materials up to you after you reach the top, so both hands are free for climbing.
- 43.2.9 Do not stand on top of a stepladder, or get too close to the top of an extension ladder.
- 43.2.10 Any portable ladder being used to gain access to an upper level such as a roof, must extend at least three feet beyond that level.

43.3 SCAFFOLDS - Working surfaces include scaffolding. Keep both feet firmly on the scaffold with these safety precautions:

- 43.3.1 Make sure scaffolds are sturdy. Check them daily prior to using for any safety defects.
- 43.3.2 Always clear work surfaces of snow, ice or slippery materials. Sand wet planking for sure footing.
- 43.3.3 Never overload scaffolds with people, equipment or supplies.
- 43.3.4 Lock casters on mobile scaffolding to prevent movement when working.
- 43.3.5 Use ladder jack scaffolds only for light duty work.
- 43.3.6 Utilize fall and climbing protection devices to prevent injury in the event of an accidental slip, trip, or fall on ladders or scaffolding.

Refer to the NOAO SOP 1000-AD-015-0027 for more details.

44.0 WELDING/CUTTING/HOT WORK (SOP#: 1000-AD-015-0017)

The OSHA requirements associated with welding, cutting and hot work are found in the OSHA Manual 29 CFR 1910.252.

- 44.1 The general safety policy is that appropriate eye, hand, and body protection will be worn at all times while welding cutting, brazing, or burning.
- 44.2 The welder will consider the safety of others in the worksite by placing glare shields, barricades, or other barriers as necessary.
- 44.3 The worksite shall be properly ventilated and respirator equipment will be worn when necessary.
- 44.4 A fire watch shall be placed for all field-welding operations.
- 44.5 A few practices for working safely apply in many situations:
 - 44.5.1 When working above ground or floor level, use a platform with toe boards and standard railings or safety harnesses and lifeline.
 - 44.5.2 Also, protect workers from stray sparks or slag in the area below an elevated surface where welding is taking place.

- 44.5.3 Aim the welding torch away from cement or stone surfaces. Moisture within these materials could cause them to explode when they reach a certain temperature.
 - 44.5.4 When finished welding or cutting, warn other workers of hot metal by marking or putting up a sign.
 - 44.5.5 Keep floors clean by putting electrode or rod stubs in an appropriate container. Keep floors clear of tripping hazards; store tools safely.
 - 44.5.6 Never use bad conductors, damaged regulators, torches, electrode holders or other defective equipment.
 - 44.5.7 Do not arc or resistance weld while standing on damp surfaces, or weld in rain.
 - 44.5.8 Routinely inspect and maintain welding equipment, including welding cylinders. Inspect cylinders regularly to make sure all parts are in good working order, especially manifolds, distribution piping, portable outlet headers, regulators and hose or hose connections. Be sure that welding torches and regulators have flashback arresters installed according to gas flow requirements.
 - 44.5.9 If the welding project itself must take place at a specific location, all fire hazards in the vicinity of a welding or cutting operation must be moved to a safe place before welding may begin.
 - 44.5.10 Suitable fire extinguishing equipment shall be maintained in a state of readiness for instant use and should generally be in reach of any welding operation.
 - 44.5.11 Consider a thorough review of the OSHA standards referenced above if welding anything with cadmium, fluorides, mercury or other materials that might give off poisonous fumes. Be sure there is adequate ventilation.
- 44.6 Your supervisor will designate a worker as a “fire watch” whenever welding or cutting is performed in locations where other than a minor fire might develop, or any of the following conditions exist: (Procedure#2100-AD-015-0072)
- 44.6.1 Where appreciable combustible material in building construction or contents is closer than 35 feet to the point of operation.
 - 44.6.2 Where appreciable combustibles are more than 35 feet away but are easily ignited by sparks.
 - 44.6.3 Where wall or floor openings within a 35-foot radius that expose combustible material in adjacent areas including concealed spaces in walls or floors.
 - 44.6.4 Where combustible materials are adjacent to the opposite side of metal partitions, walls, ceilings or roofs and are likely to be ignited by conduction or radiation.
- Refer to the NOAO SOP 1000-AD-015-0017 and procedure 2100-AD-015-0072 for more details.

45.0 REFERENCES

OSHA 29CFR1910 General Industry Regulations

46.0 USEFUL TELEPHONE NUMBERS

Local Government

Tucson Police Department Non-Emergency	911 520-791-4444
Tucson Fire Department	911
U of A Police Department 1852 East First Street Tucson, Arizona 85721	520-627-8273
Bomb Squad	911
Tohono O’Odham Department of Public Safety Fire Police Environmental Office Solid Waste Regulatory Office	911 all emergencies 520-383-4921/8276 520-383-3275 520-383-8113 520-383-8680
Livestock Facilities Tribal Herd	520-383-6480 520-383-2459
Federal Agencies	
U.S. Border Patrol	520-505-7945
U.S. Customs	520-407-2300
Center for Disease Control (CDC)	404-639-3311
U.S. Forest Service Supervisors Office	520-388-8300
State Agencies	
Dept. of Public Safety -- Highway Patrol and Helicopter Fire Marshal’s Office AZ Occupational Safety and Health Administration Road Conditions	520-746-4500 520-628-6920 520-628-5478 511
Department of Environmental Quality, Tucson Agriculture -- Pesticide Hotline AZ Game and Fish (Tucson) Poison Control	520-745-4536 602-255-3664 520-628-5376 800-222-1222

County Agencies

Sheriff	520-351-4600
Animal Control	520-724-5900
Disease Control	520-243-7800

Kitt Peak Cell Phones

Administration (cell phone number) (dial 1-520)	520-730-1276
Fire Barn (cell phone number)	520-730-1132
Telephone Room (cell phone number)	520-730-5739

Chemical Spill, Kitt Peak Emergency Number 8777/8721

Water Main Break 8777/8721

4 meter elevator emergency telephone 520-383-3540

Telephones and total power failure at Kitt Peak – Use Cell Phones**Tohono O'odham Utility Authority (Kitt Peak power lines only)**

Power Outage	1-520-383-5800
Sells access (power failure line without generator)	1-520-383-2892

Hospitals

Univ. Physicians Healthcare @ Kino
Hospital, 2800 East Ajo Way 520-874-2000

Northwest Medical Center, 6200 North La Cholla Blvd. 520-742-9000

St. Joseph's, 350 North Wilmot Road 520-873-3000

St. Mary's, 1601 West St. Mary's Road 520-872-3000

Sells Hospital 520-383-7200

Tucson Medical Center, 5301 East Grant Road 520-324-1310

University Medical Center, 1501 North Campbell Avenue 520-694-0111

Other Tucson Police Contacts

Auto Theft 520-791-4664

Burglary 520-791-5171

Fingerprinting 520-791-4697

Fraud 520-791-4481

Gangs 520-351-4460

Homicide 520-791-4487

Missing Persons 520-791-5159

Traffic 520-791-4440

Traffic Investigations 520-791-4389

Kitt Peak Mountain Staff

Larry Reddell, Kitt Peak Facilities Supervisor 520-318-8734 (Office)

William Buckingham - Visitor Center Manager 520-318-8163 (Office)

Tucson Staff

NOAO Director 520-318-8283 (Office)

Director of Kitt Peak National Observatory 520-318-8486 (Office)

Facilities Manager 520-318-8284 (Tucson Office)

Tammie Lavoie, Safety Manager 520-318-8211 (Tucson Office)
603-915-1516 (cell)

Tucson Security Service Evening cell Phone 520-312-4067

KPNO ADMINISTRATION/SUPPORT:

Conference Phone/Library	8601
Dining Room	8686
Dining Room Lobby	8687
Dining Room Lounge	8689
Disconnect Radio	#
Electrician's Shop	8654
Electronic Maintenance	8683/8722
Facilities Coordinator (Hawes)	8734
Facilities Manager (Dunlop)	8284
Fire House/First Aid	8659
Fire/Emergency Reporting	8777 or 8721
Garage	8653
Guest Phone, Reading Rm	8602
Instrument Support	8703
KPNO Software Support	8684
Kitchen Administration	8604
Maint. Shop/Tool Rm	8651
Mechanical Technical Support	8746
Mountain Electronics	8663
Observing Support (Harmer)	8218

Plumbing Shop	8657
Programmer's Office	8609
Radio for Assistance	8721
Recreation Hall	8652
Safety Manager (Lavoie)	8211
Scientific Support Supervisor	8701
Solar Aluminizing Rm	8685
Switchboard	8603
Tech. Assistant Office	8607
Telephone Equip. Rm	8699
Visitor 's Center 16" lower	8725
Visitor 's Center Mgr.	8163
Visitor's Center	8726
Water Pump House	8658
Welding Shop	8655

KPNO TELESCOPES:**4 Meter Mayall**

Elevator Phones	4229
4 Meter Mayall	8620
Main Observing Room	8621
Computer Room	8622
Coude Observing Rm	8623
Ground Floor	8624
Lounge	8625
Pump Floor	8626
Telescope Maintenance	8627
RUPS/Transformer Rm	8628
Cassegrain Focus Cage	8741

2.1 Meter Observatory

2.1 Meter	8630
Console/Ground Floor	8630
Main Observing Room	8631
Computer Room	8632
Coude Observing Rm	8633

Coude Feed Telescope 8633

16" Telescope upper 8638

CASE WESTERN RESERVE

Burrell Schmidt 8639

LSST Calypso (48" - 1.2m)

Facility 8775

MDM OBSERVATORY

Offices/Telescopes 8660

NATIONAL SOLAR OBSERVATORY

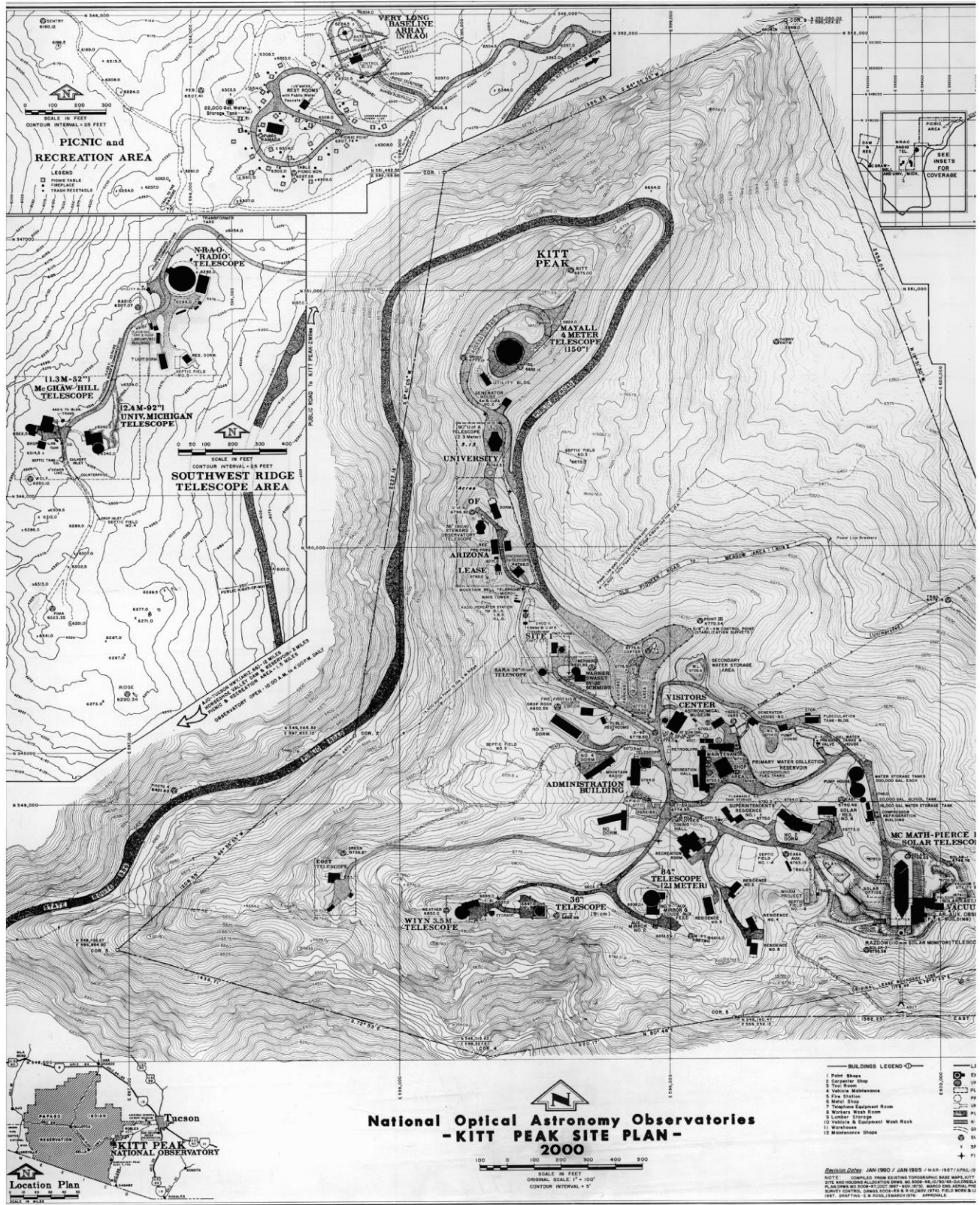
McMath-Pierce Telescope 8640

West Office 8642

Aluminizing Room 8685

KP Telescope 8646

SARA 8763



47.0 APPENDIX/CHECKLISTS

Appendix A

COMPRESSED GAS CYLINDERS CHECKLIST

- Are cylinders with water weight capacity over 30 pounds (13.5 kilograms), equipped with means for connecting a valve protector device, or with a collar or recess to protect the valve?
- Are cylinders legibly marked to clearly identify the gas contained?
- Are compressed gas cylinders stored in areas that are protected from external heat sources such as flame impingement, intense radiant heat, electric arcs, or high temperature lines?
- Are cylinders stored or transported in a manner to prevent them from creating a hazard by tipping, falling, or rolling?
- Are cylinders containing liquefied fuel gas, stored or transported in a position so that the safety relief device is always in direct contact with the vapor space in the cylinder?
- Are valve protectors always placed on cylinders when the cylinders are not in use or connected for use?
- Are all valves closed off before a cylinder is moved, when the cylinder is empty, and at the completion of each job?
- Are low-pressure fuel-gas cylinders checked periodically for corrosion, general distortion, cracks, or any other defect that might indicate a weakness or render it unfit for service?
- Does the periodic check of low-pressure fuel-gas cylinders include a close inspection of the cylinders' bottom?

COMPRESSORS AIR RECEIVERS CHECKLIST

- Is every receiver equipped with a pressure gauge and with one or more automatic, spring-loaded safety valves?
- Is the total relieving capacity of the safety valve capable of preventing pressure in the receiver from exceeding the maximum allowable working pressure of the receiver by more than 10 percent?
- Is every air receiver provided with a drainpipe and valve at the lowest point for the removal of accumulated oil and water?
- Are compressed air receivers periodically drained of moisture and oil?
- Are all safety valves tested frequently and at regular intervals to determine whether they are in good operating condition?
- Does the Division of Occupational Safety and Health use a current operating permit?

- ❑ Is the inlet of air receivers and piping systems kept free of accumulated oil and carbonaceous materials?

COMPRESSORS AND COMPRESSED AIR CHECKLIST

- ❑ Are compressors equipped with pressure relief valves and pressure gauges?
- ❑ Are compressor air intakes installed and equipped to ensure that only clean uncontaminated air enters the compressor?
- ❑ Are air filters installed on the compressor intake?
- ❑ Are compressors operated and lubricated in accordance with the manufacturer's recommendations?
- ❑ Are safety devices on compressed air systems checked frequently?
- ❑ Before any repair work is done on the pressure system of a compressor, is the pressure bled off and the system locked-out?
- ❑ Are signs posted to warn of the automatic starting feature of the compressors?
- ❑ Is the belt drive system totally enclosed to provide protection for the front, back, top and sides?
- ❑ Is it strictly prohibited to direct compressed air towards a person?
- ❑ Are employees prohibited from using highly compressed air for cleaning purposes?
- ❑ If compressed air is used for cleaning off clothing, is the pressure reduced to less than 10 psi?
- ❑ When using compressed air for cleaning, do employees wear protective chip guarding and personal protective equipment?
- ❑ Are safety chains or other suitable locking devices used at couplings of high-pressure hose lines where a connection failure would create a hazard?
- ❑ Before compressed air is used to empty containers of liquid, is the safe working pressure of the container checked?
- ❑ When compressed air is used to inflate auto tires, is a clip-on chuck and an inline regulator preset to 40 psi required?
- ❑ Is it prohibited to use compressed air to clean up or move combustible dust if such action could cause the dust to be suspended in the air and cause a fire or explosion hazard?

APPENDIX B

Confined Space Entry Permit (page 1 of 2)

Location of Confined Space:	Date/Time:
Purpose of Entry:	Duration:
Authorized By:	Expires On:
Attendant(s):	Permit Valid For One Shift Only
Standby Person(s):	

Authorized Entrants: (List Others on Back of Form)

Measures For Isolating & Equipment	Yes	No	Measures For Isolating & Equipment	Yes	No
Lock Out-De-Energize-Try-Out Equipment			Self-Contained Breathing Apparatus SCBA		
Line(s) Broken-Capped-Blanked			Air-Line Respirators w/Emergency-Escape Capability		
Purge-Flush and Vent			Resuscitator/ inhaler		
Secure Area (Post and Flag)			Communications Equipment		
Full Body Harness with "D" Ring			Protective Clothing		
Tripod Emergency Escape Unit			Head/Eye/Hearing Protection (circle)		
Lifelines			Hot Work Permit Required		
Fire Extinguishers			Air Purifying Respirators and cartridges		
Lighting (Explosion-Proof)					

ATMOSPHERE MONITORING

Test(s) to be Taken	Acceptable Entry Conditions (Circle Appropriate Level)				1	2	3	4	5	6	7	8
	Yes	No	TLV*	PEL**	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time	Date/Time
Oxygen			>19.5<23.5%									
Combustible Gas			Below 10% LEL									
Carbon Monoxide			0-25 PPM	0-50 PPM								
Hydrogen Sulfide			0-10 PPM	0-10 PPM								

Individual Conducting Test (name):			
Any Questions Pertaining to Test Requirements, Contact:			
Instrument Used	Name	Type	Identification Number
For Rescue & Emergency Services Call Extension 911			
Entry Supervisor Authorizing All Above Conditions Satisfied:			
Rescue Team Advised of Confined Space Entry (Yes), (No):			
Person Contacted of the Rescue Team:			
Time and Date of Person Contacted of the Rescue Team:			
Time & Date Rescue Team Released:			
Person Contacted of the Rescue Team:			

Confined Space Entry Permit (page 2 of 2)

CONFINED SPACES CHECKLIST FOR ENTERING

- Are confined spaces thoroughly emptied of any corrosive or hazardous substances, such as acids or caustics, before entry?
- Are all lines to a confined space, containing inert, toxic, flammable, or corrosive materials valved off and blanked or disconnected and separated before entry?
- Are all impellers, agitators, or other moving parts and equipment inside confined spaces locked-out if they present a hazard?
- Is either natural or mechanical ventilation provided before confined space entry?
- Are appropriate atmospheric tests performed to check for oxygen deficiency, toxic substances and explosive concentrations in the confined space before entry?
- Is adequate illumination provided for the work to be performed in the confined space?
- Is the atmosphere inside the confined space frequently tested or continuously monitored during conduct of work?
- Is there an assigned safety standby employee outside of the confined space, when required, whose sole responsibility is to watch the work in progress, sound an alarm if necessary, and render assistance?
- Are all participating employees properly trained?
- Is the standby employee appropriately trained and equipped to handle an emergency?
- Is the standby employee or other employees prohibited from entering the confined space without lifelines and respiratory equipment if there is any question as to the cause of an emergency?
- Is approved respiratory equipment required if the atmosphere inside the confined space cannot be made acceptable?
- Is all portable electrical equipment used inside confined spaces either grounded and insulated or equipped with ground fault protection?
- Before gas welding or burning is started in a confined space, are hoses checked for leaks, compressed gas bottles forbidden inside of the confined space, torches lighted only outside of the confined space and the confined space tested for an explosive atmosphere each time before a lighted torch is to be taken into the confined space?
- If employees will be using oxygen-consuming equipment, such as salamanders, torches and furnaces in a confined space, is sufficient air provided to assure combustion without reducing the oxygen concentration of the atmosphere below 19.5 percent by volume?
- Whenever combustion type equipment is used in a confined space, are provisions made to ensure the exhaust gases are vented outside of the enclosure?
- Is each confined space checked for decaying vegetation or animal matter, which may produce methane?

- ❑ Is the confined space checked for possible industrial waste, which could contain toxic properties?
- ❑ If the confined space is below the ground and near areas where motor vehicles will be operating, is it possible for vehicle exhaust or carbon monoxide to enter the space?

CONTROL OF HARMFUL SUBSTANCES BY VENTILATION CHECKLIST

- ❑ Is the volume and velocity of air in each exhaust system sufficient to gather the dusts, fumes, mists, vapors or gases to be controlled and to convey them to a suitable point of disposal?
- ❑ Are exhaust inlets, ducts and plenums – manifolds designed or a confined space, constructed and supported to prevent collapse or failure of any part of the system?
- ❑ Are clean out ports or doors provided at intervals not to exceed 12 feet (3.66 meters) in all horizontal runs of exhaust ducts?
- ❑ Where two or more different type of operations are being controlled through the same exhaust system, will the combination of substances being controlled constitute a fire, explosion or chemical reaction hazard in the duct?
- ❑ Is adequate make up air provided to areas where exhaust systems are operating?
- ❑ Is the source point for make up air located so that only air which is free of contaminants, will enter the work environment?
- ❑ Where two or more ventilation systems are serving a work area, is their operation such that one will not offset the functions of the other?

Appendix C

ELECTRICAL CHECKLIST

- Do you specify compliance with OSHA for all contract electrical work?
- Are all employees required to report, as soon as practicable, any obvious hazard to life or property observed in connection with electrical equipment or lines?
- Are employees instructed to make preliminary inspections and/or appropriate tests to determine what conditions exist before starting work on electrical equipment or lines?
- When electrical equipment or lines are to be serviced, maintained or adjusted are necessary switches opened, locked out, and tagged whenever possible?
- Are portable electrical tools and equipment grounded or of the double insulated type?
- Are electrical appliances such as vacuum cleaners, polishers and vending machines grounded?
- Do extension cords being used have a grounding conductor?
- Are multiple plug adapters prohibited?
- Are ground fault circuit interrupters installed on each temporary 15 or 20-ampere, 120 volt AC circuit at locations where construction, demolition, modifications, alterations or excavations are being performed?
- Do suitable disconnecting switches or plug connectors at the junction with permanent wiring protect all temporary circuits?
- Do you have electrical installations in hazardous dust or vapor areas? Is so; do they need the National Electrical Code (NEC) for hazardous locations?
- Is exposed wiring and cords with frayed or deteriorated insulation repaired or replaced promptly?
- Are flexible cords and cables free of splices or taps?
- Are clamps or other securing means provided on flexible cords or cables at plugs, receptacles, tools, equipment, etc. and is the cord jacket securely held in place?
- Are all cord, cable and raceway connections intact and secure?
- In wet or damp locations, are electrical tools and equipment appropriate for the use or location or otherwise protected?
- Is the location of electrical power lines and cables (overhead, underground, under floor, other side of walls) determined before digging, drilling or similar work is begun?
- Are metal measuring tapes, ropes, hand lines or similar devices with metallic thread woven into the fabric prohibited where they could come in contact with energized parts of equipment or circuit conductors?

- ❑ Is the use of metal ladders prohibited in areas where the ladder or the person using the ladder could come in contact with energized parts of equipment, fixtures or circuit conductors?
- ❑ Are all disconnecting switches and circuit breakers labeled to indicate their use or equipment served?
- ❑ Are disconnecting means always opened before fuses are replaced?
- ❑ Do all interior wiring systems include provisions for grounding metal parts of electrical raceways, equipment and enclosures?
- ❑ Are all electrical raceways and enclosures securely fastened in place?
- ❑ Are all energized parts of electrical circuits and equipment guarded against accidental contact by approved cabinets or enclosures?
- ❑ Is sufficient access and working space provided and maintained about all electrical equipment to permit ready and safe operations and maintenance?
- ❑ Are all unused openings (including conduit knockouts) in electrical enclosures and fittings closed with appropriate covers, plugs or plates?
- ❑ Are electrical enclosures such as switches, receptacles and junction boxes provided with tight fitting covers or plates?
- ❑ Are disconnecting switches for electrical motors in excess of two horsepower, capable of opening the circuit when the motor is in a stalled condition, without exploding? (Switches must be horsepower rated equal to or in excess of the motor hp rating.)
- ❑ Is low voltage protection provided in the control device of motors driving machines or equipment that could cause probable injury from inadvertent starting?
- ❑ Is each motor disconnecting switch or circuit breaker located within sight of the motor control device?
- ❑ Is each motor located within sight of its controller or the controller disconnecting means capable of being locked in the open position or is a separate disconnecting means installed in the circuit within sight of the motor?
- ❑ If the controller for each motor is in excess of two horsepower, is it rated in horsepower equal to or in excess of the rating of the motor it serves?
- ❑ Are employees who regularly work on or around energized electrical equipment or lines instructed in the cardiopulmonary resuscitation (CPR) methods?
- ❑ Are employees prohibited from working alone on energized lines or equipment over 600 volts?

APPENDIX D**Laser Hazard Classes**

The FDA recognizes four major hazard classes (I to IV) of lasers, including three subclasses (IIa, IIIa, and IIIb). The higher the class, the more powerful the laser is and the greater the potential to pose serious injury if used improperly. The labeling for Classes II–IV must include a warning symbol that states the class and the output power of the product. Roughly equivalent IEC classes are included for products labeled under the classification system of the International Electrotechnical Commission.

Class FDA	Class IEC	Laser Product Hazard	Product Examples
I	1, 1M	Considered non-hazardous. Hazard increases if viewed with optical aids, including magnifiers, binoculars, or telescopes.	<ul style="list-style-type: none"> • laser printers • CD players • DVD players
IIa, II	2, 2M	Hazard increases when viewed directly for long periods of time. Hazard increases if viewed with optical aids.	<ul style="list-style-type: none"> • bar code scanners
IIIa	3R	Depending on power and beam area, can be momentarily hazardous when directly viewed or when staring directly at the beam with an unaided eye. Risk of injury increases when viewed with optical aids.	<ul style="list-style-type: none"> • laser pointers
IIIb	3B	Immediate skin hazard from direct beam and immediate eye hazard when viewed directly.	<ul style="list-style-type: none"> • laser light show projectors • industrial lasers • research lasers
IV	4	Immediate skin hazard and eye hazard from exposure to either the direct or reflected beam; may also present a fire hazard.	<ul style="list-style-type: none"> • laser light show projectors • industrial lasers • research lasers • medical device lasers for eye surgery or skin treatments

There are laws, regulations, and standards that require engineering controls and risk communication to aid in the management of the biological hazards associated with each laser class. However, no controls are completely effective if lasers are improperly used.