

6CHAPTER 6

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GLOSSARY OF ABBREVIATIONS, ACRONYMS, AND DEFINITIONS

30 AMDS/SGPB - 30th Medical Group, Bioenvironmental Engineering, including the Radiation Protection Officer

30 CEG - 30th Civil Engineering Group

30 CEG/CEF - 30th Civil Engineering Group, Fire Protection

30 SW/SE - 30th Space Wing, Office of the Chief of Safety; *see also Office of the Chief of Safety*

30 SW/SEGP - 30th Space Wing, Operations Safety

30 SW/SEGW - 30th Space Wing, Explosives Safety, Nuclear Assurity

30 SW/SEW -

30 TRANS/LGTT - 30th Transportation Squadron/LGTT

45 CES - 45th Civil Engineer Squadron

45 CES/CEF - 45th Civil Engineer Squadron, Fire Protection

45 WS - 45th Weather Squadron

45 MDG/SGPB - 45th Medical Group, Bioenvironmental Engineering

45 MDG/SGPH - 45th Medical Group, Radiation Protection

45 and 30 RANS/DOS - 45th and 30th Range Squadrons, Range Scheduling

45 and 30 SW/SES - 45th and 30th Space Wing, Systems Safety

45 and 30 WS/RWO - Range Weather Operations

AF - Air Force

AFB - Air Force Base

AFI - Air Force Instruction

AFM - Air Force Manual

AFOSH - Air Force Occupational Safety and Health

AFR - Air Force Regulation

AFSPC - Air Force Space Command

AGE - aerospace ground equipment

ANSI - American National Standards Institute

API - American Petroleum Institute

ASME - American Society of Mechanical Engineers

AWS - American Welding Society

bldg - building

CAL-OSHA - California Occupational Safety and Health Act

Category A EEDs/ordnance - electroexplosive devices or ordnance that by the expenditure of their own energy or because they initiate a chain of events, may cause injury or death to people or damage to property

Category B EEDs/ordnance - electroexplosive devices or ordnance that will not, in themselves, or by initiating a chain of events cause injury to people or damage to property

CCAS - Cape Canaveral Air Station

cDR - conceptual design review

CDR - critical design review; Command Destruct Receiver

Certified Inspector - a person qualified and certified in Non-Destructive Examination inspection techniques according to the American Society for Nondestructive Testing recommended practices (SNT-TC-1A)

CFR - Code of Federal Regulations

CMAA - Crane Manufacturers Association of America

control authority - a single commercial user on-site director or manager, full time government tenant director or commander, or USAF Squadron or Detachment Commander responsible for the implementation of launch complex safety requirements

COPV - composite overwrapped pressure vessel

CPIA - Chemical Propulsion Information Agency

crew rest - that period of time immediately prior to the beginning of duty as assigned; for mission-essential personnel, it is mandatory that the rest period include the time necessary for meals, trans-

GLOSSARY OF ABBREVIATIONS, ACRONYMS, AND DEFINITIONS

portation, and 8 h of uninterrupted rest prior to reporting for duty. In preparation for launch operations, rest periods start no earlier than 2 h after the assigned personnel are released from an earlier launch or range operation. Only the Chief of Safety or Range Commander has the authority to waive the safety rest period requirements for Mission Ready (Category A) personnel. *See also rest period.*

critical facility or structure - a hazardous facility or structure; a facility or structure used to store or process explosives; a facility or structure used to process high value hardware; a facility that contains or is used to handle or process systems determined by Range Safety to be safety critical; a facility or structure determined to be critical by Range Safety

critical hardware - any hazardous or safety critical equipment or system; non-hazardous Department of Defense (DoD) high value items, such as payloads, launch vehicles, or any unique item identified by DoD as critical; high value non-hazardous hardware owned by Range Users other than DoD may be identified as critical or non-critical by the Range User

DAIP - Danger Area Information Plan; an Eastern Range document prepared by Operations Safety specifying roadblocks and the fallback area associated with hazardous areas for each launch complex during launch operations.

dB - decibel

DDESB - Department of Defense Explosives Safety Board

decibel - a unit of relative power; the decibel ratio between power levels, P1 and P2, is defined by the relation $dB = 10 \log_{10} (P1/P2)$

deviation - a term used when a design noncompliance is known to exist prior to hardware production or an operational noncompliance is known to exist prior to beginning operations at CCAS or Vandenberg Air Force Base

DOC - Command Control Directorate

DoD - Department of Defense

DOT - Department of Transportation

duty time - the time personnel are at work from the time they arrive at their duty location until the end of the duty tour; duty time begins on first arriving at the base or office for transportation to later launch support positions

EBW - high voltage exploding bridgewire, an initiator in which the bridgewire is designed to be exploded (disintegrated) by a high energy electrical discharge that causes the explosive charge to be initiated

EEAP - Emergency Evacuation Assembly Point

EED - low voltage electroexplosive device

EH - Environmental Health; on the Western Range, the Range User is responsible for performing the EH tasks described in this document for contractor operations; on the Eastern Range, the responsible agency is 45 MG/SGPB and a range contractor

EOD - Explosive Ordnance Disposal Team

EPA - Environmental Protection Agency

ER - Eastern Range

ERP - effective radiated power; Emergency Response Plan

ESMC - Eastern Space and Missile Center

ESP - Explosives Safety Plan; a type of Operations Safety Plan

essential personnel - those personnel who do not meet the requirements of mission-essential personnel, but may be permitted within safety control areas to prevent a mission impact; all requests to enter require Range Safety approval on a case-by-case basis

explosion proof apparatus - an enclosure that will withstand an internal explosion of gases or vapors and prevent those gases or vapors from igniting the flammable atmosphere surrounding the enclosure, and whose external temperature will not ignite the surrounding flammable atmosphere

explosive quantity distance site plan - a formal plan required for explosive facilities and areas in accordance with AFM 91-201 and DoD 6055.9-STD, detailing explosives quantity operating and storage limits and restrictions and the resultant

GLOSSARY OF ABBREVIATIONS, ACRONYMS, AND DEFINITIONS

distance requirements

Facility Operator - government organization or contractor responsible for maintaining and/or controlling use of a facility

FCA - flight caution area; the controlled ground area outside of the Flight Hazard Area where injury or property damage could occur because of a launch vehicle flight failure. The FCA is restricted to only mission-essential personnel during launch operations

FHA - flight hazard area; the controlled surface area and airspace about the launch pad and light azimuth where individual risk from a malfunction during the early phase of flight exceeds 1×10^{-5} . Because the risk of serious injury or death from blast overpressure or debris is so significant, only mission-essential personnel in approved blast-hardened structures are permitted in this area during launch.

FEOP - Facility Emergency Operating Plan

FEP - Facility Emergency Procedures

FM - frequency modulation; Factory Mutual Corporation

FOP - Facility Operating Plan

FSA - Fuel Storage Area

FSP - Facility Safety Plan

ft - foot, feet

FTS - Flight Termination System

GHz - gigahertz

GOP - Ground Operations Plan

GR/EP - graphite epoxy

GSE - Ground Support Equipment

h - hour, hours

hangfire - a condition that exists when the ignition signal is known to have reached an initiator but ignition of the propulsion system is not achieved

hazard, hazardous - equipment or systems with an existing or potential condition that can result in a mishap

Hazardous Launch Areas - safety clearance zones

during launch operations with defined mishap probabilities, including the Flight Caution Area, Flight Hazard Area, and Launch Danger Zone

hazard proof - a method of making electrical equipment safe for use in hazardous locations; methods include explosion proofing, intrinsically safe, purged and pressurized, and non-incendive and must be rated for the degree of hazard present

hazardous facility or structure - a facility or structure used to store, handle, or process hazardous materials or systems and perform hazardous operations

hazardous materials - liquids, gases, or solids that may be toxic, reactive, or flammable or that may cause oxygen deficiency either by themselves or in combination with other materials

hazardous operations - those operations classified as hazardous according to the following criteria: (1) consideration of the potential or kinetic energy involved, (2) changes such as pressure, temperature, and oxygen content in ambient environmental conditions, (3) presence of hazardous materials. Hazardous operations (including storage, transport, and handling) include, but are not limited to, the following: material (launch vehicle, payload, and other critical loads) handling operations; operations with acoustic hazards; operations with ionizing and non-ionizing sources and systems; operations with hazardous materials; pressure system (greater than 150) psig operations; propellant system operations; ordnance operations; and electrical system operations. **NOTE:** Some low pressure systems operations such as those involving flight hardware, large volume systems, or those containing hazardous commodities may be classified as hazardous by Range Safety.

Hazardous Clear Areas - Safety Clearance Zones for ground processing that are defined in the Operations Safety Plans for each operating facility; include BDA, Control Area Clears, and Toxic Hazard Corridor/Zone

hazardous procedure - a designation for a particular type of Range User procedure; a document containing specific steps in sequential order used to safely process hazardous materials or conduct hazardous operations. Hazardous procedures have

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specific content requirements delineated in Appendix 6B and require Range Safety approval.

HMS - Hazard Monitor System

hydraulic - operated by water or other liquid under pressure; includes all hazardous fluids as well as typical hydraulic fluids that are normally petroleum-based

IATA - International Air Transport Association

IEEE - Institute of Electrical and Electronic Engineers

initiator - low voltage electroexplosive devices and high voltage exploding bridgewire devices

intrinsically safe - incapable of producing sufficient energy to ignite an explosive atmosphere and two-fault tolerant against failure with single fault tolerance against its most hazardous failure at 1.5 times the maximum voltage or energy

ISI - In-Service Inspection Plan

KSC - Kennedy Space Center

launch complex safety - safety requirements involving risk that is limited to personnel and/or property under the control of a single commercial user, full time government tenant organization, or USAF squadron or detachment commander (control authority). Launch complex safety is limited to risks confined to a physical space for which the single control authority is responsible.

launch area safety - safety requirements involving risk that is limited to personnel and/or property on CCAS with possible extension to KSC and Vandenberg Air Force Base. Launch area safety involves multiple commercial user, government tenants, or USAF Squadron Commanders

launch vehicle - a vehicle that carries and/or delivers a payload to a desired location; this is the generic term that applies to all vehicles that may be launched from the Ranges; includes, but is not limited to airplanes, all types of space launch vehicles, manned launch vehicles, missiles and rockets and their stages, probes, aerostats and balloons, drones, remotely piloted vehicles, projectiles, torpedoes, and air-dropped bodies

LBB - leak before burst

LBS - launch base support

LBTP - Launch Base Test Plan

LEL - lower explosive limit

LDCG - Launch Disaster Control Group; a team responsible for responding to launch emergencies

LIO - laser initiated ordnance

LV - launch vehicle

mA - milliamperes

major leak or spill - a leak or spill that could affect regions beyond the immediate work area, constitute a hazard to personnel, or involve damage to facilities or equipment. A major leak or spill is more than one gallon.

MARSS - Meteorological and Range Safety System

MAWP - maximum allowable working pressure; the maximum pressure at which a component or system can continuously operate based on allowable stress values and functional capabilities

MEOP - maximum expected operating pressure; the highest pressure that a pressure vessel, pressurized structure, or pressure component is expected to experience during its service life and retain its functionality, in association with its applicable operating environments; synonymous with maximum operating pressure (MOP) or maximum design pressure (MDP); includes the effect of temperature, pressure transients and oscillations, vehicle quasi-steady, and dynamic accelerations and relief valve operating variability; *see also MOP*

MFCO - Mission Flight Control Officer

MHE - material handling equipment used to handle, lift, support, or manipulate critical or noncritical hardware. MHE includes, but is not limited to, cranes, hoists, sling assemblies, hydrasets and load cells, handling structures, and personnel work platforms

MHI - Materials Handling Institute

MHSE - Material Handling Safety Equipment

MIC - meets intent certification; a certification used to indicate an equivalent level of safety is maintained despite not meeting the exact require-

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ments stated in the document

MIL-STD - Military Standard

minor leak or spill - a leak or spill that does not affect regions beyond the immediate work area, constitute a hazard to personnel, or involve damage to facilities or equipment. A minor leak or spill is less than one gallon.

misfire - a condition that exists when it is known that the ignition signal has been sent to an initiator and ignition of the initiator was not achieved

mishap - an unplanned event or series of events resulting in death, injury, occupational illness, or damage to or loss of equipment or property or damage to the environment

mission-essential personnel - the minimum number of persons necessary to successfully and safely complete a hazardous or launch operation and whose absence would jeopardize the completion of the operation; this designation also includes people required to perform emergency actions according to authorized directives, persons specifically authorized by the Wing Commanders to perform scheduled activities, and those personnel in training. The Range Users and Wing Commanders determine, with Range Safety concurrence, the number of mission-essential personnel allowed within Safety Clearance Zones or Hazardous Launch Areas; *see also Safety Clearance Zones and Hazardous Launch Area*

Mission-Ready (Category A) Personnel - people who make irrevocable operational decisions and exercise direct control over the countdown and launch of a launch vehicle. The success of the launch vehicles mission is directly affected by the actions of mission ready personnel. Mission ready personnel include the following: Mission Flight Control Officer; Range Operations Commander; Range Control Officer; Launch Controller, Launch Control Officer, Test Director or Test Controller, as applicable; Booster Countdown Controller, Launch Vehicle Test Controller, Assistant Launch Controller, Assistant Launch Control Officers, or Launch Director, as applicable; Payload Launch Controller, Satellite Countdown Controller, or Test Controller, as applicable; Explosive Ordnance Disposal Personnel, Aeronautical Control Officer,

Booster Operations Controller, and Spacecraft Operations Controller

Mission Support (Category B) Personnel - all other support personnel engaged in direct support of mission ready personnel

MMH - monomethylhydrazine

MOP - maximum operating pressure; the maximum pressure a system will be subjected to during planned static and dynamic conditions; *see also MEOP*

MOSR - Missile Operations and Support Requirements

MSDS - Material Safety Data Sheet

MSPSP - Missile System Pre-launch Safety Package; a data package that demonstrates compliance with the system safety requirements of Chapter 3 and serves as a baseline for safety related information on the system throughout its life cycle

N²H⁴ - hydrazine

NASA - National Aeronautics and Space Administration

NCO - Non-Commissioned Officer

NDE - non-destructive examination; any testing, inspection, or evaluation that does not cause harm to or impair the usefulness of an object satisfies the meaning of the word *non-destructive*. In common usage, *non-destructive testing* (NDT) often refers just to test methods and test equipment with only a general reference to materials and/or parts. *Non-Destructive Inspection* (NDI) relates to specific written requirements, procedures, personnel, standards, and controls for the testing of a particular material of a specific part. *Non-Destructive Evaluation* is concerned with the decision making process, the determination of the meaning of the results, of the final acceptance or rejection of the material of part, and may be qualitative or quantitative.

NEC - National Electrical Code

NFPA - National Fire Protection Association

NIOSH - National Institute of Occupational Safety and Health

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non-critical hardware - equipment and systems employed for standard industry use; equipment or systems that are determined not to be hazardous, of high value, or safety critical

non-hazardous procedure - a designation for a particular type of Range User procedure; a document containing general or specific steps in sequential order to ensure proper execution of a non-hazardous, non-safety critical process. Non-hazardous procedures do not have specific content requirements and do not require Range Safety approval.

non-incendive - will not ignite group of gases or vapors for which it is rated. Similar to *intrinsically safe*, but does not include failure tolerance ratings; used in rating electrical products for Class I, Division 2 locations only

NOTU - Naval Ordnance Test Unit

NRC - Nuclear Regulatory Commission

O&SHA - Operating and Support Hazard Analysis

Operations Safety - a Range Contractor at the Eastern Range and 30 SW/SEGP, a government agency at the Western Range

OPLAN - Operations Plan

ordnance operation - any operation consisting of shipping, receiving, transportation, handling, test, checkout, installation and mating, electrical connection, render safe, removal and demating, disposal, and launch of ordnance

OSC - Operations Safety Console

OSHA - Occupational Safety and Health Act

OSP - Operations Safety Plan; detailed safety procedures used for missile operations; these plans are written by the Range Contractor and Operations Safety; includes Explosives Safety Plans, Facility Safety Plans, and Safety Operational Plans

OST - a Western Range Operations Safety Technician

PA - public address

payload - the object(s) within a payload fairing carried or delivered by a launch vehicle to a desired location. This is a generic term that applies to

all payload that may be delivered from the ER or WR and includes, but is not limited to, satellites, other spacecraft, experimental packages, bomb loads, warheads, reentry vehicles, dummy loads, cargo, and any motors attached to them in the payload fairing

PDR - Preliminary Design Review

personnel work platforms - platforms used to provide personnel access to flight hardware at off-pad processing facilities as well as at the launch pad; they may be removable, extendible, or hinged.

pneumatic - operated by air or other gases under pressure

POL - paints, oil, and lubricants

PPE - personal protective equipment

ppm - parts per million

propellant servicing - any dynamic operation involving propellants such as transfer, sampling, pressurization, decontamination, connecting and disconnecting lines, and venting

propellant storage tank - any container of propellants greater than one gallon. Application of the requirements of this document to storage tanks will normally vary with the size of the tank and associated hazards. Containers less than one gallon will also be subject to operational controls, as appropriate, as would any container of flammable liquid

psig - pounds per square inch gauge

public safety - safety involving risks to the general public or foreign countries and/or their property

QD - quantity distance; *see also quick disconnect*

radioactive material - materials that generate, or are capable of generating, ionizing radiation including naturally occurring radioactive materials, by-product materials, fission products, materials containing induced or deposited radioactivity, and nuclear reactors

Ranges - in this document, *Ranges* refers to the Eastern Range at CCAS, KSC, and PAFB, and the Western Range at VAFB

Range Users - clients of Cape Canaveral Air Station and Vandenberg Air Force Base; includes De-

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partment of Defense government agencies, civilian commercial companies, and foreign government agencies that use the Eastern and Western Range facilities and test equipment to conduct prelaunch, launch and impact operations or require on-orbit support

rated load - the maximum static load or force that can be imposed on the part or structure at any time during its intended operation and expected environment

Recertification File - a file that contains documentation showing that a specific piece of MHE/MHSE meets the periodic analysis and test requirements of Chapters 3 and 6

referee fluid - a compatible fluid, other than that used during normal operation of a system, that is substituted for test purposes because it is safer due to characteristics such as being less toxic, explosive, or easier to detect

RF Silence - turning off or powering down of RF emitters within a particular area; local RF silence is normally the launch vehicle and mobile transmitters in the area

render safe - an action to bring to a safe condition

rest period - that period of time immediately prior to the beginning of the duty period; for mission-essential personnel, it is mandatory that the rest period include the time necessary for meals, transportation, and 8 h of uninterrupted rest prior to reporting for duty. Rest periods in preparation for launch operations will start no earlier than 2 h after the assigned personnel are released from an earlier launch or range operations. Only the Chief of Safety or Wing Commander has the authority to waive the safety rest period requirements for Mission Ready (Category A) personnel; *see also crew rest*.

RF - radio frequency

RF silence - turning off or powering down of RF emitters within a particular area. Local RF silence is normally the launch vehicle and mobile transmitters in the area

RPO - Radiation Protection Officer; the responsible agent to ensure enforcement of 45 SWI 40-201

and AFI 91-110 30 SW1

RT - radiographic testing

S&A device - safe and arm device; devices that provide for mechanical interruption (safe) or alignment (arm) of the explosive train and electrical interruption (safe) or continuity (arm) of the firing circuit

Safety Clearance Zones - restricted areas designated for day-to-day prelaunch processing and launch operations to protect the public, launch area, and launch complex personnel. These zones are established for each launch vehicle and/or payload at specific processing facilities, including launch complexes; includes Hazardous Clear Areas and Hazardous Launch Areas

safety critical - an operation, process, facility, system, or component that controls or monitors equipment, operations, systems, or components to ensure personnel, launch area, and public safety (for example, Flight Termination System integrity); these operations, processes, facilities, systems, or components may or may not be hazardous in and of themselves

safety critical procedure - a designation for a particular type of Range User procedure; a document containing steps in sequential order used to reliably process safety critical systems or conduct safety critical operations. Non-hazardous safety critical procedures have no specific content requirements but do require Range Safety review and approval.

safety factor - for pressure systems, the ratio of design burst pressure over the maximum allowable working pressure or as design pressure; for mechanical systems, it can also be expressed as the ratio of tensile or yield strength over the maximum allowable stress of the material.

safing procedures - the process of taking a system that is in a hazardous configuration and performing those tasks necessary to bring it to a condition which is safe for further activities; safing procedures are part of the backout procedures for a system

SCAPE - Self-Contained Atmospheric Protective Ensemble

SFP - single failure point; in general, a component

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that, if failed, could lead to the overall failure of the system; for mechanical systems, a component, such as a lug, link, shackle, pin, bolt, or rivet, or a weld that, if failed, could cause a system inability to support a load using load path analysis

shall - mandatory action

SLC - Space Launch Complex

SOP - Safety Operating Plan; a type of Operations Safety Plan (See Appendixes 6C, 6D, and 6E.); standard operating procedure

SPIF - Spacecraft Processing Integration Facility at the ER

standing by - being at the scene and not on call

static firing - testing of a propulsion system by securing it to a rigid structure and preventing powered flight

structural sling - a rigid or semi-rigid fixture that is used between the load and hoisting device hook; such as spreader bars, equalizer bars, and lifting beams

SW - space wing

TD - technical document

THZ - toxic hazard zone

TLV - threshold limit value; time weighted average concentrations that must not be exceeded during any 8-h work shift of a 40-h work week

Toxic Hazard Zone - a generic term that describes an area in which predicted concentration of propellant or toxic byproduct vapors or aerosols may exceed acceptable tier levels; predictions are based on an analysis of potential source strength, appli-

cable exposure limit, and prevailing meteorological conditions; THZs are plotted for potential, planned, and unplanned propellant releases, and launch operations.

TMO - Transportation Management Office

TNT -Trinitrotoluene

T.O. - Technical Order

to safe - to bring to a safe condition

UDMH - unsymmetrical dimethylhydrazine

UL - Underwriters' Laboratories

UN - United Nations

USAF - United States Air Force

UT - Ultrasonic Testing; Umbilical Tower of a launch pad

visible damage - for composite pressure vessels; anomalies that are visible to the naked eye under not less than 15 foot candles at a distance no greater than 24 inches and not less than a 30 degree angle. Lighting up to 50 foot candles may be used for the detection of small anomalies

VAFB - Vandenberg Air Force Base; located in California

VIP - very important person

waiver - a designation used when, through an error in the manufacturing process or for other reasons, a hardware noncompliance is discovered after hardware production or an operational noncompliance is discovered after operations have begun at Eastern Range and Western Range

WR - Western Range

REFERENCED DOCUMENTS

- 29 CFR 1910.23, *Guarding Floor and Wall Openings and Holes*
- 29 CFR 1910.27, *Fixed Ladders*
- 29 CFR 1910.95, *Occupational Noise Exposure*
- 29 CFR 1910.146, *Permit-Required Confined Spaces*
- 29 CFR 1910.252, *Welding, Cutting, and Brazing General Requirements*
- 29 CFR 1926.104, *Safety Belts, Lifelines, and Lanyards*
- 29 CFR 1926.105, *Safety Nets*
- 29 CFR 1926.550(g), *Crane or Derrick Suspended Personnel Platforms*
- 29 CFR 1910.1200, *Hazard Communication*
- 30 SPS/SPOS OI 31-1010, Volume 2, Chapter 5
- 30 SW 105-1, *Weather Support Procedures*
- 30 SW 127-3, *Mishap Notification, Investigation Response, and Reporting Procedures*
- 30 SW OPLAN 355-1, *Disaster Preparedness*
- 30 SW Plan 91-119, *Process Safety Management Implementation Plan*
- 30 SWI 40-101, *Managing Radioactive Materials on VAFB*
- 30 SWI 91-106, *Toxic Hazard Assessments*
- 40 CFR, *Protection of the Environment*
- 45 WS *Meteorological Handbook*
- 45 SPW/JOP 15E-3-50, *Transportation of Oversized Loads*
- 45 SWR 136-1, *Ordnance Support*
- 45 SW OPLAN 355-1, *Disaster Preparedness Operations Plan, Volume II*
- 45 and 30 SW OPLAN 19-14, *Petroleum Products and Hazardous Waste Management Plan*
- 45 and 30 SW OPLAN 355-1, *Disaster Preparedness Planning and Operations*
- 45 and 30 SWR 160-1, *Radiation Protection Program*
- AFI 21-114, *Managing Intercontinental Ballistic Missiles Maintenance*
- AFI 32-1064, *Electrical Safe Practices*
- AFI 32-2001, *The Fire Protection Operations and Fire Protection Program*
- AFI 32-4001, *Disaster Preparedness Planning and Operations*
- AFI 32-4002, *Hazardous Material Emergency Planning and Response Compliance*
- AFI 48-119, *Medical Service Environmental Quality Programs*
- AFI 91-110, *Nuclear Safety Review & Launch Approval for Space or Missile Use of Radioactive Material & Nuclear Systems*
- AFI 91-202, *US Air Force Mishap Prevention Program*
- AFI 91-204, *Safety Investigations and Reports*
- AFI 91-301, *Air Force Occupational and Environmental Safety, Fire Prevention, and Health (AFOSH) Program*
- AFJMAN 24-204, *Preparing Hazardous Materials for Military Air Shipments*
- AFM 85-16, *Maintenance of Petroleum Systems*
- AFM 91-201, *Explosive Safety Standards*
- AFM 161-30, Volume II *Liquid Propellants*
- AFOSH 48-1, *Respiratory Protection Program*
- AFOSH 48-8, *Controlling Exposures to Hazardous Materials*
- AFOSH 48-19, *Hazardous Noise Program*
- AFOSH 91-25, *Confined Spaces*
- AFOSH 91-31, *Personal Protective Equipment*
- AFOSH 91-46, *Materials Handling and Storage Equipment*
- AFOSH 91-66, *General Industrial Operations*

REFERENCED DOCUMENTS

- AFOSH 91-119, *Process Safety Management of Highly Hazardous Chemicals*
- AFOSH 127-22, *Walking Surfaces, Guarding Floor/Wall Openings and Holes, Fixed Industrial Stairs, and Portable and Fixed Ladders*
- AFOSH 127-32, *Emergency Shower and Eyewash Units*
- AFOSH 127-43, *Flammable and Combustible Liquids*
- AFOSH 127-45, *Hazardous Energy Control and Mishap Prevention Signs and Tags*
- AFOSH 161-9, *Exposure to Radio Frequency Radiation*
- AFOSH 161-2, *Industrial Ventilation*
- AFOSH 161-20, *Hearing Conservation Program*
- AFOSH 161-21, *Hazard Communication*
- ANSI Z49.1, *Safety in Welding and Cutting*
- ANSI Z89.1, *Protective Headwear for Industrial Workers*
- ANSI Z117.1, *Safety Requirements for Confined Spaces*
- ANSI Z244.1, *Safety Requirements for the Lock-out/Tagout of Energy Sources*
- ANSI Z358.1, *Emergency Eyewash and Shower Equipment*
- ANSI Z359.1, *Personnel Fall Arrest Systems, Subsystems, and Components*
- ANSI/ASME B30, *Series Cranes, Hoists, and Lifting Devices*
- API 500A RP 500, *Recommended Practices for Classification of Locations for Electrical Installations at Petroleum Facilities, First Edition*
- ASME, *Section VIII, Division 2*
- ASTM-E1444, *Magnetic Particle Inspection*
- American Welding Standards*
- California Occupational Safety and Health Act*
- CMAA 70, *Specifications for Electric Overhead Traveling Cranes*
- CMAA 74, *Specifications for Top Running and Under Running Single Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist*
- CPIA 394, *Chemical Propulsion Information Agency - Hazards of Chemical Rockets and Propellants*
- DoD 6055.9-STD, *DoD Ammunition and Explosives Safety Standards*
- ESMC TR-88-01, *A Guide for Recertification of Ground Based Pressure Vessels and Liquid Holding Tanks*
- IEEE-142, *Recommended Practice for Grounding of Industrial and Commercial Power Systems*
- Interim Safety Requirements for Design, Test, and Ground Processing of Flight Graphite Epoxy Composite Overwrapped Pressure Vessels at the Kennedy Space Center, Cape Canaveral Air Force Station, and Vandenberg Air Force Base*
- MHI, *Materials Handling Institute Standards*
- MIL-HDBK-1890, *Welded Joints, Inspection of*
- MIL-STD-278, *Welding and Casting Standard*
- MIL-STD 453, *Inspection, Radiographic*
- MIL-STD-883, *Test Methods and Procedures for Microelectronics*
- MIL-STD-1265, *Radiographic Inspection, Classification, and Soundness Requirements for Steel Casting*
- MIL-STD-1576, *Electroexplosive Subsystem Safety Requirements and Test Methods for Space Systems*
- MIL-STD-2154, *Ultrasonic Inspection, Requirement for*
- MIL-STD-2175, *Castings, Classification and Inspection of*
- MIL-STD-6866, *Liquid Penetrant Inspection*
- MSFC-STD-100, *Radiographic Inspection of, Acceptance Standards for*
- MSFC-STD-1249, *Standard NDE Guidelines and Requirements for Fracture Control Programs*

REFERENCED DOCUMENTS

NASA 1740.9, *Safety Standards for Lifting Devices and Equipment*

NAVFAC P-306, *Testing and Licensing of Weight Handling and Construction Equipment Operators*

NAVSEA OP 5, *Ammunition and Explosives Ashore*

NAVSHIP 250-692-2, *Radiographic Standards for Steel Castings, Aluminum and Magnesium Alloy*

NFPA 70, *National Electrical Code*

NFPA 70E, *Electrical Safety Requirements for Employee Workplaces*

NFPA 497A, *Recommended Standard Practice for Classification of Class 1 Hazardous Locations (Classified) for Electrical Installations in Chemical Process Areas*

T.O. 00-25-232, *Control and Use of Insulating Matting for High Voltage Application*

T.O. 00-25-235, *Safety Procedures and Equipment for Confined Space Entry (including Missile Propellant Tanks)*

T.O. 00-25-245, *Operations Instructions, Testing and Inspection Procedures for Personnel Safety and Rescue Equipment*

T.O. 31Z-10-4, *Electromagnetic Radiation Hazards*

VAFB Supplement 1 to AFM 91-201

CHAPTER 6

GROUND SUPPORT PERSONNEL, EQUIPMENT, SYSTEMS, AND MATERIAL OPERATIONS SAFETY REQUIREMENTS

6.1 INTRODUCTION

6.1.1 Purpose of the Chapter

Chapter 6 contains safety requirements for ground personnel and equipment, systems, and material operations on the Ranges. The following major topics are addressed:

- 6.2 Responsibilities and Authorities
- 6.3 Ground Operations Policies
- 6.4 Documentation Requirements
- 6.5 Ground Operations General Requirements
- 6.6 Material Handling Equipment Operations
- 6.7 Acoustic Hazard Operations
- 6.8 Non-Ionizing Radiation Operations
- 6.9 Radioactive (Ionizing Radiation) Sources Operations
- 6.10 Hazardous Materials Operations
- 6.11 Ground Support Pressure Systems Operations
- 6.12 Flight Hardware Pressure Systems Operations
- 6.13 Ordnance Operations
- 6.14 Electrical Systems Operations
- 6.15 Motor Vehicle Operations
- 6.16 Convoy Operations
- 6.17 Launch Operations

6.1.2 Applicability

All agencies operating on the Ranges are subject to the requirements of this document to ensure that operations are conducted safely.

6.2 RESPONSIBILITIES AND AUTHORITIES

6.2.1 Systems Safety, 45th Space Wing and 30th Space Wing

Systems Safety, 45th Space Wing (45 SW/SES) and 30th Space Wing (30 SW/SES) are responsible for the following: **NOTE:** Unless otherwise noted, all references to *Range Safety* in this Chapter refer to Systems Safety.

- a. Reviewing and approving all procedures relating to the performance of any hazardous operation and safety critical operation
- b. Reviewing and approving all Operations Safety Plans (OSPs), Ground Operations Plans (GOPs), and Danger Area Information Plans (DAIPs)
- c. Reviewing and approving Facility Emergency Plans (FEPs), and Facility Emergency Operating Plans (FEOPs)
- d. Ensuring that hazardous facilities and safety

critical and hazardous operations are periodically inspected as required

e. Monitoring hazardous and safety critical operations as required

f. Defining the threat envelopes of all hazardous operations that may affect public safety or launch base safety and establishing safety clearance zones

g. Ensuring that all personnel performing hazardous and safety control operations are provided adequate training to ensure proper conduct of their jobs and tasks, by reviewing Range User training plans

h. In coordination with 45 Medical Group (45 MDG) and 30 Medical Group (30 AMDS), ensuring that adequate personal protective equipment is provided to personnel as defined by this document and approved OSPs

6.2.2 Operations Safety, 45th Space Wing and Ground Safety, 30th Space Wing

Operations Safety, a government contractor for the 45th Space Wing, and Ground Safety, 30th Space Wing (30 SW/SEGP) are responsible for the following. **NOTE:** Unless otherwise noted, these two groups shall be referred to as *Operations Safety* in this Chapter.

6.2.2.1 General Responsibilities

a. Observing, evaluating, and enforcing compliance of Range Safety requirements by all personnel within launch complexes, assembly and checkout areas, propellant and ordnance storage areas, and other areas as deemed appropriate by Operations Safety or Range Safety. **NOTE:** Operations Safety personnel shall not be denied access to any area where hazardous operations are conducted.

b. Reviewing and providing comments on hazardous procedures to Range Safety

c. Reviewing and commenting on system design data and operating procedures as necessary and at the ER, as directed by Range Safety

d. Implementing specified safety precautions and imposing a safety hold when necessary during ground operations as required by the appropriate procedure or OSP

e. Assisting in the resolution of safety problems in all areas where Operations Safety has jurisdiction as necessary and at the ER, as directed by Range Safety

f. Maintaining close coordination with Range Safety concerning policy and procedures

g. Attending meetings and conferences on subjects and at locations including, but not limited to, Safety Working Group Meetings, Facility Working Group Meetings, and Technical Interchange Meetings as necessary and at the ER, as directed by Range Safety

h. Coordinating with the RPO to ensure enforcement of the Radiation Control Program on launch complexes and areas where launch vehicles and payloads and their related hazards are located

i. Maintaining close coordination with Bioenvironmental Engineering and Environmental Health (both Health Physics and Industrial Hygiene) on environmental health hazards

j. In all incidents involving an environmental health hazard, immediately notifying Cape Support on the ER and Range Scheduling on the WR, Environmental Health, and Range Safety

k. When present, ensuring that complexes and facilities are cleared of personnel and operations have been halted when a lightning hazard is imminent in accordance with the OSP or other safety plans

l. Responding to any mishap and/or incident in accordance with 45 OPLAN 32-1 and 30 SW OPLAN 355-1

m. Assisting Range Users in all safety related issues

6.2.2.2 Document Preparation and Maintenance

a. Preparing OSPs, DAIPs, and other safety plans as needed and directed by Range Safety **NOTE:** OSP preparation is accomplished by the Range User at the WR

b. Preparing detailed checklists in accordance with this document, safety plans, and operating procedures for use by the OSM during surveillance of hazardous and safety critical tests and operations

c. Promptly revising checklists whenever new operational procedures or changes in system or support configuration occur

d. At the ER, maintaining an accurate log of events during launch countdown and other operations as designated by Range Safety for three launches or three years, whichever is greater for each program

e. At the ER, forwarding a written report to Range Safety of any violation of this document within five calendar days of the violation if re-

quested by Range Safety

f. At the ER, forwarding a written report to Range Safety of any launch vehicle or payload mishap, hazard, handling malfunction, or other incident creating or contributing to an unsafe condition for personnel or critical hardware within five calendar days of the incident

g. At the ER, maintaining explosive area and facility inspection reports for a period of five years

h. At the ER, providing copies of explosive area and facilities inspection reports to determine compliance with AFM 91-201 and DoD-STD 6055.9 to Range Safety

6.2.2.3 Hazardous and Safety Critical Operations Support

a. Ensuring compliance with established directives and procedures during hazardous and safety critical operations

b. Assessing procedure deviations and coordinating with Range Safety as necessary

c. Ensuring the number of personnel is kept to a minimum in the designated safety clearance zone in accordance with Range Safety approved procedures. **NOTE:** Operations Safety shall be considered part of the maximum manning level unless Range Safety determines that adequate support can be provided from a remote location.

d. Ensuring a clearly understood comprehensive briefing has been conducted prior to the start of a hazardous operation

e. Ensuring that appropriate support personnel such as Fire, Medical, Environmental Health, and other agencies are standing by at the complex, facility, or area during hazardous operations as specified in the applicable OSPs

f. Ensuring that safety road blocks and roving patrols are established to clear the FCA, FHA, and other hazardous launch areas at times required by applicable OSPs

g. In conjunction with the Range User, controlling personnel access into safety clearance zones during hazardous operations

h. As applicable, providing advice to the operation control authority regarding the continuation or stoppage of operations when an imminently hazardous condition or a safety compromise exists

i. Allowing operations to resume only after the imminent danger has been eliminated and safety requirements have been met

j. Providing inspection reports of new or modi-

fied facilities to Range Safety within 15 calendar days of the inspection. **NOTE:** This function is performed by the Range User at the WR.

k. At the ER, operating the Hazard Monitor System (HMS) console for all Spacecraft Processing Integration Facility (SPIF) hazardous operations

6.2.2.4 Launch Support

a. Providing technical support for the Launch Disaster Control Group (LDCG) as required in the Safety Operating Plan and the specific procedure in use

b. Operating the Operations Safety Console (OSC), for launches

c. Monitoring hazardous and safety critical launch operations

6.2.2.5 Notifications

a. At the ER, immediately notifying Range Safety of any launch vehicle or payload mishap, hazard, handling malfunction, or other incident creating or contributing to an unsafe condition for personnel or critical hardware

b. At the ER, verbally notifying Range Safety of any violation of this document as soon as possible followed by a written report within five calendar days if requested by Range Safety

c. At the WR, immediately notifying the 30th Command Post at 866-9961

6.2.2.6 FTS Installation, Checkout, and Status

a. At the ER, monitoring and verifying the installation, checkout, and status of the FTS in accordance with Range Safety instructions at locations designated by Range Safety. **NOTE:** At the WR, these duties are performed by the FSPO.

b. At the ER, providing representation on board submarines for specified launch operations and for in-tube conversions to monitor and ensure proper FTS installation, checkout, and readiness

6.2.2.7 Inspections

a. At the ER, periodically, but not less than annually, inspecting all explosive areas and facilities to determine compliance with the requirements of this document, AFM 91-201, and DoD 6055.9-STD. **NOTE:** At the WR, 30 SW/SEW performs these duties.

b. Inspecting critical facilities prior to the start of a hazardous operation or as determined necessary

by Operations Safety and/or Range Safety

c. At the ER, inspecting new or modified critical facilities prior to initial start up operation and forwarding inspection reports to Range Safety within 15 calendar days

d. Periodically auditing the execution of procedures for handling ordnance, propellant material, and high pressure gases at CCAS and VAFB, not less than quarterly, and for downrange stations, not less than annually

6.2.2.8 Additional 30 SW/SEGP Responsibilities and Authorities

The 30 SW/SEGP OSM is responsible for the following:

a. Managing a specific launch vehicle/payload system with decision making authority. The OSM has GO/NO-GO authority relating to all safety issues that arise during selected processing and launching activities.

b. Training new Operations Safety Technicians (OSTs) and cross-training other OSMs

c. Interfacing with local, county, state and federal safety agencies regarding OSHA and environmental issues

6.2.2.9 30 SW/SEGP Operations Safety Technicians

Under the direction of the OSM, the OST is responsible for performing the following:

a. Providing safety surveillance during hazardous and safety critical and selected routine launch operations

b. Observing and providing guidance to Range Users to ensure compliance and implementation of safety requirements

c. Performing inspections and surveys to analyze risks, identify cause factors and suggest risk assessment codes

d. Performing mishap investigations and monitoring corrective actions

e. Organizing and supervising missile support teams

f. Representing Range Safety at the daily launch vehicle and/or payload processing meetings

g. Providing in-house training, evaluation, and certification

h. Managing, scheduling, and performing source mission support requirements

6.2.3 Range Users

Range Users are responsible for the following:

6.2.3.1 Range User Control Authority Responsibilities

The option for operational safety control authority within the launch complex shall be available beginning in fiscal 1996. When certified in accordance with the Launch Complex Safety Training and Certification Requirements, the Control Authority is responsible for the following. (See Appendix 1G for the Launch Complex Safety Training and Certification Requirements.) **NOTE 1:** If this option is used, Range Safety shall audit the program on an unannounced and periodic basis. **NOTE 2:** Range Safety shall perform these duties if a control authority is not qualified. **NOTE 3:** Range Safety can assume these responsibilities for qualified control authorities, if requested. **NOTE 4:** At the WR, Operations safety will audit the program, perform duties, and assume responsibilities, if requested.

a. Reviewing and approving all procedures relating to the performance of any hazardous operation and safety critical operation that are limited to launch complex safety. **NOTE:** This does not include maintenance and testing required by this Chapter and Chapter 3. These procedures still shall be reviewed by Range Safety.

b. Reviewing and approving FEPs and FEOPs that are limited to launch complex safety and all OSPs

c. Ensuring hazardous facilities and safety critical and hazardous operations limited to launch complex safety are periodically inspected, as required

d. Monitoring hazardous and safety critical operations that are limited to launch complex safety, as required

e. Defining the threat envelopes of all hazardous operations limited to launch complex safety and establishing safety clearance zones to protect launch complex personnel and resources

f. Ensuring that all personnel performing hazardous operations that are limited to launch complex safety are provided adequate training to ensure proper conduct of their jobs and tasks by reviewing Range User training plans

g. Ensuring that adequate personal protective equipment is provided to launch complex personnel as defined by this document and approved OSPs

6.2.3.2 Conduct of Operations

a. Planning and conducting hazardous and safety critical operations in accordance with Range Safety approved procedures

b. Planning and conducting operations in accordance with the current edition of the applicable OSP for the launch complex, facility, or area in use and for ordnance and propellant operations and areas

c. Planning and conducting other operations in accordance with the current edition of other safety plans, as applicable

6.2.3.3 Notification of Hazardous and Safety Critical Operations to Range Agencies

a. Notifying Cape Support (853-5211) for the ER and (276-8823) for the WR at least 24 hours prior to the start of any hazardous or FTS-related operation. **NOTE:** The following information shall be provided: date, time, nature of the operation, location, and procedure or task number

b. Notifying Range Safety and Operations Safety of all hazardous and safety critical operations and tests including FTS-related operations

c. Notifying Range Safety and Operations Safety at least 30 calendar days prior to the scheduled erection of a launch vehicle and/or payload

6.2.3.4 Document Preparation and Maintenance

a. Developing and implementing a Ground Operations Plan in accordance with Appendix 6A to cover operations conducted on the Ranges

b. Developing and implementing procedures and general instructions to cover all operations conducted on the Ranges

c. Developing, obtaining Range Safety approval, and implementing procedures related to hazardous and safety critical operations. **NOTE 1:** The designation of a procedure as *Hazardous* or *Non-Hazardous* is evaluated on a case-by-case basis and does not necessarily result in mandatory Operations Safety coverage of the operation. **NOTE 2:** The requirements for hazardous procedures may be found in Appendix 6B.

d. Obtaining Range Safety approval of new procedures or revisions to previously approved procedures when there is an impact to the safe conduct of the procedure

e. Developing and implementing a program to

control hazardous energy sources by locking and tagging in accordance with lockout-tagout approved procedures

f. Developing, obtaining Range Safety approval, and implementing a propellant off-load plan and procedure

g. Developing, obtaining Range Safety approval, and implementing an Emergency Response Plan (ERP) for graphite/epoxy composite overwrapped and kelvar wrapped pressure vessels

h. Developing, implementing, and maintaining records for an In-Service Inspection (ISI) Plan in accordance with the requirements of this Chapter and Chapter 3

i. Developing, implementing, and maintaining records for a Non-Destructive Examination (NDE) Plan in accordance with the requirements of this Chapter and Chapter 3

j. Developing, implementing, and maintaining records for a recertification program for ground pressure vessels in accordance with ESMC TR-88-01

k. Developing and maintaining hazardous facility inspection records and submitting reports to Range Safety, as required

l. Developing and implementing a Ground System Test Plan for ordnance facilities and areas as required

m. Obtaining 45 CES or 30 CEG approval for procedures in accordance with AFI 32-2001, DoD, federal, state, and local EPA requirements

n. Obtaining 45 MDG or 30 AMDS approval for procedures in accordance with 45 SWI 40-201 or AFI 91-110 30 SW1

o. Preparing and maintaining OSPs as needed and directed by Range Safety. **NOTE:** This function is accomplished by ER Operation Safety at the ER

p. Developing, obtaining Range Safety approval, and implementing a Dual Crane Lift Plan

q. Developing, obtaining Range Safety approval, and implementing a Training Plan for all Range User personnel performing hazardous and safety critical procedures and operations

r. Developing pathfinder requirements in coordination with Range Safety

s. At the WR, developing, obtaining 30 SW Range Safety approval and implementing an 30 SW First Use Tag Program for lifting hardware at the WR.

6.2.3.5 Operational Duties

a. Ensuring required support and emergency elements approved by Operations Safety have continuous access to any area where hazardous conditions could occur

b. Obtaining Operations Safety concurrence to proceed before starting any hazardous and safety critical operations and before any operation that has been interrupted resumes. **NOTE:** Interruptions include such events as a safety hold, shift change, evacuation, or breaks.

c. Before the conduct of hazardous or safety critical operations, performing the following actions:

1. Pre-operation and shift change briefings

2. Pre-operation and shift change inspections to verify proper system, facility, and area configuration; personnel and equipment support; and use of a Range Safety approved procedure

d. Maintaining an accurate written or computerized log of events during launch countdown for three years or three launches, whichever is greater

e. Observing, evaluating, and enforcing compliance with Range Safety requirements by all personnel within launch complexes, assembly, and checkout areas, propellant and ordnance storage areas, and other areas as deemed appropriate by Range Safety.

f. Reviewing and providing comments on hazardous and safety critical procedures to Range Safety.

6.2.4 Supporting Agencies

6.2.4.1 Medical Group, 45th Space Wing and 30th Space Wing

The 45th and 30th Medical Groups, Bioenvironmental Engineering (45 MDG/SGBP and 30 AMDS/SGBP) and the 45th and 30th Medical Group, Radiation Protection (45 MDG/SGPH and 30 AMDS/SGPH) are responsible for coordinating with other groups such as Range Safety and Operations Safety to ensure that operations are in compliance with 45 SWI 40-201, AFI 91-110 30 SW1, the AFOSH 161 series, AFI 91-301, and 40 CFR. **NOTE:** Unless otherwise noted, these agencies shall be referred to as *Bioenvironmental Engineering* and *RPO* (WR) in this Chapter.

6.2.4.2 Civil Engineering Squadron, 45th Space Wing and Civil Engineering Group, 30th Space Wing

The Civil Engineering Squadron, 45th Space Wing

(45 SW/CES) and Civil Engineering Group, 30th Space Wing (30 SW/CEG) are responsible for coordinating with other groups such as Range Safety and Operations Safety to ensure that operations are in compliance with AFI 32-2001 and DoD, federal, state, and local environmental regulations at their respective ranges. **NOTE:** Unless otherwise noted, these agencies shall be referred to as *Civil Engineering* in this Chapter.

6.2.4.3 Cape Support (ER) and Range Scheduling (WR)

Prior to prelaunch and launch operations, CCAS Cape Support (ER) or Range Scheduling (WR) is responsible for notifying and requesting support as required from Operations Safety, Fire, Medical, Security, Environmental Health, and other agencies.

6.2.4.4 Facility Operators

Facility Operators are responsible for the following:

a. Developing and submitting FEOPs and FEPs for review and approval by Range Safety

b. Performing monthly inspections, developing and maintaining Hazardous Facility Inspection records, and developing and maintaining Explosives Facility and/or Area Ground System Test Plans, as required and at the ER, submitting reports to Range Safety

c. Conspicuously posting explosive limits, personnel limits, and fire symbols when ordnance and propellants are moved into or out of a facility

6.3 GROUND OPERATIONS POLICIES

6.3.1 Personnel Safety

It is the policy of the Ranges that all personnel shall be protected during the performance of operations.

6.3.2 Stopping Unsafe Operations

a. The following personnel have authority to immediately stop operations or practices that, if allowed to continue, could reasonably be expected to result in death or serious physical harm to personnel, major system damage, or the inability to accomplish its mission:

1. A Safety representative

2. Any operational supervisor

3. Personnel in the chain of command who ex-

ercise supervisory authority

b. These personnel are authorized to stop operations or practices when imminent danger cannot be eliminated through regular channels. **NOTE:** All personnel observing an unsafe operation or practice should tell one of these individuals of the problem observed.

6.3.2.1 Notification of Action

Any action taken by any of the individuals as authorized above to stop an unsafe operation where imminent danger is involved shall be followed by direct verbal, telephone, or radio communication and notification to Range Safety at the ER and Operations Safety at the WR, the Squadron Commander, the Group Commander, or their designated representative.

6.3.2.2 Notification of Work Stoppage

The Air Force Contracting Officer or Administrator for an Air Force Construction Contract shall be immediately notified of any work stoppage.

6.4 DOCUMENTATION REQUIREMENTS

6.4.1 Ground Operations Plans

GOPs shall be developed in accordance with the requirements in Appendix 6A and submitted to Range Safety for review and approval.

a. The GOP provides a detailed description of hazardous and safety critical operations for processing aerospace systems and their associated ground support equipment (GSE). **NOTE:** Along with the MSPSP, the GOP is the medium from which missile system prelaunch safety approval is obtained.

b. Preliminary drafts shall be provided 45 days prior to the Conceptual Design Review (cDR), Preliminary Design Review (PDR), and Critical Design Review (CDR) but no later than one year prior to the projected date the hardware will arrive at the Ranges.

c. The final GOP shall be submitted 45 calendar days prior to hardware delivery to the Ranges.

d. The GOP shall be approved prior to the start of any hazardous operations.

6.4.2 Test and Inspection Plans

6.4.2.1 Non-Destructive Examination Plans

a. Non-destructive examination (NDE) plans

shall be developed if material handling equipment (MHE) has single failure point (SFP) components or SFP welds. **NOTE 1:** NDE applies to all hooks and all MHE used to lift and support critical hardware. **NOTE 2:** NDE plans shall be submitted as part of the MSPSP as required in Chapter 3 of this document.

b. The NDE plan shall include the following:

1. NDE technique and acceptance criteria to be used on each SFP component or SFP weld after initial and periodic proof load tests

2. Detailed engineering rationale for each technique and acceptance criteria

3. A determination of whether the MHE is a dedicated piece of equipment used for only one function or whether it is multipurpose

4. The environment and/or conditions under which MHE will be used and stored

5. The existence of any SFP component and weld materials susceptible to stress corrosion

6. Corrosion protection and maintenance plans

c. The plan shall be submitted to Range Safety for review and approval as soon as developed and no later than the MHE PDR.

6.4.2.2 Ground Support Pressure Vessel In-Service Operating, Maintenance, and Inspection Plans and Logs

NOTE: ISI plans shall be submitted as part of the MSPSP as required in Chapter 3 of this document.

6.4.2.2.1 Ground Support Pressure Vessel In-Service Operating, Maintenance, and Inspection Plans.

a. Ground support pressure vessel in-service operating, maintenance, and inspection plans (ISI) shall be developed during the design phase by the Range User responsible for the design of fixed, mobile, and portable hazardous pressure systems

b. The ISI Plan includes the following information:

1. An analysis of credible failure mechanisms that may cause service related failures of the system during pressure vessel service life. **NOTE:** Failure mechanisms to be evaluated include corrosion, stress, fatigue, creep, design fab-

rication, installation, operation, and maintenance deficiencies.

2. Identification of the methods such as “eliminated,” “controlled by design,” “controlled by procedure,” “and controlled by corrosion protection” used to eliminate and/or control the failure mechanisms

3. Certification and recertification criteria

c. Records shall be maintained for all certification and recertification data. Requirements are included in the **Ground Based Pressure Vessels and Liquid Holding Tank Recertification Requirements** section of this Chapter.

6.4.2.2.2 Ground Support Propellant Systems Logs. Logs shall be maintained on propellant systems to keep track of use, maintenance, modification, testing, and inspection.

6.4.2.3 Material Handling Equipment Test Records and Overhead Crane Logs

6.4.2.3.1 MHE Test Records.

a. Test records verifying that MHE meets the applicable periodic testing requirements shall be maintained. **NOTE:** The data required for incorporation in the test records can be found in the **Recurring Data Requirement** section for each type of MHE addressed in this Chapter.

b. Discrepancies and their resolution shall be noted.

c. The test records shall be made available to Range Safety upon request.

6.4.2.3.2 Crane Logs.

a. Critical crane logs shall be maintained for the life of the crane.

b. All operations and maintenance, including running time, shall be recorded.

c. The critical crane logs shall be made available to Range Safety upon request.

6.4.2.4 Hazardous Facility Inspection Records and Reports

a. Hazardous facility inspection records shall be maintained by Facility Operators and/or Range Users in accordance with AFM 91-201, AFI 91-202, DoD 6055.9-STD, and this Chapter.

b. At a minimum, hazardous facility inspection records shall include discrepancies and discrepancy resolution.

c. Written reports describing actions taken to correct discrepancies shall be submitted to Range

Safety within 15 calendar days or less if requested by Range Safety.

6.4.2.5 Explosives Facility and/or Area Ground System Test Plan

A floor plan layout for all explosives facilities and/or areas showing all grounding system test points shall be developed and maintained by the Facility Operator and/or the Range User.

6.4.3 Safety and Emergency Plans

6.4.3.1 Operations Safety Plans and Danger Area Information Plans

a. At the ER, OSPs (Appendixes 6C through 6E) shall be developed by ER Operations Safety and submitted to Range Safety for review and approval 30 calendar days prior to initial use.

b. At the WR, Range Users shall develop their OSPs and submit them to Operations Safety for review and approval before use.

c. At the ER, DAIPs shall be developed by Operations Safety and submitted to Range Safety for review and approval 30 calendar days prior to initial use.

d. At the WR, Launch Safety Plans shall be developed by Operations Safety and submitted to 30 SW/SE for approval 14 calendar days prior to initial use.

6.4.3.1.1 OSPs. OSPs must meet the following requirements:

a. OSPs shall be developed for all hazardous operating areas including launch complexes and associated areas and facilities.

b. OSPs shall be developed for unique, but frequently repeated operations that require special or detailed safety considerations not addressed in this document.

c. OSPs shall be comprehensive documents intended to clarify and provide detailed safety requirements that are particular to the operating area or operation in question.

d. At a minimum, OSPs shall contain, address, and provide reference to the following:

1. A scaled map of the operating area that identifies hazardous and safety critical systems, locations, or features including, but not limited to, propellant holding areas, explosive storage areas, high pressure vessels, emergency evacuation routes and assembly points, safety control areas, warning lights, and first aid rooms

2. A matrix list of all hazardous or safety critical systems (fixed and portable) that are or will be in the operating area with designation as affecting public, launch base or launch complex safety, personal protective equipment required, and any special safety requirements

3. A matrix list of all hazardous or safety critical operations or tasks performed in the operating area in order of performance with designation as affecting public, launch base or launch complex safety; safety clearance zones required; personnel loading requirements; personal protective equipment required; any special safety requirements; and identification of those operations or tasks that may be run concurrently

4. A complete explanation of all aural-visual warning systems in the operating area including the required personnel response

5. The safety badging (permit) system at the operating area with details such as requirements for obtaining the safety badge, access control, and safety badge types for different personnel categories. **NOTE:** Range Safety and Operations Safety (ER) and Operations Safety (WR) retain the option to train Safety personnel on each launch vehicle payload, system, and launch complex

6. Range Users shall provide Range Safety and Operations Safety (ER) and Operations Safety (WR) updated listings of permit numbers, names, and assigned agencies 48 hr prior to all launches

7. Visitor safety briefings, including content and responsibility

8. Detailed personnel requirements, including, but not limited to, smoking areas especially in propellant and explosive locations; eating and drinking areas; conduct; handling of work clothes due to exposure to hazardous, toxic, or flammable materials; work hour restrictions; and tool tethering requirements

9. Fall Protection Surveys and Plans

10. Personal protective equipment (PPE) details including specific requirements regarding types and usage, especially concerning Self-Contained Atmospheric Protective Ensemble (SCAPE) and splash suits, leg and wrist stats, and hard hats

11. Training and Certification Plans

12. Detailed procedures for reaction to lightning and high wind warnings

13. Detailed procedures for general emergencies such as fire, explosion and propellant spills

14. Detailed procedures for natural disasters such as hurricanes, tornadoes or earthquakes.

15. Mishap reporting and emergency response phone numbers, including immediate notification to the OSM or OST of any personnel injury or resource damage

16. FEOPs

17. EEPs

18. Lock-out-Tag-out Plans and Procedures

19. Confined Space Operations Surveys, Plans, and Procedures

20. Hot Work Plans and Procedures

21. Self-Inspection Program and Inspection Schedules

6.4.3.2 Facility Emergency Operating Plans

FEOPs shall be developed by Facility Operators and submitted to Range Safety for review and approval 45 calendar days prior to facility use.

6.4.3.3 Emergency Evacuation Plans

a. Emergency Evacuation Plans (EEPs) detailing safety and emergency actions shall be developed by Facility Operators and posted in every building, facility, and area.

b. Emergency Evacuation Plans shall include the following information:

1. Identification of exit/egress routes

2. Identification of primary and alternate Emergency Evacuation Assembly Points (EEAPs).

NOTE: EEAPs shall be designated by signs.

3. Responsibilities of supervisors and personnel for duties assigned in an emergency

4. Actions to be taken to safe an operation

5. Methods of communication including aural warning systems and PA announcements

6. Location of fire alarm boxes and other emergency activation devices

7. Required emergency equipment and personal protective equipment

8. Required personnel training

9. Reporting requirements such as, but not limited to, Squadron Commander or Command Post

6.4.3.4 Emergency Response Plans for Graphite Epoxy Composite Overwrapped Pressure Vessels

a. ERPs for graphite epoxy composite level in vessels shall be developed by Range Users and submitted to Range Safety for review and approval.

b. ERPs shall include the following information:

1. Contingency safing procedures
2. Backout plans for leaks, impacts to the pressure vessels and exposure to incompatible chemical agents

6.4.4 Procedures

6.4.4.1 General Requirements for Procedures

a. Procedures and general operating instructions for all operations conducted on the Ranges shall be developed.

b. All procedures shall be written in a logical format with clear instructions as to the tasks to be performed and the hazards and precautions involved.

c. Brief summaries of all procedures shall be submitted as part of the GOP review and approval process. At that time, the operating procedure summaries shall be designated as *Hazardous*, *Non-Hazardous*, or *Safety Critical*. **NOTE 1:** These designations shall be justified in the operating procedure summaries. **NOTE 2:** Range Safety may designate additional processes and operations as *Hazardous* or *Safety Critical*.

d. Revisions to any procedures shall be submitted to Range Safety for review and approval when there is a potential impact on the safe conduct of an operation.

6.4.4.2 Hazardous and Safety Critical Procedures

a. Procedures for hazardous and safety critical operations shall be developed in accordance with the requirements in Appendix 6B. Emergency actions shall be included in the procedures. **NOTE:** Approval of hazardous and safety critical procedures shall not be given until the MSPSP and GOP have been reviewed and approved.

b. One copy of procedures and revisions involving hazardous and safety critical operations shall be submitted to Range Safety and one copy to Operations Safety for review and approval. **NOTE:** See Appendix 6B for transmittal letter requirements.

c. For new programs, final Operations Safety and Range Safety comments, reviews, and approval shall be provided to the Range User 45 calendar days after receipt of the procedure.

d. For existing programs, final Operations Safety and Range Safety comments, reviews, and approval shall be provided to the Range User no later than

30 calendar days after receipt of the procedures.

e. Final approved, published procedures incorporating Range Safety comments shall be submitted to Range Safety at least 7 calendar days prior to the conduct of the operation.

f. Disapproval of a formally submitted procedure may result in an additional 30 calendar day (45 calendar days for new programs) review time submittal and possible delay of operations. **NOTE:** Range Users new to the Ranges are encouraged to provide a draft of a typical procedure for early review.

6.4.5 Safety Analysis for Proposed Work Under a Load

A safety analysis shall be performed when part or all of a person's body is placed under a load to perform necessary work. The safety analysis shall be part of the GOP and address the following topics:

- a. A detailed description of the task to be performed
- b. The rationale for performing the task
- c. The number and types of personnel to be exposed
- d. The duration and extent of exposure
- e. An explanation of why the operation cannot be conducted without personnel below the load
- f. Details of any precautions to be taken to protect personnel if the load falls

6.4.6 Range User Training Plan

A training plan listing all training courses used for personnel involved with hazardous or safety critical operations and procedures shall be submitted to Range Safety as part of the GOP.

6.4.7 Mishap Reporting

6.4.7.1 Mishaps Involving Air Force Personnel and Property

Reporting criteria for mishaps involving Air Force personnel and property are established in AFI 91-204. Mishaps involving radioactive materials shall be reported in accordance with AFI 91-110.

6.4.7.2 Accident Notification Plan

An accident notification plan shall be developed by the Range User and coordinated with Range Safety (ER)/Operations Safety (WR) to ensure proper and timely notification of mishaps. The plan shall be included in the GOP.

6.5 GROUND OPERATIONS GENERAL

REQUIREMENTS

DOT, EPA, OSHA and industry standards are specified as compliance documents throughout this Chapter. When there is a conflict between Federal regulations, industry standards or other requirements in this section, the more stringent requirement shall be used unless otherwise agreed to by Range Safety.

6.5.1 Ground Operations Personnel Requirements

Range Users shall submit training plans to Range Safety for review and approval. A list of all training courses is the minimum requirement.

6.5.1.1 Ground Operations Safety Orientation and Training

a. All Range Users shall ensure that their personnel receive formal safety orientation and training prior to receiving a controlled area badge.

b. Periodic refresher training shall be required.

6.5.1.2 Job Safety, Fire Prevention, and Occupational Health Training

a. All assigned personnel shall receive job safety, fire prevention, and occupational health training.

b. This training shall include, but not be limited to, the following topics:

1. Hazards of the job tasks they will perform, including but not limited to the following:

- (a)* Crane operations
- (b)* Ordnance handling and transportation
- (c)* Forklift operations

2. Hazards of the work area

3. Range requirements, safety standards, and other guidance that applies to the job and workplace

4. PPE requirements and use

5. Location and use of emergency and fire protection equipment

6. How to report emergencies and fires to the proper authorities

7. Emergency procedures applicable to the job and work place

8. Actions to be taken in the event of specific warnings, PA announcements, or alarms

9. How to identify and report hazards

10. How to report work-related injuries and illnesses

11. First aid, and, as applicable, cardiopul-

monary resuscitation procedures

6.5.1.3 Personnel Conduct

6.5.1.3.1 Food, Beverage, and Cigarette Consumption. Eating, drinking, or smoking is authorized only in designated areas.

6.5.1.3.2 Alcoholic Beverages and Narcotics.

a. Using alcoholic beverages and narcotics while on duty is prohibited. An employee who reports for work while under the influence of alcoholic beverages or narcotics shall be removed from the premises by Security.

b. Personnel taking prescription or non-prescription medications that could affect performance shall notify their supervisor.

6.5.1.3.3 Mischief. Indulgence in practical jokes, horseplay, scuffling, and wrestling is prohibited.

6.5.1.4 Work Time Restrictions

a. Supervisors at all levels should ensure their personnel will not be assigned to, and not participate in, critical operations if it is evident that their physiological or psychological well-being is, or is likely to be, adversely affected by immunizations, fatigue, blood donations, use of drugs, illness, consumption of alcohol, or other stress conditions.

b. Each duty period for Mission Ready (Category A) and Mission Support (Category B) personnel, including participation in a launch or launch attempt activity, shall be preceded by an available rest period.

c. Planned duty for personnel in either mission ready or mission support should normally be eight hours, starting when the individual reports for duty. Those personnel identified to support operational tests shall not be scheduled for duty during the planned rest period.

6.5.1.4.1 Hazardous Operations and Pre-launch Attempts. The following criteria shall be used for determining hours worked versus rest time for all personnel who work with hazardous systems, materials, or components, or who accomplish prelaunch functions that require a high degree of concentration:

a. Maximum 12-h shift, unless approved by Range Safety or USAF Squadron Commander, with at least 8-h rest after 12 h of work

b. A maximum of 60 h per week

c. A maximum of 14 consecutive days

6.5.1.4.2 Consecutive Launch Attempts.

When 12-h shifts are required and launches are rescheduled on a 24-h basis, consideration shall be given for a 48-h launch delay after three consecutive back-to-back launch attempts. In the event mission impacts or operational requirements necessitate 12-h shifts, mission ready personnel shall not be scheduled for more than five consecutive shifts without a 48-h break and mission support personnel with not be scheduled for more than six consecutive shifts without a 24-h break.

6.5.1.4.3 30 SW Additional Work Restrictions.

a. In the event of a missile accident, emergency, or operational necessity, the duty time limits defined in this document may be exceeded with the expressed knowledge of the 30 SW Commander or Vice Commander, Commanders of tenant organizations, or the 30 SW Chief of Safety for personnel under their respective control.

b. When mission requirements dictate, the duty period may be extended to 12 h by the first level supervisor. Rest periods and break periods shall be provided according to appropriate regulations and negotiated agreements.

c. If, after a complete evaluation of the potential hazards involved, mission requirements dictate a duty period in excess of 12 h, the following criteria shall apply:

1. For Mission Ready (Category A) personnel, the duty periods may be increased to 14 h or rest periods may be waived with the expressed knowledge of the 30 SW Commander or Vice Commander, Western Range Commander, Operations Groups Commander, or the Chief of Safety.

2. For Mission Support (Category B) personnel, the duty period may be increased to 14 h with the expressed knowledge of the applicable division chief or equivalent level supervisor.

6.5.2 Personal Protective Equipment

a. Personal protective equipment (PPE) that provides sufficient protection against the hazards of specific operations and, at a minimum, meets the requirements established by OSHA, AFOSH, ANSI, and NIOSH, shall be provided.

b. All PPE shall be compatible with the toxic materials involved.

c. PPE selection shall be approved by Range Safety and the Bioenvironmental Engineering at the

ER and Range Safety and the Bioenvironmental Engineering at the WR. Contractors must ensure their employees are protected as required by OSHA regulations and CAL-OSHA, where applicable.

6.5.2.1 Use and Care of PPE

a. PPE shall be used, maintained, inspected, and stored properly to prevent degradation of its protective capability.

b. A means of cleaning and disinfecting PPE shared among employees shall be provided.

6.5.2.2 Hard Hats

a. Where the hazard of falling objects exists, hard hats meeting the requirements of ANSI Z89.1 shall be worn.

b. Hard hats shall be worn by all personnel within areas where head injury may occur unless specifically exempted by Range Safety.

c. Hard hat areas shall be clearly designated by yellow lines, barriers, signs, or other means.

6.5.2.3 Respiratory Protection Restrictions

a. Personnel requiring the use of respirators shall have the appropriate physical, training, and fit test prior to work in those areas where respiratory protection is required.

b. The wear of respirators is approved by Bioenvironmental Engineering and Environmental Health for USAF employees. Other Agencies and contractors must have their own respiratory protection program that complies with OSHA regulations and CAL-OSHA, where applicable.

6.5.2.4 Clothing Requirements in Industrial and Missile Operating Areas

a. Complete upper and lower body attire shall be worn in industrial and missile operating areas. **NOTE:** Lower arms, hands, and head do not have to be covered unless otherwise stated.

b. Open-toed and high-heeled shoes are prohibited.

c. Canvas shoes are not permitted where liquid propellants or cryogenics are handled.

d. Dresses shall not be worn on towers.

e. The appropriate attire for hazardous and safety critical operations shall be identified in the operating procedure.

f. Coveralls or other work clothes designated to be worn in toxic propellant areas shall not be worn in eating areas or other facilities off site.

g. Work clothes shall be stored in change rooms in designated lockers.

h. Work clothes requiring cleaning shall be bagged and identified.

i. Work clothes exposed to an oxygen rich atmosphere shall be thoroughly aired before smoking is allowed.

6.5.3 Fall Protection

6.5.3.1 Fall Protection General Requirements

Specific criteria for the equipment listed in this section can be found in ANSI Z359.1, A10.14, AFOSH 127-22 and 31, 29 CFR 1910.23 and 27, 29 CFR 1926.105, and MIL-STD-1212A.

6.5.3.2 Fall Hazards

a. All open-sided floors or fall hazards over 4 ft or any height where falls into hazards such as moving machinery, impaling, or drowning hazards exist shall be guarded by standard guard rails with mid-rails and toe boards.

b. Fall protective PPE shall be used when installing guardrails, safety nets, and other fall protection.

6.5.3.3 Hazard Guards

If standard guard rails are not installed, PPE, in the order of preference listed below, shall be used to protect personnel if they are within 6 ft of the hazard:

- a.* Full body harness (ANSI Class III)
- b.* Chest harness (ANSI Class II)
- c.* Safety nets (OSHA 1926.105)

6.5.3.4 PPE Lanyards

PPE shall be attached to anchorages by a lanyard that limits the length of a fall to no more than 6 ft. The order of preference is as follows:

- a.* Self-retracting lanyard (inertia reel)
- b.* Shock absorbing lanyard
- c.* Nylon rope lanyard
- d.* Wire rope lanyard (for welders)

6.5.3.5 Lanyard Anchorages

a. Lanyard anchorage points shall be based on criteria established in ANSI A10.14 as identified in Chapter 5, **Critical Facility and Structure, Personnel Anchorage and Anchorage Connections** and ANSI Z359.1.

b. Handrails shall not be used for anchorages or lanyard tie-off points.

c. Life line (dog-run) style anchorages for lanyards require specific approval by Range Safety for each application. Appropriate justification with analysis must be submitted for Range Safety approval. Dog-runs are not an acceptable alternative to installed platforms or walkways.

6.5.3.6 Installation of Permanent Anchorage Connectors

a. Visual inspection of installed permanently fixed anchorage connections and dog-runs shall be accomplished annually by the Range User. Documentation shall be available for review by Range Safety.

b. Suspect connections or anchorages shall receive NDE as determined by Range Safety and shall be repaired or replaced as required.

6.5.3.7 Fall Protection Snap Hooks

Fall protection snap hooks used in fall protection systems shall be sized to ensure proper connection.

6.5.3.8 Fall Protection Equipment Inspections

a. Each article of PPE shall be visually inspected by the user prior to use.

b. All PPE shall be thoroughly inspected at least twice a year by a qualified person of the organization that owns the PPE.

c. Each piece of PPE shall have a visible tag or other indication of inspection permanently attached with the following information:

- 1.* The date inspected
- 2.* The next inspection due date
- 3.* The stamp or signature of the quality inspector

6.5.3.9 Ladder Fall Protection

a. Ladder fall protection shall be installed on all fixed ladders with a fall hazard of 20 ft or more.

b. Ladder safety devices with body belts shall be the preferred method of fall protection.

6.5.4 Smoking Areas

6.5.4.1 Designated Non-Smoking Areas

Smoking is prohibited at all times and flame-producing devices shall be prohibited within the following areas:

- a.* Within 100 ft of any propellant storage tank
- b.* On gantries or service towers
- c.* Within 100 ft of the test stand while propellants are being transferred or during the time pro-

pellants are aboard the launch vehicle and/or payload

d. In the vicinity of the launch vehicle and/or payload during and after ordnance installation

e. In missile impact areas where radioactive contamination, ordnance, or fuels are present

f. In any area displaying NO SMOKING signs

g. In all propellant operating and storage areas except in specifically designated smoking areas

6.5.4.2 Designated Smoking Areas

Selection of designated smoking areas, their ash receptacles, and ventilation systems is subject to the review and approval of the Fire Department.

6.5.4.3 Marking Smoking and Non-Smoking Areas

No smoking and smoking areas in the complex shall be clearly designated by lines painted on the concrete or asphalt surfaces and appropriately marked by signs.

6.5.4.4 NO SMOKING Signs

NO SMOKING signs shall be posted as directed by the Fire Department.

6.5.5 Operating Restrictions Due to Lightning

Conditions under which launch complexes, launch vehicle and payload assembly areas, and other hazardous areas shall be cleared due to a threat of lightning shall be specified in the OSP.

6.5.5.1 ER Lightning Hazard Advisories and Hazard Warnings

a. Operations that will be allowed during lightning advisories and warnings shall be coordinated, reviewed, and approved by 45 SW/SES and documented in the specific OSP.

b. Phase I Lightning Advisory - For the 5 nautical miles lightning advisory (Forecast for lightning within 5 nautical miles of centroid of a specific lightning alert area, [Space Launch Complex (SLC) and/or facility], expected within some time, usually 30 minutes), the following actions shall be taken:

1. SCAPE operations, propellant tanking and detanking, hoisting hazardous materials or 1.1 to 1.3 class ordnance, and other hazardous operations that take 30 min or longer to secure shall not be started.

2. If an operation is in progress, personnel shall begin safing the system so as to have the area secured and evacuated, if required, prior to the forecasted 5 nautical miles lightning warning start time.

c. Phase II Lightning Warning - For the lightning warning, lightning is imminent or occurring within the 5 nautical mile boundary of a centroid of a specific lightning alert area (SLC and/or facility), the following actions shall be taken:

1. All operations shall cease unless they are performed remotely and have been approved by either Range Safety or are authorized in the specific OSP

2. If the Phase I lightning advisory has not been previously announced or the 5 nautical mile lightning warning start time is earlier than forecast, the operation shall be terminated at the safest safe step, the area secured and evacuated in accordance with the specific OSP.

d. Due to the differences between launch vehicle configurations and SLCs, evacuation requirements shall be specified in each specific OSP. In general, the complex shall be cleared prior to the 5 nautical mile lightning warning start time whenever a launch vehicle with payload, propellants, solid rocket motors, or Class 1.1 to 1.3 ordnance is present or EEDs are electrically connected.

e. Additional information regarding lightning hazard advisories and warnings may be found in the 45 WS Meteorological Handbook.

6.5.5.2 WR Lightning Advisories and Warnings

a. Any operation involving propellant transfer or ordnance activities shall not begin when an electrical storm is imminent.

b. Such operations shall be interrupted or expeditiously concluded if an electrical storm approaches within a 10-mile radius.

c. Meteorological and weather warning notification procedures are provided in 30 SW 105-1.

d. All personnel shall be evacuated from explosives facilities to at least PTR distance whenever the electrical storm approaches within 5 miles of the facility. **NOTE:** Exceptions to this requirement based upon small quantities of explosives materials shall be approved by Range Safety on a case-by-case basis.

6.5.6 Operating Restrictions Due to High Winds

6.5.6.1 For Winds of 18-29 Knots as Measured on or Closest to Specific Facilities

No work shall be performed on the exterior surface of umbilical or mobile service towers or other tall structures unless spider staging or similar suspended work devices are safely secured to the structure.

6.5.6.2 For Winds of 30 Knots or More as Measured on or Closest to Specific Facilities

a. No work shall be performed on the exterior surfaces of umbilical or mobile service towers or other tall structures except for emergency tasks.

b. Work performed during emergency conditions shall be approved by Operations Safety or Range Safety and all suspended work devices shall be secured to the structure.

6.5.7 Hazardous Ground Operations General Requirements

6.5.7.1 Pathfinder Requirements

a. In coordination with the Range User, Range Safety shall determine which procedures require a pathfinder and its necessary fidelity.

b. Prior to the first use of applicable hazardous procedures, including contingency, such as operations with live ordnance, pressure systems, or propellant, pathfinder operations shall be conducted at the Ranges using inert or dummy ordnance, non-pressurized systems, or non-fueled systems.

1. Handling operations shall be performed with an inert unit which simulates the flight unit in form, fit, function, weight, and center of gravity.

2. Pressure and propellant system operations shall be performed with a unit which simulates flight unit valve connections.

3. Pathfinder operations shall use GSE that will be used for flight operations.

4. Range Safety and the Range User shall jointly develop acceptance criteria for pathfinder operations and evaluate whether the acceptance criteria was met.

6.5.7.2 Hazardous Ground Operations Training and Certification

a. All personnel performing hazardous operations shall be trained and certified.

b. Hazardous operations training shall include,

but not be limited to, the following topics:

1. Hazard recognition
2. Cause and effect relationships
3. Hazard prevention and control measures
4. Inspection of equipment
5. Buddy system requirements
6. Use of checklists
7. Range Safety and Operations Safety authority
8. Human error
9. Safeguards
10. Safety devices
11. Protective equipment
12. Monitoring and warning devices
13. Emergency procedures

c. On-the-job training shall supplement classroom instruction.

d. Unique personnel training and certification requirements for hazardous operations such as ordnance, crane operations, and SCAPE shall be specified in the appropriate procedures.

e. A list of personnel training, certification, and experience requirements shall be submitted as part of the Range User Training Plan to Range Safety for review and approval 30 calendar days prior to the operation and shall be included in the GOP.

6.5.7.3 Control of Access to Hazardous Operations

Personnel limits, entry control, and control areas shall be established for all hazardous operations.

6.5.7.3.1 Personnel Limits for Hazardous Ground Operations.

a. Personnel limits shall be established for all hazardous operations and tasks and approved by Range Safety. Deviation from approved access list numbers requires Operations Safety or Range Safety approval. **NOTE:** Very Important Person (VIP) visits shall be coordinated with the Chief of Safety prior to entering a hazardous area.

b. The supervisor in charge of the building or operation is responsible for maintaining personnel load limits for a single building or operation.

6.5.7.3.2 Control of Access to All Hazardous Operations.

a. Hazardous areas shall be fenced, barricaded, or cordoned off and personnel access control maintained at a central control point.

b. Access roads shall be closed by barricades, guards, or signs during hazardous operations for

positive control of personnel and vehicles. Emergency vehicles shall not traverse the controlled area if another route is available.

c. When hazardous operations are covered by Operations Safety, Operations Safety shall control access.

6.5.7.3.3 Personnel Restrictions for Hazardous Ground Operations.

a. Non-essential personnel shall leave hazardous areas (safety clearance zones) prior to the start of operations.

b. Whenever a warning light status is changed or an audible signal is sounded, a public address (PA) announcement shall precede it and identify the reason for the change.

c. Each facility and/or area shall have instruction signs informing personnel of the area aural and warning light scheme prior to entry.

d. The buddy system shall be used in all hazardous operations.

e. Area Warning Lights. Personnel with the appropriate badge and security clearance have access to areas as follows: **NOTE:** Exceptions to these requirements require permission of the Chief of Safety or a designated representative.

1. A flashing green light indicates the controlled area is open to normal work. Hazardous commodities may be present in the area but no hazardous operations are in progress. Access is controlled by security.

2. A flashing amber light indicates a hazardous operation is in progress in the controlled area. Non-essential personnel shall be cleared from the controlled area. Personnel shall not enter without permission from Operations Safety or, in the absence of Operations Safety, the entry control authority.

3. A flashing red light indicates an emergency situation in the controlled area. All personnel shall evacuate the controlled area to the EEAP. This signal shall be accompanied by the sounding of an audible alarm and a PA announcement. This signal is also used to clear all personnel from a launch complex prior to a launch. At the WR, a flashing red light also designates a dangerous operation for ballistic missile operations; for example, Flight Operations Test and Evaluation (FOT&E) where work is performed under the strict control of technical orders (T.O.s).

6.5.7.4 Hot Work Operations

6.5.7.4.1 Hot Work Operating Standards. Hot work (open flame) operations including welding, soldering, cutting, brazing, grinding, or heating of materials in such a manner as to cause a source of ignition shall be conducted in accordance with AFOSH 127-5, 29 CFR 1910.252, and ANSI Z49.1.

6.5.7.4.2 Hot Work Operations Training and Certification. All welders shall be trained and certified by competent authority to standards no less than those established by the American Welding Society (AWS).

6.5.7.4.3 Hot Work General Operating Requirements.

a. A written permit shall be obtained from the Fire Marshall prior to performing hot work.

b. Locations where hot work will be routinely performed may operate on an indefinite permit if that area is subject to periodic Fire Department inspections.

c. A fire watch shall be maintained during and after the hot work until such time the fire watch determines that the combustion hazard no longer exists.

d. The requirement for the Fire Department to perform the fire watch shall be determined on a case-by-case basis by the Fire Marshall and Range Safety.

e. Proper housekeeping and protective shields and barriers shall be used to prevent inadvertent combustion.

f. Combustibles shall be kept at least 35 ft away from the operation.

g. A suitable fire extinguisher shall be available.

6.5.7.4.4 Hot Work Within Ordnance or Propellant Areas. Hot work within ordnance or propellant areas shall be coordinated with Range Safety or Operations Safety as well as the Fire Department.

6.5.7.4.5 Hot Work on Containers and Lines That May Have Contained Explosives or Flammables. Hot work shall not be performed on containers and lines that may have contained explosives or flammables and have not been properly cleaned and purged.

6.5.7.5 Control of Hazardous Energy Sources

6.5.7.5.1 Hazardous Energy Sources Standards.

a. Hazardous energy sources shall be controlled through a lockout/tagout program that complies with the requirements of 29 CFR 1910.147, AFOSH 127-45, and ANSI Z244.1.

b. Range Users shall have a program to control hazardous energy sources by locking and tagging.

6.5.7.5.2 Lockout/Tagout Training and Certification. Personnel shall be trained and certified in the lockout/tagout process.

6.5.7.5.3 Lockout/Tagout Procedures. Lockout/tagout procedures shall be developed by Range Users and approved by Range Safety (ER)/ Operations Safety (WR).

6.5.7.5.4 Lockout/Tagout Operations. Whenever work is to be accomplished where the start-up or energizing of equipment may cause a hazard to personnel, the equipment or its controls shall be locked in the SAFE position and controlled by the personnel potentially exposed. *EXCEPTION: Hazardous equipment that cannot be physically locked shall be modified to incorporate a locking capability or be scheduled for replacement. As an interim measure, the equipment shall be tagged out of service and a knowledgeable person posted to watch the controls while personnel are in a potentially hazardous position.*

a. Locks shall be installed prior to the following situations:

1. Personnel are out of sight of the control device
2. The personnel site is left unattended
3. The possibility exists of an unauthorized person operating the control device while personnel are exposed to the hazard

b. A tag shall be installed to identify the fact that the equipment is under the control of a work team.

- c. Tags shall include the following information:
1. The reason for placing the tag
 2. The name, organization, and phone number of the person placing the tag
 3. The date and time of tagging

d. Locks and tags shall be removed only by the personnel who installed them or by their supervisor

in their absence.

6.5.7.6 Confined Space, Tank Entry, and Tank Cleaning

NOTE: Confined spaces and their appropriate controls are defined in 29 CFR 1910.146.

a. All Range Users, contractors, and subcontractors who will be entering confined spaces (other than the contractor's equipment and flight hardware) shall contact Ground Safety at the start of the project to obtain information about the confined space.

b. Ground Safety shall provide information about the content of the space, the condition that makes it a permit-required space, and procedures implemented to protect personnel from the space.

c. Contractors entering confined spaces are responsible for the safety of their personnel and shall develop and use their own entry program. **NOTE:** Chapter 7 of AFOSH 91-25 provides details of contractor responsibilities for entering confined spaces located in AF installations.

d. If contractors encounter any difficulties during the confined space entry, they shall advise the confined space manager of the outcome.

e. AF personnel entering confined spaces shall follow all the provisions of AFOSH 91-25.

6.5.7.7 Tethering of Equipment

a. Hand-held tools, equipment, and personal belongings shall be tethered in any area where dropped objects could pose a hazard to personnel as determined by the local supervisor or on-scene safety official.

b. Hazards to be considered in determining requirements include direct contact with personnel or the consequences of damaging critical hardware.

6.5.8 Facility Use

6.5.8.1 Facility Use General Requirements

a. Facilities shall be used within the limits of their design. For example, the Range User shall not store propellants in an industrial building that is not suited for propellant storage nor equipped to handle propellant spills.

b. Only those operations that are consistent with facility design, materials, equipment, and personnel shall be performed in the facility.

6.5.8.2 Hazardous Facility Use General Requirements

a. The use of facilities for hazardous storage or processing operations shall be approved by Range Safety. **NOTE:** Range Safety approval is required to use a facility for hazardous operations even though similar operations have been conducted in the facility in the past.

b. The OSP shall be developed by Operations Safety at the ER and the Range User at the WR.

c. Facilities used for hazardous activities shall have an FEOP and an Evacuation Plan developed by Facility Operators.

d. Simultaneous hazardous operations within the same control area are prohibited.

e. Non-hazardous operations within the same control area as an ongoing hazardous operation are prohibited unless a safe distance approved by Range Safety can be maintained.

6.5.8.3 Hazardous Facility Inspection

6.5.8.3.1 Range User Facility Inspections.

a. Facilities shall be inspected prior to first use, upon modification, prior to operations, and on a monthly basis.

b. Inspection reports shall be maintained in accordance with AFMAN 91-201, AFI 91-202, and DoD 6055.9-STD.

c. Actions shall be taken to correct discrepancies identified during inspections. **NOTE:** Records of discrepancies and discrepancy corrections shall be maintained for three years.

d. A verbal report shall be made to Range Safety (ER)/Operations Safety (WR) within the same day of the inspection if discrepancies are found that may delay a planned operation or endanger personnel or MHE used to handle critical hardware, or the critical hardware itself.

e. Written reports describing actions taken to correct discrepancies identified during inspections shall be submitted to Range Safety (ER)/Operations Safety (WR) within 15 calendar days or less if deemed necessary by either group.

6.5.8.3.2 Operation Safety Facility, Complex, and Area Inspections.

a. A systematic visual examination of facilities, related ground support equipment, and any work in progress that could cause accidental damage to property or injury to people or affect the launch schedule shall be performed by Operations

Safety. **NOTE:** This inspection deals primarily with aerospace ground equipment (AGE), launch critical associated equipment, maintenance, associated hardware, fire hazards, fall protection, and equipment on the complex.

b. A safety inspection shall be performed on launch complexes, explosives storage and processing facilities and areas, and in hazardous processing and checkout facilities according to the following schedule:

1. At least two weeks prior to a launch vehicle or payload being brought to the pad or facility

2. Within 48 h of the pad erection day

3. Immediately before the start of any hazardous or safety critical operation

4. After any major or safety-related modification has been made to facilities or equipment

c. Explosives storage and operating areas and facilities shall be inspected by Operations Safety (ER)/30 SW/SEW (WR) at least annually to ensure compliance with explosives safety criteria. **NOTE:** Area monthly records shall be reviewed during the annual inspection.

6.5.8.3.3 Facility Operator Inspections. Explosive storage and operating areas and facilities shall be inspected at least once a month by the Facility Operator.

6.5.8.3.4 Facility Spot Checks. As deemed appropriate by Range Safety, spot checks of Range facilities shall be performed to ensure compliance with this document.

6.6 MATERIAL HANDLING EQUIPMENT OPERATIONS

6.6.1 MHE Operating Standards

a. MHE operations include lifting, handling, supporting, and transporting material, equipment, or personnel. **NOTE:** Vehicles used to transport hardware onto and off of the Range are not governed by this section.

b. All equipment covered in this section shall be operated, tested, and maintained in accordance with the requirements of this document, AFOSH 91-46, and applicable military and industry standards including, but not limited to, the American National Standards Institute (ANSI), the American Society of Mechanical Engineers (ASME), the Crane Manufacturer's Association of America (CMAA), and the National Fire Protection Association

(NFPA).

c. All equipment used by the Naval Ordnance Test Unit (NOTU) and that has been approved by the Chief of Naval Operations, Department of Energy, and the DoD for the specific purpose for which it is used shall be considered in compliance with this document.

d. All users of MHE used to handle the critical hardware covered by this section shall have written and approved procedures that cover selection, operation, maintenance, and testing of MHE used. Operations that include maintenance of the MHE and use of these items with no safety critical or hazardous loads shall not be considered safety critical operations. Those operations that involve MHE and safety critical or hazardous loads including direct contact, such as supporting the load, or within the immediate vicinity, such as moving the MHE without a load over a hazardous commodity, shall be considered hazardous operations.

6.6.2 MHE Operator Qualification and Training

6.6.2.1 MHE Operator Qualification Requirements

a. Operators shall be mentally and physically capable of safely operating the MHE.

b. Operators shall be physically tested for vision and hearing before being assigned to operator duty and annually thereafter.

6.6.2.2 MHE Operator Training and Certification

a. Operators shall be trained in the safe operation of the MHE used and the hazards to which they are exposed.

b. Operator training shall include, but not be limited to, the following topics:

1. The requirements of the operator's manual
2. The applicable parts of AFOSH 91-46
3. The applicable parts of 29 CFR 1910, Subpart N
4. The applicable parts of ANSI B30 and other industry standards.

6.6.3 MHE Periodic Test and Inspection

6.6.3.1 MHE Test and Inspection General Requirements

a. All MHE shall be tested initially and periodically. **NOTE:** Initial test requirements are estab-

lished in Chapter 3. Periodic test requirements for specific MHE are found in specific sections of Chapter 3 and are repeated in this Chapter. Periodic test plans for MHE shall be included in the MSPSP as required in Chapter 3.

b. All MHE shall be inspected prior to use by qualified personnel using detailed checklists or procedures as a part of the MHE test and inspection program. **NOTE:** At a minimum, the inspection and rejection criteria from applicable industry standards shall be used.

c. All damaged MHE shall be removed from service until all discrepancies are corrected.

d. All MHE periodic inspections and maintenance operations shall be verified.

e. Records of MHE inspections, tests, maintenance, and modifications shall be maintained for the life of the equipment.

f. All MHE shall be marked with the due date of next inspection.

g. Load tests shall be conducted with certified weights. These weights shall be accurately identified and tagged with total weight (lb), and owner or agency identification number. **NOTE:** Calibration load devices such as dynamometers may be used to test slings and other lifting devices except cranes. Reinforcing steel (rebar) shall not be used for lift points.

h. The test weight shall be applied a minimum of 3 min.

6.6.3.2 MHE General Data Requirements

a. All MHE shall have documentation verifying that the equipment meets the applicable periodic testing requirements.

b. Data requirements are identified in the recurring data requirement sections for each type of MHE addressed.

c. Periodic test results data shall be maintained by the Range User in a periodic test file.

d. The periodic test files shall be made available to Range Safety upon request.

6.6.3.3 Non-Destructive Examination for All Crane Hooks and MHE Used to Handle Critical Hardware Having Single Failure Points

a. NDE plans shall be developed if MHE has single failure point (SFP) components or SFP welds.

b. The NDE plan shall include the following:

1. NDE technique and acceptance criteria to be

used on each SFP component or SFP weld after initial and periodic proof load tests

2. Detailed engineering rationale for each technique and acceptance criteria

3. A determination of whether the MHE or MHSE is a dedicated piece of equipment used for only one function or whether it is multipurpose

4. The environment and/or conditions under which MHE will be used and stored

5. The existence of any SFP component and SFP weld materials susceptible to stress corrosion

6. Corrosion protection and maintenance plans

c. The plan shall be submitted to Range Safety for review and approval as soon as it is developed, but no later than the MHE PDR.

d. The following are acceptable NDE standards:

1. Surface inspection in accordance with MIL-STD-6866 or ASTM-E1444

2. Volumetric inspection in accordance with MIL-STD-453 or MIL-STD-2154

3. Visual inspections accomplished by persons trained and qualified. **NOTE:** Visual inspector qualification criteria and training shall be documented in a written procedure.

4. A non-inclusive list of standards that may be used to develop NDE acceptance criteria is provided below:

(a) AWS D1.1, D1.2, D14.1, D14.2

(b) MIL-STD-278

(c) MIL-STD-2154

(d) MIL-STD-1265

(e) MIL-HDBK-1890

(f) MIL-STD-2175

(g) NAV-SHIP 250-692-2

(h) MSFC-STD-100

(i) MSFC-STD-1249

6.6.4 MHE General Operations

a. All MHE to be used for hazardous operations shall be identified to Range Safety.

b. All MHE shall be verified as safe for its intended use by Range User.

6.6.5 Cranes and Hoists Operations

6.6.5.1 Cranes and Hoists Operating Standards

All cranes and hoists shall be identified, tested, maintained, and operated in accordance with ANSI/ASME B30 series, CMAA 70 and 74, MHI Standards, AFOSH 91-46, and NFPA 70. **NOTE:**

At VAFB, cranes not on VAFB exclusive Federal jurisdiction property also require inspection, testing, and certification in accordance with California Occupational Safety and Health (CAL-OSHA) requirements.

6.6.5.2 Crane Operator Training and Certification

a. All operators of cranes used on the Ranges shall have the minimum training listed in AFOSH 91-46.

b. All operators of Range-owned or installed hoisting apparatus of over 1,000 lb capacity (hoists [fixed or traveling] or cranes [overhead or mobile]) shall be trained and certified.

c. All operators of non-Range or privately owned cranes that are used to lift critical loads are subject to these same requirements.

6.6.5.2.1 Annual Crane Operator Certification.

Annual crane operator certification is required and shall be conducted in three parts:

a. Classroom Training and Testing: The Launch Base Support (LBS) contractor for ER shall perform classroom training and testing and maintain records for each operator. Lesson plans shall be submitted to Range Safety for approval. For WR, paragraph 6.6.2.2 applies.

b. Physical Examination: The medical contractor shall perform a physical examination of the operator as required by AFOSH 91-46.

c. Hands-On Training and Certification: The employer shall provide hands-on training, evaluation, and certification in the form of a card that includes the following:

1. Name of operator

2. Certification expiration date

3. Other pertinent information such as the types of equipment the operator is certified to operate

6.6.5.2.2 Types of Operator Certification.

a. Critical load (except for proof loads) hands-on training and certification shall be done on the specific device to be used for the lift.

b. Non-critical load hands-on training and certification shall be done on a crane of the same type for which personnel are to be certified such as mobile hydraulic, mobile mechanical (friction), overhead bridge, and overhead monorail.

6.6.5.2.3 Navy Area Crane Operator Certifi-

cation.

a. Portal and mobile crane operators shall be certified according to NAVFAC P-306.

b. Crane operators not certified according to NAVFAC P-306 shall be trained and certified according to this document as detailed above.

6.6.5.3 Cranes and Hoists Daily Inspections

a. Using a pre-operational checklist, daily inspections shall be conducted on the equipment to be used at the beginning of each shift.

b. Daily inspections shall cover the following items:

1. The function of all controls and brake

2. The condition of all components that can be inspected without major disassembly and whose failure would cause a safety hazard

6.6.5.4 Slack Rope Inspections

If a slack rope condition has occurred, inspectors shall be positioned to observe the rope seating in the drum and sheave grooves as the load is reapplied.

6.6.5.5 Cranes and Hoists Used to Handle Critical Hardware Periodic Test and Inspection

a. All inspections, tests, and functional validations shall be performed using written procedures that describe safety control areas, emergency procedures, and supervisor and operator responsibilities.

b. Whenever crane inspection and testing and/or maintenance is contracted out by the government or Range User, periodic inspections and tests shall be performed by the contractor; all other inspections shall be performed by the Range User, (daily, weekly, monthly; before use type inspection or checks), unless specifically stated in the contract approved by Range Safety.

6.6.5.5.1 Cranes and Hoists Used to Handle Critical Hardware Monthly Inspections.

a. Wire rope shall be inspected using a GO/NO-GO gauge at several points. Any broken wire shall be reported for evaluation.

b. Hooks shall be inspected for visible cracks or deformities. The tram points shall be measured for throat spread. A straight edge shall be used to evaluate twisting.

c. Brakes shall be inspected for the amount of lining remaining and indications of overheating or glazing. The brake shall be adjusted to specifica-

tions.

6.6.5.5.2 Cranes and Hoists Used to Handle Critical Hardware Periodic Test Requirements. At a minimum, the following tests shall be performed on cranes and hoists annually within the calendar month in which they are due:

a. Overhead Crane and Hoist Annual No-Load Functional Test. A complete functional test of all control systems, safety devices, and warning indicators shall be performed after the annual load test.

b. Overhead Crane and Hoist Annual 100 Percent Rated Load Tests. Overhead cranes and hoists shall be load tested to 100 percent of the rated load. The test shall be performed in the following sequence:

1. The test weight shall be hoisted approximately 2 ft and suspended for a minimum of 3 min to verify hoist drum rotation test weight drift, as measured, are within acceptable limits.

2. The hoist overload and overspeed detection devices shall be tested to verify that they activate when the test weight is greater than 110 percent of rated load or any overspeed.

3. Electrical power shall be removed from the crane so that the holding and emergency drum brakes are engaged. The brakes shall be manually released in such a manner that each individual brake demonstrates its ability to hold the entire test weight within acceptable drift. Electrical power shall be reapplied.

4. The test weight shall be raised to the maximum height and then lowered in three increments, stopping each time to verify there is no uncommanded drum rotation or test weight lowering.

5. The test weight shall be transported by the trolley for the full length of the bridge.

6. The test weight shall be transported the full length of the runway in one direction with the trolley as close to the extreme right hand of the bridge as practical and in the other direction with the trolley as close to the extreme left hand of the bridge as practical.

7. The test weight shall be moved throughout the complete operating envelope of the overhead crane and hoist, stopping and starting at various locations to verify smooth operation.

8. Crane controls shall be tested to verify that the use of reversing or plugging can control or stop the hoist, trolley, and bridge motion.

9. Bridge and trolley brakes shall be tested to verify that they function in accordance with CMAA 70 and 74 and ANSI B30 Series requirements.

10. The hoist emergency load lowering system shall be tested to verify that it is fail safe and functions properly. The load shall not be lowered more than a few feet. The brakes shall be inspected and adjusted afterwards.

11. Bridge, trolley, and hoists shall be tested at each available specified speed including bumping and jogging.

c. Crane and Hoist Annual NDE Requirements. The following NDE tests shall be performed as indicated:

1. After completion of the 100 percent load test, surface NDE testing shall be performed on the exposed portions of hooks.

2. After completion of the 100 percent load test, volumetric and surface NDE testing shall be performed on all modified and repaired SFP components and SFP welds located on overhead crane and hoist support structures.

3. NDE shall be performed in accordance with the Range Safety approved NDE plan on all SFP components and SFP welds located on overhead and hoist support structures.

d. Crane and Hoist Annual Inspection Requirements. Cranes and hoists shall be visually inspected per ANSI and Range Safety inspection criteria.

6.6.5.6 Cranes and Hoists Used to Handle Critical Hardware Recurring Data Requirements.

At a minimum, the following data shall be maintained in the Crane and Hoist Recurring Test Data files:

- a.* Crane and hoist design and initial test data
- b.* NDE results for crane hook and SFP components and SFP welds on crane support structures
- c.* Periodic crane and hoist test plans and test results
- d.* Crane design and test data updates
- e.* An Operations Log Book shall be maintained for all cranes lifting critical loads.

6.6.5.7 Cranes and Hoists Used to Handle Non-Critical Hardware Periodic Test Requirements

At a minimum, the following tests shall be performed on cranes and hoists every four years unless

otherwise approved by Range Safety:

a. Overhead Crane and Hoist Functional Test (No-Load). A complete functional test of all control systems, safety devices, and warning indicators shall be performed after load testing.

b. Portal and Mobile Crane Load Tests. Portal and mobile cranes shall be load tested to 100 percent of rated load.

c. Overhead Crane and Hoist 100 Percent Rated Load Tests. Overhead cranes and hoists shall be load tested to 100 percent of the rated load. The test shall be performed in the following sequence:

1. The test weight shall be hoisted approximately 2 ft and suspended for a minimum of 3 min to verify the hoist drum rotation and test weight drift are within acceptable limits.

2. The test weight shall be raised to the maximum height and then lowered in three increments, stopping each time to verify there is no uncommanded drum rotation or test weight lowering.

3. The test weight shall be transported the full length of the runway in one direction with the trolley as close to the extreme right hand of the bridge as practical and in the other direction with the trolley as close to the extreme left hand of the bridge as practical.

4. The test weight shall be raised to sufficient height and at least one emergency stop shall be made at the fastest lowering speed to verify that brake application is positive and effective.

5. The test weight shall be moved throughout the complete operating envelope of the overhead crane and hoist, stopping and starting at various locations to verify smooth operation.

6. Bridge and trolley brakes shall be tested to verify that they function in accordance with CMAA 70 and 74 and ANSI B30 Series requirements.

7. Bridge, trolley, and hoists shall be tested at each specified speed, including bumping and jogging.

d. Crane and Hoist NDE Requirements. After completion of the proof load test, surface NDE shall be performed on the exposed portions of overhead, portal, and mobile crane hooks.

e. Crane and Hoist Inspection Requirements. Cranes and hoists shall be visually inspected at required intervals in accordance with ANSI B30.2 and Range Safety inspection criteria.

6.6.5.8 Cranes and Hoists Used to Handle Non-Critical Hardware Recurring Data Requirements

At a minimum, the following recurring data is required as part of the Crane and Hoist Recurring Test Data File:

a. Crane and hoist design and initial test data updates

b. NDE test results for crane hooks

c. Periodic crane and hoist test plans and test results

d. Crane design and test data updates

6.6.5.9 Cranes and Hoists Re-Test and Re-Inspection

a. Following major maintenance or modification, initial acceptance inspection and testing shall be conducted in accordance with the requirements in Chapter 3.

b. If an accidental overload condition occurs, cranes and hoists shall be subjected to a complete initial reinspection and retest.

c. The equipment user shall submit a written report to Range Safety detailing the nature, cause, and effect of the overload.

6.6.5.10 Dual Crane Lift Operating Requirements

Dual crane lifts are considered hazardous operations without regard to the load. The following is required:

a. The load shall be restricted to no more than 75 percent of capacity for each crane

b. All mobile crane dual lifts shall require load cells and installed load indicators.

c. A dry run with a pathfinder shall be required for all critical hardware lifts.

d. The Dual Crane Lift Plan addressing the following information shall be submitted to Range Safety for review and approval:

1. The exact weight (+/- 1 percent) of the total load including spreader bar/beam, hoist attachments fixtures and slings

2. Any dynamic forces that affect the load

3. All crane movements, including trolley, bridge, boom up and down, and travel

4. Center of gravity established by a qualified engineer throughout the complete lift

5. Certification of cranes and crane operators

6. Soil compaction

6.6.5.11 WR First Use Tag Program

a. Range Users requesting approval of a program in which specific equipment certification expiration date and time do not start until the item is issued or installed shall provide the following documentation to Range Safety for review and approval:

1. A complete list of all items by nomenclature with identifying part numbers, rated load, maximum test load, and operation where normally tested

2. An approved quality assurance program identifying controls, inspection points, and complete First Use Tag information

3. Identification of shelf-life criteria. **NOTE:** The shelf-life shall not exceed 5 years in an environmentally controlled location without retest.

b. Range Safety shall withdraw approval upon any infraction of the program.

6.6.5.12 Mobile Cranes

a. All mobile cranes operated on the Range for permanent or short term use shall be properly inspected, functionally validated, and maintained according to AFOSH 91-46, OSHA 1910, OSHA 1926, NASA 1740.9, applicable ANSI/ASME standards, applicable state OSHA plans and the requirements identified below. These requirements apply whether the equipment is DoD or contractor owned, rented, or leased.

b. Mobile cranes shall be certified for operational use by the appropriate authorizing agency.

c. Dual crane lift operations require Range Safety approved lift plans.

6.6.6 Sling Assembly Operations

6.6.6.1 Sling Assembly Operating Standards

a. All sling assemblies shall be operated, maintained, and tested in accordance with ANSI/ASME B30.9.

b. Slings shall be visually inspected each day prior to use.

6.6.6.2 Sling Assemblies Used to Handle Critical Hardware Periodic Tests

At a minimum, the following tests shall be performed on slings annually. Unless otherwise agreed to by Range Safety, these tests shall also be performed after a sling assembly has been modified or repaired.

a. Sling assemblies shall be proof load tested to 200 percent of rated load.

b. Chain falls shall be proof load tested to 100 percent of rated load.

c. After the proof load test, NDE testing shall be performed on all sling assembly SFP components in accordance with the Range Safety approved NDE plan.

d. After the proof load test, volumetric and surface NDE shall be performed on all modified and repaired sling assembly SFP components.

e. Sling assemblies shall be visually inspected in accordance with ANSI and Range Safety inspection criteria.

6.6.6.3 Sling Assemblies Used to Handle Critical Hardware Recurring Data Requirements

At a minimum, the following data is required as part of the Sling Assembly Recurring Test Data File.

a. Sling assembly design and initial test data

b. NDE results for SFP components

c. Periodic proof load test plan and test results

d. Sling design and test data updates

6.6.6.4 Sling Assemblies Used to Handle Non-Critical Hardware Periodic Test Requirements

At a minimum, the following tests shall be performed on sling assemblies every four years. Unless otherwise agreed to by Range Safety, these tests shall also be performed after a sling assembly has been modified or repaired.

a. Sling assemblies shall be proof load tested to 200 percent of rated load.

b. Chain falls shall be proof load tested to 100 percent of rated load.

c. Sling assemblies shall be visually inspected in accordance with ANSI inspection criteria.

6.6.6.5 Sling Assemblies Used to Handle Non-Critical Hardware Recurring Data Requirements

At a minimum, periodic proof load test and inspection results are required as part of the Sling Recurring Data File.

6.6.7 Hydraset and Load Cell Operations

6.6.7.1 Hydraset and Load Cell Operating Standards

Hydrasets and load cells shall be operated, maintained, and tested in accordance with the manufacturer specifications.

6.6.7.2 Hydrasets and Load Cells Used to Handle Critical Hardware Periodic Test Re-

quirements

At a minimum, the following tests shall be performed on all hydrasets and load cells annually. Unless otherwise agreed to by Range Safety, these tests shall also be performed after a hydraset or load cell has been modified or repaired:

- a. Hydrasets and load cells shall be proof load tested to 125 percent of rated load and calibrated.
- b. After the proof load test, volumetric and surface NDE testing shall be performed on all modified and repaired SFP components and SFP welds.
- c. After the proof load test, NDE shall be performed on all hydraset and load cell SFP components and SFP welds in accordance with the Range Safety approved NDE plan.

6.6.7.3 Hydrasets and Load Cells Used to Handle Critical Hardware Recurring Data Requirements

At a minimum, the following data is required as part of the Hydraset and Load Cell Recurring Test Data File:

- a. Hydraset and load cell design and initial test data
- b. NDE test results for SFP components and SFP welds
- c. Periodic proof load test plan and test results
- d. Design and test data updates

6.6.8 Handling Structures Operations

6.6.8.1 Handling Structures Operating Standards

All structural lifting beam operations shall meet ANSI B30.20 for Range operations.

6.6.8.2 Handling Structures Used to Handle Critical Hardware Periodic Test Requirements

a. New or modified and repaired handling structures shall be tested in accordance with either Option 1 or Option 2 of Appendix 6G. *EXCEPTION: For portable launch support frames, with a yield factor of safety less than 3, Step 17 in Option 2 is changed to read "Proof test to 150 percent times rated load" and Step 16 is eliminated.*

b. Initial tests shall be performed following modification and repair or prior to first operational use at the Range.

6.6.8.3 Handling Structures Used to Handle Critical Hardware Recurring Data Requirements

At a minimum, the following recurring data is required as part of the Handling Structure Recurring Test Data File:

- a. Handling structure design and initial test data
- b. NDE test results for SFP components and SFP welds
- c. Periodic test plans and test results
- d. Design and test data updates

6.6.8.4 Handling Structures Used to Handle Non-Critical Hardware Periodic Test Requirements

At a minimum, handling structures shall be proof load tested to 200 percent of rated load every four years. Unless otherwise agreed to by Range Safety, these tests shall also be performed after handling structure modification and/or repair.

6.6.8.5 Handling Structures Used to Handle Non-Critical Hardware Recurring Data Requirements

At a minimum, periodic proof load test results are required as part of the Handling Structure Recurring Test Data File.

6.6.9 Personnel Work Platform Operations

6.6.9.1 Personnel Work Platform Operating Standards

Personnel work platforms shall be operated, maintained, and tested in accordance with the manufacturer specifications.

6.6.9.2 Removable, Extendible, and Hinged Personnel Work Platform Periodic Test Requirements

At a minimum, the following tests shall be performed on all personnel work platforms annually:

- a. Visual inspection shall be performed on all hinges, attaching points, and other high stress or abuse prone components.
- b. NDE shall be performed on all personnel work platform SFP components and SFP welds in accordance with the Range Safety approved NDE plan.

c. After the proof load test, volumetric NDE shall be performed on all modified and repaired SFP components or SFP welds.

d. Unless otherwise agreed to by Range Safety, personnel work platforms that have been modified and/or repaired shall be proof load tested to 125

percent of rated load.

6.6.9.3 Removable, Extendible, and Hinged Personnel Work Platform Recurring Data Requirements

At a minimum, the following recurring data is required as part of the Personnel Work Platform Recurring Test Data File:

- a. Platform design and initial test data
- b. NDE test results for SFP components and SFP welds
- c. Periodic personnel work platform test plans and results
- d. Design and test data updates

6.6.10 MHE Operations

6.6.10.1 Lifting Operations

6.6.10.1.1 Pre-operational Lifting Requirements. The person responsible for supervising lifting operations shall ensure the following:

a. The crane has met all of its maintenance, test, and inspection requirements and is operated within its rated capacity.

b. The operator is properly certified.

c. The operator remains at the controls the entire time a load is suspended. *EXCEPTION: Exceptions shall be allowed in the interest of operational efficiency to allow lifting hardware such as slings, spreader bars, below the hook lifting devices, load cells, and hydrasets to remain suspended while unattended provided all of the following conditions are met:*

1. A procedure documenting such exceptions has been approved by Range Safety

2. The lifting hardware suspended is connected to but not supporting the weight of the objective load; for example, the launch vehicle stage, motor segment, or payload

3. The load is scheduled to be lifted within 24h

4. The load and immediate vicinity are roped off or otherwise identified to prohibit unauthorized personnel entry

5. The crane controls are locked in the OFF position

6. The restrictions against people being under the suspended lifting hardware are enforced

d. The vicinity of the lift is controlled so that:

1. Unauthorized personnel entry is precluded.

2. Personnel or any part of their bodies are prevented from being under or in the way of the

load except as noted in the **Working Under a Suspended Load** section of this Chapter.

3. For cranes equipped with booms, the area is defined by the swing radius of the crane and includes all of the rotating superstructure.

4. A large enough area is cleared so as to protect against flying debris from a dropped object

e. All personnel within the controlled hoisting area wear suitable head and foot protection.

f. Previously announced lightning advisories and lightning warnings will not cause the load to be in jeopardy. **NOTE:** Unattended suspended loads require specific Range Safety approval.

g. All personnel are knowledgeable of the operation to be performed, tasks to be done, route to be traveled, and safety considerations.

h. If using a mobile crane, the following criteria shall be met:

1. The area shall be set up so that the lift is made within the shortest possible radius

2. The lift shall be made over the rear of the crane if possible

3. Outrigger floats shall be made of 4x4 in. or cross-hatched 2x4 in. lumber, a minimum of 4x4 feet square or equivalent support.

4. When using outriggers, they shall be fully extended and raise the crane so that the wheels are off the ground unless the crane is designed for partial outrigger use and has appropriate load rating charts.

5. No part of the crane or load shall pass within 10 ft of an electrical power line unless the line is de-energized and visibly grounded on both sides of the area of possible contact.

6. Outriggers and outrigger floats shall be used on flat surfaces. **NOTE:** Outrigger floats are required in areas that do not have a hard surface such as concrete.

i. Systems shall have sufficient assistant operators or spotters to make sure that all sides of the system are clear for operation.

j. All operators or spotters shall have aural communications for coordination between themselves when power is on the system.

k. Tag lines shall be used when there is potential for load sway which could damage the article lifted, high value equipment or flight hardware.

l. Tag line personnel shall not impart undesirable motion to the load.

6.6.10.1.2 Attaching the Load. To attach the

load, the crane hook shall be positioned directly over the center of gravity of the load prior to attachment.

6.6.10.1.3 Lifting the Load.

a. On the first lift of the day or shift, or on a critical lift, the load shall be raised a few inches, then held in place momentarily, to verify that the brakes operate normally.

b. The load shall be lifted to a height sufficient to clear all obstacles in its intended path.

c. For hoist angles, cranes are designed to function with the load raised perpendicular with respect to the ground. Crane hooks shall be moved with the crane controls rather than by hand to reduce hoist angles.

1. Fleet (side) angles shall be kept as close to zero as possible. Range Safety approval is required for all anticipated fleet angles. **NOTE:** Pulling the rope perpendicular to the drum or sheave grooves (fleet or side angle) may cause the rope to jump out of the groove and become entangled on the drum or caught between the sheave and its mounting with possible catastrophic results.

2. Lead (in-line) angles shall be kept as close to zero as possible. Range Safety approval is required for anticipated lead angles exceeding 5° unless the hoist is specifically designed for greater angles. Increasing the lead (in-line) angle increases the strain on the load line, brakes, bearings, sheaves, and other crane parts.

3. When lifting a load, load lines shall not contact load girts, structural members, or any other obstructions.

d. Loads may be lifted with the load line off-perpendicular for the purpose of rotating large pieces of hardware if all of the following conditions are met:

1. There is no safer way to accomplish the rotation.

2. The angle on the load line carrying the majority of the weight does not exceed 5° unless the hoist was specifically designed for a greater angle.

3. On an installed crane, the angle is pulled in line with the rotation of the rope onto the drum (lead angle) unless the crane is equipped with a level wind device.

4. The crane is inspected to ensure that the load line does not engage the load girts, structural members, or any other obstructions at the angle to be used.

5. Prior to the lift, the crane is checked to ensure that all rope parts are properly seated in the grooves of the drums or sheaves.

6. The load is prevented from swinging or otherwise inducing dynamic loads on the hoisting system.

e. Mobile or boom-equipped cranes shall not be used for off-perpendicular lifting due to the severe hazard of tipping the crane over or of collapsing the boom.

f. Crane maintenance instructions or checklists shall include directions to look for evidence of apparent side-pull damage during inspections.

6.6.10.2 Suspended Load Operations

6.6.10.2.1 Moving a Suspended Load.

a. Crane operations involving lifting of hazardous or explosive materials shall be limited to only those personnel required to perform the task.

b. A safety clearance zone shall be established in the vicinity around the load and all non-essential personnel cleared to a safe distance.

c. Horizontal and vertical travel speeds shall be kept at a safe level and shall be addressed, as appropriate, in procedures.

d. Each lift shall be planned so that the load will be suspended for a minimum amount of time.

e. The load shall not be lifted until immediately before intended travel.

f. The most direct route of travel shall be used.

g. Loads shall not be carried over critical hardware except when that load is being mated to the critical hardware.

h. The landing area shall be prepared so that the load may be set down immediately at the end of travel.

i. If the load remains suspended for any length of time, the safety clearance zone shall remain in force.

j. The load shall not be carried over personnel nor shall personnel be allowed to place any part of their bodies under any part of the load except as provided in the **Working Under a Suspended Load** section of this Chapter.

k. The load shall be transported as low as possible but at a height sufficient to clear all obstacles that may be in its path.

l. An alarm device or personnel accompanying the load shall be used to clear other persons out of the load path.

m. Tag lines shall be used to control movement

of the load and not impart undesirable motion to the load.

n. Tag lines shall be long enough to protect personnel from being struck by the load.

o. Tag lines shall be used when there is potential for load swag which could damage the article lifted, high value equipment, or flight hardware.

p. Crane operators shall be instructed to stop motion should anyone be in the path of the load or if anyone signals to stop.

6.6.10.2.2 Working Under a Suspended Load. Circumstances sometimes dictate the additional risk of placing part or all of a person's body under a load to perform necessary work. To allow such work to proceed, the following conditions shall be met:

a. A safety analysis shall be performed in accordance with the requirements described in the **Documentation Requirements** section of this Chapter.

b. Based on the safety analysis, Range Users shall publish procedures with safety requirements to be followed by personnel working under a suspended load.

c. Each Range User or operating agency shall form a Suspended Load Committee or equivalent.

1. Contractor Safety and Operations Safety shall be members of this committee.

2. In reviewing the necessity of such exposures, the committee shall assess the procedure to be followed and analyze the hazards involved.

3. Copies of the schedule and minutes of such committee meetings shall be forwarded to Range Safety for review and approval.

d. A secondary support system shall be used to assume support of the load if enough of a person's body is exposed to receive fatal injuries under the load.

e. The task shall be treated as a "critical lift."

f. There shall be no safer way to accomplish the task.

g. The absolute minimum number of personnel may be exposed and only as much of the person's body as is absolutely necessary for the shortest time possible.

h. The load shall be in the lowest position from which the work can be accomplished.

i. The crane shall be in a static condition, with power ON, and the operator at the controls.

j. If a mobile or boom-equipped crane is used,

the load shall not be greater than 75 percent of the capacity of the load rating chart while the work below the load is in progress.

k. The person with supervisory responsibility shall be present observing the task at all times.

l. During joint operations involving the USAF and NASA on the Ranges, NASA personnel and their contractors shall remain outside the vicinity of the suspended load.

m. Range Safety shall be the final approval authority for all operations requiring work under a suspended load.

6.6.10.2.3 Crane Suspended Personnel Platforms. Operations involving lifting suspended personnel platforms are prohibited except as provided by AFOSH 91-46 and 29 CFR 1926.550 (g) and specifically authorized by Range Safety.

6.6.10.2.4 Man-Rated Crane Criteria. All cranes used to suspend personnel platforms and work baskets shall meet the following requirements:

a. Crane free fall features shall be deactivated.

b. Load testing of the current configuration shall have been performed within past 12 months.

c. Two-way communication shall be maintained between the crane operator and the person in the basket.

d. The crane operator shall be appropriately qualified.

6.6.11 Forklift Operations

6.6.11.1 Forklifts Used in Hazardous Areas

a. Forklifts used in areas designated Class I, Division 1, Group C or D shall be rated and placarded EX in accordance with NFPA 505 and Underwriters Laboratories (UL) 583.

b. Forklifts used in areas designated Class I, Division 2, Group C or D shall be rated and placarded EE or EX in accordance with NFPA 505 and UL 583.

c. Forklifts shall not be used in either of the above areas if the movement of the forklift increases the hazard. For example, on the launch pad with a fueled booster, forklifts may be used inside the 100-ft Class I, Division 2 area to load articles onto the structure but may not be used on the structure where it could accidentally strike or puncture a pressure or propellant vessel.

6.6.11.2 Forklifts Used for Critical Loads

a. Forklifts used for critical load lifts shall be approved by Range Safety.

b. Critical loads shall not exceed 75 percent of the forklift capacity.

c. At a minimum, periodic and frequent inspection program, maintenance program, checklists, and proof load tests shall be submitted to Range Safety.

6.6.12 Elevators

a. Passenger elevators not designed in accordance with Chapter 5 criteria for freight shall not be used for propellant or other hazardous commodity.

b. Freight elevators used for the movement of ordnance that has been removed from original shipping containers, toxic propellants, or other hazardous commodities shall be controlled remotely.

c. Personnel shall not ride in elevators during movement of the commodities listed in *b* above.

6.7 ACOUSTIC HAZARD OPERATIONS

6.7.1 Acoustic Hazard Operating Standards

Acoustic (noise) protection shall be provided in accordance with the requirements in 29 CFR 1910.95 and AFOSH 91-31, 161-20, and 48-19.

6.7.2 Acoustic Hazard Operations Personnel Protection Requirements

a. Unprotected personnel shall not be exposed to hazardous noise levels.

b. Hearing protection devices shall be worn as required.

6.7.3 Acoustic Operations

a. All potential noise sources in the work environment shall be identified to the Bioenvironmental Engineer.

b. Identified noise sources shall be surveyed by the Bioenvironmental Engineer or a designated representative.

c. Warning signs shall be posted in a manner to be visible prior to entering the noise hazard area.

1. Warning signs shall warn of the hazardous noise and indicate the requirement for hearing protection.

2. Any posting of hazardous noise areas shall be coordinated with and approved by the Bioenvi-

ronmental Engineer.

6.8 NON-IONIZING RADIATION OPERATIONS

6.8.1 Non-Ionizing Radiation Operating Standards

a. Personnel and electroexplosive devices (EEDs) shall not be exposed to hazardous levels of non-ionizing radiation.

b. All non-ionizing radiation operation shall be conducted in accordance with the requirements of the following standards:

1. 45 SWI 40-201 and 30 SWI 48-102 for personnel exposure limits that are subject to change and are frequency dependent

2. AFMAN 91-201, DoD 6055.9-STD, and MIL-STD-1576 for radiation limits for ordnance exposure and that are frequency dependent

3. AFMAN 91-201, DoD 6055.9-STD, and T.O. 31Z-10-4 for guidance with respect to siting ordnance

c. The use and operating location of non-ionizing radiation producing devices shall be approved by Range Safety and the RPO.

6.8.2 RF Procedures

All transmitters capable of exceeding allowable power levels shall be operated using Range Safety and RPO approved procedures with the appropriate controls established.

6.8.3 RF Operations

6.8.3.1 RF Operations General Requirements

a. Non-ionizing radiation operations involve radio frequency (RF) transmitters in the range of 3 kHz-300 GHz and optical devices such as lasers.

b. Prior to transmitting, areas in which power density levels exceed allowable biological limits shall be controlled using the appropriate warning signs, lights, and access barriers.

c. The RPO shall survey RF transmitting devices as required.

d. The Range User or site operator shall comply with the survey recommendations.

e. Where applicable, transmitter and antenna orientation limit switches and other safety devices shall be checked by site personnel prior to operation to ensure proper function. **NOTE:** If transmission is required while performing these checks, the tests shall be performed at low output power or with a dummy load.

f. All new, modified, or relocated RF transmitters shall be reported to Range Safety and the RPO so that requirements can be established.

6.8.3.2 RF Transmission Operations for Electroexplosive Devices and Open Grain Solid Propellant

a. As determined by analyses and tests, local or Range-wide RF silence is required during periods of EED installation, removal, and electrical connection or disconnection. At a minimum, RF silence within the complex or area shall be required.

b. No radio transmissions, including hand-held radios or telephones, are allowed within 25 ft of EEDs. **NOTE:** The 25 ft requirement is the minimum requirement; however, this requirement does not take into account situations where EEDs are RF sensitive and leads are unshielded. Based on the specific radio, ordnance, and area involved, an RF analysis performed in accordance with MIL-STD-1576 may be provided to Range Safety for consideration to reduce this requirement.

c. Transmitting devices shall be kept a minimum of 50 ft from a fueling area unless they are intrinsically safe.

6.8.4 Optical/Laser Operations

6.8.4.1 Optical/Laser Operating Standards

Optics and lasers shall be operated in accordance with 45 SWI 40-201, 30 SWI 48-102, and 10 CFR 19.

6.8.4.2 Optical/Laser Operation Personnel Protection Requirements

6.8.4.2.1 Optical/Laser Operations Training and Certification. Personnel shall be trained and certified in accordance with 45 SWI 40-201 or 10 CFR 19.

6.8.4.2.2 PPE. Approved protective eye wear and other PPE shall be worn as required.

6.8.4.3 Optical/Laser Procedures

All optical devices and lasers capable of exceeding allowable energy levels, as determined by Range Safety, shall be operated using Range Safety and RPO approved procedures with the appropriate controls established.

6.8.4.4 Optical/Laser Inspection

a. Periodic inspections shall be conducted to ensure the laser is in safe working condition and is

properly protected from dangerous light radiation, temperature extremes, shatterable materials, contaminating gases, cryogenics, high voltage, and X-rays.

b. Inspection records shall be maintained for the life of the program.

c. Inspection records shall be available at the request of Range Safety.

6.8.4.5 Optical/Laser Operations

a. All nominal hazardous procedural items shall be accomplished including, but not limited to, the following:

1. 24-h notification of Operations Safety
2. Pre-operational PA announcements
3. Clearance of safety clearance zones
4. Posting of applicable warning signs, operation of area and pad warning lights
5. Operations Safety permission prior to start of the hazardous lasing activity

b. Alignment of targets, optics, filters, and other optical/laser items shall be accomplished using non-hazardous low power lasers.

c. Active beam or target viewing shall be accomplished with closed circuit television or an optical comparator with an appropriate filter.

d. Laser beams directed toward flammable or explosive materials, pressurized systems, any other system that may become hazardous due to laser energy or directed toward sensitive components of FTSS shall not exceed allowable limits as determined by Range Safety.

e. Activated lasers shall not be left unattended.

f. Unattended lasers shall be locked out and otherwise safe.

g. Operations involving laser systems with hazardous materials shall follow the requirements for hazardous materials described in the **Hazardous Materials Operations** section of this Chapter.

h. Operations involving laser systems with pressurized subsystems such as cryogenic fluids shall follow the requirements described in the **Ground Support Pressure Systems Operations** and **Flight Hardware Pressure Systems Operations** sections of this Chapter.

i. Operations involving lasers with high voltage or capacitance shall follow the requirements for the **Electrical Systems Operations** section of this Chapter.

j. All electrical and mechanical azimuth and

elevation stops, safety interlocks, shutters, and other safety devices shall be verified prior to performing each laser operation.

6.9 RADIOACTIVE (IONIZING) RADIATION SOURCES OPERATIONS

All procedures for handling radioactive sources require Range Safety, RPO, and Medical Group approval.

a. Launch approval of radioactive (ionizing radiation) sources are addressed in Chapter 3 of this document.

b. All ionizing operations shall be planned and conducted so that personnel exposure is as low as possible, but in no case shall the maximum allowable limits be exceeded.

c. Requirements established in 45 SWI 40-201 or 30 SWI 40-101 are mandatory for CCAS and VAFB operations. All procedures for handling radioactive sources require Range Safety, RPO, and Medical Group approval.

d. CCAS Cape Support (ER) or Range Scheduling (WR), Range Safety, and the RPO shall be notified of the location of radioactive material if spilled, released, or dispensed either by design or accident.

e. Flight radioactive sources shall be installed as late in the countdown as practical.

f. Mishaps involving radioactive materials shall be reported in accordance with AFI 91-110.

6.10 HAZARDOUS MATERIALS OPERATIONS

6.10.1 Hazardous Materials Operating Standards

a. Hazardous materials shall be selected in accordance with Chapter 3 of this document.

b. Hazardous operations shall be conducted in accordance with AFOSH 161-21, 29 CFR 1910.1200, 29 CFR 1910.119 and AFOSH 91-119 for process safety management.

c. Range Users shall comply with AFOSH 91-119 and 29 CFR 1910.119 for process safety management.

d. Additional ER Requirements: Range Users shall comply with the 45 SW Process Safety Management Implementation Plan. The 45 SW point of contact for process safety management is System Safety (45 SW/SES).

e. Additional WR Requirements: Range Users shall comply with 30 SW Plan 91-119. The 30 SW point of contact for process safety management is System Safety (30 SW/SES).

6.10.2 Hazardous Materials Operations PPE

a. Proper eye, hand, body, and respiratory protection shall be worn as required.

b. PPE shall be approved by Range Safety and the Bioenvironmental Engineer.

6.10.3 Hazardous Materials Procedures

Hazardous materials procedures shall include, but not be limited to, the following topics:

a. Emergency actions for unplanned events such as spills, fires, and personnel contamination

b. Actions for decontamination, neutralization, clean-up, and disposal

6.10.4 Hazardous Materials Operations

a. The use of any hazardous material is subject to Range Safety approval. **NOTE:** Hazardous material approval is normally through Bioenvironmental Engineering in the procurement process.

b. Appropriate control measures shall be established for the use of hazardous materials based on known properties. **NOTE:** If properties are unknown, testing shall be performed subject to approval by Range Safety.

c. Typical control measures for hazardous liquids include, but are not limited to, the following criteria:

1. Approved containers shall be used.

2. Containers shall remain capped (covered) when not in use.

3. Quantities shall be limited as approved by Fire Protection.

4. Work areas shall contain no more than the quantity required for a single shift.

5. Work areas shall not be used for storage unless approved storage cabinets and lockers are available.

6. Local or general exhaust ventilation shall be used to control solvent vapors from reaching toxic levels.

7. Materials that are themselves not hazardous, but that can be hazardous in conjunction with other materials, shall be controlled.

8. The location and/or facility shall be compatible with the type and quantity of hazardous material.

9. Hazardous materials and chemicals shall not be used in confined spaces without specific approval from Range Safety

10. Static producing materials, in particular materials such as plastic and non-metallic films, environmental covers, and thermal blankets shall not be used in the vicinity of ordnance or propellants.

11. Glass containers shall not be used in the immediate vicinity of flight hardware or in elevated locations so that they could fall and shattered pieces of glass strike hardware or personnel. In general, use of glass containers is discouraged.

d. The Toxic Release Contingency Plan shall be used in the event of an unplanned release.

6.10.5 Restrictions on the Use of Static-Producing and Flammable Materials

a. Static-producing and flammable materials shall not be used on or near ordnance items or in the vicinity of flammable liquids such as propellants.

b. Compliance with the restriction on static-producing materials is handled on a case-by-case basis; however, the following criteria shall be used as a guideline:

1. Materials shall not come into contact with a system having an installed EED or other ordnance.

2. Materials shall not come with 10 ft of exposed solid propellant grain; for example, no nozzle plug or cover.

3. Materials shall not come within 50 ft of exposed flammable liquids.

c. Compliance with the use of materials that could be flammable is handled on a case-by-case basis; however, all materials that are used in the vicinity of ordnance or flammable liquids such as hypergolic propellants shall pass the material tests described below.

6.10.5.1 Material Tests

a. Materials such as contamination covers, thermal blankets, splash shields, velcro, tape and any other material located in the vicinity of liquid propellant areas or ordnance areas shall be evaluated.

b. Range Users shall supply a sample of materials to KSC testing laboratory for testing, and the results shall be forwarded to Range Safety as required. **NOTE 1:** A KSC/Ranges materials list providing the test results of many types of materi-

als is available from KSC Materials Testing Labs. **NOTE 2:** A material is considered to have good electrostatic dissipation properties if it can dissipate voltage down to 350V in 5 sec using the triboelectric test.

c. Testing shall consider the following material characteristics:

1. Ability to build up a charge (triboelectric test)

2. Ability of that charge to decay (triboelectric test)

3. Flammability

4. Compatibility with other materials and liquids the material may come into contact with

d. Material restrictions may also arise from other limitations such as being humidity dependent (for charge dissipation) or degradable in sunlight (ultraviolet).

e. Range Safety shall approve the use of materials based on the test results. **NOTE:** Materials that do not meet this criteria may be acceptable for a particular usage as determined by Range Safety.

f. Material deficiencies shall result in operational restrictions.

6.10.6 Hazardous Commodity Lockers

6.10.6.1 Positioning and Use of Hazardous Commodity Lockers

a. Hazardous commodity lockers or cabinets shall be positioned and used for the purpose of storing flammable, toxic, or caustic materials in accordance with AFOSH 127-43.

b. The following rules govern the positioning and use of lockers and cabinets:

c. General Requirements

1. Only metal lockers shall be used for storage of hazardous commodities.

2. Metal lockers shall be grounded.

3. Only small quantities of commodities used in daily work shall be stored.

4. The lockers shall be kept locked to prevent unauthorized access.

5. Only unit containers shall be stored; for example, boxes of paint spray cans may not be stored.

6. Ordinary combustibles such as rags, packing, boxes, or loose paper material shall be removed.

7. Flammables, combustibles, and lubricants may be stored together, but they shall be grouped

for identification.

8. Oxidizers shall be stored separately from fuels and shall be grouped for identification.

9. Acids and bases shall be segregated from each other and from other commodities in separate lockers.

10. Different products shall be grouped within the locker for identification.

11. Toxics shall be stored in separate lockers and grouped within the locker.

12. Lockers shall be kept clean and neat.

13. A suitable fire extinguisher shall be positioned close to the locker or cabinet.

d. Indoor Lockers and Cabinets

1. Lockers shall be positioned so as not to impede emergency egress from the building.

2. The capacity of the locker shall not exceed 10 gal and the capacity of containers in the lockers shall not exceed 1 gal.

e. Outdoor Lockers and Cabinets

1. Lockers shall be located at least 50 ft from building entrances and be positioned so that in the event of a fire in the cabinet, there shall be no danger of the fire spreading to other buildings.

2. The capacity of the locker shall not exceed the limits specified in AFOSH 127-43, 4b(1) and NFPA30 4-3.1.

3. Not more than 120 gal of Class I, Class II, and Class III liquids shall be stored in a storage cabinet. Of this 120 gal total, not more than 60 gal shall be Class I and Class II liquids.

4. No more than three cabinets may be located in a single fire area.

6.10.6.2 Hazardous Commodity Locker Inspection

Hazardous commodity lockers shall be inspected at least weekly by the Range User.

6.10.7 Disposal of Contaminated Liquid Propellant, Gas, or Other Regulated Wastes

a. CCAS Cape Support (ER) or Range Scheduling (WR) shall be notified of any hazardous material requiring disposal. **NOTE:** If required, additional guidance shall be obtained from Civil Engineering (Environmental Coordinator) or their designated representative, the Bioenvironmental Engineer, and Range Safety

b. Disposal of toxic or contaminated liquid propellants, gases, or other wastes shall be performed

using methods and techniques approved by Range Safety, the Bioenvironmental Engineer, and Civil Engineering (Environmental Coordinator) in accordance with the 45th and 30th Space Wing Operations Plan 19-14 as well as all applicable federal, state, and local regulations.

c. Range Users shall notify Civil Engineering to obtain proper clearance and support to dispose of wastes prior to the generation of such wastes.

d. As needed, those operations involving toxic propellants shall be conducted under the surveillance of Environmental Health and Operations Safety to ensure the safety of personnel involved in the operation and personnel located in adjacent or downwind areas.

e. Records of management and identification of wastes shall be maintained by the organization generating the waste.

f. Records of disposal of toxic materials shall be maintained by Hazardous Waste Management (Joint Propellants Contractor for ER).

g. Hazardous procedures pertaining to liquid propellants shall be submitted to the 45th CES/CEG on the ER and to 30th CEG/CEBD on the WR for review and approval.

h. All spills or releases of hazardous substances, including petroleum products, shall be reported to CCAS Cape Support (ER) or Range Scheduling (WR) and Operations Safety immediately.

6.11 GROUND SUPPORT PRESSURE SYSTEMS OPERATIONS

6.11.1 Ground Support Pressure Systems Operating Standards

NOTE: The degree of hazard in pressure systems is proportional to the amount of energy stored, which is a function of both the pressure and the volume stored. Therefore, low-pressure, high-volume systems can be as hazardous to personnel as high-pressure systems.

a. Only pressure systems that meet the design requirements of Chapter 3 shall be operated on the Ranges.

b. The handling and storage of propellants shall be in accordance with CPIA 394 and DoD 6055.9 and subtier documents such as AFMAN 91-201 and DoD 6055.9-STD or Navy OP 5.

c. Propellants shall be used and stored only in Range Safety approved facilities designed and suited for that purpose and only during time peri-

ods approved by Range Safety

d. Propellants shall be used and stored only in systems that meet the design requirements of Chapter 3.

e. Portable or mobile vessels and packaging used for transportation of pressurized or hazardous commodities shall be designed, maintained, and recertified in accordance with DOT CFR 49.

f. If a DOT vessel is installed on a permanent basis, it shall fall under the recertification requirements for a fixed system.

6.11.2 Ground Support Pressure Systems Personnel Requirements

6.11.2.1 Ground Support Pressure Systems Training and Certification

All personnel who operate, test, and maintain ground support pressure systems shall be trained and certified.

6.11.2.2 Ground Support Pressure Systems PPE

6.11.2.2.1 Selection of PPE. The selection and use of personal protective equipment shall be approved by Range Safety and Bioenvironmental Engineering.

a. Approval shall be limited to a particular model number of protective equipment and a particular operation.

b. Approval of PPE for an operation depends on the type and volume of propellants involved, the size of the lines, flow rate, pressure, capability to deal with emergencies, and egress accessibility.

c. Approvals are not transferable; approval for similar operations require a re-evaluation of these parameters.

d. Protective gear shall be compatible with the propellants involved and shall be fire resistant and non-static producing as well.

e. If the protective gear has limitations, these limitations and subsequent protective actions shall be identified in the operating procedure. For example, splash suits are not to be used when hydrazine concentrations can exceed 100 ppm.

6.11.2.2.2 SCAPE, Category I or IV. SCAPE, Category I and IV is required for propellant flow and pressurization during the following operations:

a. Connection and disconnection of wet lines or contaminated (not purged and flushed) dry lines

b. Sampling operations

c. During propellant flow

d. During initial pressurization with propellants until system integrity has been verified (no leaks)

e. Connections and disconnections of tanker load/off load lines

f. Removal and replacement of components in a liquid line

g. Opening any liquid system that has not been drained, purged, and flushed with referee fluid

h. When the condition of the system is uncertain or unknown

i. The maximum operating time in a Category I SCAPE suit is 110 min; however, Range Safety or Operations Safety can authorize on-station time not to exceed 120 min. In extreme temperatures, Range Safety or Operations Safety can restrict on-station times in Category I SCAPE suits to less than 110 min. (ER Only) Personnel using Category I SCAPE suits shall observe a 60-min rest period between consecutive SCAPE operations (for example, no double-packing).

j. For physiological purposes, the maximum operating time in a Category IV or VI SCAPE suit must not exceed 4 h at one time.

6.11.2.2.3 Splash Suits. Splash suits, with self-contained breathing apparatus or air-line respirator may be approved by Range Safety for use with systems that only contain residual vapors; no liquid in the system is allowed.

a. Removal of full protective gear after system integrity verification requires Operations Safety approval.

b. Emergency protective gear shall be available throughout operations to the crew and other personnel who might be affected in the event of a spill.

c. The following non-liquid operations require splash suits as approved by Range Safety:

1. Removal and replacement of components on purged and isolated liquid lines

2. Removal and replacement of components on vent lines

3. Connections and disconnections of drained, purged, and isolated lines

4. Pressure leak checks when required by procedure

d. With Operations Safety Manager concurrence, the WR allows the use of splash suits during propellant flow after integrity has been established.

6.11.2.2.4 PPE for Cryogenic Systems.

a. All personnel performing liquid oxygen and liquid hydrogen transfer operations, repairs, or adjustments to the system shall wear flame-resistant treated, non-static producing overalls of liquid resistant material, cryogenic service gloves, hoods or face shields, and non-absorbent shoes approved by Range Safety.

b. Personnel performing operations on other cryogenic systems shall be similarly protected, except that flame-resistant treating of coveralls is not required for non-flammable commodities.

6.11.2.2.5 PPE for Hydrogen Peroxide Transfers. Hydrogen peroxide transfers require the use of boots, gloves, and face shields of material approved by Range Safety.

6.11.3 Ground Support Pressure Systems Procedures

a. Procedures shall be prepared governing the safe operation, testing, maintenance, and installation of pressurized systems by the agency performing the specific task.

b. Procedures shall be developed for all operations involving propellants and the checkout of propulsion systems.

c. Off-loading procedures for payloads and launch vehicles are required at any time propellant is loaded in flight hardware. Off-loading design as outlined in Chapter 3 of this document addresses the complete system during the complete processing flow. The off-loading procedure shall include integration of the following:

1. Hardware
 - (a) Launch vehicle
 - (b) Launch vehicle fairing
 - (c) Spacecraft
 - (d) Launch complex
 - (e) Process facility
 - (f) Transport vehicle
 - (g) Fixed GSE
 - (h) Portable GSE
2. Software Command capability
 - (a) Flight Hardware
 - (b) GSE
3. Personnel capability
 - (a) Remote
 - (b) SCAPE
 - (c) Combination of both

6.11.4 Ground Support Pressure Systems Test, Inspection, and Maintenance**6.11.4.1 Ground Support Pressure Systems General Tests**

a. Pressure systems shall be initially tested in accordance with Chapter 3.

b. Any system that has been opened shall be leak tested at 100 percent maximum operating pressure (MOP) with an inert medium.

c. Pressure relief valves and flex hoses shall be retested annually.

d. Pressure gauges shall be calibrated annually.

e. After any disconnection, modification, or repair of a system, the affected part of the system shall be leak tested.

f. Any component that has been damaged, potentially damaged, repaired, replaced, or modified shall be proof tested in accordance with Chapter 3.

g. After component proof test, the system or subsystem shall be proof tested, functionally tested, and leak tested. **NOTE:** The determination for system proof testing shall be made on a case-by-case basis.

h. New, modified, or repaired propellant systems shall be tested in accordance with Chapter 3.

i. A log shall be kept on propellant systems to keep track of use, maintenance, modification, testing, and inspection.

6.11.4.2 Ground Support Pressure Systems General Inspection

a. Prior to each operation, facilities and equipment shall be inspected by Range Users and Operations Safety to ensure a safe configuration for the facilities, equipment, and propellants involved.

b. Propellant transfer and storage areas shall be spot checked by Operations Safety, Range Safety, the Fire Department, Environmental Health; the appropriate area supervisor shall be advised of any discrepancies noted.

c. Periodic inspections shall be performed on all ground pressure systems in accordance with applicable procedures.

d. Periodic inspections shall be performed on ground based pressure vessels and liquid holding tanks in accordance with the ISI Plan. These inspections shall be performed during the following periods:

1. Certification Period: Period from initial operational use of vessel and/or system until vessel

and/or system requires recertification.

2. First Certification Period: Period from first recertification effort until second recertification.

3. All subsequent Recertification Periods.

4. The hazardous pressure system operator shall retain all documentation generated as a result of the recertification effort and place this documentation in the system ISI certification and recertification file.

6.11.4.3 Ground Support Pressure Systems General Maintenance

a. Prior to replacement, storage, or repair of hypergolic or toxic system components, the system shall be purged and flushed of all residual contaminants and appropriately capped, bagged, and labeled prior to moving the component.

b. A record shall be kept on the certification of system and component cleanliness.

6.11.4.4 Ground Support Pneumatic Systems Tests

6.11.4.4.1 Periodic Test Requirements for Ground Support Pneumatic System Components.

a. Flex hoses shall be hydrostatically proof tested to 1.5 times their MAWP once a year unless otherwise approved by Range Safety.

b. All permanently installed flex hoses shall be visually inspected over their entire length at least annually for damaged fittings, broken braid, kinks, flattened areas, or other evidence of degradation.

c. Pressure gauges and transducers shall be calibrated once a year.

d. Pressure relief valves shall be tested for proper setting and operation once a year.

6.11.4.4.2 Testing Modified and Repaired Ground Support Pneumatic Systems.

a. Any pressure system or system component including fittings or welds that has been repaired, modified, or possibly damaged after having been hydrostatically tested shall be retested hydrostatically to 1.5 times MAWP prior to reuse. **NOTE:** Replacement of gaskets, seals, and valve seats that do not affect structural integrity does not require a retest.

b. After hydrostatic testing, modified or repaired pneumatic systems shall be leak tested at the system MOP prior to normal use. **NOTE:** This test shall be conducted at the Ranges unless prior approval from Range Safety as been obtained.

c. After hydrostatic testing, modified or repaired pneumatic systems shall be revalidated and functionally tested at the system MOP prior to reuse.

d. All pneumatic system mechanical joints affected in the disconnection, connection, or replacement of components shall be leak tested at the system MOP before being placed back in service.

6.11.4.4.3 Ground Support Pneumatic Systems Tagging.

a. After test and inspection, ground support pneumatic system components shall be tagged.

b. Tags shall provide the date of the last inspection and proof load test and the component MAWP.

6.11.4.5 Ground Support Hydraulic Systems Tests

6.11.4.5.1 Periodic Test Requirements for Ground Support Hydraulic System Components.

a. Flex hoses shall be hydrostatically proof tested to 1.5 times their MAWP once a year, unless otherwise approved by Range Safety.

b. All permanently installed flex hoses shall be visually inspected over their entire length at least annually for damaged fittings, broken braid, kinks, flattened areas, or other evidence of degradation.

c. Pressure gauges and transducers shall be calibrated once a year.

d. Pressure relief valves shall be tested for proper setting and operation once a year.

6.11.4.5.2 Testing Modified and Repaired Ground Support Hydraulic Systems.

a. Any hydraulic system or system component including fittings or welds that has been repaired, modified, or possibly damaged after having been hydrostatically tested shall be retested hydrostatically to 1.5 times MAWP prior to reuse. **NOTE:** Replacement of gaskets, seals, and valve seats that do not affect structural integrity does not require a retest.

b. After hydrostatic testing, modified or repaired hydraulic systems shall be leak tested at the system MOP prior to normal use. **NOTE:** This test shall be conducted at the Ranges unless prior approval from Range Safety as been obtained.

c. After hydrostatic testing, modified or repaired hydraulic systems shall be functionally tested at the system MOP prior to being placed back in service.

d. All hydraulic system mechanical joints affected in the disconnection, connection, or replacement of components shall be leak tested at the system MOP before being placed back in service.

6.11.4.5.3 Ground Support Hydraulic Systems Tagging.

a. After test and inspection, ground support hydraulic system components shall be tagged.

b. Tags shall provide the date of the last inspection and proof load test and the component MAWP.

6.11.4.6 Ground Support Hypergolic Systems Tests

6.11.4.6.1 Periodic Test Requirements for Ground Support Hypergolic Systems.

a. Flex hoses shall be hydrostatically proof tested to 1.5 times their MAWP once a year, unless otherwise approved by Range.

b. All permanently installed flex hoses shall be visually inspected over their entire length at least annually for damaged fittings, broken braid, kinks, flattened areas, or other evidence of degradation.

c. Pressure gauges and transducers shall be calibrated once a year.

d. Pressure relief valves shall be tested for proper setting and operation once a year.

6.11.4.6.2 Testing Modified and Repaired Ground Support Hypergolic Systems.

a. Any hypergolic system or system component including fittings or welds that has been repaired, modified, or possibly damaged after having been hydrostatically tested shall be retested hydrostatically to 1.5 times MAWP prior to reuse. **NOTE:** Replacement of gaskets, seals, and valve seats that do not affect structural integrity does not require a retest.

b. A hypergolic system that has been modified or repaired shall be leak tested at the system MOP prior to its normal use. **NOTE:** This test shall be conducted at the Ranges unless prior approval from Range Safety as been obtained.

c. After hydrostatic testing, modified or repaired hypergolic systems shall be functionally tested at the system MOP prior to being placed back in service.

d. All hypergolic system mechanical joints affected in the disconnection, connection, or replacement of components shall be leak tested at the system MOP before being placed back in service.

6.11.4.6.3 Ground Support Hypergolic Systems Tagging.

a. After test and inspection, ground support hypergolic system components shall be tagged.

b. Tags shall provide the date of the last inspection and proof load test and the component MAWP.

6.11.4.7 Ground Support Cryogenic Systems Tests

6.11.4.7.1 Periodic Test Requirements for Ground Support Cryogenic Systems.

a. Flex hoses shall be hydrostatically proof tested to 1.5 times their MAWP once a year, unless otherwise approved by Range Safety.

b. Pressure gauges and transducers shall be calibrated once a year.

c. Pressure relief valves shall be tested for proper setting and operation once a year.

6.11.4.7.2 Testing Modified and Repaired Ground Support Cryogenic Systems.

Any cryogenic system component that has been repaired or modified shall be retested by the following sequence:

a. The component shall be hydrostatically tested to 1.5 times the component MAWP. **NOTE:** The fluid shall be at ambient temperature

b. A hydrostatic test using an inert cryogenic fluid at or below the expected lowest temperature shall be performed in accordance with the requirements in Chapter 3, section **3.11.5.11.1, Hydrostatic Tests.**

c. The component shall be reinstalled in the system and a leak check performed in accordance with the requirements in Chapter 3, section **3.11.5.11.3, Pneumatic Leak Tests.**

6.11.4.7.3 Ground Support Cryogenic Systems Tagging.

a. After test and inspection, ground support cryogenic system components shall be tagged.

b. Tags shall provide the date of the last inspection and proof load test and the component MAWP.

6.11.4.8 Ground Support Pressure Vessels and Liquid Holding Tanks Recertification

NOTE: These requirements are repeated from Chapter 3. Data shall be submitted as part of the MSPSP as required in Chapter 3.

6.11.4.8.1 Ground Support Pressure Vessels

and Liquid Holding Tank Recertification Standards. Recertification of ground based pressure vessels and liquid holding tanks shall be performed in accordance with ESMC TR-88-01.

6.11.4.8.2 Ground Support Pressure Vessels and Liquid Holding Tank General Recertification Criteria. The recertification period for ground based pressure vessels and liquid holding tanks shall not exceed the shortest period based on the following criteria:

- a. The shortest service life based on an assessment of in-service failure mechanisms in accordance with the ISI plan
- b. Twenty years for systems and for vessels that can be 100 percent inspected both internally and externally
- c. Ten years for systems and for vessels that cannot be 100 percent inspected internally but can be 100 percent inspected externally
- d. Five years for systems and for vessels that cannot be 100 percent inspected either internally or externally
- e. Manufacturer recommendation

6.11.4.8.3 Ground Support Pressure Vessel and Liquid Holding Tank Recertification Criteria.

a. All ground based pressure vessels and liquid holding tanks shall be recertified when one or more of the following changes or conditions occur:

1. The vessel or tank is planned for service at a higher or lower temperature than the previous certification and/or recertification.
2. The vessel or tank was removed from service and deactivated without protection from environmental effects; for example, the vessel is not stored inside an environmentally controlled building and does not have a positive internal pressure.
3. The vessel or tank was relocated from another installation, agency, or source.
4. There is a change of service or commodity, resulting in a new failure mechanism or a change in failure mechanisms.
5. The vessel or tank was repaired or modified.
6. The vessel or tank has reached the end of its certification or recertification period.

b. Portable or mobile vessels and packaging used for transportation of pressurized or hazardous commodities shall be maintained and recertified in accordance with 49 CFR. **NOTE:** If a DOT vessel is installed on a permanent basis, it shall fall under the recertification requirements for a fixed system.

c. Periodic inspections shall be performed on hazardous pressure systems in accordance with the ISI Plan (See the **Inservice Operating, Maintenance, and Inspection Plan** section of Chapter 3). These inspections shall be performed during the following periods:

1. From initial operational use of the vessel and/or system until the vessel and/or system requires recertification. (Called recertification period)
2. Period from first recertification effort until second recertification. (Called first recertification period)
3. All subsequent recertification periods.
- d. The hazardous pressure system operator shall retain all documentation generated as a result of the recertification effort and place this documentation in the system certification and recertification file located at the Ranges.

6.11.4.8.4 Ground Support System Engineering Assessment and Analysis.

a. *General Requirements*

1. An engineering assessment and/or analysis shall be performed prior to the start of the first recertification period.
2. The engineering assessment of the design, fabrication, material, service, inspection, and testing shall be evaluated against the latest codes, standards, regulations, and requirements identified in this document.
3. Discrepancies with the latest requirements shall be resolved by repair, modification, analysis, inspection, or test.

b. *Design, Fabrication, and Installation Deficiencies.* At a minimum, the following potential design, fabrication, and installation type deficiencies shall be addressed:

1. Design deficiencies such as design notches, weld joint design, and reinforcements
2. Material deficiencies such as laminations, laps, seams, cracks, hardness variations, or notch brittleness
3. Welding deficiencies such as cracks, incomplete fusion, lack of penetration, overlap, undercut, arc strikes, porosity, slag inclusions, weld spatter, residual stresses, and distortion
4. Installation deficiencies such as fit-up, alignment, attachments, and supports

c. *Operations and Maintenance Deficiencies.* At a minimum, the following potential operation and maintenance deficiencies shall be assessed:

1. Refurbishment damage
2. Modification and repair deficiencies
3. Operation beyond allowable limits or improper sequence
4. Maintenance deficiencies

d. Analysis Methodology. The engineering analysis shall be performed as follows:

1. A stress analysis of all vessels and piping shall be available for evaluation or performed to verify that stresses are within allowable limits of current codes, standards, and regulations as identified in this document.

2. The number of stress cycles experienced by the vessel during the Certification Period as well as the number of cycles expected during the First Recertification Period shall be determined.

3. A safe-life analysis shall be determined in accordance with the following requirements:

- (a) A fatigue analysis shall be performed to determine the remaining cycles to failure.

- (b) A fracture mechanics safe-life analysis shall be performed on vessels with a burst-before-leak failure mode and on vessels whose structural integrity can not be determined by NDE (the vessel can not be 100 percent inspected internally or externally). Failure mode determination shall be in accordance with Appendix 3C.

- (c) If performed, the fatigue and fracture mechanics analysis shall be reviewed and approved by Range Safety.

6.11.4.8.5 Ground Support Pressure Vessels and Liquid Holding Tank Recertification Requirements.

- a. Vessels and packaging designed to 49 CFR specifications shall be retested to DOT requirements.

- b. All vessels, tanks, and systems shall be hydrostatically proof tested at ambient temperatures to 150 percent of the system MOP.

- c. Vessels designed to ASME Section VII, Division 2 that are prohibited from pressure testing to 150 percent of the MOP shall, at a minimum, be hydrostatically proof tested to 125 percent of system MOP.

- d. Cryogenic systems shall be tested in accordance with the testing requirements in the **Testing Cryogenic Systems After Assembly** section of Chapter 3 of this document unless otherwise agreed to by Range Safety.

- e. Before and after proof tests, a 100 percent

visual inspection of all joints and connections shall be performed. **NOTE:** Parts that indicate a change in volume, permanent deformation, leaks, or cracks shall be rejected.

- f. A 100 percent visual inspection of the external surfaces of a vessel and system and 100 percent of the internal surfaces of vessels shall be performed.

1. Any signs of corrosion, dents, or other damages shall be identified and annotated on permanently maintained recertification documents.

2. For corroded areas, the corrosion shall be removed.

3. The entire surface area that was affected by the corrosion shall be measured using ultrasonic testing (UT) to determine the remaining wall thickness.

4. Wall areas that are below the minimum required thickness and other unacceptable findings shall be fixed prior to placing the system back into service.

5. The susceptibility effects of corrosion such as cracking, delamination, or intergranular attack shall be assessed.

- g. All weld joints on vessels and systems with pressure greater than 500 psig or containing a hazardous fluid shall be 100 percent volumetrically surface inspected.

1. Radiographic examination shall be used to the maximum extent possible.

2. UT shall be used if radiographic testing (RT) is determined to be ineffective.

3. Surface and volumetric testing shall be performed after the proof test.

- h. All components and systems shall be leak checked and functionally tested.

1. Leaks shall be repaired.

2. Components that do not function properly shall be repaired or replaced prior to starting the subsequent recertification period.

6.11.4.8.6 Ground Support Pressure Vessel and Liquid Holding Tank Recertification Documentation. Documentation shall be maintained in accordance with ESMC TR-88-01.

6.11.5 Ground Support Pressure Systems Operating Requirements

6.11.5.1 Ground Support Pressure Systems General Operating Requirements

Only pressure systems that meet the design re-

quirements of Chapter 3 of this document shall be used.

6.11.5.1.1 Ground Support Pressure Systems Marking.

a. Warning signs shall be posted to keep personnel out of areas where pressurization is taking place.

b. High and ultra-high pressure systems shall be marked with DANGER signs indicating the maximum pressure that could be involved.

c. Pressure relief valves that present a noise hazard on activation shall be marked with DANGER signs.

6.11.5.1.2 Ground Support Pressure Systems Remote Pressurization.

a. Remote pressurization is required for the following conditions:

1. Initial pressurization of any vessel or system with an inert medium

2. Any pressurization that will exceed MOP

3. Any system or vessel whose design or condition is considered unknown or questionable by Range Safety

b. All personnel shall be evacuated whenever pressure exceeds the MAWP.

c. Suitable barriers shall be used to protect personnel. **NOTE:** The Range User and Range Safety shall determine the adequacy of the blast shield for the pressure and volume of the system.

6.11.5.1.3 Ground Support Pressure Systems Pressurization Operations.

a. Pressure systems shall be inspected upon arrival on the Ranges or prior to first operation.

1. Where there is evidence that systems have been damaged or overstressed, replacement or, at a minimum, remote initial pressurization shall be required.

2. Range Users who do not perform initial pressurization remotely shall certify that no evidence of damage or overstress exists to Range Safety.

b. A system and/or facility check shall be made prior to the start of the pressurization operation.

c. Personnel present during any pressurization shall be limited to those in direct support of the operation.

d. If a leak occurs during pressurization, the system and/or subsystem shall be depressurized prior to adjusting any fittings.

e. Flexible hose shall be secured along its length at 6 ft intervals.

f. Bolts and fittings shall not be loosened or torqued while the system is under pressure.

g. Any system that requires devices such as pressure regulators, pressure-reducing valves, safety valves, or pressure relief valves shall not be activated unless the devices are in place and in operable condition. **NOTE:** Only qualified and authorized personnel are allowed to change the setting of these valves and regulators with Range Safety approval.

h. When changes are made, valves and regulators shall be tested to ensure they are operating at the desired settings, and documentation of the settings shall be made.

6.11.5.1.4 Ground Support Pressure Systems Entry, Maintenance, and Repair.

a. *Ground Support Pressure Systems Entry and Repair Requirements*

1. Prior to entry into or repair of a pressurized system, depressurization of that portion of the system is mandatory.

2. The steps listed below shall be followed:

(a) A minimum of two block valves shall be closed between the portion of the system to be opened and the source of pressure.

(b) The section of line to be opened and the section between the block valves in series shall be vented (depressurized) to atmospheric pressure prior to the start of work and remain vented (depressurized) during all phases of work.

(c) Whenever operations permit, the entire system shall be depressurized before a portion of the system is isolated, vented, and opened.

(d) Venting a pressure system shall be accomplished through vent valves. Regardless of pressure, venting shall never be accomplished by loosening or removing a fitting.

(e) Lock-out devices and warning tags shall be attached to the valves that are isolating the area where system entry will be made.

(f) The isolated area shall be verified as being depressurized prior to opening.

b. Open System Work Precautions

1. Whenever a depressurized section of a pressurized facility system is to be entered, it is considered open system work and the following precautions shall be observed:

(a) Authorization for entry is required from the responsible complex or area supervisor.

(b) Personnel limits shall be established in a Range Safety approved procedure.

2. When it is necessary to remove components from the system, due care shall be exercised to prevent moisture or particle contamination from outside sources.

3. Lockout devices and tagging shall be used to ensure systems or subsystems are not operated while work is being performed on the system.

4. Work requiring lockout and tagging includes the following:

(a) The system is depressurized for maintenance.

(b) The work to be performed extends to another shift, either same crew next day or a different crew the same day.

(c) The work site is left unattended.

(d) The valve is not visible at all times.

(e) Valves may be rendered inoperative by the following methods:

(1) Passing a metal chain through the hand wheel and the valve yoke or around the bottom of the valve body or pipe, and then locking the chain

(2) Making the valve inaccessible by locking the housing that encloses the valve, locking the cover of a valve pit, or removing or locking the hand wheel extension of an underground valve or a valve that cannot be reached from the ground or a valve platform

(3) Locking and tagging electrical controls of valves with electric motor actuators

5. The following criteria shall be observed when removing locks and tags and returning the system to service:

(a) Lockout devices used to render a valve inoperative shall be removed only by an authorized work crew after all work has been accomplished and, when applicable, approved by the proper authority.

(b) Tags shall be removed only by the crew placing the tag.

(c) Removed tags shall be returned to the

crew office and mated with the tear off portion of the tag.

(d) Both tag and tear off portion shall then be filed or disposed of in accordance with current practice.

6.11.5.2 Ground Support Pressure Systems With Liquid Propellant Operations

In addition to the requirements noted above, the following requirements shall be adhered to when operating, testing, and maintaining ground support pressure systems containing liquid propellants.

6.11.5.2.1 Ground Support Pressure Systems With Liquid Propellants General Operating Requirements.

a. The Fire Department shall be notified of the presence of propellants in any facility as well as any specific fire fighting and spill handling support requirements.

b. During any mishap or incident: At the ER, the designated Operations Controller is the on-scene commander until relieved by the Cape Commander or Fire Chief. Operations Safety advises, ensures control, and supports, as necessary, in accordance with 45 SW OPLAN 32-1. At the WR, the Support Group Commander or Fire Chief serves as the on-scene commander and Operations Safety advises, ensures control, and supports, as necessary.

c. Simultaneous tanking of fuels and oxidizers aboard a launch vehicle/payload is prohibited.

d. Vessels, lines, and propellant loading systems shall be properly bonded and commonly grounded.

e. Vapor monitoring equipment shall be used for leak (sniff) checks and general atmosphere monitoring to determine the necessity for protective equipment. The type of vapor monitoring equipment used shall be approved by Range Safety and the Bioenvironmental Engineer.

f. A toxic vapor check shall be made by Environmental Health when personnel are in a facility that has toxic propellants contained in flight hardware and GSE at the start of each 8 h shift and prior to entering a facility in which toxic propellant has been left unattended for 8 h or more. Toxic vapor checks are performed by the Range User on the WR for contractor operations.

g. In locations where liquid propellants will be handled, water shall be available in the area in suf-

efficient quantities for fire, spill and medical usage. **NOTE:** Skin or eye contact with toxic propellants requires flushing with copious amounts of water. For specified flush periods, consult the Material Safety Data Sheet (MSDS) for the product being used. Appropriate medical attention must be sought after flushing.

h. The supervisor shall notify Range Safety and Bioenvironmental Engineering of any injury involving toxic or non-toxic propellants.

i. Transport of more than 5 gal of hypergolic propellants requires a security escort as described in the **Convoy Operations** section of this Chapter.

6.11.5.2.2 Ground Support Pressure Systems With Liquid Propellants Pre-Operational Requirements.

a. Range Safety approved procedures shall be used for all propellant operations and the checkout of propulsion systems.

b. As required by procedure, Operations Safety and other required support shall be on hand prior to the conduct of operations.

c. Operations Safety concurrence to proceed shall be obtained prior to the conduct of operations.

d. Personnel qualification and training shall be verified by their respective supervisors.

e. Prior to starting operations, the Range User and Operations Safety shall verify that the facility and equipment are ready by performing the following checks:

1. Wet check of safety showers and water lines prior to propellant transfer
2. Accessibility and operability of emergency exit doors
3. Operability of drain and sump systems and their capability for handling a worst case spill and wash down
4. Operability of vent systems
5. Availability of fire protection
6. Proper configuration and grounding of propellant systems
7. Weather conditions
8. PA announcements warning lights and barriers
9. Implementation of access control
10. All required support on hand
11. Availability of approved operating procedures and emergency procedures
12. Removal of ignition sources from the area

f. The Test Conductor shall be informed by Operations Safety that a danger/caution period exists in the blast area at the start of oxidizer tanking if the launch vehicle and/or payload is fueled or at the start of fueling if the launch vehicle and/or payload has oxidizer on board.

g. At the ER, propellant transfer shall not start when the passage of an electrical storm is imminent (within 5 miles). A propellant transfer operation already in progress shall be interrupted or expeditiously concluded at the discretion of Operations Safety or the supervisor in charge of the operation. The Operations Safety Plan for each launch vehicle or facility shall detail the procedure for this situation. At the WR, propellant operations shall not start when lightning is within 10 miles.

h. Emergency protective equipment shall be provided as required by Range Safety.

i. The Range User shall provide the maximum source strength based on quantity (gal or lb) and surface area. **NOTE:** The worst case spill (quantity) shall be based on a failure analysis provided to Range Operations Safety and CCAS Cape Support weather facility prior to the operation. This information shall be used to determine the downwind sector that shall be evacuated if a large spill occurs.

j. Where feasible, the Range User shall develop a means to minimize the surface area of spills by providing a dike or other means of containment.

6.11.5.2.3 Controls for Ground Support Pressure Systems With Liquid Propellants. **NOTE:** Leaks, spills, and venting of toxic propellants may create a toxic cloud. This toxic cloud will diffuse through the atmosphere at a rate that varies with meteorological conditions and spill size.

a. A localized safety clearance zone that limits personnel access to those individuals directly involved with the operation and who have the proper protective equipment shall be established.

b. A larger safety clearance zone that limits personnel access to those individuals directly or indirectly involved in the operation or mission shall be established. **NOTE:** The availability of fencing and security check points is a major factor in determining this larger safety clearance zone. The TNT equivalency of the propellants involved may also be a factor.

c. The minimum downwind sector that must be immediately evacuated in the event of a major spill

shall be provided to all personnel involved in the operation and controls shall be in place to implement the control of this sector. The downwind sector shall be defined in the Operations Safety Plan.

6.11.5.2.4 Ground Support Pressure Systems With Liquid Propellants Operating Requirements.

a. Operations Safety concurrence shall be obtained prior to starting propellant transfer operations and prior to pressurization.

b. Fire Protection and Environmental Health shall be available as required by procedure.

c. All persons and vehicles not absolutely essential to the operation shall be evacuated.

d. Prior to opening a contaminated or toxic propellant system, the system shall be flushed or purged to concentration levels coordinated with Bioenvironmental Engineering and approved by Range Safety. **NOTE:** At the ER, Environmental Health shall monitor and report any levels exceeding health standard criteria to the Operations Safety Manager. At the WR, Bioenvironmental Engineering and Environmental Health monitor for AF operations only. Contractors are responsible for monitoring their own systems.

e. The handling and transfer of toxic materials and propellants shall be monitored by Operations Safety to ensure the safety of personnel involved in the operation and personnel downwind of the operation.

f. Vapor monitoring shall be continuous whenever personnel are in enclosed processing or operating areas having stored toxic propellants.

g. At the ER, in the case of a lightning warning (lightning within 5 miles), the system shall be secured; the complex, storage, or operating area shall be cleared; and the required actions called for in procedures and Operations Plans shall be taken. (See Appendixes 6C, 6D, and 6E.) At the WR, work stops and systems shall be secured when lightning is within 10 miles. Buildings are evacuated when lightning approaches 5 miles.

h. Reentry into the area of a launch vehicle and/or payload with fuel and oxidizer aboard shall be held to a minimum and shall be subject to approval by Operations Safety.

i. Reentry into the area of a launch vehicle and/or payload with only fuel aboard shall also be held to a minimum and shall be subject to the approval of the task or area supervisor.

j. Tanking of toxic or cryogenic liquids aboard a launch vehicle or payload shall be performed as late in the countdown as practicable.

k. The appropriate actions and evacuations shall take place in the event of an emergency such as a propellant spill.

l. Cape Support (ER) and Range Safety (ER) or Range Scheduling (WR) and Operations Safety (WR) shall be notified of any propellant mishap and incidents, including near misses.

6.11.5.3 Releases of Toxic Vapors

a. All releases of toxic vapors shall comply with AFI 32-4002, *Hazardous Material Emergency Planning and Response Compliance*; 30 SW Instruction 91-106, *Toxic Hazard Assessments*; and 45 SW *Launch Toxic Hazard Control Plan*.

b. At the ER, any plans to vent toxic vapors requires coordination with Bioenvironmental Engineering and Environmental Health and Range Safety approval. At the WR, venting operations are conducted in accordance with 30 SWI 91-106 and the applicable facility or operations plan.

c. The actual venting operation shall not start without Operations Safety approval.

d. Venting restrictions and controls shall be identified in the appropriate Operations Safety Plan or operating procedure.

e. Venting operations require that the appropriate downwind sector be evacuated.

f. Environmental Health shall be present to verify concentration levels at the control area boundary.

g. Security Police shall maintain the appropriate road blocks.

h. Planned releases shall be in accordance with permits maintained by Civil Engineering.

6.11.5.4 Emergency Decontamination of Facilities and Personnel

Emergency decontamination of facilities and personnel shall be accomplished under Operations Safety direction with Environmental Health and the Fire Department performing the decontamination, if required.

6.11.5.5 Handling Leaks and Spills of Liquid Propellant

6.11.5.5.1 PPE for Treating Spills. Personnel treating or flushing major spills of toxic and corrosive propellants shall wear the proper protective

clothing and equipment.

6.11.5.5.2 Leak and Spill Procedures.

a. Range Users and supporting agencies shall develop procedures for handling major and minor leaks and spills.

b. Each area that contains liquid propellants shall have a Range Safety approved plan for evacuation based on spill size (quantity and surface area). **NOTE:** At the ER, an evacuation zone for a small spill (for example, a gallon of hypergolic propellant) is typically 700 ft downwind or more and approximately 200 ft radially if the spill is allowed to spread out on a flat surface. At the WR, required evacuations are 2,000 ft upwind or as published in the Operations Safety Plans and Toxic Hazard Zones (THZs).

1. The plan shall describe the localized safety clearance zone, the general support (larger) safety clearance zone, and the minimum downwind sector to be evacuated in the case of a large spill.

2. The downwind sector shall be based on the following factors:

(a) Maximum source strength based on quantity (gal or lb) and surface area. The Range User shall determine a worst case spill (quantity) based on a failure analysis

(b) Maximum vapor concentration acceptable for personnel exposure

(c) Average weather criteria such as wind direction, wind speed, temperature, temperature lapse rate. **NOTE:** These variables can be obtained from the Range Weather Officer.

c. These procedures shall be in accordance with the applicable Operations Safety Plan, and shall be submitted to Range Safety for review and approval.

d. Procedures shall address the topics covered in the **Disposal of Contaminated Liquid Propellant, Gas, or Other Regulated Wastes** section of this Chapter.

6.11.5.5.3 Handling Minor Leaks or Spills.

a. Minor leaks or spills can be washed or flushed with water into collecting tanks or holding basins if no ecological or health hazard is involved. **NOTE:** Refer to CPIA 394 for information on treating spills.

b. Operations Safety shall be notified of minor leaks and spills and subsequent actions.

6.11.5.5.4 Handling Major Leaks or Spills.

a. Major leaks or spills shall be handled according to the situation with the objective of minimizing injury to personnel and damage to facilities and equipment in accordance with 45 SW OPLAN 32-1 and 30 SW OPLAN 32-1. If the requirements in this section are in conflict with the aforementioned OPLANS, the OPLANS shall be complied with.

b. The following actions shall be taken:

1. Time and the situation permitting, the source of the propellant flow and pressure source shall be shut down.

2. All personnel shall be evacuated out of the area including the minimum downwind sector. Travel shall be upwind or cross-wind to the minimum evacuation radius as defined in the Facility Operating Plan, Operations Safety and Area Safety Plan, or the Range User emergency procedure, and away from the downwind sector.

3. Injured or trapped personnel shall be rescued. **NOTE:** Appropriate PPE shall be used.

4. Operations Safety shall obtain the real-time downwind sector from the Range Weather Officer and modify the evacuation area accordingly.

5. The 30th Command Post (866-9961) or CCAS Cape Support (853-5211) shall notify the following personnel or agencies:

(a) Fire Department

(b) Operations Safety

(c) Cape/VAFB Medical

(d) Security Police

(e) Environmental Health

(f) Disaster Preparedness

(g) Environmental Engineering

(h) Range Weather Operations (RWO) to

put the MARSS system on printout and stand by to provide downwind cloud isopleths and activate the Toxic Release Contingency Plan (Cape Aural Warning Plan) on the ER and Toxic Hazards Corridors on the WR as required. The RWO shall have data regarding spill site location and the type and amount of material involved to properly prepare downwind cloud dispersions forecasts.

6. Adjacent areas shall be alerted.

7. Personnel shall be available to direct emergency crews and to provide information to assist them.

8. All personnel shall report to the supervisor at the designated assembly point for head count.

6.11.5.5.5 Handling Cryogenic Liquid Spills.

a. Spills of cryogenic liquids shall be flushed with large amounts of water into the surrounding ground surface or a holding basin.

b. Spills of toxic or corrosive propellants, or those that could affect the public health or ecology, shall normally be flushed with water or another neutralizing agent into a collecting tank to be disposed of in accordance with approved procedures. **NOTE:** Refer to AFM 161-30, Vol. II, CPIA 394, Vol. III; and Range Safety for guidance.

6.12 FLIGHT HARDWARE PRESSURE SYSTEMS OPERATIONS

6.12.1 Flight Hardware Pressure Systems Operating Standards

NOTE: The degree of hazard in pressure systems is proportional to the amount of energy stored, which is a function of both the pressure and the volume stored. Therefore, low-pressure, high-volume systems can be as hazardous to personnel as high-pressure systems.

a. Only pressure systems that meet the design requirements of Chapter 3 shall be operated on the Ranges.

b. The handling and storage of propellants shall be in accordance with CPIA 394 and DoD 6055.9 or subtier documents such as AFMAN 91-201 and DoD 6055.9-STD or Navy OP 5.

c. Propellants shall be used and stored only in Range Safety approved facilities designed and suited for that purpose and only during time periods approved by Range Safety.

d. Propellants shall be used and stored only in systems that meet the design requirements of Chapter 3.

6.12.2 Flight Hardware Pressure Systems Operations Personnel Requirements

6.12.2.1 Flight Hardware Pressure Systems Training and Certification

All personnel who operate, test, and maintain flight hardware pressure systems shall be trained and certified.

6.12.2.2 Flight Hardware Pressure Systems Operations PPE Requirements

6.12.2.2.1 Selection of PPE. The selection and use of personal protective equipment shall be approved by Range Safety and Bioenvironmental Engineering.

a. Approval shall be limited to a particular model number of protective equipment and a particular operation.

b. Approval of PPE for an operation shall depend on the type and volume of propellants involved, the size of the lines, flow rate, pressure, capability to deal with emergencies, and egress accessibility.

c. Approvals are not transferable; approval for similar operations shall require a re-evaluation of these parameters.

d. Protective gear shall be compatible with the propellants involved, and fire resistant and non-static producing as well.

e. If the protective gear has limitations, these limitations and subsequent protective actions shall be identified in the operating procedure; for example, splash suits are not to be used when hydrazine concentrations can exceed 100 ppm.

6.12.2.2.2 SCAPE, Category I and IV. SCAPE, Category I or IV shall be required for propellant flow and pressurization during the following operations:

a. Connection and disconnection of wet lines or contaminated (not purged and flushed) dry lines

b. Sampling operations

c. During propellant flow

d. During initial pressurization with propellants until system integrity has been verified (no leaks)

e. Connection and disconnection of vehicle load/off-load lines

f. Removal and replacement of components in a liquid line

g. Opening any liquid system that has not been drained, purged, and flushed with referee fluid

h. When the condition of the system is uncertain or unknown

6.12.2.2.3 Splash Suits. Splash suits, with self-contained breathing apparatus or air-line respirator may be approved by Range Safety for use with systems that only contain residual vapors; no liquid in the system is allowed.

a. Removal of full protective gear after system integrity verification requires Operations Safety approval.

b. Emergency protective gear shall be available throughout operations to the crew and other personnel who might be affected in the event of a spill.

c. The following non-liquid operations require splash as approved by Range Safety:

1. Removal and replacement of components on purged and isolated liquid lines

2. Removal and replacement of components on vent lines

3. Connection and disconnection of drained, purged, and isolated lines

4. Pressure leak checks when required by procedure

d. The WR allows the use of splash suits during propellant flow after integrity has been established with Operations Safety Manager concurrence.

6.12.2.2.4 PPE for Cryogenic Systems.

a. All personnel performing liquid oxygen and liquid hydrogen transfer operations, repairs, or adjustments to the system shall wear flame-resistant treated, non-static producing overalls of liquid resistant material, cryogenic service gloves, hoods or face shields and non-absorbent shoes approved by Range Safety.

b. Personnel performing operations on other cryogenic systems shall be similarly protected, except that flame-resistance treating of coveralls is not required for non-flammable commodities.

6.12.2.2.5 PPE for Hydrogen Peroxide Transfers. Hydrogen peroxide transfers require the use of boots, gloves, and face shields of material approved by Range Safety.

6.12.3 Flight Hardware Pressure Systems Procedures

a. Procedures shall be prepared governing the safe operation, testing, maintenance, and installation of pressurized systems by the agency performing the specific task.

b. Procedures shall be developed for all operations involving propellants or the checkout of propulsion systems.

c. Off-loading procedures for payloads and launch vehicles are required at any time propellant is loaded in flight hardware. Off-loading design as outlined in Chapter 3 of this document addresses the complete system during the complete processing flow. The off-loading procedure shall include integration of the following:

1. Hardware

(a) Launch vehicle

(b) Launch vehicle fairing

(c) Spacecraft

(d) Launch complex

(e) Process facility

(f) Transport vehicle

(g) Fixed GSE

(h) Portable GSE

2. Software Command Capability

(a) Flight hardware

(b) GSE

3. Personnel capability

(a) Remote

(b) SCAPE

(c) Combination of both

6.12.4 Flight Hardware Pressure Systems Test, Inspection, and Maintenance

6.12.4.1 Flight Hardware Pressure Systems General Tests

a. Pressure systems shall be initially tested in accordance with Chapter 3 of this document.

b. Any system that has been opened shall be leak tested at 100 percent MOP with an inert medium.

c. Any disconnection, modification, or repair of the system shall necessitate leak testing the affected part of the system.

d. Any component that has been damaged, suspected to be damaged, repaired, replaced, and/or modified shall be proof tested in accordance with Chapter 3 of this document.

e. After the component proof test but prior to installation, the system or subsystem shall be proof tested, functionally tested, and leak tested. **NOTE:** The determination for system proof testing shall be made on a case-by-case basis.

f. New, modified, or repaired propellant systems shall be tested in accordance with Chapter 3 of this document. A log shall be kept on propellant systems to keep track of use, maintenance, modification, testing, and inspection.

6.12.4.2 Flight Hardware Pressure Systems General Inspection

a. Prior to use and prior to each operation, facilities and equipment shall be inspected by Range Users and Operations Safety to ensure a safe configuration for the facilities, equipment, and propellants involved.

b. Prior to operations, the facility and equipment shall be inspected by Operations Safety to

ensure a safe configuration exists for the facility, equipment, and propellants involved.

6.12.4.3 Flight Hardware Pressure Systems Purging

a. Prior to replacement, storage, or repair of hypergolic or toxic system components, the system shall be purged and flushed of all residual contaminants and appropriately capped, bagged, and labeled prior to movement.

b. A record shall be kept on the certification of system and component cleanliness through launch.

6.12.4.4 Testing Modified and Repaired Flight Hardware Pneumatic Systems

a. Any flight pressure pneumatic system element that has been repaired, modified, or damaged after having been proof tested shall be retested at proof pressure prior to its normal use.

b. A modified or repaired pneumatic system shall be leak tested at the system MOP prior to its normal use. **NOTE:** This test shall be conducted at the Ranges unless prior approval from Range Safety has been obtained.

c. A modified or repaired pneumatic system shall be revalidated and functionally tested at the system MOP prior to its normal use.

d. If any pneumatic system element such as valves, regulators, gauges, and tubing has been disconnected or reconnected for any reason, the affected system or subsystem shall be leak tested at MOP.

6.12.4.5 Testing Modified and Repaired Flight Hardware Hydraulic Systems

a. Any hydraulic system element that has been repaired, modified, or damaged after having been proof tested shall be retested at proof pressure prior to its normal use.

b. A modified or repaired hydraulic system shall be leak tested at the system MOP prior to its normal use. **NOTE:** This test shall be conducted at the Ranges unless prior approval from Range Safety has been obtained.

c. A modified or repaired hydraulic system shall be revalidated and functionally tested at the system MOP prior to its normal use.

d. If any hydraulic system element such as valves, regulators, gauges, or tubing has been disconnected or reconnected for any reason, the affected system or subsystem shall be leak tested at MOP.

6.12.4.6 Testing Modified and Repaired Flight Hardware Hypergolic Systems

a. Any hypergolic system element that has been repaired, modified or damaged after having been proof tested shall be retested at proof pressure prior to its normal use.

b. A modified or repaired hypergolic system shall be leak tested at the system MOP prior to its normal use. **NOTE:** This test shall be conducted at the Ranges unless prior approval from Range Safety has been obtained.

c. A modified or repaired hypergolic system shall be revalidated and functionally tested at the system MOP prior to its normal use.

d. If any hypergolic system element such as valves, gauges, and tubing has been disconnected or reconnected for any reason, the affected system or subsystem shall be leak tested at MOP.

6.12.4.7 Testing Modified and Repaired Flight Hardware Cryogenic Systems

a. Any cryogenic system element that has been repaired, modified or possibly damaged after the system leak test shall be retested.

b. The component retest sequence shall be as follows unless otherwise agreed to by Range Safety:

1. The component shall be hydrostatically proof test at ambient temperature to 1.5 times the component MAWP.

2. The component shall be reinstalled into the cryogenic system and leak check performed at system MOP.

3. The functional capability of the modified or repaired component shall be revalidated using the intended service fluid at system MOP.

c. If any cryogenic system element such as valves, regulators, gauges, or pipes has been disconnected or reconnected for any reason, the affected connection shall be leak checked at MOP.

6.12.4.8 Flight Hardware Pressure Systems Recertification

Recertification requirements for flight components and systems shall be performed in accordance with Chapter 3, **Flight Hardware Pressure Systems**

and Pressurized Structures.

6.12.5 Flight Hardware Pressure Systems Operating Requirements

6.12.5.1 Flight Hardware Pressure Systems General Operating Requirements

Only pressure systems that meet the design requirements of Chapter 3 of this document shall be used.

6.12.5.1.1 Flight Hardware Pressure Systems Area Posting Requirements. Warning signs shall be posted to keep personnel out of areas where pressurization is taking place.

6.12.5.1.2 Flight Hardware Pressure Systems Remote Pressurization.

a. Remote pressurization is required for the following conditions:

1. Initial pressurization at the Ranges of any vessel or system with an inert medium. *EXCEPTION: For the 30 SW, remote pressurization can be waived provided the following is provided:*

(a) *The assembled system has been proof tested at a pressure equal to 1.5 times the system MEOP or to an agreed-upon level for tanks with less than 2:1 safety factor for burst*

(b) *System configuration has not been modified or repaired subsequent to above testing. Unwelded relief or sensing devices may be replaced after system proof testing.*

(c) *Inspection of the pressure system at the launch site verifying damage has not been sustained during transportation or handling subsequent to above testing*

2. Any pressurization that will exceed MOP

3. Any system or vessel whose design or condition is considered unknown or questionable by Range Safety

b. Suitable barriers shall be used to protect personnel. **NOTE:** The Range User and Range Safety shall determine the adequacy of the blast shield for the pressure and volume of the system.

6.12.5.1.3 Flight Hardware Pressure Systems Pressurization Operations.

a. Pressure systems shall be inspected upon arrival or prior to first operation where there is evidence that systems have been damaged or overstressed, replacement or, at a minimum, remote initial pressurization shall be required.

b. A system and/or facility check shall be

made prior to the start of the pressurization operation.

c. Personnel present during any pressurization shall be limited to those in direct support of the operation. All personnel shall be evacuated whenever pressure exceeds the MEOP.

d. If a leak occurs during pressurization, the system and/or subsystem shall be depressurized prior to adjusting any fittings.

e. Bolts and fittings shall not be loosened or torqued while the system is under pressure.

f. Any system that requires devices such as pressure regulators, pressure-reducing valves, safety valves, or pressure relief valves shall not be activated unless the devices are in place and in operable condition. **NOTE:** Only qualified and authorized personnel are allowed to change the setting of these valves and regulators with Range Safety approval.

g. When changes are made, valves and regulators shall be tested to ensure they are operating at the desired settings, and documentation of the settings shall be made.

h. Pressure vessels that exhibit a brittle fracture or hazardous leak-before-burst (LBB) failure mode shall maintain a minimum safety factor of 2:1 during transport or ground handling operations.

i. Pressure vessels that have a non-hazardous LBB failure mode shall maintain a minimum safety factor of 1.5:1 during transport or ground handling operations.

6.12.5.1.4 Flight Hardware Pressure Systems Maintenance and Repair. When it is necessary to remove components from the system, due care shall be exercised to prevent moisture or particle contamination from outside sources.

6.12.5.2 Flight Hardware Systems With Liquid Propellants Operations

In addition to the requirements noted above, the following requirements shall be adhered to when operating, testing, and maintaining flight hardware pressure systems containing liquid propellants.

6.12.5.2.1 Flight Hardware Pressure Systems With Liquid Propellants General Operating Requirements:

a. The Fire Department shall be notified of the presence of propellants in any facility as well as any specific fire fighting and spill handling support requirements.

b. During any mishap or incident: At the ER, the designated Operations Controller is the on-scene commander until relieved by the Cap Commander or Fire Chief. Operations Safety advises, ensures control, and supports, as necessary, in accordance with 45 SW OPLAN 32-1. At the WR, the Support Group Commander or Fire Chief serves as the on-scene commander and Operations Safety advises, ensures control, and supports, as necessary

c. Simultaneous tanking of fuels and oxidizers aboard a launch vehicle and/or payload is prohibited.

d. Vessels, lines, and propellant loading systems shall be properly bonded and commonly grounded.

e. Vapor monitoring equipment shall be used for leak (sniff) checks and general atmosphere monitoring to determine the necessity for protective equipment. The type of vapor monitoring equipment used shall be approved by Range Safety and the Bioenvironmental Engineers.

f. On the ER, a toxic vapor check shall be made by Environmental Health when personnel are in a facility that has toxic propellants contained in flight hardware and GSE at the start of each 8-h shift and prior to entering a facility in which toxic propellant has been left unattended for 8 h or more. On the WR, toxic vapor checks are accomplished by Range User for contractor operations.

g. In locations where liquid propellants will be handled, water shall be available in the area in sufficient quantities for fire, spill and medical usage. **NOTE:** Skin or eye contact with toxic propellants requires flushing with copious amounts of water for a minimum of 15 min and transport to the nearest dispensary immediately afterward unless a qualified medical technician or doctor directs other actions.

h. The supervisor shall notify Range Safety and the Bioenvironmental Engineer of any injury involving toxic or non-toxic propellants.

6.12.5.2.2 Flight Hardware Pressure Systems With Liquid Propellant Pre-Operational Requirements.

a. Range Safety approved procedures shall be used for all propellant operations and the checkout of propulsion systems.

b. As required by procedure, Operations Safety and other required support shall be on hand prior to

the conduct of operations.

c. Operations Safety concurrence to proceed shall be obtained prior to the conduct of operations.

d. Fire Protection and Environmental Health personnel qualifications and training shall be verified by their respective supervisors.

e. Prior to starting operations, the Range User and Operations Safety shall verify that the facility and equipment are ready by performing the following checks:

1. Wet check of safety showers and water lines prior to propellant transfer

2. Accessibility and operability of emergency exit doors

3. Operability of drain and sump systems and their capability for handling a worst case spill and wash down

4. Operability of vent systems

5. Availability of fire protection

6. Proper configuration and grounding of propellant systems

7. Weather conditions

8. PA announcements warning lights and barriers

9. Implementation of access control

10. All required support on hand

11. Availability of approved operating procedures and emergency procedures

12. Removal of ignition sources from the area

f. The Test Conductor shall be informed by Operations Safety that a danger/caution period exists in the blast area at the start of oxidizer tanking if the launch vehicle and/or payload is fueled or at the start of fueling if the launch vehicle and/or payload has oxidizer on board.

g. At the ER, propellant transfer shall not start when the passage of an electrical storm is imminent (within 5 miles). A propellant transfer operation already in progress shall be interrupted or expeditiously concluded at the discretion of Operations Safety or the supervisor in charge of the operation. The Operations Safety Plan for each launch vehicle or facility shall detail the procedure for this situation. At the WR, propellant operations shall not start when lightning is within 10 miles.

h. Emergency protective equipment shall be provided as required by Range Safety.

i. The Range User shall provide the maximum source strength based on quantity (gal or lb) and

surface area. **NOTE:** The worst case spill (quantity) shall be based on a failure analysis provided to Range Safety Operations and CCAS Cape Support weather facility prior to the operation. This information shall be used to determine the downwind sector that shall be evacuated if a large spill occurs.

j. Where feasible, the Range User shall develop a way to minimize the surface area of spills by providing a dike or other means of containment.

6.12.5.2.3 Controls for Flight Hardware Pressure Systems With Liquid Propellants. **NOTE:** Leaks, spills, and venting of toxic propellants may create a toxic cloud. This toxic cloud will diffuse through the atmosphere at a rate that varies with meteorological conditions and spill size.

a. A localized safety clearance zone that limits personnel access to those individuals directly involved with the operation and who have the proper protective equipment shall be established.

b. A larger safety clearance zone that limits personnel access to those individuals directly or indirectly involved in the operation or mission shall be established. **NOTE:** The availability of fencing and security check points is a major factor in determining this larger safety clearance zone. The TNT equivalency of the propellants involved may also be a factor.

c. The minimum downwind sector that must be immediately evacuated in the event of a major spill shall be provided to all personnel involved in the operation, and controls shall be in place to implement the control of this sector. The downwind sector shall be defined in the Operations Safety Plan.

6.12.5.2.4 Flight Hardware Pressure Systems With Liquid Propellants Operating Requirements.

a. Operations Safety concurrence shall be obtained prior to starting propellant transfer operations and prior to pressurization.

b. Fire Protection and Environmental Health shall be available as required by procedure.

c. All persons and vehicles not absolutely essential to the operation shall be evacuated. All personnel shall be evacuated whenever pressure exceeds the MEOP.

d. Prior to opening a contaminated or toxic propellant system, the systems shall be flushed or purged to concentration levels approved by Range Safety.

e. The handling and transfer of toxic materials and propellants shall be monitored by Operations Safety to ensure the safety of personnel involved in the operation and personnel downwind of the operation.

f. Vapor monitoring shall be continuous whenever personnel are in enclosed processing or operating areas having stored toxic propellants.

g. In the case of a lightning warning (lightning within 5 miles) the system shall be secured; the complex, storage, or operating area shall be cleared; and the required actions called for in procedures and Operation and Area Safety Plans shall be taken.

h. Reentry into the area of a launch vehicle and/or payload with fuel and oxidizer aboard shall be held to a minimum and shall be subject to approval by Operations Safety.

i. Reentry into the area of a launch vehicle and/or payload with only fuel aboard shall also be held to a minimum and shall be subject to the approval of the task or area supervisor.

j. Tanking of toxic or cryogenic liquids aboard a launch vehicle or payload shall be performed as late in the countdown as practicable.

k. The appropriate actions and evacuations shall take place in the event of an emergency such as a propellant spill.

l. CCAS Cape Support (ER) or Range Scheduling (WR) and Range Safety shall be notified of any propellant mishap and incidents, including near misses.

6.12.5.3 Releases of Toxic Vapors

a. All releases of toxic vapors shall comply with AFI 32-4002, VAFBR 127 *Toxic Hazard Corridors*, and 45 SW *Launch Toxic Hazard Control Plan*.

b. Any plans to vent toxic vapors requires coordination with Bioenvironmental Engineering and Environmental Health and Range Safety approval.

c. The actual venting operation shall not start without Operations Safety approval.

d. Venting restrictions and controls shall be identified in the appropriate Operations Safety Plan or operating procedure.

e. Venting operations require that the appropriate downwind sector be evacuated.

f. Environmental Health shall be present to verify concentration levels at the control area bound-

ary.

g. Security Police shall maintain the appropriate road blocks.

h. Planned releases shall be in accordance with permits maintained by Civil Engineering.

6.12.5.4 Emergency Decontamination of Facilities and Personnel

Emergency decontamination of facilities and personnel shall be accomplished under Operations Safety direction with Environmental Health and the Fire Department performing the decontamination, if required.

6.12.5.5 Handling Leaks and Spills of Liquid Propellant

6.12.5.5.1 PPE Requirements for Treating Major Spills. Personnel treating or flushing major spills of toxic and corrosive propellants shall wear the proper protective clothing and equipment.

6.12.5.5.2 Leak and Spill Procedures.

a. Range Users and supporting agencies shall develop procedures for handling major and minor leaks and spills.

b. Each area that contains liquid propellants shall have a Range Safety approved plan for evacuation based on spill size (quantity and surface area). **NOTE:** At the ER, an evacuation zone for a small spill (for example, a gallon of hypergolic propellant) is typically 700 ft downwind or more and approximately 200 ft radially if the spill is allowed to spread out on a flat surface. At the WR, required evacuations are 2,000 ft upwind or as published in Operations Safety Plans and THZs.

1. The plan shall describe the localized safety clearance zone, the general support (larger) safety clearance zone, and the minimum downwind sector to be evacuated in the case of a large spill.

2. The downwind sector shall be based on the following factors:

(a) Maximum source strength based on quantity (gal or lb) and surface area. The Range User shall determine a worst case spill (quantity) based on a failure analysis.

(b) Maximum vapor concentration acceptable for personnel exposure.

(c) Average weather criteria such as wind direction, wind speed, temperature, and temperature lapse rate. **NOTE:** These variables can be obtained from the Range Weather Officer.

c. These procedures shall be in accordance with the applicable Operations Safety Plan, and shall be submitted to Range Safety for review and approval.

d. Procedures shall address the topics covered in the **Disposal of Contaminated Liquid Propellant, Gas, or Other Regulated Wastes** section of this Chapter.

6.12.5.5.3 Handling Minor Leaks or Spills.

a. Minor leaks or spills can be washed or flushed with water into collecting tanks or holding basins if no ecological or health hazard is involved. **NOTE:** Refer to CPIA 394 for information on treating spills.

b. Operations Safety shall be notified of minor leaks and spills and subsequent actions.

6.12.5.5.4 Handling Major Leaks or Spills.

a. Major leaks or spills shall be handled according to the situation with the objective of minimizing injury to personnel and damage to facilities and equipment in accordance with 45 SW OPLAN and 30 SW OPLAN 355-1. If the requirements in this section are in conflict with the OPLANs, the OPLANs shall be complied with.

b. The following actions shall be taken:

1. Time and the situation permitting, the source of the propellant flow and pressure source shall be shut down.

2. All personnel shall be evacuated out of the area, including the downwind sector. Travel shall be upwind or cross-wind to the minimum evacuation radius as defined in the Facility Operating Plan or the Range User emergency procedure and away from the downwind sector.

3. Injured or trapped personnel shall be rescued. **NOTE:** Appropriate PPE shall be used.

4. Operations Safety shall obtain the real-time downwind sector from the Range Weather Officer and modify the evacuation area accordingly.

5. The CCAS Cape Support (ER) or Range Scheduling (WR) shall notify the following personnel or agencies:

- (a) Fire Department
- (b) Operations Safety
- (c) Cape Medical
- (d) Security Police
- (e) Environmental Health
- (f) Disaster Preparedness

(g) Environmental Engineering
 (h) RWO to put the MARSS system on printout and stand by to provide downwind cloud isoplots and activate the Toxic Release Contingency Plan (Cape Aural Warning Plan) on the ER

and Toxic Hazards Corridors on the WR as required. RWO shall have data regarding spill site location and the type and amount of material involved to properly prepare downwind cloud dispersions forecasts.

6. Adjacent areas shall be alerted.

7. Personnel shall be available to direct emergency crews and to provide information to assist them.

6.12.5.5.5 Cryogenic Liquid Spills.

a. Spills of cryogenic liquids shall be flushed with large amounts of water into the surrounding ground surface or a holding basin.

b. Spills of toxic or corrosive propellants, or those that could affect the public health or ecology, shall normally be flushed with water or another neutralizing agent into a collecting tank to be disposed of in accordance with approved procedures.

c. Refer to AFM 161-30, Vol. II; CPIA 194, Vol. III; and Range Safety for guidance.

6.12.6 Flight Graphite Epoxy Composite Overwrapped Pressure Vessels Operations

Ground operations requirements for graphite epoxy (Gr/EP) composite overwrapped pressure vessels (COPVs) can be found in the 23 November 1993 letter, "Interim Safety Requirements for Design, Test, and Ground Processing of Flight Graphite Epoxy (Gr/EP) Composite Overwrapped Pressure Vessels (COPVs) at the Kennedy Space Center (KSC), Cape Canaveral Air Force Station (CCAFS), and Vandenberg Air Force Base (VAFB)" issued by the Director, Safety and Reliability, NASA, KSC and the Chiefs of Safety, USAF, 30 SW and 45 SW. **NOTE:** The requirements stipulated in this letter are interim requirements for Gr/EP COPVs. Final requirements will be incorporated in this document when the results of the GR/EP COPV test programs are complete.

6.13 ORDNANCE OPERATIONS

6.13.1 Ordnance Operations Procedure Requirements

a. All ordnance operations shall be covered by a Range Safety approved operating procedure.

b. Ordnance operations conducted in ordnance facilities shall be specified in procedures and/or operating instructions approved by Range Safety

c. Procedures shall include transportation to and from the facility.

6.13.2 Ordnance Transportation, Receipt, and Storage

6.13.2.1 Ordnance Transportation, Receipt, and Storage Standards

a. All ordnance transportation, receipt, and storage shall be performed in accordance with 45 SWR 136-1 (ESMCR) and 136-2 and VAFB Sup 1 to AFMAN 91-201.

b. Over-the-road and rail shipments from the Ranges shall comply with Department of Transportation (DOT) requirements.

c. To be acceptable for transportation by any mode, explosives shall have the following items provided and verified prior to shipment:

1. Proper DOT classification for transport.

NOTE: For air transport, refer to AFJMAN 24-204.

2. An assigned hazard classification hazard class and/or division; storage compatibility group; DOT class, markings, shipping name and label; and the United Nations (UN) serial number.

3. The availability of adequate and suitable storage space on Ranges. **NOTE:** Availability of adequate and suitable storage space depends on the hazard classification, the size of the storage containers, and temperature and humidity requirements.

4. The availability of proper connectors and cabling for ordnance checkout if Range facilities and equipment are to be used.

d. All ordnance air shipments shall comply with the requirements of the International Air Transport Association (IATA) for commercial air shipments and AFJMAN 24-204 for military air shipments as well as DOT requirements.

6.13.2.2 Ordnance Transportation General Requirements

6.13.2.2.1 Transportation Restrictions. Launch vehicles, payloads, spacecraft, and vehicle stages shall not be shipped to the Ranges with ordnance such as EEDs installed unless prior written approval has been obtained from Range Safety.

6.13.2.2.2 Ordnance Services Coordination. Plans for shipment of ordnance to CCAS shall be coordinated with CCAS Ordnance Services. Plans for shipment of ordnance to VAFB shall be coordi-

nated with 30 SW/SEGW.

6.13.2.2.3 Ordnance Transportation Address. All ordnance shipments including Category B EEDs shall be addressed as follows:

To: Transportation Officer
Patrick Air Force Base, FL 32925
Marked for: Manager, Ordnance Services
Bldg. 72905, Cape Canaveral Air Station,
FL

Special Markings: Name of Program
Name of Project Monitor or Office
Complete Address

From: Sender's Name and Address

or:

To: Transportation Officer
Vandenberg Air Force Base, CA 93437
Marked for: 30 TRANS/LGTT
2010 New Mexico Street
Vandenberg Air Force Base, CA 93437
Name of Project Monitor and Office
Complete Address

From: Sender's Name and Address

6.13.2.3 ER Ordnance Delivery and Receipt

a. Ordnance deliveries shall be scheduled through CCAS Cape Support (853-5211) on the ER and deliver only to Range Safety approved facilities.

b. Operations Safety shall be notified of ordnance deliveries on CCAS.

c. Ordnance shipments arriving at the Range shall be escorted from the gate to the proper storage area.

d. After receipt at fuel storage Area (FSA) 2 at CCAS, all ordnance transportation shall be performed by CCAS Ordnance Services unless specifically approved by Range Safety.

e. All ordnance transportation shall be approved by Range Safety.

6.13.2.4 Ordnance Shipment Inspection

a. As soon as possible after receipt, a receiving inspection shall be conducted by ER Contractor Ordnance Services or 30 SW TMO and the Range User to ensure that no damage has occurred during shipment.

b. Any shipment discrepancy or DOT violation shall be reported to the Transportation Management Office (TMO) and Range Safety.

6.13.2.5 Ordnance Storage

a. Ordnance and propellants shall be stored in facilities specifically designed for that purpose and approved by Range Safety and/or the Department of Defense Explosive Safety Board (DDESB). **NOTE:** Processing facilities shall not be used for the storage of ordnance.

b. Instructions for disposing of stored ordnance items shall be furnished by the Range User to Ordnance Services upon project termination or when ordnance items are no longer required.

6.13.3 Ordnance Systems Grounding

6.13.3.1 Ordnance Systems Grounding PPE

a. Personnel handling, installing, or electrically connecting ordnance or working within 10 ft of exposed, solid propellant grain shall wear Range Safety approved, flame-retardant, non-static producing, long-sleeve, cuff-less, full-body garments (coveralls) with leg stats, conductive shoes, or wrist stats. **NOTE:** If required, Range Users shall submit a sample of the garment for testing.

b. Other persons who may come in contact with ordnance, test equipment when ordnance is connected, flight hardware when ordnance connections are not complete shall wear the same coveralls described in *a* above.

c. Sweaters and jackets shall not be worn as outer garments over protective coveralls.

d. When solid and/or liquid propellants are present, smocks shall not be used as a substitute for full body protection (coveralls).

e. More stringent controls shall be used by the Range User when necessary to enforce Range Safety policy. For example, it may be necessary to require all personnel entering a particular control area to wear the proper coveralls.

6.13.3.2 Ordnance Processing Restrictions on the Use of Static-Producing Materials

a. Static-producing materials shall not be used on or near ordnance items or in the vicinity of flammable liquids such as propellants.

b. Compliance with the restriction on static-producing materials is handled on a case-by-case basis; however, the following criteria shall serve as a guideline:

1. Materials shall not come into contact with a system having an installed EED or other ordnance.

2. Materials shall not come within 10 ft of exposed solid propellant grain; for example, no nozzle plug or cover.

c. Further restrictions and testing requirements are provided in the **Restrictions on the Use of Static-Producing and Flammable Material** section of this Chapter.

6.13.3.3 Ordnance System Static Ground Point Test

Static ground points in all ordnance and propellant operating and storage facilities shall be tested according to the **Grounding Systems Test Requirements** section of this Chapter.

6.13.3.4 Ordnance Systems Grounding Operations

6.13.3.4.1 Ordnance Systems Grounding Operations General Requirements.

a. Ordnance associated equipment such as handling fixtures and missile structures shall be provided to ensure that an electrostatic charge can not build up to levels that can cause ignition of the ordnance.

b. Platforms and ladders shall be grounded when used in conjunction with vehicles and/or payloads containing ordnance.

c. Launch complex service towers are not necessarily good electrical conductors due to corrosion, paint, and questionable bonding of work platforms to ground. Conductive mats that are grounded to the service tower shall be used. Wrist stats shall be required if proper grounding cannot be attained.

d. Grounding system megger checks shall not be made after initiators are installed or electrically connected unless proper fault protection is provided; for example, fuses placed in the leads, as approved by Range Safety.

6.13.3.4.2 Ordnance Systems Grounding Pre-Operational Checks.

a. When leg stats or conductive shoes are required, grounding of personnel shall be verified using a conductive shoe tester prior to the start of an ordnance operation. **NOTE:** Leg stat or conductive shoe resistance shall not exceed 1 megohm.

b. When wrist stats are required, grounding of personnel shall be checked with an ohmmeter. **NOTE:** Wrist stats are required to have a resistance between 10 kilohms and 1 megohm. The

standard resistance is 100 kilohms.

c. To ensure grounding of personnel, conductive floors shall be verified in all ordnance and propellant operating facilities prior to operations.

d. Conductive floors and terminals shall be verified to be electrically bonded to a grounding system common to the EED prior to operations.

e. Static ground points shall be verified to have a resistance to ground of 25 ohms or less using the methods of measuring resistance to earth described in IEEE-142.

6.13.3.4.3 Ordnance Systems Grounding Operating Requirements.

a. Touching a grounded surface is required prior to handling an EED.

b. When hoisting ordnance with a crane, a trailing ground connection to the facility ground shall be maintained during the hoist.

c. Metal shipping containers shall be grounded prior to opening the containers.

d. Before removing an ordnance item from a shipping container, the specific ordnance item shall be grounded.

e. When hoisting ordnance with a crane, the ordnance and/or container and the hook shall be commonly grounded before connecting the hook to the ordnance and/or container.

6.13.4 Ordnance Operations

6.13.4.1 Ordnance Operating Standards

a. All ordnance operations on the Ranges are considered hazardous and are subject to stringent controls.

b. Ordnance operations shall be conducted in accordance with AFMAN 91-201 and DoD 6055.9-STD.

c. All initiators are considered Category A until Range Safety concurs with the Category B designation.

6.13.4.2 Ordnance Facility Inspection

a. All new or modified explosives and propellant facilities shall be inspected prior to first use by Operations Safety (ER)/30 SW/SEW (WR).

b. An annual explosive safety inspection shall be conducted by Operations Safety (ER)/30 SE/SEW (WR) to determine compliance with explosives safety criteria as defined in this document, other DoD and USAF standards (for example, AFMAN 91-201 and DoD 6055.9-STD), and the provisions of Explosives Safety Plan 1 (ESP 1). (See Appen-

dix 6D.)

c. The annual inspection shall include, but not be limited to, the following explosives storage and operating areas:

1. Launch complexes
2. Assembly area processing facilities
3. Support facilities
4. Solid and liquid propellant storage areas

d. The results of the annual explosives safety inspection shall be reported under the provisions of ESP 1.

e. Ordnance facilities shall be inspected monthly by the Facility Manager.

6.13.4.3 Ordnance Operations General Requirements

a. All ordnance operations on the Ranges shall be monitored and approved by Range Safety.

b. Testing of any ordnance circuit or device that could result in personnel injury or death (if the ordnance should fire) shall be conducted with no personnel exposed (remotely, in a test cell, or behind a barricade or shield.) **NOTE:** Operations Safety shall represent Range Safety during on-site ordnance activities.

c. Operations Safety shall be present to monitor all ordnance operations designated by Range Safety and shall spot check all other ordnance operations. **NOTE:** Examples of Operations Safety coverage during ordnance operations are as follows: the receipt of ordnance at the assembly and/or processing area; resistance and continuity checks; "No voltage" (stray voltage) checks; Category A ordnance installation and electrical connection; solid propellant work involving open grain; handling of liquid and solid propellant motors, segments, stages, or payloads; cycling and checkout of S&As or other safety devices; destruct system checks; any render-safe operations; ordnance removal; launch operations.

d. Ordnance electrical continuity and resistance checkout shall not be conducted at a launch complex or vehicle or payload assembly area without the written approval of Range Safety.

e. All test equipment used to check out ordnance shall be approved by Range Safety prior to use on the Ranges. **NOTE 1:** A list of currently approved instruments shall be maintained by ER Operations Safety and 30 SW/SES. **NOTE 2:** Applied current shall not exceed 10 percent of the no-fire current of

any EED in the circuit, or 50 mA, whichever is less.

f. No current, voltage, power, energy, or other type of energy source shall be applied to any ordnance device outside of an approved test facility or with personnel in the immediate vicinity of the ordnance device except under the following conditions:

1. The operation is covered by an approved procedure

2. Approved equipment is used

3. The system or subsystem is approved

g. RF silence is required during periods of ordnance installation, removal, and electrical connection and disconnection aboard a vehicle and/or payload. **NOTE 1:** Where practical, the RF control area shall include the entire facility and/or complex. **NOTE 2:** Radiating payloads are handled on an individual basis.

h. The Explosive Ordnance Disposal Team (EOD) shall be provided with familiarization of the vehicle and/or payload ordnance systems.

i. For each electrically initiated ordnance device installed on the vehicle and/or payload, the following tools and equipment shall be supplied to EOD in the event of a malfunction that requires render-safe actions or a mishap recovery effort:

1. One complete set of shielding caps (current design)

2. One set of safety pins

3. Special tools used in installation, removal, and safing the ordnance

6.13.4.4 Ordnance Operations Pre-Operational Requirements

6.13.4.4.1 Operations Safety and Range User. Prior to giving concurrence for any ordnance operations to begin, Operations Safety and the Range User shall ensure the following:

a. All necessary controls are established

b. Test equipment and the system conform to a configuration approved by Range Safety

c. Radio transmissions are not made within 25 ft of launch vehicles and/or payloads containing EEDs or other RF susceptible ordnance

d. All ordnance circuit control switches and firing line interrupt switches are in the off (OPEN) position before electrical connection of ordnance and thereafter when pad access is required

e. Personnel and explosive limits are enforced

f. Proper safety clearance zone has been established and cleared prior to starting the hazard-

ous operation

g. Proper signs are posted, warning lights are operating, barricades are established, and security is posted

h. Proper aural warnings and announcements have been made

i. All serial numbers, calibration dates, proof test dates, and other equipment requirements have been verified prior to operations

6.13.4.4.2 Pre-Installation Checkout of Ordnance Items.

a. The pre-installation checkout of all ordnance items shall be performed only at Range Safety approved test facilities.

b. Requests to use alternate facilities shall be submitted in writing to Range Safety.

6.13.4.4.3 Ordnance NO VOLTAGE Checks.

a. Prior to any ordnance electrical connection, NO VOLTAGE (stray voltage) checks shall be performed on all launch vehicle and payload ordnance electrical connectors.

b. These checks shall be made first with power ON, then with power OFF, and include all pin-to-pin and pin-to-case combinations.

c. The power ON configuration requires the launch vehicle and payload to be powered up in launch configuration. **NOTE:** This configuration requires the payload and upper stage to be powered (along with the launch vehicle) in launch configuration on the launch complex unless the payload does not have any electrical interfaces with the upper stage.

d. The power ON check may be performed anytime in the launch processing after the launch vehicle, upper stage, and payload are mated provided the electrical system is not altered prior to final ordnance electrical connection.

e. The power OFF configuration requires the launch vehicle and payload to be powered down.

f. Power OFF checks shall be made immediately prior to ordnance electrical connection.

g. If a number of connections must be made in the same general area of the launch vehicle and payload, power OFF checks may be made on all of the connectors prior to ordnance electrical connection. **NOTE:** These connections shall be made before any electrical configuration or system changes such as bringing power back up occur.

h. Shielding caps shall not be removed from EEDs until electrical connection to the ordnance is

to be made.

i. The resulting measured signal (current, voltage, power, energy) from a NO VOLTAGE check shall not be capable of producing a current greater than 20 dB below the no-fire current of the EED. **NOTE:** The NO VOLTAGE test procedure shall specify the maximum acceptable reading.

j. Meters that are used for NO VOLTAGE checks shall have a valid calibration seal.

k. On the ER only, the integrity of the meter and test leads shall be demonstrated to Operations Safety prior to use. Fixed- or facility-test instrumentation that is used in place of portable GSE shall have a procedure that verifies the integrity of the system. **NOTE:** A copy of the completed procedure shall be provided to Operations Safety.

6.13.4.5 Ordnance Operating Requirements

a. All ordnance and propellant operations shall be conducted in accordance with written procedures approved by Range Safety.

b. Ordnance operations shall not be conducted when the relative humidity is less than 35 percent.

c. Ordnance and propellant operations shall not be conducted except in facilities specifically designed for this purpose and approved by Range Safety and the DDESB.

d. At the ER, ordnance items shall not be handled, installed, or electrically connected when the passage of an electrical storm is imminent (within 5 miles). Operations Safety Plans shall detail the procedures to be followed for different configurations. At the WR, the distance for electrical storm warning is 25 miles; work stops and systems are safed at 10 miles; and facilities are evacuated at 5 miles.

e. Ordnance items, particularly Category A initiators, shall be installed and electrically connected as late in the countdown as possible.

f. A rotation test shall be performed on all launch vehicle and/or payload S&As after installation and erection on the launch pad but prior to final connection to the ordnance train. This test shall be performed using the launch day system configuration such as monitor circuitry, power sources, and circuits for cycling the S&A.

g. The ordnance train shall be disconnected from the S&A output during all checkout operations except during the following circumstances:

1. Single complete rotation test (SAFE to

ARM to SAFE)

2. Final rotation to ARM on the last day of the count

h. When the S&A is rotated on the pad, all personnel shall be cleared to an area designated in the OSP.

i. EMI testing shall not be conducted with initiators installed on the vehicle or payload without Range Safety approval.

6.13.4.6 Laser Initiated Ordnance Operations Personnel Access Criteria

a. For laser initiated ordnance (LIO) systems, the following personnel access criteria are required:

1. For unlimited personnel exposure during LIO tests: three independent verifiable circuit inhibits (dual-fault tolerance)

2. For essential personnel exposure during LIO tests: two independent circuit inhibits (single-fault tolerance)

3. For no personnel exposure during LIO tests: one circuit inhibit

b. One inhibit shall be a disconnection of the ordnance train at the LIO or the destruct charge/solid rocket motor igniter (other ordnance end item).

6.13.5 Explosive Ordnance Disposal

6.13.5.1 Rendered Safe Ordnance

All damaged ordnance shall be rendered safe by the AF EOD Team.

6.13.5.2 Obtaining EOD Services

AF EOD services may be obtained by calling Cape Support (853-5211) or Patrick AFB Command Post (494-7001) on the ER or Range Scheduling (276-8825) on the WR.

6.13.5.3 Range Safety Approval of Shipment of Damaged or Rendered Safe Ordnance

a. Shipments of damaged or rendered safe ordnance from the Ranges or the downrange stations shall be approved in writing by Range Safety.

b. This approval and/or certification shall accompany the shipment.

c. A DOT exception shall normally be obtained by the Range User before AF EOD will release damaged ordnance.

6.13.6 Ordnance Facilities Operations

a. Ordnance items shall not be delivered to,

placed in, or processed through facilities or locations on the Ranges, or downrange stations unless the facility or area has been approved for such operations by Range Safety.

b. Ordnance deliveries from storage to the Range User shall be coordinated with ER Operation Safety Manager and 30 SW/SEGW.

c. All facilities in which ordnance operations are conducted or stored shall be properly equipped, display the correct explosive safety markings, and otherwise meet the minimum explosives safety standards cited in AFMAN 91-201 and DoD 6055.9-STD and subtier documents and this document.

d. All operations and activities within an explosives sited facility must be ordnance-related and require Range Safety approval.

6.14 ELECTRICAL SYSTEMS OPERATIONS

6.14.1 Electrical Systems Operating Standards and Definitions

6.14.1.1 Electrical Systems Operating Standards

a. As applicable, AF Pamphlet 85-1, T.O. 00-25-232, and the National Electric Code (NEC) shall be followed in the design, maintenance, and conduct of electrical systems operations at the Ranges.

b. Workplace electrical safety shall be in accordance with NFPA 70E, AFI 32-1064, and OSHA 1910, Subpart S.

6.14.1.2 Definition of Hazardous (Classified) Locations for Electrical Equipment Operations

Hazardous (classified) locations are defined in Article 500 of the NEC and NFPA 497A; however, some explosives and propellants are not covered. For Range installations, the following paragraphs define the minimum requirements to be applied in the definitions of locations in which explosives, pyrotechnics, or propellants are or are expected to be present. These requirements shall be followed unless less stringent classifications are justified and approved as part of the design data submittal process. Range Safety and the Fire Department shall approve all potential safety critical facility hazardous location designations. (See Appendix 6I for a Hazardous Area Classification decision flowpath.)

a. Class I, Division 1

1. Locations in which flammable liquids, va-

por, or gases may be present in air during normal operations

2. Locations in which ignitable concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage

3. Locations in which the breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases or vapors and might also cause simultaneous failure of electrical equipment

4. As a baseline, these include the following locations:

(a) Within 25 ft of any vent opening unless the discharge is normally incinerated or scrubbed to non-flammable conditions (less than 25 percent of LEL). This distance may be increased if the vent flow rate creates a flammability concern at a distance greater than 25 ft.

(b) Below grade locations in a Class 1, Division 2 area.

b. Class 1, Division 2

1. Locations in which volatile flammable liquids or flammable gases are handled, processed or used, but in which the liquids, vapors, or gases will normally be confined in closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or system or in case of abnormal operation of equipment

2. Locations in which ignitable concentrations of gases or vapors are normally prevented by positive mechanical ventilation and which might become hazardous through failure or abnormal operation of ventilation equipment

3. Locations adjacent to a Class 1, Division 1 location and to which ignitable concentrations of gases or vapors might occasionally be communicated unless communication is prevented by adequate positive pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided. **NOTE 1:** This classification usually includes locations where volatile flammable liquids or flammable gases or vapors are used but, in the judgment of Range Safety and the Fire Department, would become hazardous only in case of an accident or of some unusual operating condition. The quantity of flammable material that might escape in case of an accident, the adequacy of ventilating equipment, the total area involved, and the record of the Range User with respect to

explosions or fires are all factors that merit consideration in determining the classification and extent of each location. **NOTE 2:** Piping without valves, checks, meters, and similar devices would not ordinarily introduce a hazardous condition even though used for flammable liquids or gases. Locations used for the storage of flammable liquids or of liquefied or compressed gases in sealed containers would not normally be considered hazardous unless also subject to other hazardous conditions. **NOTE 3:** As determined by Range Safety and the Fire Department, locations may actively change classification depending upon the flammable fluid system activity and configuration. For these types of locations, fixed or permanently installed electrical equipment shall be designed for the worst case hazardous environment. **NOTE 4:** Portable electrical equipment shall be designed for the worst case hazardous environment in which it will be used. Portable equipment that is not designed for use in a particular hazardous environment is not allowed in that environment or shall be locked out from use in that environment.

4. As a baseline, Class 1, Division 2 locations include the following equipment or areas:

(a) Storage vessels (including carts and drums) - 25 ft horizontally and below to grade and 4 ft vertically above the vessel (25 ft in any direction for hydrogen)

(b) Transfer lines - 25 ft horizontally and below to grade and 4 ft above the line (25 ft in any direction for hydrogen)

(c) Launch vehicle - An analysis shall be performed per API 500 RP 500. The minimum distances shall be 100 ft radius horizontally from and 25 ft vertically above (100 ft for hydrogen) the highest leak or vent source and below the vehicle to grade.

(d) Enclosed locations such as rooms, work bays, and launch complex clean rooms that are used to store and handle flammable and combustible propellants when the concentration of vapors inside the room resulting from a release of all fluids stored and handled equals the LEL. **NOTE:** The quantity of fluids used in the analysis shall be the maximum amount allowed in the quantity distance site plan.

c. Hazardous Commodity Groups. Hazardous commodities are grouped by similar characteristics. **NOTE:** These fuels shall be considered ignitable regardless of the ambient temperature. The follow-

ing fuels shall be categorized as follows:

1. Group B - Liquid or gaseous hydrogen
2. Group C - Hypergolic fuels such as N₂H₄, MMH, UDMH, A-50
3. Group D - Hydrocarbon fuels
4. Group D - Oxidizers. Oxidizers shall be considered Group D hazardous substances in addition to the fluids listed in Section 500-3 of the NEC.

d. Exposed Solid Propellants. The atmosphere within 10 ft of exposed solid propellant shall be classified as a Class 1, Division 2, Group D location. Solid rocket motors are considered exposed in the following situations:

1. The motor nozzle is not attached and the aft end of the motor does not have a cover
2. The motor nozzle is attached but does not have a nozzle plug
3. The unassembled motor segments do not have front and rear covers
4. The igniter is removed from the motor and cover is not provided

6.14.2 Electrical Systems Operations Personnel and Special Insulated Equipment

6.14.2.1 Personnel Equipment

Personnel wearing conductive grounding devices shall not operate electrically powered devices which could result in a shock hazard.

6.14.2.2 Special Insulated Equipment

a. If live electrical maintenance or repair work must be performed, special insulated equipment shall be provided.

b. Special insulated equipment includes, but is not limited to the following:

1. Insulated hook sticks for opening and closing disconnect switches
2. Insulated fuse sticks for removing and installing cartridge type fuses
3. Rubber insulating sleeves and gloves
4. Rubber insulation floor mats
5. Rubber insulating line conductor hose
6. Dielectric hard hats

6.14.3 Electrical Systems Procedures

a. Procedures shall be written for all electrical maintenance and repair work.

b. Procedures shall include, but not be limited to, the following topics:

1. Tagging and locking out control switches
2. Use of approved non-conductive fuse pullers
3. Provision and use of PPE
4. Grounding of equipment and personnel
5. Use of "Buddy System" (mandatory when working on energized equipment and circuits)
6. Safety precautions to be followed when working on energized equipment and circuits
7. Fire Protection and equipment
8. Knowledge of resuscitation procedures

6.14.4 Electrical Equipment and Systems Test, Inspection, and Maintenance

6.14.4.1 Grounding Systems Tests

6.14.4.1.1 Grounding Systems General Tests.

a. Grounding system tests for lightning protection, electrical fault protection, and static protection systems shall be performed for all facilities and/or locations (including launch complexes) used to store, handle, or process ordnance or liquid propellants.

b. Facility Operators and Range Users shall inspect their portable and movable equipment connections to ground before starting operations each day the equipment is to be used.

6.14.4.1.2 Grounding Systems Test Plan and Test Frequency Criteria.

a. A floor plan layout showing all grounding system test points shall be developed by the Facility Operator and/or the Range User.

b. Based on the floor plan, the following tests shall be conducted:

1. Lightning protection system resistance to ground shall be tested annually to the following criteria:

(*a*) 10 ohms or less for the counterpoise system

(*b*) 10 milliohms from the terminal to the counterpoise system

2. The lightning protection system shall be inspected visually and mechanically twice a year.

3. The facility static/electrical ground system resistance shall be tested annually to a criteria of 25 ohms or less using the methods of measuring resistance to earth described in IEEE-142.

4. Facility equipment connections to the facility ground system shall be visually inspected prior to each use and tested every two months to a criteria of 1 ohm or less. **NOTE:** During this test, ground support equipment and flight hardware containing hazardous commodities may be discon-

nected but do not have to be removed from the facility.

5. Conductive floors shall be visually inspected and tested twice a year to a criteria of test-point to test-point resistance of 250,000 ohms or less. **NOTE:** Hazardous commodities shall be removed before testing.

6. All resistance measurements shall be taken with a currently calibrated instrument in accordance with a Range Safety approved procedure.

7. Measuring devices such as megohm meters (meggers) shall be current-limited by use of fuses or equivalent devices when the facility contains electrically connected EEDs.

8. Procedures shall require testing to demonstrate a resistance of 1 ohm or less measured from the equipment surface to the facility ground point.

9. Test and inspection results shall be provided to the facility custodian and be available at the facility.

6.14.4.2 Electrical Equipment Inspection

Electrical equipment shall be inspected prior to use.

6.14.4.3 Electrical Equipment Maintenance

a. Electrical equipment shall be properly maintained in serviceable condition.

b. Conductors with worn, abraded, or defective insulating material shall be repaired or replaced prior to the circuit being energized.

c. Electric motors shall be properly maintained and excess dust and oil shall be removed from motors by vacuum cleaning or wiping.

6.14.5 Electrical Systems Operating Requirements

6.14.5.1 Electrical Systems General Operating Requirements

NOTE: Excessive humidity, wet areas, lack of protective matting, or equipment with exposed contacts to ground may require low or lesser voltage to be designated as high voltage. If these conditions exist, they increase the hazards.

a. Personnel working with high voltage equipment shall not wear conductive grounding devices.

b. Supervisors shall be responsible for assuring that safe working conditions are provided; the work is done in a safe manner; and frequent inspections of equipment, materials, and the work site are conducted.

c. Whenever maintenance or repair work is per-

formed on potentially hazardous energized electrical equipment or circuits, there shall be a minimum of two people present (buddy system).

d. Rescue and first aid equipment shall be readily available in areas where electrical maintenance and repair work is being performed.

e. Personnel exposed to electrical circuits shall not wear loose clothing, rings, watches, or other metallic objects that can act as conductors of electricity.

f. Only Underwriters' Laboratories (UL) or Factory Mutual (FM) listed weather proof or water-tight equipment shall be used in areas subject to excessive moisture.

g. Only explosion and/or hazard-proofed equipment shall be used in potentially hazardous atmospheres.

h. Before working on capacitor circuitry, external power and short terminals shall be disconnected and discharged to ground.

i. If power lines are required to extend across outside work areas, they shall be protected by a wooden cover or elevated so as not to interfere with personnel, vehicles, or equipment traffic.

j. Electrical equipment cords shall have an equipment grounding conductor and shall be grounded when in use. Unless double insulated, the equipment exterior shall be securely bonded and grounded.

k. Dead-end wires shall be completely insulated.

6.14.5.2 Electrical Systems Pre-Operational Requirements

a. With the exception of test and check-out, all electrical equipment and circuits shall be de-energized before any work is started on these circuits or equipment through a scheduled power outage.

b. Power outages in facilities shall be coordinated with the affected parties.

c. The line switch shall be locked out and tagged in accordance with the **Control of Hazardous Energy Sources** section of this Chapter whenever work is being done on circuits.

d. Electrical conductors shall be routed to eliminate tripping hazards or contact with energized lines.

6.14.5.3 Electrical Systems Operating Requirements

a. If panel covers are removed or left open to

obtain power where none is available, a DANGER HIGH VOLTAGE sign shall be placed next to the open panel. When cable connections are made, the panel cover shall be installed, if possible, using as many attach points that are available to secure it.

b. Insulated fuse pullers shall be used for removal of fuses. Only fuses of proper rating shall be used in circuits. No other material shall be used in place of a fuse.

c. Personnel who are exposed to energized circuits for electrical activities such as troubleshooting, maintaining, or repairing electrical equipment energized with 25 volts or more shall stand on non-conductive matting.

d. Grounding or shorting sticks (or cables) shall be used on potentially "hot" circuits and shall not be removed until repairs are completed.

6.14.6 Battery Operations

6.14.6.1 Battery Operating Standards

a. An approved means of disposal or transportation to an off-site approved disposal site shall be in place prior to receipt of the batteries on the Ranges.

b. The means of disposal shall be in accordance with DOT and EPA requirements and carry DOT and EPA approvals.

6.14.6.2 Battery Operations Personnel Requirements

6.14.6.2.1 Battery Operations Training and Certification.

a. A training program shall be generated and approved by the Range User for all personnel handling batteries.

b. For personnel handling lithium batteries, a training program shall be reviewed and approved by Range Safety. **NOTE:** Personnel who handle batteries that have a Underwriters Laboratory (UL) listing and are intended for public use are exempt from these requirements.

6.14.6.2.2 Emergency First Aid and PPE Requirements.

a. Emergency First Aid

1. An emergency eye wash and shower shall be provided in locations where batteries are serviced. They shall be installed in accordance with AFOSH 127-32 and ANSI Z358.1. **EXCEPTION:** *An emergency eye wash and shower are not required if batteries are present but will not be serviced in that location.*

2. An emergency first aid kit, containing a burn neutralizer shall be provided.

b. PPE. The following PPE shall be provided in accordance with AFOSH 91-66 and used when servicing or handling batteries:

1. Front and side face and eye protection
2. Rubber gloves
3. Rubber apron
4. Foot protection

6.14.6.3 Battery Procedures

a. Procedures for battery receipt, transportation, checkout, handling, installation, safing, packing, storage, and disposal shall be developed and submitted to Range Safety for review and approval.

b. Specific safing operations of batteries shall be in battery handling and checkout procedures.

c. Battery handling and checkout procedures shall include the following topics:

1. A list of proper handling equipment
2. Identification of specific personnel qualified to safe batteries if in a unsafe condition
3. Identification of the exact location of the storage site of depleted or unsafe batteries

6.14.6.4 Lithium Batteries Special Requirements

NOTE: Batteries that have a UL listing and are intended for public use are exempt from these requirements.

a. Range Safety shall approve temporary lithium battery storage and handling facilities. These facilities shall be used only for lithium batteries and shall not be used for other purposes. **NOTE:** Lithium batteries shall not be stored permanently on the Ranges.

b. The Range User shall provide certification with the lithium battery confirming that all safety critical steps and processes agreed to by Range Safety during the battery development phase have not been altered.

c. Prior to delivery of lithium batteries to the Ranges, an approved off-site disposal contract shall be in place for the batteries in any condition.

6.14.6.5 Battery Maintenance, Storage, and Operations

a. Rechargeable storage batteries and batteries requiring activation at the Ranges shall be handled only in designated battery shops and areas equipped for servicing and recharging in accor-

dance with the **Battery Storage and Processing Area Design Requirements** in Chapter 3 of this document.

b. Separate areas shall be provided for servicing of batteries that have incompatible electrolytic solutions; for example, acid and alkaline.

6.15 MOTOR VEHICLE OPERATIONS

6.15.1 Motor Vehicle Operating Standards

All vehicle operations shall comply with federal, state, Air Force, and Range laws and regulations including, but not limited to, the following criteria:

- a.* Proper licensing of operators
- b.* The use of vehicle restraint devices such as seat belts
- c.* Restrictions on wearing head phones or ear speaker type radios while operating a vehicle
- d.* The use of spotters when backing with restricted rear vision vehicles

6.15.2 Motor Vehicle Operating Requirements

6.15.2.1 Use of Spotters and Chocks

- a.* Maneuvering in the vicinity of hazardous commodities requires the use of a spotter.
- b.* When backing, chocks shall be used to prevent contact.

6.15.2.2 Gasoline and Diesel Vehicle Operations Approval

Gasoline or diesel vehicle operations within buildings shall be as approved by the Bioenvironmental Engineer.

6.15.2.3 Ordnance and Propellant Area Parking

6.15.2.3.1 General Parking Requirements.

a. Vehicle parking in areas sited and used for ordnance or propellants shall be in accordance with the applicable Safety Plan. (See Appendixes 6C, 6D, and 6E.)

b. These Safety Plans shall be developed by Operations Safety using AFMAN 91-201 and DoD 6055.9-STD for criteria

6.15.2.3.2 General Parking Restrictions.

1. Designated parking areas shall be used.
2. Privately owned vehicles shall not be parked within the fenced-in area of hazardous processing facilities.

3. No vehicle shall be parked within 25 ft of lines containing liquid propellants.

4. No vehicle shall be parked within 50 ft of storage tanks containing liquid propellants.

5. When required, delivery vehicles are exempt from the preceding requirements during loading and off-loading and shall be removed immediately afterwards.

6. While parked, the parking brake shall be engaged and wheels shall be chocked.

6.15.2.3.3 Restricted Parking Areas. All government, private, and contractor-owned vehicles are prohibited from parking in the following areas under the following conditions:

1. Within the FHA once the FHA has been established

2. In the BDA during wet dress rehearsal (cryogen tanking)

3. Within the launch complex fence line during core vehicle tanking (other than cryogenics that are tanked) after the BDA/FHA is established

4. Within the launch complex fence line during fueled spacecraft/upperstage mating operations

6.15.2.4 Internal Combustion Engine Vehicles

Motor vehicles or equipment using internal combustion engines shall require spark arresters and carburetor flame arresters under the following conditions:

a. When transporting explosives that have exposed grain, scrap, waste or items visibly contaminated with explosives

b. When operating internal combustion engines within the control area during propellant transfer operations or continuously within POL and/or propellant storage areas

6.15.2.5 Hazardous Commodities Vehicle Transportation Standards

Vehicles transporting hazardous commodities shall meet DOT and DoD (for example, AFMAN 91-201 and DoD 6055.9-STD) regulations.

6.16 CONVOY OPERATIONS

NOTE 1: At the ER, all transportation of oversized loads (larger than 12 ft in width, 13.5 ft in height, or 55 ft in length) is considered a hazardous operation. **NOTE 2:** At the ER, if the convoy is to travel onto KSC, 45 SPW/JOP 15E-3-50 is applicable. **NOTE 3:** At the WR, all convoys shall be conducted in accordance with 30 SPS/SPOS OI 31-1010, Volume 2, Chapter 5.

6.16.1 Convoy Transportation Procedures

A procedure for transportation shall be submitted to Range Safety for review and approval.

6.16.2 Convoy Operations Requirements

The Range User and/or the agencies responsible for the transportation of a load shall ensure the following items are performed:

a. The load or commodity to be transported shall be identified.

b. The convoy shall be scheduled through CCAS Cape Support (853-5211) at the ER and through Range Scheduling (30 RANS/DOS 276-8825) at the WR.

c. A convoy commander shall be designated.

d. If flight hardware or hazardous commodities are involved, a security escort shall be arranged.

e. At the ER, as required by Range Safety, Operations Safety approval shall be obtained prior to start of the convoy if hazardous commodities or flight hardware are involved.

f. When transporting hazardous commodities, the transfer route shall be chosen to minimize exposure to populated areas and critical facilities. **NOTE:** Transfer should occur during off-peak traffic and population hours.

g. The selected route shall be identified and the following items noted:

1. Horizontal and vertical clearances
2. The hazardous commodity transported
3. Population along the route
4. Traffic that may be encountered
5. Condition of surface being traveled upon
6. Distance of route

h. Radio contact shall be maintained with the convoy commander for all elements of the convoy.

i. At a minimum, the following items of equipment are required:

1. Flashlights if transport occurs during periods of darkness
2. Emergency apparatus such as fire extinguishing equipment, reflectors, and flares

j. Proper environmental health required by the commodity transported shall be ensured.

k. As required by Range Safety, areas shall be cordoned off.

l. Emergency actions shall be taken to secure the item being transported in the event of a mishap.

m. A pre-operational check of the loaded vehicle and trailer shall be conducted.

n. A convoy commander pre-departure briefing guide and requirements shall be prepared and conducted. The briefing guide includes such information as hazards, communication checks, and stop points.

6.17 LAUNCH OPERATIONS

6.17.1 Launch Operations Procedures

At a minimum, procedures for the launch count-down and prelaunch count shall contain the following Operations Safety functions for the specific launch vehicle and payload systems:

a. Monitoring and verifying no-voltage checks, installation, and hookup of destruct ordnance

b. Approval to start ordnance tasks

c. Monitoring the installation and electrical hookup of ordnance

d. Approval to start propellant transfer and launch vehicle tanking

e. Approval to start pressurization

f. Initiating holdfire when safety constraints or emergency situations dictate

g. At the ER, monitoring and verifying FTS checkout

h. At the ER, conducting holdfire checks

6.17.2 Operations Safety Launch Countdown

6.17.2.1 Operations Safety Launch Countdown General Requirements

Operations Safety OSM and/or OST shall perform the following launch countdown general functions:

a. Verification that the permanent fire fighting and cooling water systems are operating properly and that adequate water, at the correct operating pressure, is available until after launch or until the test is scrubbed and propellants have been detanked

b. Monitoring and verifying destruct Safe & Arm Device (S&A) rotation on the pad

c. Requesting and verifying RF silence as required

d. Monitoring and verifying FTS checkout

e. Immediately notifying Range Safety of any airborne FTS discrepancy, component, subsystem, or system failure

f. Conducting holdfire checks

g. Verifying removal of the FTS and ignition S&A safety pin and Explosive Bridgewire (EBW) circuitry safing plug and clearing the Flight caution area prior to launch

h. Verifying reinsertion of the FTS and ignition S&A safety pin and EBW circuitry safing plug in the event of a scrub as directed by Range Safety

i. Verifying reinsertion of the Category A ordnance safety device in the event of a scrub as directed by Range Safety

j. Calling a HOLD during a test or actual launch countdown or preventing further progress of a test when, in the opinion of the OSM, such action is necessary in the interest of safety

6.17.2.2 Operations Safety Launch Countdown Pre-Operational Requirements

Operations Safety shall perform the following launch countdown pre-operational requirements:

a. At the ER, within five calendar days of F-0 day, monitoring and verifying S&A and EBW detonator electromechanical checks at the Range Contractor solid propellant test facility or other locations

b. At the ER, ensuring that the command receivers are not turned on during any time that ordnance of the FTS is electrically connected unless Range Control Officer concurrence has been given of the OSM

c. Monitoring and verifying no-voltage checks, installation, and hookup of the FTS ordnance

d. Verifying that the Launch Disaster Control Group (LDCG) is in place at the “fall back” position for each static firing or launch

6.17.2.3 Launch Countdown Operations

a. At the ER, to ensure proper operation, the holdfire and firing line interrupt capability shall be checked out at a mutually agreed time on the launch pad as close to launch as practical with Operations Safety present.

b. At the ER, results of the checkout shall be reported by Operations Safety Console in the blockhouse/Launch Control Center/Launch Support Center, or on board ship to the Mission Flight Control Officer (MFCO) during the launch countdown.

c. At the time specified in the applicable documents (Range User launch countdown/pre-count), the OSM shall be on station at the Operations Safety Console in the blockhouse/Launch Control Center, or on board ship if a sea launch is scheduled, and at the launch area.

d. At the ER, the OSM shall clear all non-essential personnel from the Blast Danger Area

when required. At the WR, the OSM shall clear the Hazard and Caution Areas when required.

e. The OSM shall control all warning devices provided to indicate hazard conditions. For all launches except at the WR, the Monitor and Control Officer (MC) controls warning devices for ballistic launches.

f. The OSM shall declare caution and danger periods at the times such action becomes necessary in the interest of safety.

g. At a mutually agreed upon point in the countdown at the ER, the OSM shall report verbally to the MFCO, “The Flight Caution Area is clear;” at the WR, the OSM shall send a green light signal. (See Chapter 7 for further information.)

h. The blockhouse door Security Guard shall permit no one to leave the blockhouse unless specifically authorized by the OSM.

i. Where applicable, blockhouse air conditioning air intakes shall be closed prior to booster ignition.

j. Searchlight and photographic supervisors shall report to Operations Safety when clearing the complex and upon arrival at the “fall back” position.

k. The OSM shall initiate HOLDFIRE when safety constraints or emergency situations dictate.

6.17.3 Launch Abort and Misfire/Hangfire Operations

Any failure to launch or ignite properly shall be treated as a hangfire until it can be definitely established that a misfire has occurred or until the 30-min waiting period has elapsed. The 30-min waiting period is not applicable to ballistic vehicles at the WR where it is dictated by T.O.s.

6.17.3.1 Common Abort or Misfire/Hangfire Operations

a. The Range Safety System shall remain configured in a manner that will enable the MFCO to take destruct action if necessary until Operations Safety has verified to the MFCO that the launch vehicle is no longer in a launch configuration.

b. In the event of a launch abort or misfire or following expiration of the 30-min waiting period in the case of a hangfire with solid propellant stages, or a solid propellant and starter devices, the OSM shall perform the following activities: **NOTE:** The 30-min waiting period is not applicable to ballistic vehicles at the WR where it is dictated by T. O.s.

1. Ensure the ignition firing circuit has been disabled.

2. Allow rotation of the destruct S&A rotors to SAFE with approval of the MFCO.

3. Verify to the MFCO that the destruct S&A devices are in the SAFE position.

4. Allow the command receivers to be turned OFF after coordination with the MFCO.

5. Verify to the MFCO that the safety pins are reinstalled.

6. Make a launch complex inspection in conjunction with the Launch Agency and allow access to the launch complex for work when it is safe to do so.

7. Adjust or lift road blocks as required.

8. When no further launch attempt is contemplated, verify that hazardous ordnance items are disconnected electrically and shielded and, if required, removed for return to the storage area.

9. Request support by the Explosive Ordnance disposal (EOD) team when disarming of ordnance systems or components cannot be accomplished in normal methods.

c. If necessary, the EOD team shall initiate RENDER-SAFE procedures.

6.17.3.2 Launch Vehicles Using Liquid Propellant Stages Abort or Misfire/Hangfire Operations

a. In the event of launch abort or misfire/hangfire, the Range User shall depressurize the vehicle propellant tanks and pressure systems to safe.

b. Operations Safety shall monitor the detanking of propellants where applicable.

6.17.3.3 Launch Vehicles Using Solid Propellant Stages or Solid Propellant Starting Devices Abort or Misfire/Hangfire Operations

a. In the event of hangfire, Operations Safety (ER)/FSPO (WR), the Range User, and 45 or 30 RANS shall ensure that the Range Safety System shall remain configured in a manner that will enable MFCOs to take destruct action, if necessary, in the event of unscheduled launch. **NOTE** :The waiting period in this configuration is a minimum of 30 min during which time the Flight Caution Area shall remain cleared.

b. For vehicles using solid propellant stages or solid propellant starting devices, Operations Safety shall restrict access to the pad until it can be veri-

fied that power did not reach the initiator (misfire) or it is assumed that power did reach the initiator (hangfire) and a 30-min waiting period has elapsed.

6.17.4 Launch Disaster Control Group Operations

6.17.4.1 Launch Disaster Control Group Duties and Responsibilities

a. ER. The duties and responsibilities of the ER LDCG are defined in the 45 SPW OPLAN 32-1, Vol II; the Safety Operating Plan for the 45 SW Launch Disaster Control Group; and the Safety Operating Plan for LDCG Procedures.

b. WR. The duties and responsibilities of the WR LDCG are defined in applicable Launch Support Plans.

6.17.4.2 LDCG Operations Requirements

a. During major launch operations, the LDCG shall be available for immediate response to a launch vehicle and/or payload impact on the Ranges, KSC, or the public domain.

b. The Range User shall have the required vehicle launch crew necessary to support the LDCG Commander at fallback at least 60 min prior to T-0.

NOTE: If more than one fallback position is used, the crew should report to the primary fallback area.

c. Crews for securing the complex after a normal launch shall not be located in the same area as the LDCG. **NOTE:** These crews shall be located so as not to interfere with LDCG operations.

6.17.5 Post-Launch Operations

a. Immediately after a launch, Operations Safety shall inspect the pad for personnel hazards such as contamination, exposed wiring, damaged high pressure systems, or damaged propellant tanking systems.

b. The blockhouse OSM shall coordinate with the Safety Technical Director and the Range User to determine when it is safe to permit personnel to leave the blockhouse or shelter and when it is safe to operate the pad for normal work.

c. Operations Safety shall direct Security to adjust or lift road blocks as warranted by existing conditions.

d. Fire, medical, and pumping station support shall be released when no longer needed and normal security measures are instituted.

APPENDIX 6A GROUND OPERATIONS PLAN

6A.1 INTRODUCTION

6A.1.1 Purpose

The Ground Operations Plan (GOP) provides a detailed description of the hazardous and safety critical operations associated with a missile system and its associated ground support equipment. It is the medium from which Missile Systems Pre-Launch Safety approval is obtained from the Ranges along with the Missile Systems Pre-Launch Safety Package (MSPSP) required in Chapter 3.

6A.1.2 Content

This Appendix contains the content preparation instructions for the data generated by the requirements delineated in Chapter 6.

6A.1.3 Applicability

The requirements in this Appendix are applicable to all launch vehicle and spacecraft contracts.

6A.1.4 Submittal Process

The GOP submittal periods are as follows:

a. Preliminary drafts of the GOP shall be provided to Range Safety 45 days prior to the cDR, the PDR, and the CDR but not later than one year prior to the projected date hardware will arrive at the Ranges.

b. The final GOP shall be submitted 45 calendar days prior to the delivery of hardware on the Ranges.

6A.1.5 Final Approval

The GOP shall be approved by Range Safety prior to the start of any hazardous operations on the Ranges.

6A.2 PREPARATION INSTRUCTIONS

6A.2.1 Content

The GOP contains a description of planned operations, including backout, and the associated hazard analysis of those operations. Where applicable, previously approved documentation may be referenced throughout the package.

6A.2.2 Format

Contractor format is acceptable provided the information described below is provided.

6A.2.2.1 Table of Contents and Glossary

The GOP shall contain a table of contents and a

glossary.

6A.2.2.2 Introduction

The Introduction shall address the purpose and scope of the GOP.

6A.2.2.3 General Description

The General Description section shall present an overview of the system and the processing flow as a prologue to the hazardous and safety critical operation descriptions. The following items are included in this section:

- a.* General flow of system integration and testing
- b.* Facilities to be used
- c.* Generic timeline with sufficient granularity to identify the major hazardous and/or FTS operations

6A.2.2.4 Ground Operations

The Ground Operations section shall identify the ground processing flow including all hazardous and safety critical operations. The following items are included in this section:

a. List of all non-hazardous, hazardous, and safety critical procedures by title and numerical designation with an indication as to which have been designated as hazardous or related to FTS operation

b. Procedure Descriptions. Procedure descriptions shall include separate listing of tasks so that hazardous tasks within each procedure can be identified.

c. Procedure Task Summaries. Task summaries for each procedure shall include the following information:

1. Each separate task
2. Responsible agency
3. Objective
4. Initial and final configuration
5. Equipment and support required
6. Description
7. Hazards and precautions
8. List of approved PPE and detection equipment used in ground operations.

d. Flow Chart. A flow chart indicating expected time sequence and location of each individual procedure and task shall be included. Each flow chart block used shall be assigned a maximum of one procedure and include the following information:

1. Identifier for each procedure
2. Procedure number

APPENDIX 6A GROUND OPERATIONS PLAN

3. Hazardous, non-hazardous, or safety critical designation

4. Task summary number(s)

e. Identification of Emergency and Abort/Back-out Actions

f. A list of personnel training, certification, and experience requirements for each type of hazardous operation such as ordnance, crane, and propellant operations.

6A.2.2.5 Off-Site Processing

The Off-Site Processing section shall include the following information:

a. A detailed description of the off-site build-up and transport configuration of the launch vehicle and payload that will be transported to the Range

b. A description of the tests performed on hazardous and safety critical systems such as rotation of S&A devices, no voltage checks on ordnance systems, pressure checks of pressure and propellant vessels, RF radiation measurements, and preliminary FTS checks

6A.2.2.6 Operating and Support Hazard Analysis

An Operating and Support Hazard Analysis (O&SHA) shall be performed for each procedure and the results summarized in the GOP.

a. The O&SHA shall identify and evaluate the safety considerations associated with environments, personnel, procedures, and equipment involved throughout the operational phase of the program and shall meet the intent of Appendix 1B, O&SHA requirements.

b. O&SHAs shall be conducted for activities such as testing, installation, maintenance, support, transportation, storage, operations, and training.

c. O&SHAs shall coincide with the flow chart task summaries in **6A.2.2.3 General Description**.

d. O&SHAs shall incorporate a worksheet associated with each specific flow block in the flow chart and shall include the following information:

1. The general hazard group
2. The specific hazard condition

3. The effect if the hazard is not controlled

4. Hazard control hardware

5. The hazard control procedure

6. Hazard control personnel

7. Reference to the flow block task number

e. Proposed work under a load safety analysis shall be included in this section.

6A.2.2.7 Range User Plans

The following plans shall be included in or added as appendixes to the GOP.

a. Range User Training Plan

b. Accident Notification Plan

c. Emergency Response Plans for Graphite Epoxy Composite Overwrapped Pressure Vessels

6A.2.2.8 Compliance Checklist

a. A Compliance Checklist based on a non-deliverable O&SHA and the requirements of Chapters 3 and 6 for each task may be submitted in place of a formal submittal of the O&SHA described in **6A.2.2.6 Operating and Support Hazard Analysis**.

b. The task breakout shall be associated with each specific flow block in the flow chart described in **6A.2.2.3 General Description**.

c. The Compliance Checklist shall include the following information:

1. EWRR 127-1 Criteria/Requirement

2. O&SHA reference hazard group and hazard condition

3. System and specific procedure and task within the procedure

4. Compliance

5. Noncompliance

6. Not applicable

7. Resolution

8. Reference

d. Copies of all Range Safety approved noncompliances associated with hazardous or safety critical operations shall be included.

6A.2.2.8 Changes

The Change section contains a summary of all changes to the latest edition of the GOP. All changes shall be highlighted using change bars or similar means of identification.

APPENDIX 6B

HAZARDOUS AND SAFETY CRITICAL PROCEDURE REQUIREMENTS

6B.1 INTRODUCTION

6B.1.1 Determination of Hazardous and Safety Critical Procedures

The Ground Operations Plan (GOP) (Appendix 6A) is the basic document used to initially determine the classification of a procedure. Specifically all procedure description and task summaries along with the associated Operating & Support Hazard Analyses (O&SHAs) are reviewed. This review validates the Range User's determination of Hazardous, Non-Hazardous, and Safety Critical procedures. Once the classification of Hazardous, Non-Hazardous, and Safety Critical is determined, the procedures are submitted for review and approval as described in the documentation section of this Chapter. During review of the initial draft procedures, a determination is made for Operations Safety attendance and notification. The basic rules for inclusion of Operations Safety into hazardous and safety critical procedures is defined in the Operations Safety responsibility list. This list shall be used for writing the initial draft procedures. The initial review by Range Safety shall determine if Operations Safety notification or attendance shall be required. Also, the review of the draft procedures allows a second opportunity to ensure the classification is appropriate.

6B.1.2 Purpose

Hazardous and safety critical procedures provide a detailed, step-by-step description of the manner in which hazardous and safety critical operations will be accomplished. The procedures are the medium from which approval to start any hazardous or safety critical operation is obtained from the Ranges.

6B.1.3 Content

This Appendix contains the content preparation instructions for the data generated by the requirements delineated in Chapter 6 of this document.

6B.1.4 Applicability

This Appendix is applicable to the following:

- a. All launch vehicle, payload, or service contractors performing hazardous or safety critical operations on the Ranges
- b. Construction and management contracts for

hazardous facilities

6B.1.5 Submittal Process

The hazardous procedure submittal process is as follows:

a. One copy of procedures involving hazardous or safety critical operations shall be submitted to Range Safety and one copy to Operations Safety for review and approval. The Range User shall review, approve, and sign the final procedures to be submitted to Range Safety for approval.

b. For new programs, final Operations Safety and Range Safety comments, reviews, and approvals shall be provided to the Range User 45 calendar days after receipt of the procedure.

c. For existing programs, final Operations Safety and Range Safety comments, reviews, and approvals shall be provided to the Range User 30 calendar days after receipt of the procedure.

d. Final approved, published procedures incorporating Range Safety comments shall be submitted to Range Safety at least seven calendar days prior to the conduct of the operation.

6B.1.6 Final Approval

Hazardous and safety critical procedures shall be approved prior to starting any hazardous or safety critical operations on the Ranges.

6B.2 PREPARATION INSTRUCTIONS

6B.2.1 Content

Hazardous or safety critical procedures shall be written in a logical format with clear instructions as to the tasks to be performed and hazards and precautions involved.

6B.2.2 Cover Page

a. A cover page with the procedure title and required approval signatures and date shall be provided. For WR, the signature page shall contain a block for Range Safety signature approval.

b. The cover page shall indicate that the procedure covers hazardous or safety critical operations.

c. The words *Draft* or *Preliminary* shall appear on any signed procedure that does not have the required Range Safety approval.

APPENDIX 6B

HAZARDOUS AND SAFETY CRITICAL PROCEDURE REQUIREMENTS

d. The cover sheet shall state “Warning: This Procedure Contains Hazardous (or Safety Critical) Operations” and shall be outlined with a border and marked in bold print.

e. The cover sheet shall indicate revision level.

6B.2.3 Purpose Section

a. The purpose section shall provide a brief synopsis of all major tasks in each operating procedure.

b. The synopsis shall include the following information:

1. A brief description of the tasks, operations, tests, or checkouts to be performed.

2. The facility and area where the procedure is to take place

3. The departure and arrival locations if transportation is required

4. For launch vehicle and payload tests, when the test is normally performed in relation to launch day (for example, L-5)

6B.2.4 Identification of Specific Hazards

The following specific hazards shall be identified in each procedure:

a. The quantity and hazard classification of ordnance and propellants involved

b. The hazardous and non-hazardous configurations of the system prior to, during, and upon completion of the operation

6B.2.5 List of Safety Precautions

As applicable, a list of the following precautions shall be incorporated in each procedure:

a. Warnings

b. Cautions

c. Note inhibits

d. Safety devices

e. Control areas

6B.2.6 Facility Configuration Inspections

The procedure shall indicate the specific facility and safety clearance zone control area to be used.

a. The requirements for the performance of facility configuration inspections shall be incorporated in the procedures.

b. The facility configuration inspection requirements shall address verification of the following:

1. Facility explosive limits

2. Facility personnel limits

3. Posting of fire symbols when ordnance and propellants are moved into or out of a facility

6B.2.7 PPE and Emergency Equipment

a. PPE and emergency equipment requirements for each operation shall be incorporated in hazardous procedures.

b. The PPE and emergency equipment shall address the following:

1. PPE requirements according to the manufacturer model number, MIL-SPEC, or standard for compliance

2. The occasions for the use of PPE

3. Types of emergency equipment required

4. Location of the emergency equipment during the operation

5. The number of emergency equipment units required. **NOTE:** No substitution or configuration alteration of PPE will be allowed without specific Range Safety approval.

6B.2.8 Pre-Operational Checklist of Required Tools and Equipment

a. A pre-operational checklist of all tools and equipment required for safe operations shall be incorporated in the procedures.

b. For safety critical equipment, the following information shall be included:

1. Manufacturer, model, and serial number

2. Location of the equipment during the operation

3. The number of units required

4. The required monitoring devices and their alarm settings

5. Proof test requirements

6. Non-destructive examination requirements

7. Calibration requirements

6B.2.9 Support Personnel Requirements

a. Range User and Range support personnel requirements such as Operations Safety, Fire, Medical, and Security personnel shall be incorporated in the procedures. **NOTE:** In a multi-task procedure, the times these support personnel are needed shall be stipulated.

b. The following support personnel requirements shall be addressed:

1. The hazardous periods when personnel limits

APPENDIX 6B

HAZARDOUS AND SAFETY CRITICAL PROCEDURE REQUIREMENTS

shall be enforced

2. The minimum essential personnel by functional title and number required

3. The Operations Safety notification in all cases. **NOTE:** Operations Safety presence and concurrence is required prior to beginning all hazardous operations unless determined otherwise by Range Safety.

4. Special training, certifications, or experience requirements

6B.2.10 References to Applicable Documents

a. All applicable documents, drawings, and specifications shall be referenced in the procedures.

b. If a specific operations safety plan or other safety plans apply to the procedure, they shall be listed in the procedure reference section.

c. EWRR 127-1 shall be listed in the procedures.

d. Procedures shall not use excessive second tier references.

6B.2.11 CCAS Cape Support and WR Range Scheduling Notification

Notification of CCAS Cape Support (853-5211) on the ER and Range Scheduling (276-8825) on the WR 24-h prior to the planned start of the operation shall be incorporated in the procedures.

6B.2.12 Pre-Task Briefing

a. A step for the conduct of a pre-task briefing shall be incorporated in the procedures.

b. The following topics shall be addressed:

1. Operational hazards

2. Precautions

3. Emergency actions

4. Critical task items

5. Procedure flow

6. Operational discipline

7. Communication discipline

c. Specification that the briefing shall be repeated if a shift change is required.

6B.2.13 Step-by-Step Directions

a. Step-by-step directions, written in clear language, with sufficient detail to allow a qualified technician or mechanic to clearly understand and follow them, shall be incorporated.

b. The procedure shall contain applicable data

sheets, figures, and schematics to document or clarify system parameters and connect points.

6B.2.14 Identification of Hazardous and Safety Critical Portions of Procedures

a. The beginning and end of a hazardous or safety critical portion of a procedure shall be incorporated according to the following criteria:

1. A "Warning" shall be used to identify hazards to personnel.

2. A "Caution" shall be used to identify hazards to equipment.

3. A "Note" shall be used to indicate an operating procedure of such importance that it must be emphasized.

b. The activation of warning lights, Public Address (PA) announcements, and notification to Security of any controlled areas, if not accomplished as a pre-task item, shall be incorporated.

c. Safety highlights such as evacuations, safety clearance zones, clearances, activation of aural and visual warnings shall be detailed prior to the hazardous sequence and in the applicable section of the procedure.

6B.2.15 Emergency Shutdown and Backout Steps

Emergency shutdown and backout procedures or steps necessary to safe the system or facility in the event of a mishap, incident, or abort shall be incorporated.

6B.2.16 Transmittal of Procedures

Procedures shall be forwarded to Range Safety with a transmittal letter containing the following information:

a. Need Date (minimum of 30 calendar days review time required for existing programs; 45 for new programs)

b. Procedure title and number

c. Program identified or other identifier to ensure that the proper Range Safety point of contact receives the procedure

d. Special instructions for such items as review and comment and final copy for filing

e. Pertinent information such as "procedure is non-hazardous," "procedure change does not affect the hazardous portion of the procedure nor other-

APPENDIX 6B

HAZARDOUS AND SAFETY CRITICAL PROCEDURE REQUIREMENTS

wise have a safety impact,” or “all previous comments have been incorporated”

f. If the procedure has been previously submitted as a draft or with a different revision number, clarify the extent of the changes.

6B.3 EXAMPLES OF HAZARDOUS PROCEDURES

Examples of hazardous procedures include, but are not limited to, the following topics:

a. Pressurized Propellant Systems: Pressurization (pneumostat and hydrostat), loading and unloading, sampling, leak testing, venting.

b. Launch Vehicle and Payload Systems: Pressurization, loading and unloading, leak test, erection and lifting with ordnance and/or propellant, application of power with ordnance and/or propellant, safe and arm pin removal, mate and demate operation

c. Hazardous Facilities: High pressure systems, propellant flows in ground systems, propellant cart loading, ordnance checkout and installation, X-ray operations, cryogenic operations, fixture proof tests, emergency blackout procedures

d. Ordnance: Bore scope, X-ray, continuity test, propellant trimming, installation, electrical connection and disconnection

e. Work involving lasers, high energy RF emissions, radioactive materials, and hazardous materials

6B.4 CHANGES

Changes to previously submitted procedures shall be noted with change bars or a similar method of marking.

APPENDIX 6C INDEX OF PAD/AREA SAFETY PLANS

6C.1 ER OPERATIONS SAFETY PLANS

DELTA II COMPLEX 17 Operations Safety Plan and Safety Operations Plans (SOPs)

DELTA II AREA 57 Safety Plan and SOPs (Solid Motor Facility)

DELTA II AREA 55 Safety Plans and SOPs

DELTA II HANGAR M AREA Safety Plans and SOPs

DELTA II HAZARDS PROCESSING FACILITY AREA Safety Plan/SOP

ATLAS/CENTAUR Operations Safety Plan and Safety OP Plan

TITAN IV COMPLEX 40 Operations Safety Plan and SOPs

TITAN IV COMPLEX 41 Operations Safety Plan and SOPs

Operations Safety Plan for METEOROLOGICAL ROCKETS

TRIDENT I (CA)/II(D5) Operations Safety Plan and SOPs 1-5

EXPLOSIVE SAFE AREA EPA-60A, Area Safety Plan and Safety Op Plans

Safety OP Plans for Solid Rocket Booster Recovery and Disassembly Facility (Hangar AF)

NAVSTAR Processing Facility Safety Plan

Propellant Servicing Facility Safety Plan

DSCS III PROCESSING Facility Operations Safety Plan

Propellant Conditioning Facility Safety Plan

Payload Spin Test Facility Safety Plan

SHUTTLE PAYLOAD INTEGRATION FACILITY Safety Plan

COMPLEX 20 AND AREA 59 Operations Safety Plans and SOPs

SMAB EAST BAY and CENTER HIGH BAY Safety Plan

SMARF Operations Safety Plan

6C.2 WR OPERATIONS SAFETY PLANS

LMSC Building 3000 Safety Plans

SLC-4 Launch Complex Safety Plan

Lockheed Martin Astronautics Integrated Safety Plan for SLC-3E and SLC-3W

NASA Ground Safety Plan Off-Site Facility

Integration Processing Facility Safety Plan Space Launch Complex 6

Integration Processing Facility (IPF) Safety Plan

Astrotech Space Operations, L.P. Safety Standard Operating Procedure at VAFB.

Orbital Sciences Corporation Space Systems Division Facility Safety Plan for VAB.

Delta, SLC-2 VTC Safety Plan

NOTE: Additional plans shall be developed for facilities, systems, and operations as needed.

APPENDIX 6D
INDEX OF EXPLOSIVE (OPERATING AND AREA) SAFETY PLANS

- | | |
|---|--|
| 1 Conducting Scheduled Inspections of Explosives and Propellant Facilities on CCAS and Downrange Stations | 308 Handling OTTO Fuel |
| 2 Disposition of Unserviceable, Obsolete, Excess, and Suspended Ordnance Items | 309 Moving Trident D-5 Motors Through the Titan ITL Area |
| 201 Fuel Storage Area 1 (FSA-1), Liquid Propellants | 501 Demonstrations Involving Explosives |
| 302 Handling Explosives at CCAS Wharves | 502 Conducting Hazardous Operations in Explosives Operating Buildings |
| 303 Loading and Unloading Aircraft with Explosives or Other Hazardous Material at CCAS Auxiliary Air Field | 601 Storage of Explosives at Downrange Bases |
| 304 Loading and Unloading Aircraft with Explosives at Downrange Bases | 901 Transporting Explosives at CCAS |
| 305 On-Loading/Off-Loading Explosives Laden Trailer on Flatcars (TOFC) at the Railroad Loading Dock in the ITL Area | 902 Transporting Explosives at Downrange Bases |
| 307 HANDLING TRIDENT Missile Motors between the TITAN ITL Transfer Dock | 903 Motor Vehicle Transportation of Liquid Propellants and other Hazardous Chemicals at CCAS |
- NOTE:** Additional plans shall be developed for facilities, systems, and operations as needed.

APPENDIX 6E
MISCELLANEOUS SAFETY PLANS

SOP for Storage and handling of Acoustic Recoverable Deep Ocean Transponders and Lithium-Sulfur Dioxide Battery Assemblies

SOP for 45 SW LDCG

Danger Area Information Plan

Toxic Materials Release Contingency Plan (Cape Aural Warning Plan)

Ionizing Radiation and Radioactive Material Safety Operating Plans

DOT 5C Hydrazine Drum Storage and Operation Plan - Fuel Storage #1 CCAS Cape Support

SOP for Post Launch Safing Operations

SOP for Hazardous Material Debris Water Recovery Operation

**APPENDIX 6F
OVERHEAD CRANES AND HOISTS INSPECTION AND TEST SCHEDULE**

Category	Nomenclature	Operational Checks	Frequency			
			Structural/ Mechanical/ Electrical Checks	Rope/Hook Checks	Load Test	Hook Test
I	Enclosed environment; frequent or daily use (critical loads)	D	SA	M	A	A
IA	Enclosed environment; general use (critical loads)	P/U	SA	M	A	A
IB	Enclosed environment; idle 6 months (critical loads)	P/U (Q)	SA	P/U (M)	A	A
IC	Enclosed environment; standby (critical loads)	P/U (A)	SA	P/U (M)	P/U (1)	P/U (1)
II	Semi-enclosed environment; frequent or daily use (critical loads)	D	Q	M	A	A
IIA	Semi-enclosed environment; frequent or daily use (critical loads)	P/U	Q	M	A	A
IIB	Semi-enclosed environment; idle 6 months (critical loads)	P/U (Q)	P/U (Q)	P/U (M)	A	A
IIC	Semi-enclosed environment; standby (critical loads)	P/U (SA)	P/U	P/U (M)	P/U (1)	P/U (1)
III	Exposed environment; frequent or daily use (critical loads)	D	M	M	A	A
IIIA	Exposed environment; general use (critical loads)	P/U	P/U (M)	M	A	A
IIIB	Exposed environment; idle 6 months (critical loads)	P/U (Q)	P/U (M)	P/U (M)	A	A
IIIC	Exposed environment; standby (critical loads)	P/U (Q)	P/U	P/U (M)	P/U (1)	P/U (1)
IV	Enclosed environment; frequent or daily use (non-critical loads)	D	A	M	BE	A
IVA	Enclosed environment; general use (non-critical loads)	P/U	A	M	BE	A
IVB	Enclosed environment; idle 6 months (non-critical loads)	P/U (Q)	A	P/U (M)	BE	A

Category	Nomenclature	Operational Checks	Frequency			
			Structural/ Mechanical/ Electrical Checks	Rope/Hook Checks	Load Test	Hook Test

			Structural/ Mechanical/ Electrical Checks	Rope/Hook Checks	Load Test	Hook Test
IVC	Enclosed environment; standby (non-critical loads)	P/U (A)	P/U	P/U (M)	P/U (2)	P/U (1)
V	Semi-enclosed environment; frequent or daily use (non-critical loads)	D	SA	M	BE	A
VA	Semi-enclosed environment; general use (non-critical loads)	P/U	SA	M	BE	A
VB	Semi-enclosed environment; idle 6 months (non-critical loads)	P/U (Q)	P/U (6)	P/U (M)	BE	A
VC	Semi-enclosed environment; standby (non-critical loads)	P/U (SA)	P/U	P/U (M)	P/U (2)	P/U (1)
VI	Exposed environment; frequent or daily use (non-critical loads)	D	SA	M	BE	A
VIA	Exposed environment; general use (non-critical loads)	P/U	SA	M	BE	A
VIB	Exposed environment; idle 6 months (non-critical loads)	P/U (Q)	P/U (6)	P/U (M)	BE	A
VIC	Exposed environment; standby (non-critical loads)	P/U (Q)	P/U	P/U (M)	P/U (2)	P/U (1)

LEGEND

- A - Annually
- SA - Semi-Annually
- D - Daily (If used daily; otherwise prior to use)
- M - Monthly
- Q - Quarterly
- BE - Biennially
- P/U - Prior to use
- P/U(1) - Prior to use if longer than 1 year

- P/U(2) - Prior to use if longer than 2 years
- P/U(6) - Prior to use if longer than 6 months
- P/U(M) - Prior to use if longer than 1 month
- P/U(Q) - At least quarterly and prior to use
- P/U(SA) - At least semiannually and prior to use
- P/U(A) - At least annually and prior to use

NOTE: If a crane has been secured/mothballed, all checks shall be made prior to use.

APPENDIX 6F OVERHEAD CRANES AND HOISTS INSPECTION AND TEST SCHEDULE

SCOPE OF CHECKS/TESTS

Operational Checks: Operation of all controls, limits and safety circuits, and a running examination of ropes.

NOTE: The frequencies indicated in the “Operational Checks” column are binding on the range contractor only when the contractor has sole operating responsibility for the equipment. Under any other operating arrangement, the range contractor shall perform these checks only as a pre-requisite to the checks and at the frequencies specified in the “Struc/Mech/Elect Checks” column.

Struc/Mech/Elect Checks: Complete examination of structure and supports, gears, wheels, bearings, and brakes.

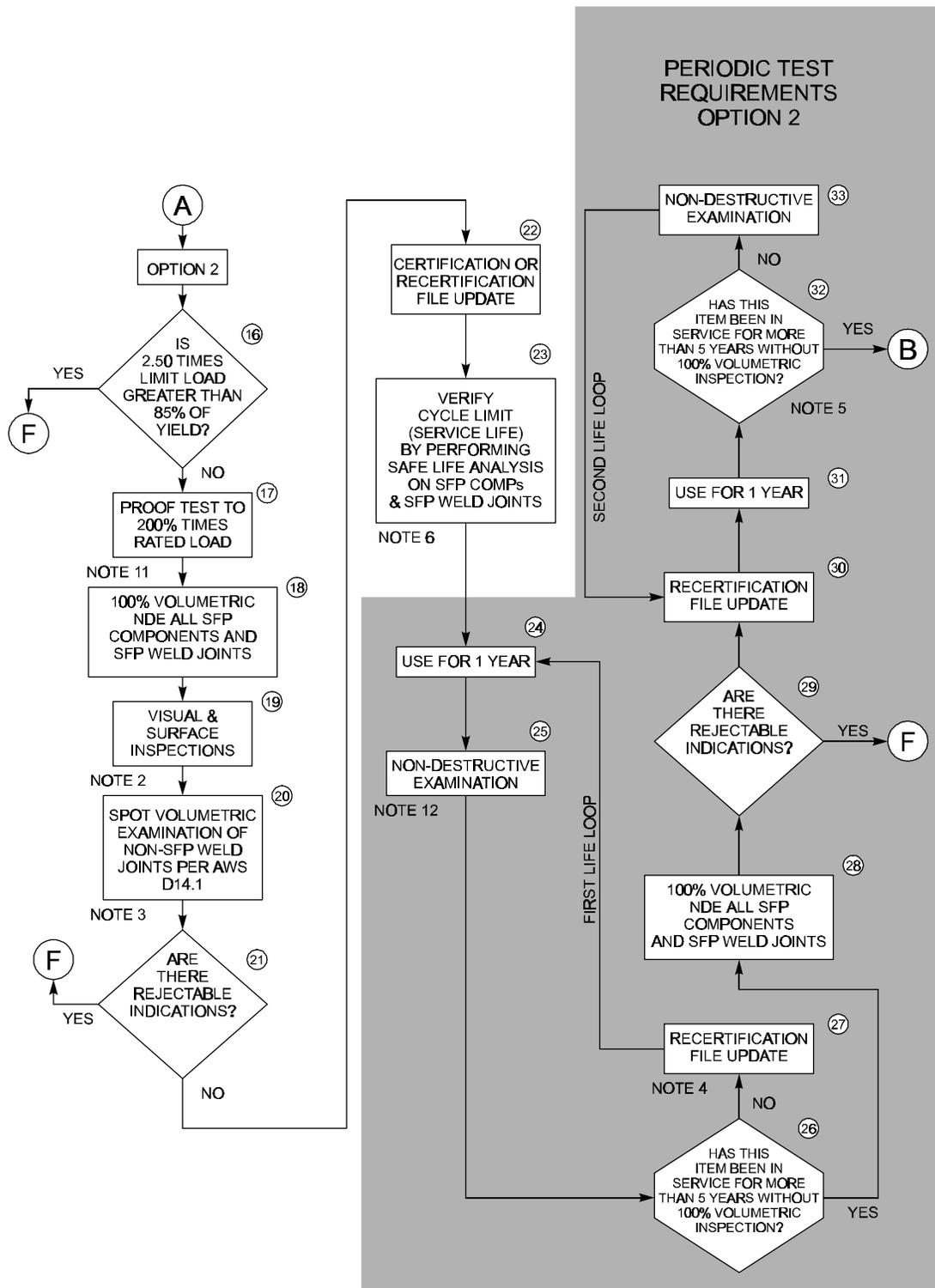
Rope/Hook Checks: Complete rope inspection for wear, broken wires, diameter reduction, and corrosion. Hook inspection for damage and distortion. **NOTE:** On installations with dead-end rope terminations, closely examine the termination to ensure the rope has not slipped in/through its fitting, and that the fitting is not cracked.

Load Test: Test initially and following major repairs, alterations and modifications to 125 percent of rated load, and thereafter to 100 percent per range policy.

Hook Test: Test by magnetic particle or other suitable crack detecting process.

This Appendix supersedes all previous editions.

APPENDIX 6G HANDLING STRUCTURES INITIAL AND PERIODIC TEST REQUIREMENT FLOWPATH



APPENDIX 6G HANDLING STRUCTURES INITIAL AND PERIODIC TEST REQUIREMENT FLOWPATH

NOTES

1. Design, Fabrication, and In-Process Requirements:
 - a. Meet EWR 127-1 design requirements for handling structures.
 - b. Identify Single Failure Point (SFP) components and SFP welds.
2. Perform 100 percent visual inspection of all components (including SFP) and weld joints (including SFP and non-SFP) and perform 100 percent surface Non-Destructive Examination (NDE) testing of all SFP components and SFP welds.
3. Perform volumetric NDE inspection of 4 inches or 10% (which ever is less) of every continuous non-SFP weld in accordance with AWS D14.1, paragraph 8.9.5.
4. A cycle count is required.
5. Material Handling Equipment (MHE) and Material Handling Safety Equipment (MHSE) that has been in service for 10 years or 2500 cycles, whichever is less, shall be evaluated against current Range Safety standards and requirements.
6. Perform safe-life analysis assuming flaws to be in the worst location (i.e. transition areas, heat affected areas, weld joints, membrane sections, and highest stressed areas). Safe-life analysis shall be performed using fatigue crack growth computer programs such as NASA/FLAGRO (JSC-22267) or other Range Safety approved computer programs or analysis methods.

NOTE: Fracture Mechanics Analysis used to established cyclic limits may assume "crack like defects", this does not imply that cracks or other rejectable indications are acceptable. The logic identified in this flow chart requires that cracks and rejectable indications be fixed.
7. Provide noncompliance issues (if any) to Range Safety for disposition.
8. All parts shall be considered to have a low-fracture toughness their material property ratio $K_{Ic}/F_{ty} < 0.33 \text{ in}^{1/2}$. If the part is a steel bolt and the K_{Ic} value is unknown, low fracture toughness shall be assumed when $F_{tu} > 180 \text{ ksi}$.

Where: K_{Ic} = Plane strain fracture toughness.
 F_{ty} = Allowable tensile yield strength.
 F_{tu} = Allowable tensile ultimate strength.

Reference: NASA NBH 8071.1
9. Fix hardware. This means either repair or an analytical solution is required as approved by Range Safety.
10. Periodic test and inspection requirements are identified within the gray areas of the flow chart. All other processes identified within the figure are considered initial test requirements.
11. Proof test shall be performed on fully assembled handling structures, unless otherwise approved by Range Safety. Do not proof test greater than 85 percent of yield.
12. Perform (NDE) in accordance with Range Safety approved NDE plan.

APPENDIX 6H

WESTERN RANGE SPACE AND MISSILE MISHAP PREVENTION PROGRAM FOR BALLISTIC MISSILE OPERATIONS

6H.1 INTRODUCTION

This Appendix describes procedures, requirements, and responsibilities for the VAFB Space and Missile Mishap Prevention Program applicable only to visiting DoD ballistic missile operators.

6H1.1 Policy

The policy of the mishap prevention program is to prevent mishaps or malfunctions which could result in personnel fatality or injury, or destruction or damage to property and equipment.

6H.1.2 Responsibilities

Mishap prevention is a direct function of command and because of the scope and variety of Space and Missile Operations at VAFB, command direction and support are essential.

6H.1.2.1 30 SW Commander

As the host, the 30 SW Commander has the overall responsibility for safety at VAFB. The Commander's safety responsibilities include:

- a.* Directing the development and implementation of a safety program which integrates safety policy into all operations and activities.
- b.* Taking action to abate hazards.
- c.* Ensuring supporting programs are implemented by all subordinate and tenant commanders.
- d.* Providing safety support to tenant organizations as defined in AFR 11-4 agreements.
- e.* Providing for a Radiation Safety Committee to enforce radiation protection of radioactive sources according to applicable USAF and NRC directives and licenses.
- f.* Support investigating and reporting of mishaps, including missile mishaps which include AFSPC resources; furnish investigative resources to tenants when requested.

6H.1.2.2 30th Space Wing, Chief of Safety (30 SW/SE)

All personnel are charged with performing those technical, management, and staff actions necessary to ensure comprehensive and coordinated execution of mishap prevention programs. As such, each shall:

- a.* Ensure compliance with safety directives and

applicable standards and maintain formal, written plans to implement those directives and standards.

- b.* Provide safety policy for subordinate units involved in missile and space operations.

- c.* Establish and define mishap prevention criteria for hazardous operations associated with each type of missile and space system at VAFB and coordinate, as required.

- d.* Provide policy on the types, standards, and use of protective clothing and equipment. Such policy, when appropriate, shall be coordinated with the 30th MDG/SGPB, VAFB.

- e.* Furnish policy for the handling and storage of fuels, oxidizers, and other potentially hazardous materials associated with missile and space operations. Such policy, when appropriate, shall be coordinated with all appropriate agencies.

- f.* Conduct safety inspections of activities and facilities.

- g.* Initiate requests for appointing accident investigation boards and investigating officers, as required.

- h.* Monitor and coordinate USAF Hazard Reports as required by AFI 91-202.

- i.* Maintain mishap and accident records and statistics, analyze cause factors, and disseminate information on accident prevention to appropriate organizations and agencies.

- j.* Coordinate with the 30th Medical Group/ SGB and other directorates and agencies on mishap prevention.

- k.* Monitor adequacy of safety training.

- l.* Assign safety personnel to periodically observe hazardous operations at all levels to ensure adherence to safety principles and compliance with appropriate technical data.

- 1.* The degree and frequency of surveillance (i.e., spot checks) necessary shall depend on factors such as the nature of the operation; the history and experience of the system; the quality of written directives available; the personnel involved (task force, local missile squadron, or contractor); the number of safety personnel available; and the type of facility.

- 2.* A minimum number of safety personnel may be present during all hazardous operations. Sound professional judgment shall be used to keep the

APPENDIX 6H
WESTERN RANGE SPACE AND MISSILE MISHAP PREVENTION PROGRAM
FOR BALLISTIC MISSILE OPERATIONS

total number of personnel to an absolute minimum while ensuring adequate safety surveillance.

6H.1.2.3 576 Flight Test Squadron/Test and Evaluation (576 FLTS/TE)

a. Exercise staff supervision over missile combat crews and ensure established safety procedures are used in all missile activities under their control.

b. Coordinate with directorates and appropriate agencies on test and evaluation functions pertaining to missile ground safety.

c. Ensure prompt reporting to 576 FLTS/CC and 30 SW/SE of all personnel injuries or property damage occurring during missile ground operations under the 30 Range Sq control.

d. Obtain the required approvals from 30 SPW/SES, in coordination with 576 FLTS/CC, for 20th AF launch programs as required by Chapter 1 of this document.

e. The Command Control Directorate (DOC) shall establish policies and procedures to ensure prompt notification of required agencies per AFI 91-204, AFI 32-4001, 30 SW OPLAN 355-1, 30 SW 127-3, and this document. Additionally, DOC shall ensure prompt reporting to 30 SW/SE of all personnel injuries or property damage.

6H.1.2.4 576 Flight Test Squadron/Test Maintenance (576 FLTS/TM)

a. Exercise staff supervision of missile maintenance activities performed by 20th AF task force personnel.

b. Coordinate with appropriate agencies on functions pertaining to missile ground safety.

c. Ensure prompt reporting to 576 FLTS/CC and 30 SPW/SE of all personnel injuries or property damage occurring at launch facilities or during maintenance activities.

d. Exercise staff supervision to ensure maintenance time lines do not exceed duty limitations in AFI 21-114 and this document.

e. Ensure comprehensive plans are developed for Missile Potential Hazards, PSRE Emergency Response, and other life-threatening or potentially dangerous situations.

f. Develop Task Supervisor's safety check-lists for the operational base task forces to support the SAC Follow-on Operational Test and Evaluation

program.

6H.1.2.5 30th Civil Engineering Group (30 CEG/DEO)

a. Provide personnel and equipment to support missile operations as specified in this document and the MOSR system.

b. Establish policies and procedures governing activities of the base Disaster Control per Section 7.4.2.5 and this document in accordance with AFI 91-202.

c. Ensure compliance with established safety standards on installed missile equipment and facilities, supporting shops, and associated facilities.

6H.1.2.6 30th Medical Group

a. Provide medical personnel and equipment to support missile and space operations as required by higher headquarters directives and policies or as specified in this document and the MOSR system.

b. Monitor health problems associated with missile and space operations.

c. Conduct health hazard surveys and coordinate findings with 310th TTW and 30 SW/SE as appropriate.

d. Establish supplementary policy pertaining to medical care and support requirements for missile and space operations on VAFB. Such supplemental policies shall be coordinated with affected agencies.

e. Coordinate on specific MOSRs to ascertain compliance with medical care and support requirement policies.

f. Coordinate on and provide Bioenvironmental Engineering support as required for missile and space operations and associated facilities or as specified in the applicable MOSR.

6H.1.2.7 Tenant, Range User, Organizations Supporting Missile and Space Operations, and Contractors

a. Comply with safety standards and criteria contained in this document and other pertinent safety directives such as AFOSH and OSHA.

b. Forward recommended revisions and new safety criteria to 30 SW/SE and maintain an approved safety plan covering all activities.

c. Expeditiously report personnel injuries and property damage to the appropriate safety office as

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required by existing directives.

d. Conduct safety training for assigned personnel as appropriate.

6H.1.2.8 Task Supervisor

Task Supervisor is defined as “the person immediately responsible for all aspects, including safety, of a specific task or operation.” For example, in the Minuteman system, the dispatching maintenance team chief would be the Task Supervisor. While the requirements contained in this document are primarily designed for hazardous operations, the basic safety philosophy applies for all operations at VAFB. **NOTE:** The presence of a safety officer and NCO does not relieve the Task Supervisor of any safety responsibilities. Task Supervisors shall ensure all safety requirements are met.

a. Specific Task Supervisor safety responsibilities and requirements which shall be accomplished before and during a hazardous operation are as follows:

1. Activation of the appropriate safety clearance zone(s) using barriers, warning devices, or other means, as required.

2. Ensuring clearance of nonessential personnel from the applicable safety clearance zone before starting the operation and controlling areas thereto throughout the operation.

3. Ensuring the accomplishment of a thorough pre-task briefing, in addition to those specified in the applicable tech data. The Task Supervisor pre-briefing shall cover all special procedures to be followed during the operation.

4. Verifying communications meet established safety standards, required safety equipment is correctly pre-positioned and personnel warning devices, hazard detecting warning systems, damage control systems, and primary electrical power systems are operable before starting the operation.

5. Ensuring the necessary support personnel

required for the operation are available before starting the operation and operational control of such support elements are clearly maintained at all times throughout the task. **NOTE:** This responsibility includes briefing such support elements before the start of the hazardous operation regarding positioning, communications, and emergency actions.

6. Maintaining strict compliance with approved safety criteria, operating procedures, checklists, and other such directives appropriate to the task to be performed. **NOTE:** This requirement includes the proper use of protective clothing and equipment required to support the task.

7. Ensuring good housekeeping exists before starting the operation and ensuring the site is left in good condition upon task completion.

8. Ensuring all applicable personnel are aware of emergency procedures. **NOTE:** This responsibility includes ensuring personnel understand all warning lights, sirens, and barriers and the use and location of proper escape routes.

9. Properly announcing the start and termination of the operation and ensuring all support agencies are properly released.

10. Calling a Safety Hold or GO/NO-GO whenever any of the above requirements are not properly performed, or if the safety of the operation or personnel in surrounding areas become jeopardized.

b. Task Supervisors shall ensure all visitors are briefed on specific facility operations in progress and the inherent safety hazards present.

c. Task Supervisors safety checklists for hazardous operations and visitors safety briefing shall be developed in consonance with this document, as necessary.

1. These checklists shall be designed to assist individual Task Supervisors in activating safety clearance zones and accomplishing the safety responsibilities noted above.

2. Agencies shall use the following checklist as a guide. Before publication, coordinate checklists and have them approved by 30 SW/SE.

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TASK SUPERVISOR GUIDELINES
CHECKLIST FOR HAZARDOUS OPERATIONS
(may be modified as appropriate)

Pre-Task Requirements

- _____ 1. Hazardous operation identified and scheduled on MOSR.
- _____ 2. Name of Task Supervisor provided.
- _____ 3. Safety Clearance Zone(s) identified, as applicable.
 - _____ a. Hazard Area _____ (size of area, radius)
 - _____ b. Potential Hazard Corridor (PHC) identified.
(Superimposed on appropriate Safety Clearance Zone.)
 - _____ (1) Source strength based on maximum anticipated spill.
 - _____ (2) See GO/NO-GO restrictions in this document.
 - _____ (3) Operation shall not start until all facilities in the Safety Clearance Zone have been alerted or cleared.
- _____ 4. Identify essential personnel authorized to remain in Safety Clearance Zone.
- _____ 5. Ensure applicable Emergency Support Team(s) is/are present and notified per applicable MOSR.
- _____ 6. Assemble and brief applicable task personnel, to include support team elements.
 - _____ a. Type of operation and identification of Safety Clearance Zone(s).
 - _____ b. Period of activation of Safety Clearance Zones and hazards involved.
 - _____ c. Location of Emergency Support Team “control point” and access control requirements.
 - _____ d. Communication procedures and requirements.
 - _____ e. Emergency response actions and use of warning devices and barriers, etc.
 - _____ f. Emergency and personal protective clothing and equipment required.
 - _____ g. Escape routes and additional precautions to be exercised.
 - _____ h. Special procedures in addition to procedures specified in appropriate TO checklist.

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- _____ 7. Ensure personnel warning devices are operable as required.
- _____ 8. Ensure availability of emergency and protective clothing and equipment.
- _____ 9. Make final check that area housekeeping is adequate.
- _____ 10. Position technicians and Emergency Support Team(s), as applicable.
- _____ 11. Establish pre-task communications checks.
- _____ 12. Activate appropriate warning light and clear area of nonessential personnel.

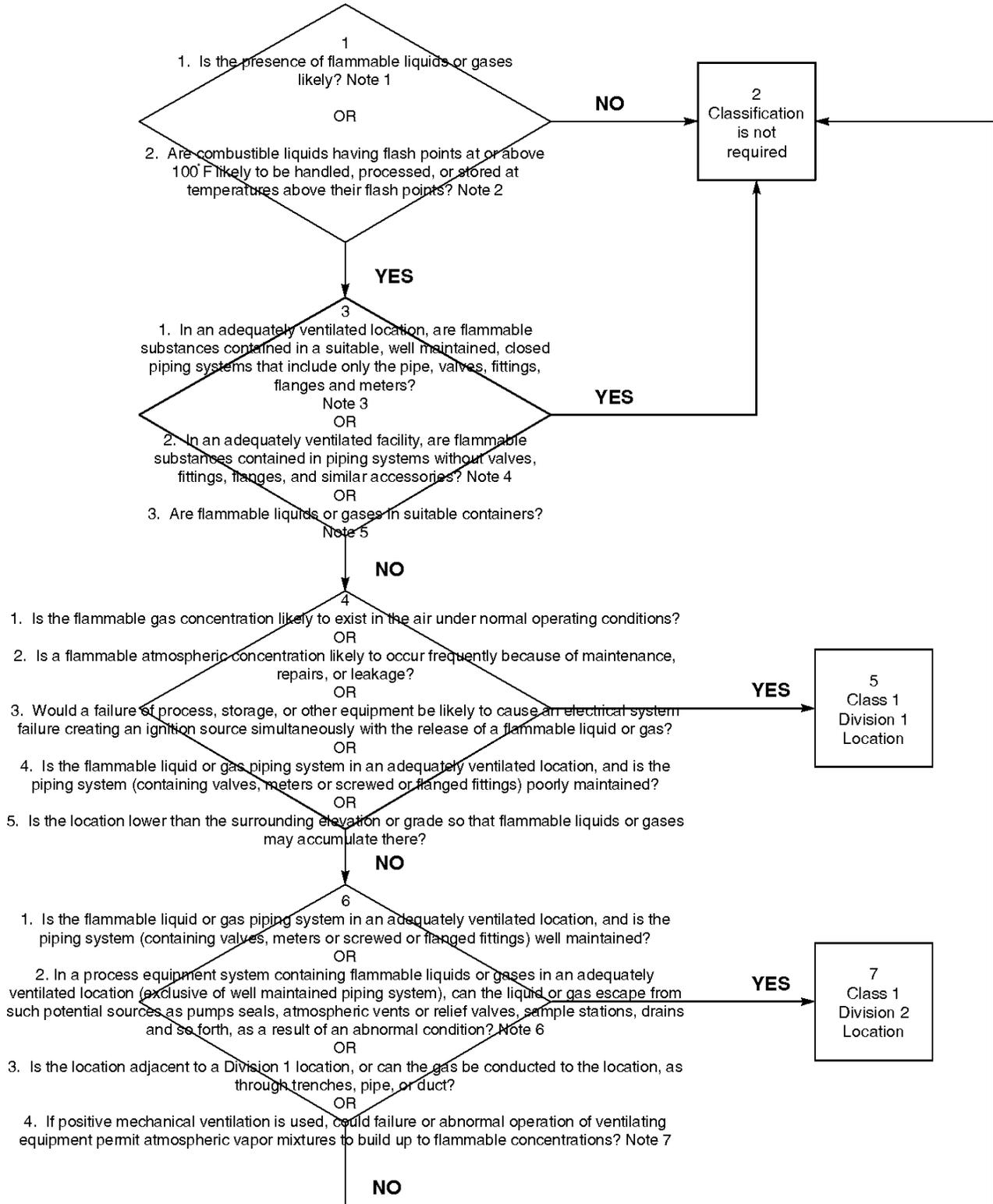
Task Requirements

- _____ 1. Control access to Safety Clearance Zone for duration of hazardous and/or dangerous period.
- _____ 2. Ensure compliance with approved checklists and established safety criteria.
- _____ 3. Monitor operating procedures as necessary to ensure proper task completion.
- _____ 4. Announce start and termination of applicable tasks, as required.
- _____ 5. Violation of approved criteria shall require a Hold be declared.

Post-Task Requirements

- _____ 1. Announce termination of hazardous operation.
- _____ 2. Extinguish warning light and deactivate Safety Clearance Zone.
- _____ 3. Dismiss support elements and ensure work area is left in proper condition.
- _____ 4. Check, clean, and return emergency equipment to proper storage.

APPENDIX 6I HAZARDOUS AREA CLASSIFICATION



APPENDIX 6I HAZARDOUS AREA CLASSIFICATION

NOTES

- 1: The following are considered flammable liquids/gasses:
 - a. Unsymmetrical dimethyl hydrazine (UDMH) - Flashpoint 34⁰F
 - b. Monomethyl hydrazine (MMH) - Flashpoint 62⁰F
- 2: Hydrazine (N₂H₄) - is considered a combustible liquid.
 - a. The surface temperature of potential spill areas must also be considered.
 - b. Temperature in the area must be single fault tolerant to remain below 100⁰F.
 - c. Below grade locations may still accumulate enough N₂H₄ to become flammable at lower temperatures.
- 3: Adequate ventilation is defined by NFPA 30, *Flammable and Combustible Liquids Code*, as that which is sufficient to prevent the accumulation of significant quantities of vapor-air mixtures in concentrations over 25 percent of the lower flammability limit.
 - a. An adequately ventilated location is one of the following:
 1. An outside location
 2. A building, room, or space that is substantially open and free of obstruction to the natural passage of air, either vertically or horizontally. Such locations may be roofed over with no walls, may be roofed over and closed on one side or may be provided with suitably designed wind breaks.
 3. An enclosed or partly enclosed space provided with mechanical ventilation equivalent to natural ventilation. The mechanical ventilation system must have adequate safeguards against failure.
 - b. Lower flammability limits of specific commodities are as follows:
 1. N₂H₄ - 4.7 percent
 2. MMH - 2.5 percent
 3. UDMH - 2.0 percent
 - c. Payload propellant systems cannot normally be considered closed piping systems that include only the pipe, valves, fittings, flanges, and meters; they normally also include a pressure vessel.
- 4: Payload propellant systems cannot normally be considered piping without valves, fitting, flanges, and similar accessories.
- 5: Payload propellant systems cannot be considered suitable containers unless they meet DOT or ASME requirements or meet EWR 127-1, section 3.12 and are also protected from outside damage.
- 6: A payload propellant system would normally be considered a process equipment system. In a dynamic mode, the answer to this question will almost always be *yes*; in a static mode, the answer may be *yes* or *no* depending on past history and adequacy of protection from outside damage.
- 7: An analysis must be provided. Consideration must be given to the size of the containment area, credible potential size of the spill, adequacy of the ventilation equipment and its potential failure modes, and the specific gravity of the commodity in question.