BY ORDER OF THE COMMANDER
AIR FORCE SPACE COMMAND

AIR FORCE SPACE COMMAND
MANUAL 91-710 VOLUME 6

1 JULY 2004

Safety

RANGE SAFETY USER REQUIREMENTS MANUAL VOLUME 6 - GROUND AND LAUNCH PERSONNEL, EQUIPMENT, SYSTEMS, AND MATERIAL OPERATIONS SAFETY REQUIREMENTS

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OPR: AFSPC/SEC (Lt Col John Humphries)

Certified by: AFSPC/SE (Col Billy Colwell)
Pages: 143
Distribution: F

This manual implements Department of Defense Directive (DoDD) 3100.10, ***Space Policy***; DoDD 3200.11, ***Major Range and Test Facility Base***; DoDD 3230.3, ***DoD Support for Commercial Space Activities***; Air Force Policy Directive (AFPD) 91-1, ***Nuclear Weapons and Systems Surety***; AFPD 91-2, ***Safety Programs***; AFPD 63-12, ***Assurance of Occupational Safety, Suitability, and Effectiveness***; Air Force Instruction (AFI) 91-202, ***The US Air Force Mishap Prevention Program***, (AFSPC Sup 1); and the ***Memorandum of Agreement between the Department of the Air Force and the Federal Aviation Administration on Safety for Space Transportation and Range Activities***.

This volume contains information previously found in Eastern and Western Range 127-1, Chapter 6, ***Ground Personnel, Equipment, Systems, and Material Operations Safety Requirements***. It contains safety requirements for ground and launch support personnel and equipment, systems, and material operations on the Air Force Space Command (AFSPC) ranges, including the Eastern Range (ER) and Western Range (WR). The following major topics are addressed: Range User responsibilities; ground operations policies; documentation requirements; ground operations general requirements; material handling equipment, crane and hoist, personnel platform, powered industrial truck, and elevator operations; acoustic hazard operations; non-ionizing radiation operations; radioactive (ionizing radiation) sources operations; hazardous materials operations; ground support and flight hardware pressure systems operations; ordnance operations; electrical systems operations; motor vehicle operations; convoy operations; launch operations; and solid rocket motor and motor segment operations.

This volume applies to all Range Users conducting or supporting operations on the AFSPC ranges. Range Users include any individual or organization that conducts or supports any activity on resources (land, sea, or air) owned or controlled by AFSPC ranges. This includes such organizations as the Department of Defense (DoD), United States (US) government agencies, civilian launch operators, and foreign government agencies and other foreign entities that use AFSPC range facilities and test equipment; conduct prelaunch and launch operations, including payloads to orbital insertion or impact; and/or require on-orbit or other related support. Commercial users intending to provide launch services from one of the ranges shall have a license or license application in process from the Department of Transportation's Federal Aviation

Administration (FAA) or have a DoD sponsorship and be accepted by the DoD to use the ER or WR. Foreign government organizations or other foreign entities shall be sponsored by an appropriate US government organization or be a customer of a Range User. This volume applies to the Air National Guard. It does not apply to the Air Force Reserve Command.

NOTE: Volume 1 includes a complete table of contents for all the volumes of AFSPCMAN 91-710. In addition, each individual volume contains its own table of contents. Volume 7 contains a glossary of references, acronyms and abbreviations, and terms for use with all the volumes. Special publication formatting features are described in 1.2 of this volume.

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CHAPTER 1

INTRODUCTION

1.1. Applicability. All Range Users operating on the AFSPC ranges are subject to the requirements of this volume to ensure that operations are conducted safely. Air Force Occupational Safety and Health (AFOSH) standards do not apply to contractors or contractor employees except where Air Force personnel or property are endangered or if specifically required by the contract.

1.2. Organization of the Volume:

1.2.1. Main Chapters. The main chapters of this volume include common requirements for all vehicle classes. Appendixes include additional requirements to supplement the main chapters.

1.2.2. Open Text. The open text contains the actual mandatory performance-based requirements. The only tailoring expected for these requirements would be the deletion of non-applicable requirements. For example, solid rocket motor performance requirements would be deleted for launch systems that do not use solid rocket motors.

1.2.3. Bordered Paragraphs:

1.2.3.1. Bordered paragraphs are non-mandatory and are used to identify some of the potential detailed technical solutions that meet the performance requirements. In addition, the bordered paragraphs contain lessons learned from previous applications of the performance requirement, where a certain design may have been found successful, or have been tried and failed to meet the requirement. These technical solutions are provided for the following reasons:

1.2.3.1.1. To aid the tailoring process between Range Safety and Range Users in evaluating a potential system against all the performance requirements.

1.2.3.1.2. To aid Range Safety and Range Users in implementing lessons learned.

1.2.3.1.3. To provide benchmarks that demonstrate what Range Safety considers an acceptable technical solution/implementation of the performance requirement and to help convey the level of safety the performance requirement is intended to achieve.

1.2.3.2. The technical solutions in the bordered paragraphs may be adopted into the tailored version of the requirements for a specific program when the Range User intends to use that solution to meet the performance requirement. At this point, they become mandatory requirements to obtain Range Safety approval. This process is done to:

1.2.3.2.1. Provide an appropriate level of detail necessary for contractual efforts and to promote efficiency in the design process.

1.2.3.2.2. Avoid contractual misunderstandings that experience has shown often occur if an appropriate level of detail is not agreed to. The level of detail in the bordered paragraphs is necessary to avoid costly out-of-scope contractual changes and to prevent inadvertently overlooking a critical technical requirement.

1.2.3.3. The Range User always has the option to propose alternatives to the bordered paragraph solutions. Range User proposed alternative solutions shall achieve an equivalent level of safety

and be approved by Range Safety. After meeting these two requirements, the Range User proposed solutions become part of the tailored AFSPCMAN 91-710 for that specific program.

1.2.3.4. Range Safety has final decision authority in determining whether Range User proposed detailed technical solutions meet AFSPCMAN 91-710 performance requirements.

1.3. Compliance Documents. Occupational Safety and Health Administration (OSHA) (29 CFR), Environmental Protection Agency (EPA) (40 CFR), Department of Transportation (DOT) (49 CFR), AFOSH, Air Force instructions (AFIs), and industry standards are specified as compliance documents throughout this volume. When there is a conflict between federal regulations, industry standards, and other requirements, the more stringent requirement shall be used.

CHAPTER 2

RESPONSIBILITIES AND AUTHORITIES

2.1. Range Safety, 45 and 30 Space Wings. Unless otherwise noted, all references to *Range Safety* in this volume refer to the Systems Safety organizations of the 30 and 45 Space Wings. The Range Safety offices are responsible for the review and approval of all hazardous and safety critical procedures and operations at the ER and WR, other than those limited to complex safety, in accordance with the requirements of this volume. Specific responsibilities of Range Safety include the following:

2.1.1. Review and Approval. Reviewing and approving:

2.1.1.1. Operations Safety Plans (OSPs).

2.1.1.2. Ground Operations Plans (GOPs).

2.1.1.3. Danger Area Information Plans (DAIPs).

2.1.1.4. Facility Emergency Operating Plans (FEOPs) other than those limited to complex safety.

2.1.1.5. Launch Complex Operations Safety Program Plans (LCOSPPs).

2.1.1.6. Other documents as specified in this document.

2.1.1.7. During the review and approval process, both Range Safety and the Range User shall assure timely coordination with other Wing agencies as appropriate. Other Wing agencies include, but are not limited to, Pad Safety, Medical, Civil Engineering, and the Fire Department.

2.1.2. General:

2.1.2.1. Ensuring that hazardous and safety critical facilities are periodically inspected as required.

2.1.2.2. Monitoring hazardous and safety critical operations.

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

2.1.3. Pad Safety. Although the following are not Range User requirements, it is intended that the Range User be familiar with some of the key responsibilities of the Pad Safety function as they relate to the Range User's safety requirements. Pad Safety functions are performed by the 30 SW Ground Safety organization and by a contractor at the 45 SW. ***NOTE:*** Unless otherwise noted, these two groups (Ground Safety (30 SW) and contractor (45 SW)) shall be referred to as Pad Safety in this volume.

2.1.3.1. General Responsibilities. Pad Safety shall participate in meetings and events as directed by Range Safety, including the following.

2.1.3.1.1. Observe, evaluate, and enforce compliance of Range Safety requirements by all personnel within the launch complexes, assembly and checkout areas, propellant and ordnance storage areas, and other areas as deemed appropriate by Range Safety. Note: Pad Safety personnel shall not be denied access to any area where hazardous operations are conducted.

2.1.3.1.2. Review and provide comments on hazardous procedures to Range Safety.

2.1.3.1.3. Review and provide comments on system design data and operating procedures.

2.1.3.1.4. Implement specified safety precautions and impose safety holds, when necessary, during ground operations, as required by procedures or OSP.

2.1.3.1.5. Assist in the resolution of safety problems in areas where Pad Safety has jurisdiction.

2.1.3.1.6. Attend meetings and conferences that involve safety working groups and facility working groups, technical interchange meetings, etc., as necessary.

2.1.3.1.7. Coordinate with the Radiation Protection Officer (RPO) to ensure enforcement of the Radiation Control Program in all areas where launch vehicles, payloads, and their related hazards are located.

2.1.3.1.8. Coordinate with Bioenvironmental Engineering and Environmental Health (both Health Physics and Industrial Hygiene) on environmental health hazards.

2.1.3.1.9. Notify Environmental Health, Range Safety, Range Scheduling (30 SW), and Cape Support (45 SW) immediately anytime an incident involves an environmental health hazard.

2.1.3.1.10. When present, Pad Safety shall ensure the evacuation of personnel from launch complexes and facilities and operations are halted when a lightning hazard is imminent in accordance with the various safety plans.

2.1.3.1.11. Respond to mishaps and/or incidents in accordance with 30/45 SW OPLANs 32-1.

2.1.3.1.12. Assist Range Users on safety related issues.

2.1.3.2. Hazardous and Safety Critical Pad Support. Pad Safety shall provide oversight of the Range User for the following:

2.1.3.2.1. Ensure compliance with established directives and procedures during hazardous and safety critical operations.

2.1.3.2.2. Assess procedure deviations and resolve with Range Safety, as necessary.

2.1.3.2.3. Ensure the number of personnel is kept to a minimum in designated safety clearance zones in accordance with Range Safety approved procedures. Note: Pad Safety shall be included in the maximum allowable manning level, unless Range Safety determines that adequate support can be provided from a remote location.

2.1.3.2.4. Ensure a comprehensive safety briefing is conducted and understood by participants prior to the start of a hazardous operation.

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

2.1.3.2.6. Advise the operation control authority on whether or not to stop operations when a hazardous condition or a safety compromise exists.

2.1.3.2.7. Allow operations to resume only after the imminent danger no longer exists and safety requirements are met.

2.1.3.2.8. Pad Safety shall operate the Hazard Monitor System (HMS) console for all Spacecraft Processing Integration Facility (SPIF) hazardous operations (45 SW only).

2.1.3.3. Notifications:

2.1.3.3.1. Immediately notify the appropriate agency (Command Post at the 30 SW and Range Safety at the 45 SW) 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.

2.1.3.3.2. Verbally notify Range Safety of any violation of this document as soon as possible. If requested by Range Safety, a written report shall be provided to Range Safety within five calendar days of the violation. The requirements in 2.1.6.3.2 apply only to the 45 SW.

2.1.3.4. Flight Termination System (FTS) Installation, Checkout, and Status (45 SW Only).

Monitor and verify the installation, checkout, and status of the FTS in accordance with Range Safety instructions at locations designated by Range Safety, including submarines.

2.1.3.5. Inspections:

2.1.3.5.1. Inspect all explosive areas and facilities at least annually to determine compliance with the requirements of this document and AFI 91-201, ***Explosives Safety Standards***. These duties are performed by SEW at the 30 SW.

2.1.3.5.2. Inspect critical facilities prior to the start of a hazardous operation or as directed by Range Safety.

2.1.3.5.3. Inspect new and modified critical facilities prior to the initial start up operation, prepare inspection reports on these facilities, and submit the reports to Range Safety within 15 calendar days of the inspection (45 SW only).

2.1.3.5.4. Audit the execution of procedures for handling ordnance, propellant material, and high pressure gases performed on CCAFS and VAFB at least quarterly.

2.1.3.5.5. Audit the execution of procedures for handling ordnance, propellant material, and high pressure gases performed on down range facilities at least annually.

2.2. Range User Responsibilities. Range Users are responsible for the following:

2.2.1. Range User Control Authority Responsibilities. When certified in accordance with the Launch Complex Safety Training and Certification Requirements, the control authority is responsible for the following. (See Volume 1, Attachment 7 for the Launch Complex Safety Training and Certification Requirements.) If this option is used, Range Safety shall audit the program on an unannounced and periodic basis. Range Safety shall perform these duties if a control authority is not qualified. Range Safety can assume these responsibilities for qualified control authorities, if requested.

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

2.2.1.2. Reviewing and approving Emergency Evacuation Plans (EEPs) and Facility Emergency Operating Plans (FEOPs) that are limited to launch complex safety.

2.2.1.3. Where the hazard is limited to launch complex safety or to the defined geographic areas specified in the Range User's safety control authority per the LCOSPP, ensuring facilities are inspected in accordance with 5.8.3.1 of this volume.

2.2.1.4. Monitoring hazardous and safety critical operations that are limited to launch complex safety or to the defined geographic areas specified in the Range User's control authority per the LCOSPP, as required.

2.2.1.5. Defining the threat envelopes of all hazardous operations limited to launch complex safety or assigned facilities (the defined geographic area specified in the Range User's safety control authority per the LCOSPP) and establishing safety clearance zones to protect launch complex personnel and resources.

2.2.1.6. Reviewing Range User training plans to ensure that all personnel performing hazardous operations that are limited to defined geographic areas specified in the Range User's LCOSPP are provided adequate training to conduct their jobs and tasks properly.

2.2.1.7. Ensuring that adequate PPE required to comply with approved procedures, OSPs, FSDPs, and GOPs is available to all personnel entering the defined areas specified in the Range User's LCOSPP.

2.2.1.8. Coordinating with and supporting Pad Safety in carrying out Pad Safety required inspections.

2.2.2. Conduct of Operations:

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

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

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

2.2.3. Notification of Hazardous and Safety Critical Operations to Range Agencies:

2.2.3.1. Notifying Cape Support (853-5211) for the ER and Range Scheduling (606-8825) for the WR at least 24 hours before the start of any hazardous or flight termination system (FTS)-related operation. The following information shall be provided: date, time, nature of the operation, location, and procedure or task number.

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

2.2.3.3. Notifying Range Safety and Pad Safety at least 30 calendar days before the scheduled erection of a launch vehicle and/or payload.

2.2.4. Document Preparation and Maintenance:

2.2.4.1. Developing and implementing a Ground Operations Plan (GOP) in accordance with Attachment 1 of this volume to cover operations conducted on the ranges.

2.2.4.2. Developing and implementing procedures and general instructions to cover all operations conducted on the ranges.

2.2.4.3. Developing, obtaining Range Safety approval, and implementing procedures related to hazardous and safety critical operations.

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 Pad Safety coverage of the operation. The requirements for hazardous procedures may be found in Attachment 2 of this volume.

2.2.4.4. 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.

2.2.4.5. Developing and implementing a program to control hazardous energy sources by locking and tagging in accordance with lockout/tagout approved procedures.

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

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

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

2.2.4.9. Developing, implementing, and maintaining records for a Nondestructive Examination (NDE) Plan in accordance with the requirements of this volume and Volume 3.

2.2.4.10. Developing, implementing, and maintaining records for a recertification program for ground pressure vessels in accordance with ESMC TR-88-01, ***A Guide for Recertification of Ground Based Pressure Vessels and Liquid Holding Tanks***.

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

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

2.2.4.13. Obtaining Base Civil Engineering approval for compliance with AFI 32-2001**,** ***The Fire Protection Operations and Fire Prevention Program***.

2.2.4.14. Obtaining 45 MDG or 30 MDOS approval for procedures in accordance with 45 SWI 40-201, ***Radiation Protection Program*** or 30 SW1/Sup1 ***Radiation Protection Plan***, supplement to AFI 91-110, ***Nuclear Safety Review and Launch Approval for Space or Missile Use of Radioactive Material and Nuclear Systems***.

2.2.4.15. Preparing and maintaining OSPs as needed and directed by Range Safety, this function is accomplished by Pad Safety at the 45 SW..

2.2.4.16. Developing, obtaining Range Safety approval, and implementing a Dual Crane Lift Plan, if required.

2.2.4.17. Developing and implementing a training plan for all Range User personnel performing hazardous and safety critical procedures and operations and submitting an outline of this training plan to Range Safety for approval.

Range Safety will only evaluate the training plan for areas that could lead to a mishap caused by inadequate training and could affect workers of other employers, range assets, and the general public.

2.2.4.18. Developing pathfinder requirements in coordination with Range Safety.

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

2.2.5. Operational Duties:

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

2.2.5.2. Obtaining Pad Safety concurrence to proceed before starting any hazardous and safety critical operations and before resuming any operation that has been interrupted resumes.

Interruptions include such events as a safety hold, shift change, evacuation, or breaks.

2.2.5.3. Before initiating hazardous or safety critical operations, the following shall be accomplished:

2.2.5.3.1. Pre-operation and shift change briefings.

2.2.5.3.2. 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.

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

2.2.5.5. 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.

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

CHAPTER 3

GROUND OPERATIONS POLICIES

3.1. Personnel Safety. It is the policy of the ranges that all personnel shall be protected during the performance of operations.

3.2. Stopping Unsafe Operations:

3.2.1. 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 or major system damage:

3.2.1.1. A Safety representative.

3.2.1.2. Any operational supervisor.

3.2.1.3. Personnel in the chain of command who exercise supervisory authority.

3.2.2. These personnel are authorized to stop operations or practices when imminent danger cannot be eliminated through regular channels. Personnel observing an unsafe operation or practice shall report their observations to one of these individuals.

3.2.3. 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 Pad Safety at the ER and Range Safety at the WR, the Squadron Commander, the Group Commander, or their designated representative.

3.2.4. 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.

CHAPTER 4

DOCUMENTATION REQUIREMENTS

4.1. Ground Operations Plans. GOPs shall be developed in accordance with the requirements in Attachment 1 of this volume and submitted to Range Safety for review and approval.

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

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

4.1.3. The final GOP shall be submitted 45 calendar days before hardware delivery to the ranges.

4.1.4. The GOP shall be approved before the start of any hazardous operations.

4.2. Test and Inspection Plans. Test and inspection plans shall be developed to document the initial and recurring validation of component compliance and assessment of hazards. Test and inspection plans shall be developed for the following items that include, but are not limited to, material handling equipment, ground support pressure vessels, and ground support propellant systems. Specific requirements for each of these systems are discussed in this volume.

4.2.1. Equipment and System Logs and Test Records:

4.2.1.1. Unless otherwise specified in a separate part of this volume that addresses a particular class of system or equipment, logs and test records shall be maintained on critical ground support systems and major fixed equipment. Logs and test records shall comply with the following:

4.2.1.1.1. Logs and test records shall contain chronological entries including:

4.2.1.1.1.1. Records of use or running time.

4.2.1.1.1.2. Maintenance.

4.2.1.1.1.3. Modifications.

4.2.1.1.1.4. Tests, inspections, acceptable parameters, and results.

4.2.1.1.2. Discrepancies and out of specification results shall be clearly identified.

4.2.1.1.3. Resolution of discrepancies and out of specification results shall be noted.

4.2.1.2. Logs and test records shall be maintained for the life of the system/equipment.

4.2.1.3. Logs and test records shall be available to Range Safety upon request.

4.2.2. Hazardous Facility Inspection Records and Reports. Unless otherwise specified in a separate part of this volume that addresses a particular class of facility, inspection records of hazardous facilities shall comply with the following:

4.2.2.1. Hazardous facility inspection records shall be maintained by Facility Operators and/or Range Users in accordance with AFMAN 91-201, ***Explosives Safety Standards***, AFI 91-202, ***The***

US Air Force Mishap Prevention Program, DoD 6055.9-STD, ***Ammunition and Explosives Safety Standards***, and this volume.

4.2.2.2. At a minimum, hazardous facility inspection records shall include discrepancies and discrepancy resolution. These records shall be available to Range Safety upon request.

4.2.2.3. 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.

4.2.2.4. 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.

4.3. Safety and Emergency Plans:

4.3.1. Operations Safety Plans and Danger Area Information Plans

4.3.1.1. OSP and Danger Area Information Plan Review and Approval:

4.3.1.1.1. At the ER, OSPs (Attachment 3 of this volume) shall be developed by ER Pad Safety and submitted to Range Safety for review and approval 30 calendar days before initial use. Range users shall provide data to Pad Safety for the development of OSPs.

4.3.1.1.2. At the WR, Range Users shall develop their OSPs in accordance with 4.3.1.2 and shall submit the final OSP to Pad Safety no later than 45 days before the start of any hazardous operation.

4.3.1.1.3. At the ER, Danger Area Information Plans (DAIPs) shall be developed by Pad Safety and submitted to Range Safety for review and approval 30 calendar days before initial use. Range Users shall provide data to Pad Safety for the construction of the DAIPs.

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

4.3.1.2. OSP Data Requirements. OSPs shall meet the following requirements:

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

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

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

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

4.3.1.2.4.1. 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.

4.3.1.2.4.2. 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,

launch complex, or launch support facility safety, PPE required, and any special safety requirements.

4.3.1.2.4.3. 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, launch complex or launch support facility safety; safety clearance zones required; personnel loading requirements; PPE required; any special safety requirements; and identification of those operations or tasks that may be run concurrently.

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

4.3.1.2.4.5. 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. Range Safety and Pad Safety retain the option to train Safety personnel on each launch vehicle payload, system, and launch complex.

4.3.1.2.4.6. Range Users shall provide Range Safety and Pad Safety updated listings of permit numbers, names, and assigned agencies 48 hours before all launches.

4.3.1.2.4.7. Visitor safety briefings, including content and responsibility.

4.3.1.2.4.8. 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.

4.3.1.2.4.9. Fall protection surveys and plans.

4.3.1.2.4.10. 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.

4.3.1.2.4.11. Training and certification plans.

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

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

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

4.3.1.2.4.15. Mishap reporting and emergency response phone numbers, including immediate notification to the Pad Safety Officer (PSO) or Operations Safety Technician (OST) of any personnel injury or resource damage.

4.3.1.2.4.16. FEOPs.

4.3.1.2.4.17. Emergency Evacuation Plans (EEPs).

4.3.1.2.4.18. Lockout/tagout plans and procedures.

4.3.1.2.4.19. Confined space operations surveys, plans, and procedures.

4.3.1.2.4.20. Hot work plans and procedures.

4.3.1.2.4.21. Self-inspection program and inspection schedules.

4.3.2. Facility Emergency Operating Plans. FEOPs shall be developed by facility operators and submitted to Range Safety for review and approval at least 45 calendar days before facility use. FEOPs describe necessary measures to assure safety of personnel, government resources, and operations essential to establish safe conditions. Conditions that should be addressed in the FEOPs include, but are not limited to, response to fire and response to spill, leak, or release of hazardous commodities. Topics that should be addressed in FEOPs include notifications and announcements, safing of systems, evacuation routes, and EEAP locations. FEOPs are typically combined as a subset of another publication such as an Operations Safety Plan, but this format is not a requirement. The Range Safety offices are available to provide guidance if required by the Range User.

4.3.3. Emergency Evacuation Plans:

4.3.3.1. EEPs detailing safety and emergency actions shall be developed by facility operators and posted in every building, facility, and area.

4.3.3.2. EEPs shall include the following information:

4.3.3.2.1. Identification of exit/egress routes.

4.3.3.2.2. Identification of primary and alternate Emergency Evacuation Assembly Points (EEAPs); EEAPs shall be designated by signs.

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

4.3.3.2.4. Actions to be taken to safe an operation.

4.3.3.2.5. Methods of communication including aural warning systems and public address (PA) announcements.

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

4.3.3.2.7. Required emergency equipment and PPE.

4.3.3.2.8. Required personnel training.

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

4.4. Procedures:

4.4.1. General Requirements for Procedures:

4.4.1.1. Procedures and general operating instructions for all operations conducted on the ranges shall be developed.

4.4.1.2. All procedures shall be written in accordance with the requirements provided in Attachment 2 of this volume.

4.4.1.3. 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.” These designations shall be justified in the operating procedure summaries. Range Safety may designate additional processes and operations as “Hazardous” or “Safety Critical.”

4.4.1.4. 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.

4.4.2. Hazardous and Safety Critical Procedures:

4.4.2.1. Procedures for hazardous and safety critical operations shall be developed in accordance with the requirements in Attachment 2 of this volume. Emergency actions shall be included in the procedures. Approval of hazardous and safety critical procedures shall not be given until the pertinent data sections of the MSPSP and GOP have been reviewed and approved.

4.4.2.2. 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. Range Users new to the ranges are encouraged to provide a draft of a typical procedure for early review.

4.5. 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.

4.6. Mishap Reporting:

4.6.1. Mishaps Involving Air Force Personnel and Property. Reporting criteria for mishaps involving Air Force personnel and property are established in AFI 91-204, ***Safety Investigations and Reports***. Mishaps involving radioactive materials shall be reported in accordance with AFI 91-110.

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

CHAPTER 5

GROUND OPERATIONS SAFETY REQUIREMENTS

5.1. Ground Operations Personnel Requirements:

5.1.1. Personnel Training, Certification and Experience. A list of personnel training, certification, and experience requirements shall be available as part of the Range User training plan.

5.1.2. Ground Operations Safety Orientation and Training:

5.1.2.1. All Range Users shall ensure that their personnel receive formal safety, fire prevention, and occupational health orientation and training before receiving a controlled area badge. The employer is responsible to ensure the training is adequate and complete.

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

5.1.3. Personnel Conduct:

5.1.3.1. Food, Beverage, and Cigarette Consumption. Range Users shall ensure that eating, drinking, or smoking is authorized only in designated areas.

5.1.3.2. Alcoholic Beverages and Narcotics:

5.1.3.2.1. Range Users shall ensure that the use of alcoholic beverages and narcotics while on duty is prohibited.

5.1.3.2.2. Range Users shall require that their personnel taking prescription or non-prescription medications that could affect performance notify their supervisor.

5.1.3.3. Mischief. Range Users shall ensure that their personnel are prevented from indulgence in practical jokes, horseplay, scuffling, and wrestling.

5.1.4. Work Time Restrictions:

5.1.4.1. Range User supervisors at all levels shall ensure their personnel will not be assigned to, and will 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.

5.1.4.2. 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.

5.1.4.3. Planned duty for personnel in either mission ready or mission support should normally be 8 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.

5.1.4.4. Hazardous Operations and Prelaunch 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:

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

5.1.4.4.2. A maximum of 60 hours per week.

5.1.4.4.3. A maximum of 14 consecutive days.

5.1.4.5. Consecutive Launch Attempts:

5.1.4.5.1. When 12-hour shifts are required and launches are rescheduled on a 24-hour basis, consideration shall be given for a 48-hour launch delay after 3 consecutive back-to-back launch attempts.

5.1.4.5.2. In the event mission impacts or operational requirements necessitate 12-hour shifts, mission ready personnel shall not be scheduled for more than 5 consecutive shifts without a 48-hour break and mission support personnel shall not be scheduled for more than 6 consecutive shifts without a 24-hour break.

5.1.4.5.3. Mission Ready Crew Rest Waiver Authority. Crew rest and/or rest period requirements for mission ready (Category A) personnel can only be waived by the Chief of Safety or the Space Wing Commander.

5.1.4.6. 30 SW Additional Work Restrictions:

5.1.4.6.1. In the event of a missile accident, emergency, or operational necessity, the duty time limits defined in this volume 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.

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

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

5.1.4.6.3.1. For mission ready (Category A) personnel, the duty periods may be increased to 14 hours or rest periods may be waived with the express knowledge of the 30 SW Commander or Vice Commander, WR Commander, Operations Groups Commander, or the Chief of Safety.

5.1.4.6.3.2. For mission support (Category B) personnel, the duty period may be increased to 14 hours with the expressed knowledge of the applicable division chief or equivalent level supervisor.

5.2. Hazardous Ground Operations General Requirements:

5.2.1. Pathfinder Requirements:

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

5.2.1.2. Before the first use of applicable hazardous procedures, including contingency, such as operations with live ordnance, pressure systems, or propellant, pathfinder operations shall be con-

ducted at the ranges using inert or dummy ordnance, non-pressurized systems, or non-fueled systems.

5.2.1.2.1. Handling operations shall be performed with inert or dummy equipment that simulates the flight unit in form, fit, function, weight, and center of gravity.

5.2.1.2.2. Pressure and propellant system operations shall be performed with equipment that simulates flight equipment valve connections and operations.

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

5.2.1.2.4. Range Safety and the Range User shall jointly develop acceptance criteria for pathfinder operations and evaluate whether the acceptance criteria have been met.

5.2.2. Control of Access to Hazardous Operations. The launch complex authority shall establish personnel limits, entry control, and control areas for all hazardous operations with Range Safety approval.

5.2.2.1. Personnel Limits for Hazardous Ground Operations:

5.2.2.1.1. Personnel limits shall be established for all hazardous operations and tasks and approved by Range Safety. Deviation from approved access list numbers requires Range Safety approval.

5.2.2.1.2. The supervisor in charge of the building or operation is responsible for maintaining personnel load limits for that building or operation.

5.2.2.2. Control of Access to All Hazardous Operations:

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

5.2.2.2.2. 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.

5.2.2.2.3. When hazardous operations are covered by Pad Safety, Pad Safety shall control access.

5.2.2.3. Personnel Restrictions for Hazardous Ground Operations:

5.2.2.3.1. Non-essential personnel shall leave hazardous areas (safety clearance zones) before the start of operations.

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

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

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

5.2.2.3.5. Area Warning Lights. Personnel with the appropriate badge and security clearance have access to areas in accordance with the following:

5.2.2.3.5.1. 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/Hazardous Support Operations (HOS).

5.2.2.3.5.2. 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 Pad Safety or, in the absence of Pad Safety, the entry control authority.

5.2.2.3.5.3. 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 before a launch. At the WR, a flashing red light also designates a dangerous operation for ballistic missile operations; for example, follow-on test and evaluation (FOT&E) where work is performed under the strict control of technical orders (T.O.s).

5.2.3. Hot Work Operations:

5.2.3.1. 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 AFOSHSTD 91-5, ***Welding, Cutting, and Brazing***, 29 CFR 1910.252, (Subpart Q, Welding, Cutting and Brazing), ***General Requirements***, and American National Standards Institute (ANSI) Z49.1, ***Safety in Welding and Cutting***.

5.2.3.2. 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).

5.2.3.3. Hot Work General Operating Requirements:

5.2.3.3.1. A written permit shall be obtained from the Fire Marshall before performing hot work.

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

5.2.3.3.3. 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.

5.2.3.3.4. 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.

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

5.2.3.3.6. Combustibles shall be kept at least 35 feet away from the operation.

5.2.3.3.7. A suitable fire extinguisher shall be available.

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

5.2.3.5. 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 that have not been properly cleaned and purged.

5.2.4. Control of Hazardous Energy Sources:

5.2.4.1. Hazardous energy sources shall be controlled through a lockout/tagout program that complies with the requirements of 29 CFR 1910.147, ***The Control of Hazardous Energy (Lockout/Tagout)***, AFOSHSTD 91-501, ***Air Force Consolidated Occupational Safety Standard***, and ANSI Z244.1, ***Safety Requirements for the Lockout/Tagout of Energy Sources***.

5.2.4.2. Lockout/tagout procedures shall be developed by Range Users and approved by Range Safety (ER)/Pad Safety (WR) per 5.2.4.1.

5.2.5. Confined Space, Tank Entry, and Tank Cleaning:

5.2.5.1. Personnel who enter and work within permit-required confined spaces shall comply with appropriate controls as defined in 29 CFR 1910.146, ***Permit-Required Confined Spaces***, ANSI Z117.1, ***Safety Requirements for Confined Spaces***, and AFOSHSTD 91-25, ***Confined Spaces***.

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

5.2.6. Tethering of Equipment:

5.2.6.1. Hand-held tools, equipment, and personal belongings shall be tethered in any area where dropped objects could pose a hazard to personnel.

5.2.6.2. Hazards to be considered in determining tethering requirements include direct contact with personnel or the consequences of damaging critical hardware providing the potential of latent or immediate hazards to personnel from damaged hardware.

5.3. Personal Protective Equipment:

5.3.1. Range User Responsibilities. The Range User shall provide the applicable PPE required for the work location that meets the requirements established by 29 CFR 1910.132, (Subpart I-Personal Protective Equipment), ***General Requirements***, 29 CFR 1910.133, ***Eye and Face Protection***, 29 CFR 1910.134, ***Respiratory Protection***, 29 CFR 1910.135, ***Head Protection***, 29 CFR 1910.136, ***Foot Protection***, California Occupational Safety and Health (CAL-OSHA) (WR only), AFOSHSTD 91-501, ANSI, and National Institute of Occupational Safety and Health (NIOSH).

5.3.2. PPE Compatibility. All PPE shall be compatible with the hazardous materials involved and shall be subject to approval by Range Safety and Bioenvironmental Engineering.

5.3.3. Clothing Requirements in Industrial and Missile Operating Areas:

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

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

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

5.3.3.4. Dresses and shorts shall not be worn on towers.

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

5.3.3.6. 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.

5.3.3.7. Expended work clothes shall be clearly segregated from work clothes ready for use.

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

5.4. Fall Protection. The Range User shall observe and use applicable industry standards for fall protection (such as guard rails, lanyard anchorages, lanyards, snap hooks, ladders, inspections). Specific criteria for the equipment listed above can be found in ANSI Z359.1, ***Personnel Fall Arrest Systems, Subsystems, and Components***; ANSI A10.14, ***Construction and Demolition Operations - Requirements for Safety Belts, Harnesses, Lanyards and Lifelines for Construction and Demolition Use***; AFOSHSTD 91-501; 29 CFR 1910.23, ***Guarding Floor and Wall Openings and Holes***; 29 CFR 1910.27, ***Fixed Ladders***; and 29 CFR 1926.105, ***Safety Nets***.

1. Fall Hazards:

a. All open-sided floors or fall hazards over 4 feet or any height where falls into hazards such as moving machinery, impaling, or drowning hazards exist should be guarded by standard guard rails with mid-rails and toe boards.
b. Fall protective PPE should be used when installing guardrails, safety nets, and other fall protection.

2. Hazard Guards. If standard guard rails are not installed, PPE, in the order of preference listed below, should be used to protect personnel if they are within 6 feet of the hazard:

a. Full body harness (ANSI Class III).
b. Chest harness (ANSI Class II).
c. Safety nets (29 CFR 1926.105).

3. PPE Lanyards. PPE should be attached to anchorages by a lanyard that limits the length of a fall to no more than 6 feet. 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).

4. Lanyard Anchorages:

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

5. Installation of Permanent Anchorage Connectors:

a. Visual inspection of installed permanently fixed anchorage connections and dog-runs should be accomplished annually by the Range User. Documentation should be available for review by Range Safety.
b. Suspect connections or anchorages should receive NDE as determined by Range Safety and should be repaired or replaced as required.

6. Fall Protection Snap Hooks. Fall protection snap hooks used in fall protection systems should be sized to ensure proper connection.

7. Fall Protection Equipment Inspections:

a. Each article of PPE should be visually inspected by the user before use.
b. All PPE should be thoroughly inspected at least twice a year by a qualified person of the organization that owns the PPE.
c. Each piece of PPE should have a visible tag or other indication of inspection permanently attached with the following information:
   i. The date inspected.
   ii. The next inspection due date.
   iii. The stamp or signature of the quality inspector.

8. Ladder Fall Protection:

a. Ladder fall protection should be installed on all fixed ladders with a fall hazard of 20 feet or more.
b. Ladder safety devices with body belts should be the preferred method of fall protection.

5.5. Smoking Areas:

5.5.1. The Range User shall observe and use applicable industry standards for smoking areas. No smoking signs shall be posted as directed by the range Fire Department.

Selection of designated smoking areas, their ash receptacles, and ventilation systems is subject to the review and approval of the Fire Department. No smoking and smoking areas in the complex should be clearly designated by lines painted on the concrete or asphalt surfaces and appropriately marked by signs.

5.5.2. Designated Non-Smoking Areas. Smoking is prohibited at all times and flame-producing devices shall be prohibited within the following areas:

5.5.2.1. Within 100 feet of any propellant storage tank.

5.5.2.2. On gantries or service towers.

5.5.2.3. Within 100 feet of the test stand while propellants are being transferred or during the time propellants are aboard the launch vehicle and/or payload.

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

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

5.5.2.6. In any area displaying NO SMOKING signs.

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

5.6. Operating Restrictions Due to Lightning:

5.6.1. General. 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

5.6.2. ER Lightning Hazard Watches and Hazard Warnings:

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

5.6.2.2. Phase I Lightning Watch. For the 5 nautical miles lightning watch (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:

5.6.2.2.1. SCAPE operations, propellant tanking and detanking, hoisting hazardous materials or 1.1 to 1.4 class ordnance, and other hazardous operations that take 30 minutes or longer to secure shall not be started.

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

5.6.2.3. 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:

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

5.6.2.3.2. If the Phase I lightning watch 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 step and the area secured and evacuated in accordance with the specific OSP.

5.6.2.4. 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

before the 5 nautical mile lightning warning start time whenever a launch vehicle with payload, propellants, solid rocket motors, or Class 1.1 to 1.4 ordnance is present or EEDs are electrically connected.

5.6.2.5. Additional information regarding lightning hazard watches and warnings may be found in the 45 SW OPLAN 15-1, ***Weather Operations Plan***.

5.6.3. WR Lightning/Thunderstorm Watches and Warnings. The 30th Weather Squadron issues two messages related to lightning/thunderstorms: A watch and a warning.

5.6.3.1. A Lightning/Thunderstorm Watch is a forecast issued when the potential for lightning/ -thunderstorms is expected to occur within 10 nautical miles of any location on VAFB. The desired lead time for this watch is 2 hours. The watch is forecast for a period of time (valid time) that lightning/thunderstorms are expected to be within 10 nautical miles.

5.6.3.2. A Lightning/Thunderstorm Warning is issued when lightning is observed within 10 nautical miles of VAFB.

5.6.3.3. Meteorological and weather warning notification procedures are provided in 30 SWI 15-101, ***Weather Support***.

5.6.3.4. Upon issuance of the Lightning/Thunderstorm Watch, all operations involving propellant or ordnance activities shall be completed before the start of the Lightning/Thunderstorm Watch "valid time." All propellant or ordnance activities not completed before the watch "valid time," may continue if the facility has a certified lightning protection system and the organization's commander grants approval to continue. All other non-propellant or non-ordnance activities may continue in the facility during the Lightning/Thunderstorm Watch.

5.6.3.5. Upon issuance of the Lightning/Thunderstorm Warning, a space launch complex, explosive/missile processing facility, launch facility, storage facility, or any other hazardous operating location that has a certified lightning protection system does not require evacuation; and all non-propellant or non-ordnance activities may continue in the facility during the Lightning/Thunder- storm Warning. ***Exception:*** *If either of the following conditions apply, all personnel shall evacuate to at least the public transportation route (PTR) distance regardless of the lightning protection system: Condition 1: There is exposed solid propellant. Condition 2: There is an explosive initiation device that cannot be placed in a safe configuration.*

The intent of 5.6.3.4 and 5.6.3.5 is to allow all non-ordnance and non-propellant activities to continue in facilities with certified lightning protection systems during a Lightning/Thunderstorm Watch or Warning. A "certified" lightning protection system is inspected and maintained in accordance with AFI 32-1605 or National Fire Protection Association Standard 780. These are the minimum lightning protection requirements imposed by 30 SW Safety. Range Users may be more conservative at their own discretion.

5.6.3.6. Upon issuance of the Lightning/Thunderstorm Warning, any operation involving propellant or ordnance activities in a space launch complex, explosive/missile processing facility, launch facility, storage facility, or any other hazardous operating location that does not have a certified lightning protection system shall evacuate to at least the PTR distance.

5.6.3.7. If a Lightning/Thunderstorm Watch or Warning has not been previously issued or the Lightning/Thunderstorm Watch or Warning "valid time" is earlier than forecast, the propellant or ordnance activities shall be terminated at the safest point and the area secured.

5.6.3.8. Lightning/Thunderstorm Watch and Warning notifications and Range User action requirements for propellant or ordnance activities apply to both day-to-day and day-of-launch operations.

5.6.3.9. Range Users working an approved operation involving propellant or ordnance activities during a Lightning/Thunderstorm Watch can call 30 WS (x6-8022) to get an update of the status of the watch. To ensure the consistent and accurate relay of information, Range Users should designate a single point of contact to make these calls, preferably the individual in charge of the operation.

Examples of approved activities are installation of electrical cables, mechanical components, flight hardware, stud standoff, and wing installation. Examples of unapproved activities are handling of rocket motors or launch vehicles by lifting, mating, or roll transfer; fuel transfer and pressurization; and ordnance installation and connection.

5.7. Operating Restrictions Due to High Winds:

5.7.1. 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.

5.7.2. For Winds of 30 Knots or More as Measured on or Closest to Specific Facilities:

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

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

5.8. Facility Use:

5.8.1. Facility Use General Requirements:

5.8.1.1. Facilities shall be used within the limits of their design. If facilities are leased from the USAF, the Range User shall coordinate with Range Safety and Civil Engineering for proper use within the limits of their design.

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

5.8.2. Hazardous Facility Use General Requirements:

5.8.2.1. The use of facilities for hazardous storage or processing operations shall be approved by Range Safety.

5.8.2.2. The OSP shall be developed by the Range User in coordination with the Pad Safety and shall be approved by Range Safety.

5.8.2.3. Facilities used for hazardous activities shall have an FEOP and an Evacuation Plan developed by facility operators.

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

5.8.2.5. 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.

5.8.3. Hazardous Facility Inspection:

5.8.3.1. Range User Facility Inspections:

5.8.3.1.1. Facilities shall be inspected before first use, upon modification, before operations, and at least annually, as determined by the Range User and Pad Safety.

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

5.8.3.1.3. Actions shall be taken to correct discrepancies identified during inspections. Records of discrepancies and discrepancy corrections shall be maintained for 3 years.

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

5.8.3.1.5. 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.

5.8.3.2. Operations Safety Facility, Complex, and Area Inspections:

5.8.3.2.1. A systematic visual examination of facilities, related GSE, 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 Pad Safety. 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.

5.8.3.2.2. 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:

5.8.3.2.2.1. At least 2 weeks before a launch vehicle or payload being brought to the pad or facility.

5.8.3.2.2.2. Within 48 hours of the pad erection day.

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

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

5.8.3.2.3. Explosives storage and operating areas and facilities shall be inspected by Pad Safety at least annually to ensure compliance with explosives safety criteria. Area monthly records shall be reviewed during the annual inspection.

5.8.3.3. Facility Operator Inspections. The facility operator shall inspect explosive storage and operating areas and facilities at least once a month.

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 publication.

CHAPTER 6

MATERIAL HANDLING EQUIPMENT, CRANE AND HOIST, PERSONNEL PLATFORM, POWERED INDUSTRIAL TRUCK, AND ELEVATOR OPERATIONS

This chapter is divided into the following: 6.1. Material Handling Equipment (MHE) Operations, 6.2. Crane and Hoist Operations, 6.3. Personnel Platform Operations, 6.4. Powered Industrial Trucks (See ANSI B56), and 6.5. Elevator Usage. Requirements for vehicles used to transport hardware onto and off of the ranges are not governed by this chapter. (See Chapter 15 of this volume.).

6.1. Material Handling Equipment Operations. The operations requirements for material handling equipment (MHE) used for handling (lifting, supporting, or manipulating) critical and non-critical hardware are described below. These requirements are applicable to new or modified MHE. The requirements are also applicable to permanent or short-term use MHE and apply whether the equipment is owned, rented, or leased by the government, contractors, or commercial operators.

MHE is comprised of below-the-hook lifting devices (BTHLD), handling structures, support structures, slings, load cells, Hydrasets, and rigging hardware.

6.1.1. MHE Operating Standards:

6.1.1.1. Existing equipment shall not be used in operations unless it meets all the requirements in Volume 3, Chapter 6 unless otherwise agreed to by Range Safety.

6.1.1.2. All MHE shall be operated, tested, and maintained in accordance with the requirements of this publication, AFOSHSTD 91-501, and applicable military and industry standards including, but not limited to, ANSI, the American Society of Mechanical Engineers (ASME), and the National Fire Protection Association (NFPA).

6.1.1.3. 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 publication.

6.1.1.4. All users of MHE used to handle the critical hardware covered in this publication shall have written and approved procedures that cover selection, operation, maintenance, and testing of the 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. Moving or parking an empty hook over a hazardous/critical commodity shall not be considered a hazardous operation.

6.1.2. MHE Operator Qualification and Training:

6.1.2.1. MHE Operator Qualification Requirements:

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

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

6.1.2.2. MHE Operator Training and Certification:

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

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

6.1.2.2.2.1. The requirements of the operator manual.

6.1.2.2.2.2. The applicable parts of AFOSHSTD 91-501 and/or ANSI/ASME B30 series, ***Material Handling Equipment***, as applicable.

6.1.2.2.2.3. The applicable parts of 29 CFR 1910, Subpart N, ***Material Handling and Storage***.

6.1.2.2.2.4. The applicable parts of ANSI B30 and other industry standards.

6.1.3. MHE Periodic Test and Inspection Requirements:

6.1.3.1. MHE Test and Inspection General Requirements:

6.1.3.1.1. MHE shall be tested initially and periodically in accordance with Volume 3, 6.1.1.3.

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

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

6.1.3.2. MHE General Data Requirements. All MHE data requirements shall be provided in accordance with Volume 3, Chapter 4, and Attachment 1 of Volume 3.

6.1.4. MHE General Operations:

6.1.4.1. All MHE to be used for hazardous operations and/or safety critical operations shall be identified to Range Safety.

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

6.1.4.3. MHE documentation (inspections, tests, maintenance, and modifications) shall be maintained by the Range User for the life of the MHE. This documentation shall be made available to Range Safety.

6.1.5. Sling Operations:

6.1.5.1. Sling Operating Standards. All slings shall be operated, maintained, and tested in accordance with ANSI/ASME B30.9, ***Slings***.

6.1.5.2. Sling Inspection and Periodic Test Requirements. Slings shall be inspected and tested in accordance with Volume 3, 6.1.2.2.

6.1.5.3. Sling Recurring Data Requirements. Recurring data is required in accordance with Volume 3, Chapter 4.

6.1.6. Hydraset and Load Cell Operations:

6.1.6.1. Operator Training. Hydraset operators shall be trained and certified in accordance with manufacturer recommendations.

6.1.6.2. Hydraset and Load Cell Operating Standards. Hydrasets and load cells shall be operated, maintained, and tested in accordance with the manufacturer instructions and the additional requirements described below.

6.1.6.3. Hydraset and Load Cell Inspection and Periodic Test Requirements. Hydrasets and load cells shall be inspected and tested in accordance with Volume 3, 6.1.6.2.

6.1.6.4. Hydraset and Load Cell Recurring Data Requirements. Recurring data is required in accordance with Volume 3, Chapter 4

6.1.7. Handling Structure Operations:

6.1.7.1. Handling Structure Operating Standards. All structural lifting beam operations shall meet ANSI/ASME B30.20, ***Below Hook Lifting Devices***, for range operations.

6.1.7.2. Handling Structure Inspection and Periodic Test Requirements. Handling structures shall be inspected and tested in accordance with Volume 3, 6.1.4.2.

6.1.7.3. Handling Structure Recurring Data Requirements. Recurring data is required in accordance with Volume 3, Chapter 4.

6.2. Crane and Hoist Operations:

6.2.1. Crane and Hoist Operating Standards. In addition to the requirements in 6.1, all cranes and hoists shall be identified, tested, maintained, and operated in accordance with ANSI/ASME B30 series, CMAA 70, ***Specifications for Electric Overhead Traveling Cranes***, and CMAA 74, ***Specifications for Top Running and Under Running Single Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist***, MHI Standards, AFOSHSTD 91-501, and NFPA 70, ***National Electric Code***.

At VAFB, cranes not on VAFB exclusive federal jurisdiction property also require inspection, testing, and certification in accordance with CAL-OSHA requirements.

6.2.2. Crane Operator Training and Certification:

6.2.2.1. All operators of cranes used on the ranges shall have the training listed in AFOSHSTD 91-46, ***Materials Handling and Storage Equipment***, and the qualifications stated in the ANSI/ASME B30 series, 29 CFR 1910.179, and 29 CFR 1910.180, as applicable.

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

6.2.2.3. All operators of non-range or privately owned cranes that are used to lift critical loads are subject to the requirements stated in ANSI/ASME B30 series.

6.2.2.4. Annual Crane Operator Certification. Annual crane operator certification is required and shall be conducted in three parts:

6.2.2.4.1. Classroom Training and Testing: Employers shall ensure their personnel receive classroom training as evidenced by testing. Employers shall maintain records for each operator they employ. For the WR, the requirements in 6.2.2.1, 6.2.2.2, and 6.2.2.3 apply.

6.2.2.4.2. Physical Examination: The employer is responsible for obtaining a physical examination of the operator as required by AFOSHSTD 91-501 and/or ANSI/ASME B30 series.

6.2.2.4.3. 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:

6.2.2.4.3.1. Name of operator.

6.2.2.4.3.2. Certification expiration date.

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

6.2.2.5. Types of Operator Certification:

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

6.2.2.5.2. Non-critical load hands-on training and certification shall be conducted 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.

6.2.2.6. Navy Area Crane Operator Certification:

6.2.2.6.1. Portal and mobile crane operators shall be certified according to NAVFAC P-306, ***Testing and Licensing of Weight Handling and Construction Equipment Operators***.

6.2.2.6.2. Crane operators not certified according to NAVFAC P-306 shall be trained and certified according to the requirements detailed above.

6.2.3. Crane and Hoist Inspection and Periodic Test Requirements:

6.2.3.1. Daily Inspections:

6.2.3.1.1. Using a pre-operational checklist, daily, or otherwise before first use, inspections shall be conducted on the equipment to be used at the beginning of each shift.

6.2.3.1.2. Daily inspections shall cover the following items:

6.2.3.1.2.1. The function of all controls and brake.

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

6.2.3.1.3. Cranes and hoists are exempted from daily inspection requirements during periods of non-use

6.2.3.2. 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.

6.2.3.3. Crane and Hoist Periodic Test Requirements. At a minimum, periodic tests shall be performed on cranes and hoists annually in accordance with Volume 3, 6.2.2.1.

6.2.3.4. Cranes and Hoists Used to Handle Critical Hardware Periodic Test and Inspection:

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

6.2.3.4.2. 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.

6.2.3.5. Cranes and Hoists Used to Handle Critical Hardware Monthly Inspections:

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

6.2.3.5.2. 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.

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

6.2.3.5.4. Crane and hoists are exempted from monthly inspections during periods of non-use exceeding 1 month.

6.2.4. Crane and Hoist Recurring Data Requirements:

6.2.4.1. At a minimum, recurring data shall be maintained in accordance with Volume 3, Chapter 4.

6.2.4.2. An Operations Log Book shall be maintained for all cranes lifting critical loads.

6.2.5. Crane and Hoist Retest and Reinspection:

6.2.5.1. Following major maintenance or modification, initial acceptance inspection and testing shall be conducted in accordance with the requirements in Volume 3, 6.2.2.1.

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

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

6.2.6. Dual Crane Lift Operating Requirements. Dual crane lifts are considered hazardous operations without regard to the load. The following is required:

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

6.2.6.2. All mobile crane dual lifts shall require load cells and cab-installed load indicators.

6.2.6.3. A dry run with a geometric/mass simulator shall be required for all critical hardware lifts.

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

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

6.2.6.4.2. Any dynamic forces that affect the load.

6.2.6.4.3. All crane movements, including trolley, bridge, boom up, down, extension, and swing, and crane travel.

6.2.6.4.4. Center of gravity throughout the complete lift.

6.2.6.4.5. Certification of cranes and crane operators.

6.2.6.4.6. Operating surface capacity compatibility with mobile cranes (paved areas).

6.2.6.4.7. Soil compaction compatibility with mobile cranes (unpaved areas).

6.2.6.4.8. Provisions for a lift director, two-ways communication, and spotter(s).

6.2.6.5. Operations involving offset lifts shall not exceed the crane's capability.

6.2.7. WR First Use Tag Program:

6.2.7.1. 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 or first used shall provide the following documentation to Range Safety for review and approval:

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

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

6.2.7.1.3. Identification of shelf-life criteria.

The shelf-life shall not exceed 5 years in an environmentally controlled location without retest.

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

6.2.8. Mobile Cranes. All mobile cranes operated on the range for permanent or short term use shall be properly inspected, functionally validated, and maintained according to AFOSHSTD 91-501, 29 CFR 1910, 29 CFR 1926, NASA 1740.9, ***Safety Standards for Lifting Devices and Equipment***, (only if used in NASA activities or NASA facilities), applicable ANSI/ASME standards, applicable state OSHA plans, and the requirements identified below. These requirements apply whether the equipment is government, Range User, or contractor owned, rented, or leased.

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

6.2.8.2. Dual crane lift operations require Range Safety approved lift plans (See 6.2.6.4).

6.2.9. Lifting Operations:

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

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

6.2.9.1.2. The operator is properly certified.

6.2.9.1.3. 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, BTHLDs, load cells, and Hydrasets to remain suspended while unattended provided all of the following conditions are met:6.2.9.1.3.1.A procedure documenting such exceptions has been approved by Range Safety.6.2.9.1.3.2.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.6.2.9.1.3.3.The load is scheduled to be lifted within 24 hours.6.2.9.1.3.4.The load and immediate vicinity are roped off or otherwise identified to prohibit unauthorized personnel entry.6.2.9.1.3.5.The crane controls are locked in the off position.6.2.9.1.3.6.The restrictions against people being under the suspended lifting hardware are enforced.*6.2.9.1.4.The vicinity of the lift is controlled so that:

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

6.2.9.1.4.1. Unauthorized personnel entry is precluded.

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

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

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

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

6.2.9.1.6. Previously announced lightning advisories and lightning warnings will not cause the load to be in jeopardy.

Unattended suspended loads require specific Range Safety approval.

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

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

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

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

6.2.9.1.8.3. Outrigger floats shall be made of 4 x 4 inch or cross-hatched 2 x 4 inch lumber, a minimum of 4 x 4 feet square or equivalent support.

6.2.9.1.8.4. 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.

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

6.2.9.1.8.6. Outriggers and outrigger floats shall be used on flat surfaces.

Outrigger floats or cribbing is required in areas that do not have a hard surface such as concrete.

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

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

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

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

6.2.9.1.13. If the weight of the load to be lifted is not known, the weight shall be estimated with a reasonable degree of accuracy before attempting to lift the load.

6.2.9.2. Attaching the Load. To attach the load, the crane hook shall be positioned directly over the center of gravity of the load before attachment unless authorized in a written procedure approved by Range Safety.

6.2.9.3. Lifting the Load:

6.2.9.3.1. 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.

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

6.2.9.3.3. For hoist angles, cranes are designed to function with the load raised perpendicular with respect to the ground. Cranes are normally designed for vertical lifts. Side angle pull lifts should not be attempted unless the crane is specifically designed for this purpose in accordance with the requirements in Volume 3

6.2.9.3.3.1. Fleet (side) angles shall be kept as close to zero as possible. Range Safety approval is required for all anticipated fleet angles.

Pulling the rope with a load component 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.

6.2.9.3.3.2. Lead (in-line) angles shall be kept as close to zero as possible. Range Safety approval is required for anticipated lead angles exceeding 5 degrees 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.

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

6.2.9.3.3.4. 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:

6.2.9.3.4. 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:

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

6.2.9.3.4.2. The angle on the load line shall not exceed 5 degrees unless the hoist was specifically designed for a greater angle.

This angle is sometimes referred to as the lead or draft angle; it is not to be confused with the fleet angle.

6.2.9.3.4.3. 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.

6.2.9.3.4.4. 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.

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

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

6.2.9.3.5. 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.

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

6.2.10. Suspended Load Operations:

6.2.10.1. Moving a Suspended Load:

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

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

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

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

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

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

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

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

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

6.2.10.1.10. 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.

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

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

6.2.10.1.13. Tag lines shall be used to control movement of the load and not impart undesirable motion to the load.

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

6.2.10.1.15. Tag lines shall be used when there is potential for a load swing that could damage flight hardware, property, or cause injury or death.

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

6.2.10.2. Crane-Suspended Personnel Platforms. Operations involving lifting suspended personnel platforms are prohibited except as provided by AFOSHSTD 91-501 and 29 CFR 1926.550 (g), ***Crane or Derrick Suspended Personnel Platforms***, and specifically authorized by Range Safety.

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

6.2.10.3.1. Crane free-fall features shall be deactivated.

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

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

6.2.10.3.4. The crane operator shall be appropriately qualified.

6.2.10.3.5. The total weight of the loaded personnel platform and related rigging shall not exceed 50 percent of the crane capacity rating.

6.3. Personnel Work Platform Operations:

6.3.1. Removable, Extendible, and Hinged Personnel Work Platforms:

6.3.1.1. Removable, Extendible, and Hinged Work Platform Operating Standards. Personnel work platforms shall be operated, maintained, and tested in accordance with the manufacturer instructions and the additional requirements listed below.

6.3.1.2. Removable, Extendible, and Hinged Work Platform Periodic Test Requirements.

At a minimum, periodic tests shall be performed on all personnel work platforms annually in accordance with Volume 3, 6.3.3.

6.3.1.3. Removable, Extendible, and Hinged Work Platform Recurring Data Requirements.

At a minimum, recurring data is required in accordance with Volume 3, Chapter 4.

6.3.2. Aerial Work Platforms:

Aerial work platforms are commercial (whether or not modified) vehicle-mounted elevating and rotating aerial devices, manually propelled elevating aerial platforms, boom-supported elevating work platforms, self-propelled elevating work platforms, and airline ground support vehicle-mounted vertical-lift devices.

6.3.2.1. Aerial Work Platform Operating Standards. All aerial work platforms shall be verified to meet the design and construction standards of ANSI A92.1, ***Manually Propelled Mobile Ladder Stands-Scaffolds***, and bear identifying mark(s) evidencing the same.

6.3.2.2. Aerial Work Platform Designations. All aerial work platforms operated in a hazardous environment as defined by NFPA 505, ***Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation***, shall be approved for fire safety purposes by a nationally recognized testing laboratory (for example, Underwriters Laboratories, Inc. [UL], Factory Mutual Engineering Corp [FM]) using nationally recognized testing standards, bear mark(s) evidencing testing, and bear the appropriate designation (D, DS, DY, E, ES, EE, EX, G, GS, LP, LPS).

6.3.2.3. Aerial Work Platform Operations:

6.3.2.3.1. Only qualified and trained personnel shall operate aerial work platforms.

6.3.2.3.2. Aerial work platforms shall be operated in accordance with the safety rules and practices of ANSI B56.2 ***Type Designated Area, Use Maintenance, Operator***, and ANSI B56.3, ***Electric Battery-Powered Industrial Trucks***, safety standards.

6.3.2.3.3. Usage in NFPA 505 Hazardous Area Classifications shall be restricted to aerial work platforms with the appropriate designation per UL 558, ***Standard for Safety, Industrial Trucks, Internal Combustion Engine Powered***, UL 583, ***Standard for Safety, Battery Powered Industrial Trucks***, or comparable nationally recognized testing laboratory.

6.3.2.3.4. Aerial work platforms shall not be used in proximity of critical hardware where inadvertent operation could result in damage of same.

In some cases, aerial work platforms are intentionally used in close proximity to critical hardware; for example, to disconnect the rigging from the top of solid rocket motor upgrade (SRMU) segments when they are placed vertically in the stands. A hazard analysis should be conducted on such aerial platforms and identified hazards mitigated. Examples of mitigation include padded platform handrails, elimination of single point failures from the hydraulic control system, and stabilization of the chassis to prevent sudden shifting of the platform in case of tire failure. Lessons learned from the SRMU program are listed below:
Cont:

1. Do not use worn or dry rotted tires on aerial platform vehicles. Sudden tire failure may cause platform translation and impact against sensitive flight hardware.

2. Keep the hydraulic system clean and ensure adequate hydraulic hose chafing guards are installed in the boom articulated joint areas. At least one hydraulic hose failure occurred on the SRMU program, spraying the entire lift with hydraulic oil.

3. Ensure that the hydraulic system components have no unacceptable failure modes. In case of an SRMU aerial platform, reverse command resulted in the vehicle lurching forward and the platform impacting the doorframe. This malfunction was attributed to contamination in the hydraulic system.

6.4. Powered Industrial Trucks:

Powered industrial trucks are commercial (whether or not modified) fork trucks, platform lift trucks, crane trucks, tow tractors, personnel and burden carriers, and other specialized industrial trucks powered by electric motors or internal combustion engines.

6.4.1. Powered Industrial Truck Standards. All powered industrial trucks shall be verified to meet the design and construction standards of ANSI B56 series safety standards and bear identifying mark(s) evidencing the same.

6.4.2. Powered Industrial Truck Designations. All powered industrial trucks shall be approved for fire safety purposes by a nationally recognized testing laboratory (for example, UL, FM) using nationally recognized testing standards, bear mark(s) evidencing testing, and bear the appropriate designation (D, DS, DY, E, ES, EE, EX, G, GS, LP, LPS).

6.4.3. Powered Industrial Truck Operations:

6.4.3.1. Only qualified and trained personnel shall operate powered industrial trucks.

6.4.3.2. Operations of all powered industrial trucks shall be operated in accordance with the safety rules and practices of ANSI B56 series safety standards.

6.4.3.3. Use in NFPA 505 Hazardous Area Classifications shall be restricted to powered industrial trucks with the appropriate designation per UL 558, UL 583, or a comparable nationally recognized testing laboratory.

6.4.3.4. Powered industrial trucks shall not be used in the proximity of critical hardware where inadvertent operation could result in damage of the hardware.

6.4.3.5. If external attachments, such as special lifting adaptors, are attached to the forks for lifting, the attachment components shall have the proper load rating and meet the appropriate testing requirements in this publication.

6.4.3.6. Lift trucks shall be derated to 75 percent of rated capacity for critical loads.

6.5. Elevator Usage:

6.5.1. Passenger elevators not designed in accordance with Volume 5 criteria for freight shall not be used for propellant or other hazardous materials.

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

6.5.3. Personnel shall not ride in elevators during movement of the materials listed in 6.5.2.

CHAPTER 7

ACOUSTIC HAZARD OPERATIONS

7.1. Acoustic Hazard Operating Standards. Acoustic (noise) protection shall be provided in accordance with the requirements in 29 CFR 1910.95, ***Occupational Noise Exposure***, and AFOSHSTD 91-501, AFOSHSTD 48-20, ***Hearing Conservation Program***, and AFOSHSTD 48-19, ***Hazardous Noise Program***. AFOSH standards do not apply to contractors or contractor employees except where Air Force personnel or property are endangered or if specifically required by the contract.

7.2. Acoustic Hazard Operations Personnel Protection Requirements:

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

7.2.2. Approved hearing protection devices shall be worn as required.

7.3. Acoustic Operations:

7.3.1. All potential hazardous noise sources in the work environment that could expose Air Force personnel shall be identified to the Bioenvironmental Engineer.

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

7.3.3. A means of warning personnel before entering the noise hazard area shall be provided. A description of the hazard and what measures are necessary to ensure the safety of personnel shall be included.

1. Warning signs should be posted in a manner to be visible before entering the noise hazard area.

2. Warning signs should warn of the hazardous noise and indicate the requirement for hearing protection.

3. Any posting of hazardous noise areas should be coordinated with and approved by the Bioenvironmental Engineer.

CHAPTER 8

NON-IONIZING RADIATION OPERATIONS

8.1. Non-Ionizing Radiation Operating Standards:

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

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

8.1.2.1. 45 SWI 40-201 and 30 SWI 48-102, ***Radiation Protection Program***, for personnel exposure limits.

8.1.2.2. AFMAN 91-201, DoD 6055.9-STD, and MIL-STD-1576, ***Electroexplosive Subsystem Safety Requirements and Test Methods for Space Systems***, for radiation limits for ordnance exposure.

8.1.2.3. AFMAN 91-201, DoD 6055.9-STD, and T.O. 31Z-10-4, ***Electromagnetic Radiation Hazards***, for guidance with respect to siting ordnance.

8.1.3. The use and operating location of non-ionizing radiation producing devices shall be approved by Range Safety and the Radiation Protection Officer (RPO).

8.2. Radio Frequency Procedures. All radio frequency (RF) transmitters shall be operated using Range Safety and RPO approved procedures with the appropriate controls established. 45 SWI 40-201 or 30 SWI 48-102 specifies minimum power levels below which RF transmitters are exempt from controls.

8.3. RF Operations:

8.3.1. RF Operations General Requirements:

Non-ionizing radiation operations involve RF transmitters in the range of 3 kHz to 300 GHz and optical devices such as lasers.

8.3.1.1. Before transmitting, areas in which power density levels exceed permissible exposure limits shall be controlled to restrict access.

Area control may be accomplished using appropriate warning signs, lights, and access barriers.

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

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

8.3.1.2.2. Where applicable all safety devices shall be checked by site personnel before operation to ensure proper function. If transmission is required while performing these checks, the tests shall be performed at low output power or with a dummy load.

A safety device (or feature) is levied on the system design to control the cause of an identified hazard or to mitigate the effect of a hazard once the cause has been satisfied. As a result, the probability and/or severity of a hazard can be reduced to an acceptable level. Safety devices (or features) can take numerous forms in a design. No matter what form a safety device (or feature) takes, its purpose is to prevent an undesirable (hazardous) event from occurring. Safety devices (or features) may be wholly or partly mechanical, electrical, or software in nature. A safety device (or feature) may inherently be part of the system or be specifically added to a system. Safety devices (or features) may include the following:

1. Barriers - a physical means to keep personnel away from hazardous energy or to contain/deflect hazardous energy if it were released.

2. Fail-safe design - a design feature in which a system reacts to a failure by switching to or maintaining a safe operating mode that may include system shutdown.

3. Inhibit - a device that prevents system operation if a predetermined condition is not satisfied.

4. Interlock - a device that may be inserted into the system to prevent system operation (often used in maintenance).

5. Interrupt - a device that disrupts system operation if a predetermined condition is violated.

6. Redundancy/fault tolerance - the built-in ability of a system to provide continued correct operation in the presence of a specific number of faults or failures.

7. Special system features - systems or devices, such as fire suppression and hazardous gas detection, that control and/or warn of system hazards.

8.3.1.3. All new, modified, or relocated RF transmitters shall be reported to Range Safety and the RPO so that potential hazards can be evaluated.

8.3.2. RF Transmission Operations for EEDs and Open Grain Solid Propellant:

8.3.2.1. 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.

8.3.2.2. Radio transmitters shall be kept away from systems with installed EEDs in accordance with the guidance found in AFMAN 91-201, Paragraph 2.58.

The 25-foot radio transmission distance 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.

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

8.4. Optical/Laser Operations:

8.4.1. Optical/Laser Operating Standards. Optics and lasers shall be operated in accordance with 45 SWI 40-201 or 30 SWI 48-102.

8.4.2. Optical/Laser Operation Personnel Protection Requirements:

8.4.2.1. Optical/laser operations personnel shall be trained and certified in accordance with 45 SWI 40-201 or 30 SWI 48-102.

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

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.

8.4.4. Optical/Laser Inspection:

8.4.4.1. Periodic inspections shall be conducted to ensure the laser and controls are in safe working condition and are properly protected from potential damage.

Conditions of concern include dangerous light radiation, temperature extremes, shatterable materials, contaminating gases, cryogenics, high voltage, and X-rays.

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

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

8.4.5. Optical/Laser Operations:

8.4.5.1. Alignment of targets, optics, filters, and other optical/laser items shall be accomplished using non-hazardous low power (Class I or Class II) lasers.

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

8.4.5.3. 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.

8.4.5.4. Activated lasers shall not be left unattended.

8.4.5.5. Unattended lasers shall be locked out and otherwise safed.

8.4.5.6. Operations involving laser systems with hazardous materials shall follow the requirements for hazardous materials described in Chapter 10 of this volume.

8.4.5.7. Operations involving laser systems with pressurized subsystems such as cryogenic fluids shall follow the requirements described in Chapter 11 of this volume.

8.4.5.8. Operations involving lasers with high voltage or capacitance shall follow the requirements in Chapter 14 of this volume.

8.4.5.9. All electrical and mechanical azimuth and elevation stops, and other safety devices shall be verified before performing each laser operation. (See the bordered paragraph immediately after 8.3.1.2.2 for examples of safety devices.)

8.4.5.10. Laser platforms shall comply with the requirements for mechanical ground support equipment used to handle critical hardware as described in Chapter 6 of this volume.

CHAPTER 9

RADIOACTIVE (IONIZING) RADIATION SOURCES OPERATIONS

Launch approval of radioactive (ionizing radiation) sources is addressed in Volume 3, Chapter 9 of this publication.

9.1. Range Safety and the RPO shall approve all procedures for handling radioactive sources.

9.2. All ionizing operations shall be planned and conducted so that personnel exposure is as low as reasonably achievable (ALARA), but in no case shall the maximum dose and exposure limits in 10 CFR 20, ***Standards for Protection Against Radiation***, be exceeded.

9.3. In addition to the requirements in this publication, Range Users shall also comply with any range-specific requirements. Range-specific requirements are in 45 SWI 40-201 or 30 SWI 40-101 ***Managing Radioactive Materials on VAFB***.

9.4. CCAFS 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.

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

9.6. Mishaps involving radioactive materials shall be reported in accordance with AFI 91-110 and AFI 91-204.

CHAPTER 10

HAZARDOUS MATERIALS OPERATIONS

10.1. Hazardous Materials Operating Standards:

10.1.1. Hazardous materials shall be selected in accordance with 3.10. of Volume 3 of this publication.

10.1.2. Hazardous operations shall be conducted in accordance with AFOSHSTD 161-21, ***Hazard Communication***, 29 CFR 1910.1200, ***Hazard Communication,*** 29 CFR 1910.119, ***Process Safety Management of Highly Hazardous Chemicals*****,** 40 CFR 68, ***Chemical Accident Prevention Provisions*****,** ***subpart G Risk Management Plan***, AFOSHSTD 91-119, ***Process Safety Management of Highly Hazardous Materials*****,** AFOSHSTD 91-501, and AFOSHSTD 91-68, ***Chemical Safety***, for process safety management (PSM) and risk management plan (RMP).

10.1.3. Additional ER Requirements: Range Users shall comply with the 45 SWI 91-101, ***Process Safety Management***, and 45 SWI 91-202, ***Risk Management Plan***. The 45 SW point of contact for process safety management is System Safety (45 SW/SES).

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

10.2. Hazardous Materials Operations PPE. Proper head, eye, hand, body, and respiratory protection shall be worn as required in accordance with AFOSHSTD 91-501 and 29 CFR 1910. The PPE shall be approved by Range Safety and is subject to the approval of the Bioenvironmental Engineer.

10.3. Hazardous Materials Procedures. Hazardous materials procedures shall be established per AFMAN 32-4013 and include, but not be limited to, the following topics:

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

10.3.2. Actions for decontamination, neutralization, cleanup, and disposal.

10.4. Hazardous Materials Operations:

10.4.1. The use of any hazardous material is subject to Range Safety approval.

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

10.4.3. Control measures for hazardous liquids include, but are not limited to, the following criteria:

10.4.3.1. Approved containers shall be used.

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

10.4.3.3. Quantities shall be limited as approved by Fire Department.

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

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

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

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

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

10.4.3.9. Hazardous materials and chemicals shall not be used when personnel are in confined spaces. Proper ventilation shall be used to ensure that buildup and/or pocketing of hazardous materials and chemicals have been vented or are offgassing does not occur.

10.4.3.10. Materials prone to electrostatic charge buildup shall not be used in the vicinity of ordnance or propellants.

10.4.3.11. 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.

10.4.4. In the event of an unplanned toxic release, the Range User shall comply with AFI 32-4002, ***Hazardous Material Emergency Planning and Response Compliance***, 30 SWI 91-106, ***Toxic Hazard Assessments***, and 45 SW ***Launch Toxic Hazard Control Plan***.

10.5. Restrictions on the Use of Static-Producing and Flammable Materials:

10.5.1. General. Materials prone to electrostatic charge buildup shall not be used on or near ordnance items or in the vicinity of flammable liquids such as propellants.

10.5.1.1. 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:

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

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

10.5.1.1.3. Materials shall not come within 50 feet of exposed flammable liquids.

10.5.1.2. 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.

10.5.2. Material Tests:

10.5.2.1. 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 for compatibility with their intended use.

10.5.2.2. 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.

A KSC/ranges materials list providing the test results of many types of materials is available from KSC Materials Testing Labs.

10.5.2.3. Testing shall consider the following material characteristics:

10.5.2.3.1. Ability to build up a charge (triboelectric test).

10.5.2.3.2. Ability of that charge to decay (triboelectric test).

A material is considered to have good electrostatic dissipation properties if it can dissipate voltage down to 350 volts in 5 seconds using the triboelectric test.

10.5.2.3.3. Flammability.

10.5.2.3.4. Compatibility with other materials and liquids the material may come into contact with.

10.5.2.4. Material restrictions may also arise from other limitations such as being humidity dependent (for charge dissipation) or degradable in sunlight (ultraviolet).

10.5.2.5. Range Safety shall approve the use of materials based on the test results.

Materials that do not meet these criteria may be acceptable for a particular usage as determined by Range Safety.

10.5.2.6. Material deficiencies shall result in operational restrictions.

10.6. Hazardous Commodity Lockers:

10.6.1. Positioning and Use of Hazardous Commodity Lockers. Hazardous commodity lockers or cabinets shall be positioned and used for the purpose of storing flammable and combustible liquids in accordance with 29 CFR 1910.106, NFPA 30, ***Flammable and Combustible Liquids Code***, and AFOSHSTD 91-501

10.6.2. Hazardous Commodity Locker Inspection. The Range User shall inspect hazardous commodity lockers at least weekly.

10.7. Disposal of Contaminated Liquid Propellant, Gas, or Other Regulated Wastes:

10.7.1. CCAFS Cape Support (ER) (853-5211) or Range Scheduling (WR) (606-8825) shall be notified of any hazardous material requiring disposal.

If required, additional guidance shall be obtained from Civil Engineering (Environmental Coordinator) or their designated representative and Range Safety.

10.7.2. Disposal of toxic or contaminated liquid propellants, gases, or other wastes shall be performed using methods and techniques approved by Range Safety and Civil Engineering (Environmental Coordinator) in accordance with the 45 and 30 Space Wing Operations Plan 19-14, ***Petroleum***

Products and Hazardous Waste Management Program, as well as all applicable federal, state, and local regulations.

10.7.3. Range Users shall notify Civil Engineering to obtain proper clearance and support to dispose of wastes before the generation of such wastes.

10.7.4. As needed, those operations involving toxic propellants shall be conducted under the surveillance of Environmental Health and Pad Safety to ensure the safety of personnel involved in the operation and personnel located in adjacent or downwind areas

10.7.5. Records of management and identification of wastes shall be maintained by the organization generating the waste.

10.7.6. Records of disposal of toxic materials shall be maintained by Environmental Flight or their designated contractor as outlined in the applicable hazardous waste management plan at the ranges.

10.7.7. All spills or releases of hazardous substances, including petroleum products, shall be reported to CCAFS Cape Support (ER) (853-5211) or Range Scheduling (WR) (606-8825) and Pad Safety immediately.

CHAPTER 11

GROUND SUPPORT AND FLIGHT HARDWARE PRESSURE SYSTEMS OPERATIONS

The minimum operational requirements for both ground support and flight hardware pressure systems operations are described below. Operational requirements unique to either category are identified.

11.1. Pressure Systems Operating Standards:

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. As a result, low-pressure, high-volume systems can be as hazardous to personnel as high-pressure systems.

11.1.1. Only pressure systems that meet the design requirements of Volume 3 as tailored for each specific program by Range Safety shall be operated on the ranges.

11.1.2. The handling and storage of propellants shall be in accordance with CPIA 394, ***Chemical Propulsion Information Agency-Hazards of Chemical Rockets and Propellants***, and DoD 6055.9-STD and subtier documents such as AFMAN 91-201 and NAVSEA OP 5, ***Ammunition and Explosives Ashore: Safety Regulations for Handling, Storing, Production, Renovation and Shipping.***

11.1.3. 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.

11.1.4. Propellants shall be used and stored only in systems that meet the design requirements of Volume 3, Chapter 11 and Chapter 12 and shall be approved by Range Safety.

11.1.5. Portable or mobile vessels and packaging used for transportation of pressurized or hazardous commodities shall be maintained and recertified in accordance with applicable Department of Transportation (DOT) CFR 49 regulations.

11.1.6. If a DOT vessel is installed on a permanent basis, it shall fall under the recertification requirements for a fixed system.

11.2. Pressure Systems Personnel Requirements:

11.2.1. Pressure Systems Training and Certification. All personnel who operate, test, and maintain pressure systems shall be trained and certified.

11.2.2. Pressure Systems PPE:

11.2.2.1. Selection of PPE. The selection and use of PPE shall be approved by Range Safety and is subject to approval by Bioenvironmental Engineering as identified in 5.3.

11.2.2.1.1. Approval shall be limited to a particular model number of protective equipment and a particular operation.

11.2.2.1.2. 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.

11.2.2.1.3. Approvals are not transferable; approvals for similar operations require a reevaluation of the parameters stated above.

11.2.2.1.4. Protective gear shall be compatible with the propellants involved, shall be fire resistant, non-static producing, and shall be approved by Range Safety before use.

11.2.2.1.5. 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.

11.2.2.2. SCAPE, Category I or IV:

11.2.2.2.1. SCAPE, Category I or IV shall be used for propellant flow and pressurization during the following operations:

11.2.2.2.1.1. Connection and disconnection of wet lines or contaminated (not purged and flushed) dry lines.

11.2.2.2.1.2. Sampling operations.

11.2.2.2.1.3. During propellant flow.

11.2.2.2.1.4. During initial pressurization with propellants until system integrity has been verified (no leaks).

11.2.2.2.1.5. Connections and disconnections of tanker load/off load lines.

11.2.2.2.1.6. Removal and replacement of components in a liquid line.

11.2.2.2.1.7. Opening any liquid system that has not been drained, purged, and flushed with referee fluid.

11.2.2.2.1.8. When the condition of the system is uncertain or unknown.

11.2.2.2.2. The maximum operating time in a Category I SCAPE suit is 110 minutes; however, Range Safety or Pad Safety can authorize on-station time not to exceed 120 minutes. In extreme temperatures, Range Safety or Pad Safety can restrict on-station times in Category I SCAPE suits to less than 110 minutes. (ER Only) Personnel using Category I SCAPE suits shall observe a 60-minute rest period between consecutive SCAPE operations; for example, no double-packing.

11.2.2.2.3. For physiological purposes, the maximum operating time in a Category IV or VI SCAPE suit shall not exceed 4 hours at one time.

11.2.2.3. Splash Suits. Splash suits, with self-contained breathing apparatus, shall only be used with systems that contain residual vapors and only after Range Safety approval. If any liquid is in the system, splash suits shall not be used.

11.2.2.3.1. Removal of full protective gear after system integrity verification shall require Pad Safety approval.

11.2.2.3.2. Emergency protective gear shall be available throughout operations to the crew and other personnel who might be affected in the event of a spill.

11.2.2.3.3. The following non-liquid operations shall require splash suits:

11.2.2.3.3.1. Removal and replacement of components on purged and isolated liquid lines.

11.2.2.3.3.2. Removal and replacement of components on vent lines.

11.2.2.3.3.3. Connections and disconnections of drained, purged, and isolated lines.

11.2.2.3.3.4. Pressure leak checks when required by procedure.

11.2.2.3.4. With Pad Safety Officer concurrence, the WR allows the use of splash suits during propellant flow after integrity has been established.

11.2.2.4. PPE for Cryogenic Systems:

11.2.2.4.1. 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.

11.2.2.4.2. 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.

11.2.2.5. PPE for Hydrogen Peroxide Transfers. Hydrogen peroxide transfers shall require the use of boots, gloves, and face shields of material approved by Range Safety.

11.3. Pressure Systems Procedures:

11.3.1. .Procedures shall be prepared governing the safe operation, testing, maintenance, and installation of pressurized systems by the agency performing the specific task.

11.3.2. Procedures shall be developed for all operations involving propellants and the checkout of propulsion systems.

11.3.3. Off-loading procedures for payloads and launch vehicles shall be made available at any time propellant is loaded in flight hardware. Off-loading design as outlined in Volume 3, Chapter 11 and Chapter 12 of this publication addresses the complete system during the complete processing flow. The off-loading procedures shall include integration of the following:

11.3.3.1. Hardware:

11.3.3.1.1. Launch vehicle.

11.3.3.1.2. Launch vehicle fairing.

11.3.3.1.3. Spacecraft.

11.3.3.1.4. Launch complex.

11.3.3.1.5. Process facility.

11.3.3.1.6. Transport vehicle.

11.3.3.1.7. Fixed GSE.

11.3.3.1.8. Portable GSE.

11.3.3.2. Software Command Capability.

11.3.3.2.1. Flight Hardware.

11.3.3.2.2. GSE:

11.3.3.3. Personnel Capability.

11.3.3.3.1. Remote:

11.3.3.3.2. SCAPE.

11.3.3.3.3. Combination of both.

11.4. Pressure Systems Test, Inspection, and Maintenance Requirements:

11.4.1. General Test Requirements:

11.4.1.1. Pressure systems shall be initially tested in accordance with Volume 3, Chapter 11 or Chapter 12.

11.4.1.2. Any system that has been opened shall be leak tested at 100 percent maximum operating pressure (MOP) with an inert medium.

11.4.1.3. Pressure relief valves and flex hoses shall be retested within one year of intended use.

11.4.1.4. Pressure gauges and transducers shall be calibrated annually.

11.4.1.5. After any disconnection, modification, or repair of a system, the affected part of the system shall be leak tested.

11.4.1.6. Any component that has been damaged, potentially damaged, repaired, replaced, or modified shall be proof tested in accordance with Volume 3.

11.4.1.7. After the component proof test, the system or subsystem shall be proof tested, functionally tested, and leak tested. The determination for system proof testing shall be made on a case-by-case basis.

11.4.1.8. New, modified, or repaired propellant systems shall be tested in accordance with Volume 3, Chapter 11 or Chapter 12.

11.4.1.9. A log shall be kept on propellant systems to keep track of use, maintenance, modification, testing, and inspection.

11.4.2. Ground Support Pressure Systems General Inspection Requirements:

11.4.2.1. Before use and each operation, facilities and equipment shall be inspected by Range Users and Pad Safety to ensure a safe configuration for the facilities, equipment, and propellants involved.

11.4.2.2. Propellant transfer and storage areas shall be spot checked by Pad Safety, Range Safety, the Fire Department, and Environmental Health. The appropriate area supervisor shall be advised of any discrepancies noted.

11.4.2.3. Periodic inspections shall be performed on all ground pressure systems in accordance with applicable procedures.

11.4.2.4. Periodic inspections shall be performed on ground based pressure vessels and liquid holding tanks in accordance with the ISI Plan in Volume 3. These inspections shall be performed during the following periods:

11.4.2.4.1. Certification Period. Period from the initial operational use of the vessel and/or system until the vessel and/or system requires recertification.

11.4.2.4.2. 11.4.2.4.2.First Certification Period. Period from the first recertification effort until second recertification.

11.4.2.4.3. All subsequent Recertification Periods.

11.4.2.4.4. 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.

11.4.3. Pressure Systems General Maintenance:

11.4.3.1. Before replacement, storage, or repair of hypergolic or toxic system components, the system shall be purged and flushed of all residual contaminants. System connections and removed components shall be appropriately capped, bagged, and labeled before moving the component.

11.4.3.2. A record shall be kept on the certification of system and component cleanliness.

11.4.3.3. When it is necessary to remove flight hardware components from the system, all broken connections shall be bagged and tagged to prevent moisture or particle contamination from outside sources.

11.4.4. Pressure Systems Tests. Tests performed shall meet the requirements as outlined in Volume 3, Chapter 11 and Chapter 12.

11.4.4.1. Periodic Test Requirements for Pressure System Components:

11.4.4.1.1. Flexible hoses shall be hydrostatically proof tested to 1.5 times their MAWP once a year unless otherwise approved by Range Safety.

11.4.4.1.2. All permanently installed flexible 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.

11.4.4.1.3. Pressure gauges and transducers shall be calibrated once a year.

11.4.4.1.4. 11.4.4.1.4.Pressure relief valves shall be tested for proper setting and operation once a year.

11.4.4.2. Testing Modified and Repaired Pressure Systems. Tests performed shall meet the requirements as outlined in Volume 3, Chapter 11 and Chapter 12.

11.4.4.3. Pressure Systems Tagging:

11.4.4.3.1. After test and inspection, pressure system components shall be tagged.

11.4.4.3.2. Tags shall provide the date of the last inspection and proof-load test and the component MAWP.

11.4.5. Ground Support Pressure Vessels and Liquid Holding Tanks Recertification. Recertification data shall be submitted as part of the MSPSP as required in Volume 3, Chapter 11 and Chapter 12.

11.4.6. Pressure Vessel and Liquid Holding Tank Recertification Documentation. Documentation shall be maintained in accordance with ESMC TR-88-01.

11.5. Pressure Systems Operating Requirements:

11.5.1. General Operating Requirements. Only pressure systems approved by Range Safety shall be used.

11.5.1.1. Pressure Systems Marking:

11.5.1.1.1. Warning signs shall be posted to keep personnel out of areas where pressurization is taking place.

11.5.1.1.2. High and ultra-high pressure systems (systems equal to or greater than 3,000 psig) shall be marked with danger signs indicating the maximum pressure that could be involved.

11.5.1.1.3. Pressure relief valves that present a noise hazard on activation shall be marked with danger signs.

11.5.1.2. Pressure Systems Remote Pressurization. ***Exception:*** *For the 30 SW, remote pressurization can be waived provided the following is provided: (1) 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; (2) system configuration has not been modified or repaired before the above testing. Unwelded relief or sensing devices may be replaced after system proof testing; and (3) Inspection of the pressure system at the launch site verifying damage has not been sustained during transportation or handling before the above testing.*

11.5.1.2.1. Remote pressurization is required for the following conditions:

11.5.1.2.1.1. Initial pressurization of any vessel or system with an inert medium.

11.5.1.2.1.2. Any pressurization that will exceed MOP.

11.5.1.2.1.3. Any system or vessel whose design or condition is considered unknown or questionable by Range Safety.

11.5.1.2.2. All personnel shall be evacuated whenever pressure exceeds the MAWP.

11.5.1.2.3. Suitable barriers shall be used to protect personnel. The Range User and Range Safety shall determine the adequacy of the blast shield for the pressure and volume of the system.

11.5.1.3. Pressure Systems Pressurization Operations:

11.5.1.3.1. Pressure systems shall be inspected upon arrival on the ranges or before first operation.

11.5.1.3.1.1. Where there is evidence that systems have been damaged or overstressed, replacement or, at a minimum, remote initial pressurization shall be required.

11.5.1.3.1.2. Range Users who do not perform initial pressurization remotely shall certify to Range Safety that no evidence of damage or overstress exists.

11.5.1.3.2. A system and/or facility check shall be made before the start of the pressurization operation.

11.5.1.3.3. Personnel present during any pressurization shall be limited to those in direct support of the operation.

11.5.1.3.4. If a leak occurs during pressurization, the system and/or subsystem shall be depressurized before adjusting any fittings.

11.5.1.3.5. Flexible hose shall be secured along its length at 6-foot intervals.

11.5.1.3.6. Bolts and fittings shall not be loosened or torqued while the system is under pressure.

11.5.1.3.7. 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. Only qualified and authorized personnel shall change the setting of these valves and regulators.

11.5.1.3.8. Flight hardware 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 unless otherwise specified and approved by Range Safety.

11.5.1.3.9. Flight hardware 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.

11.5.1.4. Pressure Systems Entry, Maintenance, and Repair:

11.5.1.4.1. Pressure Systems Entry and Repair Requirements:

11.5.1.4.1.1. Before entry into or repair of a pressurized system, depressurization of that portion of the system is mandatory.

11.5.1.4.1.2. The steps listed below shall be followed:

11.5.1.4.1.2.1. A minimum of 2 block valves shall be closed between the portion of the system to be opened and the source of pressure.

11.5.1.4.1.2.2. The section of line to be opened and the section between the block valves in series shall be vented (depressurized) to atmospheric pressure before the start of work and remain vented (depressurized) during all phases of work.

11.5.1.4.1.2.3. Whenever operations permit, the entire system shall be depressurized before a portion of the system is isolated, vented, and opened.

11.5.1.4.1.2.4. Venting a pressure system shall be accomplished through vent valves. Regardless of pressure, venting shall never be accomplished by loosening or removing a fitting.

11.5.1.4.1.2.5. Lockout devices and warning tags shall be attached to the valves that are isolating the area where system entry will be made.

11.5.1.4.1.2.6. The isolated area shall be verified as being depressurized before opening.

11.5.1.4.2. Open System Work Precautions:

11.5.1.4.2.1. 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:

11.5.1.4.2.1.1. Authorization for entry is required from the responsible complex or area supervisor.

11.5.1.4.2.1.2. Personnel limits shall be established in a Range Safety approved procedure.

11.5.1.4.2.2. When it is necessary to remove components from the system, due care shall be exercised to prevent moisture or particle contamination from outside sources.

11.5.1.4.2.3. Lockout devices and tagging shall be used to ensure systems or subsystems are not operated while work is being performed on the system.

11.5.1.4.2.4. Work requiring lockout and tagging includes the following:

11.5.1.4.2.4.1. The system is depressurized for maintenance.

11.5.1.4.2.4.2. The work to be performed extends to another shift, either same crew next day or a different crew the same day.

11.5.1.4.2.4.3. The work site is left unattended.

11.5.1.4.2.4.4. The valve is not visible at all times.

11.5.1.4.2.4.5. Valves shall be rendered inoperative with a lockout device compatible with the valve material and the lockout devices shall be approved by Range Safety.

Range Safety Approved Lockout Devices:

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.

11.5.1.4.2.5. The following criteria shall be observed when removing locks and tags and returning the system to service:

11.5.1.4.2.5.1. 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.

11.5.1.4.2.5.2. Tags shall be removed only by the crew placing the tag.

11.5.1.4.2.5.3. Removed tags shall be returned to the crew office and mated with the tear off portion of the tag.

11.5.1.4.2.5.4. Both tag and tear off portion shall be filed or disposed of in accordance with current practice.

11.5.2. Pressure Systems Containing Liquid Propellant. In addition to the requirements noted above, the following requirements shall be adhered to when operating, testing, and maintaining pressure systems containing liquid propellants.

11.5.2.1. General Operating Requirements for Pressure Systems Containing Liquid Propellants:

11.5.2.1.1. 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.

11.5.2.1.2. 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. Pad Safety advises, ensures control, and supports, as necessary, in accordance with 45 SW OPLAN 32-1, ***Disaster Preparedness Operations Plan***. At the WR, the Support Group Commander or Fire Chief serves as the on-scene commander and Pad Safety advises, ensures control, and supports, as necessary.

11.5.2.1.3. Simultaneous tanking of fuels and oxidizers aboard a launch vehicle/payload is prohibited.

11.5.2.1.4. Vessels, lines, and propellant loading systems shall be properly bonded and commonly grounded.

11.5.2.1.5. Vapor monitoring equipment shall be used for leak (sniff) checks and general atmosphere monitoring to determine the necessity for PPE. Vapor monitoring equipment shall be approved by Range Safety and is subject to approval by Bioenvironmental Engineering.

11.5.2.1.6. A toxic vapor check shall be conducted by the operations control authority when personnel are in a facility that has toxic propellants contained in flight hardware and GSE at the start of each 8-hour shift and before entering a facility in which toxic propellant has been left unattended for 8 hours or more.

11.5.2.1.7. In locations where liquid propellants will be handled, water shall be available in the area in sufficient quantities for fire, spill, and medical use. Skin or eye contact with toxic propellants shall be flushed with copious amounts of water. For specified flush periods, consult the Material Safety Data Sheet (MSDS) for the product being used. Appropriate medical attention shall be sought after flushing.

11.5.2.1.8. The supervisor shall notify Range Safety and Bioenvironmental Engineering of any injury involving toxic or non-toxic propellants.

11.5.2.1.9. Transport of more than 5 gallons of hypergolic propellants shall require a Security or HOS escort as described in Chapter 16 of this volume.

11.5.2.2. Pre-Operational Requirements for Pressure Systems Containing Liquid Propellants:

11.5.2.2.1. Range Safety approved procedures shall be used for all propellant operations and the checkout of propulsion systems.

11.5.2.2.2. As required by procedure, Pad Safety and other required support shall be on hand before the conduct of operations.

11.5.2.2.3. Pad Safety concurrence to proceed shall be obtained before the conduct of operations.

11.5.2.2.4. Personnel qualification and training shall be verified by the respective supervisors.

11.5.2.2.5. Before starting operations, the Range User and Pad Safety shall verify that the facility and equipment are ready by performing the following checks:

11.5.2.2.5.1. Wet check of safety showers and water lines before propellant transfer.

11.5.2.2.5.2. Accessibility and operability of emergency exit doors.

11.5.2.2.5.3. Operability of drain and sump systems and their capability for handling a worst case spill and wash down.

11.5.2.2.5.4. Operability of vent systems.

11.5.2.2.5.5. Availability of fire protection.

11.5.2.2.5.6. Proper configuration and grounding of propellant systems.

11.5.2.2.5.7. Weather conditions.

11.5.2.2.5.8. PA announcements, warning lights, and barriers.

11.5.2.2.5.9. Implementation of access control.

11.5.2.2.5.10. All required support on hand.

11.5.2.2.5.11. .Availability of approved operating procedures and emergency procedures.

11.5.2.2.5.12. Removal of ignition sources from the area.

11.5.2.2.6. Pad Safety shall inform the Test/Launch Conductor that the appropriate roadblocks have been established, the hazard area cleared, and propellant tanking can begin.

11.5.2.2.7. At the ER, propellant transfer shall not start when the passage of an electrical storm is imminent (within 5 nautical miles). A propellant transfer operation already in progress shall be interrupted or expeditiously concluded at the discretion of Pad Safety or the supervisor in charge of the operation. The OSP 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 nautical miles. At the WR, the guidance provided in 5.6.3 shall be followed.

11.5.2.2.8. Emergency protective equipment shall be provided as required by Range Safety.

11.5.2.2.9. The Range User shall provide the maximum source strength based on quantity (gallon or pound) and surface area. The worst case credible spill (quantity) shall be based on a failure analysis provided to Range Pad Safety and 45 Weather Squadron Range Weather Operations (ER) or Range Pad Safety and 30 Weather Squadron (WR) before the operation. This information shall be used to determine the downwind sector that shall be evacuated if a large spill occurs.

11.5.2.2.10. 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.

11.5.2.3. Controls:

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.

11.5.2.3.1. 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.

11.5.2.3.2. A larger safety clearance zone that limits personnel access to those individuals directly or indirectly involved in the operation or mission shall be established. The determination of the larger safety clearance zone shall include consideration of the availability of fencing and Security or HOS check points and the TNT equivalency of the propellants involved.

11.5.2.3.3. 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 OSP.

11.5.2.4. Operating Requirements for Pressure Systems Containing Liquid Propellants:

11.5.2.4.1. Pad Safety concurrence shall be obtained before starting propellant transfer operations and before pressurization.

11.5.2.4.2. Portable vessels and systems containing incompatible fuels and oxidizers shall not be brought into closer proximity than allowed for permanent systems unless otherwise agreed to in advance by Range Safety.

11.5.2.4.3. Fire Protection and Environmental Health shall be available as required by procedure.

11.5.2.4.4. All persons and vehicles not absolutely essential to the operation shall be evacuated.

11.5.2.4.5. Before 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. At the ER, Environmental Health shall monitor and report any levels exceeding health standard criteria to the Pad Safety Office. At the WR, Bioenvironmental Engineering and Environmental Health monitor for AF operations only. Contractors are responsible for monitoring their own systems.

11.5.2.4.6. The handling and transfer of toxic materials and propellants shall be monitored by Pad Safety to ensure the safety of personnel involved in the operation and personnel downwind of the operation.

11.5.2.4.7. Vapor monitoring shall be continuous whenever personnel are in enclosed areas having toxic propellants present.

11.5.2.4.8. At the ER, in the case of a lightning warning (lightning within 5 nautical miles), the system shall be secured; the complex, storage, or operating area shall be cleared; and the required actions called for in procedures and OSPs shall be taken. (See Attachments 3, 4, and

5 of this volume.) At the WR, work stops and systems shall be secured when lightning is within 10 nautical miles. Buildings are evacuated when lightning approaches 5 miles.

11.5.2.4.9. 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 Pad Safety.

11.5.2.4.10. 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.

11.5.2.4.11. Tanking of toxic or cryogenic liquids aboard a launch vehicle or payload during launch countdown shall be performed as late as possible. If tanking is required during launch processing before the countdown, tanking shall be performed as late in the processing as is practical.

11.5.2.4.12. The appropriate actions and evacuations shall take place in the event of an emergency such as a propellant spill.

11.5.2.4.13. Cape Support (ER) and Range Safety (ER) or Range Scheduling (WR) and Pad Safety (WR) shall be notified of any propellant mishap and incidents, including near misses.

11.5.3. Releases of Toxic Vapors:

11.5.3.1. All releases of toxic vapors shall comply with AFI 32-4002, ***Hazardous Material Emergency Planning and Response Compliance***; 30 SWI 91-106, ***Toxic Hazard Assessments***; 30 SW OPLAN 32-1, ***Vandenberg Air Force Base Disaster Preparation Operations Plan***; 30 OPLAN 32-4002-A, ***Hazardous Materials (HAZMAT) Emergency Response Plan***; 45 SW ***Launch Toxic Hazard Control Plan***; 45 SW Range Safety Operations Requirements, Number 19, ***Toxic Hazard Control Daily and Launch Operations***; ***Consolidated Comprehensive Emergency Management Plan (CCEMP)***; 45 SWI 91-204, ***Launch Vehicle Toxic Plume Instruction for On-Base Personnel***.

11.5.3.2. At the ER, any plans to vent toxic vapors shall require coordination with the Civil Engineer – Environmental Flight, Bioenvironmental Engineering, and Environmental Health and Range Safety approval. At the WR, venting operations shall be conducted in accordance with 30 SWI 91-106 and the applicable facility or operations plan.

11.5.3.3. The actual venting operation shall not start without Pad Safety approval.

11.5.3.4. Venting restrictions and controls shall be identified in the appropriate OSP or operating procedure.

11.5.3.5. Venting operations require that the appropriate downwind sector be evacuated.

11.5.3.6. The operations control authority shall verify that Environmental Health is present to verify concentration levels at the control area boundary.

11.5.3.7. The operations control authority shall verify that Security Police or HOS maintain the appropriate roadblocks.

11.5.3.8. Planned releases shall be in accordance with permits maintained by Civil Engineering.

11.5.4. Emergency Decontamination of Facilities and Personnel. . Emergency decontamination of facilities and personnel shall be accomplished under Pad Safety direction with Environmental Health and the Fire Department performing the decontamination, if required

11.5.5. Handling Leaks and Spills of Liquid Propellant:

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.

11.5.5.2. Leak and Spill Procedures:

11.5.5.2.1. Range Users and supporting agencies shall develop procedures for handling major and minor leaks and spills. CCAFS Cape Support (ER) or Wing Operations Control Center (WOCC) (WR) shall be notified of any spill or release of hazardous material.

11.5.5.2.2. Each area that contains liquid propellants shall have a Range Safety approved plan for evacuation based on spill size (quantity and surface area). At the ER, an evacuation zone for a small spill (for example, a gallon of hypergolic propellant) is typically 700 feet downwind or more and approximately 200 feet radially if the spill is allowed to spread out on a flat surface. At the WR, required evacuations are 2,000 feet upwind or as published in the OSPs and Toxic Hazard Zones (THZs).

11.5.5.2.2.1. The approved evacuation 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.

11.5.5.2.2.2. The downwind sector shall be based on the following factors:

11.5.5.2.2.2.1. Maximum source strength based on quantity (gallon or pound) and surface area. The Range User shall determine a worst case spill (quantity) based on a failure analysis.

11.5.5.2.2.2.2. Maximum vapor concentration acceptable for personnel exposure.

11.5.5.2.2.2.3. Average weather criteria, such as wind direction, wind speed, temperature, temperature lapse rate.

Weather variables can be obtained from the Range Weather Officer.

11.5.5.2.3. These procedures shall be in accordance with the applicable OSP and shall be submitted to Range Safety for review and approval.

11.5.5.2.4. Procedures shall address the topics covered in 10.7.

11.5.5.3. Handling Minor Leaks or Spills:

11.5.5.3.1. Minor leaks or spills shall be cleaned up with absorbent material where possible.

For safety and hardware protection reasons, certain spills may require the spill to be washed or flushed with water into collecting tanks or holding basins and disposed of properly to prevent ecological or health hazards. See CPIA 394 for information on treating spills.

11.5.5.3.2. Pad Safety shall be notified of minor leaks and spills and subsequent actions.

See CPIA 394 and Range Safety for guidance on disposal of toxic or corrosive propellants.

11.5.5.4. Handling Major Leaks or Spills:

11.5.5.4.1. 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 CCEMP/JHB 2000, 45 SW OPLAN 32-3, Volume 1, ***Hazardous Material Emergency Response and Training Operations Plan***; 30 SW OPLAN 32-1, ***Vandenberg Air Force Base Disaster Preparation Operations Plan***; 30 SW OPLAN 32-4002-C, ***Hazardous Materials (HAZMAT) Emergency Response***; 30 SWI 91-106. If the requirements described below are in conflict with these OPLANS, the OPLANS shall take precedence.

11.5.5.4.2. The following actions shall be taken:

11.5.5.4.2.1. Time and the situation permitting, the source of the propellant flow and pressure source shall be shut down.

11.5.5.4.2.2. All personnel shall be evacuated out of the area including the minimum downwind sector. Travel shall be upwind or crosswind 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.

11.5.5.4.2.3. Injured or trapped personnel shall be rescued. Appropriate PPE shall be used.

11.5.5.4.2.4. Adjacent areas shall be alerted.

11.5.5.4.2.5. .Personnel shall be available to direct emergency crews and to provide information to assist them.

11.5.5.4.2.6. All personnel shall report to the supervisor at the designated assembly point for head count.

11.5.5.5. Handling Cryogenic or Toxic Liquid Spills:

11.5.5.5.1. Spills of cryogenic liquids shall be flushed with large amounts of water into the surrounding ground surface or a holding basin.

11.5.5.5.2. Spills of toxic or corrosive propellant, or those that could affect the public health or ecology, shall be flushed with water or another neutralizing agent into a collecting tank to be disposed of in accordance with approved procedures.

Refer to CPIA 394 Volume III, ***Liquid Propellants,*** the Medical Department, and the Florida Department of Environmental Protection (ER) or the California Department of Environmental Protection (WR) for guidance.

11.5.5.6. Flight Graphite Epoxy Composite Overwrapped Pressure Vessel Operations. Only composite overwrapped pressure vessels (COPVs) that meet the design, test, and inspection requirements described in Volume 3 of this publication shall be operated on AFSPC ranges.

11.5.5.6.1. If COPVs that contain inert pressurants are in close proximity to propellant tanks, the Range User shall provide test data proving that the composite overwrap is compatible with the propellant in terms of strength degradation, flammability, and ignition/combustion requirements, when personnel are at risk. If this data is not available, the following actions shall be accomplished:

11.5.5.6.1.1. Verification that the COPV is not in a credible "drip zone" for liquid propellants during ground processing operations.

11.5.5.6.1.2. If the COPV is in a credible "drip zone", the COPV shall be protected with a coating and/or covers and/or splash shields to guard against contact with potentially incompatible liquids.

11.5.5.6.1.3. Hazardous vapor detectors shall be used to monitor the propellant tanks.

11.5.5.6.2. If COPVs will be pressurized to pressures greater than 1/3 of the COPV design burst pressure on AFSPC ranges, the pressurization shall be performed remotely or a blast shield shall be used to protect personnel. If the vessel is to remain pressurized, personnel access shall not be permitted for a minimum of 10 minutes after the pressurization is completed.

11.5.5.6.3. Personnel limits for each operation on or near a pressurized COPV/spacecraft shall be established to minimize personnel exposure to pressurized COPVs.

11.5.5.6.4. The transport of pressurized COPVs shall only occur on Range Safety approved routes that minimize personnel and facility exposure. In addition, pressurized COPV transport shall utilize escorts and shall only occur during Range Safety approved and designated time periods.

11.5.5.6.5. COPVS shall be protected from damage due to impacts during manufacturing, handling, transportation, assembly, and integration of COPVs into the Range User's system(s).

11.5.5.6.6. Except for the pressure test requirements of Volume 3 of this publication, pressure testing of systems with COPVs shall not exceed the manufacturer MEOP pressure limit without the manufacturer's approval and Range Safety's agreement.

11.5.5.6.7. Range Users shall develop and provide to Range Safety Emergency Response Plans (ERPs). These ERPs shall include contingency safing and backout plans for COPVs (taking into consideration leaks, impacts, and exposure to incompatible chemical agents). If implemented, a real time assessment shall be accomplished and contingency operations taken, as required. The ERP shall be approved by the 30 SW/45 SW Chief of Safety.

CHAPTER 12

RESERVED

CHAPTER 13

ORDNANCE OPERATIONS

13.1. Ordnance Operations Procedure Requirements:

13.1.1. All ordnance operations shall be covered by a Range Safety approved operating procedure.

13.1.2. All operations conducted in ordnance facilities shall be specified in procedures and/or operating instructions approved by Range Safety

13.1.3. Procedures shall include all on-base transportation.

13.2. Ordnance Transportation, Receipt, and Storage:

13.2.1. Ordnance Transportation, Receipt, and Storage Standards:

13.2.1.1. All ordnance transportation, receipt, and storage shall be performed in accordance with DoD 6055.9-STD, AFJMAN 24-204, ***Preparing Hazardous Materials for Military Air Shipments***, CFR 49, ***Transportation***, AFMAN 91-201, VAFB Sup 1 to AFMAN 91-201 and 30 SWI 91-107, ***Contractor/Commercial/Associate Unit Explosive Storage, Transportation, Handling and Inspection***, as applicable.

13.2.1.2. Over-the-road and rail shipments to and from the ranges shall comply with DOT requirements.

Receipt inspection requires DOT violations to be reported. See 13.2.4.

13.2.1.3. To be acceptable for transportation by any mode, explosives shall have the following items provided and verified by the Range User before shipment:

13.2.1.3.1. Proper DOT classification for transport. For air transport, refer to AFJMAN 24-204.

13.2.1.3.2. 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.

13.2.1.3.3. The availability of adequate and suitable storage space on the ranges. Availability of adequate and suitable storage space depends on the hazard classification, the size of the storage containers, and temperature and humidity requirements.

13.2.1.3.4. The availability of proper connectors and cabling for ordnance checkout if range facilities and equipment are to be used.

13.2.1.4. All ordnance air shipments shall comply with AFJMAN 24-204 for military air shipments.

13.2.1.5. All hazardous ordnance on VAFB that requires a convoy shall use Hazardous Operations Support (HOS).

13.2.2. Ordnance Transportation General Requirements:

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.

13.2.2.2. Ordnance Services Coordination. Plans for shipment of ordnance to CCAFS shall be coordinated with CCAFS Ordnance Services. Plans for shipment of ordnance to VAFB shall be coordinated with 30 SW/SEGW.

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 Force 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

13.2.3. ER Ordnance Delivery and Receipt:

13.2.3.1. Ordnance deliveries shall be scheduled through CCAFS Cape Support (853-5211) on the ER and delivered only to Range Safety approved facilities.

13.2.3.2. Pad Safety shall be notified of ordnance deliveries on CCAFS.

13.2.3.3. Ordnance shipments arriving at the range shall be escorted from the gate to the proper storage area.

13.2.3.4. After receipt at the Fuel Storage Area (FSA) 2 at CCAFS, all ordnance transportation shall be performed by CCAFS Ordnance Services unless specifically approved by Range Safety.

13.2.3.5. All ordnance transportation shall be approved by Range Safety.

13.2.4. Ordnance Shipment Inspection:

13.2.4.1. As soon as possible after receipt, a receiving inspection shall be conducted by ER Contractor Ordnance Services or 30 SW Transportation Squadron, Traffic Management Office (TMO) and the Range User to ensure that no damage has occurred during shipment.

13.2.4.2. Any shipment discrepancy or DOT violation shall be reported to the TMO and Range Safety.

13.2.5. Ordnance Storage:

13.2.5.1. 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). Processing facilities shall not be used for the storage of ordnance.

13.2.5.2. Range Users shall make arrangements to remove ordnance from the ranges when it is no longer needed.

13.2.5.3. Range Users shall furnish instructions for the disposition of stored ordnance items to the storage provider upon project termination or when ordnance items are no longer required.

13.3. Ordnance Systems Grounding:

13.3.1. Ordnance Systems Grounding PPE:

13.3.1.1. Personnel handling, installing, or electrically connecting ordnance or working within 10 feet of exposed, solid propellant grain shall wear Range Safety approved, flame-retardant, non-static producing, long-sleeve, cuffless, full-body garments (coveralls) with leg stats, or conductive shoes, and/or wrist stats. If required, Range Users shall submit a sample of the garment for testing.

Ordnance Systems Grounding PPE Criteria:

1. The two primary concerns in selecting garments to be worn by personnel handling, installing, or electrically connecting ordnance or working within 10 feet of exposed, solid propellant grain are static and fire. The static concern is self-explanatory. Anti-static smocks may be approved by Range Safety if there is no significant fire hazard. Fire is a primary concern because of the potential for solid/liquid propellant fires. This concern dates back to the X-248 solid motor mishap in the spin test facility at the ER in 1964. Although the most probable cause for this mishap was static electricity, it was observed the survivors of the mishap would have fared much better had they been wearing full-body protection; in other words, coveralls, rather than smocks. Another key piece of information is the fact that the inadvertent motor initiation occurred during a non-hazardous operation.

(Continued..)

2. With the transition of the Air Force and NASA expendable launch programs to the Space Shuttle program in the early 1980s, many activities involved both agencies from a launch vehicle, facility, or personnel point of view. It became increasingly more difficult for safety personnel to ascertain the acceptability of the coveralls being used, particularly with respect to Air Force operations in the Payload Changeout (clean) Room on NASA/KSC's shuttle launch pad. For that reason, the ER Safety Office joined forces with the KSC Safety Office to develop common standards and specifications for coveralls for both non-cleanroom and cleanroom environments. The standardized requirements were documented in the KSC Ground Operations Safety Plan GP 1098, a publication that has since been superceded by other documents. The following guidance on the selection of coveralls is provided for Range Users:

3. General Criteria for Coveralls:

a. Flame Retardant. Cotton garments meeting the Range Safety flame retardant requirements should meet the requirements of MIL-C-43122G, ***Cloth, Sateen, Cotton, Flame Retardant Treated:*** "finished cloth shall have an average time of after-flame of not more than 2.0 seconds, and not more than 40% consumed both initially and following 15 launderings." Per NHB 8060.1B, ***Flammability, Odor, and Offgassing Requirements and Test Procedures for Materials in Environments that Support Combustion,*** Test 1: "less than 6 inches sample consumed and no sparking, sputtering, or dripping of flaming particles."

NOTE: NOMEX garments are not covered by MIL-C-43122F.

b. Thermal Protection. Garments used in solid rocket motor open grain and Category A ordnance operations should provide a measure of radiant heat and flame contact protection where practical. See Aerospace Medicine, Volume 40, Number 11, ***Method and Rating System for Evaluation of Thermal Protection***, November 1969. NASA/KSC blue-collar garments have been tested for thermal protection (***Naval Air Development Center technical memorandum***, 6 March 1979) and provide greater than 14 seconds radiation protection before skin blister at a brightness temperature of 1900oC and greater than 3 seconds flame contact protection before skin blister at a flame temperature of 1220oC.

c. Static Dissipation. Garments meet the Range Safety static dissipation requirement when voltage drops below 350 volts in 5 seconds at 45 plus 5 percent relative humidity (maximum) and 75oF temperature (maximum). See NFPA 77, ***Recommended Practices on Static Electricity*** or NASA KSC Materials Testing Branch Report MMA-1985-79, ***Standard Test Method for Evaluating Triboelectric Charge Generation and Decay***.

d. Rescue. Consideration should be given to rescue of personnel during hazardous operations. Rescue aids can usually be applied external to the garments in general use applications. However, because of frequent confining work, rescue straps are mandatory for cleanroom garments used for hazardous operations.
(Cont:)

e. Sleeves/Legs. Coveralls should contain full-length sleeves and legs; frocks should contain full-length sleeves.

f. Pockets. Pockets, if any, should be lattice type, arranged not to trap hazardous fluids.

g. Cuffs. Garments should not have cuffs (hazardous fluids must not be trapped).

h. Fasteners. Fasteners should be protected from contact (burning) with the skin.

i. Color. Garments should be white or natural in color to take advantage of flame/heat reflectivity.

4. Detailed Criteria for Non-Cleanroom Coveralls. In addition to meeting general criteria, non-cleanroom coveralls used in ordnance facilities/operations should meet the following:

a. Garments should be readily identifiable as meeting Range Safety requirements:

(1) Approved general-use, NASA/KSC hazardous operation coveralls are identified by blue collars.

(2) Aramid (NOMEX) garments containing 1 percent (minimum) filament wire "Brunsmet" or "Bekinox" or carbon thread in one-quarter inch raised grid pattern (carbon grid suits) are approved. (Carbon thread garments are identified by green rescue straps per Paragraph. 2.16.1.3.d in MIL-C-43122F.)

(3) Aramid (NOMEX) garments (non-carbon grid suits) dipped with a Range Safety-approved anti-static solution, such as Ethoquad, subject to periodic checks to ensure the anti-static solution remains active, can be used and should be stenciled "KSC Safety Approved."

NOTE: Range Safety prefers that Range Users acquire white blue-collar coveralls per the KSC specification because the coveralls are known to meet requirements and are readily recognizable. Often the available data on other coveralls is insufficient to determine static resistant and/or fire retardant acceptability. In these cases, a sample set of coveralls needs to be provided to Range Safety for testing by the KSC Materials Laboratory.

b. Coveralls should be properly cleaned to comply with the manufacturer instructions.

5. Detailed Criteria for Cleanroom Coveralls. In addition to meeting the general criteria, cleanroom coveralls used in ordnance facilities/operations should meet the following:

a. The maximum permissible concentration of particles and fibers should not exceed 2,000 particles per square foot of 5 microns and larger, with a maximum of 25 fibers. See ASTM F51-68, ***Standard Method for Sizing and Counting Particulate Contaminant In and On Cleanroom Garments***, (1984), U.S. Air Force Technical Order T.O.-00-25-203, ***Contamination Control of Aerospace Facilities***, and Johnson Space Center JSCM 5322, ***Contamination Control Requirements Manual.***

NOTE: Blue-collar garments should not be used for cleanroom use.

b. Garments should be readily identifiable as meeting Range Safety requirements.

(1) Approved cleanroom coveralls used in hazardous operations are identifiable in that they are 99 percent continuous filament NOMEX with approximately 1 percent conductive nylon filament yarn (carbon impregnated) arranged in a one-half inch raised grid pattern (carbon grid suits).

(2) Continuous filament Aramid (NOMEX) garments dipped with a Range Safety-approved anti-static solution such as Ethoquad, subject to periodic checks to ensure the anti-static solution remains active, are approved and should be stenciled "KSC Safety Approved" or "Range Safety Approved" (non-carbon grid suits).

c. Non-metallic ("Deleren" or equal) zippers should be used on garments in lieu of buttons/snaps in the vicinity of flight hardware where the loss of a button/snap is a concern.

d. When rescue provisions are applicable, green NOMEX parachute grab straps suitable for rescue purposes should be provided on the legs, shoulders, torso, and back of the garment. Straps should withstand a pull of 200 pounds. Grab straps should be tacked down by breakaway stitching at the center of the strap length to prevent the strap catching on objects while the garment is being worn.
(Continued...)

NOTE: In Air Force contractor-operated cleanroom facilities, facility users are expected to use cleanroom coveralls provided by the Air Force facility operator. Besides the fact that (1) it took a long time to develop the currently approved (carbon-grid) cleanroom coveralls and (2) gaining approval for a new type of coverall could be difficult, logistical considerations are involved. For example, a facility evacuation typically requires the facility user to exit the facility to the outside thereby invalidating the cleanroom garments that are worn. Additionally, it is easier for a facility operator to maintain the necessary inventory for replacement garments rather than a facility user. It is strongly recommended that non-Air Force contractor-managed cleanroom facilities use cleanroom garments that meet the NASA/KSC specifications.

13.3.1.2. Other persons who may come in contact with ordnance, test equipment when ordnance is connected, or flight hardware when ordnance connections are not complete shall wear the same coveralls and equipment as described in 13.3.1.1 or as required in procedures specific to the subject equipment and operations.

13.3.1.3. Sweaters and jackets shall not be worn as outer garments over protective coveralls.

13.3.1.4. When solid and/or liquid propellants are present, smocks shall not be used as a substitute for full body protection (coveralls).

13.3.1.5. More stringent controls shall be used when necessary to enforce Range Safety policy.

Range Safety has the option to invoke more stringent controls regarding PPE when necessary to enforce Range Safety policy. For example, all personnel entering a particular control area may be required to wear the proper coveralls.

13.3.2. Ordnance Processing Restrictions on the Use of Static-Producing Materials:

13.3.2.1. Materials prone to electrostatic charge buildup shall not be used in the vicinity of ordnance and propellants.

13.3.2.2. 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:

13.3.2.2.1. Static-producing materials shall not come into contact with a system having an installed EED or other ordnance.

13.3.2.2.2. Static-producing materials shall not come within 10 feet of exposed solid propellant grain; for example, no nozzle plug or cover.

13.3.2.3. Further restrictions and testing requirements are provided in 10.5.

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 14.4.1 of this volume.

13.3.4. Ordnance Systems Grounding Operations:

13.3.4.1. Ordnance Systems Grounding Operations General Requirements:

13.3.4.1.1. Ordnance associated equipment such as handling fixtures and missile structures shall be connected to a common ground to ensure that an electrostatic charge cannot build up to levels that can cause ignition of the ordnance.

13.3.4.1.2. Platforms and ladders shall be grounded when used in conjunction with vehicles and/or payloads containing ordnance.

13.3.4.1.3. Launch complex service tower platforms 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 ground shall be used if proper grounds cannot be achieved by other means. Wrists stats shall be required if proper grounding cannot be attained.

13.3.4.1.4. Grounding system, megger high-voltage checks shall not be performed after initiators are installed or electrically connected unless proper fault protection is provided, as approved by Range Safety.

Proper fault protection for grounding system megger high voltage checks can include fuses placed in the leads or other measures, as approved by Range Safety.

13.3.4.2. Ordnance Systems Grounding Pre-Operational Checks:

13.3.4.2.1. When leg stats or conductive shoes are required, grounding of personnel shall be verified using a conductive shoe tester before the start of an ordnance operation. Leg stat or conductive shoe resistance shall not exceed 1 megohm.

13.3.4.2.2. When wrist stats are required, grounding of personnel shall be checked with an ohmmeter. Wrist stats are required to have a resistance between 10 kilohms and 1 megohm.

13.3.4.2.3. To ensure grounding of personnel, conductive floors shall be verified in all ordnance and propellant operating facilities before operations.

13.3.4.2.4. Conductive floors and terminals shall be verified to be electrically bonded to a grounding system common to the ordnance device before operations.

13.3.4.2.5. Static ground points shall be verified to have a resistance to ground of 10 ohms or less using the methods of measuring resistance to earth described in ANSI/IEEE 142, ***Recommended Practice for Grounding of Industrial and Commercial Power Systems***.

13.3.4.3. Ordnance Systems Grounding Operating Requirements:

13.3.4.3.1. Touching a grounded surface is required before handling an EED or other static-sensitive ordnance device.

13.3.4.3.2. When hoisting ordnance systems with a crane, a trailing ground connection to the facility ground shall be maintained during the hoist.

13.3.4.3.3. Metal shipping containers shall be grounded before opening the containers.

13.3.4.3.4. Before removing an ordnance item from a shipping container, the specific ordnance item shall be grounded.

13.3.4.3.5. 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.

13.4. Ordnance Operations:

13.4.1. Ordnance Operating Standards:

13.4.1.1. All category A ordnance operations on the ranges shall be monitored and approved by Range Safety. Category B ordnance and ordnance systems are not required to meet the design requirements of Volume 3, Chapter 13; however, all ordnance and ordnance systems shall meet the operations requirements of this volume.

13.4.1.2. Ordnance operations shall be conducted in accordance with AFMAN 91-201 and DoD 6055.9-STD.

13.4.1.3. All initiators are considered Category A until Range Safety concurs with the Category B designation.

13.4.2. Ordnance Facility Inspection:

13.4.2.1. All new or modified explosives and propellant facilities shall be inspected before first use by Pad Safety.

13.4.2.2. An annual explosive safety inspection shall be conducted by Pad Safety (ER) or 30 SE/SEW (WR) to determine compliance with explosives safety criteria as defined in this publication, other DoD and USAF standards (for example, AFMAN 91-201 and DoD 6055.9-STD), and the provisions of the ***Explosives Safety Plan 1*** (ESP 1). (See Attachment 4 of this volume.)

13.4.2.3. The annual inspection shall include, but not be limited to, the following explosives storage and operating areas:

13.4.2.3.1. Launch complexes.

13.4.2.3.2. Assembly area processing facilities.

13.4.2.3.3. Support facilities.

13.4.2.3.4. Solid and liquid propellant storage areas.

13.4.2.4. The results of the annual explosives safety inspection shall be reported under the provisions of ESP 1.

13.4.2.5. Ordnance facilities shall be inspected monthly by the facility manager.

13.4.3. Ordnance Operations General Requirements:

13.4.3.1. All category A ordnance operations on the ranges shall be monitored and approved by Range Safety. Category B ordnance and ordnance systems are not required to met the design requirements of Volume 3, Chapter 13; however all ordnance and ordnance systems shall comply with the operations requirements of this volume.

13.4.3.2. 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). Pad Safety shall represent Range Safety during on-site ordnance activities.

13.4.3.3. Pad Safety shall be present to monitor all ordnance operations designated by Range Safety and shall spot check all other ordnance operations.

Examples of Pad 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; and launch operations.

13.4.3.4. 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.

13.4.3.5. All test equipment used on the ranges to check out ordnance shall be approved by Range Safety before use. A list of currently approved instruments shall be maintained by ER Pad Safety and 30 SW/SES. Applied current shall not exceed 10 percent of the no-fire current of any EED in the circuit, or 50 mA, whichever is less.

13.4.3.6. 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:

13.4.3.6.1. The operation is covered by an approved procedure.

13.4.3.6.2. Approved equipment is used.

13.4.3.6.3. The system or subsystem is approved.

13.4.3.7. RF silence is required during periods of ordnance installation, removal, and electrical connection and disconnection aboard a vehicle and/or payload. Where practical, the RF control area shall include the entire facility and/or complex. Radiating payloads are handled on an individual basis.

13.4.3.8. Range Safety, with the assistance of the appropriate Range User, shall provide the Explosive Ordnance Disposal (EOD) team with familiarization training on the launch vehicle and/or payload ordnance systems upon request. Training will entail (a) launch pad walkdown and (b) launch vehicle familiarization that includes descriptions, locations, and hazards associated with any ordnance. Additionally, Range Users shall provide 8 x 10 inch color photographs of all ordnance items. The photographs should be of sufficient detail to identify individual ordnance items as well as to show the ordnance items in installed configurations on the launch vehicle.

13.4.3.9. 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:

13.4.3.9.1. One complete set of shielding caps (current design).

13.4.3.9.2. One set of safety pins.

13.4.3.9.3. Special tools used in installing, removing, and safing the ordnance.

13.4.4. Ordnance Operations Pre-Operational Requirements:

13.4.4.1. Pad Safety and Range Users. Before giving concurrence for any ordnance operations to begin, Pad Safety and the Range User shall ensure the following:

13.4.4.1.1. All necessary controls are established.

13.4.4.1.2. Test equipment and the system conform to a configuration approved by Range Safety.

13.4.4.1.3. For RF susceptible ordnance distance separation requirements, refer to AFMAN 91-201, Paragraph 2.58.

13.4.4.1.4. 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.

13.4.4.1.5. Personnel and explosives limits are enforced.

13.4.4.1.6. Proper safety clearance zone has been established and cleared before starting the hazardous operation.

13.4.4.1.7. Proper signs are posted, warning lights are operating, barricades are established, and Security/HOS is posted.

13.4.4.1.8. Proper aural warnings and announcements have been made.

13.4.4.1.9. All serial numbers, calibration dates, proof test dates, and other equipment requirements have been verified before operations.

13.4.4.2. Pre-Installation Checkout of Ordnance Items:

13.4.4.2.1. The pre-installation checkout of all ordnance items shall be performed only at Range Safety approved test facilities.

13.4.4.2.2. Requests to use alternate facilities shall be submitted in writing to Range Safety.

13.4.4.3. Ordnance No Voltage Checks:

13.4.4.3.1. Before any ordnance electrical connection, no voltage (stray voltage) checks shall be performed on all launch vehicle and payload ordnance electrical connectors.

13.4.4.3.2. These checks shall be made first with power on, then with power off, and include all pin-to-pin and pin-to-case combinations.

13.4.4.3.3. The power on configuration requires the launch vehicle to be powered up in launch configuration. This configuration also requires the payload and upper stage to be powered (along with the launch vehicle) unless the payload does not have any electrical interfaces with the upper stage.

13.4.4.3.4. The power on check shall be performed anytime in the launch.

13.4.4.3.5. The power off configuration requires the launch vehicle and payload to be powered down.

13.4.4.3.6. Power off checks shall be made immediately before ordnance electrical connection.

13.4.4.3.7. If a number of connections must be made in the same general area of the launch vehicle and payload, power off checks shall be made on all of the connectors before ordnance electrical connection. These connections shall be made before any electrical configuration or system changes such as bringing power back up occur.

13.4.4.3.8. Shielding caps shall not be removed from EEDs until electrical connection to the ordnance is to be made.

13.4.4.3.9. 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. The no voltage test procedure shall specify the maximum acceptable reading.

13.4.4.3.10. Meters that are used for no voltage checks shall have a valid calibration seal.

13.4.4.3.11. The integrity of the meter and test leads shall be verified before 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. A copy of the completed procedure shall be provided to Pad Safety.

13.4.5. Ordnance Operating Requirements:

13.4.5.1. Ordnance operations shall not be conducted when the relative humidity is less than 35 percent.

Static Charge Risk Assessment. The static charge risk assessment should address the extent of low humidity conditions, any plastic or other materials being used such as contamination covers, the propellant/ordnance that is part of the planned task, and the potential of the activity to build up static electricity and create a hazardous electrostatic discharge situation. The risk assessment should also include a discussion of the hazard controls used, such as equipment grounding, personnel grounding, static meter scans, and static dissipation methods. It should be noted that "approved" plastic materials are considered "anti-static" based on testing at 30 percent humidity; therefore, the use of such materials where the humidity is less than 30 percent is cause for concern.

13.4.5.2. Ordnance operations shall be conducted in facilities and/or locations specifically approved by the DDESB and/or Range Safety. Such approvals shall be accomplished by explosives site plans or facility licenses. Range Safety shall determine the appropriate approval.

13.4.5.3. At the ER, ordnance items shall not be handled, installed, or electrically connected when the passage of an electrical storm is imminent (within 5 nautical miles). Operations Safety Plans shall identify the procedures to be followed for different configurations. At the WR, the guidance provided in 5.6.3 shall be followed.

13.4.5.4. Ordnance items, particularly Category A initiators, shall be installed and electrically connected as late in processing flow as practical.

13.4.5.5. A rotation test shall be performed on all launch vehicle and/or payload safe and arm devices (S&As) after installation and erection on the launch pad but before final connection to the ordnance train. This test shall be performed using the launch day system configuration for cycling the S&A.

Launch day system configuration for performing a rotation test on S&As includes items such as monitor circuitry, power sources, and circuits for cycling the S&A.

13.4.5.6. The ordnance train shall be disconnected from the S&A output during all checkout operations except during the following circumstances:

13.4.5.6.1. Single complete rotation test (safe to arm to safe).

13.4.5.6.2. Final rotation to arm on the last day of the count.

13.4.5.7. When the S&A is rotated on the pad, all personnel shall be cleared to an area designated in the OSP.

13.4.5.8. EMI testing shall not be conducted with initiators installed on the vehicle or payload without Range Safety approval.

13.4.6. Laser Initiated Ordnance Operations Personnel Access Criteria:

13.4.6.1. For laser initiated ordnance (LIO) systems, the following personnel access criteria are required:

13.4.6.1.1. For unlimited personnel exposure during LIO tests - the system shall contain three independent verifiable circuit inhibits (dual-fault tolerance).

13.4.6.1.2. For essential personnel exposure during LIO tests - the system shall contain two independent circuit inhibits (single-fault tolerance).

13.4.6.1.3. For no personnel exposure during LIO tests - the system shall contain one circuit inhibit.

13.4.6.2. 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).

13.5. Explosive Ordnance Disposal:

13.5.1. Rendered Safe Ordnance. All damaged ordnance shall be rendered safe by the AF EOD Team unless otherwise approved by Range Safety.

13.5.2. Obtaining AF EOD Services. AF EOD services may be obtained by calling Cape Support (853-5211) or PAFB Command Post (494-7001) on the ER or Range Scheduling (606-8825) on the WR.

13.5.3. Range Safety Approval for Shipment of Damaged or Rendered Safe Ordnance:

13.5.3.1. Shipments of damaged or rendered safe ordnance from the ranges or the downrange stations shall be approved in writing by Range Safety.

13.5.3.2. This approval and/or certification shall accompany the shipment.

13.5.3.3. A DOT exception shall normally be obtained by the Range User before AF EOD will release damaged ordnance.

13.6. Ordnance Facilities Operations:

13.6.1. 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.

13.6.2. Ordnance deliveries from storage to the Range User shall be coordinated with ER Operation Safety Manager and 30 SW/SEGW.

13.6.3. 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, DoD 6055.9-STD, subtier documents, and this publication.

13.6.4. All operations and activities within an explosives sited facility shall be related and require Range Safety approval.

CHAPTER 14

ELECTRICAL SYSTEMS OPERATIONS

14.1. Electrical Systems Operating Standards and Definitions:

14.1.1. Electrical Systems Operating Standards:

14.1.1.1. ANSI C2, ***National Electric Safety Code***, shall be followed in the conduct of electrical systems operations and maintenance.

14.1.1.2. Workplace electrical safety shall be in accordance with NFPA 70E, ***Electrical Safety Requirements for Employee Workplaces***, AFI 32-1064, ***Electrical Safe Practices***, and AFOSH-STD 91-501, ***Air Force Consolidated Occupational Safety Standard.***

14.1.1.3. Maintenance of electric power systems shall be in accordance with AFI 32-1063, ***Electrical Power Systems.***

14.1.1.4. Maintenance of grounding systems shall be in accordance with AFI 32-1065, ***Grounding Systems***.

14.1.2. Electrical Equipment Operations in Hazardous (Classified) Locations:

See Volume 3, Attachment 3 for a Hazardous Area Classification decision flowpath.

14.1.2.1. Definition of Hazardous (Classified) Locations for Electrical Equipment Operations. Hazardous (Classified) locations are defined in NEC Article 500, ***Hazardous (Classified) Locations***.

14.1.2.2. Explosives and Propellants Not Covered in NEC Article 500. 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 present 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 Marshal shall approve all potential critical facility hazardous location designations. (See Attachment 3 of Volume 3 for a flowpath for classifying hazardous areas.)

14.1.2.2.1. Class I, Division 1. Complete definitions of classified locations are found in NFPA 70. These include the following locations:

14.1.2.2.1.1. Within 25 feet of any vent opening unless the discharge is normally incinerated or scrubbed to nonflammable conditions [less than 25 percent of Lower Explosive Limit (LEL)]. This distance may be increased if the vent flow rate creates a flammability concern at a distance greater than 25 feet.

14.1.2.2.1.2. Below grade locations in a Class II, Division 1 area.

14.1.2.2.1.3. Locations in which flammable liquids, vapors, or gases may be present in the air during normal operations.

14.1.2.2.2. Class II, Division 1. Complete definitions of classified locations are found in NFPA 70.

Class II, Division 1 usually includes locations where volatile flammable liquids or flammable gases or vapors are used but, in the judgment of Range Safety and the Fire Marshal, 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, and the total area involved are all factors that merit consideration in determining the classification and extent of each location.

14.1.2.2.2.1. 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.

14.1.2.2.2.2. As determined by Range Safety and the Fire Marshal, locations may actively change classification depending on 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.

14.1.2.2.2.3. 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.

14.1.2.2.2.4. Class II, Division 1 locations include the following equipment or areas:

14.1.2.2.2.4.1. Storage vessels (including carts and drums). 25 feet horizontally and below to grade and 4 feet vertically above the vessel (25 feet in any direction for hydrogen).

14.1.2.2.2.4.2. Transfer lines. 25 feet horizontally and below to grade and 4 feet above the line (25 feet in any direction for hydrogen).

14.1.2.2.2.4.3. Launch vehicle (liquid fueled vehicle, stage, or payload). 100 foot radius horizontally from and 25 feet vertically above (100 feet for hydrogen) the highest leak or vent source and below the vehicle to grade.

14.1.2.2.2.4.4. 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 or exceeds the LEL. The quantity of fluids used in the analysis to determine vapor concentration shall be the maximum amount allowed in the explosives site plan.

14.1.2.2.2.4.5. Locations adjacent to a Class I, Division 1 location into 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.

14.1.2.2.3. Hazardous Commodity Groups. Hazardous commodities are grouped by similar characteristics.

14.1.2.2.3.1. These fuels shall be considered ignitable regardless of the ambient temperature.

14.1.2.2.3.2. The following fuels shall be categorized as follows:

14.1.2.2.3.2.1. Group B: Liquid or gaseous hydrogen.

14.1.2.2.3.2.2. Group C: Hypergolic fuels such as N_2H_4, MMH, UDMH, A50.

14.1.2.2.3.2.3. Group D: Hydrocarbon fuels (RP and JP).

14.1.2.2.3.2.4. Group D: Oxidizers. Oxidizers shall be considered Group D hazardous substances in addition to the fluids listed in NFPA 497, ***Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas***.

14.1.2.2.3.2.5. Group D: Exposed Solid Propellants. The atmosphere within 10 feet horizontally and directly overhead of exposed solid propellant shall be classified as a Class II, Division 1, Group D location. Solid rocket motors are considered exposed in the following situations:

14.1.2.2.3.2.5.1. The motor nozzle is not attached and the aft end of the motor does not have a cover.

14.1.2.2.3.2.5.2. The motor nozzle is attached but does not have a nozzle plug.

14.1.2.2.3.2.5.3. The unassembled motor segments do not have front and rear covers.

14.1.2.2.3.2.5.4. The igniter is removed from the motor and cover is not provided.

14.1.3. Photography:

14.1.3.1. Photography General Requirements:

14.1.3.1.1. Manual (with a photographer) photography shall not be allowed in a hazardous (Class I, Division 1) environment.

14.1.3.1.2. Remotely operated, hazard-proofed cameras and UL listed lighting sources shall be used for Class I, Division 1 environments as well as for Class II, Division 1 environments that cannot be verified as non-hazardous.

14.1.3.2. Class II, Division 1 Photography Requirements. Requirements for the use of cameras and camera flash attachments in areas containing solid and liquid propellants that would normally be classified as Class II, Division 1 are listed below:

14.1.3.2.1. Before and during the use of photography equipment within 100 feet of a flight vehicle propellant system or within 25 feet of propellant storage vessels, the operating environment of the photography equipment shall be verified to be free of hazardous vapors.

14.1.3.2.2. Before bringing photography equipment into an area, all ordnance installation and/or connection operations and liquid propellant system operations that affect propellant systems within 100 feet of the photography equipment shall cease.

14.1.3.2.3. The user of the photography equipment shall certify to Range Safety in writing that the camera and/or flash attachments have no sparking/arcing capability. Information, including vendor specifications, shall be made available to Range Safety upon request.

14.1.3.2.4. Camera batteries shall be securely installed in the camera or in a protective case. Battery replacement shall occur outside the Class II, Division 1 area. No battery charging shall take place in a hazardous area.

14.1.3.2.5. All equipment that is brought into the hazardous area and poses a drop hazard shall remain in the tethered possession of the photographer or his/her assistant(s).

14.1.3.2.6. The camera shall be tethered to the photographer.

14.1.3.2.7. Photography using heat-producing, expendable flash bulbs such as flash cubes and sunguns is not permitted within 100 feet of hazardous liquid propellant systems or solid propellant grain.

14.1.3.2.8. Cameras and/or flash attachments shall be enclosed or otherwise contained to prevent parts from falling into or contacting flight hardware.

14.1.3.2.9. The maximum operating temperature of the camera and/or flash attachment shall not exceed 80 percent of the ignition temperature for any vapor that may occur in the operating environment of the photography equipment.

14.1.3.2.10. Cameras and/or flash attachments to be used inside solid rocket motor bores shall be designed and specified for that particular use.

14.1.3.2.11. Photo equipment shall not be stored in the Class II, Division 1 area.

14.1.3.2.12. Photo equipment shall be removed from the Class II, Division 1 area before any operation that could cause an increase in the hazardous environment.

14.2. Electrical Systems Operations Personnel and Special Insulated Equipment:

14.2.1. If live electrical maintenance or repair work must be performed, special insulated equipment shall be provided.

14.2.2. Special insulated equipment includes, but is not limited to, the following:

14.2.2.1. .Insulated hook sticks for opening and closing disconnect switches.

14.2.2.2. Insulated fuse sticks for removing and installing cartridge-type fuses.

14.2.2.3. Rubber insulating sleeves and gloves.

14.2.2.4. Rubber insulation floor mats.

14.2.2.5. Rubber insulating line conductor hose.

14.2.2.6. Dielectric hard hats.

14.3. Electrical Systems Procedures:

14.3.1. Procedures shall be written for all electrical maintenance and repair work.

14.3.2. Procedures shall include, but not be limited to, the following topics:

14.3.2.1. Tagging and locking out control switches.

14.3.2.2. Use of approved non-conductive fuse pullers.

14.3.2.3. Provision and use of PPE.

14.3.2.4. Grounding of equipment and personnel.

14.3.2.5. Use of the buddy system (mandatory when working on energized equipment and circuits).

14.3.2.6. .Safety precautions to be followed when working on energized equipment and circuits.

14.3.2.7. Fire protection and equipment.

14.3.2.8. Knowledge of resuscitation procedures.

14.4. Electrical Equipment and Systems Test, Inspection, and Maintenance Requirements:

14.4.1. Grounding Systems Tests:

14.4.1.1. Grounding Systems General Test Requirements:

14.4.1.1.1. 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 and integrated rocket checkout facilities) used to store, handle, or process ordnance or liquid propellants.

14.4.1.1.2. 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.

14.4.1.2. Grounding Systems Test Plan and Test Frequency Criteria:

14.4.1.2.1. A floor plan layout showing all grounding system test points shall be developed by the facility operator and/or the Range User.

14.4.1.2.2. Lightning and grounding systems shall be tested in accordance with AFI 32-1065.

14.4.1.2.3. Based on the floor plan, the following tests shall be conducted:

14.4.1.2.3.1. .Lightning protection system resistance to ground shall be tested annually to the following criteria:

14.4.1.2.3.1.1. 10 ohms or less for the counterpoise system.

14.4.1.2.3.1.2. 10 milliohms from the terminal to the counterpoise system.

14.4.1.2.3.2. The lightning protection system shall be inspected visually and mechanically twice a year.

14.4.1.2.3.3. The facility static/electrical ground system resistance shall be tested annually to a criteria of 10 ohms or less using the methods of measuring resistance to earth described in ANSI/IEEE-142.

14.4.1.2.3.4. Portable and movable facility equipment connections to the facility ground system shall be visually inspected before each use and tested every two months to a criteria of 1 ohm or less.

Grounding Test Preparations. During the grounding test, ground support equipment and flight hardware containing hazardous commodities may be disconnected but do not have to be removed from the facility.

14.4.1.2.3.5. Conductive floors shall be visually inspected and tested twice a year to the requirements of AFI 32-1065, Paragraph 13.4. Hazardous commodities shall be removed before testing.

14.4.1.2.3.6. All resistance measurements shall be taken with a currently calibrated instrument in accordance with a Range Safety approved procedure.

14.4.1.2.3.7. Measuring devices such as megohm meters (meggers) shall be current-limited by the use of fuses or equivalent devices when the facility contains electrically connected EEDs.

14.4.1.2.3.8. Test and inspection results shall be provided to the facility custodian and be available at the facility.

14.4.2. Electrical Equipment Inspection. Before first use or first use after repair, electrical distribution equipment shall be inspected for compliance with NFPA 70 and NFPA 70E.

14.4.3. Electrical Equipment Maintenace and Testing:

14.4.3.1. Electrical equipment shall be maintained in accordance with AFJMAN 32-1083, ***Facilities Engineering - Electrical Interior Facilities***, and NFPA 70E.

14.4.3.2. Conductors with worn, abraded, or defective insulating material shall be repaired or replaced before the circuit being energized.

14.4.3.3. In addition to maintenance requirements in AFJMAN 32-1083, Chapter 15, electric motors shall be properly maintained and excess dust and oil shall be removed from motors by vacuum cleaning or wiping.

14.4.3.4. Electrical system interior inspection and testing of wiring, power circuit breakers, and protective relaying shall be accomplished in accordance with AFJMAN 32-1083, Chapter 14 and 15 with testing intervals not to exceed two years.

14.5. Electrical Systems Operating Requirements:

14.5.1. Electrical Systems General Operating Requirements. Personnel working with electrical equipment shall comply with NFPA 70E and AFI 32-1064. Particular attention shall be given to the following:

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 of the operation.

14.5.1.1. Personnel working with high voltage equipment shall not wear conductive grounding devices.

14.5.1.2. Supervisors shall be responsible for ensuring 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.

14.5.1.3. Whenever maintenance or repair work is performed on potentially hazardous energized electrical equipment or circuits, a minimum of two people shall be present (buddy system).

14.5.1.4. Rescue and first aid equipment shall be readily available in areas where electrical maintenance and repair work is being performed.

14.5.1.5. Personnel exposed to energized electrical circuits shall not wear loose clothing, rings, watches, or other metallic objects that can act as conductors of electricity.

14.5.1.6. Only a nationally recognized testing laboratory such as UL or FM, or those accredited by OSHA under the Nationally Recognized Testing Laboratory (NRTL) accreditation program, 29 CFR.1910.7, ***Definition and Requirements for a Nationally Recognized Testing Laboratory***, weather proof or water-tight test and maintenance equipment shall be used in areas subject to excessive moisture.

14.5.1.7. Only listed explosion and/or hazard-proofed test and maintenance equipment shall be used in potentially hazardous atmospheres.

14.5.1.8. Before working on capacitor circuitry, external power and short terminals shall be disconnected and discharged to ground.

14.5.1.9. If temporary 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.

14.5.1.10. 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.

14.5.1.11. Dead-end wires shall be completely insulated.

14.5.2. Electrical Systems Pre-Operational Requirements:

14.5.2.1. With the exception of test and checkout, all electrical equipment and circuits shall be de-energized before any work is started on these circuits or equipment through a scheduled power outage.

14.5.2.2. Power outages in facilities shall be coordinated with the affected parties.

14.5.2.3. When work is being done on circuits, the line switch shall be locked out and tagged in accordance with NFPA 70E, Part II.

14.5.2.4. Electrical conductors shall be routed to eliminate tripping hazards or contact with energized lines.

14.5.3. Electrical Systems Operating Requirements:

14.5.3.1. During repair or maintenance, if panel covers are removed and panels left open to obtain power where none is available, a DANGER HIGH VOLTAGE sign shall be placed next to the open panel and a temporary cover manufactured and installed. When cable connections are made

that require the removal of the panel cover, a suitable temporary cover with openings to accommodate the temporary cables shall be used.

14.5.3.2. .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.

14.5.3.3. Personnel who are exposed to energized circuits for electrical activities such as troubleshooting, maintaining, or repairing electrical equipment energized with 50 volts or more shall stand on non-conductive matting.

14.5.3.4. Grounding or shorting sticks (or cables) shall be used on potentially "hot" circuits and shall not be removed until repairs are completed.

14.6. Battery Operations:

14.6.1. Battery Operating Standards:

14.6.1.1. An approved means of disposal or transportation to an off-site approved disposal site shall be in place before receipt of the batteries on the ranges.

14.6.1.2. The means of disposal shall be in accordance with DOT and EPA requirements and carry DOT and EPA approvals.

14.6.2. Battery Operations Personnel Requirements:

14.6.2.1. Battery Operations Training and Certification. A training program shall be generated and approved by the Range User for all personnel handling batteries not listed or not intended for public use.

14.6.2.2. Emergency First Aid and PPE Requirements:

14.6.2.2.1. Emergency First Aid:

14.6.2.2.1.1. An emergency eye wash and shower shall be provided in locations where batteries are present/installed and serviced. They shall be installed in accordance with AFOSHSTD 91-501 and ANSI Z358.1, ***Emergency Eyewash and Shower Equipment***.

14.6.2.2.1.2. An emergency first aid kit, containing a burn neutralizer shall be provided.

14.6.2.2.2. PPE:

14.6.2.2.2.1. The following PPE shall be provided in accordance with AFOSHSTD 91-501 and used when servicing or handling batteries:

14.6.2.2.2.1.1. Front and side face and eye protection.

14.6.2.2.2.1.2. Rubber gloves.

14.6.2.2.2.1.3. Rubber apron.

14.6.2.2.2.1.4. Foot protection.

14.6.2.2.2.2. In addition, electrolyte/chemical spill containment/adsorption material shall be provided in the close vicinity of the battery(s) for use by operating personnel in the event of an electrolyte spill.

14.6.3. Battery Procedures:

14.6.3.1. 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.

14.6.3.2. Specific safing operations of batteries shall be in battery handling and checkout procedures.

14.6.3.3. .Battery handling and checkout procedures shall include the following topics:

14.6.3.3.1. A list of proper handling equipment.

14.6.3.3.2. Identification of specific personnel qualified to safe batteries if in an unsafe condition.

14.6.3.3.3. Identification of the exact location of the storage site of depleted or unsafe batteries.

14.6.4. Lithium Batteries Special Requirements:

Batteries that have a UL listing and are intended for public use are exempt from these requirements.

14.6.4.1. 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. Lithium batteries shall not be stored permanently on the ranges.

14.6.4.2. The Range User shall provide certification of lithium battery(s) conforming with all safety critical steps and processes agreed to by Range Safety during the battery development phase.

14.6.4.3. Before delivery of lithium batteries to the ranges, an approved off-site disposal contract shall be in place for the batteries in any condition.

14.6.5. Battery Maintenance, Storage, and Operations:

14.6.5.1. 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.

14.6.5.2. Separate areas shall be provided for servicing of batteries that have incompatible electrolytic solutions; for example, acid and alkaline.

CHAPTER 15

MOTOR VEHICLE OPERATIONS

15.1. Motor Vehicle Operating Standards. All vehicle operations shall comply with federal and state laws, and Air Force and range regulations, including, but not limited to, the following criteria:

15.1.1. Proper licensing of operators.

15.1.2. The use of vehicle restraint devices such as seat belts.

15.1.3. Restrictions on wearing headphones or ear speaker type radios while operating a vehicle.

15.1.4. The use of spotters when backing with restricted rear vision vehicles.

15.2. Motor Vehicle Operating Requirements:

15.2.1. Operator Instructions:

15.2.1.1. Maneuvering in the vicinity of hazardous commodities requires the use of a spotter.

15.2.1.2. When backing, chocks shall be used to prevent contact.

15.2.2. Indoor Operations. Gasoline or diesel vehicle operations in buildings shall require the approval of the Bioenvironmental Engineer.

15.2.3. Ordnance and Propellant Area Parking:

15.2.3.1. General Parking Requirements:

15.2.3.1.1. Vehicle parking in areas sited and used for ordnance or propellants shall be in accordance with the applicable OSP. (See Attachments 3, 4, and 5 of this volume.)

15.2.3.1.2. These OSPs shall be developed using the criteria found in this document and shall also take into consideration the criteria from AFMAN 91-201 and DoD 6055.9-STD.

15.2.3.2. General Parking Restrictions:

15.2.3.2.1. Designated parking areas shall be used.

15.2.3.2.2. Privately owned vehicles shall not be parked within the fenced-in area of hazardous processing facilities.

15.2.3.2.3. No vehicle shall be parked within 25 feet of lines containing liquid propellants.

15.2.3.2.4. No vehicle shall be parked within 50 feet of storage tanks containing liquid propellants.

15.2.3.2.5. When required, delivery vehicles are exempt from the preceding requirements during loading and off-loading but they shall be removed immediately afterwards.

15.2.3.2.6. While parked, the parking brake shall be engaged and wheels shall be chocked.

15.2.3.3. Restricted Parking Areas. All non-essential vehicles are prohibited from parking in the following areas under the following conditions:

15.2.3.3.1. Within the flight hazard area (FHA) once the FHA has been established.

15.2.3.3.2. In the blast danger area (BDA) during wet dress rehearsal (cryogen tanking).

15.2.3.3.3. Within the FHA during core vehicle tanking (other than cryogens that are tanked) after the BDA/FHA is established.

15.2.3.3.4. Within the launch complex fence line during fueled spacecraft/upperstage mating operations.

15.2.4. Internal Combustion Engine Vehicles. Motor vehicles or equipment having internal combustion engines shall be equipped with spark arresters and carburetor flame arresters as applicable:

15.2.4.1. When transporting explosives that have exposed grain, scrap, waste or items visibly contaminated with explosives.

15.2.4.2. When operating within the control area during propellant transfer operations or continuously within propellant off-loading and/or propellant storage areas.

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 unless exempted or approved for use by Range Safety per Volume 3, 15.1.1.

15.2.6. Hazardous Location Restrictions. Vehicles shall not be operated in locations classified as hazardous by NEC Article 500 without Range Safety approval.

CHAPTER 16

CONVOY OPERATIONS

16.1. General:

16.1.1. A convoy is required for all transportation considered hazardous operations unless exempted by Range Safety. At VAFB, HOS is required for all hazardous transportation convoys.

16.1.2. All transportation of over-sized loads (larger than 12 feet in width, 13.5 feet in height, or 55 feet in length) is considered a hazardous operation.

16.1.3. All convoys shall be conducted in accordance with AFJMAN 24-306 ***Manual for the Wheeled Vehicle Driver***.

16.1.4. At the ER, if the convoy is to travel onto KSC, 45 SPW/JOP 15E-3-50, ***Transportation of Oversized Loads***, is applicable.

16.1.5. At the WR, all convoys shall be conducted in accordance with 30 SW 31-101, ***Convoy Operations***.

16.2. Convoy Operations Procedures. A procedure for convoy operations shall be submitted to Range Safety for review and approval.

16.3. Convoy Operations Requirements. The Range User and/or the agencies responsible for the transportation of a load shall ensure the following items are performed:

16.3.1. The load or commodity to be transported shall be identified.

16.3.2. The convoy shall be scheduled through CCAFS Cape Support (853-5211) at the ER and through Range Scheduling (606-8825) at the WR.

16.3.3. A convoy commander shall be designated.

16.3.4. If flight hardware or hazardous commodities are involved, a Security/HOS escort shall be arranged.

16.3.5. At the ER, as required by Range Safety, Pad Safety approval shall be obtained before the start of the convoy if hazardous commodities or flight hardware are involved.

16.3.6. When transporting hazardous commodities, the transfer route shall be chosen to minimize exposure to populated areas and critical facilities. Transfer should occur during off-peak traffic and population hours.

16.3.7. The selected route shall be identified and the following items noted:

16.3.7.1. Horizontal and vertical clearances.

16.3.7.2. The hazardous commodity transported.

16.3.7.3. Population along the route.

16.3.7.4. Traffic that may be encountered.

16.3.7.5. Condition of surface being traveled upon.

16.3.7.6. Distance of route.

16.3.8. Radio contact shall be maintained with the convoy commander for all elements of the convoy.

16.3.9. At a minimum, the following items of equipment are required:

16.3.9.1. Flashlights if transport occurs during periods of darkness.

16.3.9.2. Emergency apparatus such as fire extinguishing equipment, reflectors, and flares.

16.3.10. Proper environmental health required by the commodity transported shall be ensured.

16.3.11. As required by Range Safety, areas shall be cordoned off.

16.3.12. Emergency actions shall be taken to secure the item being transported in the event of a mishap.

16.3.13. A pre-operational check of the loaded vehicle and trailer shall be conducted.

The prescribed tire air pressure should be verified.

16.3.14. 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

CHAPTER 17

LAUNCH OPERATIONS

17.1. Operations Safety Launch Countdown:

17.1.1. Operations Safety Launch Countdown Pre-Operational Requirements. Range Safety shall perform the following launch countdown pre-operational functions:

17.1.1.1. Within 21 calendar days of F-0 day, monitoring and verifying FTS S&A and EBW detonator electromechanical checks at a Range Safety approved location.

17.1.1.2. Ensuring command receivers are not turned on any time FTS ordnance is electrically connected unless Range Control Officer concurrence has been given to Range Safety

17.1.1.3. Monitoring and verifying no-voltage checks, installation, and hookup of FTS or any other Category A ordnance.

17.1.1.4. Verifying the Launch Disaster Control Group (LDCG) (ER)/Launch Support Team (LST) (WR) is in place at the "fall back" position for each static firing or launch.

17.1.2. Operations Safety Launch Countdown General Requirements. The Pad Safety Officer (PSO) shall perform the following launch countdown general functions:

17.1.2.1. Verifying permanent fire fighting and cooling water systems are operating properly and that adequate water, at the correct operating pressure and flow rate, is available until after launch or until the test is scrubbed and propellants have been detanked.

17.1.2.2. Requesting and verifying RF silence, as required.

17.1.2.3. Monitoring and verifying FTS S&A rotation on the pad.

17.1.2.4. Monitoring and verifying FTS end-to-end and other FTS checkouts.

17.1.2.5. At the ER, immediately notifying Range Safety of any FTS system, subsystem, or component failure, discrepancy, or parameter violation.

17.1.2.6. At the ER, conducting holdfire and launch enable/disable checks.

17.1.2.7. Verifying removal of the FTS and ignition S&A safing pin and EBW circuitry safing plug and clearing the flight hazard area before launch.

17.1.2.8. Verifying reinsertion of the FTS and ignition S&A safing pin and EBW circuitry safing plug in the event of a scrub as directed by Range Safety.

17.1.2.9. Verifying reinsertion of any Category A ordnance safing devices in the event of a scrub as directed by Range Safety.

17.1.2.10. 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.

17.1.3. Launch Countdown Operations:

17.1.3.1. At the ER, to ensure proper operation, the holdfire and firing line interrupt capability shall be checked out at a mutually agreed time as close to launch as practical with Pad Safety present.

17.1.3.2. At the ER, results of the checkout shall be reported to the Mission Flight Control Officer (MFCO) by Operations Safety Console in the blockhouse/Launch Control Center/Launch Support Center, or on board ship during the launch countdown.

17.1.3.3. 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.

17.1.3.4. At the ER, the OSM shall clear all non-essential personnel from the BDA and FHA when required. At the WR, the OSM shall clear the hazard and caution areas when required.

17.1.3.5. The OSM shall control all warning devices provided to indicate the status of hazard conditions. At the WR, the Monitor and Control Officer controls warning devices for ballistic launches.

17.1.3.6. The OSM shall declare caution and danger periods at times such action becomes necessary in the interest of safety.

17.1.3.7. At a mutually agreed upon point in the countdown at the ER, the OSM shall report verbally to the MFCO, "The Flight Hazard Area is clear." At the WR, the OSM shall send a green light signal and verbally validate "the Flight Caution Area is clear."

17.1.3.8. The blockhouse door security guard shall permit no one to leave the blockhouse unless specifically authorized by the OSM.

17.1.3.9. Where applicable, blockhouse air conditioning air intakes shall be closed before booster ignition.

17.1.3.10. Searchlight and photographic supervisors shall report to Pad Safety when clearing the complex and upon arrival at the "fallback" position.

17.1.3.11. The OSM shall initiate a holdfire when safety constraints or emergency situations dictate.

17.2. LDCG/LST Operations:

17.2.1. LDCG/LST Duties and Responsibilities:

17.2.1.1. ER. The duties and responsibilities of the LDCG are defined in the CCEMP/JHB 2000, and the ***Safety Operating Plan*** for LDCG/LST Procedures.

17.2.1.2. WR. The duties and responsibilities of the LST are defined in 30 SWI 91-101, ***Launch Disaster Control Group Process***, and applicable launch support plans.

17.2.2. LDCG/LST Operations Requirements:

17.2.2.1. During major launch operations, the LDCG/LST shall be available for immediate response to a launch vehicle and/or payload impact on the ranges, KSC, or the public domain.

17.2.2.2. The Range User shall have the required vehicle launch crew necessary to support the LDCG/LST Commander at fallback at least 90 minutes before T-0.

If more than one fallback position is used, the crew should report to the primary fallback area.

17.2.2.3. Crews for securing the complex after a normal launch shall not be located in the same area as the LDCG/LST. These crews shall be located so as not to interfere with LDCG/LST operations.

17.3. Post-Launch Operations:

17.3.1. Immediately after a launch, the Range User, Pad Safety, Bioenvironmental Engineering, and the Fire Department shall inspect the pad for personnel hazards such as contamination, spills, exposed wiring, structural or facility damage, damaged or leaking propellant or pressure systems, low oxygen content in enclosed areas, and fires.

17.3.2. The blockhouse OSM shall coordinate with the Safety Technical Director (ER)/LST Commander (WR) 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 open the pad for normal work.

17.3.3. Pad Safety shall direct Security/HOS to adjust or lift roadblocks as warranted by existing conditions.

17.3.4. Fire, medical, and pumping station support shall be released when no longer needed and normal security measures are instituted.

17.4. Launch Abort and Misfire/Hangfire Operations:

17.4.1. General. 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-minute waiting period has elapsed. The 30-minute waiting period is not applicable to ballistic vehicles at the WR in cases where it is dictated by T.O.s.

17.4.2. Common Abort or Misfire/Hangfire Operations:

17.4.2.1. The flight safety system (FSS) shall remain configured in a manner that will enable the MFCO to take destruct action if necessary until Pad Safety (ER)/Flight Safety Project Officer (FSPO) (WR) has verified to the MFCO that the launch vehicle is no longer in a launch configuration.

17.4.2.2. In the event of a launch abort or misfire or following expiration of the 30-minute waiting period in the case of a hangfire with solid propellant stages or a solid propellant starter devices, the OSM shall perform the following activities:

17.4.2.2.1. Ensure the ignition firing circuit has been disabled.

17.4.2.2.2. Allow rotation of the FTS S&A to safe with approval of the MFCO.

17.4.2.2.3. Verify to the MFCO that the FTS S&A devices are in the safe position.

17.4.2.2.4. Allow the command receivers to be turned off after coordination with the MFCO.

17.4.2.2.5. Verify to the MFCO that the safing devices are reinstalled.

17.4.2.2.6. Range Safety shall make a launch complex inspection in conjunction with the Range User and allow access to the launch complex for work when it is safe to do so.

17.4.2.2.7. Adjust or lift roadblocks as required.

17.4.2.2.8. 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.

17.4.2.2.9. Request support by the EOD team when disarming of ordnance systems or components cannot be accomplished using normal methods.

17.4.2.3. If necessary, the EOD team shall initiate render-safe procedures.

17.4.3. Launch Vehicles Using Liquid Propellant Stages Abort or Misfire/Hangfire Operations:

17.4.3.1. In the event of a launch abort or misfire/hangfire, the Range User shall depressurize the vehicle propellant tanks and pressure systems to a safe, static condition.

17.4.3.2. Pad Safety shall monitor the detanking of propellants where applicable.

17.4.4. Launch Vehicles Using Solid Propellant Stages or Solid Propellant Starting Devices Abort or Misfire/Hangfire Operations:

17.4.4.1. In the event of a hangfire, Pad Safety (ER)/FSPO (WR), the Range User, and 45 or 2 ROPS shall ensure the FSS remains configured in a manner that will enable MFCOs to take destruct action, if necessary, in the event of unscheduled launch.

The waiting period in this configuration is a minimum of 30 minutes during which time the FHA shall remain cleared.

17.4.4.2. For vehicles using solid propellant stages or solid propellant starting devices, Operations Safety shall restrict access to the pad until it can be verified that power did not reach the initiator (misfire) or it is assumed that power did reach the initiator (hangfire) and a 30-minute waiting period has elapsed.

17.5. Range User Launch Operations Responsibilities:

17.5.1. Launch Operations Procedures. At a minimum, Range User prepared procedures for the launch countdown and prelaunch count shall contain the following Range Safety functions for the specific launch vehicle and payload systems:

17.5.1.1. Monitoring and verifying no-voltage checks, installation, and hookup of FTS and any other Category A ordnance.

17.5.1.2. Approval to start ordnance tasks.

17.5.1.3. Approval to start propellant transfer and launch vehicle tanking.

17.5.1.4. Approval to start pressurization.

17.5.1.5. Monitoring and verifying FTS checkout.

17.5.1.6. At the ER, conducting holdfire and launch enable/disable checks.

17.5.2. Range User Support of LDCG/LST. The Range User shall provide launch crew personnel required to support the LDCG or LST Commander at the identified site at least 90 minutes before T-0. Crews for securing the complex after a normal launch shall not be located in the same area as the LDCG/LST. These crews shall be located so as to not interfere with LDCG/LST operations.

17.5.3. Post-Launch Pad Support. Immediately after a launch, the Range User shall support Pad Safety, Environmental Health (government contractor or Range User (ER)/Environmental Engineering (WR) and the Fire Department to inspect the pad for personnel hazards such as contamination, spills, exposed wiring, structural or facility damage, damaged or leaking propellant or pressure systems, low oxygen content in enclosed areas, and fires

CHAPTER 18

SOLID ROCKET MOTORS AND ROCKET MOTOR SEGMENTS OPERATIONS

18.1. Solid Rocket Motors And Rocket Motor Segments Operations General Requirements. In addition to the requirements of Chapter 3 and Chapter 13 of this volume, the Range User shall comply with the following requirements for operations involving solid rocket motors and rocket motor segments.

18.2. Solid Rocket Motor and Rocket Motor Segment Transportation:

18.2.1. Solid rocket motor segments/motors transported on trailers or railroad cars shall be properly restrained to the trailer or railroad car support structures to minimize possibility of loss of load in an accident scenario.

18.2.2. For solid rocket motor/segment transporting trailers or railroad cars that use internal combustion engine powered generators for the environmental control units, gasoline or liquid propane gas powered engines shall not be used. If internal combustion engine generator equipped trailers or railroad cars loaded with solid rocket motors/segments are brought inside processing facilities, care shall be taken to minimize the quantity of fuel in the generator tanks. The fuel tanks shall be reinforced and equipped with a protective shield to minimize possibility of tank rupture and fuel ignition during transport. An insulation barrier shall be provided between the environmental control unit and the solid rocket motor or motor segment to protect the motor from heat or possible fuel fire.

Diesel powered generators are preferred due to much lower flammability of the diesel fuel.

18.2.3. If forced air heaters are used for environmental control on covered railroad cars or trailers transporting solid rocket motors/segments, liquid propane gas heaters or gasoline heaters shall not be used. The effects of heater failures on the trailer/railroad car shall be analyzed and reported in an analysis as required by Volume 3, 18.3.

18.2.4. Canvas covers for solid rocket motor/segment transporting trailers or railroad cars shall not be used. If their use cannot be avoided, the rubberized canvas material shall be subjected to triboelectric testing and meet the test requirements for plastic materials used in solid rocket motor/segment processing. An operational hazard analysis shall be performed to demonstrate that under the worst case conditions (for example, broken or loose canvas tie downs and canvas flapping and rubbing on the segment or motor case), not enough static can be accumulated to cause a catastrophic event, such as propellant ignition).

18.2.5. Solid rocket motor/segment transport trailers or railroad cars containing solid rocket motors/segments shall be secured to prevent inadvertent motion when parked; in other words, brakes set and wheels chocked.

18.2.6. Locomotives and tractors that transport solid rocket motor/segment cars and trailers shall be removed from processing facilities as soon as possible.

18.2.7. If air pallets are used for transport of solid rocket motors/segments inside processing facilities, the structure of the air pallet shall be rigid enough to minimize elastic deformation of the pallet under load and, thus, minimize stresses transferred to the solid rocket motor/segment.

Due to the strict requirements for floor surfaces required for such air pallet operation and the fact that such surfaces are easily damaged, extensive use of air pallets for solid rocket motor/segment transport is not recommended.

18.3. Solid Rocket Motor and Rocket Motor Segment Inspections:

18.3.1. If wetting of a solid rocket motor/segment with water is required for ultrasonic inspections, adequate water intrusion barriers shall be provided to prevent the propellant from getting wet.

The wetting of propellant surfaces with water could result in precipitation of ammonium perchlorate crystals on the propellant surface and possibly increase propellant sensitivity.

18.3.2. Solid rocket motors/segments with graphite epoxy casings, which are very sensitive to external damage, shall be visually inspected for case damage at each major stage of processing and upon arrival at the launch pad.

Protective measures, such as blankets, should be used to shield solid rocket motors/segments from damage during transport and storage where practical.

18.3.3. For igniter uncrating and inspection operations of separately shipped igniters, corrosion protection coatings shall be removed from the igniter metal flange before special lifting adapters are attached to the flange.

Failure to remove the coatings may cause the lifting adapter to stick to the igniter flange, possibly resulting in the igniter being lifted after the adaptor bolts have been removed when attempting to remove the unsecured adaptor. This may result in the igniter being raised and dropped into its crate.

18.3.4. Extreme care shall be taken when inspecting and handling igniters.

Igniter propellant contains a higher percentage of oxidizer than regular motor propellant and is very energetic.

18.3.5. Fixtures using cradles for the storage and handling of solid rocket motors/segments shall be inspected for cleanliness and the absence of any objects that could damage the sensitive solid rocket motor/segment cases when they are lowered into the cradles.

18.3.6. For open grain inspections, wrist stats shall be used within 5 feet of the open grain.

18.4. Solid Rocket Motor and Rocket Motor Segment Processing and Handling:

18.4.1. Solid Rocket Motor and Rocket Motor Segment Processing and Handling General Requirements:

18.4.1.1. Pathfinder operations using size and weight representative of inert solid rocket motors/segments shall be conducted before live/operational solid rocket motor/segment processing operations are conducted.

18.4.1.2. For solid rocket motor/segment lifting operations, main processing facility overhead doors shall be kept at least partially open, weather permitting, to provide additional exit routes, unless the doors are required to be closed to reduce exposure of additional personnel.

18.4.1.3. If rotating fixtures are used to rotate solid rocket motors/segments (for purposes of cork installation, for example), the rotating fixture cradles shall be equipped with a means to restrain the solid rocket motors/segments during rotation.

A hydraulic powered rotating mechanism is preferred.

18.4.1.4. If internal combustion powered vehicles, such as forklifts or man lifts, are required for support of solid rocket motor/segment handling operations and are operated in close proximity of the solid rocket motors/segments, gasoline and liquid propane gas powered equipment shall not be used. The equipment shall be located no less than 25 feet from the solid rocket motors/segments and at least 100 feet away when being refueled. If a forklift is used as a hoist in close proximity of a solid rocket motor/segment OSHA approved fork lifting adapters shall be used.

Battery powered equipment is preferred.

18.4.1.5. All tapes and plastic materials used around open grain areas of a solid rocket motor/segment shall be subjected to triboelectric and flammability testing and be listed on NASA-STD-6001, ***Flammability, Odor, Offgassing, and Compatibility Requirements and Test Procedures for Materials in Environments that Support Combustion***, and/or KTI-5212, ***Material Selection List for Plastic Films, Foams, and Adhesive Tapes***.

18.4.1.6. For joint cleaning operations, where solid rocket motors/segments are placed on elevated adaptors, extreme care shall be taken to ensure that such adaptors are properly attached to the support structures. If solid rocket motors/segments are suspended from a crane during such operations, at least 50 percent of the solid rocket motor/segment weight shall be supported by the crane.

18.4.1.7. An operations safety plan shall be written for each solid rocket motor/segment processing facility. This plan shall define the required clearance areas for all hazardous operations.

18.4.1.8. .Solid rocket motor/segment processing facilities shall be kept clean and uncluttered at all times. Separate facilities for storage of support equipment and receiving and uncrating of flight hardware shall be used, as necessary, to maintain unobstructed access to exits at all times. Shipping containers shall be removed from the processing facility immediately as soon as possible after unpacking the hardware.

18.4.1.9. Solid rocket motor/segment processing facilities shall not be used for storage of ground support equipment or flight hardware belonging to other programs or not related or not needed for the solid rocket motor/segment handling operations.

18.4.1.10. Solid rocket motor/segment processing and storage facilities containing ordnance shall not be used as emergency garage facilities for motor vehicles; for example, storing these vehicles next to stored solid rocket motors/segments before an earthquake, tropical storm, or a hurricane.

18.4.1.11. An unobstructed access to at least two exits in the processing facility shall be maintained at all times during solid rocket motor/segment handling operations.

18.4.1.12. Breakout gates shall be provided in the processing facility perimeter fence to enable speedy evacuation in case of emergency. The number and location of the gates shall be based on worst case conditions (facility population, facility configuration, and meteorological conditions) and shall be approved by Range Safety.

18.4.1.13. Waste collection dumpsters shall not be located inside solid rocket motor/segment processing and storage facilities.

18.4.1.14. Combustible materials, such as lumber and dunnage used in support of rocket segment/motor handling operations, shall be treated with flame retardant paint. Bulk stacks of combustible materials shall be no closer than 100 feet from the solid rocket motors/segments and removed from the facility as soon as possible.

18.4.1.15. Flammable materials needed for processing of solid rocket motors/segments shall be stored in Range Safety approved lockers and used in minimum necessary quantities around the solid rocket motors/segments. Waste, such as degreaser or oil soaked rags, shall be placed in closed Range Safety approved metal containers and the containers shall be emptied at the end of every shift. Due to the possibility of spontaneous fires, contaminated waste material shall be removed from the facility as soon as possible and, in no case, left unattended overnight. Waste collection metal containers shall be placed no closer than 25 feet from the solid rocket motor segments/motors.

18.4.1.16. Complete solid rocket motors that are capable of unguided flight upon ignition (as determined by analysis) that are stored vertically or horizontally shall be restrained or thrust termination devices shall be provided to prevent fly-aways.

Vertical storage of built-up rocket motors is undesirable unless they are mated to the core vehicle.

18.4.1.17. When built-up solid rocket motors must be stored vertically in the stands, provisions shall be made to protect the motor nozzles from external facility fires. The motors shall be restrained in the stands to ensure that they will not topple in case of an earthquake, tornado, high winds, or a hurricane impacting the facility, or some other mishap in the facility.

For example, a separation wall could be built between the processing area and the stand.

18.4.1.18. 18.4.1.18.If desiccant cartridges are used in the stored solid rocket motor/segment covers, provisions shall be made for their periodic replacement.

18.4.1.19. For large vertically stacked solid rocket motor igniter installations, the bore opening on top of the motor shall be guarded to prevent personnel from falling into the motor bore.

18.4.2. Grounding and Open Grain Work:

18.4.2.1. All solid rocket motors/segments and built-up motors shall be grounded at all times. When solid rocket motor segments and built-up motors are in storage stands or fixtures, the resistance to ground shall not exceed 10 ohms. When moving the solid rocket motors/segments, make-before-break technique shall be applied. The new ground wire shall be connected to ground and the resistance verified.

18.4.2.2. If a solid rocket motor/segment and/or built-up motor is found ungrounded for any reason (for example, the grounding wire is disconnected), the ground wire shall be immediately reconnected, the ground verified, and a static meter shall be used to measure the voltage on the case surface. The voltage shall be 1,000 V or less before the solid rocket motor/segment can be worked on or moved from its storage stand or fixture. Grounding shall be accomplished in the manner that attaches the grounding wire to the ordnance item first and then to the facility ground (away from the ordnance) last.

18.4.2.3. For open grain work, wriststats shall be used within 5 feet of the open grain. Electrically powered equipment used within 10 feet of the open grain shall be explosion proof or designed to be intrinsically safe.

18.4.3. Solid Rocket Motor and Rocket Motor Segment Processing and Handling Crane Operations:

18.4.3.1. If lifting of rocket motors/segments with cranes is required, the height of such lifts shall be kept to the absolute required minimum and below the propellant ignition threshold. For those lifts where the lift height must exceed the propellant ignition threshold, detailed justification data shall be submitted to Range Safety for review and approval.

18.4.3.2. A clear area shall be established around each lift to ensure that the solid rocket motor/segment will not impact a sharp object in case of crane or rigging failure.

Sharp object impalement may reduce the ignition threshold of propellant by a factor of two.

18.4.3.3. Lifting of solid rocket motors/segments over other motors or flight hardware shall be avoided except where necessary for stacking or storing operations.

18.4.3.4. The number of spotters and personnel required to support the solid rocket motor/segment lift operations shall be kept to the absolute minimum required. Remote cameras or similar devices shall be used in locations where NFPA 101, ***Life Safety Code***, requirements for evacuation of personnel from high hazard facilities cannot be met.

18.4.3.5. Proposed breakover operations of solid rocket motors/segments shall be submitted to Range Safety with substantiation that there is no other practical means to accomplish the task. The data shall illustrate how risks are minimized and managed. A detailed operational hazard analysis is required.

The cranes shall be designed for breakover operations in accordance with 3.6 and the heights of the lift kept to the absolute minimum required.

18.4.3.6. Crane hoisting operations that involve lifting large stacked solid rocket motors are not recommended due to the extreme hazards involved. A detailed operational hazard analysis is required. Lifting heights shall be kept to the absolute minimum required.

Stacking on a transporter or on the launch pad is always a safer alternative.

18.4.3.7. If a crane operational fault occurs during a solid rocket motor/segment lifting operation that leaves the load suspended, the crane power shall not be recycled to clear the fault until crane troubleshooting determines the nature of the fault.

BILLY R. COLWELL, Col, USAF
Director of Safety

ATTACHMENT 1

GROUND OPERATIONS PLAN

A1.1. Introduction:

A1.1.1. 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 Prelaunch Safety approval is obtained from the ranges along with the Missile Systems Prelaunch Safety Package (MSPSP) required in Volume 3.

A1.1.2. Content. This attachment contains the content preparation instructions for the data generated by the requirements delineated in Volume 6.

A1.1.3. Applicability. The requirements in this attachment are applicable to all ground, launch facility, launch vehicle, and spacecraft systems.

A1.1.4. Submittal Process. The GOP submittal periods are delineated in 4.1.

A1.1.5. Final Approval. The GOP shall be approved by Range Safety as delineated in 4.1 and 4.1.4.

A1.2. Preparation Instructions:

A1.2.1. 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.

A1.2.2. Format. Range User format is acceptable provided the information described below is provided.

A1.2.2.1. Table of Contents and Glossary. The GOP shall contain a table of contents and a glossary.

A1.2.2.2. Introduction. The “introduction” section shall address the purpose and scope of the GOP.

A1.2.2.3. General Description. The “general description” section shall present an overview of the system and the general processing flow as a prologue to the hazardous and safety critical operation descriptions. The following items are included in this section:

A1.2.2.3.1. General flow of system integration and testing.

A1.2.2.3.2. Facilities to be used.

A1.2.2.3.3. Generic timeline with sufficient granularity to identify the major hazardous and/or FTS operations.

A1.2.2.4. 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:

A1.2.2.4.1. 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.

A1.2.2.4.2. Procedure Descriptions. Procedure descriptions shall include separate listing of tasks so that hazardous tasks within each procedure can be identified.

A1.2.2.4.3. Procedure Task Summaries. Task summaries for each procedure shall include the following information:

A1.2.2.4.3.1. Each separate task.

A1.2.2.4.3.2. Responsible agency.

A1.2.2.4.3.3. Objective.

A1.2.2.4.3.4. Initial and final configuration.

A1.2.2.4.3.5. Equipment and support required.

A1.2.2.4.3.6. Description.

A1.2.2.4.3.7. Hazards and precautions.

A1.2.2.4.3.8. List of approved PPE and detection equipment used in ground operations.

A1.2.2.4.4. Flow Chart Task Summary. 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:

A1.2.2.4.4.1. Identifier for each procedure.

A1.2.2.4.4.2. Procedure number.

A1.2.2.4.4.3. Hazardous, non-hazardous, or safety critical designation.

A1.2.2.4.4.4. Task summary number(s).

A1.2.2.4.5. Identification of emergency and abort/back-out actions.

A1.2.2.4.6. A list of personnel training, certification, and experience requirements for each type of hazardous operation such as ordnance, crane, and propellant operations.

A1.2.2.5. Off-Site Processing. The "off-site processing" section shall include the following information:

A1.2.2.5.1. 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.

A1.2.2.5.2. 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.

A1.2.2.6. 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.

A1.2.2.6.1. 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 Volume 1, Attachment 2, O&SHA requirements.

A1.2.2.6.2. O&SHAs shall be conducted for activities such as testing, installation, maintenance, support, transportation, storage, operations, and training.

A1.2.2.6.3. O&SHAs shall coincide with the flow chart task summaries in A1.2.2.4.

A1.2.2.6.4. O&SHAs shall incorporate a worksheet associated with each specific flow block in the flow chart and shall include the following information:

A1.2.2.6.4.1. The general hazard group.

A1.2.2.6.4.2. The specific hazard condition.

A1.2.2.6.4.3. The effect if the hazard is not controlled.

A1.2.2.6.4.4. Hazard control hardware.

A1.2.2.6.4.5. The hazard control procedure.

A1.2.2.6.4.6. Hazard control personnel.

A1.2.2.6.4.7. Reference to the flow block task number.

A1.2.2.7. Range User Plans. Range User plans that include, but are not limited to, the following, shall be submitted in or added as appendixes to the GOP as identified in 4.5 and 4.6.2.

A1.2.2.7.1. Range User Training Plan.

A1.2.2.7.2. Accident Notification Plan.

A1.2.2.7.3. Emergency Response Plans for Graphite Epoxy Composite Overwrapped Pressure Vessels.

A1.2.2.8. Compliance Checklist:

A1.2.2.8.1. A Compliance Checklist based on a non-deliverable O&SHA and the requirements of Volumes 3 and 6 for each task may be submitted in place of a formal submittal of the O&SHA described in A1.2.2.6 of this attachment.

A1.2.2.8.2. The task breakout shall be associated with each specific flow block in the flow chart described in A1.2.2.3 and A1.2.2.4 of this attachment.

A1.2.2.8.3. The Compliance Checklist shall include the following information:

A1.2.2.8.3.1. AFSPCMAN 91-710 criteria/requirement.

A1.2.2.8.3.2. O&SHA reference hazard group and hazard condition.

A1.2.2.8.3.3. System and specific procedure and task within the procedure.

A1.2.2.8.3.4. Compliance.

A1.2.2.8.3.5. Noncompliance.

A1.2.2.8.3.6. Not applicable.

A1.2.2.8.3.7. Resolution.

A1.2.2.8.3.8. Reference.

A1.2.2.8.4. Copies of all Range Safety approved noncompliances associated with hazardous or safety critical operations shall be included.

A1.2.2.9. 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.

ATTACHMENT 2

HAZARDOUS AND SAFETY CRITICAL PROCEDURES

A2.1. Introduction:

A2.1.1. Determination of Hazardous and Safety Critical Procedures. The Ground Operations Plan (GOP) (Attachment 1 of this volume) 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 part of this volume. During review of the initial draft procedures, Range Safety shall determine if Pad Safety notification or attendance shall be required. The review of the draft procedures allows a second opportunity to ensure the classification is appropriate.

A2.1.2. 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.

A2.1.3. Content. This attachment contains the content preparation instructions for the data generated by the requirements delineated in Volume 6 of this document.

A2.1.4. Applicability. This attachment is applicable to the following:

A2.1.4.1. All launch vehicle, payload, or service contractors performing hazardous or safety critical operations on the ranges.

A2.1.4.2. Construction and management contracts for hazardous facilities.

A2.1.5. Submittal Process. The hazardous procedure submittal process is as follows:

A2.1.5.1. One copy of procedures involving hazardous or safety critical operations shall be submitted to Range Safety and one copy to Pad Safety for review and approval. The Range User shall review, approve, and sign the final procedures to be submitted to Range Safety for approval.

A2.1.5.2. For new programs, final Pad Safety and Range Safety comments, reviews, and approvals shall be provided to the Range User 45 calendar days after receipt of the procedure.

A2.1.5.3. For existing programs, final Pad Safety and Range Safety comments, reviews, and approvals shall be provided to the Range User 45 calendar days after receipt of the procedure.

A2.1.5.4. Final approved, published procedures incorporating Range Safety comments shall be submitted to Range Safety at least seven calendar days before the conduct of the operation.

A2.1.6. Final Approval. Hazardous and safety critical procedures shall be approved before starting any hazardous or safety critical operations on the ranges.

A2.2. Preparation Instructions:

A2.2.1. 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.

A2.2.2. Cover Page:

A2.2.2.1. A cover page with the procedure title and required approval signatures and date shall be provided. The signature page shall contain a block for Range Safety signature approval.

A2.2.2.2. The words *Draft* or *Preliminary* shall appear on any signed procedure that does not have the required Range Safety approval.

A2.2.2.3. 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.

A2.2.2.4. The cover sheet shall indicate revision level.

A2.2.3. Purpose Section:

A2.2.3.1. The "purpose" section shall provide a brief synopsis of all major tasks in each operating procedure.

A2.2.3.2. The synopsis shall include the following information:

A2.2.3.2.1. A brief description of the tasks, operations, tests, or checkouts to be performed.

A2.2.3.2.2. The facility and area where the procedure is to take place.

A2.2.3.2.3. The departure and arrival locations if transportation is required.

A2.2.3.2.4. For launch vehicle and payload tests, when the test is normally performed in relation to launch day (for example, L-5).

A2.2.4. Identification of Specific Hazards. The following specific hazards shall be identified in each procedure:

A2.2.4.1. The quantity and hazard classification of ordnance and propellants involved.

A2.2.4.2. The hazardous and non-hazardous configurations of the system before, during, and upon completion of the operation.

A2.2.5. Safety Precautions. As applicable, the following precautions shall be incorporated in each procedure at the beginning of the procedure as well as at the applicable step in the body of the procedure:

A2.2.5.1. Warnings.

A2.2.5.2. Cautions.

A2.2.5.3. Note inhibits.

A2.2.5.4. Safety devices.

A2.2.5.5. Control areas.

A2.2.6. Facility Configuration Inspections. The procedure shall indicate the specific facility and safety clearance zone control area to be used.

A2.2.6.1. The requirements for the performance of facility configuration inspections shall be incorporated in the procedures.

A2.2.6.2. The facility configuration inspection requirements shall address verification of the following:

A2.2.6.2.1. Facility explosive limits.

A2.2.6.2.2. Facility personnel limits.

A2.2.6.2.3. Posting of fire symbols when ordnance and propellants are moved into or out of a facility.

A2.2.7. PPE and Emergency Equipment:

A2.2.7.1. PPE and emergency equipment requirements for each operation shall be incorporated in hazardous procedures.

A2.2.7.2. The PPE and emergency equipment shall address the following:

A2.2.7.2.1. PPE requirements according to the manufacturer model number, MIL-SPEC, or standard for compliance.

A2.2.7.2.2. The occasions for the use of PPE.

A2.2.7.2.3. Types of emergency equipment required.

A2.2.7.2.4. Location of the emergency equipment during the operation.

A2.2.7.2.5. The number of emergency equipment units required. No substitution or configuration alteration of PPE shall be allowed without specific Range Safety approval.

A2.2.8. Pre-Operational Checklist of Required Tools and Equipment:

A2.2.8.1. A pre-operational checklist of all tools and equipment required for safe operations shall be incorporated in the procedures.

A2.2.8.2. For safety critical equipment, the following information shall be included:

A2.2.8.2.1. Manufacturer, model, and serial number.

A2.2.8.2.2. Location of the equipment during the operation.

A2.2.8.2.3. The number of units required.

A2.2.8.2.4. The required monitoring devices and their alarm settings.

A2.2.8.2.5. Proof test requirements.

A2.2.8.2.6. Nondestructive examination requirements.

A2.2.8.2.7. Calibration requirements.

A2.2.9. Support Personnel Requirements:

A2.2.9.1. Range User and range support personnel requirements such as Pad Safety, Fire, Medical, and Security/HOS personnel shall be incorporated in the procedures. In a multi-task procedure, the times these support personnel are needed shall be stipulated.

A2.2.9.2. The following support personnel requirements shall be addressed:

A2.2.9.2.1. The hazardous periods when personnel limits shall be enforced.

A2.2.9.2.2. The minimum essential personnel by functional title and number required.

A2.2.9.2.3. The Pad Safety notification in all cases. Pad Safety presence and concurrence is required before beginning all hazardous operations unless determined otherwise by Range Safety.

A2.2.9.2.4. Special training, certifications, or experience requirements.

A2.2.10. References to Applicable Documents:

A2.2.10.1. All applicable documents, drawings, and specifications shall be referenced in the procedures.

A2.2.10.2. If a specific operations safety plan or other safety plans apply to the procedure, they shall be listed in the procedure reference section.

A2.2.10.3. AFSPCMAN 91-710 shall be listed in the procedures.

A2.2.10.4. Procedures shall not use excessive second tier references.

Use of excessive second tier references means to incorporate references in such volume that the meaning is lost and use of the procedure becomes confusing, unnecessarily complex, or irrelevant.

A2.2.11. CCAFS Cape Support and WR Range Scheduling Notification. Notification of CCAFS Cape Support (321-853-5211) and Range Scheduling (321-853-5941) on the ER and Range Scheduling (805-606-8825) on the WR 24 hours before the planned start of the operation shall be incorporated in the procedures.

A2.2.12. Pre-Task Briefing:

A2.2.12.1. A step for the conduct of a pre-task briefing shall be incorporated in the procedures.

A2.2.12.2. The following topics shall be addressed:

A2.2.12.2.1. Operational hazards.

A2.2.12.2.2. Precautions.

A2.2.12.2.3. Emergency actions.

A2.2.12.2.4. Critical task items.

A2.2.12.2.5. Procedure flow.

A2.2.12.2.6. Operational discipline.

A2.2.12.2.7. Communication discipline.

A2.2.12.3. Specification that the briefing shall be repeated if a shift change is required.

A2.2.13. Step-by-Step Directions:

A2.2.13.1. 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.

A2.2.13.2. The procedure shall contain applicable data sheets, figures, and schematics to document or clarify system parameters and connect points.

A2.2.14. Identification of Hazardous and Safety Critical Portions of Procedures:

A2.2.14.1. The beginning and end of a hazardous or safety critical portion of a procedure shall be incorporated according to the following criteria:

A2.2.14.1.1. A “Warning” shall be used to identify hazards to personnel.

A2.2.14.1.2. A “Caution” shall be used to identify hazards to equipment.

A2.2.14.1.3. A “Note” shall be used to indicate an operating procedure of such importance that it must be emphasized.

A2.2.14.2. The activation of warning lights, Public Address (PA) announcements, and notification to Security/HOS of any controlled areas, if not accomplished as a pre-task item, shall be incorporated.

A2.2.14.3. Safety highlights such as evacuations, safety clearance zones, clearances, activation of aural and visual warnings shall be detailed before the hazardous sequence and in the applicable section of the procedure.

A2.2.15. 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.

A2.2.16. Transmittal of Procedures. Procedures shall be forwarded to Range Safety with a transmittal letter containing the following information:

A2.2.16.1. Need Date (minimum of 30 calendar days review time required for existing programs; 45 for new programs).

A2.2.16.2. Procedure title and number.

A2.2.16.3. Program identified or other identifier to ensure that the proper Range Safety point of contact receives the procedure.

A2.2.16.4. Special instructions for such items as review and comment and final copy for filing.

A2.2.16.5. Pertinent information such as “procedure is non-hazardous,” “procedure change does not affect the hazardous portion of the procedure nor otherwise have a safety impact,” or “all previous comments have been incorporated.”

A2.2.16.6. If the procedure has been previously submitted as a draft or with a different revision number, clarification of the extent of the changes.

A2.3. Examples of Hazardous Procedures. Examples of hazardous procedures include, but are not limited to, the following topics:

1. Pressurized propellant systems - pressurization (pneumastat and hydrostat), loading and unloading, sampling, leak testing, venting. 2. 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. 3. 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. 4. Ordnance - bore scope, X-ray, continuity test, propellant trimming, installation, electrical connection and disconnection. 5. Work involving lasers, high energy RF emissions, radioactive materials, and hazardous materials.

A2.4. Changes. Changes to previously submitted procedures shall be noted with change bars or a similar method of marking.

ATTACHMENT 3

INDEX OF OPERATIONS/AREAS SAFETY PLANS

A3.1. ER Operations Safety Plans:

A3.1.1. Atlas V Program Operations Safety Plans (approval pending).

A3.1.2. ATLAS/CENTAUR Complex 36 Operations Safety Plan.

A3.1.3. DELTA II AREA 55 Safety Plans and SOPs.

A3.1.4. DELTA II AREA 57 Safety Plan and SOPs (Solid Motor Facility).

A3.1.5. DELTA II COMPLEX 17 Operations Safety Plan and Safety Operations Plans (SOPs).

A3.1.6. DELTA II HANGAR M AREA Safety Plans and SOPs.

A3.1.7. DELTA II HAZARDS PROCESSING FACILITY AREA Safety Plan/SOP.

A3.1.8. Delta IV Complex 37 Operations Safety Plan.

A3.1.9. Delta IV Processing Solid Rocket Motors at the RIS and SRS Operations Safety Plan.

A3.1.10. Delta Launch Vehicles at Horizontal Integration Facility (HIF) Operations Safety Plan.

A3.1.11. DELTA VEHICLE at the Booster Processing Facility Operations Safety Plan.

A3.1.12. DSCS PROCESSING Facility Operations Safety Plan.

A3.1.13. Hanger AO/ Delta Storage Facility Operations Safety Plan.

A3.1.14. LOCC Operations Safety Plan.

A3.1.15. NAVSTAR Processing Facility Safety Plan.

A3.1.16. Operations Safety Plan for METEOROLOGICAL ROCKETS.

A3.1.17. Payload Spin Test Facility Safety Plan.

A3.1.18. Propellant Conditioning Facility Safety Plan.

A3.1.19. Propellant Servicing Facility Safety Plan.

A3.1.20. Safety OP Plans for Solid Rocket Booster Recovery and Disassembly Facility (Hangar AF).

A3.1.21. SLC-46 Commercial Assembly and Launch Operations, OSP and Safety Operating Plans.

A3.1.22. Solid Motor Assembly and Readiness Facility Operations Safety Plan.

A3.1.23. Solid Motor Assembly Building Operations Safety Plan.

A3.1.24. Spacecraft Processing and Integration Facility Operations Safety Plan.

A3.1.25. TITAN IV COMPLEX 40 Operations Safety Plan and SOPs.

A3.1.26. TRIDENT I (C4)/II(D5) Operations Safety Plan.

A3.1.27. X-Ray Facility Operations Safety Plan.

A3.2. WR Operations Safety Plans:

A3.2.1. LMSC Building 3000 Safety Plans.

A3.2.2. SLC-4 Launch Complex Safety Plan.

A3.2.3. Lockheed Martin Astronautics Integrated Safety Plan for SLC-3E and SLC-3W.

A3.2.4. NASA Ground Safety Plan Off-Site Facility.

A3.2.5. Integration Processing Facility Safety Plan Space Launch Complex 6.

A3.2.6. Integration Processing Facility (IPF) Safety Plan.

A3.2.7. Astrotech Space Operations, L.P. Safety Standard Operating Procedure at VAFB.

A3.2.8. Orbital Sciences Corporation Space Systems Division Facility Safety Plan for VAFB.

A3.2.9. Delta, SLC-2 VTC Safety Plan.

A3.2.10. United Paradyne Corporation Operations Safety Plan.

A3.2.11. Taurus and OSP/TLV Launch Vehicle Safety Plan TD 2401 Rev. G.

A3.2.12. National Missile Defense VAFB Ground Operations Plan.

A3.2.13. Pegasus Facility Safety Plan TD 0193 Rev E.

A3.2.14. MSLS Launch Complex Safety Plan.

A3.2.15. California Spaceport Space Launch Facility Safety Plan.

NOTE: Additional plans shall be developed for facilities, systems, and operations as needed.

ATTACHMENT 4

INDEX OF EXPLOSIVE (OPERATING AND AREA) SAFETY PLANS

1 Conducting Scheduled Inspections of Explosives and Propellant Facilities on CCAFS and Downrange Stations.

2 Disposition of Unserviceable, Obsolete, Excess, and Suspended Ordnance Items.

201 Fuel Storage Area l (FSA-1.

302 Handling Explosives at CCAFS Wharves.

303 Loading and Unloading Aircraft with Explosives or Other Hazardous Material at CCAFS Auxiliary Air Field.

304 Loading and Unloading Aircraft with Explosives at Downrange Bases.

307 HANDLING TRIDENT Missile Motors between the TITAN ITL Transfer Dock.

308 Handling OTTO Fuel.

310 Handling Commercial Solid Rocket Motors at the Titan ITL Transfer Dock.

501 Demonstrations Involving Explosives.

502 Conducting Hazardous Operations in Explosives Operating Buildings.

601 Storage of Explosives at Downrange Bases.

901 Transporting Explosives at CCAFS.

902 Transporting Explosives at Downrange Bases.

903 Motor Vehicle Transportation of Liquid Propellants and other Hazardous Chemicals at CCAFS.

NOTE: Additional plans shall be developed for facilities, systems, and operations as needed.

ATTACHMENT 5

MISCELLANEOUS SAFETY PLANS

A5.1. ER Miscellaneous Safety Plans:

A5.1.1. Cape Canaveral Spaceport Consolidated Comprehensive Emergency Management Plan (CCEMP).

A5.1.2. Danger Area Information Plan.

A5.1.3. SOP for Hazardous Material Debris Water Recovery Operation.

A5.2. WR Miscellaneous Safety Plans:

A5.2.1. 30 SWI 91-101 for 30 SW LDCG.

A5.2.2. Launch Support Plans.

A5.2.3. 30 SWI 91-106 for Toxic Hazard Assessments.

A5.2.4. AFI 91-110 30 SW Sup 1 for Ionizing Radiation and Radioactive Material.

A5.2.5. 30 SWI 91-119 for Process Safety Management.

ATTACHMENT 6

OVERHEAD CRANES AND HOISTS INSPECTION AND TEST SCHEDULE

Table A6.1. 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

Category	Nomenclature	Operational Checks	Frequency			
			Structural/ Mechanical/ Electrical Checks	Rope/ Hook Checks	Load Test	Hook Test
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	QR	A
IVA	Enclosed environment; general use (non-critical loads)	P/U	A	M	QR	A
IVB	Enclosed environment; idle 6 months (non-critical loads)	P/U (Q)	A	P/U (M)	QR	A
IVC	Enclosed environment; standby (non-critical loads)	P/U (A)	P/U	P/U (M)	P/U (2)	P/U (1)

Category	Nomenclature	Operational Checks	Frequency			
			Structural/ Mechanical/ Electrical Checks	Rope/ Hook Checks	Load Test	Hook Test
V	Semi-enclosed environment; frequent or daily use (non-critical loads)	D	SA	M	QR	A
VA	Semi-enclosed environment; general use (non-critical loads)	P/U	SA	M	QR	A
VB	Semi-enclosed environment; idle 6 months (non-critical loads)	P/U (Q)	P/U (6)	P/U (M)	QR	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	QR	A
VIA	Exposed environment; general use (non-critical loads)	P/U	SA	M	QR	A
VIB	Exposed environment; idle 6 months (non-critical loads)	P/U (Q)	P/U (6)	P/U (M)	QR	A
VIC	Exposed environment; standby (non-critical loads)	P/U (Q)	P/U	P/U (M)	P/U (2)	P/U (1)
(Cont.)						

LEGEND

A - Annually

SA - Semi-Annually

D Daily *(If used daily; otherwise before use)*

M - Monthly

Q - Quarterly

QR - Quadriennially

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.

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 prerequisite 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 as detailed in the inspection plan and/or procedures.

Rope/Hook Checks: Complete rope inspection for wear, broken wires, diameter reduction, and corrosion. Hook inspection for damage and distortion. 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 attachment supersedes all previous editions.

ATTACHMENT 7

RANGE SAFETY LAUNCH COMMIT CRITERIA

A7.1. Introduction. Range Safety launch commit criteria (RSLCC) are those criteria associated with launch day parameters that must be met prior to final SW/SE approval for launch. These criteria ensure public, launch site, and launch complex safety. They include launch vehicle, range, and environmental factors.

A7.1.1. Purpose. This attachment provides Range Users with general, and, where possible, specific information regarding RSLCC. Knowledge of this criteria may help Range Users to better understand and plan for potential Range Safety holds or scrubs as a result of related violations during the launch countdown.

A7.1.2. Content. Descriptions of each RSLCC are included in this attachment. Where possible, the exact criteria used during the countdown are provided. General criteria are provided for cases in which the criteria are too complex to address in this publication and/or where the criteria is in a state of flux. Range Safety offices of primary responsibility (OPR) and referenced documents are provided as sources of additional information.

A7.1.3. Applicability. All RSLCC are not applicable to all launch vehicles. The applicability of each RSLCC is identified in the individual descriptions. Additional specific RSLCC may be provided as part of the range safety operational requirements (RSOR) or operations supplement to the RSOR for each individual mission.

A7.2. Range Safety Launch Commit Criteria:

A7.2.1. Flight Safety Systems. Flight safety systems are those ground and airborne systems required to monitor, track, aid decision making, and, if necessary, destroy errant launch vehicles in flight.

A7.2.1.1. Ground Range Safety Systems:

A7.2.1.1.1. General Description. Ground Range Safety Systems include such systems as the command terminate system, range tracking system (RTS), telemetry data transmitting system (TDTS), Range Safety display systems (RSD), and all other associated ground-based systems necessary to monitor, track, aid decision making, and destroy an errant launch vehicle.

A7.2.1.1.2. Applicability. All launch vehicle missions using a command flight termination system (FTS) require certain ground range safety system assets to be operational prior to launch. The launch vehicle configuration, launch azimuth, and other factors drive the selection of necessary ground safety system assets.

A7.2.1.1.3. Ground Range Safety System Launch Commit Criteria:

A7.2.1.1.3.1. Range tracking systems include radars, optics, and telemetered inertial guidance downlinks.

A7.2.1.1.3.1.1. Two adequate and independent tracking sources shall be available throughout powered flight.

A7.2.1.1.3.1.1.1. *Adequate* is defined by error statistics for each source.

A7.2.1.1.3.1.1.2. *Independent* is defined as having no common components or systems between the vehicle and the front-end computers in the Range Operations Control Center (ROCC) such as to create a common failure mode.

A7.2.1.1.3.1.2. Tracking sources shall be tested prior to launch to ensure requirements for accuracy and data integrity such as good communication with the ROCC.

A7.2.1.1.3.2. The CDS has dual transmitter sites connected to central command in the ROCC. The system is capable of operation in both secure and non-secure modes.

A7.2.1.1.3.2.1. A dual command site (two transmitters connected by an automatic failover control system) and two command data links shall be available throughout powered flight.

A7.2.1.1.3.2.2. Using test codes, closed loop testing shall be performed between command central and each site prior to launch to ensure proper performance of the system.

A7.2.1.1.3.2.3. Using flight codes, closed loop testing shall be performed between command central and the Launch Area command site prior to launch to ensure code integrity.

A7.2.1.1.3.2.4. Using test codes, open loop testing shall be performed between command central, via the Launch Area command site, to the launch vehicle before launch to ensure total system integrity.

A7.2.1.1.3.2.5. System testing shall include the use of both the Flight Termination Unit (FTU) and the Range Safety control and display (RASCAD) console.

A7.2.1.1.3.2.6. Using test codes, open loop testing shall be performed between command central, via each command site, to the command destruct independent test sets (CDITS) prior to launch to quantitatively verify proper message, code, and radio frequency parameters.

A7.2.1.1.3.3. Computer and data communications systems, including RSD systems, collect and process data from the tracking sources. They calculate vehicle state vector information and predict the vacuum impact point of a vehicle in real time. In addition, the vehicle positional information generated in the RSD system is used to point command terminate antennas at the vehicle and provide the MFCO with graphic displays of vehicle position, velocity, and impact point overlaid on a geographic representation of the flight.

A7.2.1.1.3.3.1. Using end-to-end playback of theoretical data, the proper function of all computer and data communication systems shall be verified prior to launch.

A7.2.1.1.3.3.2. The data processing and display (RTP/RSD) systems and their associated peripheral support equipment are configured in two independent strings connected with an automatic failover system. A minimum of two strings shall function correctly before allowing a vehicle to launch.

A7.2.1.1.4. Offices of Primary Responsibility. 30 SW/SEO and 45 SW/SEO are the OPRs and 1 ROPS and 2 ROPS the Office of Corollary Responsibility (OCR) for determining ground safety systems launch commit criteria. 30 SW/SEO and 45 SW/SEO are the OPRs and the Chief of Wing Safety approves the RSOR. 30 SW/SEO and 45 SW/SEO are the OPRs and

1 ROPS and 2 ROPS are the OCRs for the operations supplement. The operations supplement is approved by the Chief of Wing Safety.

A7.2.1.1.5. Reference Documents. Vehicle-specific ground safety systems launch commit criteria shall be documented in the RSOR. Mission-specific modifications to the RSOR are published for each operation in the operations supplement.

A7.2.1.2. Airborne Flight Safety Systems:

A7.2.1.2.1. General Description. Airborne FSSs include the FTS and the airborne RTS.

A7.2.1.2.2. Airborne FTS. An airborne FTS is required for all powered flight stages of a launch vehicle in accordance with Volume 2 of this publication. The need for an airborne FTS for all upper stages, payloads, and/or spacecraft capable of powered flight is determined as part of the flight plan approval process addressed in Volume 2. An RTS is required for all launch vehicles per Volume 2.

A7.2.1.2.3. Airborne FSS Launch Commit Criteria:

A7.2.1.2.3.1. The Operations Safety Console (OSC) (ER) and the Flight Safety Project Officer Console (FSPOC) (WR) shall be used to monitor the status of the airborne FTS prior to launch.

A7.2.1.2.3.1.1. Final airborne FTS open-loop testing shall be performed while on airborne power just before launch.

A7.2.1.2.3.1.2. All components of the airborne FTS shall be operating within expected limits prior to launch.

A7.2.1.2.3.1.3. The FTS shall be armed prior to launch.

A7.2.1.2.3.2. Radar installations and mobile frequency measurement vans are used to monitor the status of the airborne RTS. The airborne RTS shall be operating within expected limits before launch.

A7.2.1.2.3.3. If providing tracking data, the airborne TDTS shall be operating within the expected limits before proceeding with the launch.

A7.2.1.2.3.4. A launch hold or launch scrub shall be implemented if the above criteria are not met.

A7.2.1.2.4. Offices of Primary Responsibility:

A7.2.1.2.4.1. 30 SW/SES and 45 SW/SES are the OPRs for airborne FTS launch commit criteria.

A7.2.1.2.4.2. 30 SW/SEO and 45 SW/SEO are the OPRs for airborne RTS launch commit criteria. The 1 ROPS and 2 ROPS are OCRs for airborne RTS launch commit criteria.

A7.2.1.2.5. Reference Documents:

A7.2.1.2.5.1. Operating characteristics of the OSC and FSPOC are required as part of the airborne Flight Termination System Report (FTSR) in accordance with Volume 4, Chapter 9 of this publication.

A7.2.1.2.5.2. Vehicle-specific airborne RTS launch commit criteria shall be documented in the RSOR. Mission-specific modifications to the RSOR shall be published in the operations supplement to the RSOR for each operation.

A7.2.2. Blast:

A7.2.2.1. General Description. The BLAST model addresses intermediate hazardous range effects of a shock wave from an inadvertent detonation, such as from a launch vehicle malfunction, impact, or destruction. Near-in areas of overpressure above one pound per square inch (psi) are evacuated of personnel and are not considered in the assessment. At far-out distances, with overpressures of less than 0.1 psi, there are relatively small hazards. It is the intermediate distance with overpressures of 0.1 to 0.5 psi that are of concern. The area encompassing overpressures in this range varies considerably with local meteorological conditions.

A7.2.2.2. Applicability. This launch commit criteria is generally applicable to large launch vehicles with large amounts of propellants, solid rocket motor launch vehicles with high energy propellants, and launch vehicles using launch complexes near the borders of general population.

A7.2.2.3. Blast Launch Commit Criteria. If the expected casualties of a potential blast overpressure exceed those limits defined in Volume 1 of this publication, Range Safety recommends the range go "red" until another BLAST model run can be made with updated meteorological data.

A7.2.2.4. Offices of Primary Responsibility. 30 SW/SEY is the OPR for launch commit criteria associated with the Blast C model; 45 SW/SESE is the OPR for launch commit criteria associated with the Blast X (tailored version of Blast C) model.

A7.2.2.5. Reference Documents. Mission-specific blast launch commit criteria shall be addressed in the RSOR.

A7.2.3. Collision Avoidance:

A7.2.3.1. General Description. A collision avoidance (COLA) analysis is used in the minus count to protect manned/mannable orbiting objects from collision with a launch vehicle or its jettisoned components.

A7.2.3.2. Applicability. All launch vehicles with the potential to collide with manned/mannable orbiting objects shall meet the following criteria:

A7.2.3.3. Collision Avoidance Launch Commit Criteria:

A7.2.3.3.1. The COLA program computes the closest approach between the launch vehicle and an orbiting object based on a miss distance screening criteria of 200 kilometers for manned/mannable objects.

A7.2.3.3.2. A COLA (no launch) closure time period is calculated for the defined miss distance for any object approaching within distances less than the above criteria.

A7.2.3.3.3. A COLA closure time period shall result in a launch hold for that time period. A launch scrub occurs only if the closure time period conflicts with any remaining T-0 for the mission launch window.

A7.2.3.4. Offices of Primary Responsibility. 30 SW/SEY and 45 SW/SEO are the OPRs for determining COLA launch commit criteria.

A7.2.3.5. Reference Documents. Mission-specific COLA criteria shall be documented in the COLA Requirements letter by 45 SW/SEO and 30 SW/SEY.

A7.2.4. Launch Winds and Debris Hazard:

A7.2.4.1. Launch Winds (ER Only). A Range Safety wind check (RSWC) program is used to compare forecasted T-0 winds and actual winds with statistical wind data and their effects on potential launch vehicle debris impacts.

A7.2.4.1.1. Applicability. All launch vehicles with potentially hazardous launch vehicle debris are subject to this launch commit criteria.

A7.2.4.1.2. Day of Launch Winds Commit Criteria. If forecasted T-0 winds cause potential launch vehicle debris dispersions to exceed acceptable statistical wind dispersion limits, a launch hold or launch scrub shall be implemented.

A7.2.4.1.3. Offices of Primary Responsibility. 45 SW/SEO is OPR for day of launch wind commit criteria.

A7.2.4.1.4. Reference Documents:

A7.2.4.1.4.1. The requirements shall be listed in the Range Safety Wind letter in accordance with Volume 2, of this publication.

A7.2.4.1.4.2. At the WR, weather requirements and associated safety analyses shall be listed in the RSOR.

A7.2.4.2. Debris Hazard (WR Only). At the WR, the Launch Risk Analysis (LARA) program is used to compute the estimate of casualty to personnel supporting the operation and to the general public due to debris from a vehicle destroyed during flight. The LARA program incorporates the latest available atmospheric data as well as vehicle breakup, malfunction turn, trajectory, and failure rate data.

A7.2.4.2.1. Applicability. In general, the launch commit criteria is applicable to all launch vehicles using an FTS and/or active guidance systems. Some larger rail-launched or unguided vehicles may also be affected.

A7.2.4.2.2. Debris Hazard Launch Commit Criteria. If the expected casualties exceed those limits defined in Volume 1 of this publication, Range Safety recommends the range go "red" until another LARA model run can be made with updated wind data.

A7.2.4.2.3. Office of Primary Responsibility. 30 SW/SEY is OPR for debris hazard commit criteria.

A7.2.4.2.4. Reference Documents:

A7.2.4.2.4.1. Data requirements are specified in Volume 2 of this publication.

A7.2.4.2.4.2. Weather requirements are specified in the RSOR.

A7.2.5. Natural and Triggered Lightning:

A7.2.5.1. General Description. Both natural and triggered lightning can cause launch vehicle malfunction and/or destruction. Triggered lightning is the phenomena associated with launch vehicles affecting the atmosphere during flight so that, under certain meteorological conditions, lightning is triggered and attracted to the launch vehicle.

A7.2.5.2. Definitions and Explanations:

A7.2.5.2.1. anvil -Stratiform or fibrous cloud produced by the upper level outflow or blow-off from thunder-storms or convective clouds.

A7.2.5.2.2. associated - Used to denote that two or more clouds are causally related to the same weather disturbance or are physically connected. *Associated* is not synonymous with occurring at the same time. An example of clouds that are *not* associated is air mass clouds formed by surface heating in the absence of organized lifting. Also, a cumulus cloud formed locally and a physically separated cirrus layer generated by a distant source are not associated, even if they occur over or near the launch site at the same time.

A7.2.5.2.3. Subsidiary Definition: Weather Disturbance

A7.2.5.2.4. bright band - An enhancement of radar reflectivity caused by frozen hydrometeors falling through the 0 deg C level and beginning to melt.

A7.2.5.2.5. cloud base - The visible cloud base is preferred. If this is not possible, then the 0 (zero) dBZ radar reflectivity cloud base is acceptable.

A7.2.5.2.6. cloud edge - The visible cloud edge is preferred. If this is not possible, then the 0 (zero) dBZ radar reflectivity cloud edge is acceptable.

A7.2.5.2.7. cloud layer - A vertically continuous array of clouds, not necessarily of the same type, whose bases are approximately at the same level.

A7.2.5.2.8. cloud top - The visible cloud top is preferred. If this is not possible, then the 0 (zero) dBZ radar reflectivity cloud top is acceptable.

A7.2.5.2.9. cumulonimbus cloud - Any convective cloud with any part above the –20 deg C temperature level.

A7.2.5.2.10. debris cloud - Any cloud, except an anvil cloud, that has become detached from a parent cumulonimbus cloud or thunderstorm or that results from the decay of a parent cumulonimbus cloud or thunderstorm.

A7.2.5.2.11. Subsidiary Definition: Cumulonimbus Cloud

A7.2.5.2.12. electric field measurement aloft - the magnitude of the instantaneous, vector, electric field (E) at a known position in the atmosphere, such as measured by a suitably instrumented, calibrated, and located airborne-field-mill aircraft

A7.2.5.2.13. Subsidiary Definition: Field Mill

A7.2.5.2.14. electric field measurement at the surface - The one-minute arithmetic average of the vertical electric field (Ez) at the ground measured by a ground-based field mill. The polarity of the electric field is the same as that of the potential gradient; that is, the polarity of the field at the ground is the same as the dominant charge overhead. Electric field contours shall not be used for the electric field measurement at the surface.

A7.2.5.2.15. Subsidiary Definition: Field Mill

A7.2.5.2.16. field mill - A specific class of electric-field sensor that uses a moving, grounded conductor to induce a time-varying electric charge on one or more sensing elements in proportion to the ambient electrostatic field.

A7.2.5.2.17. flight path - the planned flight path including its uncertainties ("error bounds")

A7.2.5.2.18. moderate precipitation - a precipitation rate of 0.1inches/hr or a radar reflectivity factor of 30 dBZ

A7.2.5.2.19. nontransparent - Sky cover through which forms are blurred, indistinct, or obscured is nontransparent. Sky cover through which forms are seen distinctly *only* through breaks in the cloud cover is considered nontransparent. Clouds with a radar reflectivity of 0 (zero) dBZ or greater are also considered nontransparent. Nontransparency shall be assessed for launch time.

A7.2.5.2.20. Subsidiary Definition: Transparent

A7.2.5.2.21. precipitation - detectable rain, snow, sleet, hail, or graupel at the ground, or virga, or a radar reflectivity greater than 18 dBZ. Moisture on the windscreen of an airplane does not by itself constitute a detection of precipitation.

A7.2.5.2.22. thunderstorm – Any convective cloud that produces lightning.

A7.2.5.2.23. transparent – Sky cover is transparent if such items as higher clouds, blue sky, and stars, can be distinctly seen from below; or if terrain, buildings, lights on the ground, can be distinctly seen from above. Visible transparency is required. Transparency must be assessed for launch time. Sky cover through which forms are seen distinctly *only* through breaks in the cloud cover is considered *non*transparent.

A7.2.5.2.24. Subsidiary Definition: Nontransparent

A7.2.5.2.25. weather disturbance – a weather system where dynamical processes destabilize the air on a scale larger than the individual clouds or cells. Examples of disturbances are fronts, troughs, and squall lines.

A7.2.5.2.26. within – used as a function word to specify a margin in all directions (horizontal, vertical, and slant separation) between the cloud edge, base or top and the flight path. For example, "*within* 10 nautical miles of a thunderstorm cloud" means that there must be a 10 nautical miles margin between every part of a thunderstorm cloud and the flight path.

A7.2.5.2.27. Subsidiary Definitions: Cloud Base, Cloud Edge, Cloud Top, Flight Path

A7.2.5.3. Applicability. The Launch Weather Team (LWT) shall have clear and convincing evidence that the following hazard avoidance criteria are not violated. Even when these criteria are not violated, if any other hazardous condition exists, the LWT will report the threat to the Launch Director (LD). The LD may hold at any time based on the instability of the weather. All launch vehicles are subject to these launch commit criteria.

A7.2.5.4. Natural and Triggered Lightning Launch Commit Criteria:

A7.2.5.4.1. Lightning:

A7.2.5.4.1.1. Do not launch for 30 minutes after any type of lightning occurs in a thunderstorm if the flight path will carry the vehicle within 10 nautical miles of that thunderstorm.

A7.2.5.4.1.2. Do not launch for 30 minutes after any type of lightning occurs within 10 nautical miles of the flight path. *Unless:*

A7.2.5.4.1.2.1. *The cloud that produced the lightning is not within 10 nautical miles of the flight path;*

and

A7.2.5.4.1.2.2. *There is at least one working field mill within 5 nautical miles of each such lightning flash;*

and

A7.2.5.4.1.2.3. *The absolute values of all electric field measurements at the surface within 5 nautical miles of the flight path and at the mills(s) specified in A7.2.5.4.1.2.2 above have been less than 1,000 V/m (volts per meter) for 15 minutes.*

A7.2.5.4.1.3. Anvil clouds are covered in A7.2.5.4.3 below.

A7.2.5.4.1.4. If a cumulus cloud remains 30 minutes after the last lightning occurs in a thunderstorm, then the criteria in A7.2.5.4.2 apply.

A7.2.5.4.2. Cumulus Clouds. Cumulus clouds discussed below do not include altocumulus, cirrocumulus, or stratocumulus.

A7.2.5.4.2.1. Do not launch if the flight path will carry the vehicle within 10 nautical miles of any cumulus cloud with its cloud top higher than the –20°C level.

A7.2.5.4.2.2. Do not launch if the flight path will carry the vehicle within 5 nautical miles of any cumulus cloud with its cloud top higher than the –10°C level.

A7.2.5.4.2.3. Do not launch if the flight path will carry the vehicle through any cumulus cloud with its cloud top higher than the –5°C level.

A7.2.5.4.2.4. Do not launch if the flight path will carry the vehicle through any cumulus cloud with its cloud top between the +5°C and –5°C levels. *Unless:*

A7.2.5.4.2.4.1. *The cloud top is not producing precipitation;*

and

A7.2.5.4.2.4.2. *The horizontal distance from the center of the cloud top to at least one working field mill is less than 2 nautical miles;*

and

A7.2.5.4.2.4.3. *All electric field measurements at the surface within 5 nautical miles of the flight path and at the mills(s) specified in A7.2.5.4.2.4.2 above have been between –100 V/m and +500 V/m for 15 minutes.*

A7.2.5.4.3. Anvil Clouds:

A7.2.5.4.3.1. Attached Anvils:

A7.2.5.4.3.1.1. Do not launch if the flight path will carry the vehicle through nontransparent parts of attached anvil clouds.

A7.2.5.4.3.1.2. Do not launch if the flight path will carry the vehicle within 5 nautical miles of nontransparent parts of attached anvil clouds for the first 3 hours after the time of the last lightning discharge that occurs in the parent cloud or anvil cloud.

A7.2.5.4.3.1.3. Do not launch if the flight path will carry the vehicle within 10 nautical miles of nontransparent parts of attached anvil clouds for the first 30 minutes after the time of the last lightning discharge that occurs in the parent cloud or anvil cloud.

A7.2.5.4.3.2. Detached Anvils. Detached anvil clouds are never considered *debris clouds*, nor are they covered by the criteria in A7.2.5.4.4.

A7.2.5.4.3.2.1. Do not launch if the flight path will carry the vehicle through nontransparent parts of a detached anvil cloud for the first 3 hours after the time that the anvil cloud is observed to have detached from the parent cloud.

A7.2.5.4.3.2.2. Do not launch if the flight path will carry the vehicle through nontransparent parts of a detached anvil cloud for the first 4 hours after the time of the last lightning discharge that occurs in the detached anvil cloud.

A7.2.5.4.3.2.3. Do not launch if the flight path will carry the vehicle within 5 nautical miles of nontransparent parts of a detached anvil cloud for the first 3 hours after the time of the last lightning discharge that occurs in the parent cloud or anvil cloud before detachment or in the detached anvil cloud after detachment. *Unless:*

A7.2.5.4.3.2.3.1. *There is at least one working field mill within 5 nautical miles of the detached anvil cloud;*

and

A7.2.5.4.3.2.3.2. *The absolute values of all electric field measurements at the surface within 5 nautical miles of the flight path and at the mill(s) specified in A72.5.4.3.2.3.1. above have been less that 1,000 V/m for 15 minutes;*

and

A7.2.5.4.3.2.3.3. *The maximum radar return from any part of the detached anvil cloud within 5 nautical miles of the flight path has been less than 10 dBZ for 15 minutes.*

A7.2.5.4.3.2.4. Do not launch if the flight path will carry the vehicle within 10 nautical miles of nontransparent parts of a detached anvil cloud for the first 30 minutes after the time of the last lightning discharge that occurs in the parent cloud or anvil cloud before detachment or in the detached anvil cloud after detachment.

A7.2.5.4.4. Debris Cloud:

A7.2.5.4.4.1. Do not launch if the flight path will carry the vehicle through any nontransparent parts of a debris cloud during the 3-hour period defined in the A7.2.5.4.4.3 below.

A7.2.5.4.4.2. Do not launch if the flight path will carry the vehicle within 5 nautical miles of any nontransparent parts of a debris cloud during the 3-hour period defined in the A7.2.5.4.4.3 below. *Unless:*

A7.2.5.4.4.2.1. *There is at least one working field mill within 5 nautical miles of the debris cloud;*

and

A7.2.5.4.4.2.2. *The absolute values of all electric field measurements at the surface within 5 nautical miles of the flight path and at the mill(s) specified in a. above have been less that 1,000 V/m for 15 minutes;*

and

A7.2.5.4.4.2.3. *The maximum radar return from any part of the debris cloud within 5 nautical miles of the flight path has been less than 10 dBZ for 15 minutes.*

A7.2.5.4.4.3. The 3-hour period cited in A7.2.5.4.4.1 and A7.2.5.4.4.2 above begins at the time when the debris cloud is observed to have detached from the parent cloud or when the debris cloud is observed to have formed from the decay of the parent cloud top below the altitude of the -10^0C level. The 3-hour period begins anew at the time of any lightning discharge that occurs in the debris cloud.

A7.2.5.4.5. Disturbed Weather. Do not launch if the flight path will carry the vehicle through any nontransparent clouds that are associated with a weather disturbance having clouds that extend to altitudes at or above the 0^oC level and contain moderate or greater precipitation or a radar bright band or other evidence of melting precipitation within 5 nautical miles of the flight path.

A7.2.5.4.6. Thick Cloud Layers:

A7.2.5.4.6.1. Do not launch if the flight path will carry the vehicle through nontransparent parts of a cloud layer that is:

A7.2.5.4.6.1.1. Greater than 4,500 feet thick and any part of the cloud layer along the flight path is located between the 0^oC and the -20^oC levels

or

A7.2.5.4.6.1.2. Connected to a cloud layer that, within 5 nautical miles of the flight path, is greater than 4,500 feet thick and has any part located between the 0^oC and the -20^oC levels.

Exception*: The following exception applies to both A7.2.5.4.6.1.1 and A7.2.5.4.61.2 above:*

The cloud is a cirriform cloud that has never been associated with convective clouds,

and

is located entirely at temperatures of –15oC or colder,

and

shows no evidence of containing liquid water (for example, aircraft icing).

A7.2.5.4.7. Smoke Plumes. Do not launch if the flight path will carry the vehicle through any cumulus cloud that has developed from a smoke plume while the cloud is attached to the smoke plume, or for the first 60 minutes after the cumulus cloud is observed to have detached from the smoke plume. Cumulus clouds that have formed above a fire but have been detached from the smoke plume for more than 60 minutes are considered *cumulus clouds* and are covered in A7.2.5.4.2.

A7.2.5.4.8. Surface Electric Fields (ER Only):

A7.2.5.4.8.1. Do not launch for 15 minutes after the absolute value of any electric field measurement at the surface within 5 nautical miles of the flight path has been greater that 1,500 V/m.

A7.2.5.4.8.2. Do not launch for 15 minutes after the absolute value of any electric field measurement at the surface within 5 nautical miles of the flight path has been greater that 1,000 V/m. *Unless:*

A7.2.5.4.8.2.1. *All clouds within 10 nautical miles of the flight path are transparent;*

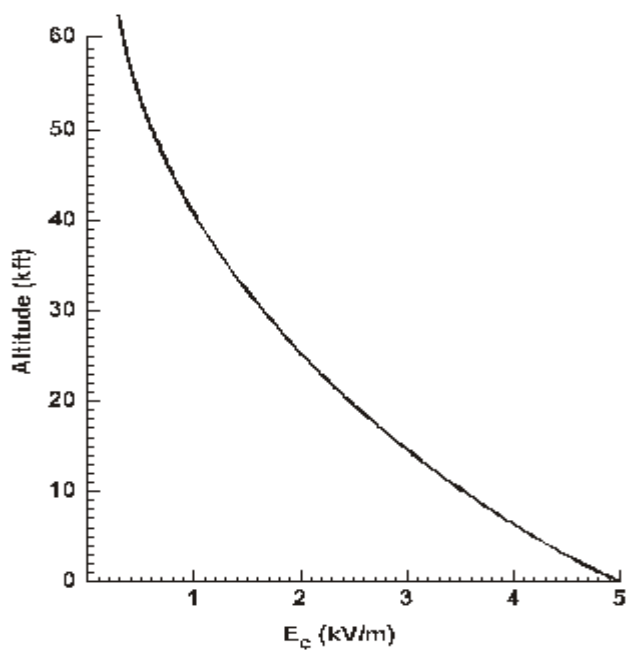
or

A7.2.5.4.8.2.2. *All nontransparent clouds within 10 nautical miles of the flight path have cloud tops below the +5oC level and have not been part of convective clouds with cloud tops above the –10oC level within the last 3 hours.*

A7.2.5.4.8.3. Electric field measurements at the surface are used to increase safety by detecting electric fields caused by unforeseen or unrecognized hazards. For confirmed failure of one or more field mill sensors, the countdown and launch may continue.

A7.2.5.4.9. Electric Fields Aloft (ER Only). The criteria cited in A7.2.5.4.3, A7.2.5.4.4, A7.2.5.4.5, A7.2.5.4.6, A7.2.5.4.7, and A7.2.5.4.8.2 need not be applied if, during the 15 minutes prior to launch time, the instantaneous electric field aloft throughout the volume of air expected to be along the flight path, does not exceed E_C where E_C is shown as a function of altitude in Figure A7.1. The thresholds on electric field measurements at the surface in A7.2.5.4.8 and elsewhere in these LCC are lower than 5 kV/m (kilovolts per meter) to allow for the effect of the surface screening layer.

Figure A7.1. Instantaneous Critical Electric Field (E_c) Versus Altitude.



Legend: kft = thousand feet

A7.2.5.4.10. Triboelectrification. Do not launch if a vehicle has not been treated for surface electrification and the flight path will go through any clouds above the –10ºC level up to the altitude at which the vehicle's velocity exceeds 3,000ft/sec. A vehicle is considered "treated" for surface electrification if:

A7.2.5.4.10.1. All surfaces of the vehicle susceptible to precipitation particle impact have been treated to assure

A7.2.5.4.10.1.1. *That the surface resistivity is less than 109 ohms/square;*

and

A7.2.5.4.10.1.2. *That all conductors on surface (including dielectric surfaces that have been treated with conductive coatings) are bonded to the vehicle by a resistance that is less than 105 ohms;*

or

A7.2.5.4.10.2. It has been shown by test or analysis that electrostatic discharges (ESDs) on the surface of the vehicle caused by triboelectrification by ice particle impact will not be hazardous to the launch vehicle or the mission. In A7.2.5.4.10.1.1 above, the correct unit for surface resistivity is ohms/square. This means that any square area of any size measured in any units has the same resistance in ohms when the measurement is made from an electrode extending the length of one side of the square to an electrode extending the length of the opposite side of the square. The area-independence is literally valid only for squares; it is not true for other shapes such as rectangles and circles.

A7.2.5.5. Offices of Primary Responsibility. 30 SW/SEY and 45 SW/SESE along with 30 WS and 45 WS are the OPRs for natural and triggered lightning launch commit criteria. 30 SW/SE and 45 SW/SE are the OCRs.

A7.2.5.6. Reference Documents. Additional or different mission specific natural and triggered lightning launch commit criteria shall be documented in the RSOR.

A7.2.6. Toxics:

A7.2.6.1. General Description. A variety of predictive models and analytical techniques are used to ensure that the public and launch area personnel are not exposed to toxic chemicals in concentrations that exceed applicable threshold limits. Key considerations include, but are not limited to, the specific commodities loaded and their quantity; potential agents resulting from mixing and/or reactions; nature or mechanism of release; and weather parameters such as wind speed, wind direction, temperature, temperature gradient, inversion layer, surface reflection coefficient, exposure response functions, and cloud cover as well as the uncertainty of these parameters.

A7.2.6.2. Applicability. All launch vehicles, including payloads, with potentially hazardous chemicals are subject to this toxic launch commit criteria. Range Users shall identify the specific toxic/hazardous commodities and the quantity that will be contained on each launch vehicle/payload mission, and shall provide data in compliance with Volume 2 of this publication.

A7.2.6.3. Toxic Launch Commit Criteria. Acceptable exposure limits for various commodities are governed by a number of standards, statutes, and specifications. These standards, statutes, and specifications are subject to frequent revision based on controlled studies, real-world events, and

other discoveries. Additionally, commodity loads also vary among launch vehicle classes and there are differences between variants within the same class. If the expected casualties of an exposure to a toxic commodity exceed those limits defined in Volume 1 of this publication, Range Safety recommends that the range go "red" until another run can be made with updated meteorological data. For ER toxic launch commit criteria see RSOR 19, and for guidance regarding a specific commodity or set of commodities in the case of a particular launch vehicle, contact the 45 SW Office of Safety, Missile Systems Division, Engineering Support Section (45 SW/SESE). At the WR, the 30 SWI 91-106 defines the exposure criteria, unit support requirements, actions required for hot and cold spill potential Hazard Zones as well as other requirements.

A7.2.6.4. Offices of Primary Responsibility. 30 SW/SEY and 45 SW/SESE are the OPRs for toxic launch commit criteria.

A7.2.6.5. Reference Documents. Mission-specific toxic launch commit criteria shall be addressed in the RSOR.

A7.2.7. Safety Clearance Zones. Safety Clearance Zones are 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 to include launch complexes. Safety Clearance Zones include Hazardous Clear Areas and Hazardous Launch Areas.

A7.2.7.1. Hazardous Clear Areas:

A7.2.7.1.1. General Description. Hazardous Clear Areas are Safety Clearance Zones for ground processing that are defined in the Operations Safety Plan for each operating facility. Hazardous Clear Areas include Blast Danger Areas (BDA), Control Area Clears, and Toxic Hazard Corridor (THC) (ER) and Toxic Hazard Zone (WR).

A7.2.7.1.2. Applicability. All launch vehicles and, if necessary, associated payloads shall be evaluated and hazardous clear areas determined.

A7.2.7.1.3. Hazardous Clear Areas Launch Commit Criteria:

A7.2.7.1.3.1. Blast Danger Area. Clearance prior to establishment of a major explosive hazard such as vehicle fuel/oxidizer load and pressurization. This is the area subject to fragment and direct overpressure resulting form the explosion of the booster/payload.

A7.2.7.1.3.2. Control Area Clear. Clearance of defined areas to protect personnel from hazardous operations

A7.2.7.1.3.3. Toxic Hazard Corridor/Zone. Clearance area of a sector in which toxic material may exceed predetermined concentration levels

A7.2.7.2. Hazardous Launch Areas:

A7.2.7.2.1. General Description. Hazardous Launch Areas are Safety Clearance Zones used during launch operations and include the flight caution area (FCA), flight hazard area (FHA), the vessel exclusion area (VEA)(ER) /boat exclusion area (BEA)(WR) and the Impact Limit Lines (ILLs).

A7.2.7.2.2. Applicability. All launch vehicles and, if necessary, associated payloads, shall be evaluated and hazardous launch areas determined.

A7.2.7.2.3. Hazardous Launch Area Launch Commit Criteria:

A7.2.7.2.3.1. FHA. Only Range Safety approved launch-essential personnel in approved blast-hardened structures with adequate breathing protection are permitted in this area during a launch. (See Volume 7 for the definition of *flight hazard area*.)

A7.2.7.2.3.2. FCA. Only Range Safety approved launch-essential personnel with adequate breathing protection are permitted in this area during launch. (See Volume 7 for a definition of *flight caution area*.)

A7.2.7.2.3.3. VEA/BEA. Ships and aircraft shall remain outside this area during launch. Ships/boats are protected to a P_i level of 1×10^{-5}. Aircraft are protected to a P_i level of 1×10^{-8}. (See Volume 7 for definitions of *vessel exclusion area* and *boat exclusion area*.)

A7.2.7.2.3.4. ILL. Range Safety approved launch-essential and neighboring operations personnel are permitted within ILLs during a launch. Non-essential personnel, with SW Commander approval, may be permitted in this area during a launch; however, the collective risk shall not exceed acceptable standards for the general public. (See Volume 7 for definitions of *impact limit line*, *launch-essential personnel*, and *neighboring operations personnel*.)

A7.2.8. Launch Area Air And Sea Surveillance:

A7.2.8.1. General Description. Areas to be cleared of boats and ships are defined by Flight Analysis and based on probability contours and/or Toxic Hazard Zones, including known impact areas of jettisoned stages/bodies and destruct debris resulting from malfunction scenarios plus the areas and altitudes in which Toxic Hazards will exist. Areas defined by Notice to Airmen (NOTAM) and Notice to Mariners (NTM) are surveyed on launch day for intruder aircraft and are analyzed as a potential for risk to the launch vehicle or the aircraft.

A7.2.8.2. Applicability. These criteria are applicable to all CCAFS/KSC pad launches and select offshore Navy launches and all 30 SW launch operations.

A7.2.8.3. Launch Area Air and Sea Surveillance Launch Commit Criteria:

A7.2.8.3.1. Boat and Ship Traffic:

A7.2.8.3.1.1. At the ER, if the sum total of the individual hit probabilities of all targets plotted within, or predicted to be within, the established probability contours exceed 10^{-5}, a launch hold or scrub may be initiated.

A7.2.8.3.1.2. At the WR, if an individual vessel is exposed to a probability of impact greater than 10^{-5}, the vessel shall be moved or a launch hold or scrub may be initiated.

A7.2.8.3.2. Aircraft. For an aircraft posing a threat to itself or the launch vehicle by its expected position being within predetermined hazard corridors, launch hold or scrub may result until the aircraft clears the hazard corridor.

A7.2.8.4. Offices of Primary Responsibility. At the ER, 45 SW/SEO is the OPR for launch area air and sea surveillance. At the WR, the ACO is the OPR for launch area air and sea surveillance; however, 30 SW/SEY performs the analysis for the hazard areas and the boat exclusion area (BEA).

A7.2.9. Jettisoned Bodies Impacting Land in Launch Area:

A7.2.9.1. General Description. Jettisoned components shall be prohibited from impacting on a landmass. For certain launch vehicles, the possibility exists for jettisoned bodies such as nozzle closures to impact in the launch area near occupied facilities or resources requiring protection. This is allowed in these cases when the risks associated are mitigated or minimized. Hit probability contours are created and used in conjunction with launch day impact prediction runs to determine possible threat near the predicted impact location.

A7.2.9.2. Applicability. All vehicles jettisoning components in the launch area with the potential to impact land.

A7.2.9.3. Jettisoned Bodies Launch Commit Criteria. Launch day impact prediction runs are made and the associated probability contours or impact dispersions are overlaid with the launch areas. A launch hazard may result in a launch hold or scrub condition.

A7.2.9.4. Offices of Primary Responsibility. 30 SW/SEY and 45 SW/SEO are the OPRs for jettisoned bodies impacting land.