FINAL
ENVIRONMENTAL IMPACT STATEMENT
FOR THE
PROGRAM DEFINITION AND RISK REDUCTION
PHASE OF THE AIRBORNE LASER PROGRAM

VOLUME 1

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PROGRAM DEFINITION AND RISK REDUCTION PHASE OF THE AIRBORNE LASER PROGRAM

FINAL ENVIRONMENTAL IMPACT STATEMENT

Lead Agency:	U.S. Air Force
Purpose and Need:	To conduct Airborne Laser Program Definition and Risk Reduction Phase activities at the following locations: Home Base—Edwards Air Force Base, Kern County; Diagnostic Test Range—White Sands Missile Range, Dona Anna, Socorro, Otero, Sierra, and Lincoln Counties; and Expanded-Area Test Range—Western Range (Vandenberg Air Force Base, Santa Barbara County and Point Mugu Naval Air Warfare Center Weapons Division, Ventura County)
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Designation:	Final Environmental Impact Statement

Abstract:
Pursuant to the National Environmental Policy Act of 1969 (42 USC §4321 *et. seq.),* DoD Directive 6050.1, and U.S. Air Force (USAF) Instruction 32-7061, this Final Environmental Impact Statement (FEIS) analyzes the potential environmental effects associated with conducting Program Definition and Risk Reduction (PDRR) Airborne Laser (ABL) Phase activities at the following proposed locations: Home Base—Edwards Air Force Base; Diagnostic Test Range—White Sands Missile Range; and Expanded-Area Test Range—Western Range (Vandenberg Air Force Base, and Point Mugu Naval Air Warfare Center Weapons Division). The PDRR ABL Phase seeks to develop an airborne laser system to protect the United States and its allies against hostile theater-ballistic missile attacks. The PDRR ABL Phase would demonstrate that the USAF can integrate a laser device, a beam control system, and a target acquisition and tracking system in a militarily useful aircraft and use the laser energy to acquire and destroy theater-ballistic missile targets during boost phase under operational conditions. These activities are described as the proposed and preferred action in the Final EIS. Several other alternatives (test site locations) are proposed for conducting the PDRR ABL Phase activities and described as the alternatives in this Final EIS.

Potential environmental impacts from the PDRR ABL Phase activities for the Proposed Action and the Alternatives are discussed to provide the USAF decision-makers with information on potential environmental impacts related to the PDRR Phase of the ABL Program. This Final EIS serves as the foundation from which future, more detailed, site-specific environmental documentation could be prepared.

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EXECUTIVE SUMMARY

This is a summary of the Final Environmental Impact Statement (FEIS) for the Program Definition and Risk Reduction (PDRR) Phase of the Airborne Laser (ABL) Program. A complete copy of the Final Environmental Impact Statement (FEIS) can be viewed at the libraries listed at the end of the Executive Summary. This FEIS examines the potential for impacts to the environment as a result of conducting U.S. Air Force (USAF) PDRR Phase activities at various proposed military locations.

PROGRAM OVERVIEW

The Airborne Laser Acquisition Program has completed the Concept Design Phase, with two competing contractors developing a proposed system design. The next acquisition phase is the PDRR, for which this document was prepared. The selected contractor will proceed with verifying preliminary design and engineering and building a prototype ABL aircraft that can be tested. If the demonstration tests of the prototype are successful, two phases will follow. Engineering, Manufacturing and Development (EMD) will include building a second full-scale ABL aircraft and operational performance tests. Production will involve procuring an additional five aircraft. The ABL acquisition program is depicted in Figure ES-1.

The PDRR ABL Program will comply with National Aerospace Standard 411 or a comparable program. This Hazardous Material Management Program will ensure environmental compliance and seek to minimize the use of all hazardous materials. The USAF will also develop a pollution prevention program to ensure that the environment is protected to the greatest extent feasible. The PDRR ABL contractor will be required to implement a comprehensive system safety program, using MIL-STD-882-C as guidance. The program will identify hazards and impose design requirements, operating procedures, and management controls to prevent mishaps.

NEED FOR AND PURPOSE OF ACTION

The United States needs a more accurate and effective defense against mobile theater ballistic missiles (TBMs) by destroying them during boost phase, just after launch. The debris would then fall back on the aggressor. The U.S. and its allies have a limited capability to defend against hostile TBM attacks. Current capabilities are limited to defense of troops or high-value assets within a small area of a theater of operations as the missile nears its target. Improvements in missile range and accuracy, the rapid increase in the number of missile-capable nations, and the absence of arms limitation treaties increase the threat. TBM launchers are difficult to detect because the launchers and support equipment are highly mobile.

The purpose of the PDRR ABL Phase is to demonstrate under operational conditions that the USAF can use a high-energy chemical oxygen iodine laser (COIL) onboard an aircraft to acquire and destroy TBM targets during boost phase (while the rocket motor is still burning).

PDRR ABL DESCRIPTION

The PDRR ABL is a modified B747 aircraft that would accommodate a laser-weapon device and laser-fuel storage tanks. The aircraft would also incorporate a low-powered acquisition, tracking and pointing laser, a laser-beam control system designed to focus the beam on target, and a beam director (telescope) enclosed in a turret at the front of the aircraft. A Battle Management Command Center provides computerized control of all aspects of the laser-weapon system, communications, and intelligence systems onboard the aircraft (Figure ES-2).

The PDRR ABL would fly at high altitude, and would detect and track launches of TBMs using onboard sensors. Active tracking of the missile would begin when the TBM breaks clear of the clouds at approximately 40,000 feet above mean sea level (AMSL). The high-energy laser (HEL) would then be directed horizontally or in an upward position toward the missile. The energy from the laser would heat the missile's booster components and cause a stress fracture, which would destroy the missile. The geometry of the tests would preclude operation of the laser except at a horizontal or upward angle.

The COIL operates by creating chemical reactions between chlorine gas and a mixture of hydrogen peroxide and alkali metal hydroxides. Iodine is added to the mixture, and the chemicals are pulled through a mixing nozzle at high velocities. The reaction of the chemicals creates light energy, which is then focused by mirrors and lenses into a laser beam.

The USAF has more than 25 years experience in working with chemical lasers. Fundamental work on chemical lasers began in 1960. The COIL was invented in 1977 at the Air Force Weapons Laboratory, which has since become a part of the USAF Phillips Laboratory, and has been under continuous development since then. A dedicated COIL facility was constructed at Kirtland AFB in 1979, giving the USAF 17 years of experience in routine storage and handling of laser chemicals and operation of the COIL. The USAF has also had experience with lasers integrated aboard aircraft. The Airborne Laser Laboratory aircraft was tested in the early 1980s, using a laser to successfully destroy five air-to-air missiles.

IMPLEMENTING REGULATIONS

The USAF is committed to conducting the PDRR ABL Phase activities in compliance with all applicable environmental laws, regulations, executive orders, DoD and USAF instructions, permits, and consultation and compliance agreements with regulatory agencies.

The Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR §§ 1500-1508), DoD Instruction 4715.9, *Environmental Planning and Analysis*, DoD Regulation 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs*, and Air Force Instruction (AFI) 32-7061, *The Environmental Impact Analysis Process*, direct USAF officials to consider environmental consequences when authorizing or approving federal actions. This FElS evaluates the environmental consequences and impacts of specific PDRR ABL Phase activities and informs the public of the important issues and any reasonable alternatives that would avoid or minimize adverse impacts of the PDRR ABL Phase activities.

DECISION TO BE MADE

The decision to be made by the USAF is to determine where the activities will occur. The PDRR ABL Phase requires a Home Base, a Diagnostic Test Range, and an Expanded-Area Test Range. The decision possibilities include selecting the proposed action, selecting one of the alternatives, or selecting the no-action alternative. The Assistant Secretary of the Air Force for Acquisitions will be the decision-maker.

PUBLIC PARTICIPATION

Public scoping meetings were held in New Mexico and California in April and May 1995. The scoping process identified seven significant issues, which are described in detail in Table 1-1 and addressed in Chapters 1 and 3. Those issues are 1) laser-eye safety and potential beam impacts, 2) aircraft safety, 3) impacts on air quality and upper atmosphere, 4) impacts to marine mammals and endangered species,
5) storage and handling of laser fuel, 6) impacts on surrounding communities, and 7) impacts on recreation and commercial fishing.

The DEIS was issued in October 1996. Copies were made available for review in local libraries and provided to those requesting them. At public hearings held in early-to-mid December 1996, the Air Force presented the findings of the DEIS and invited public comments through January 10, 1997. All comments were reviewed and addressed and have been included in their entirety in Volume II of this document.

The text of this FEIS has been revised, when appropriate, to reflect responses to public comments. These changes range from typographical corrections to additional analyses. Notable changes to the FEIS include modification of the document to address questions about the impacts of PDRR ABL activities on the upper atmosphere, the addition of clarifying language regarding potential impacts of missile debris on marine mammals, revised language to show the status of lands surrounding White Sands Missile Range, and a description of future environmental documentation to be prepared for the Airborne Laser Program.

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

A Home Base, Diagnostic Test Range, and Expanded-Area Test Range are required to effectively demonstrate the ability of the PDRR ABL to destroy a TBM in boost phase. This FEIS considers the following locational alternatives for PDRR ABL activities:

Home Base (1999-2002)	Edwards Air Force Base (Proposed Action) Kirtland Air Force Base (Alternative 1)
Diagnostic Test Range (2001-2002)	White Sands Missile Range (Proposed Action) China Lake Naval Air Warfare Center (Alternative 1)
	Western Range, including Vandenberg AFB and/or Point Mugu Naval Air Warfare Center Weapons Division and their operational areas (Alternative 2)
Expanded-Area Test Range (2001-2002)	Western Range, including Vandenberg AEB and/or Point Mugu and their operational areas (Proposed Action)
No-action Alternative	PDRR ABL activities would not be conducted at any location

The proposed action is the USAF preferred alternative: selection of Edwards AFB as Home Base, White Sands Missile Range as Diagnostic Test Range, and the Western Range as Expanded-Area Test Range.

Home Base. The Home Base is the location where the laser-weapon system will be integrated into the aircraft and where ground tests and initial aircraft flight tests will occur. The Home Base will also house the B747 aircraft, its flightline maintenance, ground test facilities, fuel storage and transfer, ground pressure recovery system for the laser, and technical and support personnel.

Diagnostic Test Range. The Diagnostic Test Range is the location for initial airborne equipment checks of the laser-weapon system after it has been integrated into the aircraft, including acquisition, tracking and pointing of missile and drone targets. These checks may include flights to determine airworthiness of the B747 aircraft and to test the air-refueling modifications to the plane. Although up to 20 flights of the PDRR ABL aircraft may occur, a maximum of six missiles and four drones would be launched and recovered at the Diagnostic Test Range.

Expanded-Area Test Range. The Expanded-Area Test Range is the location where the PDRR ABL laser-weapon system would track and destroy either a single TBM or multiple TBMs during boost phase. Up to ten flights of the PDRR ABL aircraft may occur, and up to ten missiles may be launched at the Expanded-Area Test Range. However, the high-energy laser would only be used against a maximum of six missiles.

ADDITIONAL ENVIRONMENTAL DOCUMENTATION

The Missile Defense Act of 1991 mandated the development of a theater missile defense (TMD) program to defend United States personnel and assets against the threat of theater ballistic missiles. Various elements of the TMD program were delegated to the Army, Air Force, Navy, and Marine Corps. The Ballistic Missile Defense Organization (BMDO) was designated as the management office, and it prepared the Final Theater Missile Defense Programmatic Life-Cycle Environmental Impact Statement (U.S. Army, 1993). TMD integrated three components: (1) Active Defense, to destroy enemy missiles in flight; (2) Counterforce, to destroy an enemy's ability to launch missiles; and (3) Passive Defense, to evade detection and enhance survival from missile attack. The TMD Programmatic Life-Cycle EIS addressed, in broadest terms, the potential environmental impacts of the proposed research, development, and testing of the various TMD components. While calling for a mix of Active Defense, Counterforce, and Passive Defense, it did not focus on system-specific or site-specific activities, and was intended to be a first-tier document from which future environmental documentation could be prepared.

The USAF concluded that a deficiency in Active Defense, that is, destroying missiles during their boost phase, should be addressed. It made the decision to build on its long experience with high-energy lasers and fund the early ABL concept-design phase. The USAF prepared this FEIS to study the potential impacts of PDRR ABL activities on alternative locations where the weapons system might be tested and to assist the decision makers in the site selection process. This FEIS will be supplemented by additional environmental documentation. The USAF expects to prepare an Environmental Assessment to cover the Engineering, Manufacturing, and Development Phase of the Airborne Laser Program, and a full Programmatic EIS to cover production, deployment, maintenance and training for the system.

ENVIRONMENTAL IMPACTS ASSESSMENT

Routine PDRR ABL operations would impact environmental resources at Home Base and the Test Ranges, but the impacts are of short duration. The assessment of potential impacts is based on the requirements in 40 CFR § 1508.27. Those guidelines established by the CEQ specify that significance should be determined in relationship to both context and intensity (severity).

An interdisciplinary team analyzed the affected environment and the impact from the PDRR ABL Phase activities at each location. This analysis was performed very early in the development of the ABL so that environmental considerations could be incorporated into the design.

SUMMARY OF ENVIRONMENTAL IMPACTS

The consequences for each environmental attribute at the proposed and alternative locations have been assessed. The environmental impact analyses were based on the two competing contractor designs. Where the contractor designs differed, the USAF provided a set of assumptions to encompass both designs and ensure an appropriate analysis of potential environmental impacts. Table ES-1 summarizes the environmental impacts of routine PDRR ABL activities at Home Base. Because activities at the Test Ranges differ from those at Home Base, Table ES-2 summarizes the environmental impacts of routine PDRR ABL activities at the ranges.

Potential impacts to upper atmosphere and those resulting from accidents are not site-specific. Therefore, they are discussed separately from the environmental attributes listed in the impact tables.

Impacts to Upper Atmosphere (Normal Operations). Routine operation of the high-energy laser (HEL) at 12 km altitude will release chlorine and ammonia in the upper reaches of the troposphere and in the lower stratosphere. However, at normal aircraft cruising speed, the concentrations of the chemicals in the mixing volume of the atmosphere would be low and would not pose any toxicity hazards. The concentration levels would rapidly disperse in the high winds. In the troposphere, chlorine emissions would be quickly converted to water soluble forms, and most would be removed from the atmosphere through precipitation without ever reaching the stratosphere. If the ABL aircraft is flying in the stratosphere when the HEL is fired, the local concentration of chlorine would increase approximately 35 percent for a short period of time (less than 24 hours). The naturally occurring winds would continue to mix the chlorine from the HEL firing within the stratosphere. The long term increase of chlorine in the stratosphere from all PDRR ABL HEL firings would be less than 3×10^{-7} percent over normal background levels of chlorine. Flights by the Black Brant and Orion target missiles would emit chlorine into the stratosphere. However, emission levels would rapidly decrease to the background level, as stratospheric winds disperse the chlorine.

Impacts to Upper Atmosphere (Emergency Operations). The PDRR ABL aircraft has Halon 1301, a Class I ozone-depleting substance, on board as a fire suppressant. The Halon 1301 could be released in the event of a fire onboard the aircraft. The probability of a fire is extremely low and in the unlikely event of a release, a very small amount of Halon would reach the atmosphere. An emergency operation could involve the dumping of aircraft fuel and laser chemicals into the atmosphere. However, concentration levels would be well below toxic exposure limits in the mixing volume of the atmosphere and would have no measurable long-term impacts on the environment.

Accidents. Accidents involving spills of fuels, fires, explosions, or other events may have harmful environmental impacts to natural resources. The possibility of such occurrences would be remote, and strict compliance with federal and state regulations for safety, transportation, and hazardous material handling would minimize adverse impacts to every degree feasible.

CUMULATIVE IMPACTS

Cumulative impacts result from the incremental impact of a PDRR ABL Phase alternative when combined with the impacts of *other* past, present, and reasonably foreseeable future actions at a location. Those activities and resource attributes associated with implementing PDRR ABL Phase activities which may contribute to cumulative impacts are summarized in the Cumulative Impact section of each location. However, no specific information regarding activities of other programs which may be scheduled at the locations in the years 1999-2002 is currently available for analysis. A more detailed analysis will be done as the information becomes available and as PDRR ABL system test details are defined.

Generally, the contribution to cumulative impacts from PDRR ABL activities at each specific site is minor. Two items, however, deserve further mention. First, missile launches at all the ranges are likely to result in startle responses in local wildlife. It is especially true, however, at Vandenberg AFB which has the fewest launches per year of any of the proposed ranges under current operations. Second, PDRR ABL Phase activities at the Home Base would add several million dollars in wages and procurement spending to the local economy, providing a beneficial effect.

CONCLUSION

The purpose of this FEIS is two-fold: 1) to determine the environmental impacts of PDRR ABL Phase activities, and 2) to utilize this information to incorporate environmental considerations early in the design process. The USAF will review the design and analyze any hazards associated with the PDRR ABL Phase. Once safety and environmental hazards are identified, design modifications, safety features, and operational procedures will be defined to reduce the risks to workers the public, and the environment.

REPOSITORIES

The full Environmental Impact Statement will be available for review for at least 30 days from the Notice of Availability published in the *Federal Register* at the following libraries:

Government Documents Section
Zimmerman Library
University of New Mexico
Albuquerque, New Mexico

Reference Section
Albuquerque Public Library
501 Copper N.W.
Albuquerque, New Mexico

Reference Section
Branigan Memorial Library
202 East Picacho Avenue
Las Cruces, New Mexico

Base Library
Building 2665
Edwards Air Force Base, California

Base Library
Building 22204
Kirtland AFB, New Mexico

Socorro Public Library
401 Park Street
Socorro, New Mexico

Reference Section
E.P. Foster Library
651 E. Main Street
Ventura, California

Government Documents Section
University Library
New Mexico State University
Las Cruces, New Mexico

Roy A. Knapp Library
Antelope Valley College
3041 W. Avenue K
Lancaster, California

Lompoc Public Library
501 E. North Avenue
Lompoc, California

Alamogordo Public Library
920 Oregon Avenue
Alamogordo, New Mexico

Truth or Consequences Public Library
325 Library Lane
Truth or Consequences, New Mexico

CHAPTER 1

INTRODUCTION

This Final Environmental Impact Statement (FElS) examines the potential for impacts to the environment as a result of conducting U.S. Air Force (USAF) Program Definition and Risk Reduction (PDRR) Phase activities of the Airborne Laser (ABL) Program at various proposed military locations.

1.0 PROGRAM OVERVIEW

The Airborne Laser Acquisition Program has completed the Concept Design Phase, with two competing contractors each developing a proposed system design. The next acquisition phase is the PDRR, for which this document was prepared. The selected contractor will proceed with verifying preliminary design and engineering and building a prototype ABL aircraft that can be tested. If the demonstration tests of the prototype are successful, two phases will follow. Engineering, Manufacturing and Development (EMD) will include building a second full-scale ABL aircraft and operational performance tests. Production will involve procuring an additional five aircraft. The ABL acquisition program is depicted in Figure 1-1.

The PDRR ABL Program will comply with National Aerospace Standard 411 or a comparable program. This Hazardous Material Management Program will ensure environmental compliance and seek to minimize the use of all hazardous materials. The USAF will also develop a pollution prevention program to ensure that the environment is protected to the greatest extent feasible. The PDRR ABL contractor will be required to implement a comprehensive system safety program, using MIL-STD-882-C as guidance. This program will identify hazards and impose design requirements, operating procedures, and management controls to prevent mishaps.

Figure 1-1

1.1 NEED FOR ACTION

The United States needs a more accurate and effective defense against mobile theater ballistic missiles (TBMs) by destroying them during initial boost phase, just after launch. The debris would then fall back on the aggressor. The U.S. and its allies have a limited capability to effectively defend against hostile TBM attacks. Current capabilities are limited to defense of troops or high-value assets within a small area of a theater of operations as the missile nears its target. Improvements in missile range and accuracy, the rapid increase in the number of missile-capable nations, and the absence of arms limitation treaties increase the threat. TBM launchers are difficult to detect because the launchers and support equipment are highly mobile.

1.2 PURPOSE OF ACTION

The purpose of the PDRR ABL Phase is to demonstrate under operational conditions that the USAF can use a high-energy chemical oxygen iodine laser (COIL) onboard an aircraft to acquire and destroy TBM targets during boost phase (while the rocket motor is still burning). The PDRR ABL is being designed to engage and destroy TBMs at long ranges, while staying within friendly airspace.

1.3 IMPLEMENTING REGULATIONS

This document has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 USC **§** 4321), the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR **§§** *1500-1508),* U.S. Department of Defense (DoD) Instruction *4715.9, Environmental Planning and Analysis,* DoD Regulation 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs,* and Air Force Instruction (AFI) 32-7061, *The Environmental Impact Analysis Process.* Implementation of the PDRR ABL Phase represents a major federal action subject to the requirements of NEPA. Appendix A contains a glossary of terms used in this document.

1.4 PDRR ABL DESCRIPTION

The PDRR ABL aircraft is a modified B747 aircraft that would accommodate a laser-weapon device and laser-fuel storage tanks. **The aircraft would also incorporate a low-powered acquisition, tracking, and pointing laser; a laser-beam control system designed to focus the beam on target; and a beam director (telescope) enclosed in a turret at the front of the aircraft.** A Battle Management Command Center provides computerized control of all aspects of the laser-weapon system, communications, and intelligence systems onboard the aircraft (Figure 1-2).

The PDRR ABL would fly at high altitude, and would detect and track launches of TBMs using onboard sensors. Active tracking of the missile would begin when the TBM breaks clear of the clouds at approximately 40,000 feet above mean sea level (AMSL). The high-energy laser (HEL) would then be directed horizontally or in an upward position toward the missile. The energy from the laser would heat the missile's booster components and cause a stress fracture, which would destroy the missile. The geometry of the tests would preclude operation of the laser except at a horizontal or upward angle. The onboard sensors would also be used to confirm that no other aircraft or satellites were within the potential path of the beam, although airspace would be cleared for PDRR ABL tests. Figure 1-3 shows the engagement scenario.

The USAF has more than 25 years experience in working with chemical lasers. Fundamental work on chemical lasers began in 1960. The COIL was invented in 1977 at the Air Force Weapons Laboratory, now a part of the USAF Phillips Laboratory, and has been under continuous development since then. A dedicated COIL facility was constructed at Kirtland AFB in 1979, giving the USAF 17 years of experience in routine storage and handling of laser chemicals and operation of the COIL. The USAF has also had experience with lasers integrated aboard aircraft. The Airborne Laser Laboratory aircraft was tested in the early 1980s, using a laser to successfully destroy five air-to-air missiles.

Figure 1-2

Figure 1-3

A COIL laser has four major parts: 1) an oxygen generator, 2) a gain generator (or resonator), 3) a pressure recovery system (PRS), and 4) fuel-storage tanks that hold all of the chemicals needed to operate the laser. In addition, there is an ammonia refrigeration unit that cools the chemicals (Figure 1-4).

Figure 1-4

In the oxygen generator, chlorine and basic hydrogen peroxide (BHP) react to create an "excited" oxygen molecule called singlet delta oxygen ($O_2[^1\Delta]$). The excited oxygen is then mixed with iodine gas (I_2) and pulled through a mixing nozzle that speeds the mixture through the gain generator. The gain generator uses mirrors and lenses to focus the light energy created by the mixture of the iodine gas (I_2) and singlet delta oxygen ($O_2[^1\Delta]$) into a laser beam. The excited oxygen and iodine are mixed at very low pressures, maintained at a constant level by an onboard PRS. A separate PRS is used during ground tests to simulate atmospheric conditions at altitude. Much like a jet engine pulls air into the engine and accelerates it out the back, the ground PRS pulls gases out of the laser and pushes them out the exhaust. The ground PRS also generates noise and a steam cloud similar to an aircraft engine.

After the BHP and chlorine react, a solution of salt water and dilute hydrogen peroxide is formed. The solution remains onboard the aircraft in a tank until it is offloaded on the ground for reuse, recycling, or proper disposal. At altitude, the gases produced by the laser, as well as the ammonia used in the refrigeration unit, are exhausted into the air. The gases must be exhausted to create the lasing action, and the ammonia is not captured due to weight constraints. During ground tests, however, the cooling device is a closed-loop system, no ammonia is released, and the gases produced by the laser are captured in a special air pollution scrubber. The management and estimated quantities of liquid effluents and gaseous emissions from the laser operation are discussed in Chapter 2.

PDRR ABL Phase activities would be performed at the following types of facilities:

> **Home Base:** the location where the weapon system would be integrated with the aircraft and where system integration and ground tests as well as initial aircraft flight tests would occur. The PDRR ABL aircraft would be housed at Home Base and test flights would originate from this location.

Diagnostic Test Range: the location for initial short-range PDRR ABL equipment tests with low- and high-power laser operations.

Expanded-Area Test Range: the location for long-range PDRR ABL equipment checks with low- and high-power laser operations.

The candidate locations for these activities, details of the activities to be conducted at each location, and summaries of potential impacts are described in Chapter 2. Figure 1-5 shows the locations of the candidate sites.

Figure 1-5

1.5 DECISION TO BE MADE

The decision to be made by the USAF is to determine where the PDRR ABL Phase activities will occur. The PDRR ABL Phase requires a Home Base, Diagnostic Test Range, and an Expanded-Area Test Range. The decision possibilities include selecting the proposed action, selecting one of the alternatives, or selecting the no-action alternative. The Assistant Secretary of the Air Force for Acquisitions will be the decision-maker.

1.6 PUBLIC PARTICIPATION

Regulations implementing the NEPA (40 CER § 1501.7) require early participation by the public and interested parties in determining the scope and content of the EIS, providing comments regarding the proposed action and alternatives, and identifying significant issues related to the proposed action. The process is called scoping. The USAF initiated the scoping process on 20 March 1995 by publication in the *Federal Register* (60 FR 14737) (Appendix B) of a Notice of Intent (NOI) to prepare an EIS. Copies of the NOI were sent to federal, state, and local agencies and other parties known or expected to be interested in the proposed action. Concerned parties were encouraged to participate in public scoping meetings conducted during April and May of 1995 in Albuquerque and Las Cruces, New Mexico, and in Lancaster and Lompoc, California. Public hearings on the Draft EIS were held in those communities in December 1996.

Comments and questions received as a result of scoping were used to assist the USAF in identifying potential environmental impacts to the quality of the human and natural environment. Table 1-1 outlines the significant issues raised, and those issues are analyzed in detail in this FEIS.

Table 1-1. Issues Raised During PDRR ABL Phase Scoping

Issue	Issue Description	Determination and Where Addressed
Laser eye safety and potential beam impacts	Includes comments about potential risk to humans or wildlife from a misfired laser, safety precautions to be taken to ensure positive control of the laser beam during firings, and the need to ensure that pilots or individuals on the ground would not directly or indirectly receive eye damage from the beam	Considered significant Issue addressed in Health and Safety, Biological Resources, and Airspace sections for each candidate location
Aircraft safety	Public concern for aircraft safety centers around the potential impacts of an aircraft accident when the PDRR ABL is in operation	Considered significant Issue addressed in Appendix C and in Air Quality, Hazardous Materials/Hazardous Waste, and Health and Safety sections for each candidate location
Air quality and upper atmosphere	Involves potential impacts of PDRR ABL Phase activities on air quality in the areas of the candidate locations; involves potential impact to the upper atmosphere of the release of effluents from operation of the chemical oxygen iodine laser at altitude or operation of aircraft in the troposphere	Considered significant Issue addressed in Air Quality section for each candidate location and in the Upper Atmosphere section
Possible impacts on marine mammals and endangered species	Concerns center around the effect PDRR ABL Phase activities would have on seals, sea birds, and mammals; includes potential impacts to threatened and endangered wildlife and plant species or habitats in the area of PDRR ABL Phase activities	Considered significant Issue addressed in Biological Resources and Noise sections for each candidate location
Storage and handling of laser fuel	Centers around potential hazards related to the storage and handling of laser fuels; includes transportation of hazardous materials to candidate locations, and includes potential releases of chemicals during storage of fueling operations	Considered significant Issue addressed in Appendix C and in Health and Safety, Hazardous Materials/Hazardous Waste, Biological Resources, and Geology, Soils, and Water Resources sections for each candidate location
Impacts on surrounding communities	Involves potential jobs and expenditures associated with PDRR ABL Phase that may have a positive economic impact on communities surrounding the candidate locations	Considered significant Issue addressed in Air Quality, Land Use, Noise, Hazardous Materials/ Hazardous Waste, Recreation and Visual Resources, Infrastructure/Transportation, Socioeconomic, and Environmental Justice sections for each candidate location
Potential impacts on recreation	Involves potential impact of PDRR ABL Phase activities on recreational uses of public lands and beaches as well as possible impacts on visual resources and on recreational boating and fishing activities oft the California coast	Considered significant Issue addressed in Recreation and Visual Resources and Land Use sections for each candidate location

The DEIS was issued in October 1996. Copies of the DEIS were made available for review in local libraries and provided to those requesting copies. At public hearings held in early-to-mid December 1996, the Air Force presented the findings of the DEIS and invited public comments through January 10, 1997. All comments were reviewed and addressed and have been included in their entirety in Volume II of this document.

The text of this FEIS has been revised, when appropriate, to reflect responses to public comments. These changes range from typographical corrections to additional analysis. Notable changes to the FEIS include modification of the Upper Atmosphere section to address questions about the impacts of PDRR ABL activities on the upper atmosphere; the addition of clarifying language regarding potential impacts of missile debris on marine mammals; revised language to show the status of lands surrounding White Sands Missile Range; and, a description of future environmental documentation to be prepared for the Airborne Laser Program.

1.7 ADDITIONAL ENVIRONMENTAL DOCUMENTATION

The Missile Defense Act of 1991 mandated the development of a Theater Missile Defense (TMD) Program to defend United States personnel and assets against the threat of theater ballistic missiles. Various elements of the TMD program were delegated to the Army, Air Force, Navy, and Marine Corps. The Ballistic Missile Defense Organization (BMDO) was designated as the management office, and it prepared the Final Theater Missile Defense Programmatic Life-Cycle Environmental Impact Statement (U.S. Army, 1993). TMD integrated three components: (1) Active Defense, to destroy enemy missiles in flight; (2) Counterforce, to destroy an enemy's ability to launch missiles; and (3) Passive Defense, to evade detection and enhance survival from missile attack. The TMD Programmatic Life-Cycle EIS addressed, in broadest terms, the potential environmental impacts of the proposed research, development, and testing of the various TMD components. While calling for a mix of Active Defense, Counterforce, and Passive Defense, it did not focus on system-specific or site-specific activities, and was intended to be a first-tier document from which future environmental documentation could be prepared.

The USAF concluded that a deficiency in Active Defense, that is, destroying missiles during their boost phase, should be addressed. It made the decision to build on its long experience with high-energy lasers and fund the early ABL concept-design phases. The USAF prepared this FEIS to study the potential impacts of PDRR ABL activities on alternative locations where the weapons system might be tested and to assist the decision makers in the site selection process. This FEIS will be supplemented by additional environmental documentation. The USAF expects to prepare an Environmental Assessment to cover the Engineering, Manufacturing, and Development Phase of the Airborne Laser Program, and a full Programmatic EIS to cover production, deployment, maintenance and training for the system.

1.8 ENVIRONMENTAL PERMITS, LICENSES, AND ENTITLEMENTS

The Airborne Laser System Program Office and the regulatory compliance organization at each host base would work together to apply for or seek to modify various air, hazardous waste, water, and wastewater permits or licenses in accordance with federal, state, or local regulatory requirements. Table 1-2 provides a summary of the required permits, licenses, and entitlements.

Table 1-2. Environmental Permits, Licenses, and Entitlements

Attribute	Permit, License, or Entitlement	Activity, Facility, or Category of Persons Required to Obtain the Permit, License, or Entitlement	Regulations	Regulatory Agencies
Air Quality	Title V Operating Permit	PRS and Aerospace Ground Equipment must be included in Base Title V Operating Permit (Kirtiand AFB)	Clean Air Act (42 USC § 7401)	Albuquerque Environmental Health Department; Kern County APCD, Santa Barbara County APCD
	Authority-to-Construct Permit	Required for ground PRS (Kirtland AFB)	20 NMAC 11.41	Albuquerque Environmental Health Department
	Surface Disturbance Permit	Required for surface disturbing activities involving an area of 3/4 of an acre or more (Kirtiand AFB)	20 NMAC 11.20	Albuquerque Environmental Health Department
Water Resources	NPDES Permit	Required if floor drain in Hangar 760 would not be connected to a collection system (Kirtland AFB)	Section 402 of Clean Water Act (33 USC § 1251)	EPA; New Mexico Environment Department
	Groundwater Discharge Permit (Kirtland AFB); Regional Water Quality Control Board Order (Edwards AFB)	Required if evaporation pond method would be used for disposal of spent-laser fuel	Clean Water Act; 20 NMAC 6.2; Porter-Cologne Act of 1969	New Mexico Environment Department; LahontanRegional Water Quality Control Board, California
Hazardous Materials/Waste	Hazardous material storage authorization and notification	Coordination with Base Environmental Departments for authorization and notification of hazardous material storage	Resource Conservation and Recovery Act, as amended (42 USC §6901); Califomia Hazardous Waste Control Law (Califomia Health and Safety Code § 25100)	EPA; New Mexico Environment Department; California EPA - Department of Toxic Substances Control
Land Use	Coastal Consistency Determination	Required for missile launch activities at Vandenberg AFB and Point Mugu	Coastal Zone Management Act of 1972 (16 USC § 1271)	California Coastal Commission
Biological Resources	Coordination with wildlife agencies	Required for missile launch activities at White Sands Missile Range, Vandenberg AFB, and Point Mugu	Endangered Species Act (16 USC § 1531); Migratory Bird Treaty Act (16 USC §§ 703-71 2); Bald and Golden Eagle Protection Act (16 USC §668); Marine Mammal Protection Act (16 USC §1361); Fish and Wildlife Coordination Act (16 USC § 661); Marine Protection Research and Sanctuaries Act (33 USC § 1401)	U.S. Fish and Wildlife Service; National Marine Fisheries Service; New Mexico Department of Game and Fish; Califonia Department of Fish and Game
	Biological Assessment	May be required if selected launch site has not been previously assessed (all ranges)		
Airspace	Coordination with Federal Aviation Administration	Required for airspace use at ranges; operation of PRS near runway areas	Federal Aviation Act (Public Law 85-726)	Federal Aviation Administration

APC DAir Pollution Control District — NMAC New Mexico Administrative Code

CAA Clean Air Act — NPDES National Pollutant Discharge Elimination System

CFR Code of Federal Regulations — USCU.S. Code

EPA U.S. Environmental Protection Agency

CHAPTER 2

ALTERNATIVES INCLUDING THE PROPOSED ACTION

CEQ requires that an EIS "rigorously explore and objectively evaluate all reasonable alternatives" (40 CFR § 1502.114 [a]). Reasonable alternatives include those that are practical or feasible from a technical and economic standpoint, using common sense, and not simply desirable from the standpoint of the applicant (51 FR 15618, April 25, 1986). Alternate methods to demonstrate the technologies required for an airborne high-energy laser (HEL) to destroy TBMs during boost phase were considered early in the ABL Program but were determined insufficient to satisfy the intent of the program and eliminated from detailed analysis (see Section 2.3).

This chapter describes alternatives for conducting the PDRR ABL Phase activities at each of the candidate locations, followed by a description of the proposed action, alternative actions, no-action alternative, and alternatives eliminated from further consideration. The chapter concludes by summarizing the environmental consequences of the considered alternative locations and lists the potential impacts.

2.0 SELECTION OF ALTERNATIVES

The proposed action consists of the selection of three sites: Home Base, Diagnostic Test Range, and Expanded-Area Test Range. The alternatives to the proposed action are other locations where the PDRR ABL Phase activities could occur. A screening process was developed to narrow the number of alternative locations for detailed analysis. This process was designed to identify a number of candidate locations that could meet a threshold of operational considerations necessary to conduct the program. The locational alternatives for the Home Base, the Diagnostic Test Range, and the Expanded-Area Test Range were based on the need for existing facilities and infrastructure to meet the selection criteria and cost considerations. Installations that did not meet any one of the selection criteria were eliminated from consideration.

The requirements for the Home Base, Diagnostic Test Range, and Expanded-Area Test Range facilities were as follows:

Home Base

- Runway with sufficient capacity to safely launch and recover a B747 aircraft
- Hangar large enough to accommodate a B747 without a modification requiring use of Military Construction (MILCON) funds
- Facility that could be modified for use as a System Integration Facility (SIF)
- Facility on a government installation

Diagnostic Test Range

- Minimum of 150 km (94 mi) separation between PDRR ABL aircraft and target launch point within range boundaries
- Capability to launch and recover test article/debris (missiles, drones, or balloons) within the confines of the range
- Positive control of airspace in the vicinity of the range
- Ability to give high priority to PDRR ABL test planning and scheduling

Expanded-Area Test Range

- Minimum of 300 km (187 mi) separation between PDRR ABL aircraft and target launch point within range boundaries
- Capability to launch multiple theater ballistic missiles (TBMs) from different locations within the confines of the range
- Positive control of the surface and airspace in the vicinity of the range
- Ability to give high priority to PDRR ABL test planning and scheduling
- Reasonable proximity to Home Base

Western Range was the only location which met the operational criteria for Expanded-Area Test Range.

2.1 PROPOSED ACTION AND ALTERNATIVES

Table 2-1 identifies the proposed action and alternatives for Home Base and the Diagnostic Test Range and the proposed action for the Expanded-Area Test Range. No alternative locations were identified for the Expanded-Area Test Range activities. Under the no-action alternative, PDRR ABL Phase activities would not be conducted at any location. Although PDRR ABL Phase activities would be essentially the same at all locations, the environmental impacts of the activities at each location would vary.

Table 2-1. Proposed Action and Alternatives

Sites	Proposed Action	Alternative 1	Alternative 2	No-action Alternative
Home Base	Edwards AFB	Kirtland AFB	None	None
Diagnostic Test Range	White Sands Missile Range	China Lake Naval Air Warfare Center(NAWC)	Western Range (including operational areas of Vandenberg AFB and Point Mugu	None
Expanded-Area Test Range	Western Range (including operational areas of Vandenberg AFB and Point Mugu Naval Air Warfare Center Weapons Division	None	None	None

The USAF's preferred alternative is the selection of Edwards AFB as Home Base, White Sands Missile Range as Diagnostic Test Range, and the Western Range as Expanded-Area Test Range.

2.1.1 Home Base Activities

The PDRR ABL aircraft would be housed at the Home Base. It is also the location where the laser device would be integrated into the aircraft, where ground tests would occur, and is the location for initial aircraft flight tests. Although all diagnostic and expanded-area flight testing of the PDRR ABL would occur over DoD ranges, flights would begin and end at the Home Base using existing runways.

Facility Modification/Equipment Installation. An existing hangar would be modified at either Edwards AFB or Kirtland AFB to house the B747 aircraft. Existing buildings would undergo minor modifications to make them suitable for laboratory and office space. Equipment would be installed for chemical storage, mixing, and transfer, as well as for waste storage. Laser-weapon system chemicals would be stored at the Home Base facility and are listed in Table 2-2. The chemicals that would be used for normal aircraft maintenance are discussed in Section 3.1.7. A pressure recovery system (PRS) would be installed within the fenced PDRR ABL complex, near the aircraft apron and hangar. The PRS would consist of an electric or natural gas-fired steam plant to power steam ejectors, a series of mechanical turbo-pumps, or a vacuum-bottle system. All construction/modification and equipment installation would occur on previously disturbed land. Table 2-3 compares the construction/modification activities at the candidate locations for Home Base.

Table 2-2. Chemical Storage Requirements at Home Base--Proposed Action

Chemical	Weight (lb)
Alkali metal hydroxides	15,000
Ammonia	5,000
Basic hydrogen peroxide/batch mix	10,000
Chlorine	2,000
Helium	600
Hydrochloric acid	8,000
Hydrogen peroxide	7,000
Iodine	150
Jet fuel for laser device	1,370
Nitrogen	2,500

Table 2-3. Comparison of Construction/Modification Activities

Item	Candidate Locations for the Home Base	
	Edwards AFB	**Kirtland AFB**
Location	Birk Flight Test Facility on South Base **(Figure 3.1-2)**	Hangar 760, near the southeast end of the east-west runway **(Figure 3.2-2)**
Labor costs	$4 million (12- to 15-month period	$6.7 million (12- to 15-month period)
Materials costs	30 million ($7.1 million procured locally	$33.3 million ($17 million procured locally)
USAF personnel onsite	5	35
PDRR ABL contractor personnel onsite	5	5

During the initial part of the PDRR ABL Phase, the contractor would complete detailed designs of the ground facilities using computer models and computer-aided design, conduct preliminary and critical design reviews, perform wind-tunnel tests, build mockups, and complete risk-reduction experiments. One of the primary risk-reduction experiments would be to build and test a HEL module at a contractor facility. After successful tests of the module, the B747 aircraft would be purchased and delivered to a contractor facility for modification. Modifications to the aircraft would include installation of the laser device, fuel-storage tanks, optical beam-control subsystem, laser-beam director and telescope mount (turret), and crew stations. PDRR ABL designs will comply with National Aerospace Standard 411 or a comparable program. This Hazardous Material Management Program will ensure environmental compliance and seek to minimize the use of all hazardous materials. The USAF will also develop a pollution prevention program to ensure that the environment is protected to the greatest extent possible. The PDRR ABL contractor will be required to implement a comprehensive system safety program, using MIL-STD 882-C as guidance.

System Integration/Ground Test. Although the contractor would build and test the various components that make up the onboard systems and obtain certification of the modified aircraft by the Federal Aviation Administration (FAA) prior to delivery to the USAF, additional tests would be performed at the Home Base. **These activities would involve linking and testing the laser components on the ground before they are integrated into the aircraft. The ground tests would be conducted to verify that all components could operate together safely in a simulated flight environment**. Initial aircraft flight tests would also be conducted. The system integration and ground-test activities would last approximately nine months.

The tests performed at the Home Base would include hot and cold flows of the laser-device system components. A cold-flow test would use inert gases to test the integrity of the laser-device plumbing, flow controllers, and diagnostics. A hot-flow test would use the actual laser fuels where chemical reactions take place and release heat into the system. The tests would also include the alignment of the optical benches and mirrors, movement and stability of the telescope-beam director, and controlled propagation of the beam into a device that measures the energy of the beam and other diagnostic equipment. The laser beam would be completely enclosed during any propagation on the ground to avoid potential hazards.

The laser-weapon system would be connected to a ground-based pressure recovery system (PRS) to test the laser on the ground. On the ground, the PRS would simulate the atmospheric pressure that occurs naturally when the laser device is operating in the aircraft at an altitude of approximately 40,000 feet. The PRS, which would operate for approximately five minutes per test, would draw the chemicals through the laser at high velocities to create the lasing action. The PRS would also capture and scrub the exhaust from the device. The cloud of steam that would result from operation of the PRS on the ground, typically, would dissipate within 91 m (300 ft) and would last about one minute after shutdown. The PRS would operate at a scrubbing efficiency of approximately 85 percent; therefore, the steam cloud would be mostly water and carbon dioxide. Small amounts of other chemicals would be discharged in the steam cloud. The constituents of the steam cloud are shown in Table 2-5. The system is expected to generate 120 decibels (dB) of noise at 30 m (100 ft).

When the modified aircraft arrives at the Home Base, the laser- and beam-control subsystems would be assembled onboard. **A series of ground tests would be performed with the integrated laser weapon onboard before the aircraft would be ready for flight testing.** The ground tests would include aircraft communication/navigation systems, tests of the integrated laser weapon (including controlled extraction of the laser beam into diagnostic equipment), and taxi tests to determine the ground maneuverability of the aircraft with the laser weapon onboard.

After ground or flight tests in which the laser is fired, the laser fuels would be removed from the aircraft and placed into above-ground storage at Home Base. The spent basic hydrogen peroxide, water, and alkali metal chloride would be neutralized and placed in a holding tank awaiting proper disposal. Three disposal options are being examined:

- Reduction of the volume of the wastewater in an evaporation pond
- Processing the wastewater to reduce the salt, and disposing of the wastewater in the sanitary sewer system
- Reuse, recycling, or collection and transportation of the wastewater to an approved commercial disposal site

The total amount of fluids to be disposed of by the Home Base are listed in Table 2-4. They include fluids generated during the nine-month period of ground test activities at Home Base as well as fluids off-loaded and disposed of during the nine-month period of flight tests at the Diagnostic and Expanded-Area Test Ranges. Total gaseous emissions and liquid effluents generated by the laser, onboard PRS, and ground PRS during the ground-test phase at Home Base are listed in Table 2-5. Gaseous emissions are vented to the atmosphere. Chlorine and iodine scrubbed from the emissions are captured in a liquid solution for disposal.

Table 2-4. Total Amount of Fluids to be Disposed of by Home Base-Proposed Action

Chemical	Weight (Ib)
Alkali metal chloride	23,700
Spent basic hydrogen peroxide (includes water and hydrogen peroxide)	297,500

Table 2-5. Laser-PRS Emissions/Effluents Generated During Nine-Month Ground Test Phase-Proposed Action

Chemicals	Gaseous Emissions to Atmosphere		Captured in Solution by Scrubber		Total Quantity (Ib)
	Quantity (Ib)	Percent Concentration	Quantity (lb)*	Percent Concentration	
Ammonia (recovered in closed-loop system)	N/A	N/A	N/A	N/A	N/A
Carbon dioxide	50,300	58.5	0	0	50,300
Chlorine	300	0.3	1,600	2	1,900
Helium/nitrogen	5,700	6.6	0	0	5,700
Hydrogen	1,300	1.5	0	0	1,300
Iodine	100	0.1	600	0.7	700
Oxygen	14,500	1730	0	0	14,500
Water	13,800	16	78,100	97.3	91,900
*Based on 85% scrubber efficiency					

Ammonia would be used onboard the PDRR ABL aircraft as a laser-device coolant. Nine-hundred and fifty pounds of ammonia would be removed from the laser-device cooling system on the aircraft after each ground test and recycled in a closed-loop system for reuse in subsequent tests. During flight tests, chlorine, iodine, and the inert gases shown above must be exhausted to create the lasing action. The ammonia is not captured because of weight constraints.

Routine maintenance of the aircraft would occur at the Home Base and would be performed by contractor and USAF personnel, using established on-site USAF equipment. Routine maintenance may include repair of aircraft engines and other equipment, tire changes, engine-oil changes, and washing the aircraft at an existing aircraft washrack.

Two-hundred persons would be associated with the Home Base activities. Table 2-6 compares the personnel requirements of each proposed location.

Table 2-6. Personnel Requirements

HOME BASE SYSTEM INTEGRATION/GROUND-TEST PERSONNEL REQUIREMENTS

Personnel	Edwards AFB	Kirtland AFB
USAF personnel already on base	15	35
New USAF personnel	30	10
PDRR ABL contractor personnel	62 would be locally hired 30 would relocate to Home Base 63 would reside in area hotels/motels 4 days per week	90 locally hired 30 would relocate to Home Base 35 would reside in area hotels/motels 4 days per week
Total personnel	200	200

The skill level/salary schedule in Table 2-7 is expected to apply to the contractor workforce.

Table 2-7. Salary Range of Contractor Work Force at Home Base-Proposed Action

Number of Jobs	Skill Level and or Title	Salary Range
16	Administrative/clerical support	<$40,000
100	Engineers/technicians	$40,000 - $60,000
31	Senior engineers	$60,000 - $80,000
8	Program managers	> $80,000

2.1.2 Diagnostic Test Range Activities

Test flights at the Diagnostic Test Range would be used to check out communications and navigation equipment and flight characteristics of the PDRR ABL. Hot- and cold-flow tests of the laser device would be performed at altitude. The air-refueling modification of the aircraft would also be tested during flights over the Diagnostic Test Range.

The PDRR ABL tests would include acquisition and tracking of missiles at short range (distances of less than or equal to 100 km [62 mi.]), as well as high-energy tests to measure laser-beam quality and power. Those tests would be conducted against instrumented diagnostic target boards carried by balloons or drones. A target board is a piece of material (Plexiglas, stainless steel, etc.) containing sensors that would be irradiated by the laser. Missiles would incorporate a flight-termination system, when required, to ensure that debris would be contained on the range in the event the target must be destroyed during flight.

Airborne diagnostic testing would revalidate and expand on-the-ground test activities, confirm computer model predictions, and enable complete system tests after all components have been integrated onboard the aircraft. **Diagnostic tests would measure the PDRR ABL' s ability to quickly acquire the next target,** ensure proper operation of onboard safety and firing control procedures, and assess overall system operation.

The flight test program at the Diagnostic Test Range would take up to five months, and would consist of up to 20 PDRR ABL flights. Approximately ten temporary test personnel are expected to rotate into the region of influence for one week (five days) for each of 16 test flights. Table 2-8 shows the total number of flights that could occur at the location of the proposed action or alternatives.

Table 2-8. PDRR ABL Flights at Diagnostic Test Range

Diagnostic Test Range	Target Flights			
	Non-engagement	Drone	Missile	
			Tracking and Pointing	Target of Opportunity
White Sands Missile Range	6	4	6	4
China Lake Naval Air Weapons Center	6	4	N/A	N/A
Vandenberg AFB	6	N/A	6	4
Point Mugu	6	4	6	4

Six flights would be non-engagement flights (a laser beam would not be generated) to test the communications/navigation systems, air-refueling modifications, airworthiness of the modified aircraft, and laser system hot and cold flow tests. Four flights (except at Vandenberg AEB) would involve drones fitted with target boards for measurement of beam power and quality. **Six flights (except at China Lake NAWC) would involve acquisition, tracking, and pointing of the missile targets with the low-power laser.** Four additional flights (except at China Lake NAWC) would be target-of-opportunity flights, during which the HEL would not be fired, and the PDRR ABL would passively or actively track other scheduled missile launches from a standoff position using the onboard sensors.

Targets proposed for use at the Diagnostic Test Range include the Lance, Terrier/Black Brant, and Terrier/Orion missiles, the QF-4 drone, and the BQM-34S drone. A description of each of the targets is included in Appendix D. All missiles could be launched at White Sands Missile Range**. Only the Lance missile would be launched at Vandenberg AFB or Point Mugu.** The QF-4 and BQM-34S drones would be used at White Sands Missile Range, China Lake NAWC, or Point Mugu.

The anticipated gaseous emissions from all airborne HEL activities at the Diagnostic Test Range are listed in Table 2-9. The emissions would be exhausted from the PDRR ABL weapon system at 40,000 feet AMSL and would be dispersed in concentrations below the EPA standards.

Spent basic hydrogen peroxide and alkali metal chloride would be offloaded from the aircraft upon landing and recycled or disposed of at the Home Base. The expected amounts of these fluids are included in Table 2-4. As an added safety precaution, target-missile flight tests may require temporary evacuation of areas near the Diagnostic Test Range. Range safety officials would coordinate with appropriate local authorities to temporarily close highways and air traffic routes, if required for missile launches.

Table 2-9. Laser-Related Gaseous Emissions During Five-Month Period at Diagnostic Test Range

Gaseous Emission	Weight (Ibs)
Iodine	300
Hydrogen	500
Chlorine	800
Helium/nitrogen	2,400
Oxygen	6,000
Carbon dioxide	8,800
Ammonia	1,800
Water	12,000

2.1.3 Expanded-Area Test Range Activities

Flights of the PDRR ABL at the Expanded-Area Test Range would include acquisition, tracking, and pointing of missile targets and firing the HEL at a single missile or at multiple missiles from geographically separated locations. These critical tests would provide demonstrations of the capabilities and effectiveness of the PDRR ABL. The total duration of the flight test program at the Expanded-Area Test Range is anticipated to be four months, and may consist of up to ten PDRR ABL flights. Approximately ten temporary test personnel are expected to rotate into the region of influence for one week (five days) for each of the ten flights at the Expanded-Area Test Range. Table 2-10 shows the maximum number of flights that would occur at each proposed location if that location were selected.

Table 2-10. PDRR ABL Flights at Expanded-Area Test Range

Expanded-Area Test Range	Target-Missile Flights	
	Tracking and Pointing	High-Energy Laser
Western Range (Point Mugu)	4	6
Western Range (Vandenberg AFB)	4	6

The gaseous emissions from all airborne activities at the Expanded-Area Test Range are listed in Table 2-11. These chemicals would be exhausted from the PDRR ABL weapon system at 40,000 feet AMSL and would be dispersed at concentrations less than EPA standards.

As would be the case at the Diagnostic Test Range, spent basic hydrogen peroxide and alkali metal chloride would be offloaded from the aircraft and recycled or disposed of at the Home Base. The expected amounts of these fluids are included in the totals shown in Table 2-4. Target missile flight tests may require evacuation of sealanes, air routes, and other areas near the Expanded-Area Test Range. Range safety officials would coordinate with appropriate local authorities to temporarily close areas, if required, for missile launches.

The target proposed for use at the Expanded-Area Test Range is the Lance missile. A description of the Lance missile is included in Appendix D.

Table 2-11 - Laser-Related Gaseous Emissions During Four-Month Period at Expanded-Area Test Range

Gaseous Emission	Weight (Ibs)
Iodine	200
Hydrogen	300
Chlorine	500
Helium/Nitrogen	1,400
Oxygen	3,600
Carbon dioxide	5,300
Ammonia	1,080
Water	6,600

2.2 NO-ACTION ALTERNATIVE

If the no-action alternative were selected, PDRR ABL Phase activities would not be conducted at any location. No environmental impacts would occur.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

CEQ regulations require that an environmental impact statement evaluate all reasonable alternatives, briefly discuss those alternatives eliminated from detailed analysis in the environmental impact analysis, and provide the reasons for elimination of any alternatives (40 CFR § 1502.14(a)). "Reasonable" is defined as practical or feasible from a common sense, technical, and economic standpoint (51 FR 15618, April 25, 1986).

2.3.1 Demonstration Methods

Simulation and Modeling. While much effort is being directed toward accurate simulation of many subsystems and of the entire PDRR ABL system, simulation alone does not allow thorough validation of the ABL technology. Program requirements include the need to demonstrate the ability to track and destroy theater-ballistic missiles with a high-energy laser. Because simulation and modeling as a standalone demonstration method does not validate that capability, it was considered, but eliminated, from detailed analysis.

Integrated Subscale and Component Tests. The contractor teams and the USAF are comparing the results of computer models and simulation to the results of actual laboratory tests of components during the Concept Design Phase. The laboratory tests can significantly improve the design and operation of components by validating the computer models. Additionally, these demonstrations and experiments can be followed by a series of tests of individual full-scale subsystems as they are designed and fabricated. However, performing only laboratory subscale- and component-level tests that incorporate ABL technology would not allow full-scale integration of flight testing and would, therefore, not adequately prove the viability of the technology. A high-power demonstration from an airborne platform against a missile with its rocket motor still burning is the only way to definitively replicate the vibration, pressure, and atmospheric and dynamic effects associated with operation of both the low-power acquisition, tracking, and pointing laser and the HEL beam required to destroy TBMs.

2.3.2 Laser Systems

The ABL mission requires use of a high-power laser that is effective at operational ranges and uses mature technology, that is technology which is past the applied research phase and ready for incorporation into the laser weapons system. Other types of lasers such as carbon dioxide, deuterium fluoride, hydrogen fluoride, free electron, and solid-state lasers were examined by the USAF and Concept Design Phase contractors for use in the ABL Program. High-power carbon dioxide and deuterium fluoride laser technologies are very mature, but because of their inherent long wavelengths (10.6 and 3.8 the laser beam diverges and becomes too large at operational ranges. Since the laser beam cannot maintain a tight focus, sufficient energy cannot be delivered onto the target.

Solid-state and free-electron lasers are not sufficiently mature to meet the high-power requirements of the ABL Program. Additionally, integration of a free-electron laser onboard an aircraft would be very difficult because of the weight of the materials required to shield the crew from the radiation generated by the laser.

The hydrogen fluoride laser's inherent wavelength (2.7 causes the beam's energy to be absorbed by the atmosphere, which makes it ineffective at operational ranges. Although the wavelength of both the hydrogen fluoride and the deuterium fluoride lasers can be altered, the technology required to do so is not mature enough for use in the ABL Program. Carbon dioxide, deuterium fluoride, hydrogen fluoride, free-electron, and solid-state lasers were considered but eliminated from detailed analysis.

2.3.3 Location Alternatives

Home Base. The Home Base location-selection criteria are listed in Section 2.0. The acceptable characteristics for both the runway and hangar are driven by the ability to accommodate a B747. Using 747 Airplane Characteristics Airport Planning, D6-5 8326 (Boeing, 1984), and information obtained from USAF flight operations personnel, the following criteria was chosen for a runway: a minimum length of 3,048 m (10,000 ft), a minimum width of 46 m (150 ft), and an adequate weight-bearing capacity for the B747 aircraft. The minimum requirements for the hangar were a door width of 62 m (205 ft), height of 14 m (45 ft), and an overall length of 55 m (180 ft). This configuration allows the body of the aircraft to fit inside the hangar, although the tail would extend outside the hangar.

Performance of ground-test activities at Home Base dictates the use of a System Integration Facility (SIP). The Home Base SIP is a facility capable of providing sufficient space (approximately 1,860 square m [20,000 square ft] located near the hangar) for component-level tests, integrated subsystem tests, and data reduction and analysis. The SIF would contain laboratory space both with and without an overhead crane, clean rooms, laser-module assembly and checkout areas, and a sensor and diagnostics calibration laboratory. Since the ABL Program is a research and development effort, the SIP is classified as a Research, Development and Test Facility, Real Property Category Code 310 (USAF, 1975). If an existing facility has to be modified to meet ABL Program needs, modification would follow established rules in AFI 32-1032, *Planning and Programming Real Property Maintenance Projects Using Appropriated Funds.* Potential Home Base locations are limited to those already having Category Code 310 facilities.

All DoD installations in the continental United States were examined in the site-selection process for Home Base. Installations without runways were eliminated. Installations having the required runway length, width, and load-bearing capacity were identified using the *DoD Flight Information Publication (Enroute), IFR -Supplement, United States* (DoD, 1994). Those installations were then contacted to determine the hangar dimensions and SIP capabilities. Installations without sufficiently large hangars were eliminated from further consideration.

Table 2-12 lists the installations that met both the runway and hangar criteria for Home Base. According to personnel at these 17 installations, existing mission commitments at seven installations would preclude use of the large hangar by the PDRR ABL. The large hangars at McClellan, Tinker, and Robins AFBs are used by the Air Logistics Centers. The 46th Test Wing at Eglin AFB is performing aircraft modifications in their hangar. Vandenberg AFB's hangar is used for Titan missile integration work. The hangar at Travis AFB is extensively used by C141 and C5 aircraft. The hangar at Miramar Naval Air Station was used to support training missions. Griffis AEB was eliminated because it was targeted for closure by the Base Realignment and Closure Commission.

Only two installations (Edwards and Kirtland AFBs) have facilities that meet all of the criteria and are available for use by the PDRR ABL.

Table 2-12. Installations with Adequate Runway and Hangar for Home Base

Installation	State	Runway Length (Feet)	Runway width (Feet)	No. Of Adequate Available Hangars	Adequate SIF
Dyess AFB	TX	13,500	300	2	None
Edwards AFB	CA	14,994	300	4	Yes
Eglin AFB*	FL	10,000	300	0	N/A
Fairchild AFB*	WA	13,901	300	1	None
Griffis AFB**	NY	11,820	300	2	BRAC
Kirtland AFB	NM	13,775	300	1	Yes
Little Rock AFB	AR	12,000	200	1	None
March AFB	CA	13,300	300	1	None
McChord AFB	WA	10,100	150	4	None
McClellan AFB*	CA	10,600	200	0	N/A
McGuire AFB	NJ	10,001	200	2	None
Miramar NAS*	CA	12,000	200	0	N/A
Off utt AFB	NE	11,700	300	1	None
Robins AFB*	GA	12,000	300	0	N/A
TinkerAFB*	OK	11,100	200	0	N/A
Travis AFB*	CA	11,002	300	0	N/A
Vandenberg AFB*	CA	15,000	200	0	N/A

*Eliminated from consideration because of existing mission commitment
**Eliminated from consideration because of targeting for closure by Base Realignment and Closure Commission (BRAC)
SIF System Integration Facility

Test Ranges. The mission of the Air Force Aircraft-Propulsion-Avionics Single Face To The Customer Office is to assist System Program Offices (SPOs) in the selection of test ranges. Test ranges were evaluated by the Single Face To The Customer Office on the basis of PDRR ABL Phase requirements. In addition to the operational requirements, weather, existing instrumentation, and location were also considered in the selection process. Poker Flat Research Range, Alaska, was eliminated because of extreme weather conditions and remote-operating costs. The Pacific Missile Range Facility, Kauai, Hawaii, and Wallops Right Facility, Virginia, were eliminated because they lacked land-based instrumentation sites. The Eastern Test Range and Eglin AEB Test Range were excluded from consideration because a Home Base location in the southeastern United States was not found using the site-selection process.

2.5 SUMMARY OF ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

Table 2-13 summarizes the environmental impacts of routine PDRR ABL activities at Home Base. Because activities at the Diagnostic and Expanded-Area Test Ranges differ from those at Home Base, Table 2-14 summarizes the environmental impacts of routine PDRR ABL activities at the ranges. The information presented in the tables is based on the environmental consequence analysis presented in Chapter 3 of this DEIS. The assessment of potential impacts is based on the guidelines from the CEQ (40 CFR § 1508.27), which specify that significance should be determined in relationship to both context and intensity (severity).

Potential impacts to upper atmosphere and those resulting from accidents are not site-specific. Therefore, they are discussed separately from the environmental attributes listed in the impact tables. Analysis of upper atmospheric impacts is included in Section 3.7. Accident scenarios and analyses are shown in Appendix C.

Impacts to Upper Atmosphere (Normal Operations). Routine operation of the high-energy laser (HEL) at 12 km altitude will release chlorine and ammonia in the upper reaches of the troposphere and in the lower stratosphere. However, at normal aircraft cruising speed, the concentrations of the chemicals in the mixing volume of the atmosphere would be low and would not pose any toxicity hazards. The concentration levels would rapidly disperse in the high winds. In the troposphere, chlorine emissions would be quickly converted to water soluble forms and most would be removed from the atmosphere through precipitation without ever reaching the stratosphere. If the ABL aircraft is flying in the stratosphere when the HEL is fired, the local concentration of chlorine would increase approximately 35 percent for a short period of time (less than 24 hours). The naturally occurring winds would continue to mix the chlorine from the HEL firing within the stratosphere. The long term increase of chlorine in the stratosphere from all PDRR ABL HEL firings would be less than 3×10^{-7} percent. Flights by the Black Brant and Orion target missiles would emit chlorine into the stratosphere. However, emission levels would rapidly decrease to the background level as stratospheric winds disperse the chlorine.

Impacts to Upper Atmosphere (Emergency Operations). Halon 1301, a fire suppressant, could be released in the event of a fire onboard the aircraft. The probability of a fire is extremely low and in the unlikely event of a release, a very small amount of Halon would reach the atmosphere. An emergency operation could involve the dumping of aircraft fuel and laser chemicals into the atmosphere. However, concentration levels would be well below toxic exposure limits in the mixing volume of the atmosphere, and would have no measurable long-term impacts on the environment.

Accidents. Accidents involving spills of fuels, fires, explosions, or other events may have harmful environmental impacts to natural resources. The possibility of such occurrences would be remote, and strict compliance with federal and state regulations for safety, transportation, and hazardous material handling would minimize adverse impacts to every degree possible.

Table 2-13

CHAPTER 3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES/MITIGATION

Chapter 3 presents environmental setting discussions directed to specific regions of influence and follows the organization below.

Section 3.0	Description of Environmental Attributes
Section 3.1	Edwards AFB
Section 3.2	Kirtland AFB
Section 3.3	White Sands Missile Range
Section 3.4	China Lake Naval Air Warfare Center/R-2508 Complex
Section 3.5	Point Mugu Naval Air Warfare Center Weapons Division/San Nicolas Island (Western Range)
Section 3.6	Vandenberg AFB (Western Range)
Section 3.7	Discussion of the Upper Atmosphere

3.0 DESCRIPTION OF ENVIRONMENTAL ATTRIBUTES

3.0.1 INTRODUCTION

This chapter describes the environmental baselines from which any environmental changes brought about by the proposed action and alternatives can be identified and evaluated. Attributes in this Final Environmental Impact Statement (FEIS) were selected because they may be affected by the PDRR ABL Phase activities. In addition, issues raised during PDRR ABL Scoping are listed in Table 3.0-1 for each attribute to identify where the issues have been addressed in this FEIS.

3.0.2 AIR QUALITY

Definition. This FEIS refers to the quality of air impacting the human environment. Only the emissions in a portion of the total volume of the atmosphere are typically considered when performing an air quality analysis. The quality of air below 3,000 feet above ground level (AGL) is the region of most concern to the human environment. EPA generally uses 3,000 feet AGL as the default-mixing height (or depth) across the United States. The mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. The value of this height is set primarily by the atmosphere's local vertical temperature profile. A boundary layer exists at the mixing height that inhibits the rapid vertical transfer of air. Pollutants emitted above the mixing height become diluted in the very large volume of air in the troposphere before they are slowly transported down to ground level. These emissions have little or no effect on ambient air quality. Therefore, the air quality section of this FEIS focuses on emissions below 3,000 feet AGL. The effect of the emergency release of chemicals used by the laser weapons in the troposphere, and the effect of emissions from firings of the HEL during flight tests are covered in Section 3.7.

Table 3.0-1. Environmental Attributes and Scoping Issues

Environmental Attribute	Scoping Issue
Air quality	Aircraft safety Impacts on surrounding communities
Airspace	Laser eye safety and potential beam impacts
Biological resources	Laser eye safety and potential beam impacts Possible impacts on marine mammals and endangered species Storage and handling of laser fuel
Geology and soils and water resources	Storage and handling of laser fuel
Cultural resources	None
Hazardous materials and waste	Aircraft safety Storage and handling of laser fuel Impacts on surrounding communities
Health and safety	Laser eye safety and potential harm Aircraft safety Storage and handling of laser fuel
Land use	Potential impacts on recreation
Noise	Possible impacts on marine mammals and endangered species
Socioeconomics	Impacts on surrounding communities Potential impacts on commercial fishing
Recreation and visual resources	Impacts on surrounding communities Potential impacts on recreation
Infrastructure and transportation	Impacts on surrounding communities
Environmental justice	Impacts on surrounding communities

Approach to Defining Environmental Setting. Air quality in a given location is measured by the concentrations of various pollutants. Pollutant concentrations, expressed in units of parts per million (ppm) or micrograms per cubic meter are determined by the type and amount of pollutants in the atmosphere, the size and topography of the air basin, and the meteorological conditions related to the prevailing climate. The significance of a pollutant concentration is determined by comparison with federal, state, and local ambient air quality standards. These standards establish limits on the maximum allowable concentrations of various pollutants to protect public health and welfare.

Regulatory Compliance. The monumental task of ensuring that the air in the United States is reasonably free from harmful contaminants falls to a regulatory program initiated in 1955 with the Air Pollution Control Act. Since then, five acts have been passed, each increasing the scope, complexity, and thoroughness of legislation and subsequent regulation in an attempt to meet the original goal of clean air. Only topics in the *Clean Air Act Amendments* (CAAA) of 1990 (Public Law 101-549) are discussed.

In general, air quality is managed by state, regional, and/or local air quality regulatory agencies. These local agencies must enforce the federal standards under the *Clean Air Act* (42 USC § 7401) but may also elect to implement more stringent regulations.

The cornerstone of air quality regulation rests on the *National Ambient Air Quality Standards* (NAAQS) (40 CFR **§** 50) for criteria pollutants that pose the greatest threat to air quality. The six criteria pollutants are ozone, carbon monoxide, sulfur dioxide, nitrogen dioxides, lead, and particulate matter less than 10 microns in diameter (PM-b). The NAAQS established acceptable concentration levels for each criteria pollutant. Table 3.0-2 provides a listing of the NAAQS.

Table 3.0-2. National Ambient Air Quality Standards

Pollutant	Averaging Time	National Primary Standard
Ozone	Max Daily 1-hour	0.12 ppm
Carbon monoxide	8-hour	9.0 ppm
	1-hour	35.0 ppm
Sulfur dioxide	Annual Average	0.03 ppm
	24-hour	0.14 ppm
Nitrogen dioxide	Annual Average	0.053 ppm
Lead	Maximum Quarterly	1.5 $\mu g/m^3$
PM-10	Annual Arith. Mean	50 $\mu g/m^3$
	24-Average	150μ g/m^3
Standards can be expressed as either parts per million (ppm) or micrograms per cubic meter ($\mu g/m^{3)}$ To convert from ppm to $\mu g/^3$ multiply ppm by the molecular weight of the compound and divide the result by 0.0245. Note: There are 24.5 liters per gram-mole at 25°C and 760 mm Hg. Source: Clean Air Act, 42 USC § 7401 et seq.		

Areas that exceed the NAAQS are designated as nonattainment areas for the specific pollutant. The fundamental method by which the EPA tracks compliance with NAAQS is by designating areas as either attainment, nonattainment, maintenance, or unclassifiable. Areas are given the status of nonattainment when violations of NAAQS occur. The areas must then comply with more stringent standards until NAAQS are satisfied. Maintenance areas are those that were previously in nonattainment but have improved their air quality to meet the NAAQS and are now in a 10-year probationary period. Under the CAAA, the nonattainment classifications for carbon monoxide and PM-10 were further divided into moderate and serious categories. Ozone nonattainment was divided into marginal, moderate, serious, severe, and extreme categories. The nonattainment classifications and the associated major level of emissions are shown in Table 3.0-3.

States have the primary responsibility to achieve compliance with the NAAQS and are required to prepare state implementation plans for any regions of noncompliance. After approval by the EPA, these enforceable plans detail how the state intends to reduce air pollution and meet the NAAQS.

The impact of the criteria pollutant regulations on the PDRR ABL Phase is determined by two factors: types and quantities of criteria pollutants estimated to be generated by the program and whether the location of the activities is in a designated attainment, nonattainment, or maintenance area. Note, the severity of the nonattainment status (i.e., moderate, serious, etc.) determines the quantity of new emissions allowed in the air basin.

Table 3.0-3. Identification of Major Sources

Emission	Nonattainment Area category	Level of Emissions Defining Major Source (tons per year)
Ozone (VOC or NO_x)	Extreme	10
	Severe	25
	Serious	50
	Moderate	100
	Marginal	100
Carbon monoxide	Moderate	100
	Serious	50

NO_x: Oxides of Nitrogen
VOC: Volatile organic compound
Source: 1990 Clean Air Act Amendments (P.L. 101-549)

Hazardous air pollutants (HAPs) are regulated differently than the criteria pollutants because they are considered to be (or have the potential to be) carcinogenic, mutagenic, and/or toxic. Under the CAAA, the EPA was tasked to develop *National Emission Standards for Hazardous Air Pollutants* (NESHAPs). Typical sources of HAPs, such as a chemical manufacturing facility, are divided into major and area source categories. Major sources are those that emit 10 tons per year of any one of the listed HAPs, or 25 tons per year of any combination of HAPs. Area sources are those that do not reach these emission levels but are specifically covered by the regulations because of the nature of their emissions.

The CAAA includes special requirements for extremely hazardous substances (EHSs). These are pollutants that could cause death or injury or require evacuation of the immediate area if an accidental release were to occur. The objective of the statute is to prevent accidental release and to minimize the consequences of any release. If the total quantity of an EHS present at a facility in a single process exceeds the threshold quantity as listed in 40 CFR **§** 68, then the facility is required to complete a safety analysis. This safety analysis includes a risk assessment to determine the public health hazards. A risk management plan must also be developed for worst-case release scenarios. Chlorine and ammonia are listed in 40 CFR **§** 68 as EHSs, but the projected maximum quantity of both substances present at Home Base would be well below the threshold quantity.

The CAAA requires Title V operating permits for nearly all stationary sources of significant air emissions for example, entire military installations. The permits generally are issued by a state regulatory agency and encompass all detailed requirements governing air emissions from the stationary source and related activities such as monitoring, record keeping, and reporting. Before commencing activities at any military installation, permit compliance and paperwork issues would be identified and managed to ensure compliance with the installation Title V permit.

The CAAA, as implemented by 40 CFR **§** 93, requires that federal agencies not engage in, approve, or support in any way action that does not conform to applicable state implementation plan efforts in attaining the NAAQS. The purpose of this requirement is to ensure that emissions from federal actions are consistent with air quality planning goals. USAF actions must not cause nor contribute to any new violation of any standard, increase the frequency or severity of any existing violation of any standard, nor delay the timely attainment of any standard or any required emission reductions or other milestones in any area.

The CAAA prohibits federal agencies from engaging in, supporting, licensing, or approving any action that does not conform to an approved state or federal implementation plan to improve the air quality in a region. This requirement was levied to ensure federal activities do not hamper local efforts to meet the NAAQS emission reduction requirements in a nonattainment or maintenance area. The USAF *Conformity Guide*, (USAF, 1995a) defined the process for analyzing the impact of USAF actions on air quality. A preliminary conformity analysis in accordance with the USAF guidance is provided in Appendix E and the results are reported in the air quality sections for each location.

3.0.3 AIRSPACE

Definition. Airspace is the space that lies above a nation and comes under its jurisdiction. Airspace is finite in nature, having dimensions of height, depth, width, and time. Time, used to define a specific period, is an essential element of airspace. Airspace may be used for widely diverse, incompatible activities (e.g., missile launch, commercial aircraft, simulated combat by military aircraft) each day. Each user of the airspace would have a specific time period allotted for their activity.

Approach to Defining Environmental Setting. The region of influence for airspace would be that airspace required for PDRR ABL flight testing.

Regulatory Compliance. Under the *Federal Aviation Act of 1958* (Public Law 85-726), the Federal Aviation Administration (FAA) is responsible for the regulation and promotion of civil aviation. The FAA encourages development and safety, providing safe and efficient use of airspace, and contributing to national security. The method used to provide this service is the National Airspace System (NAS). The NAS is an extensive network of U.S. airspace and air-traffic control computerized surveillance, communication, navigation, and landing systems.

3.0.4 BIOLOGICAL RESOURCES

Definition. Biological resources are defined for the purposes of this FEIS as the native and naturalized flora and fauna in terrestrial and aquatic ecosystems. Threatened and endangered species, migratory birds, eagles, marine mammals, and wetlands are of special importance because they receive specific protection under federal and state laws.

Approach to Defining Environmental Setting. The regions of influence for the proposed activities are specific to location and activities conducted at each site. The region of influence includes the launch and debris hazard areas at the test ranges as well as construction areas at Home Base.

Regulatory Compliance. The *Endangered Species Act* (16 USC § 1531) is intended to protect and restore endangered and threatened species of animals and plants and their habitats. Other federal statutes protecting biological resources include the *Migratory Bird Treaty Act* (16 USC § 703-7 12), the *Bald Eagle and Golden Eagle Protection Act* (16 USC § 668), the *Marine Mammal Protection Act* (16 USC § 1361), and the *Marine Protection Research and Sanctuaries Act* (33 USC § 1401), and the *Fish and Wildlife Coordination Act* (16 USC §§ 661-666c).

The official California listing of endangered and threatened animals is contained in the *California Code of Regulations*, Title 14 § 670.5. The official California listing of endangered and threatened plants is contained in the *California Code of Regulations*, Title 14 § 670.2.

The New Mexico Department of Game and Fish protects endangered and threatened wildlife species under the authority of the *New Mexico Wildlife Conservation Act* (19 NMAC § 33.1). The New Mexico Energy, Minerals and Natural Resources Department protects endangered and threatened plant species under regulations governing endangered plant species (19 NMAC § 21.2).

3.0.5 GEOLOGY, SOILS, AND WATER RESOURCES

Definition. Geologic resources consist of naturally formed minerals, rocks, and unconsolidated sediments. Soil refers to the agriculturally important, uppermost layers of surficial geologic deposits and is developed by the weathering of the geologic deposits. In arid regions, soils are generally thin and commonly rich in caliche, an accumulation of calcium carbonate in the soil. Water resources consist of surface waters and groundwater. Analysis of water resources must investigate both water quantity and quality, including current and projected use of the water resources.

Geologic and soil resources are susceptible to contamination from the surface. Prior to the enactment of current environmental laws and regulations, past aircraft operations and waste disposal practices have resulted in releases of hazardous chemicals such as petroleum products and solvents. This has created soil contamination at military installations. The contaminated geologic and soil resources may require physical removal or extensive remediation to ensure the protection of public health and safety.

Surface waters include perennial and seasonal (intermittent) waterways (rivers and streams), ponds, retention basins and surface channels (and any other man-made features), springs, and seeps. Areas where surface waters may cause localized flooding are usually identified on maps as 100- or 500-year floodplains. Surface waters can become contaminated as a result of spills and releases on the ground surface that can quickly migrate into the surface water bodies. Surface waters are rarely used as a significant source of potable water for human consumption, but they are used extensively for livestock watering, crop irrigation, and industrial purposes.

Groundwater consists of subsurface waters that are capable of being pumped from the ground in sufficient quantities to serve as a water source for humans, animals, or plants. Shallow groundwater is usually encountered under unconfined (water table) conditions close to the ground surface. Such groundwater is not isolated from surface pollution by a confining layer, such as impermeable clay. As a result, shallow groundwater can become contaminated by spills and releases on the ground surface. Shallow groundwater resources are rarely used for human consumption but may be used for industrial and agricultural purposes. Deep groundwater resources are generally encountered under confined (aquifer) conditions. The deep groundwater is isolated from surface contamination by a confining layer and as a result is used as a source of drinking water.

Approach to Defining Environmental Setting. The region of influence for geologic and soil resources depends on numerous factors, including 1) construction activities, 2) locations of contaminant releases, 3) types and quantities of contaminants released, 4) infiltration capacity of soils at the release sites, 5) the existence of resources of economic value, and 6) the risk that seismic activity could damage program facilities or alter program activities. The region of influence in this FEIS is more specifically defined by construction activities, missile-launch sites, and areas impacted by falling debris.

The region of influence for water quality is related to the type and quantity of contaminants spilled or released at the earth's surface (i.e., soils, surface waters), the location of spills and releases, the buffering capacity of soils and waters, and contaminant transport pathways. The region of influence on the quantity/availability of water resources is related to the number of personnel relocated for an action, the location of personnel housing, and the location of all facilities and activities conducted as part of the action. The region of influence on floodplains and wetlands is dependent upon the proximity of the activities to the areas, the location of facilities, and the surface water drainage pathways in the vicinity.

Regulatory Compliance. Geology and soils issues and concerns are regulated primarily under state statutes and local ordinances. However, the *Soil Conservation and Domestic Allotment Act* (16 USC § 590a) requires the control and prevention of potential soil erosion caused by federal activities and projects. The Act preserves and protects a variety of land and water resources, man-built structures (such as dams), and the public health.

Soil cleanup activities at U.S. Department of Defense (DoD) sites are covered under the Installation Restoration Program (IRP) and under solid waste management units (SWMUs), covered by the *Resource Conservation and Recovery Act* (RCRA) appendix (42 USC § 6901) for the RCRA Facility Investigation (RFI) permit with the EPA.

The *Clean Water Act* (CWA), as amended, (33 USC § 1251), is designed to restore and maintain the chemical, physical, and biological integrity of surface waters. Section 402 of the CWA establishes the National Pollutant Discharge Elimination System (NPDES), under which permits are required for point source discharges to surface waters. NPDES permits are also required for certain point and nonpoint discharges such as stormwater runoff from industrial sites. States may have more stringent requirements for discharges to groundwater under the NPDES program than the federal regulations. Program activities are required to meet the NPDES permit requirements of the state in which they are implemented. Any PDRR ABL Phase activities that generate regulated discharges would have to be discharged under existing NPDES permits at the Bases, new permits or revised existing permits.

The *Oil Pollution Prevention Regulations* (40 CER § 112), issued under Section 311 of the CWA, require the preparation of spill prevention control and countermeasures plans to prevent the accidental release of oil into surface waters or onto adjoining shorelines. Most spill control plans include best management practices designed to prevent the accidental release of other hazardous substances.

The *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) of 1980 (42 USC § 9601), as amended by the *Superfund Amendments and Reauthorization Act* (SARA) of 1986 (Public Law 99-499), established a fund (also known as Superfund) to finance the cleanup of uncontrolled hazardous waste sites. These acts focus on cleanup of contamination generated in the past. The Defense Environmental Restoration Program (DERP) was created to assess and remediate contamination at DoD facilities in accordance with CERCLA/SARA. As part of DERP, the Installation Restoration Program (IRP) was created to identify, investigate, and clean up soil and water contamination that has resulted from past practices at active and previously owned and/or operated DoD properties. The TRP is a phased process that includes a preliminary assessment/site inspection, and if required, a remedial investigation, feasibility study, and remedial design/remedial action.

The *Safe Drinking Water Act* (SDWA) (42 USC § 300) ensures the protection of water resources from contamination and overutilization. Federally funded projects that take place in critical aquifer protection areas designated under the Act are subject to special EPA review to ensure that no substantial threat to the aquifer occurs. The Resource Conservation Recovery Act (RCRA) (42 USC § 6901) is also a key consideration in the assessment of impacts to groundwater. Because spills and leaks of hazardous waste represent a major source of surface water and groundwater contamination, noncompliance with RCRA can result in impacts to surface water and groundwater quality.

Each Base has a stormwater pollution-prevention plan for all stormwater associated with industrial activities which, if necessary, could be modified for PDRR ABL Phase activities.

New Mexico regulates groundwater discharges under the *New Mexico Water Quality Control Commission Regulations* (20 NMAC § 6.2). In addition, the New Mexico Environment Department certifies EPA NPDES permits. In California, regional water quality control boards administer the federal *Clean Water Act.* The State issues one discharge permit to satisfy both state and federal law.

3.0.6 CULTURAL RESOURCES

Definition. The heritage of the United States is reflected in the sites, structures, districts, and objects that contribute to an understanding of American history and culture. This heritage includes prehistoric and historic resources and the cultural resources of Native American populations. For the purposes of this analysis, paleontological resources are also discussed in this section.

Approach to Defining Environmental Setting. The process for defining the region of influence for cultural and paleontological resources is defined in three increasingly narrow ways. First, the natural setting is the location of the resource within a specific geologic and geographic region, which can include significant bodies of water, topography, and plants and animals that once inhabited or still inhabit the region. Second, the site may be defined by modern political boundaries. Finally, the region of influence is defined as the area directly affected or disturbed by a proposed alternative during site modification or operation, including visual intrusions to the settings or environmental context, unauthorized artifact collecting, and vandalism.

Regulatory Compliance. A number of federal and state regulations protect cultural and paleontologic resources. The *Antiquities Act* (16 USC § § 43 1-433) regulates impacts to paleontologic features. The *National Historic Preservation Act* (NHPA) (16 USC § 470) is the key federal statute regulating the identification and protection of cultural resources. The NHPA established the National Register of Historic Places (NRHP), the responsibilities of the State Historic Preservation Office, and the Section 106 review and compliance process. The NRHP maintains an inventory of qualifying cultural resources. The regulations that protect properties listed on the NRHP also extend to those properties that are eligible but not yet listed. The responsibilities of the State Historic Preservation Office include participation in the review of proposed federal actions that affect cultural resources. The *New Mexico Prehistoric and Historic Sites Act* (18-8-7 NMSA 1978) requires consultation with the State Historic Preservation Officer. Section 106 is a procedural requirement whereby federal agencies must consider the effects of potential actions on cultural resources that are eligible for listing on the NRHP.

Additionally, each location must be assessed for impact to cultural or Native American resources, which need not be nationally important to be eligible for federal protection. The 1992 Amendment to the NHPA (also known as the Fowler Amendment) strengthens the role of tribal preservation officers in the national preservation program and explicitly acknowledges the preservation interests of Native Americans. The *American Indian Religious Freedom Act* (AIRFA) (42 USC § 1996) recognizes and protects the religious freedoms of Native Americans as an integral part of their culture, tradition, and heritage. The Act preserves the right of access by Native Americans to sacred sites, to use and possess sacred objects and to freely worship through ceremonial and traditional rites.

3.0.7 HAZARDOUS MATERIALS AND WASTE

Definition. The term *hazardous materials* is derived from the U.S. Department of Transportation (DOT) and EPA lists of chemicals that require packaging or that trigger notification if spilled (49 USC § 1801). A hazardous material is any material whose physical, chemical, or biological characteristics, quantity, or concentration may cause or contribute to adverse effects in organisms or their offspring, pose a substantial present or future danger to the environment, or result in damage to or loss of equipment, property or personnel.

Hazardous wastes are non-excluded solid wastes (material that has been "abandoned, recycled, or is inherently waste-like," as defined in 40 CFR **§** 261.2) that because of quantity, concentration, or characteristics may cause an increase in mortality or serious irreversible illness or pose a substantial hazard to human health or the environment if improperly treated, stored, transported, and/or disposed. If a waste is not specifically listed as hazardous under RCRA implementing regulations (40 CFR **§§**261.30-261.33), a generator must then determine if it exhibits any of the characteristics of a hazardous waste: ignitability, corrosivity, reactivity, and/or toxicity.

Approach to Defining Environmental Setting. Each of the locations proposed for the PDRR ABL activities have an operational hazardous materials and hazardous waste management program. The PDRR ABL will use the host installation's system and procedures.

Regulatory Compliance. A variety of laws and regulations have been promulgated to control the production, transportation, use, and disposal of hazardous materials and hazardous waste. A brief description of each and the special DoD and USAF hazardous material/waste programs that would be applicable to the PDRR ABL activities follows. Because not all activities have yet been identified, the list of applicable laws and regulations may be modified in future environmental documentation.

The *Occupational Safety and Health Act* (OSHA) (29 USC **§** 651) and the subsequent standards require general environmental controls, personal protective equipment, and training to ensure the safety of workers using hazardous materials. OSHA contains specific requirements for handling and storing hazardous materials. To comply with OSHA requirements, all personnel working with hazardous materials must receive Hazard Communication (HAZCOM) training when first starting the job. HAZCOM provides the worker with a basic introduction into the safe handling and management of various types of hazardous materials/waste. The remainder of the training is tailored around the specific hazards in the workplace, necessary safeguards and protective equipment, and basic emergency response actions. OSHA also requires 40 hours of specialized training for hazardous waste operators known as HAZWOPER training. The training prepares workers to respond to emergency releases of hazardous materials.

The Resource Conservation and Recovery Act (RCRA) (42 USC **§** 6901) contains standards to determine if a waste is hazardous as a result of being on one of four published lists or because it exhibits at least one of the following characteristics: ignitability, corrosivity, reactivity, or toxicity. RCRA and the resulting regulations require a detailed life-cycle program to track and control hazardous waste with specific standards and procedures for the handling, storage, treatment, and disposal of hazardous waste.

Title m of the *Superfund Amendments and Reauthorization Act* (SARA) (Public Law 99-499) is the *Emergency Planning Community Right to Know Act* (EPCRA). EPCRA requires that facilities that use or store certain hazardous materials above specified quantities must report usage to various government agencies for public access. EPCRA also requires facilities to report hazardous material releases exceeding specified quantities.

The *Hazardous Materials Transportation Act* (HMTA) (49 USC **§** 1801) authorizes the DOT to create and enforce regulations regarding the transportation of hazardous materials. DOT coordinates with other federal agencies, including the EPA, in implementing programs under HMTA. Implementing regulations establish standards for hazardous material/waste packaging, labeling, documentation and manifesting, and materials classification. The regulations also require transporters to obtain licenses, meet special material-specific container requirements, and be trained and prepared for emergency spill response.

Federal hazardous material/waste regulations are implemented through state regulatory agencies. These agencies can adopt more stringent requirements. On the state level, the New Mexico Environment Department regulates hazardous waste operations under the *New Mexico Hazardous Waste Act* (74 NMSA §§ 4.1-4.14, and the *New Mexico Hazardous Waste Regulations* (20 NMAC § 4.1). In California, the *California Hazardous Waste Control Law* (California Safety and Health Code § 25100) and the *Porter- Cologne Act* (California Water Code § 13000) water quality control provisions operate jointly in the regulation and issuance of permits for hazardous waste facilities. The California Environmental Protection Agency, Department of Toxic Substances Control administers the state's hazardous waste program. If the operation involves any waste discharge that affects water quality, permits must include any limits or requirements imposed by the Regional Water Quality, Control Board.

The *Pollution Prevention Act* (42 USC § 13101) establishes a national policy of pollution prevention through source reduction and recycling. The Act calls for the establishment of a nationwide source-reduction program and a strategy for quantifying source-reduction efforts. The DoD and the Air Force have incorporated this national policy into operations and acquisition programs, with a goal of reducing the use of hazardous materials and releases of pollutants into the environment to as near zero as possible. DoD Directive 4210.15, *Hazardous Materials Pollution Prevention,* and DoD Regulation 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs and Major Automated Information System Acquisition Programs,* establish specific pollution prevention guidelines. USAF programs include the implementation of pollution prevention management action plans, hazardous material pharmacies at every AF installation, and the incorporation of the pollution prevention ethic within the acquisition system through use of an industry standard hazardous material management program.

The USAF has implemented an environmental compliance self-assessment program, the *Environmental Compliance Assessment and Management Program* (ECAMP) (AFI 32-7045). The program's two primary objectives are to improve AF environmental compliance and management worldwide and to build supporting financial programs and budget for environmental compliance requirements. Every installation is required to conduct ECAMP inspections annually to identify compliance, poor management practices, and pollution prevention opportunities. Identified issues are reported and tracked until the appropriate solution is implemented. A main focus area of ECAMP is hazardous material/waste management.

Specific Past Experience. The USAF has 17 years of experience with the handling, storing, and operating of the chemical oxygen iodine laser (COIL) type chemicals (alkali metal hydroxides, hydrogen peroxide, chlorine, and iodine) required for the PDRR ABL Phase ground and flight tests. In 1979, the Air Force Weapons Laboratory, now known as the Phillips Laboratory, began experiments with a COIL. A facility was constructed at Kirtland AEB to accommodate confined-laser testing, storage of laser fuels, a neutralization pit and an evaporation pond for spent-laser fuels. All tests and experiments conducted at this facility have undergone system safety hazard analysis and environmental impact analyses. Process management safety plans (29 CFR § 1910.119), operating plans, spill-prevention and emergency-response plans have been developed and approved. The COIL facility operates with a safety permit that is reviewed and updated every year. All personnel at the COIL facility receive HAZCOM training and those personnel involved with spill response receive HAZWOPER training. Personal protective equipment has been identified and personnel have been fitted and trained in equipment operation.

As COIL technology has progressed, the facility has been modified to expand the quantity of laser hazardous materials storage. The facility now utilizes a 2,000-gallon tank to hold bulk quantities of hydrochloric acid, two 3,000-gallon tanks for alkali metal hydroxide, a 3,000-gallon tank for hydrogen peroxide, storage shed for the 5-kg (1 1-lb) containers of crystallized iodine, and approximately 200-300 kg (5 00-700 lb) of liquid chlorine in 68-kg (150-lb) metal bottles. The hydrochloric acid tank is placed in a bermed area that is lined with acid-resistant plastic, and the tank is plumbed directly to the neutralization pit. This setup has reduced the risk of personnel exposure to hydrochloric acid. All other hazardous materials are stored in approved cylinders and flammable storage lockers. Any hazardous wastes are collected at the initial accumulation point and subsequently disposed of in accordance with Kirtland AEB *Hazardous Waste Management Plan 1 95-95* requirements (USAF, 1995b).

3.0.8 HEALTH AND SAFETY

Definition. Health and safety is defined as the protection of workers and the public from hazards. The total accident spectrum encompasses not only injury to personnel but also damage or destruction of property or products.

Approach to Defining Environmental Setting. Since the standards applicable to worker and public health and safety differ, it is useful to consider separate regions of influence. For worker safety, the boundary of the immediate work location defines the region of influence. This would limit the area of concern to a very small area that would never extend beyond the boundaries of the DoD installation or range. For public safety, a much larger area must be considered. Safety hazards to the public would come from PDRR ABL flight operations, target (missile or drone) operations, HEL operations and transportation of materials and waste. The area of concern would vary depending on the nature of the operation but may extend for many miles from the source of the hazard. During missile flight operations the area would include not only the launch and intended impact zones but also all locations along the flight corridor. Additionally, the area would include the path of the HEL from the aircraft to the target and the footprint of the reflected laser energy from the target.

Accident Scenarios. In addition to the health and safety issues in routine operation at the Home Base and test ranges, the possibility of accidents must also be considered. This FEIS focuses on worst-case accident scenarios. The accidents would result from an improbable hazardous event that has the potential for high consequences. The accident analysis would provide the basis for evaluating local procedures and response plans to respond to these types of accidents. The accident scenarios that would be analyzed are those involving the release of the chemicals used in the PDRR ABL activities. Appendix C presents the accident scenarios analysis. The results of the analysis are included in Chapter 3 for the relevant environmental attributes at each location.

Regulatory Compliance. The principal federal statute regulating the safety of workers and the public is the *Occupational Safety and Health Act* (OSHA) (29 USC § 651). The Air Force provides additional guidance to protect personnel from occupational deaths, injuries, or illnesses through the Air Force Occupational and Environmental Safety, Fire Prevention, and Health (AFOSH) Program (AFI 91-301).

OSHA has developed standards to promote a safe working environment. The standards establish general environmental controls, including personal protective equipment, wherever necessary by reason of hazards, process, or environment. Exposure limits for noise, ionizing and non-ionizing radiation, and toxic and hazardous substances have been established as well as requirements for handling and storing compressed gases and flammable liquids. The Act also provides standards for emergency response to releases of hazardous chemicals and hazardous wastes.

The Air Force complies with the intent of standards from the Department of Labor, OSHA, EPA and DOT by directly referencing the applicable standards or incorporating the standards into AFOSH standards, technical orders, or directives. Listed below are some of the AFOSH standards that would be applicable to the PDRR ABL Phase activities.

AFOSH STD	TITLE
48-8	Controlling Exposure to Hazardous Materials
48-19	Hazardous Noise Program
48-22	Occupational Exposure to Hazardous Chemicals in Laboratories
91-5	Welding, Cutting, and Brazing
91-25	Confined Spaces
91-119	Process Safety Management (PSM) of Highly Hazardous Chemicals
127-31	Personal Protective Equipment
127-32	Emergency Shower and Eyewash Units
127-43	Flammable & Combustible Liquids
127-44	Safety Color Coding, Labeling, and Marking for Piping Systems
127-45	Hazardous Energy Control and Mishap Prevention Signs and Tags
127-56	Fire Protection and Prevention
127-67	Liquid Nitrogen and Oxygen Safety
127-68	Chemical Safety
127-100	Aircraft Right Line—Ground Operations and Activities
161-10	Health Hazards Control for Laser Radiation
161-17	Standardized Occupational Health Program
161-20	Hearing Conservation Program
161-21	Hazard Communication

The HMTA (49 USC **§** 1801) is also a key consideration in the assessment of impacts to safety. HMTA is intended to protect the nation from risks to life and property associated with the transportation of hazardous materials in commerce. The transportation of hazardous materials is also subject to transportation regulations, including handling, labeling, and routing requirements, under the California Vehicle Code, Sections 32000-32005.

The *Radiation Control for Health and Safety Act of 1968* (42 USC **§** 263b) provides for the protection of public health from radiation emissions of electronic products. Provisions of the Act call for minimizing the emissions from, and the exposure of the public to, unnecessary electronic product radiation. The Act addresses television, microwave, x-ray, accelerator, and laser products as well as products generating intense magnetic fields.

Lasers normally must meet the Food and Drug Administration's (FDA) Laser Performance Standard (21 CFR **§§** 1040.10-1040.11), which is based on the American National Standards Institute Z136.1, *Standard for Safe Use of Lasers*, unless they meet the exemption defined in MIL-STD-1425A **§** 1.3.2. The FDA Commissioner has exempted military laser products from those provisions of the FDA Standard where compliance would hinder mission fulfillment during actual combat or combat training operations or when the laser product is classified in the interest of national security (FDA Exemption No. 76 EL-0l DoD). For laser products procured under this exemption, MIL-STD-1425A defines safety design requirements.

3.0.9 LAND USE

Definition. Land may be used for residential, industrial, commercial, agricultural, recreational, military, and numerous other purposes. Some sites may have special land-use patterns that could result in testing restrictions. Specialized land uses may include restricted airspaces, radio transmission areas, bombing/missile ranges, and wildlife preserves.

Approach to Defining Environmental Setting. The region of influence for land use is highly dependent upon existing land-use patterns in the vicinity of the activity. Land-use plans, patterns, and policies of the military installations and surrounding public and private areas must be analyzed to ensure that all actions are consistent and compatible with existing and proposed land uses. For activities that could affect surrounding land-use patterns, the region of influence would be determined by changes in noise levels, increases in air emissions, added potential for hazardous material releases or accidents, falling test debris, changes in recreational use of lands, aesthetic/visual changes, and changes in land availability.

Regulatory Compliance. Land-use decisions affecting federally owned lands such as national parks, forests, seashores, wild and scenic rivers, and wilderness areas are all federally regulated. Furthermore, Executive Order 12372, *Intergovernmental Review of Federal Programs*, indirectly requires federal land-use decisions to be compatible with local standards.

The *Coastal Zone Management Act* (CZMA) of 1972 (16 USC **§** 1451) requires that a Coastal Consistency Determination be submitted by the USAF for proposed actions within the coastal zone. The Coastal Consistency Determination is coordinated with the California Coastal Commission under the authority of the CZMA and Chapter 3 of the *California Coastal Act* (California Public Resource Code **§** 30200). PDRR ABL Phase activities would also be affected by the various local land-use plans.

3.0.10 NOISE

Definition. The characteristics of sound include parameters such as amplitude, frequency, and duration. Sound can vary over an extremely large range of amplitudes (Table 3.0-4). The decibel (dB), a logarithmic unit that accounts for the large variations in amplitude, is the accepted standard unit for the measurement of sound. Different sounds may have different frequency contents. Sound levels that incorporate frequency dependent amplitude adjustments established by the American National Standards Institute (American National Standards Institute, 1983) are called weighted sound levels.

Subjective tests indicate that human response to noises is not only a function of the maximum level, but also the duration of the signal and its temporal variation. Significant evidence indicates that two signals with equal sound energy will produce the same subjective response. For example, a noise with a constant level of 85 dB occurring for ten minutes would be judged equally as annoying as an 82 dB noise signal for 20 minutes, i.e., one-half the energy lasting for twice the time period. Noises that occur during nighttime hours are also judged more annoying or intrusive than those occurring during the day.

Noise is usually defined as sound that is undesirable because it interferes with speech communications and hearing, intense enough to damage hearing, or otherwise annoying. Noise levels often change with time; therefore, to compare levels over different time periods, several descriptors were developed that take into account this time-varying nature. Two common descriptors include the annual average day-night sound level (L_{dn}) and maximum sound level (L_{max}). These descriptors are used to assess and correlate the various effects of noise on humans and animals, including land-use compatibility, sleep interference, annoyance, hearing loss, speech interference, and startle effects.

Noise can be divided into two additional categories impulsive and nonimpulsive, based on the duration of the sound. Impulsive noises are of short duration lasting less than a few seconds but having large amplitudes. Examples of impulsive noise include sonic booms, blasts, missile launches, and artillery operations. Nonimpulsive noises are of longer duration and typically do not have very large amplitudes.

When measuring *typical* sources of noise (such as transportation or equipment noises) to determine its effects on a human population, the American National Standards Institute uses a frequency-weighted number (dBA) which accounts for the frequency response of the human ear (EPA, 1982; Kryter, 1985). However, when high-intensity, impulsive noise is evaluated to determine its effects on a human population, a different frequency response weighting is used (dBC) so that the low-frequency effects of the noise are considered. The low-frequency content of impulsive noise contributes to effects such as window rattle that influence people's perception of the noise.

Table 3.0-4. Approximate Decibel Levels for Various Common Noise Sources

Noise Level (dBA)	Common Noise Levels	
	Indoor	**Outdoor**
100 - 110	Rock band Inside New York subway	Jet 300 in (1,000 ft) overhead
90 -100	Food blender 0.9 in (3 ft) away	Gas lawnmower 0.9 m (3 ft) away
80-90	Garbage disposal 0.9 in (3 fi) away	Diesel truck 15 m (50 ft) away Noisy urban daytime
70 - 80	Shouting 0.9 in (3 ft) away Vacuum cleaner 3 in (10 ft) away	Gas lawnmower 30 m (100 ft) away
60 - 70	Normal speech at 0.9 m (3 ft)	Commercial area heavy traffic 90 m (300 ft) away
50 - 60	Large business office Dishwasher next room	
40 - 50	Small theater (background) Large conference room (background)	Quiet urban nighttime
30 - 40	Library	Quiet suburban nighttime
20 - 30	Bedroom at night	Quiet rural nighttime
10 - 20	Broadcast and recording studio (background)	Rustling leaves
0 - 10	Threshold of hearing	
Source: Adapted from Acentech, 1990		

Approach to Defining Environmental Setting. PDRR ABL activities have the potential to add additional noise sources to the environment and thus affect local human and animal populations. The impacts from additional noise level sources depends upon the relative increase in noise levels that are produced from the proposed activities.

To provide a context for comparison of the new acoustical impacts, the existing acoustical environment must be described in terms of existing noise sources, sound level measurements that are available for the region of influence, and the range of sound levels typical of the land uses in the region of influence.

Federal agencies operating airfields are required to work with local, regional, state and other federal officials on compatible land use planning (OMB FMC 75-2). The USAF developed the Air Installation Compatible Use Zone Program (AICUZ) to implement the requirements of OMB FMC 75-2. One of the requirements of the AICUZ program is to analyze the affect of noise from airfield operations on the surrounding community. Land areas exposed to aircraft operations that affect public health, safety, or welfare are defined as being within the 65 dB CNEL (see Appendix A) noise contour (AFI 32-7063).

AICUZ noise studies develop noise contours by using aircraft operational and maintenance data. The contours plotted are for 65, 70, 75, and 80-plus dBs CNEL for AICUZ maps. These plots represent an average of the noise generated by all airfield operations and maintenance activities over an entire year. The AICUZ maps can be used as a baseline for background noise levels. Note, since AICUZ studies are for airfield noises, they are not applicable to missile launches at test ranges.

Missile launch locations are typically in remote locations, far away from personnel and other artificial sources of noises. The primary source of background noises at the test ranges would be the wind. Vandenberg AFB and San Nicolas Island would have the ocean as an additional source of background noise.

Regulatory Compliance. The *Federal Noise Control Act* (42 USC **§** 4901) provides the basis for the EPA to encourage the development of state and local noise control programs, and directs federal agencies to comply with local community noise statutes. The Act also directs federal agencies to carry out programs in a manner that minimizes noise impacts on public health and welfare.

No legally established national standards exist for noise outside of the work environment. The EPA guideline recommends a day/night average sound level of 55 dB to protect the public from the effects of broad band environmental noise in typically quiet outdoor and residential areas. The guideline is intended to protect against activity interference and annoyance. To protect against hearing loss in the general population from nonimpulsive noise, the EPA guideline recommends an equivalent sound level of 70 dB or less (L_{eq} of 70) over a 40-year period.

The land-use compatibility guidelines used as criteria in AFI 32-7063 specify an outdoor day/night average sound level of 65 dB as acceptable for all land uses. Somewhat higher noise levels may be acceptable for residential areas, if a proper degree of building noise insulation is included in the structures. Zones with a DNL less than 65 dB are classified as acceptable for noise-sensitive uses such as housing, schools, and medical facilities. Zones with DNLs up to 75 dB are acceptable for uses such as recreational areas, while flight line operations and industrial work areas can have DNLs up to 80 dB.

The *OSHA Act of 1970* (Public Law 91-596) was established to “assure safe and healthy working conditions for working men and women.” It delegated implementation and enforcement of the law to the OSHA of the U.S. Department of Labor. Title 29 CFR **§** 1910.95 pertains to the protection of workers from potentially hazardous occupational noise exposure. OSHA regulations establish a maximum noise level of 90 A-weighted decibels (dBA) for a continuous 8-hour exposure during a working day and higher sound levels for shorter exposure time (Table 3.0-5). Occupational noise exposure is limited for USAF activities to 85 dBA for 8 hours or equivalent exposure times (AFOSH STD 48-19). Above this limit, hearing protection is required. Both the OSHA and AFOSH limits are for an “average" exposure during an entire work day but for short periods of time the noise exposure can be significantly higher. Protection against the effects of noise exposure must be provided when sound levels exceed those in AFOSH STD 48-19. Under OSHA regulations, exposure to impulse or impact noise should never exceed a 140-dB peak sound-pressure level.

Table 3.0-5. Permissible Noise Exposures

Duration (hours per day)	Sound Level dBA Slow Response
8	90
6	92
4	95
3	97
2	100
1-1.5	102
1	105
.5	110
0.25 or less	115
Exposure to impulsive or impact noise should not exceed 140-dB sound-pressure level. Source: 29 CFR § 1910.95, Table G-16.	

3.0.11 RECREATION AND VISUAL RESOURCES

Definition. Recreation resources are considered to be outdoor recreational activities that take place away from home, and address natural features and man-made facilities that are designated available for public recreational use. Visual resources are those man-made or natural features that can be seen. The elements are described in terms of their visual quality within a physiographic region. The value and importance of these elements are described relative to the region rather than with a dissimilar landscape.

Approach to Defining Environmental Setting. It is important to consider the type of users, the amount of use, public interest, and viewer expectations when defining the environmental setting for recreational and visual resources. These factors determine the sensitivity of a landscape to change (USFS, 1973). The setting for recreational resources should be defined differently for the Home Base and the test range locations. At the Home Bases, analysis of the recreational resources can be limited to the immediate surroundings where the PDRR ABL Phase activities would take place. At the test ranges, the potential region of influence is much greater. Drones, balloons, and missiles may impact nearby primitive and semi-primitive areas in the mountains and deserts surrounding the inland ranges and beach and ocean recreational areas near the coastal ranges.

Regulatory Compliance. The visual quality of many areas is protected indirectly by regulations under a variety of statutes. For example, the *Federal Land Policy and Management Act* (43 USC **§** 1701) establishes a federal policy that public lands are to be managed in a manner that protects scenic values. The CAAA (Public Law 101-549) establishes a policy that air quality impacts from new sources must be assessed on visibility in Class I areas (natural parks and wilderness areas).

3.0.12 INFRASTRUCTURE AND TRANSPORTATION

Definition. Infrastructure refers to facilities and systems that provide power, water, wastewater treatment, and collection and disposal of solid waste to the installation and surrounding local communities. Transportation addresses the conditions and capacities of the methods (i.e., air, road, rail, and water) of moving personnel and materials within and into the DoD installations where PDRR ABL Phase activities would take place. Since all the PDRR ABL Phase activities would use existing facilities on DoD installations, the environmental analysis is limited to existing capacities and conditions on the DoD installations. No new infrastructure system projects would be initiated and there would be no expansion of the existing system.

Approach to Defining Environmental Setting. For both infrastructure and transportation systems, a similar method of analysis is used. The existing systems would be examined to determine their current conditions and capacities. PDRR ABL Phase activities would be examined to determine the estimated impact on each system and the significance of the impact.

Regulatory Compliance. The PDRR ABL program does not include any new, or changes to existing infrastructure or transportation systems. Therefore, the analysis of infrastructure and transportation systems is limited to a sufficiency determination (i.e., would the existing systems support the PDRR ABL activities or would improvement/expansion be required?). This type of analysis is not regulated by any level of government. If changes to any system are required, then additional environmental analysis would be necessary. This documentation would include the federal, state, county, and city regulations governing the specific system.

3.0.13 SOCIOECONOMICS

Definition. Socioeconomic resources are the demographic, social, and economic assets of a community or other area under study. The demographic, social, and economic conditions within a community are strongly interrelated. For example, an influx of large numbers of new workers in a community can overtax available housing and lead to an increase in the cost of housing. The housing situation could, in turn, change the demographic profile and social conditions in the community and lead to increases in divorce and crime rates. Those conditions would increase the demand for community services.

Maximum personnel requirements during the PDRR ABL development and test programs would be approximately 200 military and civilian personnel relocated for 18 months to one of two Home Base communities under consideration. That relatively short-term addition of 200 workers to the employed population of either Home Base community would be a small proportional increase to the existing workforce. The ten temporary personnel anticipated at the test ranges would rotate into those areas for very brief periods. Accordingly, the descriptions of the socioeconomic resources at the Home Base and test range communities under consideration in this FEIS focus on those demographic and economic characteristics that illustrate the minimal socioeconomic impacts that can reasonably be anticipated.

Approach to Defining Environmental Setting. Socioeconomic environments are customarily defined as the counties or portion of counties in which 90 percent or more of a site's employees reside. A geographic area defined in this manner is commonly referred to as the socioeconomic region of influence. The region of influence for an impacted community is fundamentally important to the analysis because it defines the area in which changes in population, employment, commuting patterns, earnings, and housing demand would be assessed.

Regulatory Compliance. Although any socioeconomic impacts resulting from the PDRR ABL activities would not be subject to review by any known federal, state, or local regulations, the National Environmental Policy Act (NEPA) requires that the analysis be made and any impacts be reported in the FEIS.

3.0.14 ENVIRONMENTAL JUSTICE

Definition. The basic goal of environmental justice is to ensure fair treatment of people of all races, cultures and economic situations with regard to the implementation and enforcement of environmental laws and regulations and federal policies and programs. Executive Order 12898, *Federal Action to*

Address Environmental Justice in Minority Populations and Low Income Populations, and the accompanying memorandum require that federal agencies develop strategies for protecting minority and low-income populations from disproportionate and adverse effects of federal programs and activities. The Order is "intended to promote non-discrimination in Federal programs substantially affecting human health and the environment" (Executive Order 12898).

Approach to Defining Environmental Setting. This FEIS examines the various impacts of the PDRR ABL Phase to determine if any impact from the activities would be experienced disproportionately and adversely by minority or low-income communities within geographic areas in which the PDRR activities would occur. Each resource area addressed in this FEIS has been scrutinized from an environmental justice perspective. Thus, for example, if significant levels of air pollution resulted from the PDRR ABL Phase, the question, from the environmental justice perspective, would be whether this pollution would disproportionately and adversely impact areas in which minority and/or low-income populations reside in proportions greater than in the general population.

Environmental justice analyses for the two Home Base alternatives under consideration are necessary parts of this FEIS given the number of personnel, time duration, and toxic materials associated with Home Base activities. However, the sites under consideration for the Diagnostic Test Range and Expanded-Area Test Range activities of the PDRR ABL Phase would only be impacted by small numbers of test flights over short periods of time. Given the limited scope and duration of Diagnostic and Expanded-Area Range activities and the sparsely populated areas in which these activities would occur, environmental justice analyses would be deemed unnecessary for the activities associated with the test ranges.

Regulatory Compliance. Executive Order 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low Income Populations,* directs federal agencies to examine the impacts of their programs on minority and low-income persons and develop strategies to protect those populations from disproportionately high and adverse human health or environmental effects.

3.1 EDWARDS AIR FORCE BASE (PREFERRED HOME BASE)

Edwards AEB is the preferred Home Base for conducting PDRR ABL Phase activities. Section 3.1 discusses specific affected environment and environmental consequences by environmental attribute at Edwards AFB.

3.1.1 COMMUNITY SETTING

Background. The military first began operating at the Muroc, California site in 1933, when the Army Air Corps sent an advance party to design and maintain a bombing range. At the outbreak of World War II, the south end of a dry lake located in the area was used for training fighter pilots and bomber crews. The site was designated Muroc AFB in February 1948 and became Edwards AFB in December 1949 in honor of Captain Glen Edwards, who was killed during a performance test of an experimental jet bomber. The Air Force Flight Test Center (AFFTC) was activated at Edwards AFB in June 1951, and its mission was to flight-test aircraft, operate special test facilities, and provide facilities for contractors and other government agencies. The AFFTC continues its test mission today, provides support functions to the NASA Space Shuttle Program, and serves as a secondary landing site for all space shuttle flights.

Host organizations at Edwards AFB are the AFFTC, the 95th Air Base Wing, the 412th Test Wing, and Detachment 5 of the Air Force Operational Test and Evaluation Center. Major associated organizations include the NASA Dryden Flight Research Center, the NASA Jet Propulsion Laboratory, and the Rocket Propulsion Directorate of Phillips Laboratory. Approximately 13,600 military and civilian personnel are employed on the Base, and between 90,000 and 100,000 takeoffs and landings occur each year in support of Edwards' host and tenant organizations.

Location. Edwards AFB is located in Southern California, in the Antelope Valley region of the western Mojave Desert, approximately 161 km (100 mi) northeast of Los Angeles and 129 km (80 mi) southeast of Bakersfield, and approximately 40 km (25 mi) northeast of Lancaster. Rosamond is located approximately 32 km (20 mi) west of the proposed project and Boron is approximately 18 km (11 mi) northeast of the project site (Figure 3.1-1). The base encompasses an area of approximately 1,220 square km (470 square mi) and includes portions of Kern, Los Angeles, and San Bernardino counties. The closest city is Lancaster, approximately 73 km (45 mi) from Edwards AFB.

Facilities. The proposed PDRR ABL Complex would be located at the Birk Right Test Facility (Birk) on South Base, which is operated by AFFTC. Because the Birk was the home of the B-2 flight test program, existing state-of-the-art facilities are already in place to support flight testing and data collection and analysis. Figure 3.1-2 shows the location of Birk and the proposed PDRR ABL Complex at Edwards AEB.

Affected Environment

Edwards AFB is partially sheltered from maritime weather by mountains on the west and south. Two mountain passes, Tehachapi to the west and Soledad Canyon Pass to the south, allow movement of air from the San Joaquin Valley and the Los Angeles Air Basin into the western Mojave Desert. Two large, dry lakes on the Base, Rogers Lake and Rosamond Lake, contain 170 square km (65 square mi) of usable aircraft landing area, including runways up to 12km (7.5 mi) long (Figure 3.1-1). This geographic setting results in the local vegetation consisting of desert-adapted species. The dominant plant communities include Joshua tree woodlands and several desert scrub communities.

Figure 3.1-1

Weather patterns in the area are characterized by large seasonal temperature differences. Summertime temperatures are extremely high and reach an annual mean maximum of 98°F in July. The lowest mean maximum temperature, 56°F, occurs in January. Daily temperature ranges are 30 to 40 degrees in July and 20 to 30 degrees in January. The relative humidity in the summer averages 30 to 50 percent in the early morning and 10 to 20 percent during the late afternoon. The average annual precipitation is less than 5 inches, with about 80 percent occurring between November and March. The average annual wind speed is approximately 4 m/sec (8 mph). The highest average wind speeds (about 4 m/sec, or 9 mph) occur during the spring and summer. Wind speeds are lowest during the winter, with calm winds occurring about 37 percent of the time. The prevailing wind direction throughout the year is west-southwest to southwest.

3.1.2 AIR QUALITY

A general discussion of air quality and all applicable laws and regulations is provided in Section 3.0.2. Section 3.7 provides information on the upper atmosphere and atmospheric chemistry as they could be affected by the PDRR ABL Phase.

Region of Influence

All activities associated with the PDRR ABL Phase would take place at the Birk flight Test Facility (Birk), which is located in Kern County. The Mojave Desert Air Quality Management District administers the air quality program in the area where PDRR ABL Phase activities would take place. Edwards AFB is located in the northwest portion of the Mojave Desert Air Basin (Figure 3.1-3). This air basin consists of East Kern County and portions of San Bernardino and Los Angeles Counties.

Figure 3.1-1

Figure 3.1-3

Affected Environment

Eastern Kern County is in attainment for all federal National Ambient Air Quality Standards (NAAQS) with the exception of ozone. In 1990, all of Kern County was designated a serious nonattainment area for ozone based on ambient air quality monitoring data collected in the Bakersfield area in western Kern County, not in the eastern part of the county where Edwards AFB is located. In 1992, the San Joaquin Valley portion of western Kern County was made a part of the San Joaquin Valley Unified Air Pollution Control District (APCD), and the Kern County APCD was given jurisdiction over the eastern part of the county. In 1996, the Mojave Desert Air Basin was formed from the northern half of the former Southeast Desert Air Basin, including the area of Edwards AFB, under the administration of the Mojave Desert Air Quality Management District. Even though eastern Kern County is in a different air basin and is partially separated from the Bakersfield area (a major source of pollutants) by the Tehachapi Mountains, it remains classified as serious ozone nonattainment status. Ozone-transport studies have shown that infrequent ozone exceedences in the Edwards AFB area were caused by "overwhelming transport" from the San Joaquin Valley through the Tehachapi Pass and, to a lesser extent, from the South Coast Air Basin (Los Angeles) through mountain passes (USAF, 1995c). Because Kern County has been classified as serious nonattainment status, new stationary sources are limited to an emissions rate of 50 tons per year of volatile organic compounds (VOCs) and nitrogen oxides (NO_x).

In a letter to EPA Region IX, dated 4 December 1995, the California Air Resources Board requested that the desert portion of Kern County be removed from the San Joaquin Valley ozone nonattainment area. The Board stated that the desert area within Kern County is topographically separated from the valley by a mountain range, that there are no major or fast growing population centers, and that local emissions are not sufficient to cause violations of the federal standards. EPA Region IX denied the California Air Resources Board's request. However, EPA stated that they would work with DoD to ensure new missons are not impacted by the improper designation.

The closest air monitoring station is located in Mojave, California (Poole Street). Table 3.1-1 shows the 1993 and 1994 summary of air quality data for ozone at the monitoring station. Kern County's 1996 and 1999 projected VOC and NO_x emissions are shown in Table 3.1-2. The emission rates in this table are a part of the California State Implementation Plan and would allow Kern County to meet the air quality goals in 1999.

Table 3.1-1. Ozone Emissions Data for 1993 to 1995, Kern County, California

Site	Maximum Daily 1-hour concentration (ppm)			Number of days Exceeding NAAQS		
	1993[1]	**1994**	**1995**	**1993**	**1994**	**1995**
Mojave Pool Street	0.13	0.12	0.12	1	0	0
Station opened September 1993 Source: California Environmental Protection Agency, 1993: 1994: 1995						

Table 3.1-2. Projected VOC and Nitrogen Oxide Emissions for Kern County, California (tons/yr)

Year	VOC	NO_x
1996	4,964	14,231
1999	5,001	14,812
Source: Kern County, 1994		

Table 3.1-3 shows the projected VOC and NO_x emissions for Edwards AFB in 1999. The stationary sources that are a part of the Title V permit are shown in this table. Title V of the CAAA requires that states implement an air-operating permit program. The objective of this permit is to consolidate emitting processes for a facility into a single permit. Additionally, this table shows the Kern County APCD allowed growth limit for Edwards AEB. As can be seen, the projected emissions for 1999 are much less than the 1990 emissions inventory and less than half of the limit (43 percent for VOC and 19 percent for NO_x) set by Kern County APCD. Edwards AFB has the capacity to accept new programs emitting a total of 760 tons per year of VOCs and 2,662 tons per year of NO_x.

Environmental Consequences

The PDRR ABL activities that have the potential to affect air quality at Edwards AFB would be the temporary assignment of 200 personnel, facility modifications, and operations in support of the ground and flight tests of the weapon system. These activities occur over a four-year period, 1999 to 2002, and each year the activities and resultant emissions would be slightly different. The analysis and details of each year's activities and emissions are shown in Attachment 1 to Appendix E. The emission sources from the PDRR ABL activities can be grouped into two major categories, stationary and mobile. The mobile sources include vehicles, construction activities, and aircraft operations. The only stationary source is the ground pressure recovery system.

Table 3.1-3. Projected 1999 VOC and Nitrogen Oxide Emissions for Edwards Air Force Base, California (tons/yr)

Source Aircraft		VOC	NO_x
Mobile	Aircraft	350.7	302.4
	Vehicles	84.0	232.5
	Total	434.7	534.9
Stationary (Title V Permitted)	ICE	0.1	1.9
	External Combustion	0.7	16.5
	Total	6.1	58.8
Miscellaneous Sources	NASA	11.0	5.9
	AGE	5.9	42.5
	ICE	0.7	0.9
	External Combustion	1.3	11.3
	Other	123.1	8.5
	Total	136.7	28.7
TOTAL for 1999		**577.5**	**622.4**
Emissions Inventory for 1990		1,168.0	2,956.5
Kern County APCD Allowed Limit for Edwards AFB in 1999		1,340.0	3,285.0

AGE Aerospace Ground Equipment ICE Internal Combustion Enginge
Source: U.S. Air Force, 1995c

The ground pressure recovery system emissions would need to be included in Edward AFB's Title V permit. The single PDRR ABL Phase activity that could potentially be classified as a major source is the ground pressure recovery system. The sources of potential pollutant emissions in the ground pressure recovery system are the generation of high-temperature water to produce steam and exhaust products from laser operations during ground tests that are exhausted from the laser weapon system into the ground pressure recovery system. The analysis in Appendix E shows that the maximum yearly emissions from the generation of the high-temperature water used in the ground pressure recovery system are estimated to be much less than 1 ton per year for the 30 ground tests of the high-energy laser (HEL). This analysis assumes that natural gas would be used to generate the high-temperature water. The natural gas generator may have to be fitted with pollution control devices designed as Lowest Available Emission Rate Technology or Best Available Control Technology (40 CFR **§** 52). The exhaust from the laser during ground tests would be scrubbed in the ground pressure recovery system prior to release into the atmosphere. The emissions would consist of mainly carbon dioxide and water vapor, with small amounts of chlorine and iodine (10 pounds of chlorine and 3 pounds of iodine for each test; see Table 2-5). The chlorine emission would need to be included in the Base's hazardous air pollutants inventory. Analysis of the PRS's exhaust cloud indicates that there would be no associated health issues. The PRS emission level falls well below the 50-tons-per-year definition of a new major source in a serious (ozone) nonattainment area. Since the ground pressure recovery system's boiler would be less than five million BTU in size, no construction permits would be required.

The maximum yearly estimated emissions from the aerospace ground equipment used to support the test program are approximately 0.6 ton of VOCs and 0.4 ton of NO_x in 2002 (Appendix E).

The total emissions from all sources are included in the results of the preliminary conformity analysis (Appendix E) presented in Table 3.1-4. The maximum annual level of criteria pollutant emissions in any year would be less than 8 tons of VOCs and less than 14 tons of NO_x. These emission levels would be much less than the 760 tons of VOCs and 2,662 tons of NO_x emissions projected for 1999 Edwards AEB growth. As can be seen in the table, the total yearly estimated emissions are also much less than the *de minimus* levels as established in 40 CFR **§** 93.153 (b).

Table 3.1-4. Estimated Emissions (tons/yr) from PDRR ABL Phase Activities

Year	VOC	NO_x
1999	2.85	2.98
2000	7.80	4.09
2001	7.41	4.31
2002	5.65	13.29
de minimus level	50	50

3.1.3 AIRSPACE

A general discussion of airspace and all applicable laws and regulations is provided in Section 3.0.3.

Region of Influence

The airspace region of influence is the R-2508 Airspace Complex (Figure 3.1-4) and the standard FAA flight corridors from Edwards AEB to WSMR and from Edwards AFB to the Western Range.

Figure 3.1-4

Affected Environment

The R-2508 Airspace Complex is over 51,800 square km (20,000 square mi) in area and is reserved for military and civilian research. Military traffic operating in the R-2508 Complex Military Operating Areas, restricted airspace, and air-traffic-control-assigned airspace is not segregated. Pilots receive radar traffic advisories and operate under visual flight rules to avoid other aircraft. When the airspace is activated for military use, activities are scheduled with the R-2508 Central Coordinating Facility located at Edwards AFB. When the airspace is not needed for DoD activities, it is released to the FAA for joint use. For fiscal year 1995, approximately 62,600 air operations occurred at Edwards AFB airfields (USAF, 1995f).

Environmental Consequences

The ABL aircraft would takeoff and land on existing runways at Edwards AFB. The aircraft may be scheduled for up to 30 flights and would require no special takeoff or landing procedures. R-2508 Complex airspace occupied during takeoffs and landings would be managed the same as other military and civil aircraft. The airspace occupied by the aircraft in flight to the test ranges would be managed as other aircraft by the appropriate Air Route Traffic Control Center. Evacuation of airspace and rerouting of aircraft in airspace would not be necessary, and therefore, no impacts to airspace would occur.

3.1.4 BIOLOGICAL RESOURCES

A general discussion of biological resources and all applicable laws and regulations is provided in Section 3.0.4.

Region of Influence

The region of influence is the environment within the confines of the Edwards AFB fence line. However, the primary focus of activities is in the area immediately surrounding the Birk Flight Test Facility (Figure 3.1-5).

Affected Environment

Threatened and Endangered Plant Species. No state or federally listed plant species are found at Edwards AEB. This status may be revised, based on on-going consultation with the USFWS.

Threatened and Endangered Animal Species. Four species of threatened or endangered wildlife are found at Edwards AFB (Table 3.1-5). This table may be revised, based on on-going consultation with the USFWS. Of these, the desert tortoise is most likely to be found in the vicinity of the Birk Flight Test Facility.

Table 3.1-5. Threatened and Endangered Animal Species Known or Expected to Occur at Edwards Air Force Base, California

Common Name	Scientific Name	State Status	Federal Status
Mohave ground squirrel	*Spermophilus mohavensis*	T	—
Bald eagle	*Haliaeetus leucocephalus*	E	T
American peregrine falcon	*Falco peregrinus anatum*	E	E
Desert tortoise	*Gopherus agassizil*	T	T
E Endangered T Threatened			

Figure 3.1-5

Environmental Consequences

Home Base activities that could affect biological resources at the Birk Flight Test Facility include construction related to the modification of existing structures and routine operation of the pressure recovery system. Construction would result in a temporary increase in noise levels ranging from 70 to nearly 90 dBA at 15 m (50 ft) (see Table 3.1-6) and would be less than the current noise levels generated by the operation of the adjacent military runways. Construction may also result in the disruption of vegetation in the vicinity of the facility. Only previously disturbed areas would be impacted. Such areas consist of bare soil or landscaped lawn.

According to the *Biological Opinion for Routine Operations and Facility Construction Within the Cantonment Areas of Main and South Bases, Edwards Air Force Base, California* (USFWS, 1991), surveys detected few signs of desert tortoises in the southern portion of Edwards AFB. The construction work conducted during the PDRR phase of the ABL program would be confined to the fenced-in portion of the Birk Flight Test Facility. In accordance with the procedures defined in the Biological Opinion, a survey of the area would be conducted prior to the initiation of the construction effort. Any desert tortoises found in this industrial area would be returned to the wild or to captivity, depending on the suspected origin of the animal. The Biological Opinion defines the "reasonable and prudent" measures necessary and appropriate to minimize the incidental taking of desert tortoises by routine operations and facility construction activities.

The pressure recovery system operation would result in peak noise levels of approximately 120 dB at 30 m (100 ft) for a maximum of five minutes per test. This noise level is similar to that generated by the current operation of the adjacent runway, and would be relatively infrequent. Therefore, the proposed operation activities would not impact the local biological resources significantly over current conditions.

The emissions from the pressure recovery system, composed primarily of water vapor and carbon dioxide, would be released at least 30 ft above the tarmac. This vapor cloud would quickly rise, owing to its high temperature (>100°C) and dissipate in the atmosphere. In addition to water vapor and carbon dioxide, approximately 10 pounds of chlorine would be released during each system test, resulting in brief (approximately 1 minute) peak releases greater than 1,000 ppm of chlorine that, within 2 minutes, would dissipate to less than 3 ppm. This cloud would present a temporary hazard to birds flying over the release stack. However, the steam cloud lasts for several minutes with the chlorine release occurring in the middle of this time span. It is likely that the noise, heat, and visual cues of the cloud would prevent birds from being exposed to the chlorine release.

3.1.5 GEOLOGY, SOILS, AND WATER RESOURCES

A general discussion of geology, soils and water resources and all applicable laws and regulations is provided in Section 3.0.5.

Region of Influence

The region of influence on geology, soils, and water resources is the area immediately surrounding and including the Birk Eight Test Facility at Edwards AFB South Base (Figure 3.1-2).

Affected Environment

Geology. Edwards AFB is located in the western Mojave Desert physiographic province (Figure 3.1-6). The general geology at the Base consists of a basement complex of predominantly granitic bedrock overlain by young, unconsolidated sediments (USAF, 1994b). The granite occupies rugged hill country over approximately 25 percent of the surface at Edwards AEB. The remaining 75 percent of the surface

consists of low-lying areas underlain by gravels, sands, silts, and clays. The sediments consist mostly of alluvial (water-transported) materials that slope gently away from the bedrock hills, and lacustrine (lakedeposited) materials that characterize the flat, low-lying beds of two large dry lakes (Rogers Lake and Rosamond Lake) (Figure 3.1-7). South Base, which includes the Birk Flight Test Facility, is located just beyond the western perimeter of Rogers Lake and lies mostly on alluvial sands, silts, and clays.

Two major faults have been active near Edwards AFB during the past 10,000 years (USAF, 1994c). The San Andreas fault is located approximately 20km (12 mi) southwest of the southwest corner of the Base, and the Garlock fault is located approximately 20 km (12 mi) northwest of the northwest corner of the Base (Figure 3.1-6). Numerous less active faults are present, three of which are located near the region of influence (Figure 3.1-8). The Mirage Valley and Blake Ranch faults project generally to the northwest from surface exposures south of the Base, and possibly extend under the alluvium of Rogers Lake. The faults appear to intersect approximately 2.5 km (1.5 mi) south of the region of influence. The continued northwest extension of the Blake Ranch fault passes approximately 2 km (1.2 mi) to the southwest of the region of influence.

Figure 3.1-6

Figure 3.1-7

Figure 3.1-8

Seismicity. Edwards AFB is considered to have relatively low seismicity. Four earthquakes with Richter scale magnitudes of between 3.0 and 4.4 are known to have occurred on or adjacent to the Base, the nearest of which was on the east side of Rogers Lake, approximately 6.5 km (4 mi) east of the region of influence (USAF, 1994a; Figure 3.1-8). Because no faults on the Base have been active during the past 200 years, and because all faults on the Base are considered inactive (USAF, 1994a), the primary seismic hazard is from earthquakes generated along the major San Andreas and Garlock faults (Figure 3.1-6). Movement along these faults could cause widespread, serious damage on and around Edwards AFB (USAF, 1994b). The Uniform Building Code designates seismic risk zones in the United States ranging from Zone 0 (no risk) to Zone 4 (faults known to be capable of causing major damage). Edwards AFB is located within Zone 4, indicating that stringent construction measures are necessary to minimize damage to man-made structures in the event of an earthquake.

Soils. A preliminary soil survey report for portions of Edwards AFB was published by the Soil Conservation Service in 1988 (USDA, 1988). The report includes descriptions of soil types that would be expected at South Base, but provides no map. Soil contamination in the vicinity of the Birk Complex is discussed below in conjunction with water resources under Water Quality.

Most of the soils are loams (mixtures of clay, silt and sand), sandy loams, and loamy sands. The lakebed areas consist of similar soils with important silt and clay components. Soil thickness generally varies from 0.3 to 1.5 m (1 to 5 ft). Nearly all soils are moderately to highly susceptible to wind erosion if disturbed by construction or vehicular traffic, but most are suitable for building-site development (USDA, 1988).

Surface Water. Edwards AFB is located in the Antelope Valley portion of the western Mojave Desert (Figure 3.1-6). The valley is a drainage basin of approximately 6,215-square km (2,400-square mi) that is essentially closed with respect to surface drainage and groundwater movement. The average annual rainfall at Edwards AFB is approximately 5 inches, most of which falls from November through March. Surface drainage is toward the lakebeds, although most surface water evaporates or infiltrates the ground before reaching the lower elevations. No perennial streams are located on or near the Base. However, a few permanent ponds and springs exist, and some serve as biological wetlands which support hydrophytic plants, water fowl and shorebirds (USAF, 1994a). However, none of these wetlands occurs within the area of influence. The lakebeds are generally dry, but the lakebeds and stream channels are subject to significant flooding after heavy, seasonal storms that occur approximately every five to seven years. Because the lakebeds are composed of impermeable clay, water infiltrates slowly into the subsurface, and as a result, water reaching the lakebeds usually remains at the surface until it evaporates.

Thunderstorms intense enough to cause flash floods occur in the vicinity of Edwards AFB on the average of five days per year (USAF, 1993a). Natural and man-made surface waters drain northeast from the Birk Flight Test Facility into the adjacent Rogers Lake. The record flood height (100-year flood) of 694.2m (2,277.4 ft) above mean sea level (AMSL) was measured at Rogers Lake on 23 January 1943. A flood of similar magnitude would inundate most of the South Base runways (Figure 3.1-2), but would be below the approximate 697 m (2,288 ft) elevation in the region of influence at the Birk Complex (USAF, 1994b).

Groundwater. Groundwater constitutes the only significant water supply at Edwards AFB. Groundwater occurs in a shallow (“principal”) and a deep aquifer, separated by a relatively continuous horizontal layer of low-permeability lacustrine (lake) sediments (Figure 3.1-9). The region of influence is located within the Lancaster Groundwater Basin and the Birk Eight Test Facility is located in the northern portion of the Lancaster Basin.

Figure 3.1-9

The water table at South Base varies from approximately 12 to 34 m (40 to 110 ft) below ground surface, and groundwater flows to the southeast toward Rogers Lake. The upper aquifer is recharged in the mountainous southern and western areas, and the upper aquifer recharges the lower aquifer near the foothills of the mountains. Little recharge occurs in the dry lakes because the low permeability lakebed sediments prevents significant downward infiltration. Pockets of perched groundwater have been identified across most of the Lancaster Basin within the lake deposits and in younger alluvium, both of which lie above the principal aquifer at depths between 10 and 15 m (35 and 50 ft) below ground surface (USAF, 1991a).

Much of the water used on the Base is obtained from local groundwater wellfields (South Base, South Track, and North Base). Groundwater withdrawals in the Lancaster Basin have exceeded recharge since before 1930, and have caused a long-term decline in the water table of the upper aquifer in the South Base area averaging approximately 0.6 m (2 ft) per year.

Overdraft of groundwater sources has caused subsidence of the land on and around Edwards AFB. Land subsidence of approximately 12.2 cm (4.8 inches) was recorded between 1961 and 1989 in the South Base area. An ongoing program is in place to monitor the extent and magnitude of future subsidence at Edwards AFB. Efforts have been made to reduce the demand on groundwater and to control lakebed subsidence by obtaining water from the Antelope Valley/East Kern Water District Agency.

Water Quality. Prior to the enactment of current environmental laws and regulations, groundwater quality at Edwards AFB was affected by aircraft flight and service operations, pipeline and underground storage-tank leaks, groundwater overdraft, and landfill-runoff leakage through fissures. This type of contamination is consistent with that found in industrial facilities throughout the United States. Groundwater quality was also affected by high levels of naturally occurring chemical constituents. Older abandoned wells have affected groundwater quality by cross-contamination from the upper to the lower aquifer (Figure 3.1-9). Several instances of groundwater contamination resulting from leaks and spills of organic solvents, fuels, and other potentially hazardous materials have been documented (USAF, 1991 b), and the Base has been placed on the National Priorities List for remediation in compliance with the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA, also known as Superfund) (42 USC § 9601).

Edwards AFB initiated an Installation Restoration Program (IRP) in the 1980s for the remedial investigation and cleanup of soils and groundwater at sites contaminated by past activities. Under the IRP, the sites with the worst contamination have been cleaned up first, with the goal being to remediate all sites on the Base at some future date. Assessments and remediation are ongoing and several sites have been closed. South Base and the Birk Complex are located within the boundaries of Operable Unit 2 (OU-2), which was defined by the IRP (Figure 3.1-1). The IRP investigations at OU-2 began in 1993, and five facilities of concern, one leaking underground pipeline, and 26 underground petroleum storage tanks, have been identified and are being investigated or remediated. Soil and water sampling have determined that the contamination within Birk is limited to a few small areas on the west and southwest sides of the Complex. A remediation system will be installed in the southwest corner of Birk in September 1996 and will operate for seven years. Additional remediation systems may be needed in the future for some of the smaller pockets of contamination at the site.

Environmental Consequences

Impacts on geology, soils, and water resources from construction activities would be minimal. All construction/modification activities would take place at or immediately adjacent to existing facilities. Little to no additional pavement would be created and stormwater runoff into adjacent drainages should, therefore, not increase. All existing facilities at the Birk Complex are located outside of the 100-year floodplain, and no additional facilities would be constructed within the 100-year floodplain where they could be affected by flood waters.

Accidental releases of hazardous materials would be contained in accordance with the site-specific spill plan for Edwards AFB, with minimal impact on geology, soils, and water quality. Gaseous materials accidentally released would vent to the atmosphere and would not impact geology, soils, or water quality.

Operation of the PRS would result in the generation of a cloud of mainly carbon dioxide and water, with small amounts of chlorine and iodine (10 pounds of chlorine and 3 pounds of iodine per test; see Table 2-5). However, because of the inert nature of the gases and small amounts of chemicals in the exhausts, they would not have any impact on geology, soils, or water resources.

The spent laser fuels from laser operations would be neutralized with hydrochloric acid, and the resultant wastewater considered a designated waste that would be managed, treated, or disposed of, therefore preventing the release of contamination that could spread to geology, soil, or water resources. Releases of spent laser fuels prior to neutralization would be contained in accordance with the Edwards AFB site-specific spill plan, with minimal impact on soils, or water quality.

In the event of an accident on the runway causing rupture of fuel bladders on the B747, the impact on geology, soil, or water resources from the jet fuels and firefighting materials would be similar to the impact from any other aircraft accident. The liquid and solid laser fuels released in an accident on the runway would be consumed in a fire or contained, and the gaseous laser fuels would either burn or vent to the atmosphere where they would not impact on geology, soils, or water quality.

Operation of the aircraft auxiliary power generator and aircraft ground-support equipment for six hours per week for 19 weeks, during the system integration/test phase of the project, would result in air emissions of criteria pollutants that could be deposited in soils where they might subsequently affect water resources. However, the activity would be taking place at an operating airport facility, and the total project emissions would add negligible quantities of pollutants to the atmosphere. No impact would be expected on water resources because permanent surface water bodies are nonexistent in the area, the soils would serve as a buffer without degrading the soil quality, and none of the limited amount of criteria pollutants emitted would reach the water table.

IRP activities are ongoing at South Base (including the Birk Flight Test Facility) to clean up contamination in soils and shallow groundwater. However, all production wells in the vicinity of the Birk Flight Test Facility are pumping water from deeper portions of the aquifer, where no contamination has been found. ABL PDRR activities will be conducted to insure that there is no impact to the IRP site.

3.1.6 CULTURAL RESOURCES

A general discussion of cultural and paleontological resources and all applicable laws and regulations is provided in Section 3.0.6.

Region of Influence

The region of influence for cultural resources includes all of Edwards AFB with emphasis on the South Base area surrounding the Birk facility.

Affected Environment

Cultural Resources. Cultural resources for Edwards AFB are categorized into two main groups, sensitive and nonsensitive. Sensitive sites are those which are of primary importance to cultural resource records. Efforts are made to protect the sites from damage, vandalism, and destruction. The sites generally have archeological significance with respect to historic or prehistoric time periods. An example of a sensitive site is an area which may contain hundreds of lithic flakes, tools, bone fragments and/or structures indicating an established settlement pattern. Nonsensitive sites are those sites which do not have much bearing on the past. An example of this is a small lithic scatter site composed of only a few lithic flakes or a hearth. Nonsensitive sites generally do not have any significant diagnostic features to associate them to the surrounding area or a particular time frame. These sites are usually recorded with the understanding they do not hold particularly informative data about the past.

The northeastern hilly portion of the Base at elevations greater than 2,500 feet AMSL are considered nonsensitive with respect to cultural resources. Sensitivity increases westward and is the highest in the low-lying areas surrounding the dry lakes as shown in Figure 3.1-1 (Norwood, 1995). Approximately 580 recorded prehistoric sites are scattered throughout Edwards AFB (USAF, 1994b). Site types include villages, temporary camps, rock shelters, milling stations, lithic scatters, quarries, cremations, rock features, hearths, rock art, and bone scatters. Nonsensitive prehistoric sites consisting of lithic flakes have been found within several hundred yards of the Birk facility perimeter but are not of significant importance to the archeological record of Edwards AFB. Approximately 30 sites have been formally evaluated for eligibility to the National Register of Historic Places, and of those, 12 have been recommended by the Base Historic Preservation Officer.

Approximately 800 historic sites have been recorded on Edwards AFB. Sites include trash scatters, townsites, homesteads, agricultural features, ranching features, mines and mining camps, railroad-related features, military structures, and historic rock features. The northern portion of Rogers Lake has been designated as a National Historic Landmark under the Man-In-Space theme (USAF, 1994b; 1994d). Other structures and facilities also are or may be eligible under the World War II or Man-in-Space themes (Norwood, 1995). Cultural resources near the Birk facility are of historic and prehistoric nature some of which are from the World War II era.

No sensitive Native American sites have been recorded, although it is conceivable that they may exist (Norwood, 1995). Nonsensitive sites derived from archeological surveys and consultations with Native Americans include burials, cremations, rock features, and rock art (USAF, 1994b).

Paleontological Resources. Approximately 550 paleontological finds, some as old as 21 million years, have been documented on the Base. Fossils consisting of silicified roots of reeds, plants, and palm have been located in limestone outcrops approximately 8 km (5 mi) southeast of Kramer Junction. Fossils younger than 1.8 million years old have been found in alluvial sediments associated with Rosamond Lake and Rogers Lake areas. Core samples taken from lake material deposited originally in Lake Thompson during the Ice Age reveal microfossils (ostracods) dating back as much as 1.8 to 0.45 million years ago (USAF, 1994d). Lake Thompson is thought to have encompassed Rosamond and Rogers Lakes and smaller lakes in between during the Ice Age (Norwood, 1995). A few isolated fragments of fossil tooth and bone, presumably from large mammals such as extinct camel, horse, mammoth, mastodon, and antelope, have also been discovered in lake and alluvial deposits.

Environmental Consequences

There are no foreseen impacts to cultural resources on Edwards AFB resulting from activity proposed by the PDRR ABL Phase at this time. Any modifications to Birk would occur inside the building or on previously disturbed land outside the facility. Any new specific plans that involve building construction or land disturbing activity including off-road activity require review by the Base Historic Preservation Officer.

3.1.7 HAZARDOUS MATERIALS AND WASTE

A general discussion of hazardous materials and waste and all applicable laws and regulations is provided in Section 3.0.7.

Region of Influence

The region of influence for hazardous materials/hazardous waste includes all of Edwards AFB with the main focus near the Birk Right Test Facility (Figure 3.1-10).

Affected Environment

Edwards AFB currently receives and stores approximately 30,000 items classified as hazardous materials (Tolley, 1995), including a variety of flammable aviation fuels and the chemicals that would be used on the PDRR ABL. Other hazardous materials utilized and stored at Edwards AFB include other petroleum products, cleaning solvents, corrosive liquids, paint products, hydraulic fluids, munitions, and compressed gases. Hazardous materials are stored and used in connection with flight line aircraft maintenance, base support, research and development laboratories, and various industrial operations, including aircraft repair and modification, aerospace ground equipment repair and maintenance, vehicle maintenance, painting, and insect and weed control (USAF, 1994b).

Figure 3.1-10

compressed gases. Hazardous materials are stored and used in connection with flight line aircraft maintenance, base support, research and development laboratories, and various industrial operations, including aircraft repair and modification, aerospace ground equipment repair and maintenance, vehicle maintenance, painting, and insect and weed control (USAF, 1994b).

Edwards AFB has improved the management and reduced the amount of hazardous materials used and hazardous waste generated by establishing strict usage procedures. Base Supply operates on the Hazardous Material Pharmacy Concept, which allows Base tenants to obtain hazardous materials from assigned distribution centers. The hazardous material pharmacy works with users to identify the exact quantity required and any appropriate material substitutes. Any unopened containers of materials are returned to the Pharmacy for subsequent use. Leftover portions are disposed of in accordance with Edwards AFB Hazardous Waste Management Plan. The Depot Maintenance Hazardous Material Management System database stores information on the issue and use of hazardous materials. All users of hazardous materials, including contractors, are required to maintain strict inventories of all hazardous materials, reduce large-quantity bench stocks, and use less hazardous or nonhazardous materials in place of those currently used when possible.

A wide variety of hazardous waste is generated at Edwards AFB in connection with flight line, base support, research and development laboratories, and various industrial operations. Hazardous waste generated at the Base is collected by generators at Initial Accumulation Points. The wastes are stored in approved containers, labeled in accordance with state requirements and managed by trained personnel, following procedures detailed in the Edwards AFB Hazardous Waste Management Plan. These materials are either picked up by the Environmental Management Office or are delivered to Accumulation Sites. Within 90 days, the materials are turned over to the Conforming Storage Facility for off-base disposal, which must be accomplished within one year from the accumulation start date. Edwards AFB currently maintains a RCRA Part B permit allowing on-site storage at the Conforming Storage Facility.

Preparedness and spill prevention actions are accomplished in advance to ensure that an accidental fire, explosion, or unplanned release of hazardous material is prevented if possible or mitigated and properly cleaned up. Spill prevention, control, and countermeasure procedures, methods, and equipment have been developed and implemented for Edwards AFB hazardous material/waste storage and transfer areas.

Before any ABL activities commence at Edwards AFB, a sequence of requirements must be completed to ensure safe operations and proper hazardous material/ waste management. The entire ABL PDRR Phase must be designed from a systems safety aspect using MIL-STD 882C, or a similar method, to reduce risks. The systems safety standard requires that the facilities be engineered to be as safe as possible and that procedures are developed to insure safe operations. For example, chlorine sensors are required in the test area to warn workers of a chlorine leak. The contractor is required to implement an extensive hazardous material management program using the National Aerospace Standard 411 as a guide. The main focus of this program is to provide a mechanism to incorporate pollution prevention throughout the lifecycle of the weapon system. Base environmental management, bioenvironmental engineers (industrial hygiene) and base safety offices coordinate and approve all actions.

Environmental Consequences

PDRR ABL Home Base activities that would use and generate hazardous materials/waste include modifications to existing facilities, operation and maintenance of the aircraft, and operation of the laser. All activities would have a low impact on the environment.

Hazardous Materials. Usage of hazardous materials during the PDRR ABL Phase can be grouped into three categories: construction activities, aircraft operations and maintenance, and laser operations. Under the current operating scenario, the DOT-licensed transporter would bring hazardous materials directly to one of the three chemical storage areas to minimize any potential mishaps during transport.

Construction activities would require the use of materials similar to those currently used on base, such as cutting oil, acetylene, and various paint products and would not introduce new hazardous materials. These hazardous materials would be managed with standard procedures.

Aircraft operation and maintenance would require the use of aviation fuel, solvents, detergents, paints, coolants, hydraulic fluids and other petroleum products. Ongoing pollution prevention efforts would minimize the use of hazardous waste in these operations. A minimal amount of maintenance would be required on the aircraft because of the limited number of flights and because of the decision to have major maintenance accomplished at a contractor facility currently performing this type of maintenance. These hazardous materials are similar, if not exact, to the types and quantities currently used by military aircraft at Edwards AFB. The materials are routinely handled by base personnel and would be used in accordance with base procedures.

COIL operations, for both ground and flight tests, would require the proper storage, transport, and handling of several hazardous materials. The COIL chemicals are listed in Table 2-2 in Chapter 2 with approximate quantities necessary in pounds. All of the chemicals listed within this table have been previously used at Edwards AFB, and chemical handling procedures exist to minimize occupational exposures to these chemicals. Guiding principles include proper containment, separation of incompatible and reactive chemicals, worker warning and protection systems where necessary, and handling procedures to ensure safe operations. All personnel would receive extensive Hazard Communication (HAZCOM) training before working in the area, and many would be required to receive the Hazardous Waste and Emergency Response (HAZWOPER) training.

Three locations are proposed for storage of the chemicals used to support the weapon system: 1) the existing conventional chemical storage area, 2) the existing unconventional storage area (rocket and missile fuels), and 3) the Birk Flight Test Facility (Figure 3.1-10). The existing storage facilities have the capability to store the chemicals safely and within Occupational Safety and Health Act (OSHA) requirements (29 USC § 651; 29 CER § 1910). The selected storage facility would incorporate the major elements of OSHA regulations (Safety and Health Program, Hazard Communication, Medical Surveillance Program, Decontamination Program Material Handling Program, Training Program) into the facility's operation. The Spill Prevention Control and Countermeasures Plan in the *Edwards Air Force Base Spill Response Plan* would be used for guidance in the design and operation of hazardous materials storage facilities, spill response equipment, emergency communications, and coordination with local authorities and agencies (USAF, 1995d). Key elements that would be incorporated into the facility operation include material compatibility, security, leak detection and monitoring, spill control, personnel training, and specific spill-prevention mechanisms. If required, any vehicles used to transport hazardous materials would also be equipped and supplied for responding to spills. The existing hazardous material handling capabilities at Edwards AFB would be adequate to ensure that all chemicals planned for the PDRR ABL activities are handled safely and in accordance with applicable regulatory procedures.

Hazardous Waste. PDRR ABL operations would not generate substantial quantities of hazardous waste, but information on specific quantities are not available at this time. Additional environmental analysis and documentation will be prepared when those quantities have been identified. The possibilities include paint wastes and solvent-contaminated rags from facility modifications and aircraft maintenance. The COIL, in general, only produces a wastewater that is discussed in Section 3.1.5. Any hazardous waste that is generated would be properly managed at the existing Initial Accumulation Point at the Birk Complex. Operation requirements and personnel training requirements would be followed by all PDRR ABL Phase personnel.

3.1.8 HEALTH AND SAFETY

A general discussion of health and safety and all applicable laws and regulations is provided in Section 3.0.8.

Region of Influence

PDRR ABL Phase activities at Edwards AFB would comprise three types of activities: 1) operations at Birk Flight Test Facility, 2) weapon-system integration, and 3) aircraft flight line operations. Each activity would pose its own set of health and safety issues. Potential impacts would be limited to workers performing operations at Birk and its vicinity and the use of the main runway.

Affected Environment

All USAF-related operations are required to comply with the Air Force Occupational Safety and Health (AFOSH) Program. Program requirements are specified in USAF Instruction 91-301 and AFMC Supplement ito AFT 9 1-301, both titled *Air Force Occupational and Environmental Safety, Fire Prevention, and Health (AFOSH) Program.*

The primary directive governing the AFOSH is USAF Policy Directive 48-1, *Aerospace Medical Program.* The Ground Safety Department at Edwards AFB uses AFOSH standards to ensure that all USAF workplaces meet federal safety and health requirements. The Base has prepared several local instructions that pertain to laser hazard control, radio-frequency radiation-hazard control, and ionizing radiation safety and various other health areas. Edwards AFB instructions implement AFOSH Standard 161-10 and outline the policies, responsibilities, and procedures for laser operations at Edwards AFB. All Base organizations that procure, construct, operate, and maintain laser systems must comply with these publications.

MIL-STD 882C, *System Safety Program Requirements,* is the DoD standard for all USAF systems and facilities. System safety is the application of engineering and management principles, criteria, and techniques to optimize all aspects of safety within the constraints of operational effectiveness, time, and cost throughout all phases of the system life cycle.

Environmental Consequences

The following PDRR ABL Phase activities have the potential for an impact on the health and safety of workers and the public.

Facility Modification and Equipment Installation. Existing facilities would be modified to make the Complex suitable for PDRR ABL Phase needs. Construction activities would produce the usual physical hazards such as noise, electrical, heavy-moving equipment and machinery, welding, and earth-moving and digging activities. Ultimately, it would be the prime construction contractor's responsibility under OSHA (29 CFR §§ 1910 and 1926) to ensure the safety of their workers, USAF workers, and the public during the entire construction phase. The contract for the construction effort should include a requirement for a system safety analysis of the proposed modifications based on the requirements of MIL-STD 882C before construction plans for the modification are finalized.

The USAF would periodically monitor construction projects to determine compliance with OSHA standards. Public access would not be allowed during the construction phase; therefore, the construction project should have no impact on the public since it would be confined to Edwards AFB. Once the facility modifications and equipment installations have been designed to meet the system requirements, operational procedures would be developed and hazards would be minimized. The anticipated amounts of extremely hazardous substances stored at Home Base would be below the threshold quantities for the NESHAPS (40 CFR § 68). Since this threshold would not be surpassed, emergency response planning by the PDRR ABL Phase would not be required. Table C-5 in Appendix C shows the quantities of chemicals stored at the Home Base and the reporting and planning threshold levels.

System Integration and Ground Test. The systems-integration and ground-testing activities would produce chemical, electrical, noise, and laser-radiation hazards. The USAF has extensive experience with each hazard presented by proposed Home Base operations, and the impact of these hazards would be minimal on the health and safety of workers and the public. The USAF has been safely operating a similar Chemical Oxygen Iodine Laser (COIL) facility at Kirtland AFB since 1979. The COIL facility at Kirtland AFB operates a smaller laser system, tens of kilowatt power range compared to the megawatt range of the PDRR ABL system. However, the same chemicals and similar processes are used at both facilities. Workers are trained and qualified to handle the chemicals and lasing activities. In addition, before any system integration would occur, all systems, subsystems, and components would be analyzed for hazards under the requirements of MIL-STD 882C. A laser safety program would be developed, documented, and implemented in accordance with AFOSH Standard 161-10.

The ground-testing activities would require a safety review to ensure test hazards such as exposure to chemicals, electrical circuits and equipment, noise, and laser radiation are identified and appropriately controlled (AFMC Supplement 1 to AFI91-202). During ground testing of the COIL, the laser beam emitted from the airborne laser would be enclosed within a beam containment system at all times and would be terminated in a beam dump. The contractor's design of the containment system would require a system safety analysis in accordance with MIL-STD 882C and would be reviewed prior to initial testing. With all these mechanisms in place to ensure the protection of workers and the public, no significant impact is anticipated with the system integration and ground testing activities.

Flight Test. The only flight-related activity would be takeoff and landing in support of range testing at other installations. Flight-line operations may include laser fueling, ground handling, servicing, inspection, and maintenance of the aircraft, engine runup, and vehicle and support equipment, refueling, and aircraft washing. No testing would occur in the skies over Edwards AFB. Various hazards would be encountered because of the nature of the work and the equipment and tools involved. Other factors would involve the variety of weather conditions, the different conditions during day and night operations, mission priorities, and the various aircraft systems.

Aircraft and flight-line areas pose potential fire and explosion hazards. Gasoline, jet fuel, cleaning solvents, oxygen, and powered support equipment are typical of these hazards. Falls while working on the aircraft on the ground pose another potential source of injury to personnel. Engine operation may expose personnel to dangers such as burns, high-noise levels, jet blast from the exhaust, and suction from intakes. Electrical shock, ranging from the minor shock of static electricity to electrocution from ground power units, would be another potential hazard. Fuels, cleaning compounds, and fire-extinguishing agents can be toxic and harmful when inhaled or contact is made with the skin.

To reduce the impact of these hazards on workers, qualified aircraft ground crews would perform all aircraft operations, and they would be fully evaluated for compliance with AFOSH Standard 127-100, *Aircraft Flight Line—Ground Operations and Activities.* AFFTC Safety would review these operations for compliance initially and then periodically inspect for implementation thereafter. With all these mechanisms in place to ensure the protection of workers, the public, and equipment, no significant impact would be anticipated with the proposed PDRR ABL flight-line operations at Edwards AFB.

Accidents. Accidents involving the release of chemicals used to support the operation of the laser-weapon system during ground and flight tests would have the possibility of affecting the health and safety of workers in the vicinity of the release. Detailed analysis of an aircraft accident involving the release of the chemicals onboard the aircraft and the accidental release of chemicals on the ground during transfer operations are presented in Appendix C. The accidental release of chemicals inside the aircraft during flight would not endanger the fight crew because the preliminary design of the aircraft includes a pressure bulkhead that separates the chemical storage area from the flight crew area. The preliminary design also includes air monitoring sensors to provide notification in the event of a leak and a system to vent chemicals overboard.

The safety record of the B747 indicates that the probability of a catastrophic accident that would be violent enough to rupture the onboard chemical storage tanks is less than one in a million flights (Boeing, 1996). The safety record also showed that nearly 80 percent of all catastrophic accidents for large aircraft occur during either the takeoff or landing portions of the flight. At Edwards AFB, the crash site would probably be on one of the dry lake beds, well away from any personnel. The resulting fire from the crash would be of high intensity and for a short duration. The primary components in the plume generated by the fire would be nitrogen, carbon dioxide, water vapor, carbon monoxide, nitrogen oxide, argon (component of the air), and oxygen. There would be trace percentages (less than 0.05 percent) of hydrochloric acid, chlorine gas and other oxides of nitrogen. There are no toxic chemicals in the plume in sufficient concentrations to cause health problems. The plume would rapidly rise to above 10,000 feet and the chemicals would be dispersed before returning to ground level.

The accident scenario involves the release of one of the extremely hazardous substances during fuel transfer operations (between the supplier and the ground storage tanks or between the ground storage tanks and the aircraft storage tanks. This scenario assumes that 450 kg (1000 lbs) of the chemical would be released in a five-minute period. Analysis in Appendix C shows that workers in the immediate area would be exposed to concentrations above short-term exposure limits (ACGIH, 1995). A toxic cloud would form as the chemical is released into the atmosphere (chlorine or ammonia) or evaporates from a spill (hydrogen peroxide). Areas downwind of the release point would have to be evacuated. The size of the area that would be evacuated is dependent on the chemical and the wind velocity (see Tables C-7 through C-9 in Appendix C). Toxic corridors for ammonia, chlorine and hydrogen peroxide have short durations and should not pose health problems to personnel at the Main Base area.

USAF standard operating procedures and instructions require the development of prevention procedures and response plans as well as disaster preparedness operations plans. Edwards AFB has developed two plans to meet these requirements: *Spill Response Plan* (USAF, 1 995d) and *Disaster Preparedness Plan 32-1* (USAF, 1 995e). These plans include potential or actual aircraft accidents, weapons or hazardous materials incidents or accidents, and disasters resulting from acts of nature. Fire department, medical, bioenvironmental, safety, weather and other key personnel have been trained and have the necessary equipment to respond to accidents similar to those described above.

The transportation of any hazardous material is subject to both federal and state regulations, including handling, labeling, and routing requirements. National Highway Traffic Safety Administration statistics show that the fatal accident rate for large trucks is one accident in every 37 million miles, making it a very rare occurrence. The likelihood of any impact on human health and safety from the transportation of hazardous materials to the various sites is insignificant.

3.1.9 LAND USE

A general discussion of land use and all applicable laws and regulations is provided in Section 3.0.9.

Region of Influence

The region of influence would cover the area immediately surrounding and including Hangar 151 in the Birk Flight Test Facility at the Edwards AFB South Base (Figure 3.1-1 1). Hangar 151 would house the aircraft and PDRR ABL Phase personnel. The space to the east and northeast of the hangar would be used for aircraft parking and support facilities. Aircraft flights and operation of the PRS could also influence a broader area, including runways on South Base, the Main Base administrative area north of the site, and the Base housing area northwest of the site.

Land Use of Adjacent Jurisdiction. Edwards AFB is becoming progressively surrounded to the north, west, and south by residential developments. The four communities of Lancaster, Palmdale, Rosamond, and California City constitute the major urbanized areas adjacent to the Base and figure most prominently in regional land use. The three smaller communities of North Edwards, Boron, and Desert Lake are located on the northern border of the Base. Land between these communities is sparsely populated, undeveloped high desert. Land to the west of the Base boundary consists primarily of undeveloped private holdings, with scattered areas of government-owned properties. Large areas of undeveloped, hilly, desert land exist to the south and east of the Base, and areas of agricultural, industrial, mining, and undeveloped land are interspersed with the residential communities.

Land Use at Edwards AFB. A total of 17 land-use categories have been defined for Edwards AFB in their ongoing base development program (USAF, 1994a). The densely developed areas of the Base include the facilities on the west shore of Rogers Lake, and the Phillips Laboratory research and development area in the northeastern part of the Base. The undeveloped areas of Edwards AFB include lakebed landing areas and range areas. Facilities on the west shore include a family housing area and an industrial/airfield area. The South Base facilities are located on the southern end of the west shore and consist primarily of runways and other installations associated with the Air Force Flight Test Center (AFFTC). The Birk Complex at South Base includes facilities currently used for aircraft parking, storage, and maintenance, in addition to offices and support facilities. The area is surrounded primarily by runways, taxiways, aprons, aircraft clearance zones, aircraft operations and maintenance areas, and engineering test facilities. The Base housing complex is located approximately 5 km (3 mi) northwest of the Birk Complex, and the Main Base administrative areas and flight lines are located approximately 3km (2mi) north.

Affected Environment

Land Use Plans and Policies. The Base Comprehensive Plan, which is currently being developed, includes a list of selected development proposals for the Base and the time period in which they will be implemented (USAF, 1994c). Edwards AFB has conducted an Air Installation Compatible Use Zone (AICUZ) study that is used as a guide to minimize development incompatible with aviation operations in areas on and adjacent to airfields on the Base. The AICUZ land-use recommendations were based on land uses compatible with exposure to aircraft noise and with safety considerations. Recommended compatible land uses were derived from data on noise contours (noise zones) and air pollution zones. These zones were delineated specifically for Edwards AFB using operational information derived from the Base mission.

Figure 3.1-11

Edwards AFB officials maintain an open dialogue with city and county planning offices to ensure that off-base land is zoned compatibly with Base missions. Edwards AFB officials must also identify proposals and plans that could affect the AFFTC mission and provide formal comments to the appropriate agencies.

Existing Edwards AFB assets are evaluated and strategies for their protection are developed. For example, because some instrumentation requires installation on elevated land, all hilltops and ridgelines are considered potential instrumentation sites. To ensure that an unobstructed line of sight is available for safely testing aircraft, large expanses of airspace and ground are required to be free of obstructions. New facility proposals are reviewed to ensure that mission requirements are not compromised.

Edwards AFB initiated an Installation Restoration Program (IRP) in the 1980s for the remedial investigation and cleanup of soils and groundwater at sites contaminated by past activities. The TRP serves as the basis for response actions at USAF installations under the provisions of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 (42 USC § 9601). Under the IRP, the sites with the worst contamination have been cleaned up first, with the goal being to remediate all sites on the Base at some future date. Assessments and remediation are ongoing and several sites have been closed. South Base and the Birk Complex are located within the boundaries of Operable Unit (OU-2), which was defined by the IRP (Figure 3.1-1). Site assessment and remediation activities are ongoing at OU-2. Although the presence of contamination does not necessarily mean that land uses may be altered, added precautions are required for activities at IRP sites to ensure that the contamination does not spread or impact human health and safety.

Environmental Consequences

Overall, the PDRR ABL Phase activities would be consistent with the existing land-use plans and policies at Edwards AFB. Facility modification activities would take place at a previously-active research facility on previously disturbed land, at or adjacent to existing structures. As a result, land-use patterns (including visual and aesthetic resources) would not be changed as the result of the construction or renovation of research and hangar facilities. Soil contamination exists in the vicinity of the Birk Flight Test Facility and it is possible that contaminated soil could be disturbed during the excavation for some of the PDRR ABL Phase facilities. However, soil contamination near Birk is limited to small areas, and in the unlikely event that contaminated soils were encountered, the soils could be transported to a licensed facility. All construction workers would be hired locally, and no new residents would move to the area during the construction activity. As a result, construction workers and their families would not increase demand on existing wastewater treatment facilities and solid waste disposal sites.

Because all ground-based tests of the laser system would be enclosed and would not expose adjacent areas to laser light, no adverse impacts on land-use patterns would be expected from the propagation of laser light during research activities.

Operation of the PRS would result in the generation of a cloud of mainly carbon dioxide and water, with small amounts of chlorine and iodine (10 pounds of chlorine and 3 pounds of iodine for each test; see Table 2-5*)*. The cloud would dissipate within minutes of the PRS shutdown. The PRS exhausts by themselves would not pose a direct chemical hazard to humans, and the vapor cloud would be too small and short in duration to impact aircraft flight operations on the taxiways at South Base. The PRS exhausts therefore would not impact land-use patterns.

The PRS would create 120 dB of noise within a 30 m (100 ft) radius during operation. Although the noise level would be similar to that created by aircraft takeoffs, the duration of the noise during operation of the PRS would be longer, up to five minutes. However, the noise level would be reduced to below the level of a gas lawnmower at 30 m (100 ft) when it reaches the Main Base admistrative area 3 km (2 mi) north of the site and would not be a nuisance.

Transient noise from the B747 takeoffs for the PDRR ABL Phase would not alter land-use patterns of surrounding areas. The taxiways at South Base have been used extensively during testing of the B-2 aircraft. Noise levels from the B747 during takeoff would be comparable to the B-2 aircraft, tactical jets, and cargo and tanker aircraft that use the runway.

The AICUZ study for Edwards AFB considered safety issues associated with aircraft operations to determine compatible land uses around the airfields. The study determined that the administrative and housing facilities around the airfields are compatible with aircraft operations.

3.1.10 NOISE

A general discussion of noise and all applicable laws and regulations is provided in Section 3.0.10.

Region of Influence

The region of influence for noise exposure at Edwards AFB is defined as the Birk Flight Test Facility (Figure 3.1-12).

Affected Environment

The Air Installation Compatible Use Zone (AICUZ) report for Edwards AFB contains a description of the impact area around the installation, outlines the location of runway clear zones, evaluates aircraft accident potential, and measures noise levels (USAF, 1994a).

Figure 3.1-12

The noise sources within Edwards AFB are from military aircraft operating primarily from the Air Force Flight Test Center AFFTC and highway and off-road vehicle activity. During most days of the year, noise levels from on- and off-road vehicles are generally low. However, levels along main roadways significantly increase during some heavy visitor-use times (USAF, 1994b). The Birk Flight Test Facility is on the southeast side of the runway over 2.4 km (1.5 mi) from the Main Base complex. The Birk Flight Test Facility is between the 65- and 75-dB AICUZ noise contour lines.

Environmental Consequences

The sources of loud noise generated by PDRR ABL activities are the facility renovation and equipment installation work in 1999, operation of the ground pressure recovery system and B747 engine runups in 2000 and 2001, and B747 engine runups and flight operations in 2002.

The noise level of typical commercial/industrial construction ranges from 71 to 89 dB at 15 m (50 ft) from the boundary (Golden, 1979). Table 3.1-6 shows noise levels from typical construction equipment.

Table 3.1-6. Estimated Construction Noise Levels

Activity	Equipment	Noise Level at 15 m (dB)
Earthmoving	Heavy trucks, scraper, loader caterpillar	73 - 89
	Scraper, paver	80 - 89
Material Handling	Concrete mixer, concrete pump, crane	75 - 88
Stationary	Pumps, generators, compressors	76 - 80
Impact	Pneumatic tools	80 - 85
	Jack hammer	88
Other	Saw, vibrator	85 - 90
Source: Golden, 1979		

All of the equipment listed above is below the OSHA maximum noise level of 90 dB for a continuous 8-hour exposure (29 CER § 1910.95). Other construction equipment may be used which may exceed 90 dB for short periods of time. But, none of the facility modification and equipment installation activities would exceed the OSHA 8-hour exposure limits.

Assuming a continuous noise level of 80 dB at the Birk flight Test Facility during facility modifications and equipment installation, the noise level would reduce to less than 35 dB at the Main Base area on the west side of the runway. This sound level is equivalent to a quiet suburban nighttime environment.

The major sources of noise during system integration and ground testing would be the ground pressure recovery system and B747 engine runups. The noise level at the Birk Flight Test Facility would increase on an intermittent basis, less than fifteen minutes several times per week during the test program.

The ground pressure recovery system would be operational only during the tests of the HEL weapons system. Currently, a maximum of 30 tests are anticipated for the HEL weapons system during the nine-month system integration and ground test phase of the program. The ground pressure recovery system is estimated to generate approximately 120 dB at 30 m (100 ft) for a period of 5 minutes during each test. However, the exact levels cannot be accurately predicted at this time since the design of the ground pressure recovery system has not been completed. The sound level from the ground pressure recovery system would reduce to less than 80 dB before it reaches the Main Base area. This would be within the OSHA limit for an 8-hour daily exposure. An 80-dB noise level is equivalent to a gas lawnmower at 30 m (100 ft). Since OSHA limits impulsive or impact noise to less than 140 dB and exposure to a continuous noise of 115 dB to less than 15 minutes (29 CFR § 1910.95), hearing protection would be required for personnel in the immediate vicinity (60 m or 200 ft) of the ground pressure recovery system during tests.

Noise levels for the B747 during ground tests and engine runup periods would be limited to 85 dB or less at 305 m (1,000 ft) depending on the power level setting of the engines (Boeing, 1993). The noise level from the B747 would be less than 65 dB when it reaches the Main Base area. Base housing is located 1.6 km (1 mi) beyond the Main Base area and noise levels would be reduced by an additional 5 dB (Rau and Wooten, 1980 and Thumann and Miller, 1986).

The major source of noise during flight testing would be the B747 engines. Since other B747 aircraft (NASA) already operate at Edwards AFB, the existing AICUZ study would not require modification.

3.1.11 RECREATION AND VISUAL RESOURCES

A general discussion of recreation and visual resources and all applicable laws and regulations is provided in Section 3.0.11.

Region of Influence

The region of influence for recreation and visual resources is defined as recreation, aesthetics, and public interest areas on the Base, including surrounding areas leased by the Base.

Affected Environment

Edwards AFB has large areas of land that are used for outdoor recreation (Figure 3.1-13). Off-road vehicle areas have been designated for mountain bicycles, all terrain vehicles, and off-road motorcycles in the Main Base area. Additional areas are set aside for horseback riding, and stables. Jogging trails and bicycle paths are located adjacent to the housing area, and a golf course and club are located to the south.

Based on the Bureau of Land Management (BLM) Visual Resource Management Program, scenic quality areas were determined for Edwards AFB. No areas of outstanding characteristics were located on the Base. The lakebeds, the more scenic and relatively undisturbed hills and ridges, the more dense Joshua tree woodlands, and Leuhman Ridge were determined to have some outstanding features as well as some features that are common to the physiographic region. Leuhman Ridge was included because, although it has been heavily disturbed and developed, its structures and activities hold a high degree of visual interest. North Base, South Base, Main Base, JPL, NASA, the housing area, and Phillips Laboratory (excluding the Leuhman Ridge area), were designated as heavily developed and/or extensively disturbed and lacking positive aesthetic attributes (USAF, 1994a). The remainder of the Base was determined to have features fairly common to the physiographic region.

Figure 3.1-13

Environmental Consequences

PDRR ABL Phase facility modification and ground-test activities would have a low impact on any recreation facility on Edwards AFB or the surrounding area. All modifications would occur to the existing hangar and surrounding buildings. Modification activities would not interrupt or prohibit the use of any recreation facility. Test activities would be limited to the hangar and its immediate area. No ground-test activities would extend beyond the PDRR ABL Complex, and, therefore, no effect on recreation facilities is expected. The launch and recovery of the PDRR ABL aircraft would not have an impact on recreation since an existing runway would be used.

During the 30- to 33-month period of the PDRR ABL Phase, 45 USAF and 93 contractor personnel would be new to the region of influence. The additional personnel would increase use of recreation facilities; however, overcrowding or overuse of any facility would not be expected. The increase in use would be adequately accommodated by the Base and would not result in the degradation of recreation services.

Modifications to the hangar and existing facilities would not impact the aesthetic value of the area where the PDRR ABL Complex would be located. The majority of the modifications would be within the hangar and surrounding facilities. Modifications to buildings that can be viewed by the general public would have an overall compatibility of appearance with existing facilities. The aesthetic environment outside the PDRR ABL Complex would also remain unaffected because all ground test activities would remain within the complex.

3.1.12 INFRASTRUCTURE AND TRANSPORTATION

A general discussion of infrastructure and transportation and all applicable laws and regulations is provided in Section 3.0.12.

Region of Influence

The region of influence for infrastructure and transportation is Edwards AFB and the immediate surrounding area (Figure 3.1-14).

Affected Environment

Electrical Power. Edwards AFB purchases electricity from Southern California Edison. Service is provided over a 1 15-kV transmission system. The 1 15-kV line enters the Base from the north, providing power to two substations in the North Base area, then continues on to the South Base area where it feeds a 25-MVA, 115/34kV substation. Power is distributed to the Main Base, South Base, and Phillips Laboratory areas at 34.4 kV. The 1 15-kV transmission line is capable of providing over 95-MVA while the current peak demand at Edwards AFB is less than 40 MVA. The Birk facility is serviced by two 5-MVA transformers.

Water System. Water is supplied from wells located on Base and is purchased from State Project water. Three well fields on the Base currently provide potable water: North Base, South Base, and South Track Well Fields. A study by the Corps of Engineers (USACE) Omaha District in 1992 reported that the maximum capacity of the potable water system was 8.4 million gallons per day (MGD). The majority of this water capacity is from the South Base and South Track Well Fields. In 1993, Edwards AFB began purchasing treated surface water from the Antelope Valley-East Kern County Water Agency.

Figure 3.1-14

The current agreement requires that Edwards AFB purchase a minimum of 2 MGD with a maximum of 4 MGD. Based on past well production records, the average daily water consumption on the Base has been approximately 4 MGD, a decrease in demand from the 4.6 MGD average between 1987 and 1991 reported in a USACE-Omaha District report.

Wastewater System. Edwards AFB has three separate wastewater treatment systems. Wastewater from sources on the Main and South Bases flows to the Main Base wastewater treatment plant located 7.2 km (4.5 mi) south of the Main Base on Country Road. This plant was built in 1952 and was designed to treat 1.5 MGD. The plant has been upgraded several times, with the last improvement occurring in the mid1980s. The plant is composed of a grit remover, a comminutor, primary clarifiers, a two-stage sludge anaerobic digester, and sludge drying beds. Sludge is transported to drying beds and the effluent from the primary settling tanks is pumped to five 50-acre evaporation ponds. The ponds are lined with native clay material, and the levees surrounding the ponds are stabilized. No discharge of effluent flows into a public water source. Recent studies indicate that the plant is treating an average of approximately 1.7 MGD, with peak flows of up to 2.3 MGD (USAF, 1994a). A new wastewater treatment plant is in the design/construction phase and would have a design capacity of 2.5 MGD.

The North Base and the Phillips Laboratory areas both utilize in-ground Imhoff tank systems, with the plants' effluent discharging directly into an evaporation pond. The North Base plant has a capacity of 0.02-MGD, and the Phillips Laboratory plant has a 0.05-MGD capacity.

Solid Waste Handling System. Collection of solid waste at Edwards AFB is accomplished through the use of private contractors. The waste is transported to the Main Base Landfill. The landfill is located 2 km (1.3 mi) north of the Base family housing area. The landfill is a permitted Class III landfill capable of accepting non-liquid and non-hazardous wastes including residential, construction/demolition, commercial, and industrial wastes. In July 1992, the California Regional Water Quality Control Board, Lahontan Region, issued tentative waste discharge requirements for the landfill. The waste discharge requirements defined the permitted operational area as containing 137 acres, which included 73 acres for disposal of waste. This waste discharge requirement limited the capacity of the landfill to 1.4 million cubic yards. Based on this restriction, the landfill will be filled within 20 years. However, with the isolated nature of Edwards AFB and its vast land resources, a sufficient number of suitable locations should be available for additional landfills.

Roads. The major roads near Edwards AFB are U.S. Highway 395 (US-395) and California State Highways 14 (SH-14) and SH-58. US-395 is an older two-lane road that runs along the eastern boundary of the Base. There is no significant access to the Base from US-395. California SH-58 parallels the northern boundary of the Base and connects Interstates 15 and 40 in the east and Interstate 5 and US-l0l in the west. SH-58 is a modem four-lane, divided highway except for 11 km (7 mi) of two-lane road and provides access to the Edwards AFB North Gate and to the Phillips Laboratory Complex. California SH-14 (Antelope Valley Freeway) parallels the western boundary of the Base and extends from south of Palmdale to Mojave as a modern four- and six-lane freeway. It intersects California SH-58 just south of Mojave. California SH-14 is the primary roadway connecting Edwards AFB to the greater Los Angeles area.

The principal roadway access to Edwards AFB is by way of Rosamond Boulevard from the west and north and Lancaster Boulevard/l2Oth Street East from the south. Rosamond Boulevard connects from California SH-14/Sierra Highway to the Main Base as a four-lane highway and arcs northward through the Main Base to connect to California SH-58 as a two-lane road about 0.8 km (0.5 mi) from the North Gate. The eastern portion of the Base may be reached from California SH-58 by Twenty Mule Team Road to Rich Road and Mercury Boulevard from the north and 140th Street East and Mercury Boulevard from the south. There is no improved access to the Main Base from the east.

Railroads. Two railroads are adjacent to Edwards AFB. The Southern Pacific line runs parallel to the Base's western boundary but does not provide service to the Base. Service is provided by the Atchison, Topeka, and Santa Fe Railroad from a line running parallel to the Base's northern boundary. Two rail spurs, one at Edwards Station and the other at Boron Station, connect to government-owned rail serving the Main Base and Phillips Laboratory.

The Main Base railroad spur consists of 0.08 km (0.05 mi) of 110-pound rail and 20 km (12.5 mi) of 90-pound rail extending from the Edwards Station south to the Main Base warehouse/supply area. Additional spurs from the warehouse spur serve the unconventional fuel storage area and the petroleum, lubricants, and oil-storage areas. The Main Base spur is used approximately once every three months for delivery of heavy or bulky equipment. This government-owned spur has deteriorated to the point that extensive maintenance and repair efforts would be required if used regularly to correct deficiencies such as rotted ties, loose spikes, dirty ballast, debris-filled flangeways, and gaping rail joints resulting from broken fishplate bolts.

Aircraft. Edwards AFB is served by 21 runways and landing areas, which consist of 3 paved runways, 18 unpaved runways that are painted onto the Rogers and Rosamond Lakes, and the remaining lakebed areas that are designated as emergency vehicular recovery landing sites. The Main Base paved runway is Runway 4-22, a southwest-northeast precision instrument, Class B runway that is 91 m (300 ft) wide and 4,570 m (14,995 ft) long. This runway is capable of handling heavy aircraft.

Six general aviation airports are located near Edwards AFB in Lancaster, Palmdale, Mojave, and Boron. However, the majority of personnel flying to and from Edwards AFB use one of the Greater Los Angeles Area airports.

Environmental Consequences

The PDRR ABL Phase would use existing facilities and infrastructure at Edwards AFB. The ABL Program would use facilities vacated by the B-2 Program at the Birk Flight Test Facility. These facilities would receive minor modifications. The maximum number of personnel supporting the PDRR ABL Phase at Edwards AFB would be approximately one-tenth of the maximum for the B-2 Program. The existing infrastructure and transportation systems at Edwards AFB have sufficient capacity to support the PDRR ABL Phase.

3.1.13 SOCIOECONOMICS

A general discussion of socioeconomics and all applicable laws and regulations is provided in Section 3.0.13.

Region of Influence

More than 90 percent of the military and civilian employees at Edwards AFB reside in the Antelope Valley area of southeastern Kern and northeastern Los Angeles Counties. The area is defined by subcounty areas known as Census County Divisions (CCDs). The East Kern and Tehachapi CCDs in Kern County cover the northern portion of the area in which Edwards AFB employees reside, and the South Antelope Valley and North Antelope Valley CCDs cover the southern portion of this area. Figure 3.1-15 depicts the CCDs in conjunction with Edwards AFB and several surrounding communities. Since any socioeconomic impacts from the PDRR ABL Phase would occur within the area defined by the four CCDs, it is considered the socioeconomic region of influence for this analysis.

Figure 3.1-15

Affected Environment

According to the U.S. Bureau of the Census, 347,676 persons were in the region of influence at the time of the 1990 Census. More recent estimates of the population for the region of influence are unavailable because estimates are not prepared for CCDs. However, according to the California State Data Center, the major communities within the area are growing at a rapid rate. Lancaster's estimated population in July 1995 was 118,457, for example, representing a 6.7 percent annual rate of growth since 1990. Palmdale's population has increased at 10.4 percent per annum since 1990, to an estimated total of 104,656 in mid-1995. California City has grown at 9.9 percent per year to a mid-1995 estimated total population of 888 (CASDC, 1996).

In 1990, nearly 165,001 persons 16 years of age and older (representing 66.6 percent) were in the labor force in the region of influence. Nearly 4,400 workers were Armed Forces personnel at Edwards AFB, and the remainder were civilians. Approximately 11,000 were unemployed at the time, representing 6.8 percent of the civilian labor force (DOC, 1990). More recent employment data are unavailable for the region of influence because labor force profiles are not developed for subcounty areas. However, recent employment information for the major communities in the region of influence is available. According to the state of California Employment Development Department, Lancaster's civilian labor force in February 1996 stood at 44,550, with 7.9 percent unemployed. Palmdale had a civilian labor force of 32,170, and 7.8 percent were unemployed. California City's unemployment rate was 13.7 percent of its labor force of 3,220 persons (CAEDD, 1996).

Nearly 30 percent of the civilian workers in the region of influence were employed in the service industry in 1990, while another 18 percent worked in wholesale and retail trade. Persons employed in the manufacturing industry were 18 percent of the work force, and civilian government workers were nearly 11 percent of employed persons. The 16,000 construction workers in the area in 1990 were slightly more than 10 percent of the workforce. Each of the remaining industry sectors provided work for less than 10 percent of employed persons in the region of influence in 1990 (DOC, 1990).

Temporary personnel generally would stay in the Lancaster/Palmdale area because of the communities' proximity and size. Neither the exact room count nor the annual occupancy rate was available for the 40 hotel/motel properties in the two-community area, but the number of rooms exceed 1,500 (Lancaster Chamber of Commerce, 1996; Palmdale Chamber of Commerce, 1996). There are also approximately 260 restaurants and food establishments in the area (ProCD Inc., 1996).

Environmental Consequences

If Edwards AFB is selected as Home Base for the PDRR ABL Phase, the following sequence of events would be anticipated:

- Facility modification/equipment installation phase: Fifty construction workers would be hired locally, and five USAF and five contractor personnel would relocate to Edwards AFB for a 12- to 15-month period, at a total cost of $34 million ($4 million for labor, $30 million for procurement, with $7.1 million being local procurement).

- System integration/ground test phase: 40 additional USAF personnel and 150 additional contractor personnel would supplement those already on-site (62 of the contractor employees would be hired locally, 30 would relocate for the duration of the project, and 63 would stay in local hotels and motels), for a total period of nine-months. Hotel and restaurant revenues for the period would total approximately $1.6 million (calculated at 63 persons x 38 weeks x five days/wk x $135 per diem) (41 CER § 301).

- Diagnostic test phase: 45 USAF personnel and 155 contractor personnel on the site, for an additional 5 months. Hotel and restaurant revenues for the period would total approximately $895,000 (calculated at 63 persons x 21 weeks x five days/wk x $135 per diem) (41 CFR § 301).

- Expanded-Area test phase: 45 USAF personnel and 155 contractor personnel on the site, for an additional four-months. Hotel and restaurant revenues for the period would total approximately $710,000 (calculated at 63 persons x 17 weeks x five days/wk x $135 per diem) (41 CFR § 301).

Most of the civilian workers at Home Base would be hired locally. In 1990 there were 149,754 employed civilians in the region of influence. A total of 4,176 military and 7,682 civilians in the region of influence worked on the Base at the end of fiscal year 1995. Home Base activities at Edwards AFB would add 1.1 percent to the military personnel and 2 percent to the 1995 civilian workforce on the Base. The contractor personnel required by the PDRR ABL Phase would add 0.1 percent to the employed population in the region of influence. Accordingly, no significant socioeconomic consequences in the region of influence would be anticipated as a result of the possible siting of Home Base activities at Edwards AFB.

3.1.14 ENVIRONMENTAL JUSTICE

A general discussion of environmental justice and all applicable laws and regulations is provided in Section 3.0.14.

Region of Influence

The environmental justice region of influence is defined by the East Kern and Tehachapi Census County Divisions (CCDs) in eastern Kern County, and the North Antelope Valley and South Antelope Valley CCDs in northeastern Los Angeles County. This area coincides with the region of influence utilized for the analysis of socioeconomic impacts in Section 3.1.15. The Base is located at the western extent of the Mojave Desert, and the area that extends beyond the socioeconomic region of influence is a sparsely settled desert region. Given the distribution and the demographic composition of the population and the activities associated with the PDRR ABL Phase, no examination beyond the socioeconomic region of influence is necessary.

Affected Environment

There were 347,676 persons counted in the region of influence as a whole during the 1990 Census. Nearly three of four persons were White, and approximately one in four was minority. African-Americans comprised approximately 6 percent of the population, and Asian/Pacific Islanders were slightly less than 3 percent. One of 100 persons in the region of influence was Native American in 1990. Table 3.1-7 provides details about the racial composition in the four CCDs and the region of influence. In addition, slightly more than 30,000 persons were below the poverty level based on their incomes in 1989, representing 8.7 percent of all persons in the region of influence (DOC, 1990). Table 3.1-8 identifies the individual CCDs to pinpoint the minority and low-income populations in more specific areas.

Table 3.1-7. Persons by Race/Ethnicity in the Edwards AFB Region of Influence, 1990

Persons by Race/Ethnicity	East Kern CCD	Tehachapi CCD	South Antelope Valley CCD	North Antelope Valley CCD	Total ROI	Percentage
Whites	56,009	18,219	86,980	95,879	257,087	73.9
Hispanics	7,113	5,014	23,986	19,803	55,916	16.1
African Americans	2,869	2,237	6,752	8,558	20,416	5.9
Asian/Pacific Islander	2,135	218	4,050	3,842	10,245	2.9
Native Americans	771	191	884	1,462	3,308	1.0
Other	72	23	284	325	704	0.2
Totals	68,969	25,902	122,936	129,869	347,676	100.0

CCD Census County Division ROI Region of Influence
Source: DOC, 1990.

Table 3.1-8. Percentage of Low-Income Minority Population

Census County Division	Minority	LOW-Income
East Kern	18.8	8.8
Tehachapi	29.7	8.0
North Antelope Valley	26.2	9.0
South Antelope Valley	29.2	8.5
Source: DOC, 1990		

Home Base activities at Edwards AFB would occur primarily in the East Kern CCD, but the southern portion of the Base does lie in the North Antelope Valley CCD. The proportions of minority and low-income persons in the affected CCDs are far below the thresholds established by the EPA for the examination of environmental justice impacts in an area (EPA, 1995). The Tehachapi CCD, with the highest percentage of minority persons in the region of influence, at 26.2 percent, is also the most distant from the Base and would experience no impacts from PDRR ABL Phase activities.

Environmental Consequences

As shown in Table 2-13 in Chapter 2, the environmental consequences anticipated for Home Base activities at Edwards AFB would be low or nonexistent for all resources with one exception. The impacts on health and safety would be considered moderate. However, the moderate impacts would be anticipated only for PDRR ABL Phase workers and not the population at large. Thus, no significant adverse or disproportionate health or environmental effects would be expected among the general public in the region of influence, including the minority and low-income populations, as a result of normal PDRR ABL Phase activities.

3.1.15 CUMULATIVE IMPACTS

Activities and resource attributes associated with implementing PDRR ABL Home Base activities at Edwards AFB which may contribute to cumulative impacts are summarized in this section. No specific information regarding activities which may be scheduled at Edwards in the year 2002 is currently available for analysis. The B-2 program, which is currently housed at the Birk Flight Test Facility, will be greatly reduced, if not terminated, prior to commencement of PDRR ABL Phase activities at Edwards AFB. The reduction of the B-2 activities, coupled with the minimal increase in activities related to the PDRR ABL Phase, would lessen the overall cumulative impact of activities at Edwards AFB. A more detailed analysis will be done as the information becomes available and as system-test details are defined.

Aircraft Takeoffs and Landings. PDRR ABL Phase activities would increase the number of takeoffs and landings at Edwards AFB by approximately 30 over a nine-month period. However, between 90,000 and 100,000 takeoffs and landings are projected to occur annually at Edwards in support of Base missions. The increase in aircraft exhaust and engine noise from the small number of additional aircraft operations would have minimal cumulative effects on any resource at Edwards AFB.

Air Quality. PDRR ABL Phase activities would have a minimal impact on air quality at Edwards AFB. The maximum amounts of either volatile organic compound (VOC) or nitrogen oxide yearly emissions from PDRR ABL Phase activities would increase emissions levels by less than 0.1 percent of the emissions growth allowed for Edwards by the Kern County Air Pollution Control District.

Biological Resources. Construction/modification activities may result in the removal of small areas of habitat. However, all activities would occur on previously disturbed land, and PDRR ABL Phase activities would not add to the cumulative loss of habitat at Edwards AFB.

Noise. Noise levels at Edwards AFB would increase from construction/modification activities, operation of the pressure recovery system, and engine runups. However, all noise-generating activities associated with the PDRR ABL Phase would be temporary, short-duration events, and noise levels would remain within Air Installation Compatibility Use Zone (AICUZ) noise limits.

Hazardous Materials and Waste. PDRR ABL Phase activities at Edwards AFB would result in slightly larger amounts of hazardous materials usage and hazardous waste generation. However, the existing permitted storage facilities for these materials have adequate capacity for the additional material.

Infrastructure and Transportation. Although the PDRR ABL Phase would eventually employ 200 people at Edwards AFB, there are currently 13,600 civilian and military personnel employed on Base. The PDRR ABL activities would result in minimal cumulative impacts to Base infrastructure or transportation.

Socioeconomics. PDRR ABL Phase activities would add approximately $19.7 million in wages and $7.1 million in procurement spending to the local economy. While these impacts are minimal in the socioeconomic region of influence, they would be beneficial to the economy and may help to mitigate losses to the economy from the conclusion of the B-2 Program.

3.1.16 ADVERSE ENVIRONMENTAL IMPACTS THAT CANNOT BE AVOIDED

Unavoidable adverse impacts that may arise as a result of implementing the PDRR ABL Home Base activities at Edwards AFB are discussed in the following subsections.

Air Quality. A minimal increase in yearly emissions from PDRR ABL activities cannot be avoided. However, the emissions would all be below allowable annual amounts.

Hazardous Materials/Waste. There would be a minimal increase in the storage of hazardous materials and generation of hazardous waste.

Noise. Noise from construction (e.g., during facility modification), operation of the pressure recovery system, engine runups, traffic, and aircraft overflight cannot be totally mitigated. Though aircraft noise could disturb the local population and animals, it is part of the existing environment at airport facilities. Operation of the pressure recovery system would cause high noise levels for infrequent, brief periods of time and would be scheduled during normal working hours to minimize the impact. Noise from the operation of construction equipment could annoy facility personnel who work near the construction sites. Support vehicle traffic would also cause localized impacts adjacent to site access routes. These impacts would be brief, lasting only through the construction period. All noises generated by PDRR ABL activities would remain within Air Installation Compatibility Use Zone noise limits.

3.1.17 MITIGATION MEASURES

This section summarizes mitigation measures that would be considered beyond adherence to all laws, regulations and guidelines to control or reduce impacts the environment as a result of Home Base activities. Because of the negligible impact that PDRR ABL Phase activities will have on most attributes, and the additional measures already taken by USAF, no separate mitigation plan is currently deemed necessary. Nevertheless, we have outlined areas needing special attention and management, depending on the specific actions to be taken at a facility, the level of impact, and other pertinent factors.

Hazardous Materials and Waste. Impacts would be mitigated by material substitution or process controls, but the impacts would have to be examined on a program- or system-specific basis in lower-tier environmental documentation.

Health and Safety. Aircraft layout and design would include aircrew safety measures to reduce the potential exposure to laser chemicals.

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3.2 KIRTLAND AIR FORCE BASE (ALTERNATIVE HOME BASE)

Kirtland AFB is the alternative Home Base for conducting PDRR ABL Phase activities. This section discusses specific affected environments by environmental attribute at Kirtland AFB.

3.2.1 COMMUNITY SETTING

Background. Military activity began at the site in 1939 with the leasing of 2,000 acres near the municipal airport for use in servicing transient military aircraft. Soon afterwards, Kirtland Field was established, named for Colonel Roy C. Kirtland, a military aviation pioneer. Meanwhile, the Army Air Force established Sandia Base, a training depot for aircraft mechanics, to the east of Kirtland Field. In September 1945, some units of Los Alamos National Laboratory (LANL) were moved to Sandia Base, to provide flight support and test facilities to LANL. These units were the predecessors of Sandia Corporation, now Sandia National Laboratories (SNL), the largest tenant unit on Kirtland AFB. SNL is operated by the U.S. Department of Energy (DOE). Kirtland Field and Sandia Base merged in 1971 under the USAF and is now called Kirtland Air Force Base. Kirtland is presently under control of the Air Force Materiel Command.

Approximately 20,000 people are employed on Base. An average of 30,000 takeoffs and landings of military aircraft occur each year from Albuquerque International Airport, which shares runway facilities with Kirtland AFB.

Location. Kirtland AFB is located in central New Mexico, in the southeast quadrant of Albuquerque (Figure 3.2-1). Kirtland AFB is located at the foot of the Manzanita Mountains to the east and adjacent to the Isleta Pueblo Indian Reservation to the south. Residential areas are located north of the Base, and

Figure 3.2-1

business and residential properties are located to the west. The westernmost portion of the Base is adjacent to Albuquerque International Airport. The Base encompasses an area of approximately 52,600 acres, of which nearly 16,000 acres are national forest land withdrawn for USAF use, and nearly 4,600 acres are national forest land withdrawn for DOE use. A location map of Kirtland AFB is shown in Figure 3.2-2.

Figure 3.2-2

Facilities. The PDRR ABL Complex, an approximate 70-acre site, would be located near the southeast end of the east-west runway just south of South Gate Avenue, in the area of existing Hangar 760 (Figure 3.2-2). Facilities would include 1) a hangar to house the aircraft, 2) laboratories for test and integration of the laser and laser-beam control subsystems, 3) storage for jet fuel, laser-fuel components, and spent-laser fuel, 4) a computer-software validation facility, and 5) crew-training and administrative offices. Some existing facilities may be used for other purposes by the PDRR ABL Phase.

Affected Environment

The Albuquerque metropolitan area and Kirtland AFB are situated in a river valley bounded by a high plateau on the west and a mountain range on the east. The valley is protected from passing storms and regional wind-flow patterns. Kirtland AFB supports two principal plant communities. The lower elevation areas on the central and western portion of the Base support grasslands, while to the east, coniferous woodlands become more dominant as the elevation increases.

Weather patterns in the area are characterized by low precipitation; wide temperature extremes; frequent drying winds; heavy rain showers, usually of short duration; and erratic, seasonal distribution of precipitation. The monthly mean temperature ranges from 32.7^{o}F in January to 78.7^{o}F in July. The annual average temperature is 56.8^{o}F with an average diurnal temperature range of 28°F. The air is normally dry, with an average annual relative humidity of about 44 percent, ranging from nearly 60 percent in the early morning to approximately 29 percent in the afternoon. The annual precipitation average is 8.3 inches and occurs between June and September. Evapotranspiration in the area has been estimated at 95 percent of the annual rainfall. Snowfall occurs between December and March and averages approximately 10.3 inches annually. The average annual wind speed for the area is 4 m/sec (9 mph). Sustained winds of 5.5 m/sec (12 mph) or less occur approximately 80 percent of the time at the Albuquerque International Airport. Sustained winds of greater than 11.4 m/sec (25 mph) occur less than 3 percent of the time. The prevailing wind direction is from the north in the winter and from the south along the river valley in the summer.

3.2.2 AIR QUALITY

A general discussion of air quality and all applicable laws and regulations is provided in Section 3.0.2. Section 3.7 provides information on the upper atmosphere and atmospheric chemistry as they could be affected by the PDRR ABL Phase.

Region of Influence

Kirtland AFB and Albuquerque are located in Bernalillo County. Bernalillo County and portions of Sandoval and Valencia Counties make up EPA' s Albuquerque-Mid Rio Grande Intrastate Air Quality Control Region (40 CER § 81). All activities associated with the PDRR ABL Phase would take place in Bernalillo County. The Albuquerque/Bernalillo County Air Quality Control Board (AQCB) and the Albuquerque Environmental Health Department (AEHD) administer the air quality program in Bernalillo County.

Affected Environment

The Sandia Mountains shelter the Albuquerque area from frigid winds that sweep down the plains from the east. However, this protection afforded by the mountains also reduces the ventilation of the area's air mass and leads to accumulation of pollutants in the ambient environment. The resulting accumulation of various pollutants creates unhealthy conditions during certain times of the year. Calm wind conditions occur most frequently in the area during the winter. The months of November through January are known as the carbon monoxide season. According to the *1993 Periodic Emissions Inventory for Carbon Monoxide* (AEHD, 1995a), 68 percent of the total carbon monoxide produced in Bernalillo County is from on-road sources (cars, trucks, buses, motorcycles) and 25 percent is from residential wood-burning stoves and fireplaces. Since 1992, however, Albuquerque has not exceeded the NAAQS for carbon monoxide, and the city requested reconsideration for classification as a maintenance area based on that record. The EPA redesignated Albuquerque/Bernalillo County from moderate nonattainment to maintenance attainment, effective 15 July 1996.

Table 3.2-1 shows the current and projected carbon monoxide seasonal emissions for Bernalillo County through the year 2002. The Base's major source of air pollutants is privately owned vehicles. Other large emissions sources are military vehicles and aircraft operations (Table 3.2-2).

Table 3.2-1. Current and Projected Seasonal Carbon Monoxide Emissions for Bernalillo County, New Mexico (November through January)

Year	CO Emissions (tons/season)
1993[1]	39,991
1996[2]	36,597
1999[2]	34,906
2002[2]	34,563
Sources: [1]Albuquerque Environmental Health Department, 1995a [2]Albuquerque Environmental Health Department, 1995b	

Table 3.2-2. Carbon Monoxide Emissions Inventory for 1994 and 2005 at Kirtland Air Force Base, New Mexico (tons)

Source	1994		2005
	Annual	CO-Season	Annual
Motor Vehicles	19,000	3,860	18,000
Aircraft	297	72	356
Stationary	95	30	102
Area	144	72	172
TOTAL	19,800	4,100	18,600
Source: USACE, 1995			

In a recent preliminary conformity analysis report (USACE, 1995), a carbon monoxide emissions inventory for 1994 and projected for 2005 was compiled. The results of this inventory are shown in Table 3.2-2. The projected 2005 emissions were calculated with the assumption that all sources of emissions would increase their annual activity by 20 percent over 1994 levels, except for those sources that have permitted limits. The examination of this table shows two things. First, Kirtland AFB' s 1994 total carbon monoxide seasonal emissions are approximately 10 percent of Albuquerque/Bernalillo County's emissions during the same time period. Second, the table shows that the 2005 projected total annual level of carbon monoxide emissions will be lower than in 1994. This was projected with the use of the MOBILE 5a computer program to calculate the motor vehicle emissions. This program assumes that there will be an approximate 25 percent reduction in emissions from motor vehicles by the year 2005. Since motor vehicles contribute over 95 percent of the carbon monoxide emissions, this reduction outweighs the 20 percent increase in the traffic volume and the other activities.

The air quality in the Kirtland AFB area is better than the national standards. The AEHD/Air Pollution Control Division operates two air monitoring sites in the vicinity of Kirtland AFB: one is north of the Base at the corner of Wilson and Anderson Streets and the other is southwest of the Base at the City Lift Station in Isleta. Table 3.2-3 lists the summary of 1993 and 1994 air quality data for carbon monoxide at the monitoring stations. Neither of these monitoring stations recorded pollution levels within 40 percent of the NAAQS limits (9 ppm) for carbon monoxide.

Table 3.2-3. Carbon Monoxide Monitoring Data for 1993 to 1995

Site	High 8-Hour Average (ppm)		
	1993	1994	1995
Wilson, Anderson Streets (2ZN)	5.1	4.9	4.1
City Lift Station (2R)	3.9	5.0	4.5
Source: Dennis, 1995, Peyton, 1997			

Environmental Consequences

The PDRR ABL activities that have the potential to affect air quality at Albuquerque/Bernalillo County would be the temporary assignment of 200 personnel, facility modifications, and operations in support of the ground and flight tests of the laser weapon system. These activities occur over a four-year period, 1999 to 2002, and each year the activities and resultant emissions would be slightly different. The analysis and details of each year's activities and emissions are shown in Attachment 1 to Appendix E. The emission sources from the PDRR ABL activities can be grouped into two major categories, stationary and mobile. The mobile sources include vehicles, construction activities, and aircraft operations. The stationary sources include the ground pressure recovery system and the aerospace-ground equipment.

The two stationary sources, the ground pressure recovery system and the aerospace-ground equipment, would need to be included in Kirtland AFB' s Title V permit. The single PDRR ABL Phase activity that could potentially be classified as a major source would be the ground pressure recovery system. The sources of potential pollutant emissions in the ground pressure recovery system would be the generation of high-temperature water to produce steam and exhaust products from laser operations during ground tests that are exhausted from the laser-weapon system into the ground pressure recovery system. The analysis in Appendix E shows that the maximum yearly emissions from the generation of the high-temperature water used in the ground pressure recovery system would be much less than 0.2 ton per year of carbon monoxide for the 30 ground tests of the high-energy laser (HEL). This analysis assumes that natural gas would be used to generate the high-temperature water. The natural gas generator may have to be fitted with pollution control devices designed as Lowest Available Emission Rate Technology or Best Available Control Technology (40 CFR § 52). The exhaust from the laser during ground tests would be scrubbed in the ground pressure recovery system prior to release into the atmosphere. The cloud would consist of mainly carbon dioxide and water vapor, with small amounts of chlorine and iodine (10 pounds of chlorine and 3 pounds of iodine for each test) (Table 2-5). This emission would need to be included in the Base's hazardous air pollutants inventory. The maximum yearly estimated emissions from the aerospace-ground equipment used to support the test program would be approximately 15.7 tons of carbon monoxide in 2002 (Appendix E). The aerospace ground equipment usage would be much less in the other three years and the carbon monoxide emissions would be less than 0.05 tons for 2000 and 2001. A comparison of Kirtland AFB's Title V permit and the emissions from these two stationary sources are shown in Table 3.2-4. While these PDRR ABL sources would need to be included in the Title V permit, Table 3.2-2 shows that projected stationary source emissions in 2005 would still be 25 tons per year below the Title V permitted level. This margin would be adequate to support the projected maximum 15.7 tons generated by PDRR ABL activities in 2002.

Table 3.2-4. Comparison of Title V Permit to PDRR ABL Phase Projected Stationary Source Emissions (tons/yr)

	CO	VOC	NO_x
Title V Operating Permit	127.00	130.00	126.00
Ground Pressure Recovery System	0.02	<0.01	0.09
Aerospace Ground Equipment	15.70	0.58	0.38

The total emissions from all sources are included in the results of the preliminary conformity analysis (Appendix E) presented in Table 3.2-5. The maximum annual level of carbon monoxide emissions would be approximately 36 tons in the year 2000. This is a 0.2 percent increase over the projected 2005 carbon monoxide emissions for Kirtland AFB shown in Table 3.2-2. As can be seen in Table 3.2-5, the total yearly estimated emissions would be less than half the *de minimus* levels as established in 40 CER § 93.153 (b) and would be less than 0.04 percent of Bernalillo County's projected carbon monoxide-seasonal emissions for 2002.

Table 3.2-5. Estimated Emissions from PDRR ABL Phase Activities (tons/yr)

Year	VOC	CO	NO_x
1999	0.88	28.00	0.62
2000	0.01	35.93	0.13
2001	0.01	35.37	0.13
2002	0.73	49.12	10.60
deminimis	100	100	100

3.2.3 AIRSPACE

A general discussion of airspace and all applicable laws and regulations is provided in Section 3.0.3.

Region of Influence

The region of influence for airspace is that airspace occupied by the PDRR ABL during takeoffs and landings and the standard FAA flight corridors from Kirtland AFB to the Diagnostic Test Range and from Kirtland AFB to the Western Test Range (Figure 3.2-3).

Affected Environment

Kirtland AFB uses the Albuquerque International Airport in their flight operations (Figure 3.2-3). Most aircraft enter or exit the Albuquerque area via one of the numerous airways. Albuquerque International Airport experiences an average of 960 operations per day. ABL flight-test operations would originate and end at the airport. All airspace within 56 km (35 mi) of the airport is considered Albuquerque Tower airspace and controlled by Albuquerque Tower Control 24 hrs/day, seven days/wk. Albuquerque Tower airspace is from the surface up to and including 20,000 feet AMSL. The airspace beyond 56 km (35 mi) is controlled by Albuquerque Air Traffic Enroute Center (Henson, 1995).

Figure 3.2-3

Environmental Consequences

The PDRR ABL would takeoff and land at the Albuquerque International Airport. The aircraft may be scheduled for up to 30 flights over a period of nine months. The Albuquerque International Airport and Albuquerque Tower Control are familiar with military air-operation procedures. Although the PDRR ABL aircraft would be carrying laser chemicals, it would require no special takeoff or landing procedures. Airspace occupied by the aircraft during takeoffs and landings would be managed in the same manner as any other military or civilian aircraft. The airspace occupied by the PDRR ABL in flight would also be managed as any other aircraft. Air Route Traffic Control Center evacuation of airspace and rerouting of aircraft would not be necessary, and therefore, the impacts to airspace use would be low.

3.2.4 BIOLOGICAL RESOURCES

A general discussion of biological resources and all applicable laws and regulations is provided in Section 3.0.4.

Region of Influence

The region of influence is the environment within the confines of the Kirtland AFB fence line. However, the primary focus of activities is in the area immediately surrounding the Hangar 760 Complex.

Affected Environment

Threatened and Endangered Plant Species. Only one protected plant species is found at Kirtland AFB (Table 3.2-6). Wright's fishhook cactus is listed as a federal endangered species. Currently, no Wright's fishhook cactus are located in the previously disturbed area in the Hanger 760 Complex.

Table 3.2-6. Threatened and Endangered Plant Species Known or Expected to Occur at Kirtland Air Force Base, New Mexico

Common Name	Scientific Name	State Status	Federal Status
Wright's fishhook cactus	Mammillaria wrightii var. wrightii (Sclerocactus wrightii)	--	E
E Endangered			

Threatened and Endangered Animal Species. Four threatened or endangered animal species may be present in the vicinity of the proposed action on Kirtland AFB (Table 3.2-7). Of these, the Gray vireo is most likely to be found in the area of the proposed action. The other species are included owing to their high level of mobility and the relative closeness of potentially suitable habitat in the nearby Manzanita Mountains.

Table 3.2-7. Threatened and Endangered Animal Species Known or Expected to Occur at Kirtland Air Force Base, New Mexico

Common Name	Scientific Name	State Status	Federal Status
Spotted bat	*Euderma maculatum*	T	—
American peregrine falcon	*Falco peregrinus anatum*	E	E
Mexican spotted owl	*Strix occidentalis lucida*		T
Gray vireo	*Vireo vicinior*	T	
E Endangered T Threatened			

Environmental Consequences

Home Base activities that could affect biological resources at Hangar 760 include construction related to the modification of Hangar 760 and routine operation of the pressure recovery system. Construction would result in a temporary increase in noise levels ranging from 70 to nearly 90 dBA at 15 m (50 ft) (Thumann and Miller, 1986) and would be less than the current noise levels generated by the operation of the adjacent runways. Construction may also result in the disruption of vegetation in the vicinity of the facility. Only previously disturbed vegetation would be impacted. A survey of the area would be conducted prior to the initiation of the construction effort. Based on the outcome of the survey, USFWS would be consulted on the disposition of any threatened or endangered plant or animal species found in this area.

The pressure recovery system operation would result in peak-noise levels of approximately 120 dB at 30 m (100 ft) for a maximum of five minutes per test. This noise level is similar to that generated by the current operation of the adjacent runways and would be relatively infrequent. Therefore, the proposed operation activities would not impact the local biological resources significantly over current conditions.

The emissions from the pressure recovery system, composed primarily of water vapor and carbon dioxide, would be released at least 30 ft above the tarmac. This vapor cloud would quickly rise, owing to its high temperature (>100°C) and dissipate in the atmosphere. In addition to water vapor and carbon dioxide, approximately 10 pounds of chlorine would be released during each system test, resulting in brief (approximately 1 minute) peak releases greater than 1,000 ppm of chlorine that, within 2 minutes, would dissipate to less than 3 ppm. This cloud would present a temporary hazard to birds flying over the release stack. However, the steam cloud lasts for several minutes with the chlorine release occurring in the middle of this time span. It is likely that the noise, heat, and visual cues of the cloud would prevent birds from being exposed to the chlorine release.

3.2.5 GEOLOGY, SOILS AND WATER RESOURCES

A general discussion of geology, soils, and water resources and all applicable laws and regulations is provided in Section 3.0.5.

Region of Influence

The region of influence on geology, soils, and water resources is the area immediately surrounding and including the Hangar 760 complex at the southeast corner of the east-west runway in the northwestern portion of Kirtland AFB (Figure 3.2-2).

Affected Environment

Geology. Kirtland AFB is located on the eastern flank of the Albuquerque Basin, a segment of the Rio Grande rift formed by regional extension during the last 30 million years (Figure 3.24). The basin is bounded on the east and west by normal faults. A zone of basin-bounding faults on the east side of the basin passes through the Base and divides it into two parts. The area east of the fault zone is generally characterized by bedrock exposed in the Manzanita Mountains or buried to shallow depths by alluvium (water-transported sediments). The area west of the fault zone is characterized by a thick fill of unconsolidated alluvial gravel, sand, silt, and clay deposits of the Santa Fe Group, the groundwater aquifer for the basin. The region of influence is located approximately 7 km (4.3 mi) west of the fault zone. Surface sediments in the area at the region of influence consist of unconsolidated alluvial and eolian (wind-transported) materials (Figure 3.2-5).

Seismicity. The Albuquerque Basin portion of the Rio Grande rift is seismically active, but earthquakes capable of causing even moderate damage are rare (SNL, 1993). Kirtland AFB is located within United Building Code Seismic Risk Zone 2, which is defined as a region that can be expected to receive moderate damage from earthquakes (USAF, 1993b). Only ten earthquakes capable of producing significant damage to structures have occurred in New Mexico in the last century (SNL, 1993).

Figure 3.2-4

Figure 3.2-5

Soils. A total of 18 soil series were identified during the soil survey of Kirtland AFB (SNL, 1993). The soil horizons consist primarily of fine sandy loams that are well drained and have slight to severe potential for erosion. No prime or unique farmland soils exist on Kirtland AFB. All of the soils on the Base have a dryland capability that indicates unsuitability for cultivation and a high risk of erosion. Soils in the vicinity of Hangar 760 include the Bluepoint, Embudo, and Wink Series. A description of these three soil series is included in Table 3.2-8. No soil contamination exists within the region of influence of PDRR ABL Phase activities at Hangar 760.

Table 3.2-8. Soil Types Within the Region of Influence at Kirtland Air Force Base, New Mexico

Soil Series	Soil Description	Soil Runoff	Soil Erosion	Uses
Bluepoint/Kokan (BKD)	Deep, somewhat excessively drained loamy fine sand	Slow	Moderate to severe	Range, watershed, wildlife, recreation, community development
Embudo (EMB)	Deep, well drained gravelly fine sandy loam	Medium	Moderate	Watershed, wildlife, community development
Wink (WAB)	Well drained fine sandy loam	Medium	Slight to moderate	Range, watershed, wildlife, community development.

Surface Water. The Kirtland AFB area of the Albuquerque Basin receives approximately 8.3 inches of rainfall annually, most of which occurs during high-intensity thunderstorms between the months of June and September. Nearly 95 percent of the precipitation in the area is lost by evapotranspiration and the remainder is divided nearly equally between runoff and groundwater recharge (SNL, 1993). The major surface hydrologic feature in the vicinity of the Base is the Rio Grande River, which flows north to south approximately 8 km (5 mi) west of the region of influence.

Only minor surface water bodies (wetlands produced by springs and artificial ponds at the golf course) exist at Kirtland AFB. At least 11 springs have been identified, and the major ones are all located east of the region of influence in the foothills and within the Manzanita Mountains (Figure 3.2-5) (USAF, 1995g). Kirtland AFB recognizes six wetlands on the Base (USAF, 1997). The two principal wetlands are at Coyote Springs and at “No-Name” Spring (Figure 3.2-6). Four minor wetlands occur around springs within the confines of Manzano Base and in the Manzanita Mountains (Figure 3.2-5). All are east of the region of influence. There are no vernal pools at Kirtland AFB (USAF, 1997).

No perennial streams or waterways exist on the Base. Localized flooding on the Base occurs only during short-duration flow events, and most of the surface runoff is channeled through natural and artificial flow paths into Tijeras Arroyo, the main surface channel that drains the Base (Figure 3.2-5) (USAF, 1990a). Surface flow in Tijeras Arroyo is intermittent, primarily during heavy thunderstorms and spring snowmelt, but little water reaches the Rio Grande River because of high evaporation rates and infiltration into the permeable alluvial deposits (SNL, 1993). Hangar 760 is located approximately 60 m (200 ft) north of the northern rim of Tijeras Arroyo, and approximately 45 m (150 ft) above the arroyo floor. Facilities within the region of influence would all be located outside of the 100-year floodplain (Figure 3.2-6) (USACE, 1979).

Figure 3.2-6

Groundwater. The Albuquerque Basin is designated by the state of New Mexico as a sole source of potable water (USAF, 1995h). The Santa Fe Group is the primary source of groundwater for Kirtland AFB and the city of Albuquerque. The water table under Hangar 760 occurs at a depth of 146 m (480 ft) below the surface. Recharge to the aquifer occurs from the Rio Grande to the west and from fractured bedrock in the Manzanita Mountains to the east. Vertical recharge from infiltration through soils to the water table is relatively minor.

Groundwater levels in Albuquerque have been declining at a rate of 1.2 to 1.5 m (4 to 5 ft) per year, and over-pumping is expected to cause continued decline in the water table. The greatest decline in the water table is expected in southeast Albuquerque (just north of Kirtland AFB), where the water table is expected to fall by as much as 36 m (120 ft) below the original predevelopment level (SNL, 1993).

Water Quality. With the exception of small springs in the canyons and ponds at the golf course, perennial surface waters do not exist at the Base, and quality of surface waters would not be a significant issue.

Kirtland AFB initiated an Installation Restoration Program (IRP) in the 1 980s to identify and remediate soil and water contamination on the Base. Two sites adjacent to Hangar 760 with the potential to contaminate surface waters and groundwater have been identified, investigated, remediated and closed under the IRP. At IRP Site ST-59 (ART Drum), a buried drum was found that apparently had been used for condensate collection of liquid nitrogen compressed gas. The drum did not create any known soil or water contamination, and it has been removed. At IRP Site ST-60 (ART Pit), immediately south of Hangar 760, a drain pit that was used to collect liquids from floor drains in Buildings 765 and 768 was identified. Contaminated sediments in the pit have been removed, and the pit has been plugged so that liquids will no longer drain directly from the pit into Tijeras Arroyo. However, floor drains for Hangar 760 and Buildings 765 and 768 have not yet been connected to a collection system, and until the drains are connected, any liquids that drain from the buildings could enter Tijeras Arroyo and affect water quality.

Nitrate concentrations at elevated levels have been detected at Production Well 7, on the east end of the east-west runway, just north of Hangar 760. The well is temporarily shut down. It is believed that the nitrate contamination may be a result of leakage from a sewer line east of the well. The sewer line subsequently ruptured in 1994 and has been repaired. Further monitoring of nitrate concentrations in the well is ongoing.

The SNL Environmental Restoration (ER) Program manages a groundwater monitoring program on and around Kirtland AFB, and SNL has detected trichloroethylene (TCE) contamination in several deep groundwater monitoring wells. A trace of TCE was detected in one groundwater sample at Production Well 3, 2.7 km (1.7 mi) north of Hangar 760, but subsequent sampling and analysis of the well detected no TCE.

Fecal coliform contamination has been found in Production Well 12, 3.5 km (2.2 mi) northwest of Hangar 760, and ethylene dibromide contamination has been found in Production Well 13, 4.1 km (2.6 mi) west-northwest of Hangar 760. Studies are ongoing to confirm the contamination, and both wells are closed, pending further analysis. Mitigation actions will be initiated under the IRP, if necessary, to ensure that contaminated water in the wells is remediated.

Environmental Consequences

Impacts on geology, soils, and water resources from construction activities would be negligible. All construction/modification activities would take place at or immediately adjacent to existing facilities. Because the area immediately surrounding the proposed location is almost completely paved, and little or no additional pavement would be created, storm water runoff into adjacent drainages should not increase. Soils in the vicinity of the PDRR ABL Complex are generally not subject to significant erosion, and all construction activities would take place at or immediately adjacent to existing facilities where soils have been previously disturbed. The minimal amount of soil erosion, if any, that would be created as a result of construction activities would not affect the integrity of building foundations or impact sedimentation rates within the nearby drainages. All existing facilities at Hangar 760 are located outside of the 100-year floodplain, and no additional facilities would be constructed within the 100-year floodplain where they could affect or be affected by floodwaters.

The Kirtland AFB site-specific spill plan would promote the safe storage, transfer, and mixing of hazardous materials used during the PDRR ABL Phase. Accidental releases of hazardous laser fuels, jet fuels, hydraulic and cleaning liquids, and ammonia would be addressed by the Kirtland AFB spill plan. Any liquids accidentally released would be contained in accordance with the management and response plans, resulting in minimal impact to geology, soils, or water resources, while any gaseous materials accidentally released would vent to the atmosphere and would not impact on geologic resources, soils, or water quality.

Operation of the PRS would result in the generation of a cloud of mainly carbon dioxide and water, with small amounts of chlorine and iodine (10 pounds of chlorine and 3 pounds of iodine for each test; see Table 2-5). However, because of the inert nature of the gases and small amounts of chemicals in the exhausts, they would not have any impact on geology, soils, or water resources.

Although several options exist for wastewater disposal at Edwards AFB, the disposal option has been chosen at Kirtland AFB. The spent laser fuels from the laser operation would be neutralized with hydrochloric acid, and the resultant wastewater would be discharged to a pond in the vicinity of Hangar 760 for evaporation and infiltration. Permitting and construction of the pond would be regulated by the New Mexico Water Quality Control Commission under the state of New Mexico Clean Water Act. The pond could be required to be lined and monitored. If approved by the State, the pond would receive a groundwater discharge permit. If constructed and monitored in accordance with the State regulations, the pond would not pose a significant threat to water resources. The Kirtland AFB site-specific spill plan would be followed during the handling of the spent-laser fuels. Any releases of spent-laser fuels prior to neutralization would be contained in accordance with the plans with minimal impact on soil resources and water quality.

The Albuquerque International Airport and Kirtland AFB, which share runways, have procedures and policies in place for firefighting, hazardous-material containment, and cleanup in response to an aircraft accident. In the event of an accident on the runway, during which fuel bladders on the B747 ruptures, the impacts on soil resources and water quality from the jet fuels and firefighting materials would be similar to the impacts from any other aircraft accident. The laser fuels released in an accident on the runway would be consumed in a fire or contained, while the gaseous laser fuels would either burn or vent to the atmosphere where they would not impact soil resources or water quality.

Operation of the aircraft auxiliary power generator and aircraft-ground-support equipment for six hours per week for 19 weeks during the system-integration/test phase of the project would result in air emissions of criteria pollutants that could be deposited in soils where they might subsequently affect water resources. However, the activity would be taking place at an operating airport facility, and the total project emissions would add negligible quantities of pollutants to the atmosphere. No impact would be expected on water resources, because it is expected that the soils would serve as an absorbent and none of the limited amount of pollutants emitted would reach the water table.

3.2.6 CULTURAL RESOURCES

A general discussion of cultural and paleontological resources and all applicable laws and regulations is provided in Section 3.0.6.

Region of Influence

The region of influence consists of the entire area within Kirtland AFB boundaries with particular interest surrounding Hangar 760 where PDRR ABL Phase activities would occur.

Affected Environment

Cultural Resources. Approximately 300 cultural resource sites have been recorded on Kirtland AFB prior to 1996, 90 of which are historic sites (Mariah Associates, 1995). The vast majority (98 percent) of cultural resource sites are located within 0.4 km (0.5 mi) of the "Named Drainage Zone" and "Foothill Alluvial Slope Zones," which exist in the upper and lower alluvial fans. The sites are generally located along one of the major drainages, canyons, or mountain foothills where the highest diversity of natural resources are found.

In the 20th century, two major mining districts were located in the Manzanita and North Manzano Mountains. The Tijeras Mining District (gold) extended southward into the northern portion of Kirtland AFB, and the Hell Canyon Mining District (gold, silver, copper) was located within the southern edge of the Base. Most of the mining on Kirtland AFB was terminated in the early 1930s (USAF, 1990a). Several historic structures located approximately 2.3 km (1.4 mi) northeast of Hangar 760 are eligible for inclusion in the National Register of Historic Places. The structures include five buildings that were designated in 1936 as the Sandia Girls School and three 1928 aircraft hangars.

There are approximately 127 prehistoric sites (Mariah Associates, 1995), with the highest density of prehistoric sites located within the mountain foothills and the majority of recorded historic sites primarily located on the upper alluvial fans or along the base and sides of the canyons. The site density is a function of greater vegetation and animal diversity, farmable lands, and presence of canyon springs (SNL, 1993).

The remaining 81 of the 298 recorded sites are composed of 64 multi-component sites that include both historic and prehistoric artifacts, 15 reclassified sites that have been downgraded because of destruction or complete collection of the site, one unknown site consisting of a hearth area with no associated artifacts, and one potential archeological district. The potential archeological district is referred to as Sandia National Laboratories' Tech Area II environmental sites consisting of nuclear bomb structures. The area may be considered a historic Cold War era district. Archeological surveys on Kirtland AFB are currently being conducted by Mariah Associates.

No traditional Native American sacred or ceremonial sites are known to occur within the boundaries of Kirtland AFB.

Paleontological Resources: Few fossils have been discovered in the vicinity of Kirtland AFB. Several Pleistocene horse and camel bones were found approximately 2 km (1.3 mi) southwest of the Base. These finds are believed to be associated with high-energy environment, suggesting the fossils may have been transported from their original source upstream. Lambert suggests that the fossils may be buried by the alluvial fan deposits from the Sandia Mountains (SNL, 1993). Three geologic formations within the boundary of Kirtland AFB have the potential to yield paleontological resources (Pleistocene sediments and gravel, Miocene Santa Fe Group, and Pennsylvanian/Mississippian Madera Limestone/Sandia Formation) (USAF, 1993c). No listed eligible National Natural Landmarks are identified on Kirtland AFB.

Environmental Consequences

Currently, Hangar 760 is enclosed within a fenced area that has previously been cleared of archeological or paleontological resources. No construction would occur outside the fenced area; therefore, no environmental consequences to cultural or paleontological resources would be expected at Kirtland AFB. Should any unforeseen cultural or paleontological resources be encountered or disturbed in the course of construction, activity would be halted until the Base Historic Preservation Officer is notified and consulted.

3.2.7 HAZARDOUS MATERIALS AND WASTE

A discussion of hazardous materials and waste and all applicable laws and regulations is provided in Section 3.0.7.

Region of Influence

The region of influence for hazardous materials/hazardous waste includes Kirtland AFB, with the main focus near Building 760.

Affected Environment

Kirtland AFB receives and stores a variety of hazardous material because of the wide range of activities conducted on the Base. The largest quantities of materials stored on Base are petroleum, oils, and lubricants (Curiel, 1995). Other hazardous materials utilized and stored at Kirtland AFB include other petroleum products, cleaning solvents, corrosive liquids, paint products, hydraulic fluids, munitions, and compressed gases. Hazardous materials are stored and used in connection with flightline aircraft maintenance, base support, research and development laboratories, and various industrial operations, including aircraft repair and modification, aerospace ground equipment repair and maintenance, vehicle maintenance, painting, and insect and weed control.

Kirtland AFB has improved the management and reduced the amount of hazardous materials used and hazardous waste generated by establishing strict usage procedures. Base Supply operates on the Pharmacy Concept, which allows Base tenants to obtain hazardous materials from assigned distribution centers. The hazardous material pharmacy works with users to identify the exact quantity required and any appropriate material substitutes. Any unopened containers of materials are returned to the Pharmacy for subsequent use. Leftover portions are disposed of in accordance with Kirtland AFB Hazardous Waste Management Plan. The Depot Maintenance Hazardous Material Management System database stores information on the issue and use of hazardous materials. All users of hazardous materials, including contractors, are required to maintain strict inventories of all materials, reduce large-quantity bench stocks, and use less hazardous or nonhazardous materials in place of those currently used.

Kirtland AFB generates a variety of hazardous wastes, and the types and quantities of waste vary from year to year as research activities and other mission assignments on the Base change. Hazardous waste generated at Kirtland AFB is associated with the operation of industrial shops, research and development labs, pesticide and herbicide application, radiological testing, fire-control training and fuel management (USAF, 1995h). Wastes include petroleum, oils, and lubricant (POL) wastes, and waste surplus chemicals such as halogenated solvents, silver-bearing photographic materials, acids and bases, and non-halogenated solvents and organic compounds.

Procedures for the packaging, handling, transportation, and disposal of hazardous waste materials are specified in Kirtland AFB 377 ABW Plan 195-95, *Hazardous Waste Management Plan*(USAF, 1995b). Under this plan, hazardous waste generated during activities at Kirtland AFB is collected at an initial accumulation point at or near the point of generation. From the initial accumulation point, the hazardous waste is then transferred to the Storage Facility. Kirtland AFB currently maintains a RCRA Part B permit, allowing on-site storage at the Storage Facility for periods in excess of 90 days after initial waste collection. From the Storage Facility, all waste is shipped to approved off-site facilities. There is no on-site disposal of hazardous waste on Kirtland AFB.

Preparedness and spill prevention actions are accomplished in advance to ensure that an accidental fire, explosion, or unplanned release of hazardous material is prevented if possible or mitigated and properly cleaned up. Spill prevention, control, and countermeasure procedures, methods, and equipment have been developed and implemented for Edwards AFB hazardous material/waste storage and transfer areas.

Before any ABL activities commence at Kirtland AFB, a sequence of requirements must be completed to ensure safe operations and proper hazardous material/waste management. The entire PDRR ABL Phase must be designed from a systems safety aspect using MIL-STD 882C, or a similar method, to reduce risks. The systems safety standard requires that the facilities be engineered to be as safe as possible and that procedures be developed to ensure safe operations. For example, chlorine sensors are required in the test area to warn workers of a chlorine leak. The contractor is required to implement an extensive hazardous material management program using the National Aerospace Standard 411 as a guide. The main focus of this program is to provide a mechanism to incorporate pollution prevention throughout the lifecycle of the weapon system. Coordination and approval is required for all actions through the Base environmental management, bioenvironmental engineers (industrial hygiene) and Base safety offices.

Environmental Consequences

PDRR ABL Home Base activities expected to use and generate hazardous materials/waste include modifications to existing facilities, operation and maintenance of the aircraft, and operation of the laser. All activities would have a low impact on the environment.

Hazardous Materials. Usage of hazardous materials during the PDRR ABL Phase can be grouped into three categories: construction activities, aircraft operations and maintenance, and laser operations. All hazardous materials would be ordered through the Hazardous Materials Pharmacy, which is near Building 760. Under the current operating procedures, the DOT licensed transporter would bring bulk hazardous materials directly to Building 760 to minimize any potential mishaps during transport.

Construction activities would use standard construction materials similar to those materials currently used on Base, such as cutting oil, acetylene, and various paint products and would not introduce new hazardous materials. These hazardous materials would be managed with standard procedures.

Aircraft operation and maintenance would require the use of aviation fuel, solvents, detergents, paints, coolants, hydraulic fluids and other petroleum products. Ongoing pollution prevention efforts would minimize the use of hazardous waste in these operations. A minimal amount of maintenance would be required on the aircraft because of the limited number of flights and because of the decision to have major maintenance accomplished at a contractor facility currently performing this type of maintenance.

These hazardous materials would be similar, if not exact, to the types and quantities currently used by military aircraft at Kirtland AFB. The materials would be routinely handled by base personnel and would be used in accordance with base procedures.

COIL operations, both ground and flight test, would require the proper storage, transport, and handling of several hazardous materials. The COIL chemicals are listed in Table 2-2 in Chapter 2 with approximate quantities necessary in pounds. All of the chemicals listed within this table are currently being used at the COIL facility at Kirtland AFB, and chemical handling procedures exist to minimize occupational exposures to these chemicals. Guiding principles include proper containment, separation of incompatible and reactive chemicals, worker warning and protection systems where necessary, and handling procedures to ensure safe operations. All personnel would receive extensive Hazard Communication (HAZCOM) training before working in the area, and many would be required to receive the Hazardous Waste and Emergency Response (HAZWOPER) training.

Chemical storage would be located within the PDRR ABL Complex. Existing facilities would be modified to provide safe storage for all chemicals. Kirtland AFB' s Spill Prevention Control and Countermeasures Plan would be modified to include emergency procedures for any spill associated with operation of the laser-fuel storage facility. The operation of the facility would be similar to the COIL facility currently located at Kirtland AFB. The PDRR ABL Phase would incorporate the major elements of Occupational Safety and Health Act (OSHA) regulations (Safety and Health Program, Hazard Communication, Medical Surveillance Program, Decontamination Program, Material Handling Program, Training Program). The Spill Prevention Control and Countermeasures Plan at the COIL facility would be used for guidance in the design and operation of the hazardous materials storage facilities, spill-response equipment, emergency communications, and coordination with local authorities and agencies. Key elements that would be incorporated into the facility operation include material compatibility, security, leak detection and monitoring, spill control, personnel training, and specific spill-prevention mechanisms. If required, any vehicles used to transport hazardous materials would also require equipment and supplies for responding to spills. The existing hazardous materials handling capabilities at Kirtland AFB would be adequate to ensure that all chemicals planned for the PDRR ABL activities are handled safely and in accordance with applicable regulatory procedures.

Hazardous Waste. The PDRR ABL operations would not generate substantial quantities of hazardous waste, but information on specific quantities are not available at this time. Possibilities include paint wastes and solvent contaminated rags from facility modifications and aircraft maintenance. The COIL, in general, only produces a wastewater that is discussed in Section 3.2.5. Any hazardous waste that is generated would be properly managed at the existing Initial Accumulation Point at Building 760. Operation requirements and personnel training requirements would be followed by all PDRR ABL Phase personnel.

Because Building 760 is an older facility, the potential exists that materials containing asbestos and/or lead-based paint could be encountered during the facility modification activities. Before commencing with construction, Base Environmental Management (EM) would be contacted to compare proposed activities with the Base asbestos survey. If asbestos were present, then appropriate procedures would be followed as required by EM. Existing procedures would be followed to determine if lead-based paint were present, and then to manage it if necessary.

3.2.8 HEALTH AND SAFETY

A general discussion of health and safety and all applicable laws and regulations is provided in Section 3.0.8.

Region of Influence

PDRR ABL Phase activities at Kirtland AFB would involve three types of activities: 1) operation of Hangar 760, 2) weapon system integration, and 3) aircraft flight line operations. Each activity would pose its own set of health and safety issues. Potential impacts would be limited to workers performing operations at Hangar 760 and its vicinity and the use of the Albuquerque International Airport runways.

Affected Environment

All USAF-related operations are required to comply with the AFOSH Program. Program requirements are specified in USAF Instruction 91-301 and AFMC Supplement 1 to AFI 91-301 both titled, *Air Force Occupational and Environmental Safety. Fire Prevention, and Health (AFOSH) Program.*

The Wing Safety Office manages the ground and weapons safety programs on Kirtland AFB; the 58th Special Operations Wing manages the flight safety program on Kirtland AFB. The AFOSH Program is managed by the 377th Aerospace Medical Squadron (AMDS). The primary directive governing the AFOSH Program is USAF Policy Directive 48-1, *Aerospace Medical Program.* The Base has published several local instructions that pertain to laser-hazard control, radio-frequency radiation-hazard control, and ionizing radiation safety and various other health areas. Kirtland AFB Instruction 48-109 implements AFOSH Standard 161-10 and outlines the policies, responsibilities, and procedures for laser operations at Kirtland AFB. All Base organizations that procure, construct, operate, and maintain laser systems must comply with these publications.

Both Wing Safety and the AMDS use AFOSH standards to ensure that all USAF workplaces meet federal safety and health requirements. The Phillips Laboratory Laser and Imaging Directorate (PL/LI) and the Space Experiment Directorate (PL/SX), and the Space & Missile Center Airborne Laser Program Office (SMC/TM) currently occupy Hangar 760 and other facilities in the vicinity. The PL/LI and PL/SX safety programs have been developed to comply with both the Wing ground-safety program and the Phillips Laboratory test safety program. The test safety program is a requirement of AFMC Supplement 1 to AFT 91-202, *Air Force Mishap Prevention Program.* SMC/TM has established a safety program that complies with the Wing ground safety program.

Military Standard 882C, *System Safety Program Requirements*, is the DoD standard that applies to all USAF systems and facilities. System safety is the application of engineering and management principles, criteria, and techniques to optimize all aspects of safety within the constraints of operational effectiveness, time, and cost throughout all phases of the system lifecycle.

Environmental Consequences

The following PDRR ABL Phase activities could impact the health and safety of workers and the public.

Facility Modification and Equipment Installation. Existing facilities would be modified (Hangar 760) to make the PDRR ABL Complex suitable for PDRR ABL Phase needs. Construction activities would produce the usual physical hazards, such as noise, electrical, heavy-moving equipment and machinery, welding, and earth-moving and digging activities. The contract for the construction effort would include a requirement for a system safety analysis of the proposed designs (MIL-STD 882C) before construction plans are finalized. In addition, each construction project at Kirtland AFB must undergo a safety review conducted by the Wing Safety Office. Ultimately, it would be the prime construction contractor's responsibility under OSHA (29 CFR §§ 1910 and 1926) to ensure the safety of their workers, USAF workers, and the public during the entire construction phase. The USAF would periodically monitor construction projects to determine compliance with OSHA standards. No public access would be allowed during the construction phase; therefore, the construction project should have no impact on the public since it would be confined to Kirtland AFB. Once the facility modifications and equipment installations have been designed to meet the system requirements, operational procedures would be developed and hazards would be minimized. The anticipated amounts of extremely hazardous substances stored at Home Base would be below the threshold quantities for the NESHAPS (40 CER § 68). Since this threshold would not be surpassed, emergency response planning by the PDRR ABL Phase would not be required. Table C-S in Appendix C shows the quantities of

chemicals stored at the Home Base and the reporting and planning threshold levels.

System Integration and Ground Test. The systems integration and ground-testing activities would produce chemical, electrical, noise, and laser hazards. The USAF has extensive experience with each hazard presented by the proposed Home Base operations, and the impact of these hazards on the health and safety of workers and the public would be minimal. In addition, before any system integration could occur, all systems, subsystems, and components would be analyzed for hazards under the requirements of MIL-STD 882C. Prior to any testing, the Kirtland AMDS would evaluate and certify the laser systems as required by Kirtland AFB Instruction 48-109. A laser safety program would be developed, documented, and implemented in accordance with AFOSH Standard 161-10.

The ground-testing activities would require a safety review to ensure test hazards such as exposure to chemicals, electrical circuits and equipment, noise, and laser radiation are identified and appropriately controlled (AFMC Supplement 1 to AFI 9 1-202). During ground testing of the COIL laser, the laser beam emitted from the airborne laser would be enclosed within a beam containment system at all times and would be terminated in a beam dump. The contractor's design of the containment system would require a system-safety analysis in accordance with MIL-STD 882C and would be reviewed prior to initial testing by the 377th AMDS. With all these mechanisms in place to ensure the protection of workers and the public, no significant impact would be anticipated with the PDRR ABL Phase activities.

Flight Test. The only flight-related activity would be takeoff and landing in support of range testing at other installations. No testing would occur in the skies over Kirtland AFB or Albuquerque. Flight line operations may include laser fueling, ground handling, servicing, inspection, and maintenance of the aircraft, engine runup, and vehicle and support equipment, refueling, and aircraft washing. Various hazards would be encountered because of the nature of the work and the equipment and tools involved. Other factors would involve the variety of weather conditions, the different conditions during day and night operations, mission priorities, and the various aircraft systems.

Aircraft and flight line areas pose potential fire and explosion hazards. Gasoline, jet fuel, cleaning solvents, oxygen, and powered support equipment are typical of these hazards. Falls from the aircraft pose another source of injury to maintenance personnel. Engine operation may expose personnel to dangers such as burns, high-noise levels, jet blast from the exhaust, and suction from intakes. Electrical shock, ranging from the minor shock of static electricity to electrocution from ground power units, would be another potential hazard. Fuels, cleaning compounds, and fire-extinguishing agents can be toxic and harmful when inhaled or contact is made with the skin.

To reduce the impact of these hazards on workers and the public, qualified aircraft-ground crews would perform aircraft operations. Furthermore, these operations would be fully evaluated for compliance with AFOSH Standard 127-100, *Aircraft Flight Line—Ground Operations and Activities.* Both Wing Safety

and the 58th sow would review these operations for compliance initially and then periodically inspect for implementation thereafter. With all these mechanisms in place to ensure the protection of workers, the public, and equipment, no significant impact would be anticipated with the proposed PDRR ABL flight-line operations at Kirtland AFB.

Accidents. Accidents involving the release of chemicals used to support the operation of the laser-weapon system during ground and flight tests would have the possibility of affecting the health and safety of workers in the vicinity of the release. Detailed analysis of an aircraft accident involving the release of the chemicals onboard the aircraft, and the accidental release of chemicals on the ground are presented in Appendix C. The accidental release of chemicals inside the aircraft during flight would not endanger the fight crew because the preliminary design of the aircraft includes a pressure bulkhead that separates the chemical storage area from the flight-crew area. The preliminary design also includes air monitoring sensors to provide notification in the event of a leak and a system to vent chemicals overboard. The safety record of the B747 indicates that the probability of a catastrophic accident that would be violent enough to rupture the onboard chemical storage tanks is less than one in a million flights (Boeing, 1996). The safety record also showed that nearly 80 percent of all catastrophic accidents for large aircraft occur during either the takeoff or landing portions of the flight. The crash site would probably be in the Manzanita Mountains, east of Kirtland AFB or in the southwest section of Albuquerque. The resulting fire from the crash would be of high intensity and for a short duration. The primary components in the plume generated by the fire would be nitrogen, carbon dioxide, water vapor, carbon monoxide, nitrogen oxide, argon (component of the air), and oxygen. There would be trace percentages (less than 0.05 percent) of hydrochloric acid, chlorine gas and other oxides of nitrogen. There are no toxic chemicals in the plume in sufficient concentrations to cause health problems. The plume would rapidly rise to above 10,000 feet and the chemicals would be dispersed before returning to ground level.

The accident scenario involves the release of one of the extremely hazardous substances during fuel-transfer operations (between the supplier and the ground-storage tanks or between the ground-storage tanks and the aircraft-storage tanks). This scenario assumes that 450 kg (1,000 lbs) of the chemical would be released in a five-minute period. Analysis in Appendix C shows that workers in the immediate area would be exposed to concentrations above short-term exposure limits (ACGIH, 1995). A toxic cloud would form as the chemical is released into the atmosphere (chlorine or ammonia) or evaporates from a spill (hydrogen peroxide). Areas downwind of the release point would have to be evacuated. The size of the area that would be evacuated is dependent on the chemical and the wind velocity (see Tables C-7 through C-9). Hangar 760 has many other activities located within a 2.5 km (1.5 mi) distance (e.g., Zia Base housing development, Southgate Road, New Mexico Air National Guard, etc.). There is the potential to create health risks to the public from the accidental release of these chemicals.

USAF standard operating procedures and instructions require the development of pollution prevention procedures and response plans (USAF, 1993c) as well as disaster preparedness operations plans (USAF, 1996a). These include potential or actual aircraft accidents, weapons or hazardous materials incidents or accidents, and disasters resulting from acts of nature. Fire department, medical, bioenvironmental, safety, weather and other key personnel have been trained and have the necessary equipment to respond to the accidents similar to the ones described above.

The transportation of any hazardous material is subject to both federal and state regulations, including handling, labeling, and routing requirements. National Highway Traffic Safety Administration statistics show that the fatal accident rate for large trucks is one accident in every 37 million miles, making it a very rare occurrence. The likelihood of any impact on human health and safety from the transportation of hazardous materials to the various sites is insignificant.

3.2.9 LAND USE

A general discussion of land use and all applicable laws and regulations is provided in Section 3.0.9.

Region of Influence

The region of influence would include the area immediately surrounding and including Building 760 and residential areas north and west of the area (Figures 3.2-2 and 3.2-7).

Affected Environment

Land Use of Adjacent Jurisdiction. Kirtland AFB is bounded to the north and west by the city of Albuquerque and its suburbs, to the south by the Isleta Pueblo, and to the east by the Cibola National Forest. Land use in the vicinity of Kirtland AFB includes urban/residential, industrial, commercial, rangeland, and open space (Figure 3.2-7). The Albuquerque International Airport is located immediately northwest of the Base and shares runway facilities with the Base (USAF, 1993b).

Land Use at Kirtland AFB. The general land-use pattern at Kirtland AFB consists of developed areas in the northwestern portion of the Base, a combination of industrial and vacant land in the central portions, and primarily vacant land in the eastern portions. The region of influence would be within the former area, where general land uses include the Base housing area, administrative, commercial, industrial, tenant, recreation, and large open spaces to the south. The area around Hangar 760, bordering the east-west runway of Albuquerque International Airport, is considered industrial.

Figure 3.2-7

Land-Use Plans and Policies. Land use at Kirtland AFB is controlled by the Kirtland AFB Comprehensive Plan. Private land north and east of the Base is administered by the city of Albuquerque and Bernalillo County through their adopted zoning ordinances. The city of Albuquerque has planned for the future development of approximately 9,900 acres of vacant land for single-family residences, and for the infill development of approximately 18,000 acres for residential use (USAF, 1990a). The Albuquerque Airport Authority has conducted a FAA Part 150 noise study, which provides off-base land-use recommendations similar to a USAF Air Installation Compatibility Use Zone (AICUZ) Program.

Environmental Consequences

Facility modification activities would take place on previously disturbed land at or adjacent to existing structures at an active research facility. Therefore, land-use patterns (including visual and aesthetic resources) would not be changed as the result of the construction or renovation of research and hangar facilities. Some construction-related debris would need to be sent to an approved landfill for disposal, but the type and quantity of construction-related debris would be such that it could be transported to the Kirtland AFB landfill without substantially decreasing the overall capacity of the landfill, shortening the life of the landfill, or necessitating that an additional landfill be constructed elsewhere on the Base. All construction workers would be hired locally, and no new residents would move to Albuquerque during the construction activity. Therefore, construction workers and their families would not increase demand on existing wastewater treatment facilities and solid waste disposal sites.

The proposed location is an active research facility and is situated near the Chemical Oxygen Iodine Laser (COIL) facility where ground-based laser testing is ongoing, and no adverse impacts on land use patterns would be anticipated at the PDRR ABL Complex as a result of the propagation of laser light in an enclosed structure.

Operation of the PRS would result in the generation of a cloud of mainly carbon dioxide and water, with small amounts of chlorine and iodine (10 pounds of chlorine and 3 pounds of iodine for each test) (Table 2-5). The cloud would dissipate within minutes of the PRS shutdown. PRS exhausts, by themselves, would not pose a direct chemical hazard to humans. However, the PRS would be operating in close proximity to the active east-west runway at Albuquerque International Airport, and it is possible that winds could spread the exhaust cloud over the runway where it could impact aircraft takeoffs and landings for a short period. It would be necessary to coordinate operation of the PRS with operations at the Albuquerque International Airport so that scheduled aircraft operations would not be impacted by PDRR ABL Phase testing.

The PRS would create 120 dB of noise within a 30 m (100-ft) radius during operation. Although the noise level of the PRS would be similar to that created by aircraft takeoffs, the duration would be longer (up to five minutes) and could create a short-duration nuisance at office facilities and housing areas on the north side of the east-west runway.

The transient noise from the B747 aircraft takeoffs for the PDRR ABL Phase would not alter land-use patterns of surrounding areas. Because Kirtland AFB shares its runway with the Albuquerque International Airport, the taxi tests and 30 additional takeoffs and landings of the B747 aircraft over an 18-month period would produce only minimal additional demand on the airport facilities. Noise levels from the B747 aircraft during takeoff would be greater than those of standard commercial aircraft, but would be comparable to C-141 and C-5A cargo, KC-135 tankers, NKC-135 B/E special aircraft, F-16 fighters, and other in-transit tactical military jets that currently use the runway.

Kirtland AFB initiated an Installation Restoration Program (IRP) in the 1980s for the remedial investigation and cleanup of soils and groundwater at sites contaminated by past activities. The IRP serves as the basis for response actions at USAF installations under the provisions of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 (42 USC § 9601). The IRP identified 21 contaminated sites on the Base. However, because none of the sites is located within the region of influence, no special precautions would be required for PDRR ABL Phase activities to ensure that the contamination does not spread or impact human health and safety. Sandia National Laboratories (SNL), which is housed on Kirtland AFB, has conducted a survey of its contaminated sites. The nearest of these sites is located approximately 1,100 m (3,500 ft) to the southwest, beyond the region of influence (SNL, 1993).

3.2.10 NOISE

A general discussion of noise and all applicable laws and regulations is provided in Section 3.0.10.

Region of Influence

The region of influence for noise exposure at Kirtland AFB is defined as the Hangar 760 Complex and the area approximately 1 mi (1.5 km) from the Hangar 760 Complex.

Affected Environment

The proposed locations for PDRR ABL Phase Home Base activities are less than 300 m (985 ft) south of the east end of the main east-west runway, RWY-08/26, at Albuquerque International Airport. This location falls within the 70-dB noise contour of current airport operations. The nearest housing development is Kirtland AFB's Zia Base Housing Complex, located over 900 m (3,000 ft) to the northeast of Hangar 760 (Figure 3.2-8).

Figure 3.2-8

The Environmental Assessment for Proposed Improvement to Runway 3/21 (Coffman Associates, 1994) indicates that 1991 noise profiles presented several conflicts with current land uses. These conflicts included the partial inclusion of the Zia Base housing development, the Argus Loop base housing neighborhood west of Carlisle Boulevard, and some of the Base dormitories within the 65-dB contour (Coffman Associates, 1994).

Environmental Consequences

The sources of loud noise generated by PDRR ABL activities would be facility renovation and equipment installation work in 1999, operation of the ground pressure recovery system and B747 engine runups in 2000 and 2001, and B747 engine runups and flight operations in 2002.

The noise level of typical commercial/industrial construction ranges from 71 to 89 dB at 15 m (50 ft) from the boundary (Golden, 1979). Table 3.2-9 shows noise levels from typical construction equipment.

Table 3.2-9. Estimated Construction Noise Levels

Activity	Equipment	Noise Level at 15 m (dB)
Earthmoving	Heavy trucks, Scraper, loader caterpillar	73 - 89
	Scraper, paver	80 - 89
Material Handling	Concrete mixer, concrete pump, crane	75 - 88
Stationary	Pumps, generators, compressors	76 - 80
Impact	Pneumatic tools	80 - 85
	Jack hammer	88
Other	Saw, vibrator	85 - 90
Source: Golden, 1979		

All of the equipment listed above is below the OSHA maximum noise level of 90 dB for a continuous 8-hour exposure (29 CFR § 1910.95). Other construction equipment may be used which may exceed 90 dB for short periods of time. But, none of the facility modification and equipment installation activities would exceed the OSHA 8-hour exposure limits.

Assuming a continuous noise level of 80 dB at the Hangar 760 area, the noise level would reduce to less than 45 dB at the south edge of the Zia Base housing development. This noise level is equivalent to a quiet urban nighttime environment.

The major sources of noise during system integration and ground testing would be the ground pressure recovery system and B747 engine runups. The noise level at Hangar 760 would increase on an intermittent basis, and last less than 15 minutes several times per week during the test program.

The ground pressure recovery system would be operational only during the tests of the HEL weapon system. Currently, a maximum of 30 tests would be conducted during the 9-month system integration and ground test phase of the program. The ground pressure recovery system would generate approximately 120 dB at 30 m (100 ft) for a period of five minutes during each test. Since OSHA limits impulsive or impact noise to less than 140 dB and exposure to a continuous noise of 115 dB to less than 15 minutes (29 CFR § 1910.95), hearing protection would be required for personnel in the immediate vicinity (60 m, or 200 ft) of the ground pressure recovery system during tests. However, the sound level would reduce to less than 90 dB before it reaches the south edge of the Zia Base housing development. This noise level would be annoying to the public but, because of its short duration, would not pose a health risk.

Noise levels for the B747 during ground tests and engine runup periods would be limited to 85 dB or less at 305 m (1,000 ft) depending on the power level setting of the engines (Boeing, 1993). The sound level from the B747 would be less than 70 dB when it reaches the south edge of the Zia Base housing development. This sound level is within the current AICUZ level generated by aircraft operations and would not adversely affect residents.

The major source of noise during the flight testing would be the B747 engines. The noise generated from the 30 test flights in a nine-month period should not change the existing noise patterns from commercial and other military flight operations.

3.2.11 RECREATION AND VISUAL RESOURCES

A general discussion of recreation and visual resources and all applicable laws and regulations is provided in Section 3.0.11.

Region of Influence

The region of influence for recreation and visual resources includes recreation, aesthetic, and public interests on the Base.

Affected Environment

Kirtland AFB has a number of recreational areas located throughout the Base (Figure 3.2-9). In addition, other special interest areas are protected for potential recreational use (USAF, 1995g). These include 100 archeological sites, three prairie dog towns, a line camp and rest stop, a scenic lookout at a fire tower, and three historical buildings.

The topography of the Albuquerque area and the proximity of the Sandia and Manzano Mountains afford a mostly unrestricted view of the mountain scenery from Kirtland AFB (DOE, 1995). Bordering the Base on the east is the Cibola National Forest. Within the national forest, 15,855 acres have been withdrawn for USAF use and 4,595 acres have been withdrawn for DOE use (Kluge, 1995). The area south of the Base is characterized as open space land that is owned by the Isleta Pueblo. A portion of this land, 6,345 acres is used as DOE-buffer lands under lease agreement with the Isleta Pueblo (Lucero, 1995). To the west of the Base is a 13,000-acre vacant parcel called Meas del Sol owned by the state of New Mexico. Approximately 7,700 acres of this parcel is DOE-buffer lands under lease agreements with the state of New Mexico (Callahan, 1995).

Environmental Consequences

PDRR ABL Phase facility modification and ground-test activities would have a low impact on any recreation facilities on Kirtland AFB. All modifications would occur to the existing hangar and surrounding buildings. Modification activities would not interrupt or prohibit the use of any recreation facility. Test activities would be limited to the hangar and the immediate area. No ground-test activities would extend beyond the PDRR ABL complex, and therefore, no effect on recreation facilities would be expected. The launch and recovery of the PDRR ABL aircraft would not have an impact on recreation since these activities would occur on an existing runway.

Figure 3.2-9

During the 30- to 33-month period of the PDRR ABL Phase, 45 USAF and 65 contractor personnel would be new to the region of influence. The additional personnel would increase use of recreation facilities, however, overcrowding or overuse of any facility would not be expected. The increase in use would be adequately accommodated by the Base and not result in the degradation of recreation services.

Modifications to the hangar and existing facilities would not impact the aesthetic value of the area where the PDRR ABL Complex would be located. The majority of the modifications would be within the hangar and surrounding facilities. Modifications to buildings that can be viewed by the general public would have an overall compatibility of appearance with the existing facilities. The aesthetic environment outside the PDRR ABL Complex would also remain unaffected because all ground-test activities would remain within the complex.

3.2.12 INFRASTRUCTURE AND TRANSPORTATION

A general discussion of infrastructure and transportation and all applicable laws and regulations is provided in Section 3.0.12.

Region of Influence

The region of influence for infrastructure and transportation is Kirtland AFB and the immediate surrounding area.

Affected Environment

Electrical Power. The Public Service Company of New Mexico provides power to Kirtland AFB. The primary service point is at the Sandia Switching Station (located on Eubank Boulevard which is on the east side of Kirtland AFB). This station is served by three incoming 115-kV and one 345-kV high-voltage transmission lines. There are two 44-MVA transformers in the station that are the source of the 46-kV distribution system servicing Kirtland AFB. The fiscal year 1995 peak demand occurred in August and was 62.6 MW. Four 46-kV distribution lines deliver power to 38 distribution substations located throughout Kirtland AFB and SNL. According to the *Kirtland Air Force Base Electrical Infrastructure System Comprehensive Study Report* (USAF, 1993d), the existing power sources to the Base are reliable and have sufficient capacity to meet current and projected demands. However, the distribution system's reliability on the Base has not been very good. Between 1983 and 1993, more than 338 major power outages on the Base occurred. Most of these were on the 46-ky distribution system. To correct this problem, the Base is currently undergoing several system upgrade projects. The west side of the Base is midway through the construction phase of a distribution system upgrade, and similar projects for the remainder of the Base are scheduled.

Water System. Potable water is primarily from groundwater wells located on the Base. The aquifer is a part of the Rio Grande Basin. The Base has a State Engineer-permitted allocation of over 2,000-million gallons annually from the aquifer. Kirtland AFB has nine existing water production wells that are capable of producing 12.4 million gallons per day (MGD). In addition to this, the Base is connected to the city of Albuquerque's water system by three large-diameter lines (Kirtland East High Zone, 35 cm [14 inches]; Kirtland East Low Zone, 50 cm [20 inches]; and, Kirtland West, 30 cm [12 inches]). In 1995, the wells on the Base produced an average of 3.11 MGD, which is down from 3.886 MGD average produced in 1993. The monthly peak consumption on the Base occurred in July 1995 with an average of 5.31 MGD. The city of Albuquerque supplied an average of an additional 0.88 MGD during the period of April through October. The Base is currently in the process of upgrading its water system. The upgrade project consists of drilling and equipping three new wells; constructing a 3.5-million-gallon water storage reservoir; and installing new water transmission lines; replacing the water system controls and telemetry with a supervisory control and data acquisition system; installing new pressure-regulating valves and replacing fire hydrants. The three new wells will bring the production capacity to over 20 MGD, but this capacity will decrease as existing, aging wells are removed from service. Since the actual yearly water usage on the Base has slightly decreased since 1983, the upgraded system will be more than adequate to supply all foreseeable future demands.

Wastewater System. Wastewater generated by the city of Albuquerque and Kirtland AFB is processed by the city at a combined trickling filter and activated-sludge treatment plant with an operating capacity of 60 MGD. Kirtland AFB currently contributes less than 2.5 MGD to the city's treatment facility.

Solid Waste Handling System. The Albuquerque Solid Waste Management Department is responsible for solid-waste collection and disposal. The city currently generates approximately 1,100 tons per day of solid waste and disposes of it in a city-owned sanitary landfill. The existing city landfill has a projected life of 10 years but could be expanded to increase its projected life to 50 years. Kirtland AFB produces approximately 40 tons per day of solid waste, which is collected by a contractor and disposed of in the city landfill. The landfill on the Base has been closed to all but construction debris. This landfill has a projected life span of 16 years.

Roads. Kirtland AFB is served by two major interstate highways, Interstates 25 and 40. These two highways in the central area of Albuquerque provide access to major streets. Access to the Base is provided by six gates. The Eubank, Wyoming, and Gibson gates provide access to Kirtland East while the Carlisle and Truman gates provide access to Kirtland West. The South Gate provides access to the Main Base area via Kirtland Road on the south side of the runway. Roads on the Base are generally characterized as two-lane, paved roads with many of the intersections controlled by traffic signals. Traffic is generally light, with flow peaking during the morning and afternoon commuting periods. Traffic problems are generally confined to these commuting periods along the roads leading to the gates. Once off the Base, the traffic rapidly disperses throughout the major streets in the city. Currently the network of roads on the Base is generally considered to be adequate to handle traffic influx and satisfy localized requirements except during peak rush-hour situations (Figure 3.2-10).

Railroads. The Santa Fe railroad offers passenger (Amtrak) and freight service to Albuquerque. A railroad spur services both the east and west sides of Kirtland AFB (Figure 3.2-10).

Aircraft. Kirtland AFB shares the runway with Albuquerque International Airport. This airport is served by eight major and six regional airlines. Direct air service is available to several major hubs, including Denver, Houston, Los Angeles, Chicago, Salt Lake City, and St. Louis. Albuquerque is the location of one of the 16 complete FAA ARTCC in the United States and enjoys 99-percent perfect flight conditions.

Figure 3.2-10

Environmental Consequences

The PDRR ABL Phase activities can be broken up into two distinct groups of activities: 1) facility modification and equipment installation and 2) weapon system integration and testing. It is estimated that the facility modification and equipment installation activities would last 12 to 15 months and employ approximately 60 locally hired construction workers. Additionally five personnel would be onsite from the PDRR ABL contractor to supervise and coordinate the facility modification and equipment installation activities. During the nine-month period when weapon-system integration and testing activities would occur, approximately 175 new personnel would be working at the PDRR ABL facilities. Of the 175 new personnel working at the PDRR ABL facilities, 90 are expected to be local hires.

The current infrastructure of Kirtland AFB supports nearly 20,000 workers daily and over 100 personnel currently work in proposed PDRR ABL facilities. The less than 1-percent increase in personnel working on Kirtland AFB for the two-year duration of the PDRR ABL Phase would have minimal impact on Kirtland AFB' s infrastructure and transportation systems.

3.2.13 SOCIOECONOMICS

A general discussion of socioeconomics and all applicable laws and regulations is provided in Section 3.0.13.

Region of Influence

More than 90 percent of Base personnel reside in a three-county area known as the Albuquerque Metropolitan Statistical Area (MSA) (Figure 3.2-1 1). Bernalillo County is the area in which the city of Albuquerque and Kirtland AFB are located. Immediately north and south of Bernalillo County are Sandoval County and Valencia County, respectively, in which are located rapidly growing communities within reasonable commuting distance of Albuquerque. Since any socioeconomic impacts from the PDRR ABL Phase would occur within this three-county area, the Albuquerque MSA is considered the region of influence for this analysis.

Affected Environment

According to the U.S. Bureau of the Census, 589,131 persons and 221,619 households were in the region of influence at the time of the 1990 Census. The Census Bureau estimated the population in the region of influence in July 1995 at 659,855 persons, representing a 12-percent overall increase during the 5-year period. The annual rate of population increase over the 5 years is 2.3 percent (DOC, 1995).

In 1990, nearly 300,000 persons 16 years of age and older (representing 66.6 percent) were in the labor force in the Albuquerque MSA. Fifty-six hundred workers were Armed Forces personnel at Kirtland AFB, and the remainder of the labor force (291,351 persons) was civilians. Slightly less than 20,000 persons were unemployed at the time, representing 6.8 percent of the civilian labor force (DOC, 1990).

According to the New Mexico Department of Labor, the civilian labor force had grown to just under 340,000 persons during 1995. Slightly more than 326,000 were employed, and an average of 13,838 persons, or 4.1 percent of the labor force, were unemployed during 1995 (NMDOL, 1996a).

Figure 3.2-11

Nearly one in three of the nonfarm civilian workers in the region of influence were employed in the service industry in 1995, while another 24 percent worked in wholesale and retail trade. Civilian government workers were the third largest group, with 60,700 federal, state, and local government employees in the region of influence, nearly 19 percent of the nonfarm civilian workers in the area. There also were more than 23,000 construction and mining workers in the region of influence during 1995, with the bulk of this group being construction workers. Each of the remaining industry sectors provided work for less than 10 percent of the civilian labor force in the region of influence during 1995 (NMDOL, 1996b). Kirtland AFB reported 5,600 active duty military personnel at the end of FY 1995 (USAF, 1995i).

Temporary personnel would stay in Albuquerque or on Kirtland AFB. Of the approximately 9,500 rooms available in Albuquerque, nearly 3,200 are situated in the general area of Kirtland AFB, and 400 are actually located on the Base. There are also approximately 1,200 restaurants located within the city limits of Albuquerque (Albuquerque Convention and Visitors Bureau, 1996; Atchison, L., 1996).

Environmental Consequences

If Kirtland AFB is selected as Home Base for the PDRR ABL Phase, the following sequence of events would be anticipated:

- Facility modification/equipment installation phase: Sixty construction workers would be hired locally, and 35 USAF and 5 contractor personnel would relocate to Kirtland AFB for a 12- to 15- month period, at a total cost of $40 million ($6.7 million for labor, $33.3 million for procurement, with $17 million being local procurement).

- System integration/ground test phase: Ten additional USAF personnel would relocate to supplement the 35 already onsite, and 150 additional contractor personnel would be needed to supplement the 5 already onsite (90 of the contractor employees would be hired locally, 30 would relocate for the duration of the project, and 35 would stay in local hotels and motels), for a total period of nine months. Hotel and restaurant revenues for the period would total approximately $690,000 (calculated at 35 persons x 38 weeks x five days/wk x $104 per diem) (41 CFR § 301).

- Diagnostic test phase: Forty-five USAF personnel and 155 contractor personnel would be needed onsite, for an additional five months (35 would stay in local hotels and motels). Hotel and restaurant revenues for the period would total approximately $380,000 (calculated at 35 persons x 21 weeks x five days/wk x $104 per diem) (41 CFR § 301).

- Expanded-Area test phase: Forty-five USAF personnel and 155 contractor personnel would be needed onsite, for an additional four months (35 would stay in local hotels and motels). Hotel and restaurant revenues for the period would total approximately $280,000 (calculated at 35 persons x 15 weeks x five days/wk x $104 per diem) (41 CFR § 301).

Most of the civilian workers at Home Base would be hired locally. During 1995, there were an average of 326,000 employed civilians and 5,600 active duty military personnel in the region of influence. Home Base activities at Kirtland AFB would add no more than 0.8 percent to the military personnel and 0.04 percent to the 1995 civilian workforce on the Base. Accordingly, no significant socioeconomic consequences in the region of influence would be anticipated as a result of the possible siting of Home Base activities at Kirtland AFB.

3.2.14 ENVIRONMENTAL JUSTICE

A general discussion of environmental justice and all applicable laws and regulations is provided in Section 3.0.14.

Region of Influence

The region of influence from an environmental justice perspective is an 80-km (50-mi) radius circle centered on Kirtland AFB (Figure 3.2-12).

In the region of influence, nearly 55 percent of persons were White, while another 37 percent were Hispanic. Slightly less than 5 percent of persons in the region of influence were Native Americans, mostly residing on the eight Indian Reservations within the three-county area. African Americans comprised slightly more than 2 percent of the population, and persons of Asian and Pacific Islander descent numbered about 1 of 100 persons in the region of influence. Table 3.2-10 provides details about the racial composition of the 1990 population in the region of influence.

The EPA Office of Planning and Analysis, EPA Region 6, uses a methodology based on data obtained from the Bureau of Census to evaluate and rank environmental justice concerns (EPA, 1994). Multipliers are applied to the percentages of minority and low-income populations residing in the region of influence. The results are compared to the percentages in the state in which the region is situated and ranked on a scale from one to five. For example, if the minority or low-income population in the region of influence is equal to or less than the state percentage, the ranking is one. If, however, either of those populations is equal to or greater than two times the state percentage, the ranking is five and the population is considered at high risk with regard to environmental justice concerns.

Table 3.2-10. Number of Persons by Race/Ethnicity and Number of Households in the Albuquerque Metropolitan Statistical Area, New Mexico, 1990

Persons by RacelEthnicity	Bernalillo county	Sandoval County	Valencia County	Totals (Albuquerque MSA)	Percent
Whites	268,909	32,409	20,566	321,884	54.6
Spanish/Hispanics	177,159	17,493	22,688	217,340	36.9
Native Americans	14,248	12,211	1,374	27,833	4.7
African Americans	12,124	786	389	13,299	2.3
Asian/Pacific Islander	6,618	343	123	7,084	1.2
Other	1,519	77	95	1,691	0.3
Totals	480,577	36,319	45,235	589,131	100.0
Source: DOC, 1990					

Figure 3.2-12

The EPA methodology merely establishes threshold levels in the screening process. Even in an area with a very low ranking, other factors may indicate the need for an analysis of environmental justice issues. The minority population in the state of New Mexico is 49 percent, and the low-income population is 31 percent. Total percentages in the region of influence do not exceed the statewide percentages in either area of concern, but the high concentration of minority and low-income populations in small communities throughout the region indicates the need for this analysis.

Environmental Consequences

Kirtland AFB is the alternative site selected for Home Base activities. As shown in Table 2-13 in Chapter 2, the environmental consequences anticipated for Home Base activities at Kirtland AFB would be low or nonexistent for all resources with one exception. The anticipated environmental consequences for health and safety would be considered moderate. However, the moderate impacts would only be anticipated for PDRR ABL Phase workers and not the population at large. Thus, no significant adverse or disproportionate health or environmental effects would be expected among the general public in the region of influence, including the minority and low-income populations, as a result of normal PDRR ABL Phase activities.

3.2.15 CUMULATIVE IMPACTS

Activities and resource attributes associated with implementing PDRR ABL Home Base activities at Kirtland AFB which may contribute to cumulative impacts are summarized in this section. No specific information regarding activities which may be scheduled at Kirtland in the year 2002 is currently available for analysis. A more detailed analysis will be done as the information becomes available and as system-test details are defined.

Aircraft Takeoffs and Landings. PDRR ABL Phase activities would increase the number of takeoffs and landings from Albuquerque International Airport by approximately 30 over a nine-month period. Currently, 30,000 takeoffs and landings of military aircraft occur annually at Albuquerque International in support of Base missions. The increase in aircraft exhaust and engine noise from the small number of additional aircraft operations would have minimal cumulative effects on any environmental attribute at Kirtland AFB.

Air Quality. The EPA recently upgraded Albuquerque from “nonattainment” to “maintenance” status for carbon monoxide, a criteria pollutant under the Clean Air Act. PDRR ABL Phase activities would increase carbon monoxide emissions levels by approximately 3 percent at Kirtland AFB. However, the additional emissions would increase levels for the City of Albuquerque/Bernalillo County by only 0.04 percent.

Biological Resources. Construction/modification activities may result in the removal of small areas of habitat. However, all activities would occur on previously disturbed land, and PDRR ABL Phase activities would not add to any cumulative loss of habitat at Kirtland AFB.

Noise. Noise levels at Kirtland AFB would increase from construction/modification activities, operation of the pressure recovery system, and engine runups. However, all noise-generating activities associated with the PDRR ABL Phase would be temporary, short-duration events, and noise levels would remain within Air Installation Compatibility Use Zone (AICUZ) noise limits.

Hazardous Materials and Waste. PDRR ABL Phase activities at Kirtland AFB would result in slightly larger amounts of hazardous materials usage and hazardous waste generation. However, the existing permitted storage facilities for these materials have adequate capacity for the additional material.

Infrastructure and Transportation. Although the PDRR ABL Phase would eventually employ 200 people at Kirtland AFB, there are currently 20,000 civilian and military personnel employed on Base. The PDRR ABL activities would result in minimal cumulative impacts to Base infrastructure or transportation.

Socioeconomics. PDRR ABL Phase activities would add approximately $6.7 million in wages, $17 million in procurement spending, and $1.35 million in hotel and restaurant revenues to the local economy. While these impacts are minimal in the socioeconomic region of influence, they are beneficial to the economy on a cumulative basis.

3.2.16 ADVERSE ENVIRONMENTAL IMPACTS THAT CANNOT BE AVOIDED

Unavoidable adverse impacts that may arise as a result of implementing the PDRR ABL Home Base activities at Kirtland AFB are discussed in the following subsections.

Air Quality. A minimal increase in yearly emissions from PDRR ABL activities cannot be avoided. However, the emissions would all be below allowable annual amounts.

Hazardous Materials/Waste. There would be a minor increase in the storage of hazardous materials and the generation of hazardous waste. These impacts would be mitigated by material substitution or process controls, but the impacts would have to be examined on a program- or system-specific basis in lower tier environmental documentation.

Noise. Noise from construction (e.g., during facility modification), operation of the pressure recovery system, engine runups, traffic, and aircraft overflight cannot be totally mitigated. Though aircraft noise could disturb the local population and animals, it is part of the existing environment at airport facilities. Operation of the pressure recovery system would cause high noise levels for infrequent, brief periods of time and would be scheduled during normal working hours to minimize the impact. Noise from the operation of construction equipment could annoy facility personnel who work near the construction sites. Support vehicle traffic would also cause localized impacts adjacent to site access routes. These impacts would be brief, lasting only through the construction period. All noises generated by PDRR ABL activities would remain within Air Installation Compatibility Use Zone noise limits.

Biological Resources. Only vegetation in previously disturbed areas near Hangar 760 would be destroyed under the proposed action.

3.2.17 MITIGATION TO ENVIRONMENTAL CONSEQUENCES

This section summarizes mitigation measures that would be considered beyond adherence to all laws, regulations and guidelines to control or reduce impacts the environment as a result of range activities. Because of the negligible impact that PDRR ABL Phase activities will have on most attributes and the additional measures already taken by USAF, no separate mitigation plan is currently deemed necessary. Nevertheless, we have outlined areas needing special attention and management, depending on the specific actions to be taken at a facility, the level of impact, and other pertinent factors.

Biological Resources. Based on on-going consultation with the USFWS, if Wright’s fishhook cactus were found on habitat that would be severely impacted by the proposed activity, the specimens may be transplanted to adjacent habitat with similar vegetation.

Hazardous Materials and Waste. Impacts would be mitigated by material substitution or process controls, but the impacts would have to be examined on a program- or system-specific basis in lower-tier environmental documentation.

Health and Safety. Aircraft layout and design would include aircrew safety measures to reduce the potential exposure to laser chemicals.

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3.3 WHITE SANDS MISSILE RANGE (PREFERRED DIAGNOSTIC TEST RANGE)

White Sands Missile Range (WSMR) is the preferred Diagnostic Test Range for conducting PDRR ABL Phase activities. This section discusses specific affected environments and environmental consequences by environmental attribute at WSMR.

3.3.1 COMMUNITY SETTING

Background. Before World War II, the area of the present White Sands Missile Range was used by ranchers for grazing cattle and goats. During World War II, the U.S. Army Ordnance Corps established White Sands Proving Ground to test the feasibility of using missiles in warfare. Trinity Site, a national historic landmark, is near the north boundary of the range and is the location of the world's first atomic bomb explosion in July 1945. On 1 May 1958, White Sands Proving Ground was redesignated as WSMR.

Today, WSMR is designated as a national test range and is the largest overland test facility in the United States. The Range supports missile development and test programs for the U.S. Army, U.S. Navy, U.S. Air Force, NASA, other government agencies, some foreign governments, and private industry. White Sands Space Harbor is an alternate landing site for the space shuttle and a training site for NASA shuttle pilots. Approximately 7,700 civilian, military, and contractor personnel are employed on the Range. WSMR launches approximately 150 high-altitude missiles, between 400 and 500 drone flights, and ten balloons annually.

Location. WSMR is located in south-central New Mexico and includes approximately 2-million acres in Dona Ana, Otero, Socorro, Sierra, and Lincoln Counties (Figure 3.3-1). The Range boundaries extend almost 161 km (100 mi) north to south and 65 km (40 mi) east to west. WSMR headquarters is located 32 km (20 mi) east of Las Cruces, New Mexico, and 73 km (45 mi) north of El Paso, Texas.

Facilities. The main launch complexes at WSMR encompass approximately 600 acres extending 3.2 km (2 mi) north-south and 30 km (19 mi) east-west (Figure 3.3-1). The area is located northeast of the main post and contains eight launch complexes (Launch Complexes 32 to 38 and 50). The complexes support both ground-to-ground and ground-to-air missile launches. The ABL Program would use launch facilities that have previously been used to launch the Lance, Terrier/Orion, and Terrier/Black Brant missiles chosen as PDRR ABL Phase targets. Missile assembly facilities and temporary storage facilities for missiles already exist in the area of the launch complexes, and therefore no new construction would occur. Approved impact points would be used for recovery of all missiles launched at WSMR. Flights of full-scale drones (such as the remote-controlled, unmanned Q-4 aircraft) would originate at Holloman AFB, on the east side of the Range. Flights of subscale drones, such as the BQM-34, which are air- or ground-launched, may originate anywhere within the Range boundaries and are subject to Range Safety Office direction.

Affected Environment

The launch complexes are located in the Tularosa Basin, a physiographic feature enclosed on three sides by mountain ranges discussed in more detail in Section 3.3.5 and shown on Figures 3.3-4 and 3.3-5. The San Andres Mountains form the western and northwestern margins of the basin, the Oscura Mountains form the northern boundary, the highlands surrounding Sierra Blanca Peak and the Sacramento Mountains form the eastern boundary, and the Organ Mountains form the southwestern boundary. The basin is generally open to the south, and the basin floor slopes slightly from north (5,000 ft above mean sea level [AMSL]) to south (3,900 ft AMSL). The region lies within the northern part of the Chihuahua

Figure 3.3-1

Desert and supports four major plant communities. These are Chihuahua desert scrub, coniferous woodland, closed basin scrub, and desert grasslands. Aquatic habitats are limited, but the area supports a variety of terrestrial wildlife with numerous species of mammals, birds, and reptiles (WSMR, 1994b).

The regional climate is characterized by an abundance of sunshine throughout the year, very low humidity, scant rainfall, occasional dust storms, and a relatively mild winter season. The average annual mean temperature at the southern end of the range is 60oF. The monthly mean temperature in December and January is 44oF, with daily temperatures ranging from 32oF to 560F. July is the warmest month with a mean temperature of 8 81oF and daily ranges of 69oF to 94oF. Relative humidity averages approximately 40 percent throughout the year. It is lowest in the afternoon and at a peak in the early morning. Annual precipitation varies from 7 to 11 inches, and over half occurs between June and September. The average monthly wind speeds are relatively low and range from 2.2 in/sec (4.8 mph) to 4 in/sec (9 mph). Prevailing winds are from the west, except during July and August when the wind directions are from the southeast and south-southwest, respectively. The windy season is from March to May and is characterized by strong westerly winds and periods of blowing dust.

3.3.2 AIR QUALITY

A general discussion of air quality and all applicable laws and regulations is provided in Section 3.0.2.

Region of Influence

The southern two-thirds of WSMR is located in New Mexico Air Quality Control Region (AQCR) 6, which includes Dona Ma, Sierra, Lincoln, Torrance, and Otero Counties (Figure 3.3-1). These counties, along with six in Texas, are part of the EPA El Paso-Las Cruces-Alamogordo Interstate AQCR 153 (40 CFR § 81.82). Two adjacent “Call-Up Areas” to the west and north are lands which, by prior agreement, can be evacuated during hazardous test operations. The southern part of the Western Call-Up Area is also in AQCR 6. The northern part of the Range, the northern part of the Western Call-Up Area and most of the Northern Call-Up Area are located in Socorro County, which is in New Mexico AQCR 8 and EPA Southwestern Mountains-Augustine Plains Intrastate AQCR 156 (40 CFR § 8 1.241). The northeastern corner of the Northern Call-Up Area in Torrance County is in New Mexico AQCR 4 and EPA Northeastern Plains Intrastate AQCR 154 (40 CFR § 8 1.240).

Affected Environment

Because of the low population at WSMR, the lack of industry or any major pollution sources, and atmospheric conditions favoring rapid dispersion of pollutants, the existing air quality on the Range is considered to be better than national standards. WSMR is designated as being in attainment for all six federal criteria pollutants. The state of New Mexico ambient air monitoring network has no monitoring sites on or near WSMR but does have one in Las Cruces. The monitoring site is located on the west side of the Organ Mountains and would not accurately represent conditions in the Tularosa Basin. A summary of potential criteria pollutant emissions at WSMR is presented in Table 3.3-1.

Environmental Consequences

The emissions produced by the PDRR ABL Phase would be minor and would have no significant regional impact. The PDRR ABL Phase activities that have the potential to affect air quality at WSMR would be the preparation of targets and drone-flight and missile-launch operations that occur below 3,000 ft AGL. The PDRR ABL Phase activities contain no new stationary sources that would require permits for criteria air pollutants or alterations to the Title V permit at WSMR.

Target-missile preparation activities would include receiving, temporary storage, inspection of the missile booster assembly, transport to launch location, mounting on the launcher, and equipment cleaning. These activities could involve the emissions of volatile organic compounds or hazardous air pollutants. However, these amounts would fall well below the minimal levels of federal and New Mexico regulations. There would be no missile fueling operations because the Lance missile would arrive in a pre-fueled, ready-to-fire condition, and the Terrier/Orion and Terrier/Black Brant missiles are solid-propellant rockets. The transportation of the target missiles to WSMR would be conducted in accordance with DOT regulations and would have no measurable impact on air quality. Pre-launch activities would involve flight-testing evacuations and clearances, and road closures. Vehicles would be involved with the area evacuations and road closures, and clearances may involve helicopter overflights to verify that the areas are clear. Post-flight activities to recover debris may involve the use of helicopters and four-wheel-drive vehicles.

Table 3.3-1. Estimated Potential Criteria Pollutant Emissions at White Sands Missile Range, New Mexico (tons/yr)

Source	VOC	CO	NO_x	SO_x	TSP
Boilers	0.6	2.3	11.2	0.1	1.3
Generators	148.7	1,114.9	1364.3	90.4	97.1
Surface-Coating Operations	88.2	-	-	-	75.0
Fuel Storage/Dispensing	32.1	-	-	-	
Abrasive Blasting	-	-	-	-	0.2
Woodworking Operations	-	-	-	-	115.1
Miscellaneous Chemical Operations	3.1	-	-	-	
Wastewater Treatment	3.2	1.2	0.2	<0.05	-
TOTAL	275.9	1,118.4	1,375.7	90.5	288.7

TSP—Total Suspended Particulates
Source: WSMR, 1994b

Emissions from drone-flight and missile-launch operations and accidents would be low (total emissions from all target operations would be 1 ton of CO and 0.3 tons of VOC, NO_x, and PM-10 combined). Appendix D lists the emissions from drone-flight and missile-launch operations. Launch operations would use any combination of the two-stage Terrier/Orion and Terrier/Black Brant missiles and the Lance missile. WSMR recently completed an environmental assessment on the use of the Lance missile as a target (U.S. Army, 1996a). This assessment analyzed the impact of utilizing the estimated 120 Lance missiles as targets at WSMR. The conclusions of this assessment were: “Emissions created by missiles, radar equipment, and ground vehicles will be released into the atmosphere. The quantity released is not significant when compared to yearly estimates for emissions created by daily commuters to WSMR.”

The only hazardous air pollutants produced from normal operations would be 0.04 kg (0.1 lb) of hydrochloric acid from each Lance missile launch. Accident scenarios involving the release of IRFNA and UDMH are covered in Appendix C. Toxic corridor dimensions vary with wind velocity. Analysis showed that the toxic corridor could be as great as 890 by 160 m (2,920 by 525 ft) for a wind velocity of 5 m/sec (11 mph), and only 45 by 24 m (150 by 80 ft) for a wind velocity of 1 in/sec (2.2 mph).

Because WSMR is in attainment for all National Ambient Air Quality Standards (NAAQS), a conformity analysis would not be required. However, an estimate of the total projected emissions was included as a part of the analysis for the PDRR ABL Phase (Appendix E). Emissions from target preparation, launch, and recovery were included in the analysis. The results of the emissions calculations are presented in Table 3.3-2. These minor levels are a small percent of the estimated emissions and would not affect the quality of the air at WSMR.

Table 3.3-2. Estimated Emissions from PDRR ABL Phase Activities (tons/yr)

Year	VOC	CO	NO_X
2001	0.03	0.09	0.01
2002	0.29	2.12	0.17

3.3.3 AIRSPACE

A general discussion of airspace and all applicable laws and regulations is provided in Section 3.0.3.

Region of Influence

The region of influence for airspace is the WSMR restricted area complex.

Affected Environment

WSMR complex is made up of 18 restricted areas when active (Figure 3.3-2). The Deputy for Air Force Office (DAF), WSMR, is the agency that uses 13 of the areas controlled by WSMR (Table 3.3-3). The remaining five areas are controlled by Fort Bliss, Texas and are primarily scheduled for use by U.S. Army training activities.

All 18 areas are charted by the FAA as restricted airspace, which allows for hazardous activity use. Such hazardous activities include live-ordnance delivery, missile firings, and laser shots. Any civil or military aircraft that have not been authorized and scheduled by the controlling agency are prohibited from entering active restricted airspace. During part of each day, some of WSMR restricted airspace may be returned to FAA control for use by civilian aircraft under a shared-use agreement between WSMR and the FAA. All areas are joint-use except R-5 R-5107B which is in continuous use by WSMR and is not released back to the FAA (U.S. Army, 1995b). A schematic view of the restricted airspace is depicted in Figure 3.3-3.

Environmental Consequences

All drone and missile launches, aircraft testing, and beam-characterization activities would take place in existing restricted airspace. The special-use airspace covering both WSMR and the Northern Call-Up Area protects non-military aviation from potentially hazardous military operations, including missile testing. Impacts to airspace from PDRR ABL Diagnostic Test Range activities would be low.

A maximum of 20 flights of the PDRR ABL could occur at WSMR, including six non-engagement flights, four drone flights, six missile flights, and four target-of-opportunity flights. For all diagnostic tests it is anticipated that the PDRR ABL would be orbiting at approximately 40,000 ft AMSL over the Call-Up Area. During acquisition, pointing, and tracking of the targets, the aircraft would not engage missiles or drones until they had risen above 40,000 ft AMSL and the laser would always be pointed horizontally or upward. Airspace above 35,000 ft may be closed to other system-flight operations which might impact upon the PDRR ABL flight tests. Closure of restricted airspace at this altitude is not anticipated to have an impact on other aerial operations. Because activities would occur at an altitude of 40,000 ft AMSL there would be no impact upon local civilian or private airports. The launches and intercepts would occur at sufficient distance and altitude to have little effect on local flying activities.

Figure 3.3-2

Table 3.3-3. Restricted Airspace at White Sands Missile Range, New Mexico

Air Space	Time Used	Days Used	Effective Altitude	Controller/using Agency
R-5103A	1400-0700[3]	Continuous	Surface – FL 180	Albuquerque/Fort Bliss, TX
R-5103B	1400-0700[3]	Continuous	Surface - 12,500 ft	Albuquerque/Fort Bliss, TX
R-5103C	1400-0700[3]	Continuous	12,500 ft – Unlimited	Albuquerque/Fort Bliss, TX
R-5103D	1400-0700[3]	Continuous	FL 180 – Unlimited	Albuquerque/Fort Bliss, TX
R-5107A	Continuous	Continuous	Surface - Unlimited	Albuquerque/Fort Bliss, TX
R-5107B	Continuous	Continuous	Surface - Unlimited	WSMR Security Office
R-5107C	[2]	Mon-Fri	9,000 ft – Unlimited	Albuquerque DAF WSMR
R-5107D	Continuous	Continuous	Surface - FL220	Albuquerque DAF WSMR
R-5107E	[2]		Surface - Unlimited	Albuquerque DAF WSMR
R-5107F	[1]	Mon-Fri	FL240 - FL450	Albuquerque DAF WSMR
R-5107G	[1]	Mon-Fri	FL240 - FL450	Albuquerque/DAF WSMR
R-5107H	[2]	Mon-Fri	Surface - 9,000 ft	Albuquerque/DAF WSMR
R-5107J	[1]	Mon-Fri	Surface - 9,000 ft	Albuquerque/DAR WSMR
R-5109A	[1]		FL240 - Unlimited	Albuquerque/DAF WSMR
R-5109B	[1]		FL240 - Unlimited	Albuquerque/DAF WSMR
R-5111A	[2]	Mon-Fri	13,000 ft - Unlimited	Albuquerque/DAF WSMR
R-5111B	[2]		Surface - 13,000 ft	Albuquerque/DAF WSMR
R-5111C	[2]		Surface - Unlimited	Albuquerque/DAF WSMR

[1] Thirty minute notification Monday-Friday, other times by NOTAM 12 hours in advance
[2] By NOTAM 12 hours in advance
[3] Other times by NOTAM
Source: WSMR TGORM Instruction 13-12

Figure 3.3-3

During acquisition, pointing, and tracking activities, targets would not be destroyed. After testing is completed, drones would return to the runway and missiles would fall intact in the debris-recovery areas.

Clearing WSMR airspace of all air traffic would have minimal operational impact on Holloman AFB activities. Holloman AFB uses the airspace extensively for advanced flight-training missions, and the airspace is frequently closed to air traffic during the 150 high-altitude missile launches per year.

3.3.4 BIOLOGICAL RESOURCES

A general discussion of biological resources and all applicable laws and regulations is provided in Section 3.0.4.

Region of Influence

The region of influence is the environment within the confines of the WSMR property line. However, the primary focus of activities is in the missile-launch and recovery areas and the runways used by drone aircraft.

Affected Environment

Threatened and Endangered Plant Species. Seventeen listed plant species may be present in the vicinity of the proposed action on WSMR (Table 3.3-4). This table may be revised, based on consultation with the USFWS.

Table 3.3-4. Threatened and Endangered Plant Species Known or Expected to Occur at White Sands Missile Range, New Mexico

Common Name	Scientific Name	State Status	Federal Status
Alamo penstemon	Penstemon almoensis	R	S
Castetter's milkvetch	Astragalus castetteri	R	—
Cliff brittlebush	Apacheria chiricahuensis	R	—
Desert parsley	Pseudocymopterus var. longiradiatus	R	—
Longstemmed talinum	Talinum longipes	R	—
Mescalero milkwort	Polygala rimulicola mescalerum	E	S
Mescalero pennyroyal	Hedeoma pulcherrimum	R	—
Mosquito plant	Agastache cana	R	—
Night bloomingcereus	Cereus (Peniocereus) greggii	E	S
Organ Mountain evening primrose	Oenothera organensis	R	S
Organ Mountain pincushion cactus	Escobaria orgenensis	E	—
Plank's catchfly	Silene plankii	R	—
Prairie gentian	Eustoma exaltatum	R	—
San Andres cross daisy	Perityle staurophylla var. homoflora	R	—
Sandberg's pincushion cactus	Escobaria sandbbergii	R	—
Todsen's pennyroyal	Hedeoma todsenii	E	E
Vasey bitterweed	Hymenoxys vaseyi	R	—
E Endangered R Rare S Species of Concern T Threatened			

Threatened and Endangered Animal Species. Thirteen listed animal species may be present in the vicinity of the proposed action on WSMR (Table 3.3-5). This table may be revised, based on consultation with the USFWS.

Table 3.3-5. Threatened and Endangered Animal Species Known or Expected to Occur at White Sands Missile Range, New Mexico

Common Name	Scientific Name	State Status	Federal Status
Black-footed ferret	*Mustela nigripes*	—	E
Meadow jumping mouse	*Zapus hudsonis luteus*	T	—
Desert Bighorn Sheep	*Ovis Canadensis mexicana*	E	—
Whooping crane	*Grus americana*	E	E
Bald eagle	*Haliaeetus leucocephalus*	T	T
American peregrine falcon	*Falco peregrinus anatum*	E	E
Northern aplomado falcon	*Falco femoralls septentrionalis*	E	E
Common black hawk	*Buteogallus anthracinus anthracinus*	T	—
Arizona Bell's vireo	*Vireo bellii arizonae*	T	—
Gray vireo	*Vireo vicinior*	T	—
Baird's sparrow	*Ammodramus bairdii*	T	—
Varied bunting	*Passerina versicolor*	T	—
White Sands pupfish	*Cyprinodon tularosa*	T	—
E Endangered T Threatened			

Environmental Consequences

As discussed in Section 2.1.2, missiles would not be destroyed using the HEL at the Diagnostic Test Range. Rather, missile flights would be used to test and evaluate the tracking and targeting systems, and the HEL would be tested using target boards pulled behind drone aircraft. Therefore, no widely-dispersed debris would be generated by the proposed action at the diagnostic test range, and intact missiles would return to earth at the established areas at WSMR. The most likely impact on biological resources during Diagnostic Test Range activities at WSMR would be from hazards associated with routine range activities.

Impacts associated with routine range activities would include missile-launch noise and missile-debris impacts and air emissions from missiles and drone aircraft. The addition of six missile launches and four drone aircraft flights would not significantly alter the impacts currently imposed on the local biological resources by approximately 150 missile launches per year and 400 to 500 drones aircraft flights per year.

The impacts associated with the operations of the HEL are discussed in Section 3.5.4. The laser safety calculations are available in Appendix F. This analysis shows that laser activities would not have significant impacts upon the wildlife at WSMR. Largely, this results from the high altitude at which the proposed laser activity would occur (40,000 feet AMSL or greater) and from the test geometry that would prevent the HEL from being engaged in a downward direction.

3.3.5 GEOLOGY, SOILS AND WATER RESOURCES

A general discussion of geology, soils, and water resources and all applicable laws and regulations is provided in Section 3.0.5.

Region of Influence
The region of influence for geology, soils, and water resources from launch- and debris-recovery activities includes all of WSMR, exclusive of the Call-Up areas. In addition, the full-scale drones would takeoff and land at runway facilities at Holloman AFB.

Affected Environment
Geology. Most of WSMR is located in the Tularosa Basin, which is the surface expression of an arm of the Rio Grande rift (Figure 3.3-4). The rift is a complex geologic depression that extends from southern New Mexico, north to Colorado, and was developed during the past 30-million years. The Tularosa Basin is surrounded by block-faulted mountains on the west, north, and east (Figure 3.3-4).

Bedrock uplands occupy about 45 percent of the surface area on WSMR. Most of the exposed bedrock is between a billion and 250-million years old. A small amount of bedrock consists of much younger material that was intruded as liquid magma into older rocks about 30-million years ago (e.g., in the Organ Mountains to the southwest) or extruded onto the surface as lava flows within the past 2-million years (e.g., the “malpais” flow to the northeast).

Approximately 55 percent of the surface consists of low-lying areas underlain by unconsolidated gravel, sands, silt, and clay, which are less than 30-million years old and overlie the older bedrock units. The sediments consist of mostly water-transported materials that slope gently away from the bedrock hills, lake-deposited materials in the low-lying areas, and wind-blown deposits. A large dune field of gypsum (calcium-sulfate salt) sand characterizes White Sands National Monument to the south.

Seismicity. Two major fault zones are present within the boundaries of WSMR (Figure 3.3-5) (WSMR, 1994a). The western fault zone occurs along the eastern side of the San Andres and Organ Mountains. It was active approximately 8,000 years ago (WSMR, 1994a). The eastern fault zone is located along the western side of the Sacramento Mountains. It lies mainly to the east of WSMR, but a small portion crosses into the northeastern part of WSMR. The eastern fault zone has been active within the past 2 million years and possibly as recently as within the past 10,000 years (WSMR, 1994a).

No major earthquakes have occurred within the boundaries of WSMR since historic record-keeping began in 1849, but the Range is located in a structurally active area where a major earthquake is a possibility. The Uniform Building Code seismic risk zones for WSMR are Zone 2 and Zone 3, indicating that moderate to major damage could affect structures during earthquakes (USACE, 1987). The seismic risk for non-construction projects, such as the PDRR ABL, however, would be minimal.

Soils. A total of 30 soil types were identified during the soil survey of WSMR (WSMR, 1985). The soil horizons consist primarily of fine quartz sands, gypsum sands, and gravelly, sandy, silty, and clayey loams (mixtures of clays, silt, and sand). The soils are generally well-drained, but tend to erode rapidly if disturbed (NOMTS, 1990).

Figure 3.3-4

Figure 3.3-5

Soils at the launch area belong to the Dune Land/Dona Ana Complex, which is primarily windblown sand, with some Dona Ana and Bluepoint soils in the areas between the dunes. Soils at the debris recovery areas consist primarily of Marcial, Mead, Mimbres, Berino, Lozier, Nickel, Rock Land (in the Oscura Mountains), Sonoita, and Yesum series (WSMR, 1985).

Surface Water. About 80 percent of the surface drainage of WSMR is internally into the Tularosa Basin, and most of the remainder is within the Jornada del Muerto Basin (NOMTS, 1990). Lake Lucero and Big Salt Lake, located within two of the designated debris-recovery areas, are the only significant water bodies that contain standing water year-round (Figure 3.3-6). Salt Creek, the only perennial stream, flows through the designated debris-recovery areas and discharges into Big Salt Lake. Many intermittent lakes occur on WSMR as a result of water accumulation after periods of heavy precipitation, but the water bodies are subject to rapid evaporation. Numerous springs exist on WSMR along the flanks of the San Andres Mountains, in the Oscura Mountains, and within the Tularosa Basin. The springs within the basin generally discharge water of poor quality (NOMTS, 1990).

Natural wetlands occur at several places throughout WSMR. A few notable localities are Salt Creek and Malpais Springs (located within a designated debris-recovery area), Mound Springs, Lost River Basin, Malone Draw, and Lake Lucero. Man-made or augmented wetlands occur at ponds and sewage treatment facilities. The potential for flash floods exists along the mountain fronts, but the risk is lessened because of rapid infiltration of waters into the sandy soils. The very gentle slope of the land surface within the region of influence makes flash flooding unlikely in those areas.

Groundwater. Recharge of direct precipitation is the source of essentially all of the groundwater in the Tularosa Basin. Average annual precipitation is 10 inches, but varies from approximately 7 inches in the basin to more than 25 inches in the higher elevations. Groundwater recharge to the basin occurs primarily in the alluvial fans along the basin margins at the foot of the mountains. Virtually no groundwater recharge occurs in the dry-lake areas because of impermeable clay beds.

Limited quantities of fresh groundwater with dissolved-solid concentrations less than 1,000 mg/L occur within the alluvial-fan deposits along the margins of the basin (NOMTS, 1990). The potable water generally occurs within a band that extends 5 to 8 km (3 to 5 mi) from the mountain front (NOMTS, 1990). The freshwater zone has an estimated thickness of up to 1,500 ft in places, and it thins toward the mountains. This water supplies many of the freshwater needs within the basin.

Potable water for WSMR is supplied by wells in the Main Post and Soledad Canyon areas, which are situated in the alluvial fans of the Organ and San Andres Mountains (Figure 3.3-6). The freshwater aquifer in the Tularosa Basin is in a state of overdraft, resulting in a declining water table and increasing salinity. Water levels at the weilfield are declining at a rate of 2 feet per year, and salinity levels have risen to the point that an additional source of water is needed. WSMR may withdraw up to 0.67 MGD from Soledad Canyon to the south of WSMR under an agreement with Fort Bliss. The additional source will allow withdrawal rates at the Main Post wellfield to be reduced to a level equal to recharge (U.S. Army, 1994b).

Water Quality. The surface waters at WSMR have no practical domestic or commercial value because of high salinity. Only four percent of the groundwater in the Tularosa Basin is fresh (total dissolved solids, TDS < 1,000 mg/L) and considered useful for irrigation or for human or animal consumption. TDS concentration in the groundwater increases toward the center of the basin and with increasing depth. A transition zone of slightly saline water, with TDS concentration from 1,000 to 3,000 mg/L, has limited use for irrigation. Toward the center of the basin, in the region of influence of PDRR ABL Phase activities, water becomes moderately saline, with 3,000 to 10,000 mg/L TDS, to very saline, with 10,000 to 35,000 mg/L TDS (NOMTS, 1990). The water table occurs at shallow depths across most of the central portion of the basin (NOMTS, 1990). No known contamination exists on the ground surface, in surface water, or the groundwater in the launch areas or in the debris-recovery areas (Magallanes, 1996).

Figure 3.3-6

Environmental Consequences

The PDRR ABL flights would be consistent with ongoing operations and would not impact geologic resources, soils, or water quality. The gaseous chemical emissions from high-energy laser firings, which would be vented from the aircraft at operational altitudes, would be dispersed in the atmosphere and would not reach the ground surface. Therefore, the laser emissions would not impact geology, soils, or water quality at WSMR. The four drone flights that would originate and terminate at Holloman AFB would be similar in nature to the substantial number of tactical jet flights currently conducted at the Base and would create a negligible incremental impact on geology, soil, and water quality at Holloman AEB.

During acquisition, pointing, and tracking flights, a maximum of six target missiles would be launched from an existing, active launch complex located approximately 8 km (5 mi) east of the Main Post area (Figure 3.3-1). The emissions from the missile launches are listed in Appendix D.

Missile launches would result in small quantities of emissions in the launch area. The primary emission products that could potentially impact geologic, soil and water resources would be hydrochloric acid (HCl), hydrofluoric acid (HF) and lead. The acids would react strongly with the calcium-rich soils, and would neutralize and produce minimal amounts of calcium chloride, calcium fluoride, carbon dioxide gas, and water. The neutralization by-products calcium chloride and calcium fluoride are soluble in water but would not be considered contaminants. The lead would disperse as dust over extremely large areas and would have negligible impact on soil chemistry. Therefore, missile launches would have minimal additional impact on geologic, soil, and water resources in the vicinity of the launch pads.

The planned testing at WSMR consists of tracking missions and would not destroy the missile in flight. The target missiles would impact the ground surface monolithically in designated debris-recovery areas north of the launch sites, with only small quantities or no fuel onboard (see Appendix G). According to the *Lance Missile Target Environmental Assessment for White Sands Missile Range* and the resultant *Finding of No Sign Significant Impact* (U.S. Army 1996a; U.S. Army 1996b), and the environmental analysis performed by NASA for the Sounding Rocket Program (NASA, 1994), there would be no significant impact on geology, soils, or water quality from the Lance, Terrier/Orion, or Terrier/Black Brant target missiles.

The soils at WSMR are prone to erosion, and off-road vehicle movement could destabilize soils during debris recovery. The missiles would have sufficient momentum to create soil disturbance upon impact. Because the recovery areas have been used extensively for testing at WSMR, PDRR ABL missile impacts and missile-recovery operations would not significantly increase soil erosion or pose a significant threat to the existing soil stability. Debris-recovery areas would be restored, to the extent necessary, to prevent erosion. Debris-recovery operations would also ensure that surface water and groundwater would not be impacted by other materials (i.e., metals) in the missiles.

Small quantities of gases, vapors, and particulate emissions would be dispersed rapidly in the atmosphere and neutralized by soils or incorporated as dust in soils. Therefore, impacts to geologic resources, soils, and water quality would be negligible.

3.3.6 CULTURAL RESOURCES

A general discussion of cultural and paleontological resources and all applicable laws and regulations is provided in Section 3.0.6.

Region of Influence
The region of influence for cultural and paleontological resources includes all of WSMR, exclusive of the Call-Up areas.

Affected Environment
Less than seven percent of the total area has been adequately surveyed for archeological resources (U.S. Army, 1995b). Of the land surveyed, 35 percent of the recorded sites are located in the mountains or mountain slopes, 27 percent occur on the alluvial plains, and 27 percent occur in the Malpais (WSMR, 1985). Figure 3.3-7 generalizes the known cultural resource areas at WSMR.

Approximately 6,000 prehistoric sites have been recorded with the majority of sites dating between 400 to 1400 AD. The earliest prehistoric archeological resources are found in and around the Tularosa Basin dating 9000 to 6000 BC (WSMR, 1985). Prehistoric sites include ground-stone processing areas, quarries, hunting and butchering areas, ceramic scatters, and pit houses.

There are no recorded prehistoric National Register of Historic Places (NRHP) properties on WSMR. One well-documented site, recorded on the New Mexico State Register of Cultural Properties, is known as the Mockingbird Gap Site and is located 0.4 km (0.25 mi) south of Highway 380, just north of the Oscura Mountains (WSMR, 1 994a).

Historic records indicate the Spanish explored the area in the 1600s. Athapascan people from north of the Great Lakes occupied the region until the Europeans entered in the late 1 880s and introduced cattle ranching. Cattle ranching continued through 1942 until the focus of the area changed to early atomic-weaponry research and development at Trinity Site (WSMR, 1985).

Approximately 240 historic sites are associated with homesteading, ranching, and mining. Other sites include 34 that represent military occupation during WWII and the Cold War. Two historic resources and structures that are NRHP sites include Trinity Project-related site, where the first atomic device was detonated on 16 July 1945, and the White Sands V-2 Launch Site.

Available records indicate that mountainous regions in the northern portion of WSMR have been used as traditional religious sites by Native Americans. The Oscura Mountains located in the northern portion of WSMR are used for religious purposes, and Salinas Peak, located in the San Andres Mountains, is a sacred mountain for the Chiricahua Apache. The total number and distribution of traditional resource sites is not currently available (U.S. Army, 1995b).

Paleontological Resources. One paleontological site consisting of prehistoric mammal tracks is present in the southwestern portion of WSMR (WSMR, 1985).

Environmental Consequences
Previously-used launch sites and associated debris-recovery areas would be used for the proposed action. Therefore, no new potential impacts to cultural resources are expected. However, should any unforeseen cultural or paleontological resources be encountered, activity would be suspended until the Base Preservation Office is notified and consulted. Environmental consequences for undisturbed cultural or paleontological resources would be low.

Figure 3.3-7

3.3.7 HAZARDOUS MATERIALS AND WASTE

A general discussion of hazardous materials and waste and all applicable laws and regulations is provided in Section 3.0.7.

Region of Influence
The region of influence for hazardous materials/hazardous waste includes the entire range. However, the region of influence may extend beyond the Base boundaries along established transportation networks in the event of an accident involving the transportation of missile targets.

Affected Environment
WSMR currently stores and uses a variety of hazardous materials. Hazardous materials used in range-infrastructure support activities include cleaning solvents, paints, motor fuels and other petroleum products. These materials are issued through the facility supply system to individual users. The majority of these materials are consumed in operational processes and the remainder is collected as hazardous waste. Hazardous materials used for range-testing operations include cleaning solvents, paint compounds, explosive material, and toxic propellants (U.S. Army, 1994b). Specific types and quantities of materials can vary depending upon specific system and test-configuration requirements. Each agency utilizing WSMR is responsible for procurement and management of its hazardous materials. All use of hazardous materials by Range users requires approval and coordination with WSMR safety and environmental organizations (U.S. Army, 1995b).

Users of hazardous materials are responsible for the proper collection and disposal of all hazardous waste generated as a result of their activity. This includes both waste generated during pre-flight activities at WSMR facilities and waste generated following test operations.

WSMR currently has a Part B RCRA permit for storage of hazardous waste (Smith, 1995). WSMR Regulation 200-1, *Environmental Hazardous Waste Management,* provides guidelines for the handling and management of hazardous waste and ensures compliance with all federal, state, and local laws regulating the generation, handling, treatment, storage, and disposal of hazardous waste. Under this regulation, hazardous waste generated during activities at WSMR is initially collected at the point of generation. Waste is containerized and segregated by waste type. From the initial collection point, all hazardous waste is collected and brought to a central collection facility. These wastes can be repackaged and prepared for off-site shipment and disposal. Each range user is responsible for the cost of disposal of hazardous waste from its activities.

Environmental Consequences
PDRR ABL Diagnostic Test Range activities expected to use and generate hazardous materials/waste include target-missile and drone launches. These activities would be expected to have a low impact on the environment.

Target-missile and drone pre-launch activities would include the use of solvents, lubricants, and fuels currently used at WSMR. In the pre-flight preparations of missile-launch systems, solid propellants and other explosives are widely used. Liquid propellants (hypergolic and cryogenic) would be used in Lance-missile flight systems. The use of the Lance missile for test activities would preclude any need for local fueling operations, thereby eliminating the handling and storage of liquid propellants during PDRR ABL test activities. The Terrier/Orion and Terrier/Black Brant missiles use solid propellants as fuel, which also eliminates any hazards to the local environment from fueling, storage, and handling procedures.

The existing hazardous materials storage and handling capabilities at WSMR would permit proper handling of all materials. Transportation of hazardous materials to the drone and missile preparation area can be accomplished using ground-support equipment without the need for revised procedures, because of the similarity of ABL materials to those currently in use.

Limited quantities of hazardous waste may be generated by the proposed target missile and drone pre-launch activities at WSMR. These may include unused or contaminated cleaning solvents, or unused lubricants or hydraulic fluids. Similar waste types are currently generated at WSMR during existing operations. Motor fuels and cleaning solvents are routinely collected and disposed. No hazardous waste would be generated from liquid propellants because the Lance missile is pre-fueled.

Normal target missile-launch operations would not produce any hazardous waste at WSMR. However, certain emergency actions may occur that would require the defueling of a target missile. A Spill Prevention and Response Plan would be formulated and implemented if necessary. Propellant transfers would occur on a non-permeable surface. Unloaded propellants would be containerized into approved containers, and all spills/wastes would be collected and containerized.

A launch mishap or early flight failure may result in the deposition of waste materials within the mission-designated launch hazard area. Specific standardized procedures would be developed for recovery of any remaining fuel or contaminated soil. Materials to be disposed of as hazardous waste would include structural materials and some missile components. The debris would be recovered in accordance with WSMR policy.

3.3.8 HEALTH AND SAFETY

A general discussion of health and safety and all applicable laws and regulations is provided in Section 3.0.8.

Region of Influence

PDRR ABL Phase activities would pose different hazards to workers and the public, and therefore separate regions of influence is considered. For worker safety, only the immediate work location is considered and would include the areas where target preparation, launch, and recovery operations would occur.

Affected Environment

WSMR is a national range, supporting missile and other system-testing and development programs for the U.S. Army, U.S. Navy, U.S. Air Force, NASA, and other government agencies. The range is operated under the U.S. Test and Evaluation Command.

Workplace hazards that are commonly encountered at WSMR include exposure to a wide variety of toxic materials employed in ongoing operations, the handling and use of explosive and flammable materials, and hazards associated with routine industrial and construction activities. WSMR has implemented a comprehensive safety program to identify, evaluate, and mitigate potential occupational hazards. Approximately 150 missiles launches, 400-500 unmanned drone flights, and 10 balloon launches occur from WSMR annually (Tullius, 1995). Well-established procedures exist at WSMR to provide adequate range and ground safety for these types of launches.

The safety program at WSMR was established in accordance with Army Regulation 385-100, *Safety Manual.* Several other publications stem from this manual concerning safety at WSMR, including WSMR Regulation 385-18, *Command Safety Program,* WSMR Range Customer's Handbook, and DA Pamphlet 385-64, *Ammunition and Explosives Safety Standards.* The safety division is divided into ground safety and flight safety. Ground safety has full responsibility until the missile or target leaves the launch area. WSMR flight safety takes over as soon as the missile/target is airborne and it decides which areas of the range are evacuated for each mission, determines in-flight missile termination in the event of missile malfunction, and oversees the testing of missiles.

Laser operations are coordinated through the WSMR Directorate of Environmental and Safety's Radiation Protection Officer. WSMR laser-safety documents that would apply are WSMR Regulation 385-3, *Laser Beam Safety;* WSMR 385-18, *Command Safety Program,* and TBMED 524, *Control of Health Hazards from Laser Radiation.* All of these documents implement ANSI Z136. 1, *American National Standard for Safe Use of Lasers,* which has been adopted by DoD.

The Research Rockets Branch of the Naval Air Warfare Center, Weapons Division, currently launches solid-propellant missiles from launch areas. The Terrier/Orion and Terrier/Black Brant are among the missiles routinely launched. They support an average of 12 launches each year. The Naval Missile Assembly Facility, located directly south of the launch area, is in a restricted military area. Rocket motors are prepared in the facility, then transferred to the Ready Service Magazine (Bldg. 23326) pending placement on the launch assembly.

Since 1966, there have been over 290 Lance missiles launched at WSMR. On average, eight Lance missiles are launched each year; 11 launches were scheduled for 1996. When missiles arrive at WSMR, they are stored at the missile-storage facility. The Lance missile has been launched from a variety of sites in the past.

The Drone Formation Control System, a series of antennas and relays on and adjacent to WSMR, would have positive operational control of the drone at all times. The USAF Space and Missile Systems Center, Test and Evaluation Operations Division manages and conducts high-altitude balloon and tethered aerostat-flight operations at the Balloon Operations Center located at Holloman AEB on the eastern edge of WSMR.

WSMR has implemented a comprehensive safety program to identify, evaluate, and mitigate potential occupational hazards associated with routine range activities. Health and safety resources of the range include an established range-safety organization, a fund of previous experience, and existing laser regulations. An emergency control center exists at WSMR and includes the WSMR and Stallion fire departments, WSMR McAfee Clinic, and the WSMR Ground Safety Office (WSMR, 1994a).

All missile range activities are regulated by the WSMR Missile Right Safety Department. Safety-analysis documentation is reviewed by the individual project directors and by the Missile Right Safety Office. The Missile Right Safety Office determines when an acceptable risk level is attained, based upon office reviews of launch protocols and risk factors. WSMR flight safety decides which areas of the range are evacuated for each mission, determines in-flight missile termination in the event of missile failure, and oversees the testing of missiles. Areas that are exposed to hazardous missile debris are evacuated even though the risk to the public may be minimal (WSMR, 1994a).

Range personnel have previous experience with high-power laser systems, including lasers designed for outdoor use. An average of 100 high-energy laser missions have been conducted per year from 1989 to 1993 (WSMR, 1994a). The WSMR High Energy Laser System Test Facility houses the Mid-Infrared Advanced Chemical Laser which, like the COIL system used by the PDRR ABL, is in the megawatt power class. Guidelines for the use of outdoor laser work are included in the "Laser Range Safety Manual" (Range Commanders Council, 1991).

Environmental Consequences
The PDRR ABL Phase activities proposed at WSMR would involve preparation of the targets (both drones and missiles), launch of the targets, in-flight laser engagements between the PDRR ABL and the targets, and target-debris impact. Each of these activities is discussed in the following paragraphs.

Transportation and Preparation of Targets. All prelaunch hazardous operations (e.g., handling of explosives) are conducted in accordance with established standard operating procedures that have received approval from the WSMR Safety Office and that implement all applicable WSMR safety directives. The solid-propellant Terrier/Orion and Terrier/Black Brant missiles have few pre-launch hazards beyond the handling of explosives. The Lance missile arrives at WSMR pre-fueled and ready to fire.

The transportation of the target missiles is subject to both federal and state regulations, including handling, labeling, and routing requirements. The Lance missile, specifically, is shipped in a specially designed container to protect the missile in case of accident. National Highway TrafficSafety Administration statistics show that the fatal accident rate for large trucks is one accident in every 37 million miles, making it a very rare occurrence. The likelihood of any impact on human health and safety from the transportation of targets or hazardous materials to the various sites is insignificant.

Safety procedures would be followed in case of accidental leakage or missile-casing puncture resulting in leakage of either fuel or oxidant. Monitoring of the workplace would be required to detect and warn personnel of the presence of toxic vapors. Safety equipment and safety practices during normal operations and hazardous situations are detailed in Chapter 2 of the *DS and GS Maintenance Manual* (U.S. Army, 1984). These propellants are routinely handled at WSMR.

Activities during the preparation of drone and target boards would be conducted in accordance with range and ground safety regulations and standard operating procedures that are already in place.

Launch of Targets. At launch time, the missile would be armed only after all required safety evacuations have been accomplished to ensure that no unauthorized personnel are present in hazardous areas. Following arming, positive control of the hazard areas would be established. Unauthorized entry into the hazard area would result in delay of the operation until the “all clear” has been reestablished.

A Launch Hazard Area (LHA) would be established around the launch point for the following purposes:

- Contain debris that may result from a near-launch failure and resultant missile breakup or flight-termination action

- Protect the public in the event instrumentation and computer systems used to monitor the flight path of the missile do not operate properly and the missile must be destroyed

- Secure physical and operational systems

At WSMR, the LHA size is determined by modeling a missile’s capability to veer off course for a period of up to five seconds. After five seconds of off-course flight, the missile is assumed to be terminated, and the impact locations of all fight-termination debris are modeled. The outer perimeter of the debris is plotted and this defines the LHA. The LHA radius for the Lance, Terrier/Orion, and Terrier/Black Brant missiles is 1.5 km (0.9 mi). For the two-stage missiles, Terrier/Orion and Terrier/Black Brant, the first stage flies a very short trajectory following a burn time of 4.4 seconds, and recovery is approximately 0.5 km (0.3 mi) down range. This requires an LHA of 1.5 km (0.9 mi) down-range of the launch point. Missiles would be equipped with flight-termination equipment to allow the range-safety officer to terminate the flight if the missile malfunctions.

Successful launch activities involve only small potential hazards, mainly for personnel in the immediate area of the launch site. Since personnel are in protected facilities or evacuated from the LHA, this potential hazard is controlled. State Highway 70, which runs directly beneath the flight path of launches, is closed during launch operations.

During normal launches, the exhaust products from both the solid- and liquid-propellant missiles pose no health or safety risk. The tables in Appendix D show the missiles exhaust products. The only hazardous exhaust products in the lower atmosphere would be 0.05 kg (0.1 lb) of hydrochloric acid and 0.18 kg (0.4 lb) of lead from the Lance missile, and 9.98 kg (22 lb) of lead from the Terrier missile. A spill of either unsymmetrical dimethylhydrazine (UDMH) or inhibited red-fuming nitric acid (IRFNA) from the Lance missile would cause the formation of a cloud of toxic material. A spill of the entire contents of the Lance's fuel tank would result in a toxic corridor downwind. If both IRFNA and UDMH were released simultaneously, they would ignite and burn and the resulting combustion products are not toxic. The dimensions of the toxic corridor are dependent on wind velocity. Using exposure limits of a 15-minute time-weighted average concentration of 15 parts per million (ppm) for UDMH and 25 ppm for IRFNA, analysis in Appendix C shows that the dimensions of the toxic corridors would be 155 by 40 m (508 by 130 ft) and 100 by 30 m (328 by 98 ft), respectively, at a wind velocity of 5 m/sec (11 mph). As the wind velocity decreases, the length of the toxic corridor also decreases. At a wind velocity of 1 in/sec (2.2 mph) the length of the corridors are 87 m (285 ft) for UDMH and 45 m (150 ft) for IRFNA.

A minimum of two beacon-tracking radars would follow the missile during the initial flight phase to make certain that the range-safety officer has the ability to recognize a failing missile. Once the missile gains altitude, additional radars provide tracking information to the range-safety officer. In addition to the radars, four or more optical devices would be assigned to track the target during its entire flight, from launch to impact.

In-Flight Laser Engagements. The use of lasers during the PDRR ABL Phase would be carefully controlled to minimize the health and safety risks to both human and biological resources at WSMR. During all engagement scenarios, the lasers on the PDRR ABL would be pointing horizontally or upward, above the horizon from the level of the aircraft. This would preclude the direct impact of lasers on humans or wildlife since the aircraft would be flying at approximately 40,000 ft AMSL. The only possible impact would be from laser energy reflected from the targets. The analysis of the reflected energy of the two target types, missile and a target board towed by an unmanned drone or balloon, is presented in Appendix F. The analysis shows that reflected energy levels at an altitude of 10,000 ft AMSL would be below maximum permissible exposure for human limits defined in the *American National Standard for Safe Use of Lasers,* ANSI Z136.1.

Target Debris Impact. The planned testing at WSMR consists of tracking missions and would not destroy the missile in flight. The target missiles would impact the ground surface monolithically in designated debris-recovery areas north of the launch sites, with only small quantities or no fuel onboard (see Appendix G). According to the *Lance Missile Target Environmental Assessment for White Sands Missile Range* and the resultant *Finding of No Significant Impact* (U.S. Army 1996a; U.S. Army 1996b), and the environmental analysis performed by NASA for the Sounding Rocket Program (NASA, 1994), there would be no health or safety risks from the Lance, Terrier/Orion, or Terrier/Black Brant target missiles. The remaining surrounding area of the range provides the necessary safety zones in case of missile malfunction.

Debris-recovery activities for the Terrier/Orion, Terrier/Black Brant, and Lance missiles would be conducted in accordance with WSMR Regulation 70-8, *Security, Recovery, and Disposition of Classified and Unclassified Test Material Impacting On-Range and Off-Range,* and would pose no impact on health and safety. In addition to WSMR Regulation 70-8, debris recovery from the Lance missile would follow the procedures defined in WSMR SOP No. MTD-AW-38-95, *Standard Operating Procedure for Recovery of Lance Missile.*

3.3.9 LAND USE

A general discussion of land use and all applicable laws and regulations is provided in Section 3.0.9.

Region of Influence
The region of influence on land use for diagnostic-testing activities at WSMR includes the launch areas, the debris-recovery areas located north of the launch areas, the area between launch and debris-recovery areas, and the runway facilities at Holloman AFB (Figure 3.3-9).

Affected Environment
Land Use of Adjacent Jurisdiction. Two "Call-Up" areas adjacent to the northern and western boundaries of WSMR are intended to ensure public safety and site security. The lands in the Call-Up areas are managed by the BLM for multiple uses. The uses by WSMR are defined in Memoranda of Understanding (MOUs) between the BLM and WSMR. Lands in the Call-Up areas are used primarily for livestock grazing and, to a minor extent, for recreation. Residents are evacuated during tests in their vicinity and are compensated for their time and inconvenience.

The Bosque del Apache National Wildlife Refuge and the Jornada del Muerto Wilderness Study Area are located within portions of the Western Call-Up Area of WSMR.

Portions of the Fort Bliss Military Reservation border the southern boundary of WSMR. The reservation is used as an anti-aircraft artillery center and includes firing and maneuver areas. The city of Las Cruces is located approximately 40 km (25 mi) east of the southwest boundary of WSMR. Several designated recreation areas are located between Las Cruces and the WSMR boundary and are used primarily by residents of Las Cruces. Holloman AFB is located along the eastern boundary of WSMR. The Base houses a variety of aircraft and also serves as a combat pilot-training facility. Land uses on the Base include housing, administration, technical research facilities, aircraft hangars, maintenance areas, and runways. The city of Alamogordo is located approximately 3.7 km (6 mi) east of Holloman AFB. Most of the lands along the eastern boundary of the WSMR are used for livestock grazing, although some recreational areas are located in the Sacramento Mountains approximately 8 to 16 km (5 to 10 mi**)** east of the WSMR boundary.

Land Use at White Sands Missile Range. WSMR contains an extensive complex of missile-launch complexes, debris-recovery areas, bombing ranges, weapons storage, laboratories/administrative facilities, and airfield/runway facilities (Figure 3.3-8 and Figure 3.3-10). WSMR can be categorized into two major land areas: the main range (WSMR), and the Call-Up areas adjacent to the range to the west and north. The Main Post (headquarters) and the launch area are located on the southern portion of the main range. Land uses in the Main Post area include residential, recreational, industrial, warehouse, community support, medical, administrative, technical, maintenance and supply, and range control. Special land uses on the southern portion of the main range include the Jornada Experimental Range, the San Andres Wildlife Refuge, and the White Sands National Monument. With the exception of these three, which are operated under a co-use agreement, all lands on the main range are under the direct control of the U.S. Army on an exclusive-use basis. Portions of WSMR have been used historically for livestock grazing, but grazing is currently not allowed within the boundaries of WSMR because it conflicts with mission objectives. Hunting is allowed in parts of WSMR during certain times of the year, and the public is allowed access to Trinity Site (site of the first atomic-bomb detonation) twice each year. Airspace above the main range and Call-up Areas is restricted for military use.

Figure 3.3-8

Land-Use Plans and Policies. A Land-Use Plan was prepared for WSMR in 1992 (WSMR, 1994a). The plan was developed to promote siting of facilities compatible with WSMR activities, to provide for future growth, and to ensure that facilities and activities at WSMR do not impact the visual, aesthetic, and natural resources that abound both on and off the Base.

Environmental Consequences
The B747 flights conducted at WSMR would take place over the Northern Call-Up Area in airspace restricted for military-aircraft flight and would be consistent with the goals in the WSMR Land-Use Plan.

The four drone flights that would originate and terminate at Holloman AFB would be consistent with the Holloman AFB mission that includes support of tactical jet-fighter training and testing and would not change land-use patterns at Holloman AFB. The drone flights over the main range at WSMR would also take place in airspace restricted for military aircraft flights and would be compatible with WSMR land-use plans and policies.

The six target missiles that would be illuminated by the laser system during the acquisition, pointing, and tracking flights would be launched from an existing, active launch complex approximately 8 km (5 mi) east of the Main Post area. The missiles would be programmed to impact the ground surface in designated debris-recovery areas north of the launch areas. Missile launches from an existing launch complex, and debris recovery in designated areas, would be consistent with WSMR missile-development and testing programs and would not impact land use or land-use plans.

During missile flights, it could be necessary to temporarily close U.S. Highway 70 for up to 75 minutes. This is a normal practice that is implemented during missile flights at WSMR, and New Mexico State Highway Department procedures for road closures would be followed. Because this is a routine procedure at WSMR, the impacts of road closures would be insignificant.

3.3.10 NOISE

A general discussion of noise and all applicable laws and regulations is provided in Section 3.0.10.

Region of Influence
The region of influence for noise exposure at WSMR is the entire range, including the Northern Call-Up Area and the runways at Holloman AEB. Missile launch complexes are located at the southern end of the range, impact points are located midway and at the northern end, drone takeoffs and landings are accomplished at the southeastern edge of the range at Holloman AFB, and drone missions would be flown above the central part.

Affected Environment
In the vicinity of WSMR, military-aircraft operations (both supersonic and subsonic), missile launches, range operations, weapons firings, and surface traffic on local highways are the existing primary sources of noise. There were an average of 150 high-altitude missiles launched and between 400 and 500 drone missions carried out during each of the past five years. WSMR expects a similar number of launches and drone missions during the next five years (Tullius, 1995). Additionally, supersonic-flight training occurs over most of WSMR.

These activities generate a range of noise levels on the ground. Generally flight activities are at a sufficiently high altitude and low frequency to generate sound levels anticipated to be no greater than 70 dB. Average sonic-boom levels from supersonic air-combat training are expected to be in the range of 50 to 60 dB. Other representative activities include a Hawk missile launch, generating peak sound levels of 149.8 dB, a Q-100 full-scale aircraft target drone producing single-event noise levels of 95.7 dB, vehicular traffic typically rated at 70 dB, and low-altitude military-jet traffic producing estimated noise levels of 65 to 70 dBA at ground level directly below the aircraft (WSMR, 1994a).

Ambient noise levels at the WSMR Main Post area, the WSMR property boundary, and the San Andres National Wildlife Refuge have been estimated to be 55 to 65, 45 to 55, and 45 dB, respectively (U.S. Army, 1995a).

Environmental Consequences

Drone launch and recovery operations are located at the Holloman AFB runway on the eastern edge of WSMR. Holloman AFB is an Air Combat Command Base and the WSMR drone operations are covered in its Air Force Installation Compatibility Use Zone study. Missile launching would increase ambient noise levels at WSMR for very short periods of time (5 to 10 seconds). The launch areas are located approximately 5 to 16 km (3 to 10 mi) from the Main Post. Noise generated by missile flights can be grouped into launch noise, flight noise, or landing noise. The noise from rocket launches has been investigated for some time and quantitative estimates of noise levels at distances from the launch can be made (McInerny, 1991). The same cannot be said for flight noise and landing noise. Each of the categories is discussed below.

Launch Noise. Lance missiles are regularly launched from WSMR, and since 1962, over 290 have been launched. A peak sound level of 147 dB has been measured at a distance of 90 m (295 ft) from a Lance missile launch (U.S. Army, 1995a). The burn time for the main motor on the Lance missile is approximately 6 seconds. Noise levels at the main post area from Lance missile launches would be between 104 and 77 dB, depending on the launch complex selected (Rau and Wooten, 1980).

The first-stage Terrier missile has maximum sound levels of 111, 95, and 74 dB at an elevation of 1000 m (3,280 ft), 3000 m (9,840) ft, and 11,000 m (36,090 ft), respectively (NASA, 1994). The first-stage Terrier missile burn time is approximately 4.4 seconds. The noise level from the Terrier missile would be approximately 80 dB at the Main Post area. The second stage, Black Brant or Orion, does not ignite until it reaches an altitude of over 40,000 feet AMSL.

Operations personnel in the vicinity of the launch sites would be stationed in blockhouses and would be protected from noise by the sound attenuation provided by the buildings' construction. Other personnel would be required to be approximately 1.5 km (0.9 mi) outside the launch-hazard area,. Noise levels at this distance would be below the OSHA limit for impact-noise exposure, 140 dB (29 CFR **§** 1910.95, AFOSH STD 48-19) for all types of missile launches. If personnel were required to be within the launch-hazard area and outside a blockhouse, personal-protective equipment, such as earplugs, earmuffs, or headphones, would be used. This protective equipment would reduce noise levels by 30 dB.

Flight Noise. Potential noise impacts from the flight of a target missile include sonic booms. Sonic booms would occur with each target-missile launch after the vehicle exceeded the speed of sound. The sonic boom would be directed toward the front of the vehicle and down-range of the launch site. Sonic booms from target missiles would not reach the ground near the launch site. Sound would be attenuated due to increasing altitude and thinning of the atmosphere. Noise levels from re-entry would be less than that produced when the rocket motor was burning (NASA, 1994).

Landing Noise. The missile body would produce a momentary sound as it impacts the ground. Shock waves would propagate through the ground and may be felt for some distance. Unless humans or animals are in the immediate vicinity of the debris-recovery area, noise would not be a problem. Debris recovery areas would be cleared of personnel prior to launch and no personnel would be allowed in the impact area until the test is completed.

The noise generated by the PDRR ABL Phase activities on WSMR would be within the limits of other current activities on the range and the impact would not be significant. Noise impacts upon wildlife are discussed in Section 3.3.4.

3.3.11 RECREATION AND VISUAL RESOURCES

A general discussion of recreation and visual resources and all applicable federal laws and regulations is provided in Section 3.0.11.

Region of Influence

The region of influence for recreation and visual resources is defined as recreation and public-interest areas on the range and the surrounding area. The region of influence also includes areas of aesthetic concern.

Affected Environment

WSMR is located in the south-central portion of New Mexico, an area of abundant natural recreational resources (Figure 3.3-9). The area is also noted for its rugged mountains and scenic landscapes. Recreation resources include national forests, national and state monuments, wilderness-study areas, wildlife refuges, post facilities, and state and local parks. Table 3.3-6 lists the recreational facilities in the region.

The local communities in the area of WSMR also provide recreational activities and facilities, which include golf, swimming, softball and baseball, fishing, boating, camping, sightseeing, and playgrounds. The larger communities in the vicinity of WSMR are Las Cruces, Alamogordo, and Truth or Consequences. Las Cruces recreational areas include Burn Lake, several recreation centers, and 778 acres of parks and public grounds (Pumphrey, 1995). Las Cruces is flanked to the east by the spectacular, picturesque Organ Mountains. Alamogordo' s recreation-use areas include 18 parks and playing fields and Desert Lakes Golf Course (Featherstone, 1995). Cibola and Lincoln National Forests are located to the west and east of WSMR, respectively, and White Sands National Monument is located within WSMR. The State of New Mexico manages numerous state parks in the area, and the Bureau of Indian Affairs manages several recreation-use areas on the Mescalero Apache Indian Reservation.

Environmental Consequences

PDRR ABL diagnostic-test activities would have a low impact on WSMR recreation and visual resources. Missile launches would require the temporary closure of White Sands National Monument for up to 75 minutes. U.S. Highway 70. which extends from White Sands National Monument to Las Cruces, may also be closed during missile launches. Closure of the Monument occurs on an average of twice a week and affects from 20 to hundreds of visitors annually (Wizner, 1996). PDRR ABL laser activity would be directed horizontally or upward from the B747 aircraft flying at an altitude of 40,000 ft AMSL, and therefore laser contact would not be made with the land surface. Drone flights originating from existing facilities would not require closure of recreational facilities and would not change the existing aesthetics of the area.

Figure 3.3-9

Table 3.3-6. Regional Recreation and Visual Resources at White Sands Missile Range, New Mexico

Facility	Managing Agency	Acreage
Aguirre Springs Campground	Bureau of Land Management	40
Bosque del Apache National Wildlife Refuge	U.S. Fish and Wildlife Service	32,000
Caballo Lake State Park	New Mexico	16,800
Carrizozo Lava Flow Wilderness Study Area	Bureau of Land Management	10,000
Cibola National Forest	U.S. Forest Service	1,600,000
Dripping Springs Natural Area	Bureau of Land Management	2,800
Elephant Butte State Park	New Mexico	61,000
Fort Selden State Monument	New Mexico	7
Jornado del Muerto Wilderness Study Area	Bureau of Land Management	31,147
Leasburg Dam State Park	New Mexico	140
Lincoln National Forest	U.S. Forest Service	1,000,000
Little Black Peak Wilderness Study Area	Bureau of Land Management	27,000
Oliver Lee State Park	New Mexico	200
Organ Mountains Recreation Area	Bureau of Land Management	54,000
Percha Dam State Park	New Mexico	80
Three Rivers Petroglyph	Bureau of Land Management	793
Trinity Site	U.S. Army	N/A
Valley of Fires Recreation Area	Bureau of Land Management	462
White Sands National Monument	National Park Service	146,500

Laser activity, drone flights, and missile launches on WSMR would have a low incremental impact on recreational and visual resources in the area because WSMR is currently devoted to supporting missile development and testing programs.

Approximately ten temporary test personnel are expected to rotate into the region of influence for one week (five-day week) for each of the ten test flights. The increase in personnel would have minimal impact on recreation facilities on WSMR or the surrounding off-base recreation facilities. The small increase in personnel would not overcrowd or overuse any facility.

3.3.12 INFRASTRUCTURE AND TRANSPORTATION

A general discussion of infrastructure and transportation is provided in Section 3.0.12.

Region of Influence

The region of influence for infrastructure and transportation is WSMR and the surrounding area (Figure 3.3-10).

Affected Environment

Electrical Power. Commercial electrical power is provided to WSMR by El Paso Electric Company, Otero County Electric Cooperative, Sierra Electric Cooperative, and Socorro Electric Cooperative. El Paso Electric Company is the primary provider to the WSMR Main Post and the southern range area. That company supplies approximately 94 percent of WSMR' s electrical power with 345- and 1 15-kV transmission lines and 14.4- and 24.9-kV distribution lines.

Socorro Electric Cooperative is the predominant provider to the northern range area. It supplies approximately 4 percent of WSMR's electrical power over a 24.9-kV line from San Antonio to the Stallion Range Center. Otero County Electric Cooperative owns and operates an electric-distribution system that originates at Alamogordo Substation and provides power (approximately 1 percent of the total) to the Oscura Range Center over a 14.4/24.9-kV distribution line. Sierra Electric Cooperative provides less than 1 percent of the total from the Cuchillo Substation near Truth or Consequences over a 14.4/24.9-kV line to Salinas Peak Camp and Rob sites.

Water System. The Main Post obtains its water supplies from 11 wells, and maximum storage capacity is 3-million gallons (Figure 3.3-5). Treatment of water from these wells consists of sedimentation, disinfection, and fluoridation. The volume of groundwater usage has decreased from an average of 830-million gallons annually between 1967 and 1978 to 670-million gallons annually from 1979 to 1988.

Wastewater System. WSMR's Main Post's treatment facility, located 6 km (4 mi) from the Main Post, was constructed in 1958 and has a rated capacity of 1 MGD. The system was upgraded in the mid-1970s under a USACE project. The system is currently required to operate at only 50 percent of capacity.

Solid Waste Handling System. WSMR' s solid-waste handling systems consist of landfills, and waste collection and transport. The landfills have two separate operational units. One receives solid waste and the other receives construction and demolition material. Waste at the Main Post is primarily collected and transported to the landfill by the Ground and Surface Area Branch staff. Construction/demolition and yard waste is transported by private-sector contractors. The Main Post landfill is located 11.3 km (7 mi) southeast of the Post Headquarters. This landfill is 25 acres in size and is expected to grow to 80 acres before it is closed in the year 2000. The landfill is a Class A landfill as defined by the New Mexico Solid Waste Management Regulation 2. A Class A landfill is one that serves a population greater than 3,000.

Roads. WSMR and the surrounding area are served by both Interstate and U.S.-designated highways (Figure 3.3-10). Interstate Highway 25 originates in Las Cruces (approximately 25 km [15 mi] west of WSMR) and extends through Albuquerque to the north. Interstate Highway 10 passes through both El Paso and Las Cruces. Both 1-25 and 1-10 are four-lane divided highways and are in good condition. Neither highway is overcrowded. U.S.-designated highways include US-54, US-60, US-70, US-82, and US-380, all of which are in good condition. During missile-operation activities, an agreement with the state of New Mexico allows WSMR to establish roadblocks on US-70 and US-380. The agreement specifies that a roadblock may not last longer than 75 minutes. US-70 is closed approximately four times per week because of missile firings. The closures typically last less than an hour. US-380 is only closed when the Northern Call-Up Area is required for tests.

Railroads. There is no railroad trackage on WSMR (Figure 3.3-10). WSMR uses a Southern Pacific railhead directly outside the southeast gate of WSMR to transport heavy equipment to and from the Range. The Southern Pacific Railroad tracks connect El Paso and Alamogordo east of the Range.

Figure 3.3-10

Aircraft. WSMR is serviced by five airstrips (Figure 3.3-10). Condron airstrip supports an average of four takeoffs and landings per day, and the Stallion airstrip supports a maximum of four missions per week. The Oscura airstrip is paved but needs repair, and supports an average of six missions each year. The White Sands Space Harbor airstrip is a gypsum airstrip that is capable of handling any aircraft. It supports NASA shuttle-training missions and drone operations, and is a Space Shuttle emergency-landing location. Holloman AFB also supports missions for WSMR, including drone flights.

Three general aviation airports are located near WSMR. Both Las Cruces and Alamogordo have small airports that are used primarily for general and some commercial aviation. The El Paso International Airport, located approximately 60 km (37 mi) south of the Main Post, is used primarily for commercial and general aviation. This airport is supported by five major airlines and several commuter airlines.

Environmental Consequences
Existing facilities and infrastructure at WSMR would be used to launch targets for the PDRR ABL Phase. Personnel presently employed at WSMR would be used for range operations and support. The number of target operations during the diagnostic-test phase should not exceed four drone or balloon launches and six missile launches during a five-month period. The proposed missile, drone, and balloon targets have been selected from the targets that are currently used at the range. The presence of ten temporary PDRR ABL Phase personnel during a ten-day period for each flight test should not adversely impact the infrastructure or transportation at WSMR. This small number of transient personnel is within the normal fluctuation of day-to-day personnel that uses the Range's infrastructure and transportation systems. The PDRR ABL Phase would possibly require an additional six closures of US-70 during a five-month period. The impact to the infrastructure and transportation systems in the WSMR area would be minimal.

3.3.13 SOCIOECONOMICS

A general discussion of socioeconomic resources and all applicable laws and regulations is provided in Section 3.0.13.

Region of Influence
The region of influence for socioecomonics at WSMR is Dona Ana County and parts of Otero County, New Mexico (Figure 3.3-1 1).

Affected Environment
WSMR is located in the Tularosa Basin in south-central New Mexico within Dona Ana, Socorro, Otero, Lincoln, and Sierra Counties. Based upon an analysis of transportation access routes, existing residence and commuting patterns and availability of transient housing, the affected environment is determined to include all of Dona Ana County and the Alamogordo and Southeast Otero Census County Divisions (CCDs) in Otero County (Figure 3.3-1 1). Las Cruces and Alamogordo are the only communities in the two-county area that would be expected to experience any significant effects from the stationing of short-term personnel.

The impacted communities are sufficient in size to provide temporary accommodations for the WSMR test personnel during the proposed one-week launch periods, which may be scheduled up to ten times. Temporary personnel generally would stay in Las Cruces because of the city's proximity to the Range, with Alamogordo as a less-preferred alternative. There are a total of 2,467 hotel/motel rooms in the two communities, with 667 in Alamogordo and 1,800 in Las Cruces (Alamogordo Chamber of Commerce, 1995; Las Cruces Visitors Bureau, 1996). There are also 206 restaurants and fast-food establishments in the area (ProCD Inc., 1996; Las Cruces Visitors Bureau, 1996).

Figure 3.3-11

Statistics from the New Mexico Department of Labor indicate that the average civilian labor force in the Las Cruces Metropolitan Statistical Area in 1995 was 63,063 persons, with an average 5,408 (8.8 percent) unemployed. Otero County figures for 1995 were 20,272 in the labor force, with an average 1,346 (6.6 percent) unemployed.

Environmental Consequences

Diagnostic testing at WSMR may take up to five months and involve up to 20 flights (Table 2-8 in Chapter 2). Approximately ten temporary test personnel would rotate into the two-county region-of-influence for one week (five-day work week) for each of ten test flights. The economic advantage from the temporary posting of personnel would primarily benefit hotels/motels and restaurants in the region of influence. Any impact of temporary personnel on Alamogordo would be insignificant. Additional motel/hotel/restaurant workers that may be required to accommodate the Diagnostic Test Range personnel in the area could be hired from the existing workforce. No immigration of personnel would be expected to fill any positions.

Assuming a 60-percent annual motel/hotel occupancy rate in the region-of-influence (Alamogordo Chamber of Commerce, 1995; Otero County Economic Development Council, 1996; Las Cruces Hotel/Motel Association, 1996), an average of 1,480 rooms would be available in Las Cruces and Alamogordo to accommodate the ten temporary personnel at WSMR. Income generated from local meals and incidental expenditures and hotel/motel stays by WSMR temporary personnel is estimated based on General Services Administration Federal Travel Directory guidelines and the American Automobile Association Tourbook listings for individual region-of-influence markets.

Estimated annual demand from Diagnostic Test Range personnel is 500 room-nights (calculated at ten persons x ten weeks x five days/week) and a potential $26,000 (based on average rates from the American Automobile Association, 1996) in annual motel/hotel revenues. In addition, the temporary WSMR personnel would generate $13,000 (41 CFR *§* 301, Appendix A) in local restaurant revenues. The anticipated $39,000 ($26,000 + $13,000) in additional revenue that would be generated by the posting of temporary personnel at the Diagnostic Test Range would have an insignificant impact on the affected communities.

3.3.14 ENVIRONMENTAL JUSTICE

The activities associated with diagnostic testing at WSMR would not occur in populated areas (Section 3.0. 14.2); therefore, no environmental justice analysis would be necessary.

3.3.15 CUMULATIVE IMPACTS

Activities and resource attributes associated with implementing PDRR ABL Diagnostic Test Range activities at WSMR which may contribute to cumulative impacts are summarized in this section. WSMR is working on a Cumulative Impact Statement which is expected to include PDRR ABL phase activities. That report is not yet complete, and no specific information regarding activities which may be scheduled at WSMR in the year 2002 is currently available for analysis. A more detailed analysis will be done as the information becomes available and as system-test details are defined.

Missile and Drone Launches. At WSMR, an average of 150 high-altitude missiles and 400 to 500 drones are launched annually. The potential ten missile launches and four drone flights associated with the PDRR ABL Phase over a five-month period would result in an increase of only 6 percent in the number of missiles launched and an increase of approximately 1 percent in the number of drone missions.

Air Quality. Although air quality would be minimally impacted by PDRR ABL Phase operations, emissions from target preparations and operations would increase yearly emissions by less than 0.1 percent. WSMR is already in attainment with all state and federal air quality standards.

Airspace. Access to airspace may be restricted during missile launches related to the PDRR ABL Phase. However, launches would occur in restricted-area or warning-area airspace and would be of short duration.

Hazardous Materials and Waste. PDRR ABL Phase activities at WSMR would result in slightly larger amounts of hazardous-material usage and hazardous-waste generation. However, the existing permitted storage facilities for these materials have adequate capacity for the additional amounts.

3.3.16 ADVERSE ENVIRONMENTAL IMPACTS THAT CANNOT BE AVOIDED

Unavoidable adverse impacts that may arise as a result of implementing the PDRR ABL Diagnostic Test Range Activities at WSMR are discussed in the following subsections.

Air Quality. Some testing activities would produce air pollutants. These can be direct, as a test-missile or drone is launched, or from automobile use. For ground operations and attendant launches, environmental impacts would be short-term, minor, and generally nonpersistent. At test ranges, some gases and particulate matter would be emitted to the ambient atmosphere for each launch of a target missile. Under most atmospheric conditions these pollutants would quickly and easily disperse into the atmosphere.

Airspace. An environmental impact on airspace that could not be avoided is a restriction of access by general aviation during flight tests.

Hazardous Materials/Waste. There would be a minor increase in the storage of hazardous materials and generation of hazardous waste.

Land Use. U.S. Highway 70 could be temporarily closed for up to 75 minutes during the ABL diagnostic testing.

Noise. Noise from missile and drone launches and from sonic booms cannot be totally mitigated. Though missile and aircraft noise could disturb the local population and animals, it is part of the existing environment at WSMR. None of these impacts would be major.

Recreational and Visual Resources. An unavoidable adverse impact includes curtailed recreational access to areas on or near the Range during missile flights.

3.3.17 MITIGATION MEASURES

This section summarizes mitigation measures that would be considered beyond adherence to all laws, regulations and guidelines to control or reduce impacts to the environment as a result of Diagnostic Test Range activities. Because of the negligible impact that PDRR ABL Phase activities will have on most attributes and the additional measures already taken by USAF, no separate mitigation plan is currently deemed necessary. Nevertheless, we have outlined areas needing special attention and management, depending on the specific actions to be taken at a facility, the level of impact, and other pertinent factors.

Biological Resources. Based on ongoing consultation with the USFWS and New Mexico Department of Game and Fish, surveys may be conducted to determine the presence of one or more plant or animal species in the vicinity of the proposed action. If present, such species may be relocated prior to the proposed action. All recovery operations would be in accordance with the White Sands Pupfish Agreement and the plans and agreements concerning the northern aplomado falcon.

Hazardous Materials and Waste. Impacts would be mitigated by material substitution or process controls, but the impacts would have to be examined on a program- or system-specific basis in lower-tier environmental documentation.

Land Use. Evacuation procedures would be in place for the temporary evacuation of people during the Diagnostic Test Range missile launches at WSMR.

3.4 CHINA LAKE NAVAL AIR WAREFARE CENTER/R-2508 COMPLEX—ALTERNATIVE DIAGNOSTIC TEST RANGE

The China Lake Naval Air Warfare Center (NAWC)/R-2508 Complex is an Alternative Diagnostic Test Range for conducting PD ABL Phase activities. The following information discusses specific affected environments and environmental consequences by environmental attribute.

3.4.1 COMMUNITY SETTING

Background. The U.S. Navy's presence at China Lake NAWC beg with the establishment of the Naval Ordnance Test Station (NOTS) in 1943. In 1967, the NOTS and the Naval Ordnance Laboratory, Corona, joined to form the Naval Weapons Center (NWC). In January 1992, NWC was dissolved and its functions were combined with three other U.S. Navy activities to form the China Lake NAWC. China Lake's mission includes basic and applied research, prototype hardware fabrication, test and evaluation, documentation, and support activities. It is the U.S. Navy's largest research, development, test, and evaluation facility. Over 26,000 takeoffs and landings (NFEC, 1995) occur at China Lake NAWC each year. Of these approximately 15 are drone launches.

Location. China Lake NAWC consists of two major land areas. The China Lake Complex is located adjacent to and north of the city of Ridgecrest, about 240 (150 mi) north of Los Angeles in southern California's Mojave Desert, and has an area of more than 600,000 acres. PDRR ABL activities would occur in the area of Armitage Airfield, in the southern part of the China Lake Complex. Approximately 25 km (16 mi) to the southeast lies the Randsburg/Mojave B Complex, with an area of about 500,000 acres. In this document the term China Lake NAWC refers collectively to the China Lake and Randsburg Mojave B Complexes.

China Lake NAWC is situated under restricted military airspace of nearly 27,400 square km (17,000 square mi) (Figure 3.4-1).

Facilities. The China Lake NAWC has the capability to launch drones and other aerial targets but cannot launch missiles. Drone flights would originate from the main runway of Armitage Airfield. The China Lake NAWC is a part of the R-2508 Complex, which includes all of the airspace and associated land presently managed by the Air Force Flight Test Center at Edwards AFB, the National Training Center at Fort Irwin, and the Naval Air Warfare Center Weapons Division at China Lake. The R-2508 Complex is approximately 225 km (140 mi) long by 177 km (110 mi) wide. All aircraft and drone-flight profiles at China Lake would be contained within the controlled R-2508 airspace corridor.

Affected Environment

The headquarters and community area at the China Lake Complex, collectively known as "Mainsite," and the Armitage Airfield are located in the Indian Wells Valley. The valley is surrounded by four mountain ranges: the Sierra Nevada to the west, the Coso Range to the north, the Argus Range to the east, and the El Paso Mountains to the south. These are discussed in more detail in Section 3.4.5 and shown on Figure 3.4-3.

Local topography is a controlling climatic factor. The regional climate is characterized by an abundance of sunshine throughout the year, very low humidity, scant rainfall, occasional dust storms, and a relatively mild winter season. The summers are hot and the winters are cool to cold, with large variations in daily temperature. Temperatures in the summer months exceed 100°F, with the highest maximum temperatures occurring in July and August. The temperatures in the winter months average about 60°F, with the coldest day recorded at 0°F. The mean monthly relative humidity ranges from a high of 52 percent in December to a low of 23 percent in July. The Sierra Nevada range presents a barrier to passing storms and frontal systems from the west and creates a rain shadow of low precipitation on its eastern side. The average annual rainfall at China Lake NAWC is between 4 and 6 inches per year. About every three years the area receives 2 to 5 inches of snow. Measurable rainfall can be expected about 22 days and snowfall 3 days each year. Prevailing winds are from the southwest. The windy season is from March to May, and is characterized by strong westerly winds and periods of blowing dust. On occasion, prevailing north winds create severe dust storms that affect China Lake NAWC.

Figure 3.4-1

The region within the boundaries of China Lake NAWC supports five major vegetation communities: pinon-juniper woodland, Joshua tree woodland, shadscale scrub, Joshua blackbrush, and alkali sink (Greenwood and Associates, 1982). In addition, localized pockets of riparian vegetation exist.

3.4.2 AIR QUALITY

A general discussion of air quality and all applicable laws and regulations is provided in Section 3.0.2.

Region of Influence

China Lake NAWC is located in the Southeast Desert and the Great Basin Valleys Air Basins. Activities that could impact air quality would be limited to the Mainsite area and the area surrounding Armitage Airfield where drones are launched. These areas are located in Kern County and the Searles Valley Planning Area.

Affected Environment

China Lake NAWC is located in an isolated desert region with few sources of pollutants. Kern County and the Searles Valley Planning Area are in attainment for all federal NAAQS except for ozone and PM-10. Kern County has been designated a serious nonattainment area. The reason for Kern County's nonattainment designation was discussed in the description of the Affected Environment in Section 3.1.2. The Searles Valley Planning Area has been designated by the EPA as Group I for PM-10. The area was subsequently designated as moderate nonattainment for PM-10 under the 1990 Clean Air Act Amendments. Contributors to the PM-10 emissions in the Searles Valley Planning area are large potash-production plants centering on Trona, at the west side of the Searles dry lake approximately 22km (14 mi) east of Mainsite, and the many unpaved roads used by recreational four-wheel-drive vehicles and large commercial trucks.

The closest air-quality monitoring stations are located at China Lake NAWC and the Inyokern Airport. The stations monitor only particulate pollutants. The closest stations that monitor ozone are in Trona. Tables 3.4-1 and 3.4-2 show the 1993 and 1994 summary of air quality monitoring data for ozone and particulate pollutants. These tables show that while Kern County and the Searles Valley Planning area are in nonattainment status, the air quality in the China Lake NAWC area meets all NAAQS. None of the air quality monitoring stations recorded pollution concentrations levels exceeding NAAQS in either 1993 or 1994.

Table 3.4-1. Monitoring Data for 1993 to 1995

Site	Maximum Daily 1-hour Concentration (ppm)			Number of days Exceeding NAAQS		
	1993[1]	1994	1995	1993	1994	1995
Trona – Athol[1]	0.10	0.10	0.09	0	0	0
Trona - Market Street[2]	0.09	0.07	—	0	0	—

'Station opened January 1993 [2]Station closed April 1994
Source: California Environmental Protection Agency, 1993: 1994:1995

Table 3.4-2 PM-10 Monitoring Data for 1993 to 1995

Site	24-Hour Average (μg/m^3)			Number of Days Exceeding NAAQS			Annual Arithmetic Mean (μg/m^3)		
	1993	1994	1995	1993	1994	1995	1993	1994	1995
China Lake	50	26	143	0	0	0	23.0[1]	15.5[1]	19.0[1]
Inyokern Airport	64	116	102	0	0	0	23.6[1]	25.3[1]	24.4[1]
Ridgecrest	35	107	235	0	0	1	18.3[1]	17.9[1]	46.0[1]

1 Data presented are valid. But incomplete in that an insufficient number of valid data points were collected to meet EPA and/or CARB criteria for representativeness

Source:California Environmental Protection Agency, 1993; 1994;1995

Table 3.4-3 shows Kern County's projected 1996 and 1999 VOC and NO_x emissions. The emission rates in this table are a part of the California State Implementation Plan and would allow Ken County to meet the air quality goals in 1999.

Table 3.4-3. VOC and Nitrogen Oxide Emissions Data Projected for 1999 for Kern County, California

Year	VOC (TONS/YR)	NO_x
1996	4,964	14,231
1999	5,001	14,812

Source: Kern Counjty Air Pollution District, 1994

Environmental Consequences

The PDRP ABL Phase activities that have the potential to affect air quality would be preparation of target boards and the operation of up to four drone flights. The drone flights would occur during a four-month period in the year 2002. QF-4 or BQM-34S drone aircraft would be wed to carry the target board to the desired altitude. Appendix D show's the emission rates for the drones. The QF-4 drone was used for analysis purposes since it has greater emissions. The addition of four drone missions during a four-month period is an insignificant increase to the more than 26000 missions conducted annually by China Lake NAWC.

Table 3.4-4 presents the results of the preliminary conformity analysis (Appendix E). The maximum total emissions (VOC, NO_x, and PM-10) produced by the PDRR ABL Phase activities are less than 0.4 tons per year. Emissions from PDRR ABL activities contribute less than 0.001 percent to VOC and NO_x emissions in Kern County. This would be well below *de minimus* levels and have no measurable impact on the air quality of Kern County. The PDRR ABL Phase activities contain no new stationary sources that would require permits for criteria air pollutants, or sources that would require alterations to the Title V permit.

Table 3.4-4. Estimated Emissions from PDRR ABL Phase Activities (tons/yr)

Year	VOC	NO_x	PM-1O
2001	.001	0.01	<0.01
2002	0.16	0.05	0.12
de minimus level	50	50	70

3.4.3 AIRSPACE

A general discussion of airspace and all applicable laws and regulations is provided in Section 3.0.3.

Region of Influence

The region of influence for airspace is the R-2508 Airspace Complex.

Affected Environment

The R-2508 Airspace Complex (Figure 3.4-2) includes all of the airspace and associated land presently managed by the three principal military activities in the Upper Mojave Desert Region: Air Force Flight Test Center (AFFTC), Edwards AFB; National Training Center, Fort Irwin; and Naval Air Warfare Center, China Lake. The R-2508 Complex is composed of a number of internal restricted areas, Military Operation Areas, and Air Traffic Control Assigned Airspace. High Desert TRACON a FAA Air Traffic Control Facility, is the designated controlling agency for the R-2508 Complex. Individual restricted areas within the Complex are scheduled and controlled by their respective managers (Table *3.4-5).* Each of the internal restricted areas are autonomously managed by the commanders of the principal military activities; AFFTC: R-2515; China Lake NAWC: R-2505, R-2506, and R2524; National Training Center: R2502N and R2502E. The R-2508 complex covers approximately 51,800 square km (20,000 square mi) over the China Lake NAWC and surrounding areas.

Typical operations in the R-2508 Complex include aircraft research and development, operational-weapons test and evaluation flights, student training, air-combat maneuvering and proficiency flights, and civilian-aircraft testing in direct support of DoD and/or commercial defense testing. The R-2508 Complex supports in excess of 350 aircraft missions on any day (R-2508 Complex Control Board, 1995).

When the R-2508 Complex is not activated for military use it is released to the FAA for joint use. General aviation aircraft fly unrestricted in accordance with Visual Eight Rules within the Complex military operating areas below 18,000 ft above mean sea level (AMSL). Figure 3.4-2 depicts the most heavily flown routes. The Air Traffic Control Assigned Airspace is used to fill the airspace gap between the top of the military operating areas (18,000 ft AMSL) and the base of R-2508 (20,000 ft AMSL). When R-2508 is not activated, the Air Traffic Control Assigned Airspace may extend upward to 60,000 ft AMSL.

Figure 3.4-5

Environmental Consequences

PDRR ABL diagnostic-test activities would not require exclusive use of the R-2508 Complex and would take place at altitudes that would not affect airborne activities of other missions. Therefore, it is expected that PDRR ABL Diagnostic Test Range activity impacts would be low.

Six non-engagement flights and four drone flights would occur in the R-2508 Complex. During non-engagement flights, the ABL aircraft would test communications and navigation equipment, laser-device plumbing without laser-beam extraction, and the air-refueling modification of the aircraft. PDRR ABL flights would increase the number of flights in the R-2508 Complex by less than 0.05 percent per year. Drone flights involve acquisition, pointing, and tracking of the drones. During this phase of testing the PDRR ABL aircraft would operate at 40,000 ft AMSL and would not actively track or illuminate the drones until they have risen above this altitude. The flight test plans would be developed in conjunction with the Complex Control Board and coordinated with the Joint Policy and Planning Board to ensure the proposed PDRR ABL flight test plans comply with current concept of operations for the R-2508 Complex. Once the flight test plans have been finalized and approved by the Complex Control Board, the range requirements would be presented to the R-2508 Complex Central Coordinating Facility for scheduling. Use of airspace would also be coordinated with FAA representatives or the Los Angeles ARTC Center, High Desert TRACON, FAA Western Region, and the offices of the military airspace minimal impact upon local civilian or private airports. The launches and intercepts would occur at sufficient distance and altitude to have little effect on local flying activities.

Flight operation below 20,000 ft AMSL would not be affected by ABL test activities. General-aviation aircraft fly unrestricted within the R-2508 Complex military-operating areas below 18,000 ft AMSL. Operations within the military-operating areas would remain undisturbed (Cronk, 1996). It is anticipated that rerouting of general-aviation aircraft would not be necessary. Air Traffic Control Assigned Airspace operations below 20,000 ft AMSL would also remain unaffected. However, because R-2508 would be activated during PDRR ABL activities, the Air Traffic Control Assigned Airspace would be restricted to between 18,000 and 20,000 ft AMSL.

During acquisition, tracking, and pointing activities, target drones would not be destroyed, and no debris would be anticipated from drone activities.

3.4.4 BIOLOGICAL RESOURCES

A general discussion of biological resources and all applicable laws and regulations is provided in Section 3.0.4.

Region of Influence

The region of influence is the environment within the confines of the China Lake NAWC. However, the primary focus of activities is in the area immediately surrounding the runway at Armitage Airfield. The proposed activity would not result in the damage or destruction of the drone aircraft. Therefore, the ground activities would include only the takeoff and landing of the four drone flights.

Affected Environment

Threatened and Endangered Plant Species. No state or federally listed plant species are found at China Lake NAWC.

Threatened and Endangered Animal Species. Four species of threatened or endangered wildlife are found at the China Lake NAWC (Table 3.4-6). Of these, the desert tortoise and possibly, the Inyo brown towhee are most likely to be found in the vicinity of the proposed ground operations.

Common Name	Scientific Name	State Status	Federal Status
Mojave ground squirrel	Spermophilus mohavensis	T	—
Desert bighorn sheep	Ovis Canadensis	T	—
Inyo brown towhee	Pipilo crissalis eremophilus	E	E
Desert tortoise	Gopherus agassize	T	T
E Endangered T Threatened			

Environmental Consequences

Ground support for the PDRR ABL Phase would be needed at the site only to support drone aircraft. The drone aircraft that would be used for the proposed action would takeoff from and land on the local runway and would not result in debris production. Therefore, no damage to plant or animal species would occur.

Launching drone aircraft from the China Lake NAWC runway is an ongoing activity and is the only activity associated with the proposed action that would be occurring on the base. No additional environmental consequences are anticipated from PDRR ABL Phase activities. Currently, 15 drones utilize this runway annually. The area surrounding the runway would not be adversely affected by the four additional drone launches introduced by this project.

Engagement of the high-energy laser upon a target board attached to a drone would result in laser energy being reflected upward. The altitude of missile engagement, along with the geometry of the incident high-energy laser beam with respect to the target surface, would essentially eliminate the risk of exposure levels to wildlife.

3.4.5 GEOLOGY, SOILS AND WATER RESOURCES

A general discussion of geological, soils, and wter resources and all applicable laws and regulations is provided in Section 3.0.5.

Region of Influence

The region of influence for geological, soils, and water resources is limited primarily to the main runway of Armitage Airfield at the China Lake Naval Air Warfare Center (NAWC).

Affected Environment

Geology. The China Lake NAWC is located within the Western Mojave Desert of the Basin and Range Physiographic Province (Figure 3.4-1). The topography is characterized by a closed alluvial basin, the Indian Wells Valley, surrounded by low to medium-height bedrock uplands (Figure 3.4-3). Armitage Airfield is located in the Indian Wells Valley. Several dry lakes occur in the lowest portions of the valley, the largest of which is China Lake located northeast of Armitage Airfield (NFEC, 1989).

Figure 3.4-3

The Indian Wells Valley is believed to be a fault block developed in response to the upward movement of the Sierra Nevada to the west. The valley is filled with up to 1,525m (5000 ft) of sediment eroded from the surrounding bedrock uplands. The alluvium is composed of unconsolidated gravel, sand, silt, and clay, and is exposed throughout most of the valley. Ancient lake sediments overlie the alluvium in the eastern part of the valley.

The major faults of this part of southern California are the northwest-trending San Andreas fault, about 130 km (80 mi.) to the south, and the northeast- to east-trending Garlock fault, approximately 30km (20mi) to the southeast (Figure 3.4-4). Two local faults, the northwest-trending Little Lake fault and the north-trending Airport Lake fault, converge in the vicinity of Armitage Airfield (NFEC, 1989). Most of the larger, regional faults (Sierra Nevada fault, Panamint Valley fault, Death Valley/Furnace Creek fault) strike approximately north-south. The Sierra Nevada fault, located along the western boundary of the China Lake NAWC, extends for nearly 322 km (200 mi.) along the eastern side of the Sierra Nevada and separates the mountains from the Indian Wells Valley.

Seismicity. Roughly 3,000 to 5,000 earthquakes occur each year on regional and local faults in the vicinity of the China Lake NAWC. Most of the earthquakes have magnitudes of less than 2.0, but a few have magnitudes from 4.0 to 4.8 on the Richter scale. No major earthquake damage has occurred to any facilities on the China Lake NAWC (NEFC, 1989), but the potential exists.

There is evidence that the eastern portion of the Garlock fault, which passes to the southeast of the region of influence, is temporarily locked, accumulating stress, and causing ground-cracking and fissuring. No major earthquakes have occurred along this section of the Garlock fault in at least 500 years. It has been determined that the earthquakes occur approximately every 1,000 years (+/- 500 years), and the possibility of a magnitude 7.6 to 8.0 earthquake has been suggested (NFEC, 1989). The portion of the Sierra Nevada fault adjacent to the western boundary of the China Lake NAWC is also believed to be locked, and although it has not shown movement in the last 10,000 years, the area is considered a likely location for a magnitude 7.0 or greater earthquake (NFEC, 1989).

The two faults that present the greatest hazard at the main runway of Armitage Airfield are the local Little Lake and Airport Lake faults. Much of Mainsite at the China Lake NAWC and the city of Ridgecrest are in the epicentral zone of the Little Lake fault (Figure 3.4-3). Magnitude 8.0 earthquakes are believed to have occurred on this fault in the past 1,600 years, and magnitude 5.0 earthquakes occur roghly every 20 years. The maximum earthquake magnitude anticipated on the Little Lake fault is 6.5. A possibility of a magnitude 8.0 earthquake or greater could exist if movement were simultaneous with movement on the Sierra Nevada fault (NFEC, 1989). The airport Lake fault zone and the Little Lake fault resumed activity in the early 1980s, and it is believed that regional and local stresses are being relieved by these movements at the intersection of the two fault zones (NFEC, 1989).

The region of influence at the China Lake NAWC is located in Uniform Building Code Seismic Risk Zone 4. Because the potential exists for a major earthquake in the near future, precautions are in place to minimize damage and disruption. Strict construction requirements must be followed, particularly for structures built on alluvium and in areas where liquefaction could occur. Liquefaction is considered the primary concern as a consequence of earthquakes at the NAWC. However, because many buildings were constructed prior to the strict guidelines, engineering controls are being implemented to reduce the potential damage. Studies have also been conducted to determine areas where slope failure might occur during earthquakes (NFEC, 1989).

Figure 3.4-4

Soils. A soil survey of the entire China Lake NAWC has not been completed, but over 40 soil types have been mapped. In many cases, soil properties vary dramatically within short distances. Some soils are subject to flooding, some hae poor drainage capacity, and some erode easily. Soils developed on the low-lying alluvial plains generally have a sandy surface layer and are typically also sandy in the subsurface, although clay accumulations are found in some areas (USDA, 1989). Soils in parts of the area have been cemented naturally to form caliche or strongly-cemented hardpan.

Surface Water. Average precipitation at China Lake NAWC is less than 3 inches per year. No perennial streams or lakes exist. Occasional flash-flooding occurs following winter storms or summer thunderstorms and the surface runoff accumulates in the normally dry lake beds (DoD, 1995).

A total of 49 springs hav been identified on China Lake NAWC, several of which are located in the vicinity of Armitage Airfield. Wetlands are scarce and are usually associated with springs. However, locations near the weapons-storage areas in the southern part of the site are wet for most of the year.

Groundwater. The water supply for China Lake NAWC is sole-sourced by groundwater. The majority of the water supply is derived from shallow, unconsolidated deposits in the Indian Wells Valley Basin, which is believed to be recharged entirely by precipitation within the basin and in the Sierra Nevada. Groundwater in the vicinity of Armitage Airfield occurs at a depth of approximately 100 feet. Most of the main aquifer in the valley is unconfined, and yields from the wells can vary up to 200 gallons per minute.

The China Lake Complex is also underlain by the Coso regional, confined groundwater system, which contains large quantities of deep groundwater originating in the Sierra Nevada. The nearby community aquifer is being pumped at a greater rate than it being recharged (DoD, 1995).

Flooding from stormwater runoff has resulted in significant property losses at the China Lake Complex. A number of flood-control projects have been completed since 1984 when a severe flood caused an estimated $30 million in damages in the Mainsite area. The projects were designed to control waters from a 60- to 70-year flood. The main runway at Armitage Airfield lies within a 100-year floodplain, which indicates that flooding of facilities is still possible from severe storms (NFEC, 1989).

Water Quality. Much of the groundwater found at the China Lake NAWC is saline, with total dissolved solids (TDS) concentrations of up to 2,000 parts per million (ppm), and is unsuitable for human consumption. TDS concentrations in the groundwater at the China Lake Complex well-fields range from 200 to 600 ppm, and are increasing.

Groundwater quality at the China Lake NAWC has been affected by leakage from sewage-evaporation ponds and military and industrial dumps, but the potential contaminant sources are being addressed. A total of 43 industrial/military disposal sites have been identified at the China Lake NAWC, several of which are located around the runway. Fifteen of the sites have been identified as requiring further evaluation to determine if they pose a threat to human health or the environment.

Environmental Consequences

A maximum of ten flights of the PDRR ABL would be conducted within the boundaries of China Lake NAWC. The B747 aircraft would be flying at an operational altitude of approximately 40,000 ft AMSL. The flights would be consistent with ongoing operations and would not impact geological, soil, or water resources. The gaseous chemical emissions from the **four, high-energy laser firings** would be vented from the aircraft at operational altitudes and would therefore not impact geological, soil, or water resources. The four drone flights that would originate and terminate at Armitage Airfield would be similar in nature to the substantial number of tactical jet flights currently conducted at the China Lake NAWC and would create a negligible incremental impact on geological, soil, or water resources.

3.4.6 CULTURAL RESOURCES

A general discussion of cultural and paleontological resources and all applicable laws and regulations are provided in Section 3.0.6.

Region of Influence

The region of influence for cultural resources includes all of China Lake NAWC (Figure 3.4-5).

Affected Environment

A wide variety of prehistoric and historic sites are preserved in China Lake NAWC. Cultural site-types include villages, campsites, shelters, caves, rock art, cairns, rock alignments, quarries, pottery loci, hunting blinds and decoys, milling stations, isolated prehistoric finds, and various historical structures (Greenwood and Associates, 1982). The earliest sites recorded within the China Lake NAWC were almost exclusively habitation and rock art sites (Greenwood and Associates, 1982).

China Lake Complex. Archeologically sensitive areas include playa lakes and upper terrace zones. The highest prehistoric site densities are located in mountain areas on shallow slopes, at the foot of mountains, near springs and playas, and in lithic resource areas (Greenwood and Associates, 1982).

The northwestern portion of the China Lake Complex, known as the Coso Range, contains some of the richest and most valuable prehistoric cultural resource areas in the United States (Greenwood and Associates, 1982). Regional rock art varies from a single element to miles of petroglyphs in major canyons in the Coso Range. The Coso Spring Canyon area consists of rock shelters, rock art, and lithic scatters. Most of the rock art is in the form of petroglyphs, pecked, etched, or abraded onto the surface of basalt scarps, approximately 4,000 years old (NWC, 1974). Several painted sites exist in the Coso Range's major canyons including Petroglyph, Renegade, and Sheep Canyons, which were dedicated in 1965 as National Historic Landmarks and were listed in 1982 in the National Register of Historic Places (Greenwood and Associates, 1982).

Recorded historic sites in the China Lake Complex include Old Coso, Coso Hot Springs, and the Native American Prayer Site. These sites were listed on the National Register of Historic Places in 1978 (Dames & Moore, 1991). Old Coso is an historic silver and gold mining village that flourished in the 1860s (China Lake Joint Venture, 1986). Coso Hot Springs was mined for its sulfur and cinnabar towards the latter part of the 1800s and early 1900s. There are numerous mill sites and miner's cabins associated with 19th and 20th century mining episodes. As the mining community developed, cattle and sheep ranching developed as well (Dames & Moore, 1991). A few remains of ranches, corrals, and horse traps can be found near Coso Hot Springs (NWC, 1974).

Coso Hot Springs was used as a health spa and resort during the early years of the 20th century (NWC, 1974). Historic sites incllude three former health resorts, with their associated building remains, steam wells, and mud-pit areas. The China Lake shoreline area and Indian Wells Valley contained 44 historic and 156 prehistoric isolated finds unassociated with site activity (Greenwood and Associates, 1982).

Figure 3.4-5

The Native American Prayer Site, located in the Coso region, continues to be used for ceremonial purposes (Greenwood and Associates, 1982). Religious use of the Coso Hot Springs by local Native Owens Valley Paiute-Shoshone Band of Indians and the Kern Valley Indian Community. The springs are used 4 to 12 times per year for religious and medicinal purposes (Dames & Moore, 1991). Native Americans have asserted that Coso Hot Springs therapeutic values are significant to their traditions and cultural heritage.

Randsburg Wash Range/Mojave B Complex. The Randsburg Wash/Mojave B Complex contains a few prehistoric sites such as petroglyphs, rock shelters, and occupation sites. The sothern portion of the complex also contains an obsidian deposit, which is believed to have been used as a quarry site(Greenwood and Associates, 1982). The small number of sites recorded is attributed to the scarcity of water.

Historic sites within the Randsburg Wash/Mojave B Complex include mining structures located in the Slate Range and Brown Mountain areas (NWC, 1974). Remains of a monorail that transported minerals from an Epsom salt mine are located near Layton Pass, on the east side of Searles Lake (NWC, 1974). The Randsburg Wash/Mojave B Complex is composed of relatively desolate stretches of desert, and except for mining, this area was unoccupied during historic times (NWC, 1974).

Paleontological Resources. A few extinct Pleistocene animal bones have been found in the dry bed of China Lake. Species include mammoth, giant bison, direwolf, saber tooth cat, camel, horse, ground sloth, and eagle, as well as a few aquatic birds and a reptile (NWC, 1974).

Environmental Consequences

No environmental consequences for cultural or paleontological resources are expected at the China Lake NAWC. China Lake NAWC would be used as a drone launch and recovery area for acquisition, pointing, and tracking activities. Non-destructive target-drone flights would takeoff and land on preexisting runways during a four-month period. No impacts would occur to any undisturbed land. Should unforeseen cultural or paleontological resources be encountered in the course of the ABL project, activity would be suspended until the Base Historic Preservation officer is notified and consulted.

3.4.7 HAZARDOUS MATERIALS AND WASTE

A general discussion of hazardous materials and waste and all applicable laws and regulations is provided in Section 3.0.7.

Region of Influence

The region of influence for hazardous materials/hazardous waste includes the aircraft maintenance area nand hazardous materials/hazardous waste storage areas at China Lake NAWC.

Affected Environment

China Lake NAWC generates approximately 275 tons of hazardous waste per year (NAWC, 1994). China Lake's *Hazardous Waste Management Plan* provides guidelines for the operation of hazardous waste generation and storage.

China Lake NAWC currently generates a wide variety of hazardous wastes from range infrastructure-support activities, including waste from petroleum products, solvents, mixed-paint waste, explosives, acids, and bases. Hazardous waste is collected and containerized immediately after it is generated.

Wastes are stored at satellite accumulation points at or near the points of generation and are moved within 72 hours to a less-than-90-day accumulation area or to an onsite Resource Conservation and Recovery Act (RCRA) Part B permitted storage facility. In a less- than-90-day on-site accumulation area, an internal generator can accumulate hazardous waste onsite for 90 days or less without RCRA hazardous waste storage permit. China Lake NAWC also maintains a RCRA interim status for treatment of reactive wastes (Zellmer, 1996).

Environmental Consequences

PDRR ABL diagnostic-test activities expected to use and generate hazardous materials/waste consist of drone launches. Drone flights at China Lake NAWC are expected to originate from the main runway at Armitage Airfield. Many of the hazardous materials used in drone pre-launch and launch activities would include solvents, lubricants, and fuels. These hazardous materials are currently in use. Proposed ABL uses of these materials would represent only a small increase in the total use of hazardous materials, with no significant changes in the types of materials handled and stored. Procurement, handling, and use of hazardous materials would be the responsibility of the ABL program, but China Lake NAWC would provide oversight to ensure that operations are conducted in accordance with established procedures.

The existing hazardous-materials storage and handling capabilities at China Lake NAWC are adequate to ensure that all materials are handled safely and in accordance with applicable regulatory procedures. PDRR ABL Phase materials would be similar to those currently used and would be transported to the drone preparation area using ground-support equipment without the need for revised procedures.

Limited quantities of hazardous wastes would be generated by proposed drone pre-launch and launch activities. These may include unused or contaminated cleaning solvents, or unused lubricants or hydraulic fluids. Similar waste types are currently generated at China Lake NAWC during existing operations. Motor fuels and cleaning solvents are routinely collected and disposed of. All shipping and disposal procedures would be performed in accordance with RCRA and DOT requirements.

3.4.8 HEALTH AND SAFETY

A general discussion of health and safety and all applicable laws and regulations is provided in Section 3.0.8.

Region of Influence

The region of influence would be limited to the immediate area surrounding the preparation, launch, and recovery sites for the drones at Armitage Airfield and would be limited to workers. The reasons for excluding flight operations and the public from the region of influence are as follows:

- Drone flight patterns would be within China Lake NAWC boundaries and laser engagements would take place above 40,000 ft AMSL.
- Laser engagement geometry would always have the laser energy directed horizontally or upward from the B747 aircraft
- PDRR ABL test engagements would not affect the flight of the drone, and the drone would be recovered at the end of each of the four missions.

Affected Environment

Preparation, launch, and recovery of drone aircraft would take place at Armitage Airfield located northwest of the Mainsite area. The Center's Aircraft Department has an inventory of 30 aircraft that are flown by pilots in support of various research, development, and test programs. The Department also has an inventory of approximately 50 target/drone aircraft in storage; nine of these could be expected to be operational for test purposes at any one time. Additionally, the department supports 24 aircraft operated in support of operational-test and evaluation for weapons systems. The flight patterns for the drone aircraft during PDRR ABL tests would occur in the airspace above the China Lake NAWC range.

Environmental Consequences

Operational procedures and safety programs currently exist for mission support. The projected four drone missions in support of the PDRR ABL Phase would use existing aircraft and personnel resources and would not significantly increase the Aircraft Department's workload. No new or unusual ground support or flight profiles would be anticipated. Therefore, there would be minimal health or safety risk to workers.

The use of lasers by the PDRR ABL Phase would be carefully controlled to minimize the health and safety risk to both human and biological resources at China Lake NAWC. During engagement scenarios, the lasers on the PDRR ABL aircraft would always be pointing horizontally or upward. This would preclude any direct contact of laser energy on humans or other aircraft in the R-2508 Complex because the aircraft would be flying at an altitude of approximately 40,000 ft AMSL. Detailed analysis of laser energy reflected from targets is presented in Appendix F.

3.4.9 LAND USE

A general discussion of land use and all applicable laws and regulations is provided in Section 3.0.9.

Region of Influence

The region of influence on land use at China Lake NAWC consists of the main runway at Armitage Airfield at the southern end of the China Lake Complex (Figure 3.4-1).

Affected Environment

Land Use of Adjacent Jurisdiction. As required by California law, the city of Ridgecrest, at the southern edge of the China Lake Complex, and each of the counties encompassing the China Lake NAWC, have general development plans. All zoning is accomplished by the city and county governments and must comply with land-use designations identified in the general plans (NFEC, 1989). Incorporated land for the city of Ridgecrest has been subdivided into a wide variety of land uses that include residential, commercial, industrial, professional, civic and institutional, schools and parks, and open spaces. With the exception of Ridgecrest, and the China Lake community in Mainsite within the Complex immediately north of Ridgecrest, the land is mostly vacant. Land to the west and south of the China Lake Complex in Kern County is desert country and is designated primarily for residential use and agriculture. Land to the southeast of the China Lake Complex in San Bernardino County is almost entirely desert and is designated primarily for low-intensity, rural conservation uses, although small areas along the southern border of the Complex are designated for rural living. Land within and adjacent to the China Lake Complex in Inyo County is designated primarily as open space, and is utilized for cattle grazing.

Land Use at China Lake NAWC. The remote desert location for the China Lake NAWC was initially chosen because of its isolation from the general population, favorable weather conditions for year-round flying, clear air with unrestricted visibility, and reasonable certainty that the favorable site conditions would be permanent (NWC, 1974). The NAWC has been divided into several test ranges that support operations such as munitions and ordnance testing, flight testing, propulsion testing, and various specialized tests. In addition, numerous flight squadrons use the airspace and runway facilities for training purposes. The majority of test ranges and facilities that support operations at the NAWC are north of the region of influence of PDRR ABL Phase activities in the China Lake Complex.

Land-Use Plans and Policies. A Master Plan (NEEC, 1989) has been developed by the China Lake NAWC to ensure that the land and facilities at the site are used logically and efficiently. The Master Plan serves as a guide for future growth and change at the NAWC by documenting the planning process and by providing a vehicle for planning recommendations and proposals.

Special Land Use Characteristics and Patterns. Several special land-use proposals have been submitted for lands in the vicinity of the China Lake NAWC. Two such proposals were recently dropped, including a solar-power plant that would have used reflecting surfaces and could have affected pilots' ability to navigate, radio antennas, and large fossil-fuel power plants that would have affected air quality and visibility (NFEC, 1989). In recent years several additional proposals have been submitted, including an Ultralight Park, the Ogden Environmental Hazardous Waste Incinerator, a low-level nuclear-waste repository, and Flood Control Channel for the city of Ridgecrest. The status of these proposals is pending.

Environmental Consequences

The B747 flights would take place within the R-2508 Complex, which is restricted airspace for military operations and training that covers approximately 51,800 square km (20,000 square mi) over the China Lake NAWC and surrounding areas. The primary mission of the China Lake NAWC is to support jet-fighter training, and the testing and evaluation of military aircraft. The activities included in the diagnostic testing of the PDRR ABL Phase over the Complex would be consistent with the China Lake NAWC mission and with land-use plans and policies.

The four drone flights, which would originate and terminate at the Main Runway at Armitage Airfield and take place in airspace restricted for military aircraft flight, would be consistent with the China Lake NAWC mission, land-use plans and policies. Therefore, the drone flights would not change land-use patterns at the China Lake NAWC.

3.4.10 NOISE

A general discussion of noise and all applicable laws and regulations is provided in Section 3.0.10.

Region of Influence

The region of influence for noise exposure at the China Lake NAWC is the region immediately surrounding the runway at Armitage Airfield used for target-drone launches at the China Lake Complex.

Affected Environment

The China Lake Complex has a number of sources that contribute to noise in the Indian Wells Valley. Aircraft are a major source, while motor vehicles and explosive tests and disposal are secondary sources. The two sources of aircraft noise at China Lake Complex are the Naval Air Facility and the high-speed R-2506 test range approach corridor. NAWC's Air Installation Compatible Use Zone (AICUZ) Noise Study (1977) was updated in 1995 (NFEC, 1995).

Environmental Consequences

Increases in noise levels from PDRR ABL Phase operations would be minimal. Since the target drones used to support the PDRR ABL Phase are currently operational at China Lake NAWC, noise generated from target-drone launches is already included in the approved 1995 AICUZ update. The addition of four drone missions to the total of more than 26,000 annual aircraft missions would not alter the existing AICUZ study. The 40,000 ft AMSL altitude at which the aircraft would be flying during operations over China Lake NAWC precludes the possibility of unallowable noise exposure to ground populations. No changes to existing noise levels are anticipated from PDRR ABL Phase activities.

3.4.11 RECREATION AND VISUAL RESOURCES

A general discussion of recreation and visual resources and all applicable laws and regulations is provided in Section 3.0.11.

Region of Influence

The region of influence for recreation and visual resources is defined as recreation, aesthetic and public-interest areas under the R-2508 Airspace Complex.

Affected Environment

The California Desert Conservation Area covers a 25-million acre area in the southeastern California desert (NAWC, 1995). This area includes Edwards AEB, the China Lake Complex, and all surrounding land. Lands bordering the China Lake NAWC are generally designated by the California Conservation Plan for limited and moderate uses (NAWC, 1995). The limited-use designation is designed to protect sensitive, natural, scenic and ecological resources and to permit low- intensity uses. The moderate-use designation allows mining, livestock grazing, recreation, and energy and utility development (NAWC, 1995). Thousands of acres of natural-resource lands administered by the Bureau of Land Management are open to designated public uses. The local communities also provide recreational use areas.

Environmental Consequences

It is anticipated that PDRR ABL test activity, drone flights, and beam- characterization activity would have a low impact on recreation and visual resources in the area of China Lake NAWC. Drone flights originating from the main runway would not require closure of recreation facilities and would not change the existing aesthetics of the area. PDRR ABL and laser activities would occur at an altitude of 40,000 ft AMSL with no anticipated disturbance to the land surface. Laser activity would be directed upward from the aircraft, eliminating laser contact with the land surface.

The increase in personnel would have a low impact on recreation facilities on China Lake NAWC and the surrounding area. The small increase in personnel would not overcrowd or overuse any facility.

Laser activity, drone flights, and test activities would have a low impact on recreation and visual resources because China Lake NAWC is currently supporting drone-flight development and testing.

3.4.12 INFRASTRUCTURE AND TRANSPORTATION

A general discussion of infrastructure and transportation and all applicable laws and regulations is provided in Section 3.0.12.

Region of Influence

The region of influence for infrastructure and transportation is China Lake NAWC and the surrounding area, including the communities of Inyokern and Ridgecrest (Figure 3.4-6).

Affected Environment

Electrical Power. Electricity is purchased from the Southern California Edison Company. Service is provided over three 34.5-kV transmission lines from the Inyokern Substation. The substation is rated at 110 MVA, of which over 50 MVA is available to China Lake NAWC. Any two of the three transmission lines are capable of carrying the NAWC' s entire electrical load. From the Center's substation, power is transmitted over six lines to the various on-Base substations, which transform the voltage down to 4,800 volts. Based on the availability of 50 MVA of power from the Inyokern Substation and the center's largest demand of 25.2 MVA, the capacity of the existing power supply to the center is more than adequate.

Figure 3.4-6

Water System. China Lake NAWC depends on groundwater resources for its water supply. The primary water supply is from deep wells in the Indian Wells Valley aquifer. The aquifer currently yields over 30,000 acre-ft of water each year. Of this, the center uses less than 5,000 acre-ft per year. The water is transported from the wells to the center via a transmission line that runs parallel to California SH-178. The condition of the water-distribution system ranges from good to poor. The majority of the distribution pipelines are constructed of asbestos, cement, and cast iron, and were installed in 1945 and 1946.

Wastewater System. The city of Ridgecrest owns and operates the center's sewage-treatment plant and has the responsibility of maintaining and upgrading the plant as required to meet water-quality standards and future loading. This plant processes sewage from the populated areas of the center and from the city of Ridgecrest. The center and the city are served by separate sewer systems, but they both terminate in the single sewage-treatment plant located on NAWC property. Primary treatment consists of the removal of grit and primary sediment. Secondary treatment consists of a series of oxidation and evaporation ponds on approximately 220 acres. The sewer system and treatment plant have adequate capacity. The plant has a rated-design capacity of 4.4 MGD and the average daily volume is less than 3.5 MGD. Outlying areas not located near sewer pipelines use cesspools, evaporative ponds, and septic tank/leach field systems.

Solid Waste Handling System. China Lake NAWC's solid waste is collected by a contractor and transported to the Ridgecrest sanitary landfill.

Roads. California SR-14 provides the primary access southwest to the Lancaster and Los Angeles areas. It is a modern two- and four-lane road and is in good condition. California SR-178 provides direct access west to Bakersfield. It is in adequate condition but is sometimes impassable during winter storms. US-395 provides northern access to Reno, Nevada, and southern access to San Bernardino and Riverside. It is an older two-lane road that is in adequate condition.

Railroads. There is no commercial rail service to the China Lake NAWC/Ridgecrest area. The closest mainline track is located in Mojave, 80 km (50 mi) south of China Lake.

Aircraft. The Indian Wells Valley Airport District operates the airport at Inyokern, approximately 16 km (10 mi) west of China Lake NAWC's main gate on the west side of Mainsite. This airport is serviced by regional commuter airlines only. China Lake NAWC operates the three runways at Armitage Field. Two of the runways are over 2,700 m (9,000 ft) long and the third is 2,350 m (7,700 ft).

Environmental Consequences

The primary use of China Lake NAWC would be the airspace over the range. PDRR ABL Phase ground activities that would utilize infrastructure and transportation systems would be limited to launching up to four drone aircraft with target-board missions, range-control activities, and intermittent visits by government and contractor personnel. All of these activities would utilize existing personnel, facilities, and systems, and would have minimal impact on infrastructure and transportation systems in the China Lake NAWC area.

3.4.13 SOCIOECONOMICS

A general discussion of socioeconomics and all applicable laws and regulations is provided in Section 3.0.13.

Region of **Influence**

The region of influence for China Lake NAWC is the eastern portion of Kern County, California.

Affected Environment

China Lake NAWC is located in the upper Mojave Desert, California. Based upon an analysis of transportation-access routes, existing residence and commuting patterns, and availability of transient housing, the affected environment is determined to be limited to the East Kern Census County Division (CCD) in Kern County (Figure 3.4-7). The impacted communities within the affected environment are Ridgecrest and Inyokern. Ridgecrest would be expected to experience the most significant effects from the stationing of short-term personnel.

The impacted communities are sufficient in size to provide temporary accommodations for the temporary test personnel during the proposed one-week launch periods, which may be scheduled up to four times. Temporary personnel typically would stay in Ridgecrest because of its proximity to the China Lake Complex. There are 590 hotel/motel rooms available in the area (Ridgecrest Chamber of Commerce, 1996; Mayfair Motel, 1996). There are also 61 restaurants and fast-food establishments located in the area (ProCD Inc., 1996; Ridgecrest Chamber of Commerce, 1996).

Figure 3.4-7

Figure 3.4-7. Socioeconomic Region of Influence at China Lake Naval Air Warfare Center, California

California Development Department statistics indicate that the average civilian labor force in the region of influence in 1995 was 13,700 persons, with an average 2,400 (17.5 percent) unemployed. Any additional motel/hotel/restaurant workers that may be required to accommodate the Diagnostic Test Range personnel in the area could be hired from the existing workforce.

Environmental Consequences

Diagnostic testing at China Lake NAWC may take up to five months and involve four drone flights (Table 2-8). Approximately ten temporary test personnel would rotate into the area for one week (five-day week) for each of four diagnostic-test flights. Any impact of temporary personnel on Inyokern would be insignificant. The economic advantage from the temporary posting of personnel would primarily benefit hotels/motels and restaurants in the region of influence.

Assuming a 46 percent annual motel/hotel occupancy rate in the region of influence (Ridgecrest Chamber of Commerce, 1996; Mayfair Motel, 1996), 271 rooms would be available in the area to accommodate the ten temporary personnel. Income generated from local meals and incidental expenditures and hotel/motel stays temporary personnel is estimated, based on General Services Administration Federal Travel Directory guideline for individual region of influence markets.

Estimated annual demand from Diagnostic and Expanded-Area Test Range personnel is 200 room-nights (10 personnel x 4 weeks x 5 days/week) and a potential $19,400 (200 x $95/day) (41 CFR *§* 301, Appendix A, April 1996) annual motel/ hotel revenues. In addition, the temporary personnel would generate $7,600 (200 x $38/day) in local restaurant revenues and incidentals (41 CFR *§* 301, Appendix A, April 1996). The anticipated $27,000 in additional revenue generated by the posting of temporary personnel at the Diagnostic Test Range would have a positive but insignificant impact on the affected communities.

3.4.14 ENVIRONMENTAL JUSTICE

A general discussion of environmental justice and all applicable laws and regulations is provided in Section 3.0.14. The activities associated with diagnostic testing at China Lake NAWCIR-2508 Complex would not occur in populated areas (Section 3.0.14.2); therefore, no environmental justice analyses would be necessary.

3.4.15 CUMULATIVE IMPACTS

Activities and resource attributes associated with implementing PDRR ABL Diagnostic Test Range activities at China Lake NAWC which may contribute to cumulative impacts are summarized in this section. No specific information regarding activities which may be scheduled at China Lake in the year 2002 is currently available for analysis. A more detailed analysis will be done as the information becomes available and as system-test details are defined.

Drone Launches. An average of 15 drones are launched annually from China Lake. The possible four drone flights associated with the PDRR ABL Phase over a five-month period would result in an increase of 27 percent in the number of drone missions.

Air Quality. Although air quality would be minimally impacted by PDRR ABL Phase operations, emissions from drone preparations and operations would increase yearly emissions by less than 0.1 percent. The emissions would be well below *de minimus* levels and not regionally significant.

Airspace. Access to airspace may be restricted during flight tests related to the PDRR ABL Phase. However, operations would occur in restricted-area or warning-area airspace and would be of short du:ration.

Noise. Ambient noise levels would temporarily increase during drone launches. However, because of the minimal number of launches associated with the PDRR ABL Phase and the short duration of the launch activities, cumulative impacts would be minimal.

Hazardous Materials and Waste. PDRR ABL Phase activities at China Lake NAWC would result in slightly larger amounts of hazardous materials usage and hazardous-waste generation. However, the existing permitted storage facilities for these materials have adequate capacity for the additional material.

3.4.16 ADVERSE ENVIRONMENTAL IMPACTS THAT CANNOT BE AVOIDED

Unavoidable adverse impacts that may arise as a result of implementing the PDRR ABL Diagnostic Test Range Activities at China Lake NAWC are discussed in the following subsections.

Air Quality. Some testing activities would produce air pollutants. For ground operations and attendant drone launches, environmental impacts would be short-term, minor, and generally nonpersistent.

Hazardous Materials/Waste. There would be a minor increase in the storage of hazardous materials and generation of hazardous waste at some facilities.

Noise. Noise from traffic and drone launches would cause short-term disturbance to the local population and animals, however, it is part of the existing environment at China Lake NAWC. None of these impacts would be major, and would remain within Air Installation Compatibility Use Zone noise limits.

3.4.17 MITIGATION MEASURES

This section summarizes mitigation measures that would be considered beyond adherence to laws, regulations and guidelines to control or reduce impacts to the environment as a result of Diagnostic Test Range activities. Because of the negligible impact that PDRR ABL Phase activities will have on most attributes and the additional measures already taken by USAF, no separate mitigation plan is currently deemed necessary. Nevertheless, we have outlined areas needing special attention and management, depending on the specific actions to be taken at a facility, the level of impact, and other pertinent factors.

Hazardous Materials and Waste. Impacts would be mitigated by material substitution or process controls, but the impacts would have to be examined on a program- or system-specific basis in lower-tier environmental documentation.

3.5 WESTERN RANGE (VANDENBERG AFB)—ALTERNATIVE DIAGNOSTIC TEST RANGE AND PREFERRED EXPANDED-AREA TEST RANGE

Vandenberg AFB is an alternative Diagnostic Test Range and the preferred Expanded-Area Test Range. This section discusses the specific affected environments and environmental consequences by environmental attribute at Vandenberg AFB.

3.5.1 COMMUNITY SETTING

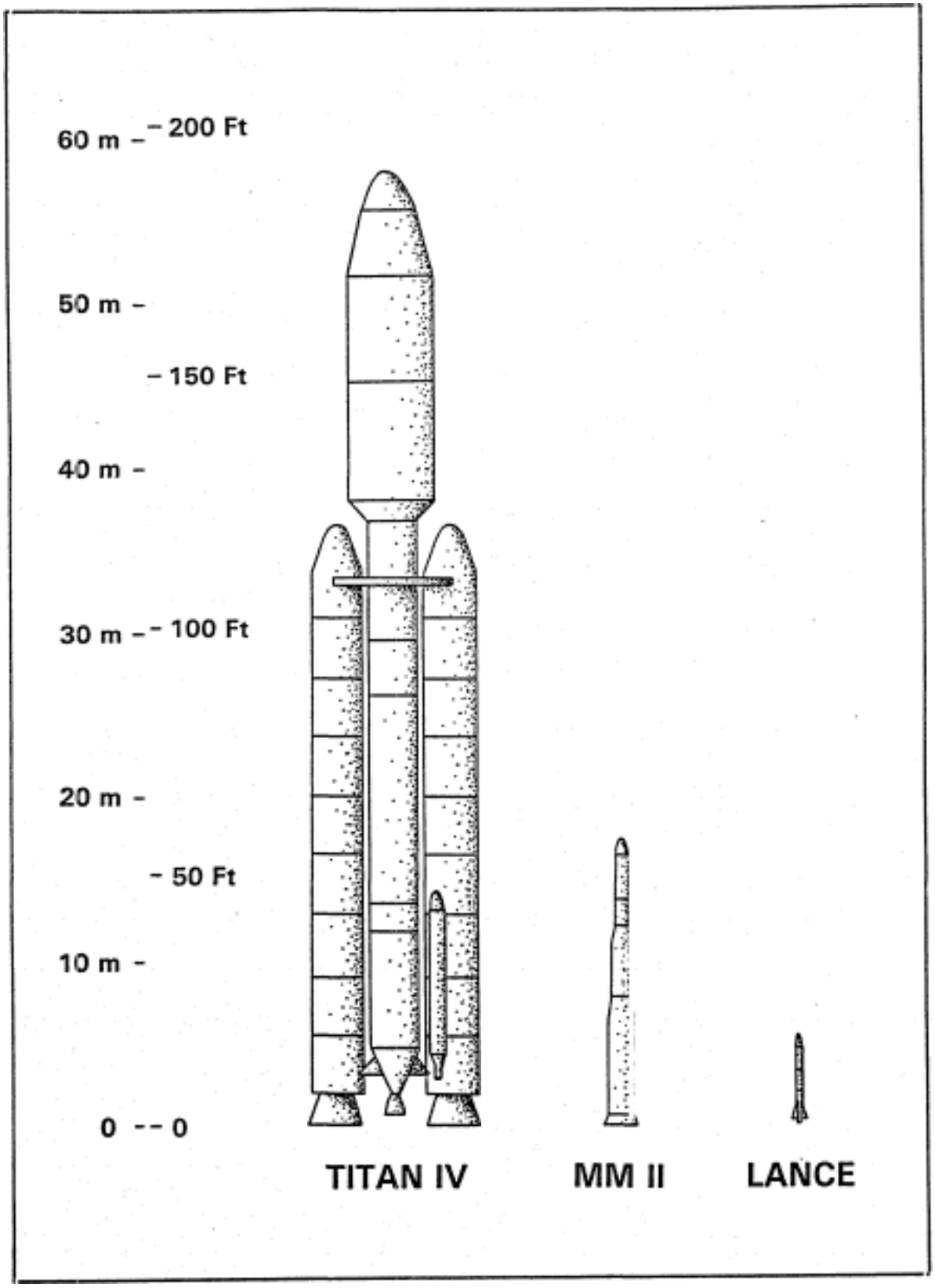
Background. The Base was originally activated as Camp Cooke in 1941 and provided infantry training for soldiers until the camp was inactivated in 1946. The USAF acquired the Base in 1957 for use as a missile launch center. The newly activated West Coast Missile Center was transferred to the USAF's Air Research and Development Command (now Air Force Materiel Command) and renamed Cooke AFB. In 1958, the Base was transferred to the Strategic Air Command and renamed Vandenberg AFB in honor of General Hoyt Vandenberg, the USAF Chief of Staff from 1948 to 1953. USAF Space Command took control of the Base in January 1991.

The Base's host unit, the 30th Space Wing, is responsible for launching satellites into polar orbit. Vandenberg AFB also provides launch facilities for testing of intercontinental ballistic missiles and is the site of all military, NASA, and commercial space launches accomplished on the west coast. Government launched missiles include the Titan IV and Minuteman II. An average of 14 government launched missiles per year occurred between 1990 and 1995, and in 1995 a proposed average of 15 government missiles per year were projected for launch between years 1996 and 2005 (USAF, 1995k, Launch Trends FY73-FYO5, September 1995). Figure 3.5-1 compares the sizes of the Titan IV and Minuteman II missiles to the Lance missile which is proposed for launch by the ABL Program. A maximum of 16 Lance missile launches would occur during ABL activity.

Location. Vandenberg AFB is located 88 km (55 mi) north of Santa Barbara near Lompoc, California. Covering more than 98,000 acres, the 399-square km (154-square mi) base includes 1,000 buildings, 840 km (520 mi) of roads, and 27 km (17 mi) of railroad track (Figure 3.5-2).

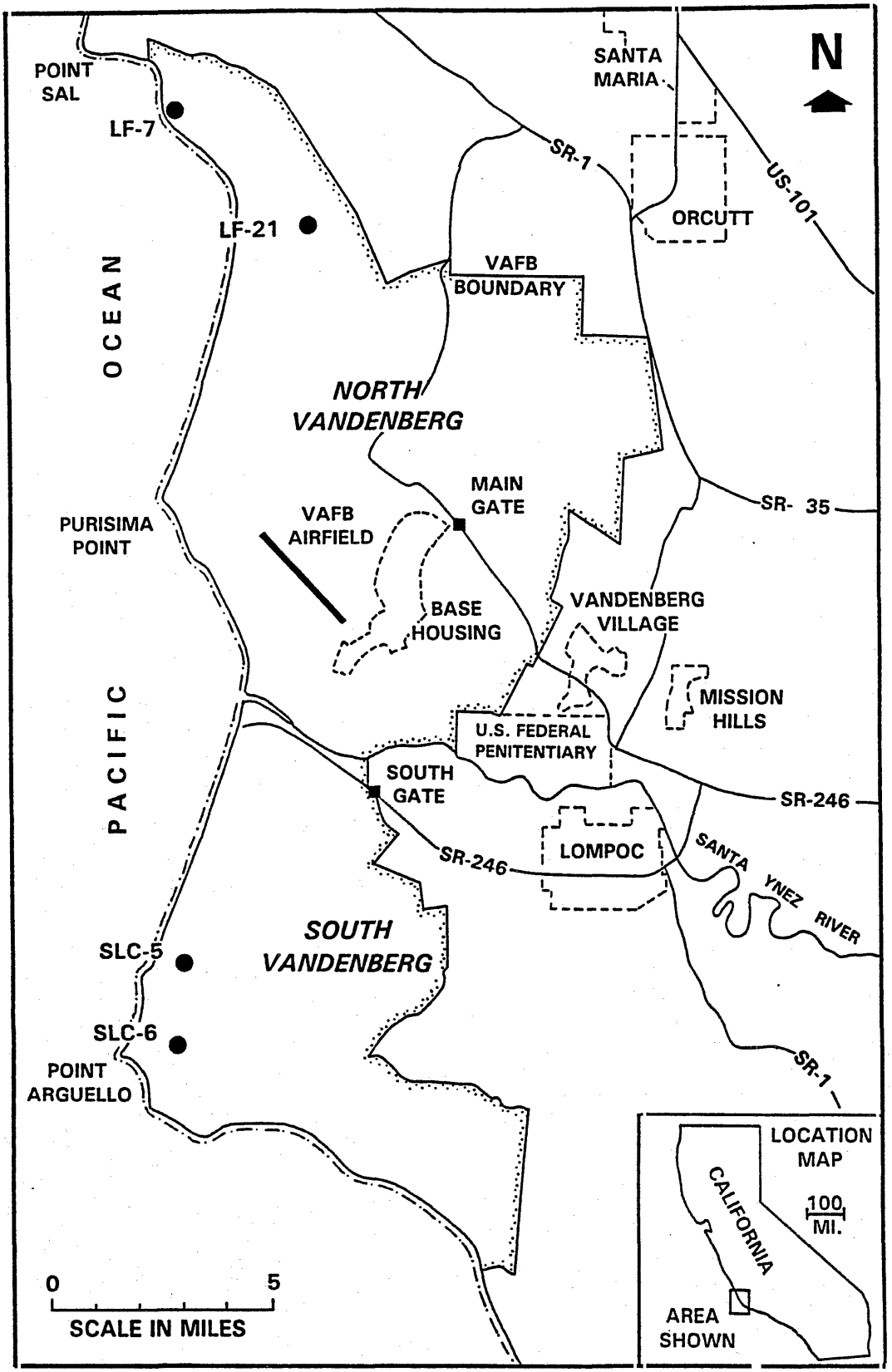
Facilities. The USAF has identified four representative sites on Vandenberg AFB that would be available for missile launches for the PDRR ABL Phase. Potential launch sites include space launch complexes SLC-5 and SLC-6 on the southern end of Vandenberg AFB, and launch facilities LF-7 and LF-21 on the northern end. While infrastructure to support the launch of the Lance missile exists at these launch facilities (i.e., communication lines, electricity, water), a mobile transporter/erector/launcher (TEL) would be brought to Vandenberg AFB for the actual launch of the missile. The mobile TEL is described in Appendix D.

The airspace of the Western Range begins at the Vandenberg AFB launch areas and extends west across the Pacific Ocean. The West Coast Offshore Operating Area (WCOOA) is managed by the 30th Space Wing as an adjunct to the Western Range. The area is a combination of restricted and warning areas as well as Federal Aviation Administration (FAA) controlled airspace and is used for missile tests. The test range is approximately 320 km (200 mi) wide and covers more than 1,600 km (1,000 mi) of coastline extending from the Gulf of Alaska to the Mexican border (Figure 3.5-3).



Modified from NASA, 1994; & Calif. Comm. Spaceport & Lockeed, 1995(1)

Figure 3.5-1. Size Comparison of Titan IV, Minuteman II, and Lance Missile



Modified from USAF, 1 994f

Figure 3.5-2. Location Map at Vandenberg Air Force Base, California

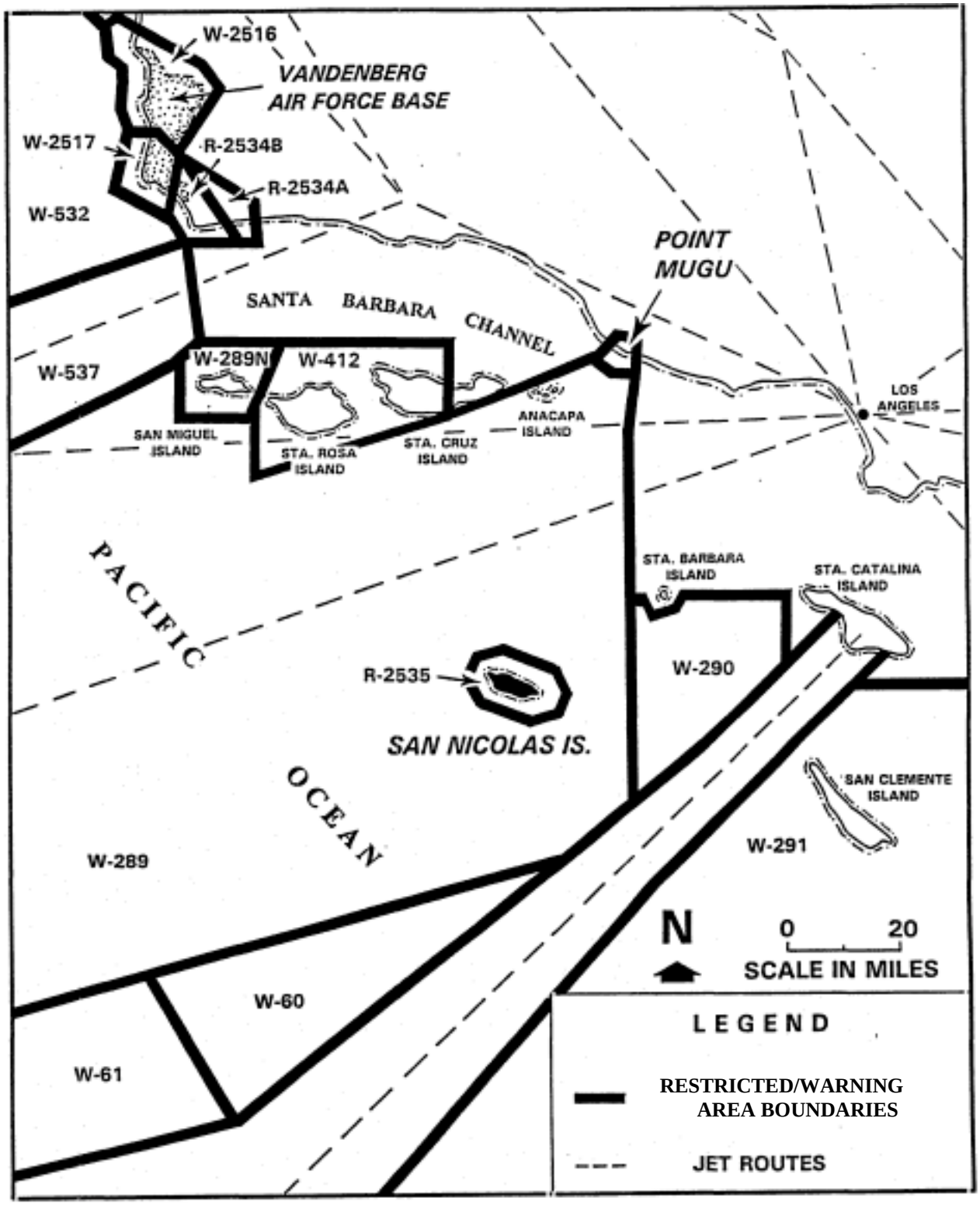


Figure 3.5-3. Low-Altitude Jet Routes, Restricted Areas, and Warning Areas at Vandenberg Air Force Base, California

Affected Environment

Vandenberg AFB is located on the coast of southern California at a point where the coastline transitions from the dry climate of the southern part of the state to the moist climate of the northern part of the state. As a result of these climatic and geographic conditions, Vandenberg AFB has a vast array of natural resources including 267 km (166 mi) of streams, 5,000 acres of wetlands, 56 km (35 mi) of undeveloped coastline, 9,000 acres of dune habitats, and numerous types of plant communities (USAF, 1991b). Vandenberg AFB also supports a diverse array of wildlife, including numerous species of mammals, reptiles, amphibians, and fish.

The climate is characterized as dry and subtropical. The Pacific Ocean is a moderating influence on temperature and moisture content of the air, resulting in a narrow range of values for these two meteorological parameters. The weather is warm and dry from May to November and wet and cool from December to April. The average annual temperature is 55^0F with a high of 74^0F in September and a low of 38^0F in January. The mean annual relative humidity recorded at the Vandenberg airfield is 77 percent.

Occasionally, a Santa Ana wind condition will cause a temporary, low-relative humidity (less than 10 percent). This condition is caused by a high-pressure cell stalled over the Colorado Plateau. This results in an off-shore airflow pattern. Dry air from the upper desert is heated as it descends to sea level and the local relative humidity is dramatically decreased. Total annual precipitation varies widely from less than 10 inches to more than 40 inches. Average annual rainfall is approximately 13 inches. The wettest month is February and the driest is July. The widely varying topography causes a great variation in local wind direction and speed. In general, winds are stronger on the higher ridge lines, along the beaches, and on Sudden Ranch. The mean annual surface wind speed is approximately 3.2 m/sec (7 mph), usually from the west-northwest direction. During Santa Ana conditions, high-velocity winds greater than 45 m/sec (100 mph) have been recorded. Coastal fog, which occurs primarily during July, August, and September, is usually confined to late evenings and early mornings.

3.5.2 AIR QUALITY

A general discussion of air quality and all applicable laws and regulations is provided in Section 3.0.2.

Region of Influence

Vandenberg AFB is located in the northern part of California's South Central Coast Air Basin (EPA Region IX) and in the Santa Barbara County Air Pollution Control District (APCD).

Affected Environment

Santa Barbara County is in attainment for all federal standards except for ozone. During the period 1991 to 1993, all stations in Santa Barbara County showed "attainment" of the federal ozone standard. This meant that no station recorded more than three exceedances of the federal ozone standard during the three year period. The APCD applied for redesignation to attainment of the federal ozone standard as a part of the 1994 Clean Air Plan. However, in May of 1996, three ozone violations were recorded. Combined with the exceedances recorded in 1994 and 1995, the County was judged to have failed to meet the statutory deadline of 1996 required for a "moderate" nonattainment area (Jammalamadaka, 1997).

Six air monitoring stations are located on or in the vicinity of Vandenberg AFB. Two are located on the Base: one at the Space Transport System Power Plant, and one at Point Arguello. Two other stations are located just south of the Base at Jalama Beach and Point Conception. The remaining two are located in

Lompoc (HS&P and South H street). Table 3.5-1 summarizes the 1993 and 1994 air quality data for ozone at the monitoring stations in the Vandenberg area. Although Santa Barbara County is in nonattainment status, this table shows that the air quality in the Vandenberg AFB area meets the NAAQS. The ozone emissions were below the 0.12-ppm limit and no exceedances were recorded in either 1993 or 1994.

Table 3.5-1. Ozone Emission Measurements

Site	**Maximum Daily 1-hour Concentration (ppm)**			**Number of days Exceeding NAAQS**		
	1993	**1994**	**1995**	**1993**	**1994**	**1995**
Lompoc HS&P	0.12	0.10	0.10	0	0	0
Lompoc H St	0.11	0.10	0.10	0	0	0
VAFB - Point Arguello	0.11	0.09	0.11	0	0	0
VAFB-STSPower	0.10	0.09	0.11	0	0	0
Jalama Beach	0.10	0.10	0.11	0	0	0
Point Conception	0.11	0.08	0.12	0	0	0
Source: California Environmental Protection Agency, 1993: 1994: 1995						

Vandenberg AFB has taken an active role to ensure that air quality goals will be met. The *Air Emissions Comprehensive Inventory Plan, Vandenberg Air Force Base,* prepared by CH_2M Hill in 1995, provided a plan for Vandenberg AFB to prepare and maintain a complete air emissions inventory. The 1990 base year and 1996 forecast emissions inventories for Santa Barbara County are shown in Table 3.5-2 and the 1994 actual emissions inventory for Vandenberg is shown in Table 3.5-3.

Environmental Consequences

The emissions produced by the PDRR ABL Phase activities would be well below *de minimis* levels, and would not be regionally significant. The PDRR ABL Phase activities with the potential to affect air quality at Vandenberg AFB would be flight-test preparation activities, a maximum of 16 target missile launches, and automobile use. The entire test period is expected to occur during a 12-month period in the years 2001 and 2002. The PDRR ABL activities would have no new stationary sources which would require permits for criteria air pollutants.

Table 3.5-2. Emissions Inventory for Santa Barbara County, California (tonslyr)

Year	**ROG***	**NO_x**
1990	51,015	18,222
1996	14,635	12,629
*Reactive Organic Gases Source: Santa Barbara County Air Pollution Control District, 1994		

Table 3.5-3. Actual VOC and NOx Emission Summary for Vandenberg Air Force Base, California (tons/yr)

Source		ROG	NOx
Stationary (Title V)	ICE	1.0	16.0
	Boilers (>1MMBtu/hr)	1.7	25.4
	Missile Operations	0.1	0.7
	Other	18.0	0.1
	Total	20.8	42.2
Mobile	Aircraft	11.5	53.2
	Vehicles	0.1	1.0
	Total	11.6	54.2
	ICE	0.9	10.6
Miscellaneous Sources	Boilers (<1 MMBtu/hr)	0.5	7.2
	Residential Units	5.7	3.6
	Biogenic (Vegetation)	276.6	0.0
	Vegetation Burning	17.4	0.0
	Other	6.7	1.4
	Total	307.9	22.7
GRAND TOTAL		**340.3**	**119.1**

ICE Internal Combustion Engine
Source: USAF, 1 996c

The impact on air quality from transportation and preparation activities would be minimal. The Lance missile is the only target that would be used at Vandenberg AFB. The Lance is a short-range theater-ballistic missile (TBM) and requires minimal infrastructure to support launch operations (U.S. Army. 1991). Target missile preparation activities would include receiving, initial inspection, temporary storage, comprehensive inspection, booster assembly, transport to launch location, mounting of missile on launcher, and equipment cleaning. These activities could involve the emissions of volatile organic compounds (VOCs) or hazardous air pollutants (HAPs). However, it is anticipated that the amounts would fall well below the minimal levels of the relevant Federal and California regulations. The Lance would arrive prefueled and no missile fueling operations would occur. Prelaunch activities would involve flight-testing evacuations and clearances and road closures. Vehicles would be involved with the road closures and area evacuations, and clearances on Vandenberg AFB may involve aircraft overflights to verify that the areas are clear.

No significant air quality impacts would occur during normal operation or accidents. The total exhaust emissions from a single launch of a Lance missile are presented in Appendix D (USACE, 1992). The only HAP produced from normal operations would be 0.10 pounds of hydrochloric acid from each Lance missile launch. The total of 1.6 pounds of hydrochloric acid from all missile launches is much less than the 10 tons per year regulatory reporting requirement of the CAAA. Detailed environmental analysis on the effects of using a Lance missile as TBM simulator is provided in the *U.S. Army Kwajalein Atoll Temporary Extended Test Range Environmental Assessment*, Appendix E (U.S. Army, 1995a) and in the *Lance Missile Target Environmental Assessment for White Sands Missile Range* (U.S. Army, 1996a). Neither analysis showed any measurable alterations to air quality as a result of normal Lance missile operations. Accident scenarios involving the release of inhibited red-fuming nitric acid (LRFNA) and unsymmetrical dimethylhydrazine (UDMH) are covered in Appendix C. Toxic corridor dimensions vary

with wind velocity. Analysis showed that the toxic corridor could be as great as 890 by 160 meters (2,920 by 525 ft) for a wind velocity of 5 m/sec (11 mph) or only 45 by 24 meters (150 by 80 feet) for a wind velocity of 1 m/sec (2.2 mph).

The results of the Preliminary Conformity Analysis (Appendix E) are presented in Table 3.5-4. The maximum annual level of emissions are approximately 0.18 tons of VOCs and 0.13 tons of nitrogen oxides. These emissions are much less than the *de minimis* levels and would not have an appreciable effect on the air quality of Vandenberg AFB or Santa Barbara County.

Table 3.5-4. Estimated Emissions from PDRR ABL Phase Activities (tonslyr)

Year	VOC	NO_x
2001	0.04	0.02
2002	0.18	0.13
de minimis level	100	100

3.5.3 AIRSPACE

A general discussion of airspace and all applicable laws and regulations is provided in Section 3.0.3.

Region of Influence

The region of influence for airspace is the Western Range restricted airspace and the WCOOA complex of warning areas.

Affected Environment

Four sites available for missile launches at Vandenberg AFB are located in restricted airspace. The northern launch sites within restricted area R-2516, and the southern space launch complexes SLC-5 and SLC-6 are within restricted area R-2517 (Figure 3.5-3). Both areas extend from the surface vertically to space.

WCOOA airspace is west of the coastline extending seaward about 200 nautical miles to the extent of range instrumentation coverage. The WCOOA is entirely over water and does not encompass any island land mass. Although generally contained within warning areas, flight profiles cross open airspace and FAA control-area extensions. Warning and restricted areas are listed in Table 3.5-5.

Figures 3.5-4 and 3.5-5 illustrate the low-altitude and high-altitude airways in the Los Angeles Coastal Area. The airways lie within the airspace managed by the Los Angeles Traffic Control Center and Oakland Air Traffic Control Center.

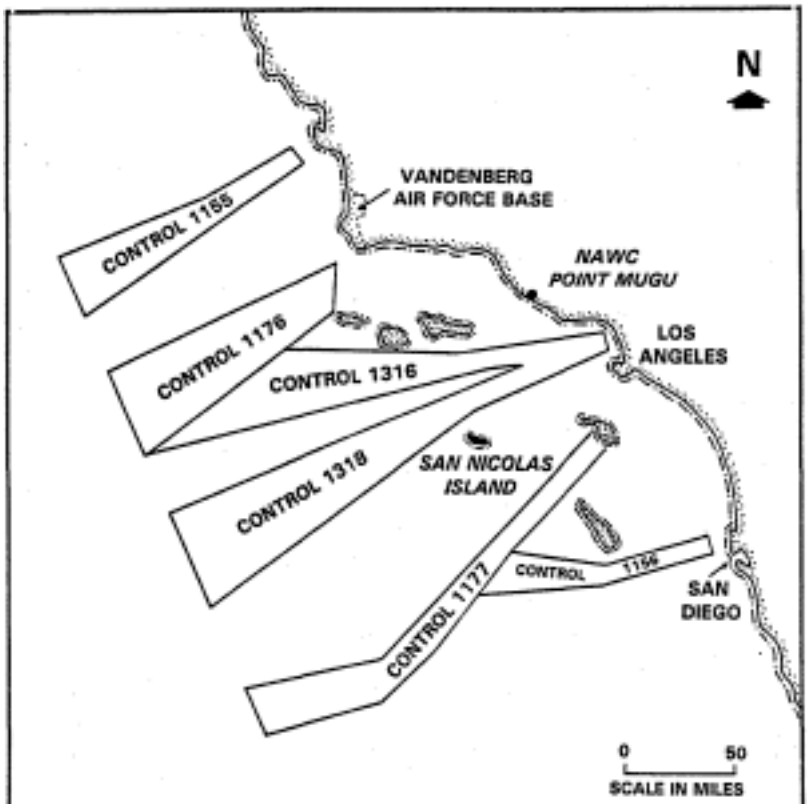
Environmental Consequences

All target missile launches, aircraft testing, and beam-characterization activities would take place in existing restricted airspace or warning areas. Restricted airspace and the special-use airspace of the WCOOA are designed to accommodate necessary military activity and to protect other users from hazardous operation. PDRR ABL Diagnostic and Expanded-Area Test Range activity impacts on airspace would be low.

Table 3.5-5 Restricted Airspace and Warning Areas at Western Range, California

Area	Hours	Effective Altitude	Manager/Scheduler
R-2516	Continuous	Surface (MSL) to unlimited	30 SPW, Vandenberg AFB
R-2517	Continuous	Surface (MSL) to unlimited	30 SPW, Vandenberg AFB
R-2519	Continuous	Surface to unlimited	NAWCWPNS
R-2534A	Continuous	500 ft AGL to unlimited	30 SPW, Vandenberg AEB
R-2534B	Continuous	500 ft AGL to unlimited	30 SPW, Vandenberg AFB
R-2535A	Continuous	Surface to 100,000 ft	NAWCWPNS
R-2535B	Continuous	Surface to 100,000 ft	NAWCWPNS
W-60	Intermittent	Surface to unlimited	NAWCWPNS
W-61	Intermittent	Surface to unlimited	NAWCWPNS
W-260	—	Surface to 60,000 ft	FACSFAC, San Diego
W-283	—	Surface to 60,000 ft	FACSFAC, San Diego
W-285A	—	Surface to 45,000 ft [a]	FACSFAC, San Diego
W-285B	—	14,000 ft to 45,000 ft	FACSFAC, San Diego
W-289	Intermittent	Surface (MSL) to unlimited	NAWCWPNS
W-289N	Intermittent	Surface (MSL) to 24,000 ft	NAWCWPNS
W-290	Intermittent	Surface to 18,000 ft	NAWCWPNS
W-291	Continuous	Surface to 80,000 ft	FACSFAC, San Diego
W-412	Continuous	Surface to 3,000 ft	NAWCWPNS
W-51 3	—	Surface to 60,000 ft	FACSFAC, San Diego
W-532	Intermittent	Surface to unlimited	NAWCWPNS
W-537	Intermittent	Surface to unlimited	NAWCWPNS

[a] Excludes 14,000 ft and above in W-285B



Modified from U.S. Navy, Pacific Missile Test Center. 1989

Figure 3.5-4. High-Altitude Jet Routes, Restricted Areas, and Warning Areas at Vandenberg Air Force Base, California

Figure 3.5-5. Control Airways at Vandenberg Air Force Base, California

Six non-engagement flights, six target-missile flights, and four target-of-opportunity flights are anticipated for Diagnostic Test Range activities. Expanded-Area Test Range activities would include four non-engagement flights and six target-engagement flights. Target-missile launches from Vandenberg AFB restricted areas would impact current aerial activities within Western Range and WCOOA airspace. Figure 3.5-4 depicts the control extensions. Launch-missile operations off the California coast would have an effect on airways and jet routes that traverse the area dependent upon the launch sites. Depending upon the flight paths of the missiles, airspace would be evacuated and flights would be rerouted to and from the Los Angeles Basin. Use of the Western Flight Corridor and a North Vandenberg target missile launch site would affect Control 1155 and Warning Area W-532. Use of the southern Right Corridor with a South Vandenberg target missile launch site would affect four air-traffic-control extensions (Control 1177, 1318, 1316, and 1176) and five Warning Areas (W-60, W-61, W-289, W-532, and W-537). Control extensions potentially affected by ABL test activities include six Control Areas (Control 1155, 1156, 1176,1177, 1316, and 1318).

W-537, W-532, and W-289 extend from sea level to an unlimited altitude and are currently in use only intermittently (Figure 3.5-4). All three warning areas are crossed by heavily used control extensions (Control 1176, 1316, and 1318). Approximately 75 to 100 flights use the control extensions daily (Daniele, 1996). Traffic using the Pacific Coastal Route also has the potential to be affected by test flights. The Pacific Coastal Route is an off-shore route established for departure relief of commercial air traffic from the Bay area to the Los Angeles Basin. Approximately five to eight flights per hour use this route daily (Daniele, 1996). As long as other corridors remain open, the impact of closing affecting air-traffic-control extensions is low.

It is anticipated that targets would not be destroyed during diagnostic test activities. Lance target missiles would fall intact into the Pacific Ocean approximately 130 km from the launch point with no recovery' anticipated. Expanded-area test activities include engaging targets with the HEL, generating debris. All debris would fall into the Pacific Ocean, with no recovery activities. Airspace impacted by debris would already be cleared of non-participating aircraft because of the missile launches.

3.5.4 BIOLOGICAL RESOURCES

A general discussion of biological resources and all applicable laws and regulations is provided in Section 3.0.4.

Region of Influence

PDRR ABL Phase activities would be limited to the preparation, launch, flight, and debris fallout of target missiles from the four proposed launch locations into the Western Range. The proposed launch locations are along the coastline at the north and south ends of Vandenberg AFB.

Affected Environment

Threatened and Endangered Plant Species. Four species of threatened or endangered plants are found at Vandenberg AFB (Table 3.5-6). This table may be revised, based on ongoing consultation with the USFWS, US National Marine Fisheries Service (NMFS), and VAFB.

Table 3.5-6. Threatened and Endangered Plant Species Known or Expected to Occur at Vandenberg Air Force Base, California

Common Name	Scientific Name	State Status	Federal Status
Beach Layia	Layla carnosa	E	E
Gambel's watercress	Rorippa gambellii	—	E
Lompoc Yerba Santa	Eriodictyon capitatum	R	C
Surf thistle	Cirsium rhothophilum	T	C

E Endangered T Threatened R Rare
C Candidate species, but information is insufficient to support listing at this time

Threatened and Endangered Animal Species. Twenty-one species of threatened or endangered wildlife are found at Vandenberg AFB (Table 3.5-7). This table may be revised, based on ongoing consultation with the USFWS, and VAFB. Six of the mammals include federally endangered whales that are found only in low densities in waters off Vandenberg AFB. In addition, the NMFS indicates that the following marine mammal species may also be found in the region: minke whales, beaked whales, fin whales, killer whales, bottlenose dolphins, common dolphins, striped dolphins, Risso's dolphin, Pacific white-sided dolphins, northern right whale dolphins, and Dall's porpoise.

Table 3.5-7. Threatened and Endangered Animal Species Known or Expected to Occur at Vandenberg Air Force Base, California

Common Name	Scientific Name	State Status	Federal Status
Southern sea otter	Enhydra lutris nereis		T
Sei whale	Balaenoptera borealis		E
Finback whale	Balaenoptera physalus		E
Blue whale	Balaenoptera musculus		E
Humpback whale	Megaptera novaengliae		E
Sperm whale	Physeter macrocephalus		E
Right whale	Balaena glacialis		E
California least tern	Sterna antillarum browni	E	E
California brown pelican	Pelecanus occidentalis californicus	E	E
Western snowy plover	Charadrius alexandrinus nivosus		E
Bald eagle	Haliaeetus leucocephalus	E	T
American Peregrine falcon	Falco peregrinus anatum	E	E
Southwestern willow flycatcher	Empidonax trailli extimus		E
Least Bell's vireo	Vireo bellii pusillus		E
Belding's savannah sparrow	Passerculus sandwichensis beldingi	E	
California red-legged frog	Rana aurora draytonii		T
Arroyo toad	Bufo microscaphus californicus		E
Coho salmon	Oncorhynchus kisutch		T
Steelhead trout	Oncorhynchus mykiss		C
Unarmored three-spined stickleback	Gasterosteus aculeatus williamsoni	E	E
Tidewater goby	Eucyclogobius newberryi		E

E Endangered T Threatened
C Candidate species, but information is insufficient to support listing at this time

Environmental Consequences

Activities involved with Diagnostic and Expanded-Area Test Range activities at Vandenberg AFB for the PDRR ABL Phase would involve routine range activities including missile preparation and launching; routine debris impacts off the coast; and use of the low-energy targeting laser and the HEL.

Sixteen Lance missile flights are expected. Of these, a maximum of six would be targeted by the HEL. Currently, Vandenberg AFB launches approximately 25 missiles each year, most of which are much larger than the Lance missile. Nonetheless, the noise is likely to cause startle responses in wildlife near the launch location. The disturbance of harbor seals, other pinnipeds, and shore birds which populate the Vandenberg AFB coast has been analyzed in many studies of space launch vehicles in the past decades, 1978 to 1997 (Space Shuttle, Titan IV, Lockheed Launch Vehicle, Atlas II, Taurus, Delta, etc.), and

many requests for "Incidental Harassment and Take Permits" have been requested (USAF, 1978; USAF, 1980b; USAF 1991b; USAF, 1991c; USAF, 19951; USAF, 1995m; USAF, 1996d; 61 FR 10727; and 62 FR 734). The conclusion from the National Marine Fisheries Services (NMFS) on the *Small Takes of Marine Mammals Incidental to Specified Activities; Taurus Space Launch Vehicles at Vandenberg Air Force Base, CA*, is similar to the results of the earlier studies (62 FR 734). The conclusion stated:

> NMFS has determined that the short-term impact of the launching of Taurus SLV rockets is expected to result at worst, in a minor, temporary reduction in utilization of the haulout as seals or sea lions leave the beach for the safety of the water. These launches are not expected to result in any reduction in the number of pinnipeds and they are expected to continue to occupy the same area. In addition, there will not be any impact on the habitat itself. Based upon studies conducted for previous space vehicle launches at Vandenberg, significant long-term impacts on pinnipeds at Vandenberg and the northern Channel Islands are unlikely.

Since the Lance missile is much smaller than any of the space launch vehicles, the potential disturbance to the indigenous pinniped population is expected to be less. The Lance missile launches are not scheduled to begin until 2002, and an Incidental Harassment and Take Permit has not yet been submitted. When detailed test plans have been finalized, the appropriate permits will be obtained.

Under non-accident conditions, the only chemicals that could threaten vegetation and wildlife at Vandenberg AFB are those in the exhaust plume of the missile. These chemicals would be produced in trace quantities during missile launches (Appendix D) and would not have a measurable affect on biological resources.

An analysis of the effects from monolithic and missile-debris as a result of HEL destruction of the target missile is shown in Appendix G. Monolithic impact of the Lance missile 130 km from the launch point would have an extremely low probability of hitting any marine mammals and the effect of the propellant remaining onboard would be localized to a small volume of water for a short period of time. An analysis of the effect on migrating gray whales from the debris resulting from HEL destruction of the Lance missile was conducted (Appendix G). Gray whales were selected as a representative species likely to be in areas impacted by missile debris. While other species may be present in the debris fall-out zone, none are likely to be found in densities higher than the maximum densities assumed for the Gray whale. The analysis in Appendix G suggests that during peak migration densities a whale could be struck and killed by falling debris with an expected probability of 0.0001. Missile launches occurring at other than peak migration times would present significantly lower risks to migrating whales.

At the time of destruction by the HEL, the Lance missile would have less than 80 kg (180 lbs) of propellant onboard, would be more than 10 km down range, at an altitude of more than 15 km (50,000 ft), and would be traveling at 1,000 m/sec (greater than 2,000 miles per hour). The remaining fuel onboard would be vaporized and quickly mixed with the surrounding air during the destruction of the missile. The release of this propellant would have no measurable effect on the aquatic ecosystem of the Western Range.

A maximum of six missiles would be targeted by the HEL. The impacts associated with the operations of the HEL are discussed in Appendix F. This analysis shows that laser activities would not have significant impacts upon the wildlife at Vandenberg AFB. Largely, this results from the high altitude at which the proposed laser activity would occur (40,000 feet or greater) and from the test geometry that would prevent the HEL from being engaged in a downward direction.

3.5.5 GEOLOGY, SOILS AND WATER RESOURCES

A general discussion of geology, soils, and water resources and all applicable laws and regulations is provided in Section 3.0.5.

Region of Influence

The region of influence on geology, soils, and water resources from PDRR ABL activities would include the areas immediately surrounding the launch facilities at Vandenberg AFB, and the areas over the Pacific Ocean in the line of the target missile trajectory.

Affected Environment

Geology. Vandenberg AFB is located at the complex juncture of the Coast Ranges and Transverse Ranges physiographic provinces of southern California (Figure 3.5-6). The region is highly folded and faulted, and its deformation is ongoing. A structural depression, the Santa Maria Basin, is located on the southwest flank of the Coast Ranges and lies beyond the northern limit of the Base. South of the Santa Maria Basin on Vandenberg AFB is a series of low hills and uplifted marine terraces, which occupy the northern and central portions of the Base, respectively. The southern part of the Base is dominated by the west-trending Santa Ynez Mountains and Santa Rita Mountains of the Transverse Ranges. Figure 3.5-6 is a generalized geologic map of Vandenberg AFB.

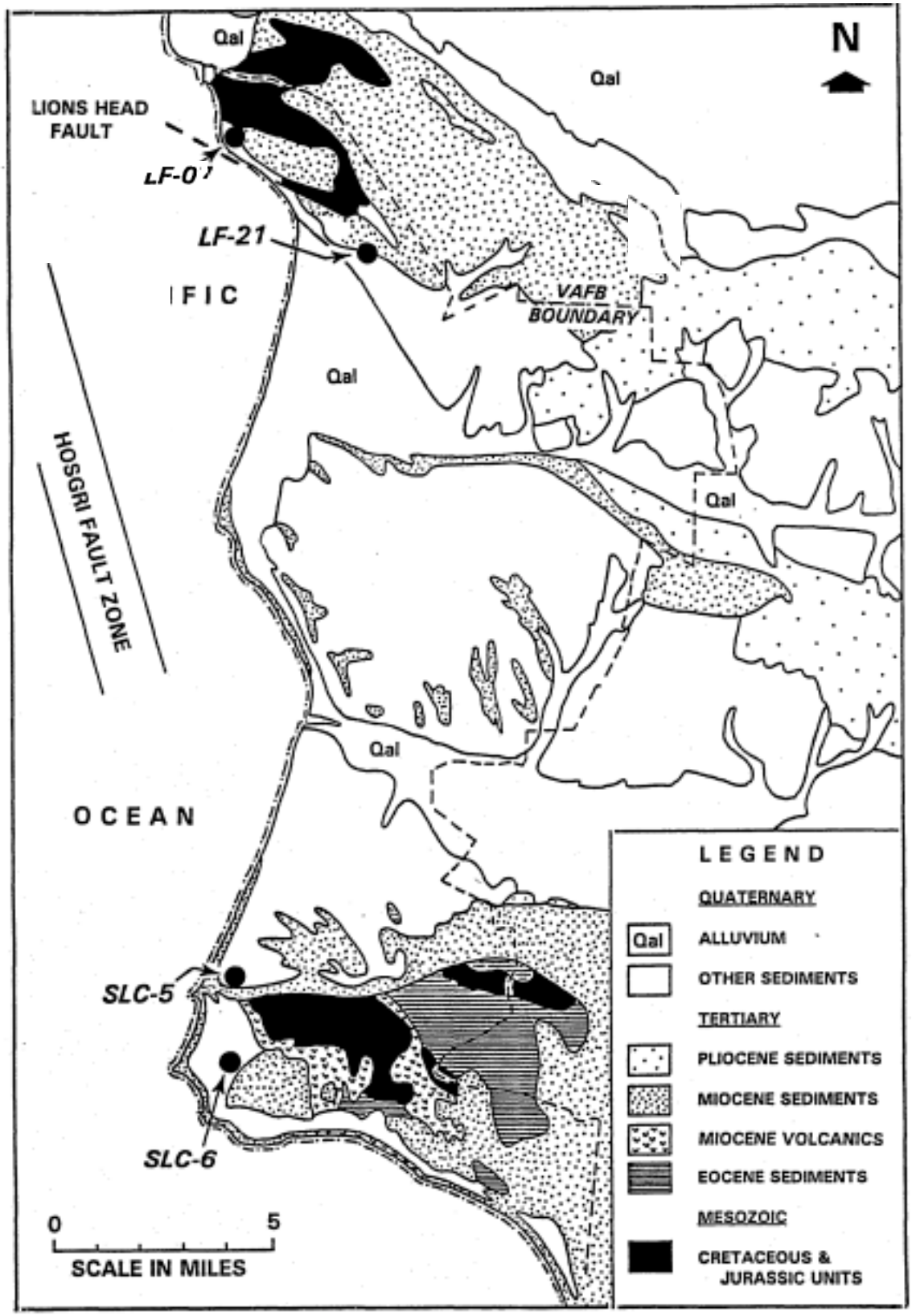
Recent dune sands, usually stabilized by vegetation, cover extensive portions of the northern part of the Base. However, none of the launch pads for the PDRR ABL Phase activities are located on sand dunes.

Seismicity. Several major, active faults are present in the vicinity of Vandenberg AFB (Figure 3.5-7). The San Andreas and Rinconada faults, located 75 km (47 mi) and 45 km (28 mi) from the Base respectively, are major faults that have been active in historic times and are capable of generating moderate to intense ground motion at the Base. The Base is on trend with the offshore Hosgri fault zone, which is a fault system related to the Coast Ranges that has been active during the last 10,000 years. The Santa Ynez, Lompoc-Solvang, and Lions Head faults are interpreted to cross portions of Vandenberg AFB. All are considered active and could generate strong to intense ground motion on the Base (USAF, 1991a). Other small faults are also present on or immediately adjacent to the Base, and some are capable of causing damaging earthquakes. The Vandenberg AFB area has experienced 90, mostly minor, earthquakes in the past 65 years, with magnitudes ranging from 3.0 to 7.3 (USAF, 1990b). The Base is located in Uniform Building Code (UBC) Seismic Risk Zone 4.

Other Potential Geologic Hazards. Vandenberg AFB is located in a seismically active area of the coast and creates additional hazards to geology, soils, and water resources. Strong ground motion from earthquakes could cause liquefaction, a process that turns water-saturated sediments from a solid to a fluid state during ground-shaking events. Areas of potential liquefaction at Vandenberg AFB exist, but none of the launch pads for the PDRR ABL Phase activities would be located within the liquefaction hazard areas (Figure 3.5-8).

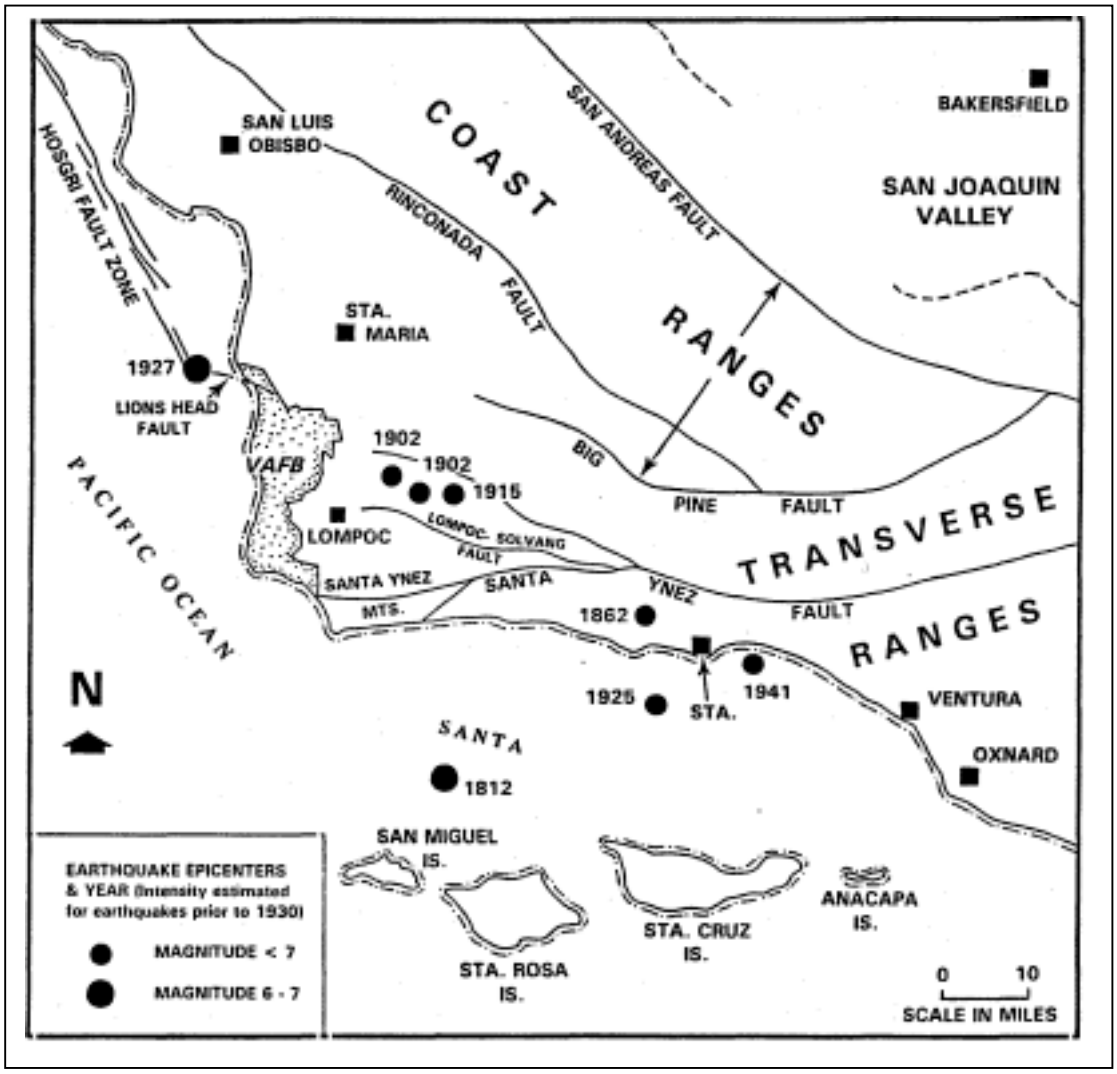
Flooding could result from excessive stream runoff from the mountains or from tsunamis (tidal waves) induced by earthquakes. None of the launch pads for the PDRR ABL Phase activities would be located within the flood hazard areas.

Landslides are possible on Vandenberg AFB as a result of earthquake-induced ground motion, increased water saturation, excessive surface loading, man-made alteration of slopes, or undercutting by water. Two principal areas prone to landslides are the Casmalia Hills to the north and the Santa Ynez Mountains to the south. LF-7 and SLC-6 are located within areas of increased landslide potential (Figure 3.5-9).



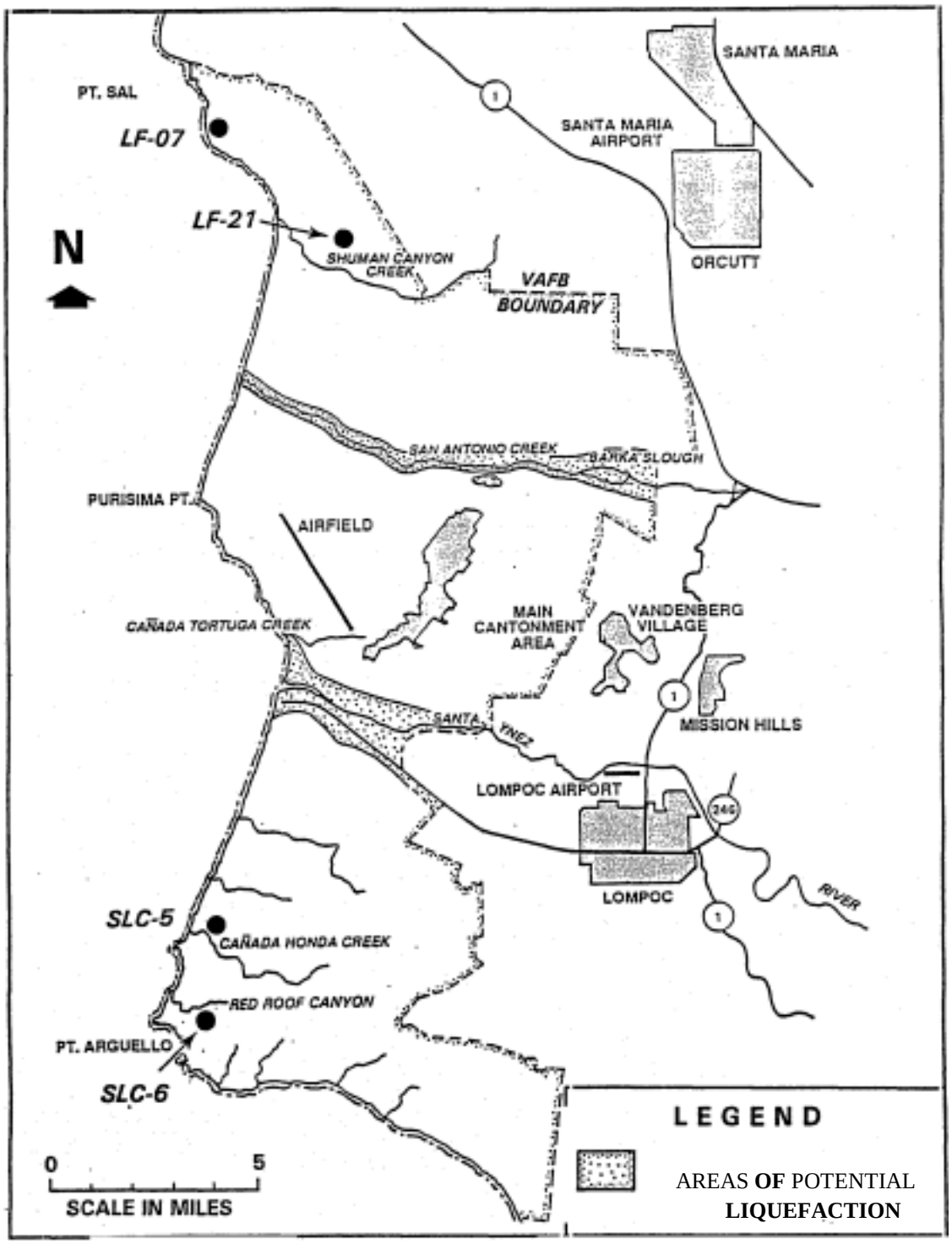
Modified from USAF, 1991 b

Figure 3.5-6. Generalized Geologic Map at Vandenberg Air Force Base, California



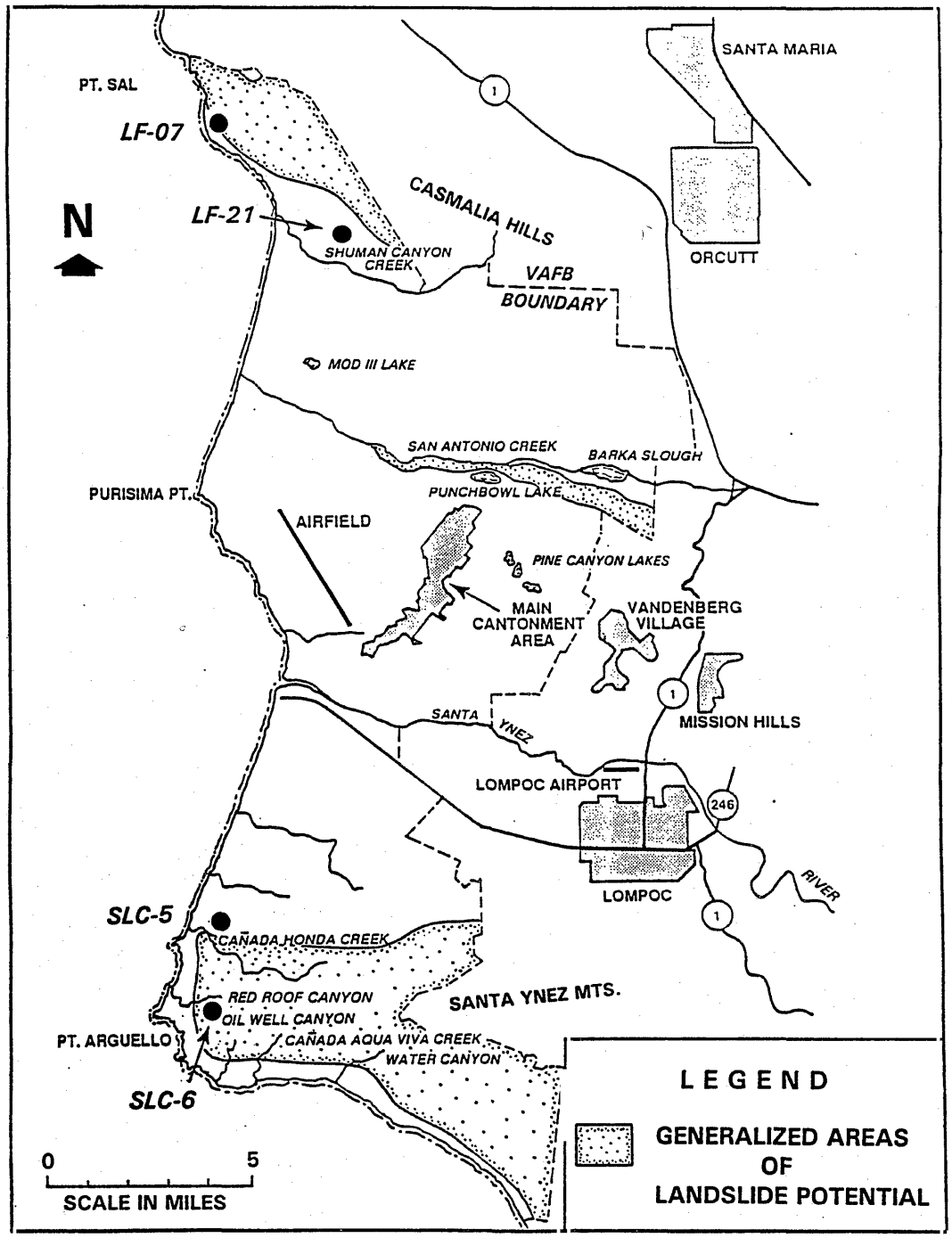
Modified from Jennings, 1977, & USAF, 1991 b

Figure 3.5-7. Major Quaternary to Recent (1.65 Million to Present) Active and Potentially Active Faults, and Large Historic Earthquakes in the Region of Vandenberg Air Force Base, California



Modified from USAF. 1991 b

Figure 3.5-8. Areas of Potential Liquefaction at Vandenberg Air Force Base, California



Modified from USAF, 1991 b

Figure 3.5-9. Landslide Potential and Surface Water Map for Vandenberg Air Force Base, California

Soils. Soils at Vandenberg AFB are generally thin, and range in thickness from 0 to 9 m (0 to 3 ft). In bedrock areas no soil horizons are developed. The potential for soil erosion generally depends on the slope gradient and vegetative cover, with steeper slope gradients having a higher potential. The Soil Conservation Service has not identified any of the soils on Vandenberg AFB as prime farmlands (U.S. Army, 1994a). All of the soils have severe limitations that make them unsuitable for cultivation and that limit their use for pasture, range, woodland, or wildlife habitat.

Surface Water. Precipitation in the area of Vandenberg AFB averages about 15 inches per year (U.S. Army, 1994a). During the wet months of November to May, flooding occurs in the streams during periods of high-intensity rainfall, and is usually short in duration. During the drier months most streams have very little to no flow.

Surface water on Vandenberg AFB occurs in small permanent ponds, lakes, and streams (Figure 3.5-10). Surface waters are not sources of drinking water but do provide aquifer recharge

Modified from USAF, 1991b

Figure 3.5-10. Groundwater Basins in the Vicinity of Vandenberg Air Force Base, California

The Santa Ynez River forms the geomorphic basis for subdividing the Base into North and South Vandenberg AFB. The river stretches 110 km (70 mi) from its headwaters in the Santa Ynez Mountains to a 1.6-km (1-mi) long lagoon at its terminus near the Pacific Ocean. Vandenberg AFB has two principal drainage systems: Shuman Canyon Creek and San Antonio Creek. Shuman Canyon Creek is located south of Launch Facility LF-21. San Antonio Creek, the larger of the two, is an ephemeral stream at its easternmost limits on the Base and is fed by discharging groundwater farther west at Barka Slough. Both creeks drain to the Pacific Ocean, but are blocked by drifting sand near the ocean, causing ponds to form (USAF, 199lb).

The principal drainage for South Vandenberg AFB is Canada Honda Creek, which flows close to SLC-5. Springs associated with a fault underlying the creek maintain a minimal flow of water for about one-half of the creek's length. No permanent lakes, impoundments, rivers, or floodplains exist on South Vandenberg. As on North Vandenberg AFB, the creeks on South Vandenberg AFB are blocked by drifting sand near the Pacific Ocean, causing ponds to form (USAF, 1991b).

Groundwater. Vandenberg AFB receives its groundwater from the San Antonio Creek Basin, the Lompoc Plain Basin, and the Lompoc Terrace Basin. None of the launch facilities in the region of influence are located within a groundwater basin that supplies the Base with water (Figure 3.5-1).

Groundwater is recharged by direct precipitation and by surface waters. Neither Shuman Canyon Creek near LF-21 in North Vandenberg AFB, nor Canada Honda Creek near SLC-5, and an unnamed creek near SLC-6, on South Vandenberg AFB, provide recharge to groundwater sources for domestic purposes.

Water Quality. Because surface waters are not used for domestic purposes and the region of influence is located outside of the groundwater basins used for domestic supply, PDRR ABL Phase activities would have no impact on surface waters that recharge groundwater supplies at Vandenberg AFB.

The watersheds are subject to the effects of construction projects on the Base and agricultural runoff. Water quality is good in Canada Honda Creek, which is relatively undisturbed and has a partially grazed watershed. Water quality is low in San Antonio Creek, the Santa Ynez River, and Shuman Canyon, which receive runoff from off-base agricultural land (USAF, 1989). In some cases, surface waters contain elevated levels of dissolved solids, phosphates, and nitrates (USAF, 199lb). However, surface water supplies are limited by seasonal stream flow and are not used for domestic purposes, and therefore drinking-water standards are not applicable to the surface waters.

Groundwater quality at Vandenberg AFB meets all National Interim Primary Drinking Water Regulation standards (40 CFR § 141).

The USAF Installation Restoration Program (IRP) has identified numerous sites on the Base that require remedial action for the cleanup of hazardous constituents in groundwater. No IRP sites or areas of concern (AOCs) have been identified at LF-7 and LF-21. On South Vandenberg AFB, no JRP sites or AOCs have been identified at SLC-5, but several AOCs are present at SLC-6 that are undergoing a second-phase preliminary assessment. Building 390 at SLC-6 is considered an AOC, where two underground-storage tanks containing hydrocarbons would be removed under a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) action. Additional compliance issues remain at SLC-6 for spills and leaks that have occurred since 1984 in Buildings 360, 390, and 391. No action has occurred to date in response to the spills, but sampling may be required in the future to assess potential health effects.

Environmental Consequences

No other geological resources would be impacted by the proposed PDRR ABL Phase activities at Vandenberg AFB. Although missile launches during the diagnostic and expanded-area testing could require a temporary evacuation of the offshore oil-production platforms and possibly a temporary shutdown in well production, there would be no impact on the petroleum resources. There would be no impacts on geology, soils, or water resources from the temporary relocation of personnel.

Laser emissions from the PDRR ABL flights would not impact geology, soils, or water resources. A maximum of 26 flights of the PDRR ABL would be conducted during testing at Vandenberg AFB. The aircraft would fly at an operational altitude of approximately 40,000 feet AMSL approximately 160 km (100 mi) offshore of the Base in the West Coast Offshore Operating Area. The gaseous chemical emissions from six laser firings would be exhausted from the onboard-laser system at the 40,000-foot operational altitude of the aircraft, would be dispersed into the atmosphere over the Pacific Ocean, and would not reach the earth's surface.

Exhaust emissions from the Lance missile would not impact soil or water quality. Carbon dioxide, water, and nitrogen dominate (97 percent) the exhaust emissions from the Lance missile. These emissions would be dispersed primarily in the atmosphere, and any emissions reaching the earth's surface would have no impacts on soils or water quality. A small amount of hydrochloric acid and hydrofluoric acid would be generated that could reach the earth's surface if rainfall occurred within two hours of a launch, but the compounds would be neutralized by calcium carbonate soils or water without impacting soil or water resources. A small amount of lead dust would also be created, but it would be dispersed over a broad area and would not impact soil or water quality.

Intercepted Lance missiles destroyed in flight could release small quantities of UDMH fuel and IRFNA oxidizer at altitudes over 40,000 feet AMSL above the Pacific Ocean. At the time of destruction less than 10 percent of the fuel would remain. It is anticipated that the majority of the unspent Lance missile fuel would be dispersed in the atmosphere during flight termination, with an insignificant concentration reaching the earth's surface. Therefore, impacts of UDMH and IRFNA on ocean waters are not expected.

3.5.6 CULTURAL RESOURCES

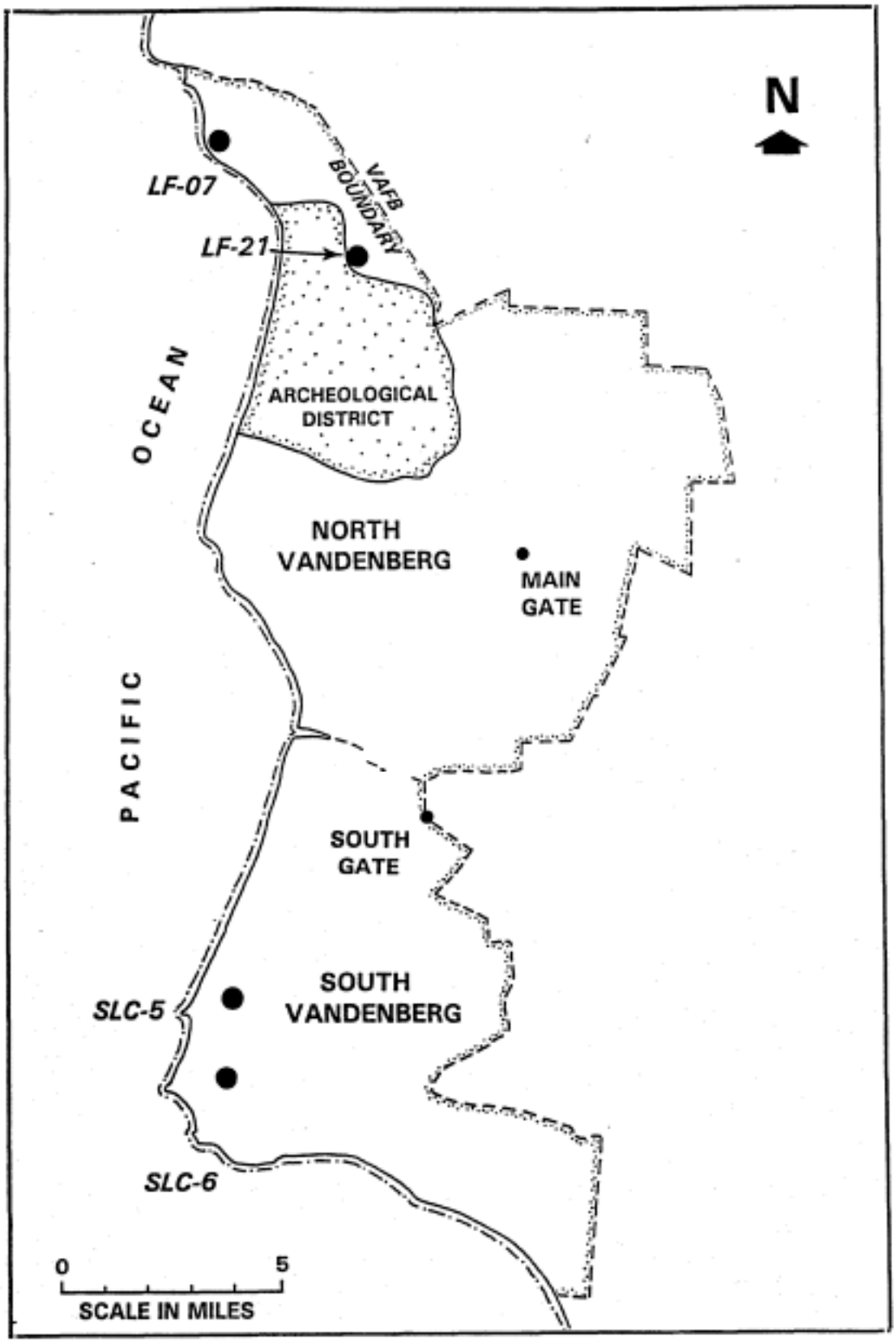
A general discussion of cultural resources and all applicable laws and regulations is provided in Section 3.0.6.

Region of Influence

The region of influence for cultural resources includes all of Vandenberg AFB.

Affected Environment

Cultural Resources. Approximately 1,600 prehistoric and historic cultural resource sites are located on Vandenberg AFB. The earliest evidence of occupation in the region was approximately 7000 B.C. (Spanne, 1995). The San Antonio Terrace National Register District, located in the northwest portion of Vandenberg AFB (Figure 3.5-11), contains 146 recorded prehistoric sites. During the late prehistoric and early historic periods, the Vandenberg region was inhabited by the Chumash Indians (U.S. Army, 1994a), a maritime adapted hunting and gathering people. Cultural remains on the Base include village and camp sites, pliant and animal processing localities, stone tool manufacturing sites, quarries, and both painted and incised rock art.



Modified from U.S. Army, 1 994b

Figure 3.5-11. San Antonio Terrace National Register District for Cultural Resources at Vandenberg Air Force Base, California

Historic records of Vandenberg reflect Spanish influence in the region, which began between 1722 and 1788 with the building of missions in Chumash territory (Spanne, 1995). In 1941, the Army acquired the territory and called it Camp Cooke. The land was used for World War II training and a prisoner-of war camp. The USAF took over the Base in 1957 and renamed it Vandenberg AFB and began flight testing weaponry (U.S. Army, 1994a).

A number of facilities on Vandenberg AFB under 50 years of age demonstrate importance under the Man in Space theme, the Cold War historic context, or for scientific and technological achievements. These sites are potentially eligible for listing on the National Register of Historic Places (U.S. Army, 1994a).

The Turtle Pond on the San Antonio Terrace along with other sites is considered by the Santa Ynez Band of Mission Indians to be a traditional resource area (U.S. Army, 1994a).

Paleontological Resources. Paleontological resources found in the vicinity include fossils of both vertebrate and invertebrate animals. Remnants of mammoth and horse fossils approximately 45,000 years old (upper-Pleistocene age) have been found at southern Vandenberg AFB. In addition, fish and crab remains and whale bone have been discovered (U.S. Army, 1994a). The Miocene Monterey Formation and Later Miocene deposits identified at northern Vandenberg AFB have yielded imprints of algae, fish fragments, coprolites, and whale bone.

Environmental Consequences

No environmental consequences for cultural or paleontological resources would be expected at Vandenberg AFB. Existing launch sites would be used to launch target missiles. Destruction of the missile causing falling debris would occur offshore and would pose no threat to cultural or paleontological resources located on Vandenberg AFB.

3.5.7 HAZARDOUS MATERIALS AND WASTE

A general discussion of hazardous materials and waste and all applicable laws and regulations is provided in Section 3.0.7.

Region of Influence

The region of influence for hazardous materials/waste includes all of Vandenberg AFB. However, the region of influence may extend beyond the Base boundaries along the established transportation networks in the event of an accidental release of hazardous materials/waste.

Affected Environment

Hazardous materials are used and stored as a result of many processes throughout Vandenberg AFB. These materials fall into two basic use categories: materials used in facility maintenance activities, and materials used in various missile-test operations.

Vandenberg AFB uses the Pharmacy Concept to distribute hazardous material to USAF customers. As part of this process, customers are required to return unused portions of the materials to Base Supply for subsequent use or disposal (USAF, 1994f). All hazardous materials must be approved for use by Vandenberg AFB before they are brought onto the Base, and only authorized users may use the hazardous materials.

Hazardous materials used in Base infrastructure support activities include various cleaning solvents, paints, cleaning fluids, pesticides, motor fuels and other petroleum products. Hazardous materials used in conjunction with range testing operations (i.e., missile launches) include cleaning solvents, various paint compounds, explosive materials, and toxic propellants. Because of the space-launch mission of the Base, hazardous materials such as hypergolic fuels (e.g., hydrazine) are used in large quantities. Specific types and quantities of materials can vary depending upon specific system and test configuration requirements. These hazardous materials are funded by the agency responsible for testing individual systems and dispensed through the Pharmacy. Each agency utilizing Vandenberg AFB is responsible for procurement, distribution to the work areas, and management of its hazardous material.

Hazardous waste originates through a variety of processes at many facilities throughout Vandenberg AFB. Origination points include power plants, launch sites, laboratories, gas stations, industrial shops, and a hospital. Categories of waste generated include petroleum products, paint, cleaning fluids, corrosives, flammables, and oxidizers.

Vandenberg AFB is currently on RCRA interim permit status, in which they are applying for permanent status through the Department of Toxic Substances Control (DTSC) (Delgadillo, 1995). Hazardous waste management procedures used at Vandenberg AFB must be in compliance with federal, state, and local requirements. DoD and USAF regulations also apply. The Vandenberg AFB Hazardous Waste Management Plan (USAF, 1994f) follows the "cradle to grave" approach. It manages hazardous waste from origination points and tracks the collection at accumulation point(s), and containerization and storage at Vandenberg AFB' s storage facility in Building 3300. Under interim status conditions, Vandenberg AFB has been granted approval to operate a longer than 90-day storage facility. Building 3300 is Vandenberg AFB's central hazardous-waste storage facility and is the only facility on Base where hazardous waste can be stored for longer than 90 days. Storage in Building 3300 cannot exceed one year. From this facility, hazardous waste is shipped offsite for treatment and disposal.

Environmental Consequences

PDRR ABL Diagnostic and Expanded-Area Test Range activities expected to use and generate hazardous materials/waste include target-missile launches. These activities are expected to have a low impact on the environment.

Classes of hazardous materials proposed for use in ABL target-missile pre-launch and launch activities are similar to hazardous materials currently in use at Vandenberg AFB. Solvents, hydraulic fluids, and other materials are used in the pre-flight preparations of launch systems. Solid propellants and other explosives are widely used in current systems. Liquid propellants (hypergolic and cryogenic) are used in some missile-flight systems. The use of the pre-fueled Lance missile for test activities would preclude any need for local fueling operations, thereby eliminating the handling and storage of liquid propellants during PDRR ABL Phase test activities.

The existing hazardous materials storage and handling capabilities at Vandenberg AFB are adequate to ensure that all materials are handled safely and in accordance with applicable regulatory procedures. PDRR ABL Phase materials would be similar to those currently used and would be transported to the missile preparation area using ground-support equipment without the need for revised procedures.

Limited quantities of hazardous waste may be generated by the proposed target-missile pre-launch activities at Vandenberg AFB. These may include unused or contaminated cleaning solvents, or unused lubricants or hydraulic fluids. Similar waste types are currently generated at Vandenberg AFB. Motor fuels and cleaning solvents are collected and disposed of routinely. Liquid propellants are not expected to generate hazardous waste from the pre-fueled Lance missile.

Normal target-missile launch operations would not produce any hazardous waste at Vandenberg AFB. However, certain emergency actions may occur that would require the defueling of a target missile. A spill prevention and response plan would be developed and implemented, if necessary. Propellant transfers would occur on a non-permeable surface. Unloaded propellants would be containerized into approved containers, and all waste spills would also be collected and containerized.

Launch mishaps or early flight failures may result in the deposition of waste materials within the designated launch-hazard area. Specific standardized procedures would be developed for recovery of any. remaining fuel or contaminated soil. Materials to be disposed of as hazardous waste would include structural materials and some missile components. The debris would be recovered in accordance with Vandenberg AFB policy.

3.5.8 HEALTH AND SAFETY

A general discussion of health and safety and all applicable laws and regulations is provided in Section 3.0.8.

Region of Influence

Since the health and safety standards applicable to workers and the public differ, separate regions of influence are considered. For worker safety, only the immediate work location needs to be considered. This would include the areas where target preparation and launch operations occur. For public safety, a larger area is used. Potential safety hazards to the public from target launch and flight operations may include explosion, impact of debris, release of toxic materials, high noise levels, or fire. The region of influence would vary depending on the type and location of operation and may extend for many miles. During missile operations, the region of influence for the public would include the launch and predicted debris-recovery impact area as well as the flight path. The region of influence for public safety includes Vandenberg AFB and the WCOOA. This area includes off-shore oil platforms.

Affected Environment

Vandenberg AFB is the launch center for the Western Range. Range users include DoD, other U.S. government agencies, civilian commercial companies, and foreign government agencies. Workplace hazards that are commonly encountered include exposure to a wide variety of toxic materials employed in ongoing operations, handling and use of explosive and flammable materials, and hazards associated with routine industrial and construction activities. Vandenberg AFB has implemented a comprehensive environmental and safety program to identify, evaluate, and mitigate potential occupational hazards. There are approximately 25 launches per year at the range. Vandenberg AFB is used primarily for the launching of missiles much larger than the Lance missile. The capability to provide adequate range and ground safety for these types of launches is well established on the Base. Four launch sites have been identified for potential use during the PDRR ABL Phase: SLC-5, SLC-6, LF-7, and LF-21.

All range activities are regulated by the Offices of the Chiefs of Safety, 45th Space Wing and the 30th Space Wing (30 SW/SE). The Missile Flight Safety Office also makes a decision as to when an acceptable risk level is attained, based upon office reviews of launch protocols and risk factors. Flight Safety decides which areas of the range are evacuated for each mission, determines in-flight missile termination in the event of missile failure, and oversees the firing of missiles. All areas that are exposed to hazardous missile debris are evacuated, even if the risk to the public may be minimal. All mission activities would be reviewed to ensure they were correctly identified as hazardous or nonhazardous. Additionally, all hazardous procedures would be reviewed and approved by 30 SW/SE prior to task performance. The 30 SW/SE would directly support hazardous operations and would

have access to the test facility at all times to observe operations. The PDRR ABL Phase Program would submit the required safety documentation as specified in Eastern and Western Range 127-1 (USAF, 1995j). This includes a Safety Assessment Report to assess the risks associated with all processing tasks on Vandenberg AFB which would govern all portions of the test program, including ground transport of targets, target erection, target-vehicle flight, and the use of the lasers. The 30 SW/SE Flight Safety also has the responsibility of determining the requirements of a flight termination system for all target vehicles.

Environmental Consequences

Activities that could contribute to health and safety concerns at Vandenberg AFB include ground support activities, including preparation of targets, launch and flight safety/mishaps, debris impact (where applicable), and laser engagements.

Transportation and Preparation of Targets. The transportation of the target missiles is subject to both federal and state regulations, including handling, labeling, and routing requirements. The Lance missile, specifically, is shipped in a specially designed container to protect the missile in case of an accident. National Highway Traffic Safety Administration statistics show that the fatal accident rate for large trucks is one accident in every 37 million miles, making it a very rare occurrence. The likelihood of any impact on human health and safety from the transportation of targets or hazardous materials to the various sites is insignificant.

All pre-launch hazardous operations (e.g., handling of explosives and hazardous materials) would be conducted in accordance with established standard-operating procedures that have received approval from 30 SW/SE. The Lance missiles would arrive at Vandenberg AFB prefueled and ready to fire. Therefore, the missile and its fuels would not be extensively handled. If a missile is not used immediately, it would have to be stored in an explosives-rated facility. Prior to firing, the missile would be transported to the launch location and placed on the launch pad. The fins would be attached and the missile elevated into firing position. Critical-missile-guidance components would be checked and flight parameters programmed into the missile. Next, the portable firing-device would be taken to a safe area approximately 100 m (330 ft) away and activated on command.

Safety procedures have been prepared for accidental release of the UDMH fuel and the IRFNA oxidizer from the Lance missile (U.S. Army, 1984). Monitoring of the workplace would be required to detect and warn personnel of the presence of toxic vapors.

Launch and Flight Safety/Mishaps. Prior to launch, an evaluation would be made to ensure that populated areas, critical range assets, and civilian property susceptible to damage are outside predicted impact limits. A Notice to Mariners and a Notice to Airmen would be published and circulated in accordance with established procedures to provide warning to personnel (including recreational users of the range space and controlled sea areas) concerning any potential debris-recovery areas that should be avoided. Radar and visual sweeps of hazard areas would be conducted immediately prior to launch to ensure they are clear of non-critical personnel. At launch time, the missile would be armed only after all required safety evacuations, sufficient to ensure that no unauthorized personnel are present in hazardous areas, have been accomplished. Following arming, positive control of the hazard areas would be established. Unauthorized entry into the hazard area would result in delay of the operation until the “ALL CLEAR” has been reestablished.

Because missile launches occur regularly in the area, and because ocean vessels are already notified on a regular basis, the impact of missile launches on marine traffic would be negligible. Offshore-oil production facilities may need to be evacuated, although the need would depend upon the flight

trajectory of the Lance missiles. Evacuations of the offshore-oil platforms are currently carried out during missile launches, and existing evacuation plans would be followed during the launching of the PDRR ABL Phase missiles. Evacuations would therefore result in minor impact on oil-production operations.

In contrast to launch anomalies, successful launch activities involve only small potential hazards, mainly for personnel in the immediate area of the launch site. Since personnel would be in protected facilities or evacuated from the LHA, this potential hazard would be controlled.

During normal launches, the exhaust products from the Lance missile pose no health or safety risk. Appendix D lists the Lance missile's exhaust products. The only hazardous exhaust products in the lower atmosphere would be 0.04 kg (0.1 lb) of hydrochloric acid per launch. These emission quantities are well below levels of concern (10 tons per year, 5 ppm of HCI). A spill of either unsymmetrical dimethylhydrazine (UDMH) or inhibited red-fuming nitric acid (IRFNA) from the Lance missile would cause the formation of a cloud of toxic material. A spill of the entire contents of the Lance's fuel tank would result in a downwind toxic corridor. If both were released simultaneously, they would ignite and burn and the resulting combustion products are not toxic. The dimensions of the toxic corridor are dependent on the wind velocity. Using exposure limits of a 15-minute, time-weighted average concentration of 15 parts per million (ppm) for UDMH and 25 ppm for IRFNA, analysis in Appendix C shows that the dimensions of the toxic corridors would be 155 by 40 m (508 by 130 ft) and 100 by 30 m (328 by 98 ft), respectively, at a wind velocity of 5 m/sec (11 mph). As the wind velocity decreases, the length of the toxic corridor also decreases. At a wind velocity of 1 m/sec (2.2 mph) the length of the corridors are 87 m (285 ft) for UDMH and 45 m (150 ft) for IRFNA.

Debris Impact. If Vandenberg AFB is used as both the Diagnostic and Expanded-Area Test Range, there is the possibility of 16 Lance missile launches. Of these, only six would be involved in HEL engagements with the intent of causing the missile to fail. The remaining 10 would impact monolithically in the ocean approximately 130 km (80 mi) downrange. HEL engagement of a Lance missile would not begin until the missile achieves an altitude greater than 40,000 feet AMSL. At this point in the missile's flight path, it is traveling over 1,000 m/sec (2,230 mph), has a flight path angle of approximately 50 degrees, and is over 10 km (6 mi) downrange. A preliminary analysis of the Lance missile debris impact pattern and location is presented in Appendix G. The results of this analysis indicate that the missile will break up into 72 fragments, of which only 6 would have over 15 joules (11 ft-lbs) of kinetic energy when they hit the ocean. This 15 joules of kinetic energy has been recommended as the lower limit below which fragments would no longer be hazardous to humans (Cole and Wolfe, 1996). The six higher kinetic-energy fragments were predicted to hit the ocean between 13 to 24 km (8 to 15 mi) downrange in an area ranging from a little over 2 to nearly 8 square km (1 to 3 square mi). The distance downrange and the size of the fragment pattern is dependent on when the missile is destroyed (20, 25, or 30 seconds).

This preliminary analysis does not account for the four oil platforms located west and south west of Vandenberg AFB or the effect of wind conditions at launch time. Once the launch location, time of launch, flight path of missile, and engagement location are established, a detailed safety analysis would be submitted to the 30 Space Wing's Flight Safety Office for review and approval. Changes would be made to ensure that fragments do not unnecessarily endanger personnel, equipment, or biological resources.

Laser Engagements. The use of lasers during the PDRR ABL Phase would be carefully controlled to minimize the health and safety risks to both humans and biological resources at Vandenberg AFB and the Western Range. During all engagement scenarios, the lasers on the PDRR ABL aircraft would be

pointing horizontally or in an upward direction. This would preclude the direct impact of lasers on human or wildlife since the aircraft would be flying at approximately 40,000 feet AMSL. The only possible impact would be from laser energy reflected from the targets. The analysis in Appendix F shows that reflected energy levels at an altitude of 10,000 feet AMSL are below the maximum permissible exposure for human limits. These exposure limits are defined in the *American National Standard for Safe Use of Lasers*, ANSI Z136.1-1993.

The ABL Program Office would need to meet the requirements of Section 2.5.11, "Directed Energy Plan Data Requirements," of the Eastern and Western Range Safety Requirements Document (USAF, 1995j) prior to approval of any testing. The data required includes: laser system parameters, test description, risk study describing all applicable and reasonable hazard and failure modes, and analysis of potential laser exposures.

The Lance missile has not been fired from Vandenberg AFB since the early 1960s and a HEL has never been used to "destroy" a boosting theater-ballistic missile (TBM). Destroying a TBM using a HEL, the preparation of targets, launch and flight safety/mishaps, debris impact (where applicable), and laser engagements as described above would represent a moderate increase in potential health and safety risks. The USAF requires that all hazardous activities undergo rigorous analysis prior to being approved and conducted.

3.5.9 LAND USE

A general discussion of land use and all applicable laws and regulations is provided in Section 3.0.9.

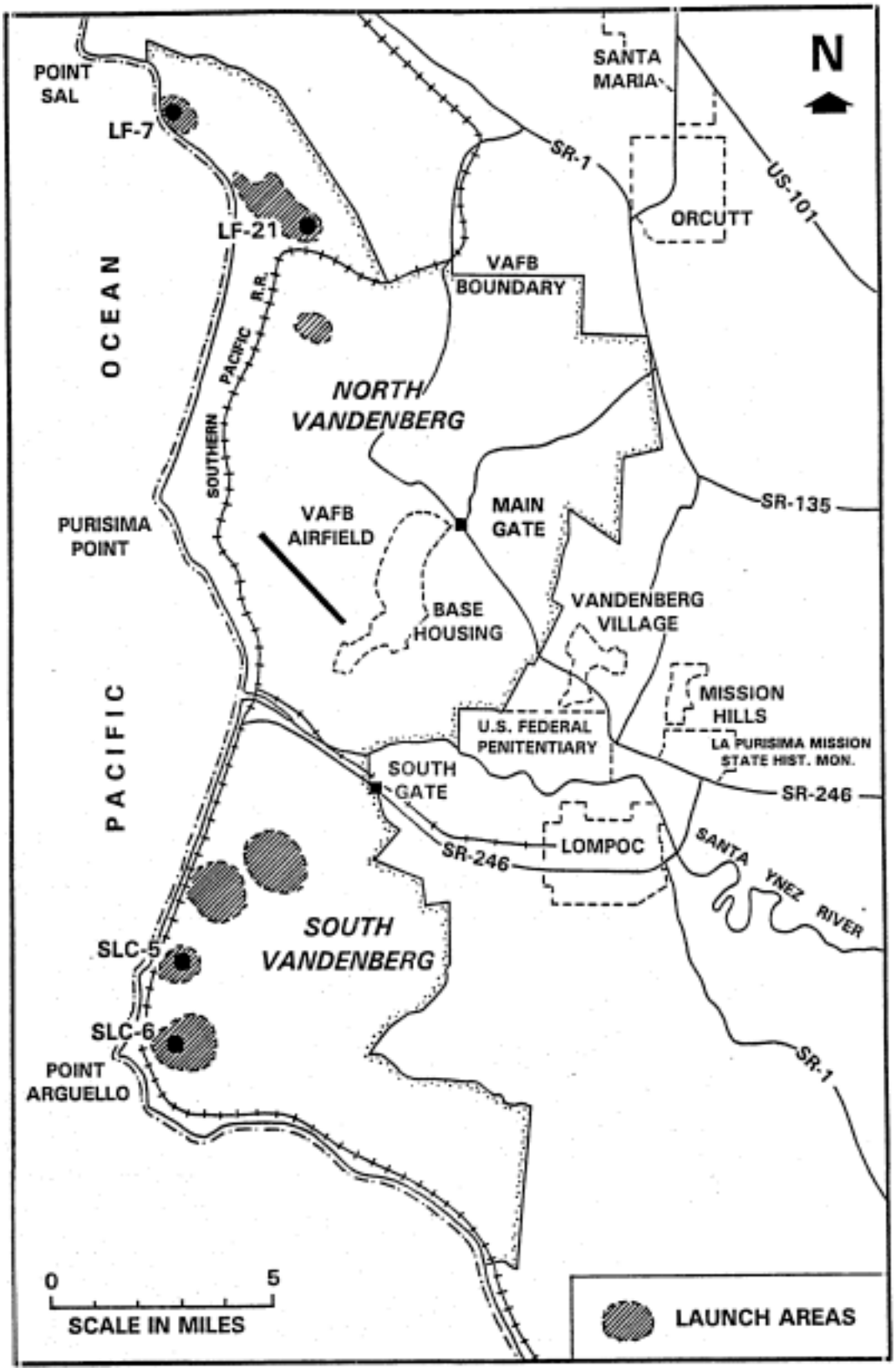
Region of Influence

The region of influence on land use from PDRR ABL Phase activities at Vandenberg AFB would include the areas immediately surrounding the missile launch facilities, the launch hazard areas over the Pacific Ocean in the line of the target missile trajectory, the shipping lanes, and offshore oil-production facilities (Figure 3.5-12).

Affected Environment

Land Use of Adjacent Jurisdiction. Vandenberg AFB is located in the western part of Santa Barbara County. Less than 3 percent of the county is urbanized, and the predominant land uses in the county are natural forest and agriculture (USAF, 1991b). The western portion of the county is largely rural. Most lands immediately surrounding Vandenberg AFB are undeveloped and used primarily for agriculture and livestock grazing, although surface mining for diatomaceous earth is also a major regional industry (USAF, 1994e). Numerous communities are located within 8 km (5 mi) of the Base, including Casmalia, Guadalupe, Santa Maria, Orcutt, Vandenberg Village, Mission Hills, and Lompoc, and are separated by wide buffers of agricultural areas. Lompoc, Santa Maria, Guadalupe, and Santa Barbara County have each adopted general land-use plans that consider the impacts and needs of Vandenberg AFB on their jurisdictions (USAF, 1990b). The Federal Correctional Institution is located along the eastern boundary of Vandenberg AFB, adjacent to Vandenberg Village. Portions of the Pacific Coast in the vicinity of Vandenberg AFB provide a vast public recreation area, and include five local parks operated by the Santa Barbara County Parks Department and the state of California.

Land Use at Vandenberg AFB. Sixty percent of Vandenberg AFB is reserved for open space and recreation, 30 percent is used for grazing and other forms of agriculture, and the remaining 10 percent is used for facilities and operations associated with USAF activities (USAF, 1994e). Most of the development is on North Vandenberg AFB, which is used for research, testing, and training activities related to various launch programs. The primary land-use functions on North Vandenberg are



Modified from USAF. 1989 & 1 994g

Figure 3.5-12. Land Use Map at Vandenberg Air Force Base, California

administrative, industrial, and residential. Other facilities include an airfield, space/defense program-test facilities, and launch facilities (U.S. Army, 1994b). Most of South Vandenberg AFB is undeveloped, with over 99 percent reserved for open space and grazing. The remaining 1 percent is used to house several mountaintop tracking stations, an administrative and industrial area, and space-launch complexes with associated support facilities (U.S. Army, 1994b). The launch-area portions, located along the coastal corridor of North and South Vandenberg AFB, have served various mission requirements for over 30 years.

Land-Use Plans and Policies. Vandenberg AFB has developed a Land Management Plan that documents and classifies various land-use types to maintain the natural resources on the Base. The Plan serves as a guide for multiple-use/sustained-yield management (U.S. Army, 1994b). Various USAF safety regulations restrict development on the Base, as do several state and federal regulations desigued to preserve the cultural, historical, and environmental integrity of the Base (U.S. Army, 1994b).

A Base Comprehensive Plan has been prepared for Vandenberg AFB to allow space and missile operations to continue at the Base in support of USAF Space Command. The primary mission of Vandenberg AFB is to conduct launch operations. The Plan is desigued to eliminate inefficient land use, reduce future siting conflicts, avoid incompatible future development, reduce or eliminate unnecessary project expenditures, and protect the environmental resources at Vandenberg AFB (USAF, 1990b). Potential constraints that could limit future launch operations include incompatible land uses on adjoining properties, oil production, transportation structures, electrical substations, and public access to coastal beaches (USAF, 1994e).

Environmental Consequences

PDRR ABL flights would be conducted in the West Coast Offshore Operating Area, and would not impact land-use patterns. The use of existing missile launch sites at Vandenberg AFB (LF-7 and LF-21 on North Vandenberg, and SLC-5 and SLC-6 on South Vandenberg) to launch up to 16 Lance missiles during the diaguostic and expanded-area tests would not change the overall land-use plans and patterns of the Base. The missile firings would take place from transporter/erector launchers at the desiguated launch sites and would be consistent with missile research that is part of Vandenberg AFB' s current mission. Currently, approximately 25 missiles are launched from Vandenberg AFB into the Western Test Range annually (U.S. Army, 1994b).

Missile launches from North Vandenberg would not directly affect land use (which is predominately livestock grazing), but could possibly have an impact on property owners who live within the launch-hazard areas (LHAs). Evacuation agreements with owners in the LHAs are either currently in place (LF-7) or have lapsed but could be renegotiated (LF-21). Missile launches from South Vandenberg (SLC-5 and SLC-6) would be conducted in remote areas far from any population centers in western Santa Barbara County. Potential launches of much larger missiles (Titan JV/Centaur, Minuteman II, and the Space Shuttle) from SLC-5 and SLC-6 have been examined and found to have insignificant impacts on the land-use plans and policies of adjacent populated areas in western Santa Barbara County (California Commercial Spaceport, 1995; USAF, 1989; USAF, 1994e). Therefore, the launch of the smaller Lance missiles would be expected to create even lower impacts on land use.

Because the PDRR ABL Phase activities at Vandenberg AFB have the potential to affect coastal resources, a Coastal Consistency Determination would be prepared in compliance with the California Coastal Management Program to provide an evaluation of the project's effects on the coastal resources. However, because the activities conducted during the PDRR ABL Phase would be similar to activities that are ongoing at Vandenberg AFB, it is anticipated that new effects on coastal resources would be negligible.

3.5.10 NOISE

A general discussion of noise and all applicable laws and regulations is provided in Section 3.0.10.

Region of Influence

The region of influence for noise exposure at Vandenberg AFB is defined as the area surrounding the proposed launch complexes. This area would extend out to a distance of 15 km (9 mi) from the Lance missile's launch complex.

Affected Environment

Operations at the Vandenberg AFB airfield are a source of noise in the region. Aircraft using the facility include transports, bombers, and fighter jets. Missile launches are more intense sources of noise in the region; however, they occur only occasionally and are of limited duration. Currently, Delta, Peacekeeper, and Minuteman missiles are launched from northern Vandenberg AFB. On southern Vandenberg AFB, Atlas and Titan rockets are launched at SLC-3 and SLC-4. SLC-5 is currently inactive. SLC-6 is used to launch the Lockheed-Martin Launch Vehicle.

Environmental Consequences

Lance missile launches would increase ambient noise levels at Vandenberg AFB for very short periods of time (less than 10 seconds). Noise generated by missile, flights can be grouped into two categories:
launch and flight noise. The impact of launch noise on wildlife is discussed in Section 3.5.4. Since the PDRR ABL aircraft would takeoff and recover at the Home Base and be located more than 100 km offshore during tests, it would have no impact on the ambient noise levels at Vandenberg AFB.

Launch Noise. A peak sound-pressure level of 147 dB has been measured at a distance of 90 m (295 ft) from a Lance missile launch (U.S. Army, 1995a). Noise levels at 1, 5, and 10 km (0.6, 3, and 6 mi) from the launch site would be approximately 125, 105, and 90 dB, respectively. The terrain, relative humidity and temperature would have an effect on these noise levels (Rau and Wooten, 1980).

Operations personnel in the vicinity of the launch sites would be in the blockhouses and would be protected from noise by the sound attenuation provided by the buildings' construction. Other personnel would be required to be outside the launch hazard area, approximately 1.6 km (1 mi) away. Noise levels at this distance would be below the OSHA limit for impact noise exposure, 140 dB (29 CER § 1910.95, and AFOSH STD 48-19). If personnel are required to be within the launch hazard area and outside a blockhouse, personal protective equipment, such as earplugs, earmuffs, or headphones, would be used. This protective equipment reduces noise levels by 30 dB.

Flight Noise. Potential noise impacts from the flight of a target-missile include sonic booms. Sonic booms would occur with each target missile launch after the vehicle exceeded the speed of sound, approximately 2 seconds for the Lance missile. The sonic boom footprint from the Lance missile would not affect the immediate area around the launch site (less than 500 meters). The sonic boom have an intensity of approximately 145 dB and a duration of less than 0.035 seconds. The intensity of the sonic boom is nearly equal to the noise level produced by the missile's motor.

3.5.11 RECREATION AND VISUAL RESOURCES

A general discussion of recreation and visual resources and all applicable laws and regulations is provided in Section 3.0.11.

Region of Influence

The region of influence for recreation and visual resources is defined as recreation and public interest areas on Vandenberg AFB and along the coastline and coastal waters. The region of influence also includes areas of aesthetic concern.

Affected Environment

Three public-access beaches are located on or immediately adjacent to Vandenberg AFB. They are Point Sal State Beach at the northernmost border of the Base; Ocean Beach County Park, also known as Surf Beach, approximately mid-way down the western coastal edge of Vandenberg AFB; and at the southernmost tip of the Base, Jalama Beach County Park. All three beaches are open to the public except during missile launches, when the access roads can be closed and visitors evacuated under an evacuation agreement between Vandenberg AFB and the county of Santa Barbara (Cortopassi, 1996).

In addition, several other coastal areas on Vandenberg AFB are open to public use. Sandy beach areas open to the public extend approximately 1.6 km (1 mi) northwest of Jalama Beach County Park and 2.4 km (1.5 mi) north of Ocean Beach County Park. These beaches provide an important recreational asset to the residents of northern Santa Barbara County as well as to visitors. In 1993, the three beaches received a combined total of 206,775 visitors (U.S. Army, 1994b). Vandenberg AFB also allows limited access by permit (weekends and holidays) for surf-fishing along another 5.6 km (3.5 mi) of primarily rocky coastline south of Purisima Point. County and state parks, and public access beaches on Vandenberg AFB are some of the public coastal-access points between Gaviota and Point Sal (Figure 3.5-13).

Environmental Consequences

Missile launches from existing facilities at Vandenberg AFB would require the establishment and activation of a LHA and the temporary clearance of the adjacent Pacific Ocean in front of the launch pad. Temporary clearance (16 times maximum) of the Launch Hazard Areas (LHA) over the nine months would not be a significant impact on recreational use of these waters.

Dependent upon the exact launch sites and missile trajectories, there is a potential for closure of public beaches during target-missile launches. A launch to the west from LF-7 or LF-21 would require the closure of Point Sal State Beach. Nominally, the closure could affect from 2 to 9 persons, depending on the time of year (U.S. Army, 1994b). Point Sal currently closes approximately twice a year (Cortopassi, 1996). A launch to the south from southern Vandenberg (SLC-5 or SLC-6) could impact Ocean Beach County Park and Jalama Beach County Park. Jalama is closed approximately twice a year, and Ocean Beach is closed approximately three times a year because of missile launches (Cortopassi, 1996). Closure of those beaches could nominally affect from 29 to 111 visitors (U.S. Army, 1994b). While it would be an inconvenience for persons utilizing the parks, only a relatively small number of visitors would be affected. Each launch must be evaluated in terms of mission-specific information before any decision is made to close a public beach. In all cases, the coastline would be reopened within a short time after a launch.

Diagnostic test and expanded-area test activities would use existing facilities on existing military installations for missile launches, and beach closures would be handled with evacuation agreements, thus the impacts to recreation and visual resources would be considered minimal.

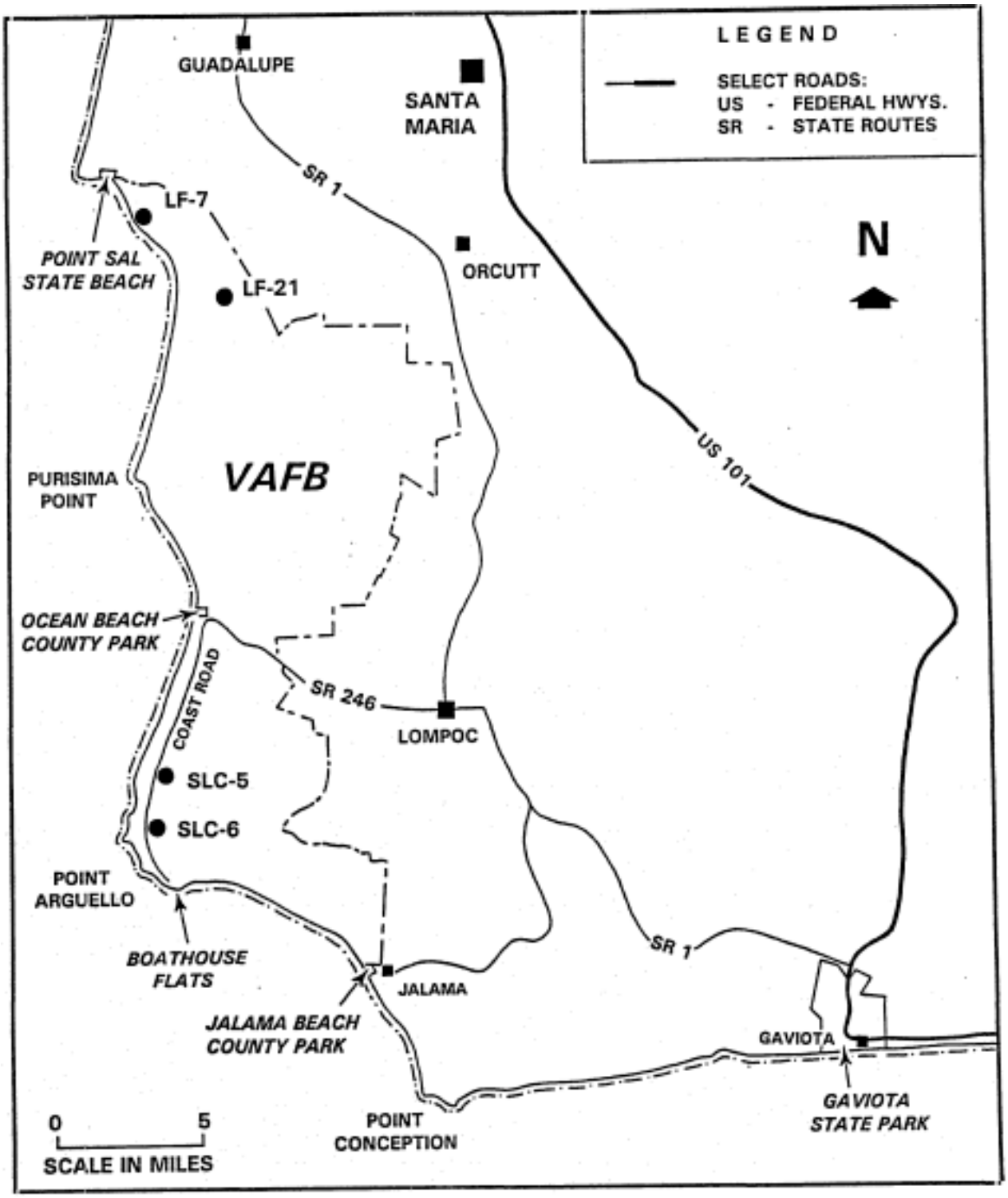


Figure 3.5-13. Recreational Uses at Western Range (Vandenberg Air Force Base), California

3.5.12 INFRASTRUCTURE AND TRANSPORTATION

A general discussion of infrastructure and transportation and all applicable laws and regulations is provided in Section 3.0.12.

Region of Influence

The region of influence for infrastructure and transportation is Vandenberg AFB and the immediate surrounding area.

Affected Environment

Electrical Power. Electrical power is provided by Pacific Gas and Electric from the Morro Bay power plant. The power is transmitted to a single metering point near Vandenberg AFB's primary substation. Internal distribution of power is over 70-kV and 12-kV transmission lines connecting 10 substations having a total capacity of over 115 MW. Eight power plants are also located on the Base and have a total capacity of 25.1 MW. The electrical power generation and distribution systems on the Base are owned and operated by the USAF. The annual power usage in 1995 was 167.8 million kW-hours.

Water System. Vandenberg AFB currently obtains its water from groundwater sources of the San Antonio Creek groundwater basin in the north and the Lompoc Terrace groundwater basin in the south (Figure 3.5-13). Current average usage is less than 4 MGD. A pipeline to tie into state water supplies has recently been built to North Vandenberg, and it is projected that by mid-1997, state water will supply North Vandenberg with about 95 percent of its needs. The San Antonio Creek groundwater basin will be maintained as a backup. South Vandenberg AFB will continue to be supplied entirely by groundwater. A projected change is to build a connecting line from North to South Vandenberg, in which case both areas would be supplied by the state (Ericson, 1997).

Wastewater System. Wastewater from Northern Vandenberg AFB is treated by the publicly owned treatment plant in Lompoc. The plant has a capacity of treating 5 MGD and currently operates at 3.5 MGD. Vandenberg AFB's portion of this is less than 0.9 MGD. In addition to primary treatment, the plant also provides secondary treatment and nitrification. Wastewater from southern Vandenberg AFB is generated from industrial areas and the space launch complexes. Each of these areas have their own sanitary sewage plants and/or septic tank-leach field systems. SLC-6 has one of the largest treatment systems, with a capacity of 28,000 gallons per day.

Solid Waste Handling System. Solid domestic waste on Vandenberg AFB is disposed of at a Class Ill landfill located on the northern portion of the Base.

Roads. State Highways 1, 135, and 246 are in the vicinity of Vandenberg AFB. All of these are in generally good condition and are adequate to service the volume of traffic (Figure 3.5-14).

Railroads. Three branch lines from the Southern Pacific Railroad provide service to Vandenberg AFB. In addition to Southern Pacific, the Santa Maria Valley and the Ventura County Railroads provide service in the vicinity of Vandenberg AFB. The Southern Pacific Railroad tracks are located between the Pacific Ocean and the launch facilities on Vandenberg AFB. Launches are not scheduled during periods when trains are passing through Vandenberg AFB. Additionally, an electronic surveillance system, radio communications between launch personnel and railroad personnel, and posted schedules are used to prevent the occurrence of a missile overflying a train.

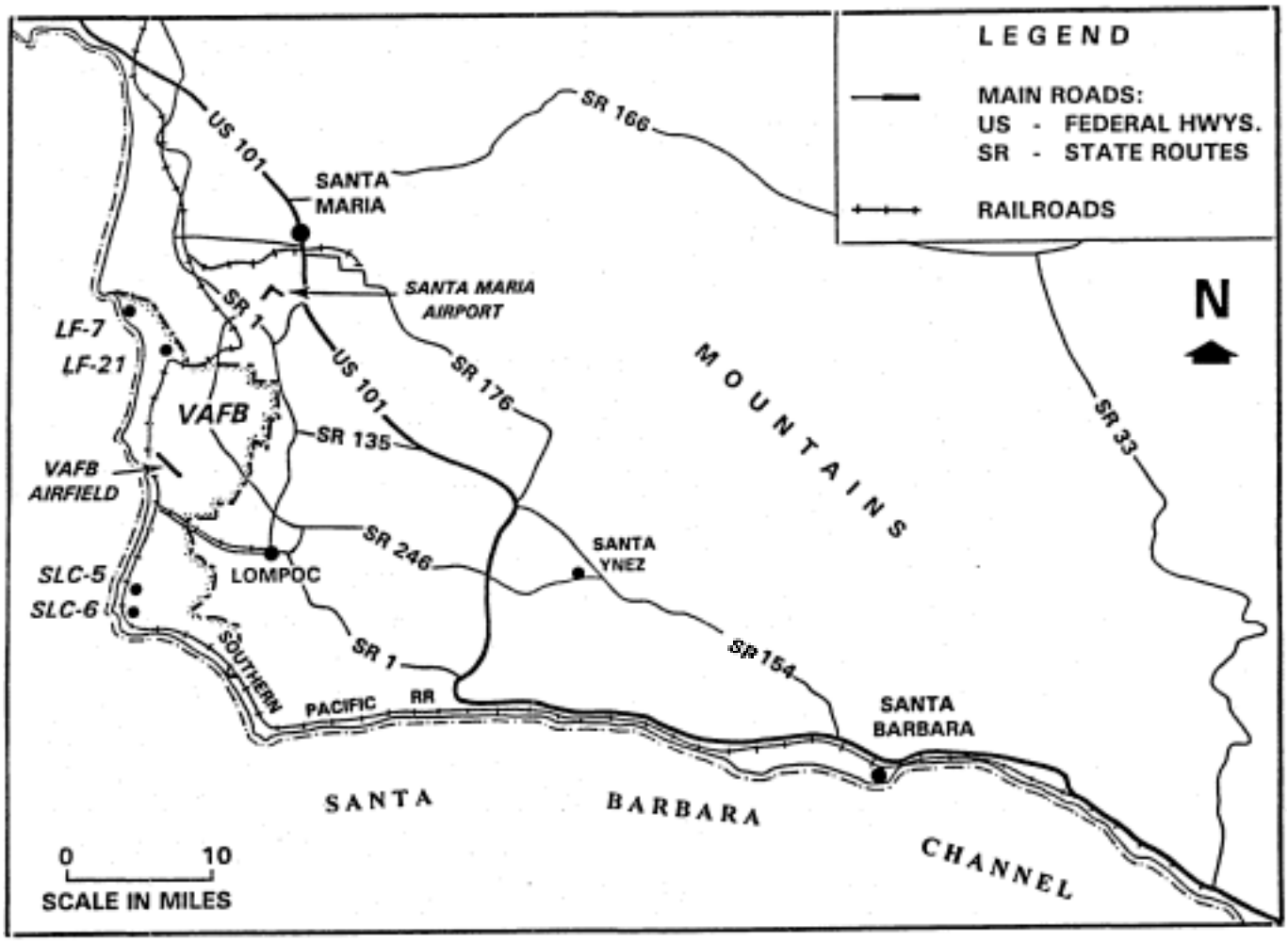


Figure 3.5-14. Transportation Network, Vandenberg Air Force Base, California

Airports. Four active commercial airports are close to Vandenberg AFB: Santa Barbara Municipal, Santa Ynez, Lompoc, and Santa Maria Public Airports. In addition to these, Vandenberg AFB has its own runway 4,570 m x 60 m (15,000 ft x 200 ft) that is capable of handling large-wide-body aircraft. The majority of flight operations at the commercial airports are general aviation, but operations do include jet-air carriers and air-taxi services.

Marine. Marine traffic in the Vandenberg AFB area primarily consists of fishing boats from Morro Bay, Port San Luis, Santa Barbara, Ventura, and Port Hueneme. The majority of the commercial activity in the Santa Barbara Channel south of Vandenberg AFB is from Los Angeles and Long Beach Harbors.

Prior to missile-launch operations, marine traffic would be advised by radio broadcasts, announcements in the "Notice to Mariners," and at local harbors to avoid the designated danger zones. Additionally, sea and air patrols sweep the area to ensure that the danger zones are cleared prior to launch. Launches would be designed to confine debris to the danger zones; however some debris may fall outside the designated areas.

Environmental Consequences

Existing facilities and infrastructure at Vandenberg AFB would be used to launch targets for the PDRR ABL Phase. Personnel already employed at Vandenberg AFB would be used for range operations and support. The number of missile launches during both the diagnostic and expanded-area tests from Vandenberg AFB should not exceed 16 launches during a nine-month period. The presence of a maximum of ten temporary PDRR ABL Phase personnel during each five-day flight-test period should not adversely impact the infrastructure or transportation at Vandenberg AFB. This small number of temporary personnel would be well within the normal fluctuation of day-to-day personnel using the installation's infrastructure and transportation systems. The impact to the infrastructure and transportation system in the Vandenberg AFB area would be minimal.

3.5.13 SOCIOECONOMICS

A general discussion of socioeconomics and all applicable laws and regulations is provided in Section 3.0.13.

Region of Influence

The region of influence for Vandenberg AFB is a portion of Santa Barbara County, California.

Affected Environment

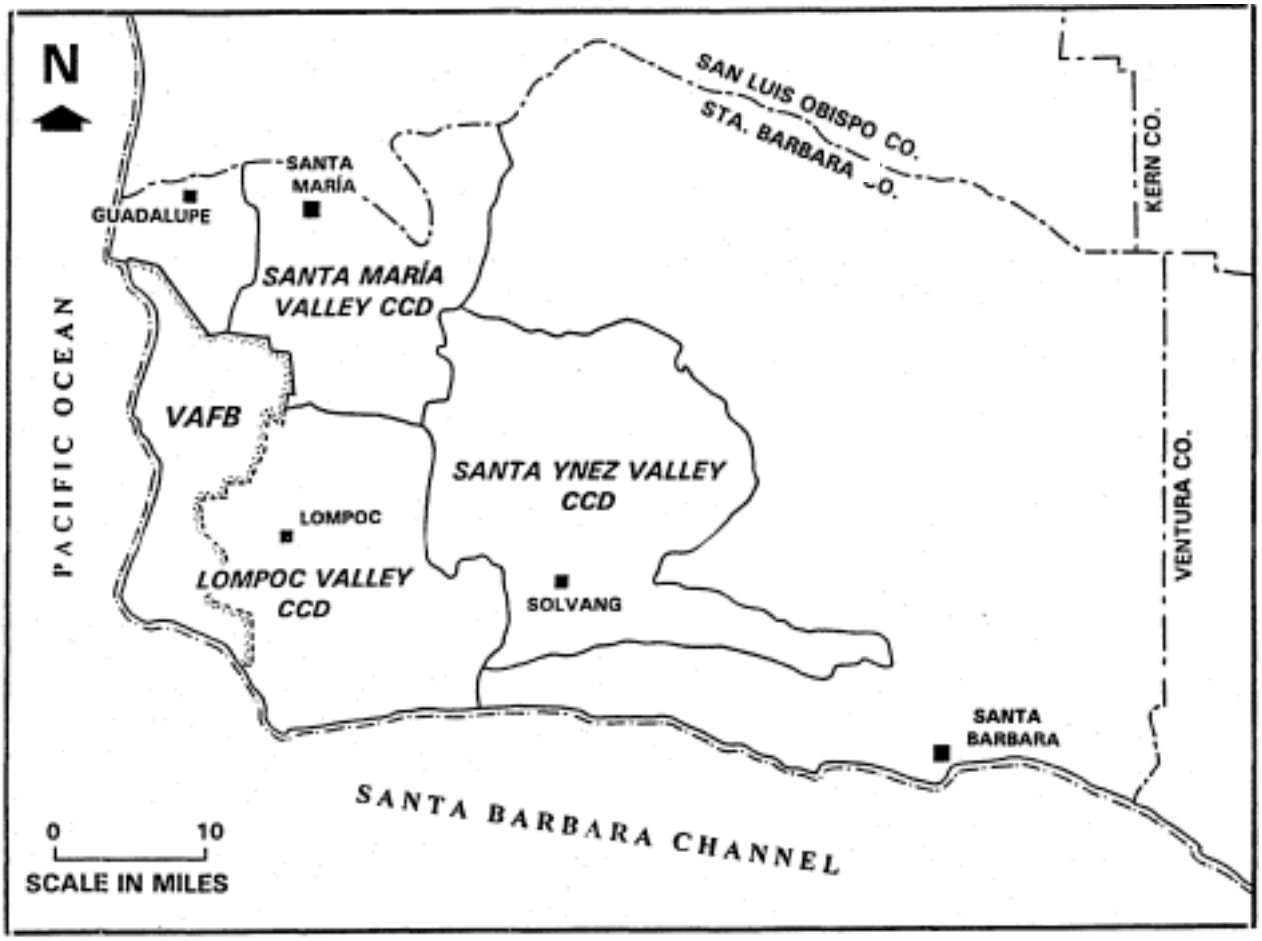
Vandenberg AFB is located in Santa Barbara County, California. Based upon an analysis of transportation access routes, existing residence and commuting patterns and availability of transient housing, the affected environment would be limited to Lompoc, Santa Ynez, and Santa Maria Census County Subdivisions (CCDs) in Santa Barbara County (Figure 3.5-15). The impacted communities within the affected environment would be Lompoc and Solvang to the southeast of Vandenberg AFB and Santa Maria to the northeast.

The impacted communities are sufficient in size to provide temporary accommodations for the Vandenberg AFB temporary personnel during the proposed one-week (five-day work week) launch periods, which may be scheduled up to 26 times. Temporary personnel typically would stay in one of three communities previously mentioned because of their proximity to the main Base. There are 4,250 hotel/motel rooms available in the area, with 1,050 in Lompoc, 1,800 in Santa Maria, and 1,400 in Solvang (Lompoc Valley, Santa Maria Valley, and Solvang Chambers of Commerce, 1995). There are also more than 600 restaurants and fast food establishments located in the area (ProCD Inc., Danvers, MA, February, 1996; Lompoc Valley, Santa Maria Valley and Solvang Chambers of Commerce, 1995).

Enviromnental Consequences

Approximately ten temporary PDRR ABL personnel would be expected to rotate into the area for one week (five-day work week) for each of 16 diagnostic test flights and ten expanded-area test flights. The markets that may be impacted by the demand for temporary housing and restaurant facilities would be Lompoc, Solvang, and Santa Maria. Any impact of temporary personnel on other communities in the area would be insignificant.

California Development Department statistics indicate that the average civilian labor force in the region of influence in 1995 was 81,512 persons, with an average 7,231 (8.9 percent) unemployed. No immigration of persons is expected to fill any positions.



Modified from Bureau of Census, 1990

Figure 3.5-15. Socioeconomic Region of Influence at Vandenberg Air Force Base, California

Assuming a 50-percent annual motel/hotel occupancy rate in the affected environment (Lompoc Valley, Santa Maria Valley, and Solvang Chambers of Commerce, 1995), 2,125 rooms would be available in the area to accommodate the 10 temporary personnel working at Vandenberg AFB.

Estimated annual demand from Diagnostic and Expanded-Area Test Range personnel would be 1,300 (calculated at 10 personnel x 26 weeks x 5 days/week) room-nights and a potential $105,300 annual motel/hotel revenues. In addition, the temporary personnel would be expected to generate $44,200 in local restaurant revenues. The anticipated $149,500 in additional revenue that would be generated by the posting of temporary personnel at Vandenberg AFB would have a slight beneficial impact to the local economies of the affected communities (41 CFR § 301, Appendix A, April 1996).

3.5.14 ENVIRONMENTAL JUSTICE

As discussed in Section 3.0.14, the activities associated with diagnostic testing at Vandenberg AFB would not occur in populated areas therefore, no environmental justice analysis would be necessary.

3.5.15 CUMULATIVE IMPACTS

Activities and resource attributes associated with implementing PDRR ABL Diagnostic and Expanded-area Test Range activities at Vandenberg AFB which may contribute to cumulative impacts are summarized in this section. No specific information regarding activities which may be scheduled at Vandenberg AFB in the year 2002 is currently available for analysis. A more detailed analysis will be done as the information becomes available and as system-test details are defined.

Missile Launches. It is projected that an average of 25 other missiles would be launched annually from Vandenberg AFB during the PDRR ABL Phase. The PDRR ABL Phase would launch up to 16 Lance missiles from Vandenberg over a nine-month period. The Lance missile is a smaller missile, and uses less fuel than ballistic and space vehicles launched at Vandenberg AFB. In addition, the Lance missile requires fewer personnel and less infrastructure to launch. Missile launches may require temporary clearing of areas of the Pacific Ocean adjacent to the trajectory path of the missile, and may require short-term evacuation of offshore-oil rigs and public beaches. However, because of the number of launches associated with the PDRR ABL Phase and the short duration of the launch activities, cumulative impacts would be minimal.

Air Quality. Since there are no emissions forecasts for the years 2001 and 2002, it is not possible to accurately assess the cumulative impact of emissions produced by PDRR ABL activities and other programs. However, emissions from target preparations and operations would increase Vandenberg AFB's 1994 NO_x emissions by less than 0.1 percent and VOC emissions by less than 0.05 percent and Vandenberg AFB' s emissions are less than 2 percent of Santa Barbara County's emissions. Therefore, PDRR ABL activities would not be expected to have a measurable cumulative impact.

Biological Resources. PDRR ABL Phase activities may result in cumulative impacts to biological resources at Vandenberg AFB. Because noise levels associated with missile launches have been shown to result in "startle response" in marine mammals and nesting shore birds, the increased frequency of launches attributed to the PDRR ABL Phase may cause cumulative impacts to wildlife.

Airspace. Access to airspace may be restricted during missile launches related to the PDRR ABL Phase. However, launches would occur in restricted- or warning-area airspace and would be of short duration.

Hazardous Materials and Waste. PDRR ABL Phase activities at Vandenberg AFB would result in slightly larger amounts of hazardous materials usage and hazardous waste generation. However, the existing permitted storage facilities for these materials have adequate capacity for the additional material.

3.5.16 ADVERSE ENVIRONMENTAL IMPACTS THAT CANNOT BE AVOIDED

Unavoidable adverse impacts that may arise as a result of implementing the PDRR ABL flight test activities at Vandenberg AFB are discussed in the following subsections by attribute.

Air Quality. Some PDRR ABL development and testing activities would produce air pollutants. Environmental impacts would generally be short term, minor, and nonpersistent. At test ranges, for each launch of a target missile, some gases and particulate matter would be emitted to the ambient atmosphere. Under most atmospheric conditions, these pollutants would quickly and easily disperse into the atmosphere.

Airspace. Access to the selected, restricted airspace by general aviation during flight tests would be denied for short periods of time during missile launches.

Biological Resources. Minor noise impacts to birds and marine mammals at the Western Range would not be avoided.

Geology, Soils, and Water Resources. Test missile and target debris would not be fully recovered from its impact site in the ocean. Resulting ocean pollution would be unavoidable but minor.

Noise. Noise from traffic, aircraft overflight, missile launches, and sonic booms cannot be totally mitigated. Though missile and aircraft noise could disturb the local population and animals, it is part of the existing environment at Vandenberg AFB. None of these impacts would be major.

3.5.17 MITIGATION MEASURES

This section summarizes mitigation measures that would be considered beyond adherence to all laws, regulations and guidelines to control or reduce impacts to the environment as a result of diagnostic and expanded-area activities. Because of the negligible impact that PDRR ABL Phase activities will have on most attributes and the additional measures already taken by USAF, no separate mitigation plan is currently deemed necessary. Nevertheless, we have outlined areas needing special attention and management, depending on the specific actions to be taken at a facility, the level of impact and other pertinent factors.

Biological Resources. Once specific launch sites are selected at VAFB, additional NEPA documentation will be developed to consider site-specific impacts to biological resources. Based on consultation with the FWS and the NMFS, appropriate mitigation measures may be taken. In part, such measures may include: selection of launch sites with reduced potential for impacts, scheduling (seasonal and diurnal) of launches to reduce impacts, and/or surveying or monitoring local species.

Hazardous Materials and Waste. Impacts would be mitigated by material substitution or process controls, but the impacts would have to be examined on a program- or system-specific basis in lower-tier environmental documentation.

3.6 WESTERN RANGE (POINT MUGU NAVAL AIR WARFARE CENTER WEAPONS DIVISION AND SAN NICOLAS ISLAND)— ALTERNATIVE DIAGNOSTIC TEST RANGE AND PREFERRED EXPANDED-AREA TEST RANGE

Point Mugu Naval Air Warfare Center Weapons Division and San Nicolas Island constitute an alternative Diagnostic Test Range and preferred Expanded-Area Test Range for conducting PDRR ABL Phase activities. Section 3.6 discusses specific affected environments and environmental consequences by environmental attribute at Point Mugu. However, this section primarily focuses on San Nicolas Island, where most of the PDRR ABL Phase activities would take place.

3.6.1 COMMUNITY SETTING

Background. The U.S. Navy took control of the Point Mugu area after the bombing of Pearl Harbor in 1941, and the first runway was constructed in 1942. In 1946, the Naval Air Special Missiles Center was established at Point Mugu. On 16 June 1958, the Pacific Missile Range at Point Mugu was established, and by the spring of 1963, San Nicolas Island and other outlying locations throughout the Pacific had been fully instrumented. In 1975, the Pacific Missile Range and the Naval Missile Center were merged to form the Pacific Missile Test Center. Point Mugu launches an average of 300 missiles and 230 drones annually.

Location. Point Mugu lies in the southern portion of Ventura County, California, on the coast of the Pacific Ocean (Figure 3.6-1). The Main Base encompasses nearly 4,500 acres. San Nicolas Island lies southwest of the Main Base approximately 100 km (60 mi) offshore (Figure 3.6-2). Its 13,370 acres accommodate missile-launching facilities, instrumentation facilities, test and research facilities, and an airfield.

Facilities. Two launch areas, the Alpha Launch Complex and the Building 807 Launch Complex, are located on San Nicolas Island. The Lance missile, the target analyzed in this EIS for use at Point Mugu, could be launched from either complex, using a Transporter/Erector/Launcher. Drones would be launched and recovered from the runway on San Nicolas Island (Figure 3.6-2).

Point Mugu uses a 90,674-square km (35,000-square mi) air/sea test range that becomes part of the Western Range when control of the airspace is turned over to Vandenberg AFB. All restricted airspace and offshore warning areas make up the West Coast Offshore Operating Area (WCOOA), which is managed as an adjunct to the Western Range. The WCOOA is approximately 320-km (200-mi) wide and covers more than 1600 km (1,000 mi) of coastline from the Gulf of Alaska to the Mexican border.

Affected Environment

San Nicolas Island is one of eight California Channel Islands located off the coast of southern California. The Island is home to a large array of unique plants. Long-term isolation from the mainland has resulted in diversification of the plant and animal species from those found on the mainland (NAWC, 1993a). Plant communities include coastal scrub, grassland coreopsis-dominated scrub, sand dune, coastal marsh, vernal pools, and annual iceplant habitats (NAWS, 1995). Only two mammals, five resident terrestrial birds, and three reptiles are known to occur on San Nicolas Island. In addition, several species of marine mammals, birds, and sea turtles may occur in the general vicinity.

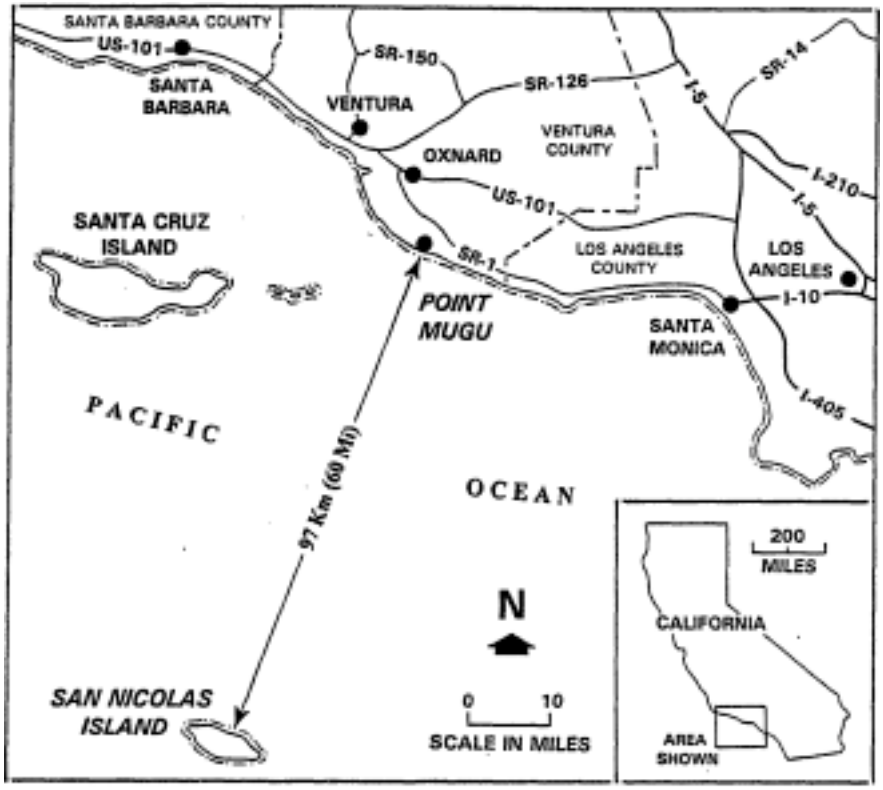
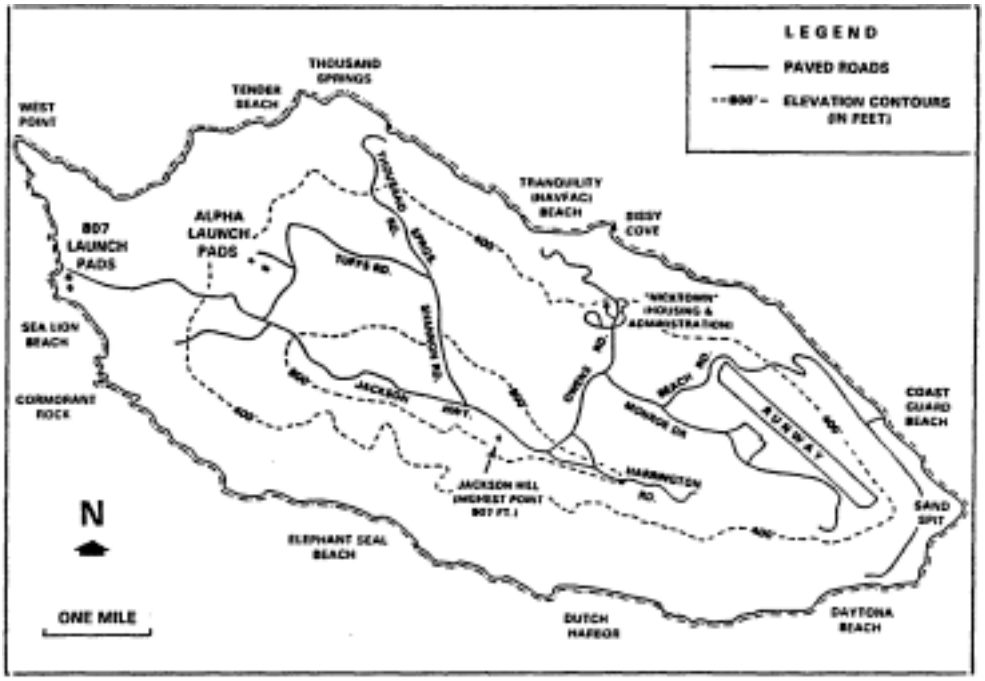


Figure 3.6-1. Regional Setting at Point Mugu and San Nicolas Island, California



Modified from NAWC. 1993a

Figure 3.6-2. Location Map of San Nicolas Island, California

The climate is categorized as subtropical, with mild temperatures and winds from the northwest. A pronounced dry season lasts from May to November, and minimal rainfall occurs the rest of the year. The average annual rainfall is approximately 6.5 inches, and occurs mostly in the winter. The average maximum temperature in the summer is near 70^0F, and average minimum temperature in the winter is near 48^0F. Because of the moist ocean air, the relative humidity is high all year, ranging from 80 to 90 percent at night to approximately 60 percent in the day. The average wind speed is between 5 and 6.3 m/sec (11 and 14 mph). However, wind speeds can reach 21 to 26 m/sec (46 to 57 mph), with greater gusts. Early morning fog is a usual occurrence throughout the year but it gradually lifts as the day progresses.

3.6.2 AIR QUALITY

A general discussion of air quality and all applicable laws and regulations is provided in Section 3.0.2.

Region of Influence

San Nicolas Island and Point Mugu are located in EPA Region IX, California's South Central Coast Air Basin and in the Ventura County Air Pollution Control District. In 40 CER 81, Ventura County and the Channel Islands (including San Nicolas Island) are listed separately under the South Central Coast Air Basin. However, the California Environmental Protection Agency does not separate the Channel Islands from Ventura County.

Affected Environment

While the air quality of most of the South Central Air Basin and Ventura County is poor, the air quality of San Nicolas Island is considered to be good because of the few sources of pollutant emissions and the predominantly strong winds that bring relatively clean air from the Pacific Ocean. The air quality at San Nicolas Island is not monitored by any federal or state agency. The Ventura County Air Pollution Control District operates air-monitoring stations throughout the county. The closest monitoring stations (one gaseous and one particulate) are currently located in the city of Ventura, approximately 100 km (60 mi) north-northeast of San Nicolas Island. Prior to 1993, an air-monitoring station was located approximately 80 km (50 mi) north of San Nicolas Island on Anacapa Island. Data collected from the monitoring station showed that Anacapa Island met all federal and state air-quality standards during the years 1989 through 1992. While Ventura County is in nonattainment status, the air quality at Anacapa Island is more representative of the levels at San Nicolas Island. Both are Channel Islands with winds from the northwest. The likelihood of pollutants entering the ambient air of either island from upwind is very low. Additionally, no large, local emissions sources exist on either island.

Environmental Consequences

The PDRR ABL Phase activities that could affect air quality at San Nicolas Island would be flight-test preparation activities, the operation of up to four drone flights and **up to 16 Lance missile launches**, and vehicle use. The PDRR ABL Program would bring no new stationary sources to San Nicolas Island. The PDRR ABL Program's activities would not require any new or changes to existing permits for criteria air pollutants.

The impacts on air quality from transportation and preparation activities at Point Mugu would be minimal. The transportation of the target missiles to Point Mugu would have no measurable impact on air quality and would be conducted in accordance with Department of Transportation (DOT) regulations. Target missile preparation activities would include receiving, initial inspection, temporary storage, comprehensive inspection, transport to launch location, mounting of missile on launcher, and equipment cleaning. These activities could involve the emissions of volatile organic compounds (VOCs) or

hazardous air pollutants (HAPs). However, it is anticipated that the amounts would fall well below the minimal levels of the relevant federal and California regulations. The Lance missile is a single-stage, prepackaged, liquid-propellant rocket. No missile-fueling operations would occur at Point Mugu. Pre-launch activities would involve launch hazard-area evacuations and clearances, and possible road closures. Vehicles would be involved with the road closures and area evacuations. Clearances on San Nicolas Island may involve overflights to verify that the areas are clear.

The total exhaust emissions from a single launch of a Lance missile are presented in Appendix D. The only HAP produced from normal operations would be 0.04 kg (0.10 lb) of hydrochloric acid from each Lance missile launch. The total of 1.6 pounds of hydrochloric acid from all missile launches is much less than the 10-tons/year regulatory reporting requirement of the CAAA. Detailed environmental analysis on the effects of using a Lance missile as TBM simulator is provided in *the U.S. Army Kwajalein Atoll Temporary Extended Test Range Environmental Assessment*, Appendix E (U.S. Army, 1995a) and in the *Lance Missile Target Environmental Assessment for White Sands Missile Range* (U.S.Army, 1996a). Neither analysis showed any measurable alterations to air quality as a result of normal Lance missile operations. Accident scenarios involving the release of inhibited red-fuming nitric acid (IRFNA) and unsymmetrical dimethylhydrazine (UDMH) are covered in Appendix C. Toxic corridor dimensions vary with wind velocity. Analysis showed that the toxic corridor could be as great as 890 by 160 m (2,920 by 525 ft) for a wind velocity of 5 m/sec (11 mph), and only 45 by 24 m (150 by 80 ft) for a wind velocity of 1 m/sec (2.2 mph).

The emissions produced by the PDRR ABL Phase activities would be well below federal and local regulatory levels and would not be significant. The results of the preliminary conformity analysis (Appendix E) are presented in Table 3.6-1. The maximum annual level of emissions would be less than 0.3 ton of VOCs and 0.15 ton of oxides of nitrogen. These emissions are much less than de minimis levels and would not have an appreciable effect on the air quality at San Nicolas Island.

Table 3.6-1. Estimated Emissions from PDRR ABL Phase Activities (tons/yr)

Year	**VOC**	NO_x
2001	0.02	0.01
2002	0.27	0.14
de minimis level	50	50

3.6.3 AIRSPACE

A general discussion of airspace and all applicable laws and regulations is provided in Section 3.0.3.

Region of Influence

The region of influence is the Western Range and the West Coast Offshore Operating Area (WCOOA) complex of restricted airspace and warning areas.

Affected Environment

Airspace managed by Point Mugu is listed in Table 3.5-5. San Nicolas Island is contained entirely within restricted area R-2535 (Figure 3.5-3), which extends from the surface (sea level) to approximately 100,000 ft. The area lies within, but is excluded from, warning area W-289. WCOOA airspace is also expected to be affected by test activities at San Nicolas Island.

Environmental Consequences

All target-drone and missile launches, aircraft-testing and beam- characterization activities would take place in existing restricted airspace or warning areas. Restricted airspace and the special-use airspace of the WCOOA are designed to accommodate necessary military activity and to protect other users from hazardous operations. Impacts on airspace from PDRR ABL Diagnostic and Expanded-Area Test Range activities would be low.

Diagnostic Test Range activities include six non-engagement flights, four target-drone flights, six target-missile flights, and four missile-of-opportunity flights. Four non-engagement flights and six target-missile flights would be anticipated for Expanded-Area Test Range activities. **Target-missile launches from San Nicolas Island** would impact current aerial activities within Western Range and WCOOA airspace. Depending upon the flight paths of the missiles, airspace and the ocean would be evacuated and flights would be rerouted to and from the Los Angeles Basin. Use of San Nicolas Island for the target-missile launch site would impact on three air-traffic-control airways (Control 1176, 1316, and 1318, Figure 3.5-4) and Warning Areas W-289 and W-537 (Figures 3.5-2 and 3.5-3). Warning Areas W-289 and W-537 extend from sea level to an unlimited altitude and are currently in use only intermittently. Both warning areas are crossed by the heavily-used control airways. Approximately 75 to 100 flights use the control airways daily (Daniele, 1996).

Traffic using the Pacific Coastal Route also has the potential to be affected by test flights. The Pacific Coastal Route is an off-shore route established for departure relief of commercial air traffic from the Bay Area to the Los Angeles Basin. Approximately five to eight flights per hour use this route daily (Daniele, 1996). As long as other corridors remain open, the impact of closing affected air-traffic-control airways is negligible.

Drone launches originating from San Nicolas Island would be contained within restricted airspace and warning areas. Drone launches would not be anticipated to restrict general aviation aircraft from warning area airspace; however, if for safety reasons the airspace is cleared, impacts to airspace use would be similar to impacts from missile launches.

During diagnostic-test activities it is anticipated that targets would not be destroyed. Target drones would return to the runway and target missiles would fall intact into the Pacific Ocean. Expanded-area test activities include engaging targets with the HEL, generating missile debris. All debris would fall into the Pacific Ocean with no anticipated recovery procedures. Airspace impacted by debris would already be cleared of non-participating aircraft from missile launches. Therefore, impact on airspace from debris would be low.

3.6.4 BIOLOGICAL RESOURCES

A general discussion of biological resources and all applicable laws and regulations is provided in Section 3.0.4.

Region of Influence

PDRR ABL Phase activities would include all of San Nicolas Island. However, the primary focus would be limited to the preparation, launch, and flight of target missiles and drone aircraft from San Nicolas Island into the Western Range and the debris impact areas for missiles to be targeted by the HEL. The potential launch locations are along the coastline at the Alpha or Building 807 launch complexes on the northwest end of the island. Drones would be launched from the island’s runway.

Affected Environment

Threatened and Endangered Plant Species. Three species of threatened or endangered plants are found at San Nicolas Island (Table 3.6-2). This table may be revised, based on on-going consultation with the USFWS.

Table 3.6-2. Threatened and Endangered Plant Species Known or Expected to Occur on San Nicolas Island

Common Name	Scientific Name	State Status	Federal Status
Beach spectacle-pod	*Dithyrea maritima*	T	—
Sari Nicolas Island buckwheat	*Eriogonum grande var. timorum*	E	—
Trask's milk vetch	*Astralagus traskiae*	R	—
E Endangered T Threatened R Rare			

Threatened and Endangered Animal Species. Ten species of threatened or endangered animals are found at San Nicolas Island, including six federally endangered species of whales that are found only in low densities in the waters off San Nicolas Island (Table 3.6-3). This table may be revised, based on ongoing consultation with the USFWS. In addition, the US National Marine Fisheries Service (NMFS) indicates that the following marine mammal species may also be found in the region: minke whales, beaked whales, fin whales, killer whales, bottlenose dolphins, common dolphins, striped dolphins, Risso's dolphin, Pacific white-sided dolphins, northern right whale dolphins, and Dall's porpoise.

Table 3.6-3. Threatened and Endangered Animal Species Known or Expected to Occur on San Nicolas Island

Common Name	Scientific Name	StateStatus	Federal Status
Island fox	*Urocyon littoralls*	T	—
Southern sea otter	*Enhydra lutris nereis*	—	T
Sei whale	*Balaenoptera borealis*	—	F
Finback whale	*Balaenoptera physalus*	—	E
Blue whale	*Balaenoptera musculus*	—	E
Humpback whale	*Megaptera novaengliae*	—	E
Sperm whale	*Physeter macrocephalus*	—	E
Right whales	*Balaena glacialis*	—	E
Western snowy plover	*Charadrius alexandrinus nivosus*	—	T
Island night lizard	*Xantusia riversiana*	—	T
E Endangered T Threatened			

Environmental Consequences

Activities involved with Diagnostic and Expanded-Area Test Range activities at San Nicolas Island for the PDRR ABL Phase would involve routine range activities including missile/drone aircraft preparation and launching; debris impacts off the coast; and use of the low-energy targeting laser and the HEL.

Sixteen theater ballistic missile flights are expected. Of these, a maximum of six would be targeted by the HEL. Four drone aircraft flights would also occur. However, the number of missile launches and drone aircraft flights planned in this proposed activity from San Nicolas Island represent less than a 2 percent increase over current operations. Therefore, the proposed activity would not significantly alter current conditions.

The relative noise intensity of the Lance missile would be comparable to noise levels produced during other previous operations at San Nicolas Island. Nonetheless, the noise is still likely to cause startle responses in wildlife near the launch location. The disturbance of harbor seals, other pinnipeds, and shore birds which populate the Vandenberg AFB coast has been analyzed in many studies of space launch vehicles in the past decades, 1978 to 1997 (Space Shuttle, Titan IV, Lockheed Launch Vehicle, Atlas II, Taurus, Delta, etc.), and many requests for "Incidental Harassment and Take Permits" have been requested (USAF, 1978; USAF, 1980b; USAF, 1991b; USAF, 1991c; USAF, 19951; USAF, 1995m; USAF, 1996d; 61 FR 10727; and 62 FR 734). The conclusion from the National Marine Fisheries Services (NMFS) on the *Small Takes of Marine Mammals Incidental to Specified Activities; Taurus Space Launch Vehicles at Vandenberg Air Force Base, CA,* is similar to the results of the earlier studies (62 FR 734). The conclusion stated:

> NMFS has determined that the short-term impact of the launching of Taurus SLV rockets is expected to result at worst, in a minor, temporary reduction in utilization of the haulout as seals or sea lions leave the beach for the safety of the water. These launches are not expected to result in any reduction in the number of pinnipeds and they are expected to continue to occupy the same area. In addition, there will not be any impact on the habitat itself. Based upon studies conducted for previous space vehicle launches at Vandenberg. significant long-term impacts on pinnipeds at Vandenberg and the northern Channel Islands are unlikely.

Since the Lance missile is much smaller than any of the space launch vehicles, the potential disturbance to the indigenous pinniped population is expected to be less. While the above studies and permits were for Vandenberg AFB missile launches, similar results and conclusions should be expected for missile launches at San Nicolas Island. The Lance missile launches are not scheduled to begin until 2002, and an Incidental Harassment and Take Permit has not yet been submitted. When detailed test plans have been finalized, the appropriate permits will be obtained.

An analysis on impacts from missile-debris fallout 10 km (6 mi) from shore on migrating gray whales was conducted (Appendix G). Gray whales were selected as a representative species likely to be in areas impacted by missile debris. While other species may be present in the debris fall-out zone, none are likely to be found in densities higher than the maximum densities assumed for the Gray whale. The analysis in Appendix G suggests that during peak migration densities a whale could be struck and killed by falling debris with an expected probability of 0.0001. Missile launches occurring at other than peak migration times would present significantly lower risks to migrating whales.

At the time of destruction by the HEL, the Lance missile would have less than 80 kg (180 lbs) of propellant onboard, would be more than 10 km down range, at an altitude of more than 15 km (50,000 ft), and would be traveling at 1,000 m/sec (greater than 2,000 miles per hour). The remaining fuel onboard would be vaporized and quickly mixed with the surrounding air during the destruction of the missile.

The release of this propellant would have no measurable effect on the aquatic ecosystem of the Western Range.

The impacts associated with the operations of the HEL are discussed in Appendix F. This analysis shows that laser activities would not have significant impacts upon the wildlife at San Nicolas Island. Largely, this results from the high altitude at which the proposed laser activity would occur (40,000 feet or greater) and from the test geometry that would prevent the HEL from being engaged in a downward direction.

3.6.5 GEOLOGY, SOILS, AND WATER RESOURCES

A general discussion of geological, soil, and water resources and all applicable laws and regulations is provided in Section 3.0.5.

Region of Influence

The region of influence on geological, soil, and water resources from PDRR ABL Phase activities at the Point Mugu Naval Air Warfare Center Weapons Division would include all of San Nicolas Island and the areas over the Pacific Ocean in the line of the trajectory of the target missiles. Point Mugu itself, on the mainland, would not be affected.

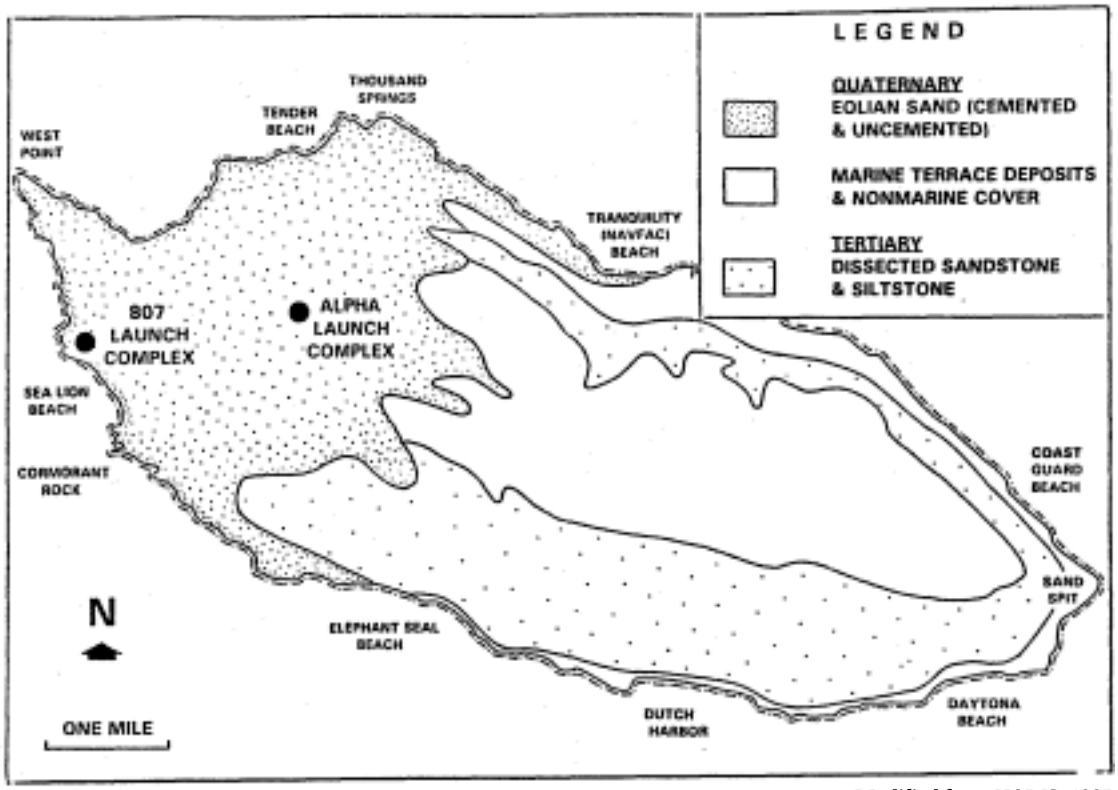
Affected Environment

Geology. San Nicolas Island is a member of the Channel Island Group (Figure 3.6-1). The perimeter of the island is characterized by cliffs averaging 150 m (500 ft) in height. The center of the island is a rolling mesa that is a remnant of a marine terrace (uplifted sea floor). The island is underlain by a series of Eocene (approximately 50 to 40 million years in age) marine sedimentary rocks, which are intruded by Miocene (24 to 5 million years in age) igneous rocks (NAWS, 1995). The Eocene and Miocene rocks are overlain by Pleistocene (1.65 million years to 10,000 years in age) marine-terrace deposits on the eastern and central part of the island, and Recent (less than 10,000 years in age) sand dunes on the western end (USAF, 1991b). Recent gravel deposited on wave-cut terraces along the coast are referred to as “dune sand.” Recent cobble-gravel, sand, and silt, 23 m (75 ft) thick, cover the low coastal plain, and Recent alluvium of variable grain-size, up to 46 m (150 ft) thick, occurs elsewhere on the island (USAF, 1991b). Structurally, San Nicolas Island is the crest of a broad, complexly-faulted anticline (convex-upward fold), with the fold-axis parallel to the length of the island (USAF, 1991b).

No significant commercial deposits of mineral resources are known to exist on San Nicolas Island. The potential for commercial quantities of oil and natural gas in the subsurface of San Nicolas Island is slight (USAF, 1991b). Figure 3.6-3 is a generalized geologic map of San Nicolas Island.

Seismicity **and Other Geological Hazards.** Tectonic activity analyzed between 1986 and 1991 suggest that San Nicolas Island is moving to the northwest about 0.5 cm (0.2 in) per year. The movement is likely associated with that along the San Andreas fault (NAWS, 1995). Faults on and just offshore of the California mainland pose a threat to San Nicolas Island and could generate moderate to strong ground motions on the island during earthquakes. The island is cut by numerous faults, and although none are known to have been active during the past 10,000 years, they are still considered potentially active (USAF, 1991b). If an earthquake occurred along these faults, intense ground motion and possible surface ruptures could occur. San Nicolas Island is located within UBC Seismic Risk Zone 4.

The high sea cliffs surrounding the shoreline of San Nicolas Island are prone to undercutting and landsliding during extremely high tides. Several large landslides have occurred along the steep slope on the northern side of the island, and a few smaller landslides have occurred on other parts (USAF, 1991b).



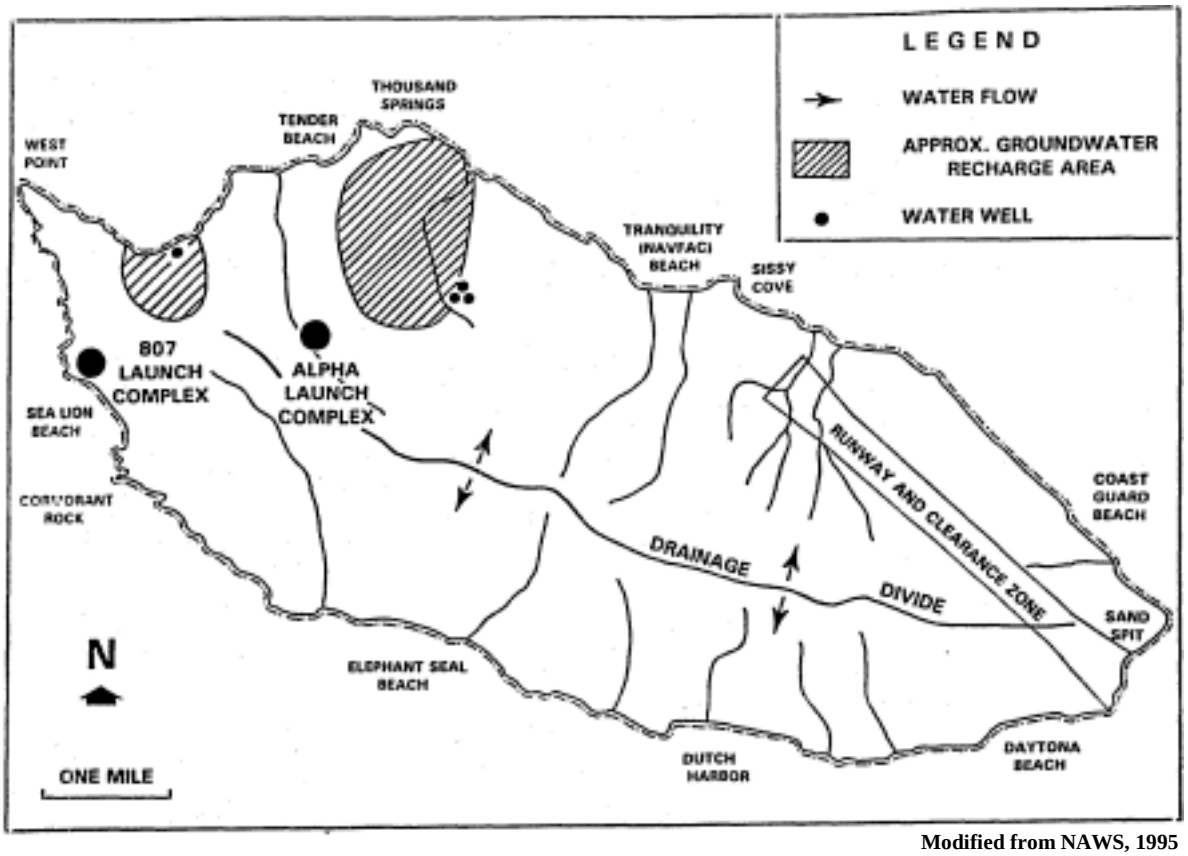
Modified from NAWS, 1995

Figure 3.6-3. Generalized Geologic Map at San Nicolas Island, California

Soils. Soils on San Nicolas Island are classified as either beaches or dune lands and consist of loams (mixtures of clay, silt and sand), sandy loams, and clays. A preliminary soil survey conducted on the island by the Soil Conservation Service identified 27 soil units. The soils are highly erodible by winds and poorly to highly erodible by water. Runoff of surface waters on the soils is slow to very slow (NAWS, 1995). Prime farmland does not exist on the island (USAF, 1991b). The extent of soil contamination on San Nicolas Island has yet to be determined.

Surface Water. Topography on the island is shaped by runoff of surface water to the ocean. A drainage divide is located along the crest of the southern escarpment of the island (Figure 3.6-4). Intermittent streams along the southern portion of the island drain surface water through very steep, straight, V-shaped canyons to the ocean. The surface-water runoff on the northern portion of the island drains initially through steep-walled gullies in the upland area, and as the water approaches the ocean it spreads out onto flat marine terraces and then into poorly defined, shallow channels within the sand dunes.

San Nicolas Island contains no permanent lakes or ponds. The one perennial stream, Tule Creek, flows from the highest point of the island northeastward to a sand dune area on the coast. The stream is fed by natural springs that are sourced by perched groundwater in the creek's drainage basin. The springs are intermittent and provide flow during most parts of the year except periods of drought (USAF, 1991b). The intermittent surface-water flow is not used as a source of potable water, but it does recharge groundwater supplies. A wetland exists on the northeast side of the runway and supports various plant species (NAWS, 1992), and small wetlands occur on the Sand Spit, Twin Rivers, and Tule Creek (Schwartz, 1996). With the exception of approximately 4,000 gallons of surface water per day that is collected in concrete cisterns at the natural springs, surface waters are not utilized on the island (NAWS, 1995).



Modified from NAWS, 1995

Figure 3.6-4. Surface Water and Groundwater Recharge Areas at San Nicolas Island, California

Groundwater. The consolidated marine sedimentary rocks of San Nicolas Island provide little storage capacity for recoverable amounts of potable groundwater. Precipitation on the island averages approximately 6.5 inches per year (U.S. Army, 1994b) and infiltration of surface water is the only source of groundwater recharge. Groundwater occurs primarily on the western end of the island in pockets within the upper few feet of the weathered surficial deposits and windblown sand deposits (USAF, 1991b). Here the groundwater flows generally in a northwestward direction toward the water-bearing areas (Figure 3.6-4). The southern beaches and terraces lack fresh-water springs and seeps, and water that infiltrates the marine terraces becomes saline through mixing with brackish groundwater. The shallow water wells on the northwest side of the island produce between 3,000 and 5,000 gallons of water per day, depending on rainfall. The wells are overdrafted to the point of exhaustion during drought years, and, when overpumped, become polluted with brackish, non-potable water (USAF, 1991b).

Water Quality. Potable water sources on San Nicolas Island are impacted primarily by salinity. Groundwater pumped from wells closest to the recharge area is generally of highest quality. The groundwater is mixed with desalinized seawater from two reverse-osmosis units to make up the potable-water supply for the island. Overpumping of groundwater has resulted in the intrusion of saline waters. The on-site sewage-treatment plant discharges up to 40,000 gallons per day of treated effluent to percolation-evaporation ponds, which are not situated near potable-water sources. The extent of surface-water and groundwater contamination of San Nicolas Island has yet to be determined.

Environmental Consequences

No known geological or soil resources exist in the region of influence. **From 20 to a maximum of 30 flights of the PDRR ABL would be conducted during testing at San Nicolas Island**. The B747 aircraft would fly at an operational altitude of approximately 40,000 ft AMSL, approximately 160 km (100 mi) offshore of San Nicolas Island in the West Coast Offshore Operating Area (WCOOA). The flights would not impact geological, soil, or water resources.

The gaseous-chemical emissions from the ten high-energy laser firings would be exhausted from the onboard-laser system at the 40,000-ft AMSL operational altitude. The emissions would be dispersed into the atmosphere over the Pacific Ocean and would not reach the earth's surface. Therefore, the laser effluents from the PDRR ABL during flight testing would not create an impact on geological or soil resources, or the Pacific Ocean. The four drone flights that would originate and terminate at the runway at San Nicolas Island would be similar in nature to the substantial number of military flights currently conducted at the facility and would have a negligible impact on geological, soil, or water resources.

Lance missiles would be the target missiles used at San Nicolas Island, and they would be programmed to impact in the Pacific Ocean within the boundaries of the WCOOA. Lance missiles are fueled by a 3.4-to-1 mixture of inhibited red-fuming nitric acid (IRFNA) oxidizer and unsymmetrical dimethylhydrazine (UDMH) fuel. Approximate levels of emissions from the launch and flight of Lance missiles (in kilograms) are listed in Appendix D. Carbon dioxide, water, and nitrogen dominate the exhaust emissions from Lance missiles. These emissions would be dispersed primarily in the atmosphere, but emissions reaching the surface would have no impacts on geological, soil, or water resources. A small amount of hydrochloric acid and hydrofluoric acid would be generated that could reach the earth's surface if rainfall were to occur within two hours of a launch, but the compounds would be neutralized by the calcium carbonate-rich soil with negligible impact on soil chemistry or water quality. A small amount of lead dust would be created and dispersed over extremely large areas, and the amount falling to the ground at any location would have a negligible effect on geological, soil, and water resources.

During the diagnostic and expanded-area tests, the PDRR ABL would illuminate the missiles over the Pacific Ocean. Any debris and unspent fuels that would result from missile intercepts during the expanded-area tests would fall into the ocean and would not create an impact on geological, soil, or water resources at San Nicolas Island.

3.6.6 CULTURAL RESOURCES

A general discussion of cultural resources and all applicable laws and regulations is provided in Section 3.0.6.

Region of Influence

The region of influence for cultural resources includes all of San Nicolas Island.

Affected Environment

Archeological Resources. San Nicolas Island is rich in archeological resources. Over 500 prehistoric sites have been discovered and recorded on the island. These include villages, food-processing areas, shell middens, cobble outcrops, camp sites, and stone-quarry sites. San Nicolas Island is also known for its sandstone cave art consisting of many pictographs (paintings) and petroglyphs (engravings) of local sea life including sharks, whales, porpoises, and fish. These locations and other archeologically sensitive areas are shown in Figure 3.6-5 (NAWC, 1993a).

Historic cultural resources include fish camps and early military sites (U.S. Army, 1994b). The island was acquired by the U.S. Navy in 1933. A number of facilities that have been built since but have not attained the age of 50 years demonstrate exceptional importance under either the Cold War or World War II contexts, making them potentially eligible for listing on the National Register of Historic Places.

Traditional Native American resources include two burial sites. No traditional sites associated with any other cultural group have been identified (U.S. Army, 1994b).

San Nicolas Island Paleontological Resources. San Nicolas Island is considered part of the Peninsular Range of Southern California. Paleontological resources that occur on San Nicolas Island include several species of foraminifera (Eocene age) and mollusks (Pliocene age), both of which have proven useful for interpretation of paleoenvironments. Pleistocene vertebrate fossils include birds, sea lions, and seals (U.S. Army, 1994b).

Environmental Consequences

No environmental consequences for cultural or paleontological resources would be expected at San Nicolas Island. Activities associated with the airborne laser would consist of drone flights and Lance target-missile launches. Activities would occur on pre-existing runway and launch sites and would not involve the use of undisturbed land. Drone flights would take-off and land at the runway, and missiles would be launched from preexisting launch sites and destroyed over the Pacific Ocean within the boundaries of WCOOA. Should any unforseen cultural or paleontological resources be encountered during operation of the ABL project, activity would be suspended until the Base Historic Preservation officer was notified and consulted.

3.6.7 HAZARDOUS MATERIALS AND WASTE

A general discussion of hazardous materials and waste and all applicable laws and regulations is provided in Section 3.0.7.

Region of Influence

The region of influence for hazardous materials/waste includes the entire Island of San Nicolas. However, the region of influence may extend beyond the island's boundary along the established transportation networks in the event of an accidental release of hazardous materials or hazardous waste.

Affected Environment

Point Mugu uses a variety of hazardous materials and generates a variety of hazardous waste. Hazardous materials/hazardous waste-management guidelines for San Nicolas Island are provided by the Point Mugu Hazardous Waste Management Plan. Hazardous materials used in base-infrastructure support activities include various cleaning solvents, paints, cleaning fluids, motor fuels and other petroleum products. These materials are procured through Point Mugu and are held in a hazardous- materials storage area pending shipment to San Nicolas Island. At San Nicolas Island, hazardous materials are stored in a designated location until issued to the using organization (U.S. Army, 1994b).

Hazardous materials are stored in accordance with established procedures applicable to individual operations. The use of all hazardous materials is subject to ongoing inspection by Point Mugu environmental compliance and safety offices to ensure the safe and proper use of all materials. Organizations using San Nicolas Island facilities for test operations are required to notify the Point Mugu Environmental Division concerning all proposed uses of hazardous material (U.S. Army, 1994b).

Most of the hazardous materials brought to San Nicolas Island are used in operational processes. Hazardous waste is initially collected at the point of generation by the using organization. Each organization must properly containerize, label, and store the waste. Once waste containers are full or accumulation time exceeds one month, the waste is transported to a satellite accumulation point near the point of generation. Point Mugu's Environmental Division is notified to arrange for disposal of the waste. The waste is picked up and transported to San Nicolas Island Central Staging Area (U. S. Army, 1994b).

At the Central Staging Area, hazardous waste is turned over to the Defense Reutilization and Marketing Office, which performs final packaging and characterization of the waste, when necessary. Waste is barged off the island to Port Hueneme, where it is accepted by a licensed hazardous-waste hauler for transport to a hazardous-waste recycling or disposal facility. No hazardous waste from San Nicolas Island is stored at Port Hueneme.

Environmental Consequences

PDRR ABL Diagnostic and Expanded Range activities expected to use and generate hazardous materials/waste include target-missile and drone launches. These activities are expected to have a low impact on the environment.

Classes of hazardous materials proposed for use in target-missile and drone pre-launch and launch activities would be similar to hazardous materials currently in use at San Nicolas Island. Solvents, lubricants, and other materials are used in the pre-flight preparations of launch systems. Solid propellants and other explosives are widely used in current systems, and liquid propellants (hypergolic

and cryogenic) are used in some missile-flight systems. The use of the Lance missile for test activities would preclude any need for local fueling operations, thereby eliminating the handling and storage of liquid propellants during ABL test activities.

Proposed PDRR ABL Phase use of pre-launch solvents and materials would increase the total usage of hazardous materials at San Nicolas Island but would not change the types of materials handled and stored. Procurement, handling, and use of hazardous materials at San Nicolas Island would be the responsibility of the ABL Program. However, Point Mugu's Environmental Division would provide oversight to ensure that operations are conducted in accordance with established procedures.

Limited quantities of hazardous waste may be generated by the proposed target-missile and drone prelaunch activities at San Nicolas Island. These may include unused or contaminated cleaning solvents, or unused lubricants or hydraulic fluids. Similar waste types are currently generated at San Nicolas Island during current operations. Motor fuels and cleaning solvents are routinely collected and disposed of. The pre-fueled Lance missile would not generate any propellant hazardous wastes. Normal target-missile launch operations would not produce any hazardous waste at San Nicolas Island.

3.6.8 HEALTH AND SAFETY

A general discussion of health and safety and all applicable laws and regulations is provided in Section 3.0.8.

Region of Influence

Since the health and safety standards applicable to workers and to the public differ, separate regions of influence are considered. For worker safety the immediate work location is considered. This would include the areas where target-preparation and launch operations occur. For public safety, a larger area is used. Potential safety hazards to the public from target-launch and flight operations may include explosion, impact of debris, release of toxic materials, high-noise levels, or fire. The region of influence would vary depending on the type of operation and may extend for many miles. During missile operations the region of influence for the public would include the launch area, flight path, and predicted impact areas. The region of influence for public safety includes San Nicolas Island and the WCOOA.

Affected Environment

Point Mugu and San Nicolas Island are well-equipped for a variety of range activities. The U.S. Navy is involved in the ongoing test and evaluation of various conventional airborne-munitions. Performance of these operations in a safe manner is a primary objective. To accomplish this, the U.S. Navy has instituted an aggressive safety-evaluation and control system that is applicable for all test operations. The U.S. Navy has conducted an average of over 300 missile launches and 230 drone missions in each of the past five years. Safety procedures have been developed as a result of past testing efforts.

Safety requirements for test operations at San Nicolas Island are defined in the Sea Range Safety Handbook, (NAWC, 1993b). The U.S. Navy requires that prior to any range operations at San Nicolas Island involving missile launches. Range Safety Operational Plans must be developed, and a Sea Range Safety Approval must be obtained from the Sea Range Safety Office. The plan must address all range safety requirements, such as safety-clear zones and responsibilities of range-safety officers. Users of lasers must provide complete operating specifications of the laser and a detailed description of the planned use.

Environmental Consequences

Activities that could impact health and safety of workers and the public at San Nicolas Island include preparation of targets, launch and flight safety/mishaps, debris recovery, and laser engagements. Established procedures would be followed to ensure health and safety.

Barging. According to information currently being prepared by the Department of the Navy in the Draft Environmental Assessment on San Nicolas Barge Operations, operations in support of the Naval facilities located on the island have been ongoing since the mid-1940s. The barges are pulled from Port Hueneme to San Nicolas by tugboat approximately 26 times annually. The barges carry heavy equipment, fuel trucks, and any items that cannot be transported by aircraft. The bi-monthly operations occur in the early morning hours when wind and swell activity is relatively calm, and the safety record of current operations is very good.

PDRR ABL activities may include transporting the missiles to the island by barge. Since public access to San Nicolas Island is very restricted, potential safety impacts on humans from barge offloading operations are essentially limited to those on authorized civilian contractors and military personnel. Barge landing safety issues, generally, and emergency response protocol are identified in Navy Safety Response Plans, and barge operations are conducted in accordance with those guidelines and regulations. Because the likelihood of a barge-operations mishap is very low, no accident scenario was discussed in Appendix C.

Transportation and Preparation of Targets. The transportation of the target missiles is subject to both federal and state regulations, including handling, labeling, and routing requirements. The Lance missile, specifically, is shipped in a specially designed container to protect the missile in case of an accident. National Highway Traffic Safety Administration statistics show that the fatal accident rate for large trucks is one accident in every 37 million miles, making it a very rare occurrence. The likelihood of any impact on human health and safety from the transportation of targets to the various sites is insignificant.

All pre-launch hazardous operations (e.g., handling of explosives and hazardous materials) would be conducted in accordance with established standard operating procedures and would not impact health and safety. The Lance missiles would arrive at Point Mugu prefueled, certified ready to fire, and be shipped by barge to San Nicolas Island. The missile and its fuels would not be handled extensively, if a missile is not used immediately, it would be stored in an explosives-rated facility. Prior to firing, the missile would be transported to the launch location and placed on the launcher. The fins would be attached and the missile elevated into firing position. Critical missile-guidance components would be checked and flight parameters programmed into the missile. Next, the portable firing device would be unreeled to a safe area approximately 100 m (328 ft) from the launch location and activated on command.

Safety procedures have been established for accidental releases of the fuel and/or oxidizer from the Lance missile (Chapter 2 of the DS and GS Maintenance Manual [U.S. Army, 1984]). Monitoring of the workplace would enable personnel to detect and warn others of the presence of toxic vapors.

Launch and Flight Safety/Mishaps. Prior to launch, an evaluation would be made to ensure that populated areas, critical range assets, and civilian property susceptible to damage are outside predicted impact limits. A Notice to Mariners and a Notice to Airmen would be published and circulated in accordance with established procedures to provide warning to personnel (including recreational users of the range space and controlled sea areas) concerning any potential debris-recovery areas that should be avoided. Radar and visual sweeps of hazard areas would be accomplished immediately prior to launch to ensure they are clear of non-critical personnel. At launch time, the missile would be armed only after all

required safety evacuations had been accomplished to ensure that no unauthorized personnel are present in hazardous areas. Following arming, positive control of the hazard areas would be established. Unauthorized entry into the hazard area would result in delay of the operation until an "ALL CLEAR" has been reestablished.

Successful launch activities would involve only small potential hazards, mainly for personnel in the immediate area of the launch site. This potential hazard would be controlled since personnel would be in protected facilities or evacuated from the launch-hazard area.

During normal launches, the exhaust products from the Lance missile pose no health or safety risk. Appendix D lists the Lance missile's exhaust products. The only hazardous exhaust products in the lower atmosphere would be 0.05 kg (0.1 lb) of hydrochloric acid per launch. These emission quantities are well below levels of concern (10 tons per year, 5 ppm of HCl). A spill of either unsymmetrical dimethyihydrazine (UDMH) or inhibited red-fuming nitric acid (IRFNA) from the Lance missile would cause the formation of a cloud of toxic material. A spill of the entire contents of the Lance's fuel tank would result in a toxic corridor (downwind), if both UDMH and IRFNA were released simultaneously, they would ignite and burn and the resulting combustion products are not toxic. The dimensions of the toxic corridor are dependent on the wind velocity. Using exposure limits of a 15 minute time-weighted average concentration of 15 parts per million (ppm) for UDMH and 25 ppm for IRFNA, analysis in Appendix C shows that the dimensions of the toxic corridors would be 155 by 40 m (508 by 130 ft) and 100 by 30 m (328 by 98 ft), respectively, at a wind velocity of 5 m/sec (11 mph). As the wind velocity decreases, the length of the toxic corridor also decreases. At a wind velocity of 1 m/sec (2.2 mph) the length of the corridors are 87 m (285 ft) for UDMH and 45 m (150 ft) for IRENA.

Debris Impact. If San Nicolas Island is used as both the Diagnostic and Expanded-Area Test Range, there is the possibility of 16 Lance missile launches. Of these, only six would be involved in HEL engagements with the intent of causing the target to fail. The remaining 10 missiles would impact monolithically into the ocean approximately 130 km (80 mi) downrange. The HEL would not engage a Lance missile until the missile had achieved an altitude greater than 40,000 ft. At that altitude, the missile would be traveling over 1,000 m/sec (2,230 mph), at a flight-path angle of approximately 50 degrees, and more than 11 km (7 mi) downrange. A preliminary analysis of the Lance missile debris-impact pattern and location is presented in Appendix G. The results of this analysis indicate that the missile will break up into 72 fragments, of which only 6 would have over 15 joules of kinetic energy when they hit the ocean. Fifteen joules of kinetic energy has been recommended as the lower limit below which fragments would no longer be hazardous to humans (Cole and Wolfe, 1996). These six higher kinetic-energy fragments were predicted to hit the ocean between 13 to 24 km (8 to 15 mi) downrange in an area ranging from a little over 2 to nearly 8 square km (0.8 to nearly 3 square mi). The distance downrange and the size of the fragment pattern is dependent on the time when the missile is destroyed in flight (20, 25, or 30 seconds).

Laser Engagements. The use of lasers by the PDRR ABL Phase would be carefully controlled to minimizethe health and safety risks to both workers and the public at San Nicolas Island. During all engagement scenarios, the lasers on the PDRR ABL would be pointing horizontally or in an upward direction. This would preclude the direct impact of lasers on humans or wildlife since the aircraft would be flying at approximately 40,000 ft AMSL. The only possible impact would be from laser energy reflected from the targets. The analysis in Appendix F shows that reflected-energy levels at 10,000 ft AMSL would be below maximum permissible exposure for humans limits. These exposure limits are defined in the *American National Standard for Safe Use of Lasers*, ANSI Z136.1-1993. Point Mugu's Laser Safety Officer will perform an independent safety analysis and compare it to the safety analysis prepared by the ABL System Program Office.

The Lance missile has not been fired from San Nicolas Island since 1960, and a HEL has never been used to destroy a boosting theater-ballistic missile. That combination, plus the preparation of targets, launch and flight safety/mishaps, debris impact (where applicable), and laser engagements as described above, would represent a moderate increase in health and safety risks. The U.S. Navy requires all hazardous activities to undergo rigorous analysis prior to being approved and conducted.

3.6.9 LAND USE

A general discussion of land use and all applicable laws and regulations is provided in Section 3.0.9.

Region of Influence

The region of influence on land use from activities at San Nicolas Island would include the areas immediately surrounding the missile-launch areas, the areas in the immediate vicinity of the runway, and the areas over the Pacific Ocean in the line of the missile trajectory.

Affected Environment

Land Use of Adjacent Jurisdiction. Four major maritime-traffic routes pass near San Nicolas Island in the Southern California Bight (Figure 3.6-6). The two closest routes account for approximately ten percent of the maritime traffic in southern California (NAWS, 1995). The island serves as a destination for many commercial-fishing operations. The volume of fishing operations is relatively consistent throughout the year, although it does increase slightly in September through December. Commercial-fishing activity in the vicinity of the island consists mainly of the harvest of abalone and sea urchins in shallow water near the shore (NAWS, 1995).

Land Use at San Nicolas Island. San Nicolas Island is entirely owned and operated by the U.S. Navy and only a small portion of the land is developed. Several land-use categories have been identified, including airfield support, test and evaluation, ordnance, operations, public works, community support, administration, supply/storage, utilities, and open space (Figure 3.6-7). The pattern of land use is dispersed, largely because of the nature of the operations taking place and because of specific siting requirements. However, the majority of the facilities on the island are located on the central plateau and the two launching facilities are located on the western end of the island.

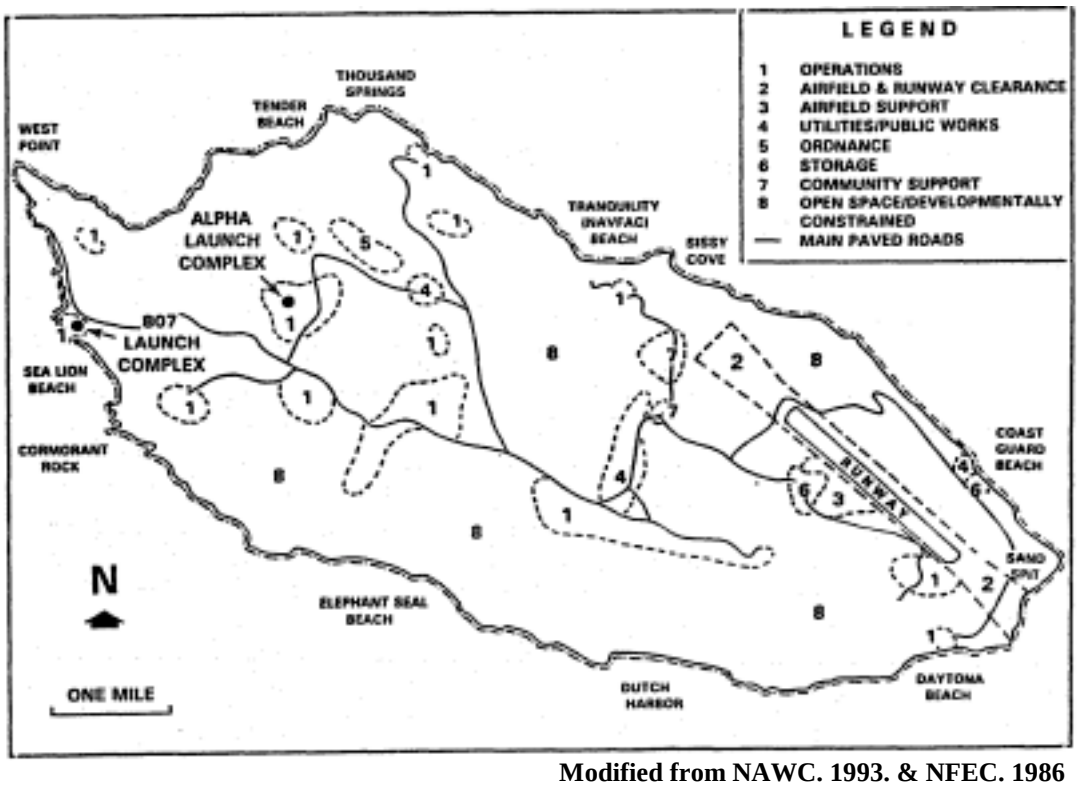
The San Nicolas Island airfield is located on the central plateau on the eastern half of the island. The runway, which is currently undergoing major repairs, is used for personnel and cargo transport. The U.S. Navy uses various beaches for off-loading supplies and storage of materials. The island serves as a wildlife and environmental-preservation area. Natural resources on the island are managed jointly by the U.S. Navy, the Department of the Interior, and the California Department of Fish and Game. Because of the remote location the general public rarely visits the island. However, personnel stationed on the island have access to and can use any open beaches for recreational purposes.

Land Use Plans and Policies. Land-use planning for San Nicolas Island is included in the Master Plan for the Pacific Missile Test Center at Point Mugu. The Plan describes the functions of the various land-use categories, the functional incompatibilities of the land-use configurations, and constraints placed on land uses. The Plan calls for the continued use of the island as a launch platform for short- and medium-range missile testing and as an observation facility for missile testing.

Western Range (Point Mugu Naval Air Weapons Center Weapons Division and San Nicolas Island)

Modified from NAWS, 1995

Figure 3.6-6. Maritime Traffic Routes at Southern California Bight



Modified from NAWC. 1993. & NFEC. 1986

Figure 3.6-7. Land Use Map at San Nicolas Island, Point Mugu Naval Air Warfare Center Weapons Division, California

Environmental Consequences

The 20 to 30 flights of the PDRR ABL would not impact land-use patterns. The aircraft would fly at an operational altitude of approximately 40,000 ft AMSL, approximately 160 km (100 mi) offshore of San Nicolas Island in the West Coast Offshore Operational Area. The four drone flights would not change land-use patterns. The drone flights would originate and terminate at the runway at San Nicolas Island and would be similar in nature to the substantial number of military flights now conducted at the facility. The drone flights would take place in airspace restricted for military aircraft flight.

The two existing missile-launch facilities at San Nicolas Island would be used to launch up to 16 Lance missiles during the diagnostic and expanded-area tests and would not change the overall land-use plans and patterns at San Nicolas Island. The launches would be consistent with missile research and testing operations that are part of San Nicolas Island's mission as a critical element of the U.S. Navy's Sea Test Range.

During missile launches it would be necessary to clear the adjacent areas of the Pacific Ocean in the trajectory path of the missile for less than one hour. Clearance of the area would temporarily impact commercial and recreational use of beaches and waters, but the impacts on utilization of the San Nicolas Island's offshore areas would be negligible.

All ocean vessels would be notified in advance of launch activities by a Notice to Mariners from the appropriate safety office of the 11th Coast Guard District as part of their routine operations. Missile launches occur regularly in the area, and because ocean vessels are already notified on a regular basis, the impact of missile launches on marine traffic would be negligible.

Because the PDRR ABL Phase activities at San Nicolas Island could have the potential to affect coastal resources (such as access to beaches, recreational use of the coastal zone, commercial-shipping lanes, and commercial and recreational fishing), a Coastal Consistency Determination in compliance with the California Coastal Management Program would be required. This determination would need to provide an evaluation of the project's effects on the coastal resources. However, because the activities would be similar to current activities at San Nicolas Island there would be negligible new impact on coastal resources.

3.6.10 NOISE

A general discussion of noise and all applicable laws and regulations is provided in Section 3.0.10.

Region of Influence

Because San Nicolas Island is only 15 km (9 mi) long, the region of influence includes the entire island.

Affected Environment

During periods when U.S. Navy launch and testing operations are not conducted, the background noise on the island is low, is primarily from wind and wave action, and varies according to the wind speed and wave size (U.S. Army, 1994b). The ambient-noise level on San Nicolas Island has not been measured and no Air Installation Compatibility Use Zone study has been prepared (NFEC, 1986).

The two launch areas on San Nicolas Island that are currently used for missiles similar in size to the Lance missile and would have similar noise impacts. The Alpha Launch Complex is used to launch the MQM-8G/ER VANDAL and the BQM-74C, and the Building 807 Launch Complex is used to launch the TOMAHAWK and Rolling Airframe Missiles (NAWC, 1993a).

Environmental Consequences

Lance missile launches would increase ambient-noise levels at San Nicolas Island for very short periods of time (less than 10 seconds). Noise generated by missile flights can be grouped into two categories: launch noise and flight noise. The noise from rocket launches has been investigated for some time (McInery, 1991) and quantitative estimates of noise levels at distances from the launch have been made. The same cannot be said for flight noise. Each of these categories is discussed in the following paragraphs.

Launch Noise. A peak sound-pressure level of 147 dB has been measured at a distance of 90 m (295 feet) from a Lance missile launch (U.S. Army, 1995a). Noise levels at 1 and 10 km (0.6 and 6 mi) from the launch area would be approximately 125 and 90 dB, respectively. The terrain, relative humidity, and temperature would reduce these noise levels (Rau and Wooten, 1980). The impact of launch noise on wildlife is discussed in Section 3.6.4.

Operations personnel would be in blockhouses and protected from noise by the sound attenuation provided by the buildings' construction. Other personnel would be required to be outside the launch-hazard area, approximately 1.5 km (1 mi) away. Noise levels at this distance would be below the 140 dB OSHA limit for impact noise exposure (29 CFR § 1910.95; AFOSH STD 48-19). If personnel are required to be within the launch-hazard area and outside a blockhouse, personal protective equipment, such as earplugs, earmuffs, or headphones, would be used. This protective equipment reduces noise levels by 30 dB.

Flight Noise. Potential noise impacts from the flight of a target-missile include sonic booms. Sonic booms would occur with each target missile launch after the vehicle exceeded the speed of sound, approximately 2 seconds for the Lance missile. The sonic boom footprint from the Lance missile would not affect the immediate area around the launch site (less than 500 meters, 1640 ft). The sonic boom have an intensity of approximately 145 dB and a duration of less than 0.035 seconds. The intensity of the sonic boom is nearly equal to the noise level produced by the missile's motor.

3.6.11 RECREATION AND VISUAL RESOURCES

An general discussion of recreation and visual resources and all applicable laws and regulations is provided in Section 3.0.11.

Region of Influence

The region of influence for recreational and visual resources is defined as recreation, aesthetic, and public interest areas along the coastline and coastal waters adjacent to San Nicolas Island.

Affected Environment

Access to San Nicolas Island is restricted and not open to public use. There are no unrestricted public recreation areas on the island. The affected environment, therefore, is limited to impacts that the PDRR ABL Phase activities would have on visual resources. The natural landscape and the ocean are the dominant features. The *San Nicolas Island Barge Operations Draft Environmental Assessment* describes the vegetation as generally treeless, mostly coarse grasses, with few large shrubs. The topography consists of a rolling mesa in the interior of the island, with large shifting sand dunes at the western end, a large sand spit at the eastern end, and cliffs rising from 300 to 700 feet within a mile of the shore on both the south and north sides of the island.

Environmental Consequences

The four drone launches from existing runways on San Nicolas Island would not impact the recreational use of Pacific Ocean waters. Missile launches from existing facilities at San Nicolas Island may require the temporary clearance of the adjoining Pacific Ocean in front of the launch pad to the southwest. Temporary clearances would consist of circulating Notice to Mariners and Notice to Airmen publications prior to launching missiles. The establishment and activation of a launch-hazard area for both the launch areas and the Building 807 Launch Complex would require the temporary clearance of the adjoining Pacific Ocean. Temporary clearance of the launch-hazard area up to 20 times during the nine-month flight-test period may have an impact on recreational use of these waters, particularly the sport-fishing industry. However, with implementation of mitigation measures, particularly adequate prior notice, the impacts on recreational use would be low. An increase in personnel would not result in any overcrowding or overuse of any facility. Impacts on recreational use at San Nicolas Island and the surrounding area would be low.

3.6.12 INFRASTRUCTURE AND TRANSPORTATION

A general discussion of infrastructure and transportation resources is provided in Section 3.0.12.

Region of Influence

The region of influence for infrastructure and transportation is San Nicolas Island.

Affected Environment

Electrical Power. No commercial power is available on San Nicolas Island. Electrical power is generated by five 4,160-volt diesel generators with a combined capacity of 3.5 megawatts (MW). The average rating of the five generators is 700 kW and the largest generator is 1 MW. Because the current peak demand is less than 1100 kW, the smallest three generators are capable of meeting the power needs of the island. A 10,000- gallon JP-5 jet fuel tank is located adjacent to the generator plant. The electrical power is distributed around the island by three 4,160-volt feeders.

Water System. Numerous fresh-water wells and catchments installed at various locations on the island are the primary sources of fresh water. In addition to the wells and catchments, two reverse-osmosis desalination units were installed in 1990 at the Harbor Area. Each unit has a capacity of 600 gallons per hour. Generally, water from the wells, catchments, and reverse-osmosis plant is pumped to a local storage tank, then to large main tanks, and from the main tanks to the facilities throughout the island. Three storage tanks located adjacent to the pumphouse in Building N196 have a combined capacity of 70,000 gallons. Fresh water can be shipped in via a barge or water tankers. These methods are very expensive and are used only as a last resort. The wells, catchments, and reverse-osmosis desalination units have a capacity to produce 40,000 gallons per day. Daily consumption of water ranges from 13,000 to 17,000 gallons per day.

Wastewater System. The sewage system is comprised of 1,430 linear m (4,700 linear ft) of underground sewer lines, septic tanks, and oxidation ponds. Two septic tanks and leach fields dispose of the wastewater generated by facilities located at the airfield, and 36 septic tanks and leach fields serve the facilities in the outlying areas. The wastewater-treatment facility consists of three concrete-lined aeration ponds, a chlorination well, a concrete-lined conic surcharge pond, and aeration-pumping and spraying equipment.

Solid Waste Handling System. The majority of the solid waste generated on the island is incinerated. Metals and other noncombustible materials are barged off the island to Point Mugu for disposal.

Roads. Approximately 50 km (30 mi) of paved and a number of improved unpaved roads are on San Nicolas Island. Average daily traffic involves 25 to 30 vehicles, with as many as 100 vehicles being on the island at any one time.

Aircraft. The San Nicolas Island airfield is located near the southeastern edge of the mesa. The concrete and asphalt runway is 3,050 m (10,000 ft) long by 61 m (200 ft) wide and is capable of handling fighter aircraft and medium-size cargo aircraft (C-130). The majority of the personnel working on San Nicolas Island commute via contract commercial airline from Point Mugu.

Ships. The U.S. Navy uses barges to transport heavy cargo, aviation fuel, motor gasoline, and diesel oil to San Nicolas Island. The barges transport materials to the island approximately once every two weeks depending on program activity. Barges are brought in close to the beach on the southeast side of the island, vvhere an earthen ramp constructed of beach sand and borrow sand is used to offload cargo. After barge landings, the earthen ramp is mechanically removed.

Environmental Consequences

The impact to the infrastructure and transportation systems in the San Nicolas area would be minimal. Existing facilities and infrastructure at San Nicolas Island would be used to launch targets for the PDRR ABL Phase. Personnel already employed at Point Mugu and San Nicolas Island would be used for range operations and support. The number of target operations during the diagnostic and expanded-area test programs would not exceed 16 missile launches and 4 drone launches during a 9-month period. The presence of ten temporary PDRR ABL Phase personnel during a 10-day period straddling each flight test would not adversely impact the infrastructure or transportation at San Nicolas Island.

3.6.13 SOCIOECONOMICS

A general discussion of socioeconomics and all applicable laws and regulations is provided in **Section 3.0.13.**

Region of Influence

The region of influence for Point Mugu is a portion of Ventura County, California.

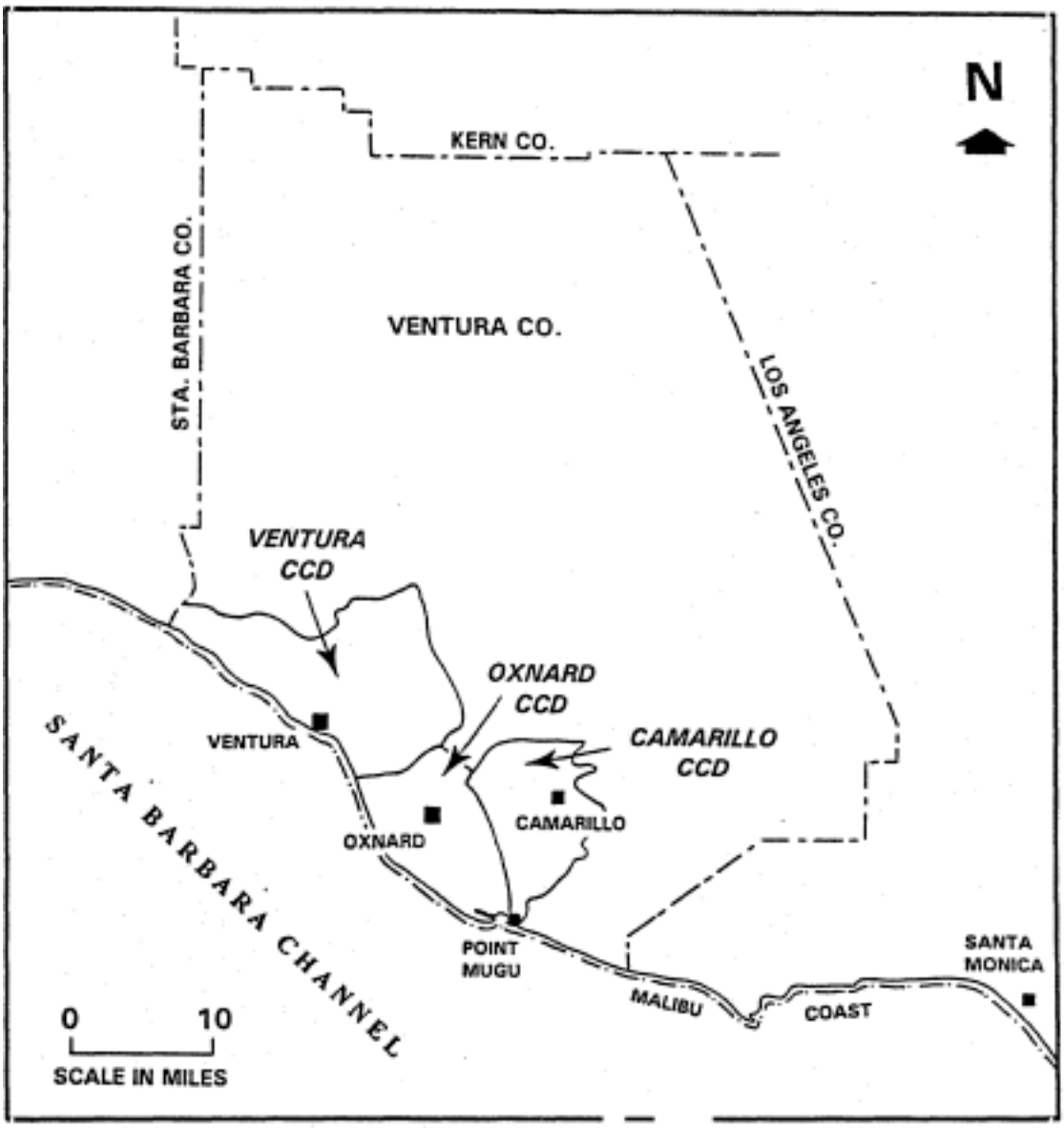
Affected Environment

The Main Base at Point Mugu is located in the southern portion of Ventura County, California. Point Mugu includes San Nicolas Island, which lies approximately 100 km (60 mi) to the southwest of the Main Base in the Pacific. No housing is available on the island, however, and temporary test personnel would be flown out daily from the mainland. Based upon an analysis of transportation access routes, existing residence and commuting patterns, and availability of transient housing, the affected environment would be limited to the Ventura, Oxnard, and Camarillo Census County Divisions (CCDs) in Ventura County (Figure 3.6-8). The impacted communities within the affected environment are Camarillo, 15 km (9 mi) to the north of the Main Base, and Oxnard and Ventura, 13 and 19 km (8 and 12 mi**)** to the northwest, respectively.

The impacted communities are sufficient in size to provide temporary accommodations for the Point Mugu temporary test personnel during the proposed 20 one-week launch periods. Temporary personnel typically will stay in one of the three communities previously mentioned because of their proximity to the

Main Base. A total of 4,699 hotel/motel rooms are available in the three communities, with 789 in Camarillo, 1832 in Oxnard, and 2,078 in Ventura (Camarillo, Ventura and Oxnard Chambers of Commerce, 1995). Further, more than 600 restaurants and fast-food establishments are located in the area (ProCD Inc., 1996; Camarillo and Oxnard Chambers of Commerce, 1995).

California Development Department statistics indicate that the average civilian labor force in the region of influence in 1995 was 183,844 persons, with an average 16,164 (8.8 percent) unemployed. No immigration of people would be expected to fill any positions.



Modified from Bureau of Census, 1990

Figure 3.6-8. Socioeconomic Region of Influence at Western Range (Point Mugu), California

Environmental Consequences

Diagnostic and expanded-area testing at Point Mugu may last up to nine months and involve up to 30 flights. **Approximately ten temporary test personnel are expected to rotate into the area for one week** (five-day week) **for each** of ten diagnostic-test flights and ten expanded-area test flights. Ten of the 30 flights would not involve additional temporary personnel. The markets that may be impacted by the demand for temporary housing and restaurant facilities would be Oxnard, Ventura, and Camarillo. Economic advantage from the temporary posting of personnel would primarily benefit hotels/motels and restaurants in the region of influence.

Assuming a 55-percent annual motel/hotel occupancy rate in the region of influence (Ventura Visitors Bureau, 1995, Oxnard and Camarillo Chambers of Commerce, 1995), 2,584 rooms would be available in the three communities to accommodate the ten temporary personnel at Point Mugu.

Estimated annual demand from Diagnostic and Expanded-Area Test Range personnel would be 1,000 room-nights (10 personnel x 20 weeks x 5 days/week) and a potential $102,000 (1000 room-nights x $102/night) annual motel/ hotel revenues. In addition, the temporary personnel would generate $38,000 (1000 days x $38/day) in local restaurant revenues (41 CFR Part 301, Appendix A). Income generated from local meals and incidental expenditures and hotel/motel stays is estimated based on General Services Administration Federal Travel Directory guideline for individual region of influence markets. The anticipated $140,000 in additional revenue that would be generated by the posting of temporary personnel at Point Mugu would have negligible impact on the affected communities.

3.6.14 ENVIRONMENTAL JUSTICE

A general discussion of environmental justice and all applicable laws and regulations is provided in Section 3.0.14.

The activities associated with diagnostic testing at Point Mugu would not occur in populated areas (Section 3.0.14.2). Therefore, environmental justice would not be affected.

3.6.15 CUMULATIVE IMPACTS

Activities and resource attributes associated with implementing PDRR ABL Expanded-Area Test Range activities at Point Mugu/San Nicolas Island which may contribute to cumulative impacts are summarized in this section. No specific information regarding activities which may be scheduled at Point Mugu/San Nicolas Island in the year 2002 is currently available for analysis. A more detailed analysis will be done as the information becomes available and as system-test details are defined.

Missile and Drone Launches. An average of 300 missiles and 230 drones are launched annually from Point Mugu/San Nicolas Island. The possible 16 missile launches and 4 drone flights associated with the PDRR ABL Phase over a nine-month period would result in an increase of only *5* percent in the number of missiles launched and an increase of only 2 percent in the number of drone missions.

Air Quality. Although air quality would be minimally impacted by PDRR ABL Phase operations, emissions from target preparations and operations would increase yearly emissions by less than 0.1 percent, well within the Ventura County Air Pollution Control District's allowed limits.

Airspace. Access to airspace may be restricted during missile launches related to the PDRR ABL Phase. However, launches would occur in restricted-area or warning-area airspace and would be of short duration.

Biological Resources. PDRR ABL Phase activities may result in cumulative impacts to biological resources at San Nicolas Island. Because noise levels associated with missile launches have been shown to result in "startle response" in marine mammals and nesting shorebirds, the increased frequency of launches attributed to the PDRR ABL Phase may cause cumulative impacts to wildlife.

Noise. Ambient noise levels would temporarily increase because of missile and drone launches. Missile launches may also require temporary clearing of areas of the Pacific Ocean adjacent to the trajectory path of the missile. However, because of the minimal number of launches associated with the PDRR ABL Phase and the short duration of the launch activities, no cumulative adverse impacts would occur.

Hazardous Materials and Waste. PDRR ABL Phase activities at Point Mugu/San Nicolas Island would result in slightly larger amounts of hazardous-materials usage and hazardous-waste generation. However, the existing permitted storage facilities for these materials have adequate capacity for the additional material.

3.6.16 ADVERSE ENVIRONMENTAL IMPACTS THAT CANNOT BE AVOIDED

Unavoidable adverse impacts that may arise as a result of implementing the PDRR ABL flight test activities at Point Mugu/San Nicolas Island are discussed in the following subsections by attribute.

Air Quality. PDRR ABL test activities would produce air pollutants. These pollutants may be generated by various sources, from missile and drone launches to automobile use. For launches and attendant ground operations, environmental impacts would generally be short-term, minor, and nonpersistent. Some gases and particulate matter would be emitted into the ambient atmosphere during missile launches. Under most atmospheric conditions, these pollutants would quickly and easily disperse into the atmosphere.

Airspace. Access to the selected, restricted airspace by general aviation during flight tests would be denied for short periods of time during missile launches.

Biological Resources. Minor noise impacts to birds and marine mammals at the Western Range could not be avoided.

Geology, Soils, and Water Resources. Test missile and target debris would not be fully recovered from its impact site in the ocean. Resulting ocean pollution would be unavoidable but minor.

Noise. Noise from traffic, aircraft overflight, missile launch, and sonic boom cannot be totally mitigated. Though missile and aircraft noise could disturb animals, it is part of the existing environment at Point Mugu/San Nicolas Island. None of these impacts would be major.

Recreational and Visual Resources. Recreational access to certain areas on or near the ranges would be curtailed during certain launch activities.

3.6.17 MITIGATION MEASURES

This section summarizes mitigation measures that would be considered beyond adherence to all laws, regulations, and guidelines to control or reduce impacts on the environment as a result of expanded-area activities. Because of the negligible impact that PDRR ABL Phase activities will have on most attributes and the additional measures already taken by USAF, no separate mitigation plan is currently deemed necessary Nevertheless, we have outlined areas needing special attention and management, depending on the specific actions to be taken at a facility, the level of impact, and other pertinent factors.

Biological Resources. Additional NEPA documentation will be developed to consider site-specific impacts to biological resources. Based on consultation with the FWS and the NMFS, appropriate mitigation measures may be taken. In part, such measures may include: selection of launch sites with reduced potential for impacts, scheduling (seasonal and diurnal) of launches to reduce impacts, and/or surveying or monitoring local species

3.7 UPPER ATMOSPHERE

3.7.1 INTRODUCTION

Air quality and upper atmospheric impacts are two related, but separate, aspects of the PDRR ABL system that are examined in this FEIS. Air quality defines the state of air resources in the layer of the atmosphere that is closest to the earth and in which weather occurs. The impacts on air quality are a matter of local concern and depend upon the emission rates of the pollutants, the local air quality control district regulations, and the level of enforcement by the regulatory agency. This is described in Section 3.0.2. The U.S. Environmental Protection Agency uses 1 km above ground level (AGL) as the default mixing height to evaluate air quality environmental impacts on the human environment. This lower portion of the troposphere which is in contact with the earth's surface is called the surface boundary layer. The upper atmospheric issues discussed in this section extend from above the surface boundary layer in the troposphere to approximately 50 km into the stratosphere (Figure 3.7-1). The PDRR ABL would fly against missile targets to be launched at the test ranges. Both HEL weapon system and target missile effluents would be released into the upper atmosphere. The convention used to describe altitude in this chapter is kilometers, without the conversion to feet.

Region of Influence

The region of influence for upper atmospheric impacts starts above the boundary layer at approximately 1 km AGL and extends to 50 km AGL. The region includes the troposphere and the stratosphere. The ABL aircraft would conduct flight operations from the earth's surface to just over 12 km. and one of the target missiles, the Black Brant, may burn over an altitude span from 5 to 44 km.

Affected Environment

The atmosphere can be described as a medium characterized by its chemical constituents and the physical forces that make it change. Chemically, it contains a set of constituents that are relatively constant, such as nitrogen, oxygen, argon and neon and another set of chemical constituents that exist in variable concentrations, such as water vapor, carbon dioxide, methane and carbon monoxide (Godish, 1991). A temperature profile can be used to subdivide the atmosphere into zones. The temperature profile of the atmospheric layers affected by the PDRR ABL Phase is depicted in Figure 3.7-2. The lowest level, from the surface to 1 km AGL, has been discussed in Section 3.0.2.

The troposphere, which extends from the surface up to approximately 10 km, contains 90 to *95* percent of all air mass (gas molecules). This is the portion of the atmosphere that supports life and is affected by weather, including dramatic temperature changes. Temperature in the troposphere decreases with altitude at an average rate of 6.50^{o} C/km. The troposphere is the key portion of the atmosphere in regulating the transport of both incoming sunshine and outgoing thermal radiation from the Earth's surface. The jet streams also occur in the troposphere, and high wind speeds are common which can contribute to rapid disbursement of emissions. At 12 km altitude, the average monthly wind speed above White Sands Missile Range varies from lows of 10 to 20 mph in July and August, to speeds greater than 70 mph, November through April. Wind velocities above the proposed locations in California are more constant. The minimum speeds of 20 to 30 mph occur only in July and increase to speeds greater than *45* mph in October through April (Johnson, 1997).

The tropopause is the transition zone between the troposphere and the stratosphere, and is defined as the zone where the temperature decrease of the troposphere (6.5^{0}C/km) drops dramatically and then begins to increase with altitude. The height of the tropopause is not constant, but changes both in time and location. The altitude of the tropopause varies from 8 km to over 15 km. The tropopause is higher in the

summer than in the winter, and it is higher in the tropics than in polar latitudes (Belinskii, 1948). The tropopause rises with the increase of the temperature of the troposphere. The stratosphere is above the tropopause and extends to approximately 48 km. It is characterized by a relatively stable environment with essentially no weather, minimal air volume, some horizontal winds, and gradual temperature increases with altitude. The current stratospheric burden of chlorine (based on a Cl volume mixing ration of 3.5 ppbv) is 2.45 million tons (NOAA, 1994). The ozone layer protects the earth and its inhabitants from harmful ultraviolet radiation from the sun.

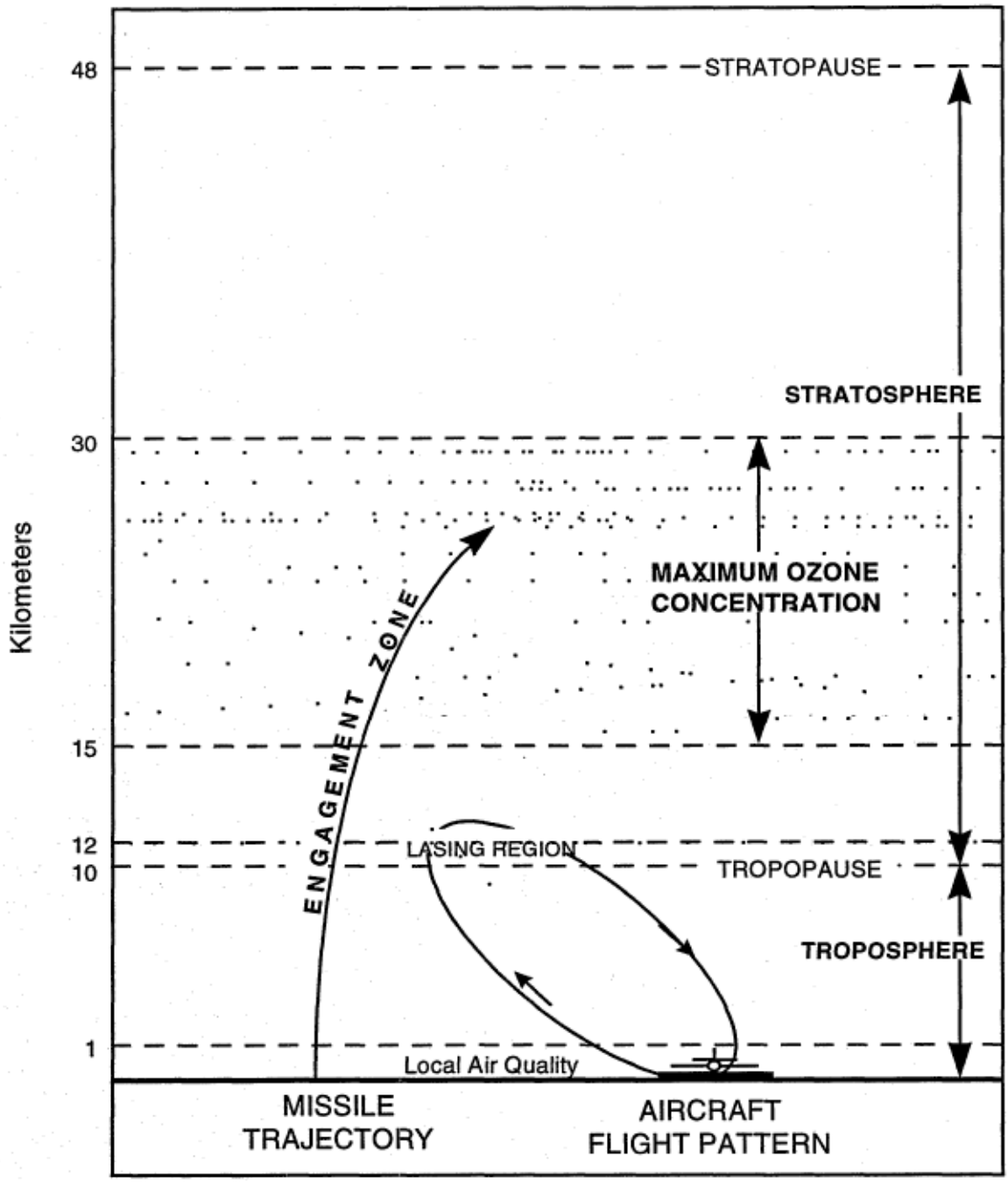


Figure 3.7-1. Atmospheric Layers

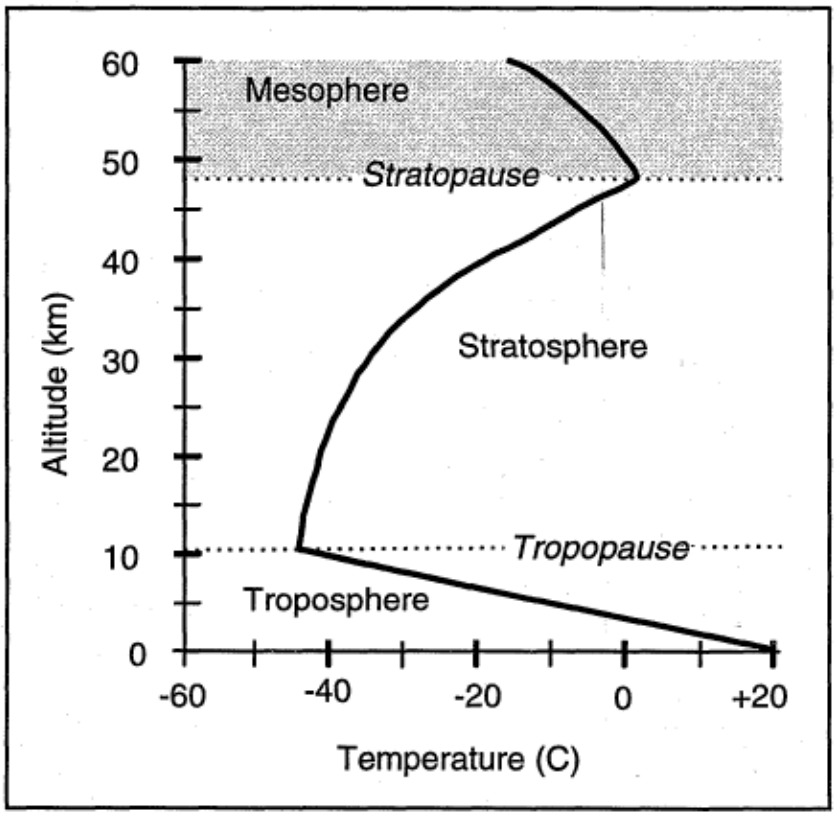


Figure 3.7-2. Temperature Profile of the Atmospheric Layers

Applicable Regulations

The upper atmosphere is not governmentally controlled like air quality in the boundary layer. There are very few regulations concerning pollutants in this region of the atmosphere. Title I of the CAA amendments is directed towards the reduction of National Ambient Air Quality Standards (NAAQS) criteria pollutants, and Title Ill addresses the emissions of substances for which no NAAQS have been set but which are still feared to be harmful to human health and the environment. The PDRR ABL aircraft does carry and exhaust chemicals whose emissions are regulated by Title Ill. However, release of small quantities of these chemicals at high altitude would pose no threat to humans or the environment.

Title VI of the CAA amendments addresses stratospheric ozone depletion by establishing a program with regulations for a phase-out of ozone depleting chemicals (ODCs). The program provides for the elimination of the manufacture of these chemicals by certain dates, depending upon the chemicals. Class I and Class II ODCs were identified as requiring action to replace them. Class I substances include chlorofluorocarbons (CFCs), halons, carbon tetrachloride and methyl chloroform. Class II substances include hydrochlorofluorocarbons. The Montreal Protocol of 1987, of which the United States is a signatory, and subsequent amendments to the Protocol discuss the major issues surrounding the ozonelayer depletion, and all agencies of the U.S. Government must comply with the Protocol. Implementing U.S. regulations that fulfill Montreal Protocol requirements are included when regulatory standards are periodically updated.

The Department of Defense has established regulations and policies to implement Title VI and the Montreal Protocol requirements. These regulations and policies forbid all use of Class I ODCs in new weapon systems without a special waiver from the Secretary of the Air Force. New weapon systems must incorporate non-halon fire suppression system. However, Major Air Commands can request a waiver for mission-critical halon applications to meet flight-safety requirements, as long as appropriate substitutes are not available (USAF, 1994g).

There are no U.S. regulations with specific regard to the problem of global warming. However, the Energy Policy Act of 1992 requires that the Energy Information Administration prepare a report on the aggregate U.S. national emissions of greenhouse gasses annually.

Environmental Consequences

The proposed PDRR ABL action that may impact the upper atmosphere can be divided into two general categories: normal operations and response to emergencies. Emissions during normal activities that will be analyzed are the exhaust products from the target missiles and the operation of the HEL weapon system. The effect of engine emissions in the upper atmosphere of the 30 flights of the B-747 and 4 flights of the target drone during the 9 months of Diagnostic and Expanded-Area flight testing will not be analyzed. Their incremental impact on the upper atmosphere is insignificant when compared to the millions of commercial and military flights occurring during the same time period. In 1995, for instance, there were over 15 million commercial jet aircraft flights worldwide (Boeing, 1996), 359,000 flights at Los Angeles International Airport (City of Los Angeles, 1997), over 90,000 flights at the Albuquerque International Airport (Santiago, 1996), and over 90,000 flights at Edwards AFB (USAF, 1994a). Emissions during emergencies that will be analyzed are the release of fire suppressant chemicals and the dumping of aircraft fuel and laser weapon system chemicals.

Normal Operations. During the nine-month Diagnostic and Expanded-Area flight tests, there are a projected total of 30 flights currently scheduled. Of these, only 16 would involve the use of the HEL weapon system. There are also 16 missile launches scheduled. However, it should be noted that the HEL weapon system will not be used during all missile launches. Many of the missile launches will be used to test the acquisition, tracking and pointing system.

All HEL operations would occur while the aircraft is at approximately 12 km altitude and each operation would be less than 30 seconds in duration. The release of emissions from the HEL weapon system would occur in the upper reaches of the troposphere, in the tropopause, or in the lower stratosphere. Since the 16 test flights involving HEL weapon system operation are spread over a 9 month period and each would have different flight paths, the emissions would not repeatedly impact a single geographic location.

Table 3.7-1 lists the estimated quantities of exhaust products from a typical, single HEL operation. At normal cruise speed, the mixing volume for the HEL exhaust products would be approximately 10 km^3. The concentrations of chemicals in the vicinity of the aircraft are also shown in Table 3.7-1. The only two chemicals which are classified as hazardous substances are ammonia and chlorine. The concentrations of these chemicals is very low and would not pose any hazards in the mixing volume. These concentrations would rapidly decrease to below detection levels as the high winds in the troposI)here further disperse the chemicals.

Table 3.7-1. Estimated HEL Gaseous Emissions

Chemical	Quantity (kg)	Concentration in Mixing Volume (ppm)
Water	540	0.0735
Carbon Dioxide	396	0.0220
Oxygen	270	0.0207
Helium/Nitrogen	108	0.0378
Ammonia	81	0.0117
Chlorine	36	0.0012
Hydrogen	23	0.0564
Iodine	13	0.0001

A complete listing of the emissions from each of the target missiles are shown in Appendix D. Over 97 percent of the Lance missile and first-stage Terrier emissions consist of water, carbon monoxide, carbon dioxide, nitrogen, and hydrogen. Additionally, nearly all of the emissions occur at altitudes of less than 10 km. The second stage Black Brant and Orion missiles would not begin firing until the missile had reached an altitude of approximately 10 km. The primary emissions consist of carbon monoxide, carbon dioxide, hydrogen chloride and aluminum oxide. The mixing volume for the missiles would be a long cylindrical tube-shape approximately 1 km in radius along the missile's flight path. The concentrations of the Black Brant and Orion emissions along the flight path are shown in Table 3.7-2. As with the exhaust from HEL weapon system operations, the concentrations in the mixing volume are very small and the winds in the upper troposphere and stratosphere would quickly dissipate the chemicals.

Table 3.7-2. Target Missile Emissions

Chemical	**Black Brent**		**Orion**	
	Quantity (kg)	**Concentration in Mixing Volume (ppm)**	**Quantity (kg)**	**Concentration in Mixing Volume (ppm)**
Carbon Monoxide	228	0.0015	50	0.0004
Carbon Dioxide	14	0.0001	44	0.0003
Aluminum Oxide	356	0.0003	31	>0.0001
Hydrogen Chloride	187	0.0010	64	0.0005
Water	40	0.0004	58	0.0040
Nitrogen	76	0.0011	26	0.0006
Hydrogen	30	0.0030	4	0.0008
Other	6	N/A	1	N/A

If the aircraft is operating in the troposphere, the chlorine emissions from the firing of the HEL would be quickly converted to forms that dissolve in water and would be removed from the atmosphere (NOAA, 1994) through precipitation. Thus, the chlorine would not be transported through the tropopause and have any impact on stratospheric ozone. Because ammonia is water soluble, it also has a short residence time in the atmosphere (approximately 20 days) and would be removed through precipitation (Seinfeld, 1986).

While Title VI of the Clean Air Act Amendments does not regulate chlorine emissions in the atmosphere, chlorine does destroy ozone. The background level of chlorine in the stratosphere is estimated to be 3.5 ppb (NOAA, 1994). If the ABL aircraft is operating in the lower stratosphere, the HEL emissions would temporarily increase the chlorine concentration in the mixing volume by approximately 35 percent. Similarly, the gaseous emissions from the Black Brant and the Orion would temporarily increase the level of chlorine-containing compounds in the mixing volume by approximately 28 and 14 percent, respectively. These increased levels would rapidly decrease to the background level within several hours, as stratospheric winds disperse the chlorine. Since the ABL flight tests would be spread out over a nine-month period, weather in the stratosphere would ensure that repeated launches would not have a local, cumulative effect. Table 3.7-3 shows a comparison of sources of stratospheric chlorine and PDRR ABL contributions. Other studies (AIAA, 1991; AFSMC, 1994; NASA, 1990; and NOAA, 1994) on the effect of chlorine emissions by large space-launch vehicles conclude that the impact on stratospheric ozone would be negligible. PDRR ABL emissions are insignificant when compared to the quantities emitted by the space-launch vehicles (790 tons to 1.9 tons). Therefore, if large space-launch vehicle emissions produce negligible impacts, the impact of ABL target-missile emissions would be even less.

Table 3.7-3. Relative Annual Contributions to Stratospheric Chlorine

Source	Quantity (ktons/yr)
Industrial (halocarbon-derived)	450
Natural (oceans and burning vegetation)	15
Volcanoes Long-Term Average (1 - 10 ktons/yr)	5
Mount Pinatubo Estimate (1991 Philippines)	45
Large Space Launch Vehicles (9 Shuttle and 6 Titan IV Launches)	0.79
ABL PDRR Activities	0.0019
Source: McDonald and Bennett, 1995	

Emergency Operations. There are two emergency operations which have the potential to affect the environment: onboard fires which require the operation of fire-suppression systems and the dumping of aircraft fuel and chemicals used by the HEL weapon system.

The B747 fire-suppression systems contain 330 lbs of Halon 1301 and 20 lbs of Halon 1211, both of which are Class I ODCs that contribute to ozone depletion when released into the atmosphere. While fires of various types have been experienced in both civilian and military airplanes, the use of the Halon CFC fire suppression systems takes place in an emergency situation, and a minimum amount would be released to the atmosphere. A check with the FAA for statistical information on fires in military and commercial B747s revealed a listing of 49 incidents from January 1978 through October 1995, an average of two fires per year (FAA, 1996). Not every fire resulted in the discharge of the Haloncontaining fire suppressant, so the average suggested is conservative.

According to the Boeing Commercial Airplane Group (Webb, 1997), the B747 fleet flies approximately 750 million miles each year. A typical ABL test flight, is expected to be on the order of 2,000 miles. Therefore, the probability of a discharge of Halon would be less than 1 in 187,000 for each test flight. In the unlikely event of a fire, the amount of Halon released (350 lbs) would be very small compared to the over 36 million tons of CFCs already existing in the atmosphere (NOAA, 1994). Additionally, the DoD and industry are aggressively working to find a solution to eliminate Class I ODCs. Halon 1301 and 1211 substitutes are being considered and may be available by the time the PDRR ABL system is built.

The second emergency-operation scenario involves the jettisoning of aircraft fuel or HEL weapon system chemicals. According to the Air Force (USAF, 1980), the basic purpose for dumping the fuel is to reduce the aircraft's gross weight to facilitate a safe landing. In 1980, the Air Force published a report on fuel jettisoning by Air Force aircraft (USAF, 1980). The report examined fuel jettisoning over a three-year period for the entire Air Force and concluded that "Fuel jettisoning as carried out by Air Force aircraft does not appear to entail any serious environmental implications." During the study period, Air Force aircraft performed approximately 80 fuel dumps each month, worldwide. The fuel released to the atmosphere averaged 1.3 million pounds per month. The report analyzed the effect of dumping 440,000 lbs over a small area and stated that the impact would be equivalent to spraying a quart of gasoline on an area the size of a football field.

Reasons for jettisoning the HEL weapon system chemicals include the rupture of one of the storage vessels, a leak in the plumbing in the rear of the aircraft, or to minimize the potential for a fire in the case of a crash landing (ammonia, hydrogen peroxide mixture, and chlorine are oxidizers). In these events, the remaining chemicals in the vessel or vessels would be jettisoned. Since some of the HEL weapon system's chemicals are oxidizers, they would not be jettisoned into the same air volume with the aircraft fuel. The quantities of the HEL weapon system chemicals onboard the aircraft are listed in Table 3.74, along with the estimated mixing volume for each chemical and the concentration of the chemical in the mixing volume. The concentrations of these chemicals are well below toxic exposure limits in the mixing volume, and would be rapidly disbursed by the tropospheric weather (ACGIH, 1995). Note that iodine is carried onboard but is in solid form and would not be jettisoned.

Hydrogen peroxide, ammonia, chlorine, helium, and nitrogen are all naturally occurring in the atmosphere (Seinfeld, 1986). Hydrogen peroxide, along with methane, carbon monoxide, formaldehyde, ozone, NOx, and nitric acid, are key chemical species involved in the control of the concentration levels of the normal background components of the troposphere. The gas-phase atmospheric reactions for hydrogen peroxide are:

$$\mathbf{HO_2} + HO_2 \rightarrow H_2O_s + O_2$$

$$H_2O_s + hu \rightarrow 2OH$$

Table 3.7-4. HEL Weapon System Chemical Dumping

	Quantity Onboard Aircraft (Ibs)	Concentration in Mixing Volume (ppm)	Toxic Exposure Limits STEL1 (ppm)
Hydrogen Peroxide Mixture	10,000	0.035	None Listed
Ammonia	1,800	0.072	35
Chlorine	1,500	0.017	1
Helium	1,000	0.613	None Listed
Nitrogen	500	0.175	None Listed
Iodine	100	N/A	N/A
[1] **STEL - Short Term Exposure Limit (ACGIH, 1995)**			

Ammon:ia is readily absorbed by water and soil and neutralizes acidic substances such as sulfuric acid and nitric acid in urban environments. Because of this, its residence time in the atmosphere is short, approximately 20 days. The deposition of atmospheric ammonia may represent an important nutrient to the biosphere is some areas. The release of less than 1,800 lbs of ammonia, when compared to the over 77,900 tons released into the atmosphere from industrial sources in the United States in 1994, is insignificant (EPA, 1996a).

As stated earlier, chlorine is readily converted to forms that dissolve in water and are then removed from the atmosphere. One form is hydrogen chloride which, when mixed with water, has the potential to increase the acidity of the precipitation. However, there are no regulatory requirements limiting the release of chlorine or hydrogen chloride to prevent an increase in the acidity of precipitation. Title IV of the 1990 Clean Air Act Amendments, Acid Deposition Control, is limited to the control of sulfur dioxide and oxides of nitrogen emissions from electric utilities that burn coal for power generation, and the Act is not applicable to the release of chlorine. The release of 1,500 lbs of chlorine when compared to the over 29,800 tons released into the atmosphere from industrial sources in the United States in 1994 is insignificant (EPA, 1996a). The release of nitrogen and helium to the atmosphere would cause no environmental impacts.

Conclusion. Neither normal nor emergency operations would have any measurable, long-term impact on the environment. The PDRR ABL emissions in the stratosphere would increase the level of chlorine in the mixing volume for short periods of time but would have no long-term measurable impact. The relatively small quantities of chemicals released into the troposphere during either normal and emergency operations would be rapidly dispersed to concentrations well below measurable levels and would have no identifiable impact on regional air quality.

Assuming that there are six Black Brant launches, 16 HEL operations, and that there is an emergency condition that requires the release of all Halon and the dumping of a full load of chlorine, the combined maximum potential release of chlorine and chlorine compounds (HCI and CFCs) would be only 2.96 tons over the entire flight test program. Compared to the over 470,000 tons (Table 3.7-4) contributed annually by other sources, the potential PDRR ABL release would not be significant (0.00063 percent).

CHAPTER 4

LIST OF INDIVIDUALS AND ORGANIZATIONS CONSULTED

This chapter presents the federal, state, and local agencies and private organizations/agencies that were contacted during the course of preparing the FEIS.

Federal

National Marine Fisheries Service—Southwest Division, Steve Ayela
U.S. Fish and Wildlife Service, Christine Barskey
U.S. Bureau of Census
U.S. Geological Survey, Albuquerque, NM
U.S. Soil Conservation Service, Lancaster, CA
U.S. Soil Conservation Service, Eastern Kern County, CA
White Sands National Monument, Nancy Wiener

U.S. Air Force

Edwards AFB, Mark Hagan, Rick Norwood, Bob Busch, Rebecca Hobbs, Greg Turner, Steve Cronk, Jorge Rodriguez-Negron, John Franz, Sally Burrows, Bob Kraszowski
Edwards AFB, High Desert TRACON, Greg Turner
Vandenberg AFB, Capt Michael Winthrop, Larry Spanne, Billy Delgadillo, Chris Gillespie, Jack Yamauchi, Ron Cortopassi, Jane Goldberg
Kirtland AFB, Ed Nowlin, Jerry Sillerud, Chris DeWitt, Ron Curiel, Marsha Karra, Jeff Moler, Cliff Richardson, Terry Cooper, Maj Bob Kelsey, Maj Jim Steele, Lt Darren Landeringer, Maj Keith Smith, Chris Tuttle
Eglin AFB, Russ Howard
Brooks AFB, Human Systems Center, Tony Jasek; Armstrong Laboratory, Capt Ken Keppler

U.S. Army

White Sands Missile Range, David Lee Anderson, Robert Burton, Sgt Steven A. Van Vliet, Bob Brenan, Robin Smith, Tom Gonzales, Jr., Bob Myers, Hector Magallanes, Rudy Ayala, Thomas G. Tullius, John Winstead, Karen Hay, Harrison Orr

U.S. Navy

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Point Mugu NAWS, Tom Keeney, Steve Schwartz, Greg Wiffle, Diane Bentley, Jeff Ballow

State, California

California Air Resources Board, Ron Rothacker

State, New Mexico

New Mexico Environment Department, Surface Water Quality Bureau, Jim Piatt, Glen Saums; Hazardous and Radioactive Materials Bureau, Coby Muckelroy; Air Quality Bureau, Martin Rinaldi, Cecilia Williams; Groundwater Protection and Remediation Bureau, Richard Ohrbom
New Mexico Department of Game and Fish, Greg Schmitt
New Mexico Department of Labor
New Mexico State Land Office, Tim Callahan
New Mexico Environment Department, Las Cruces, NM, Ken Smith
New Mexico Forestry Resource Conservation Division

Regional, California

Bureau of Land Management, Bakersfield Office, Steve Larson
Bureau of Land Management, Ridgecrest Office, Ahmed Mosher
Palmdale Parks and Recreation, Alice Berryman
California Employment Development Department, Labor Market Information Division, Santa Barbara Office

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Bureau of Indian Affairs, Branch of Realty, Loraine Lucero
Cibola National Forest, Steve Kluge
Bureau of Land Management, Mark Hakkila
Alamogordo Parks and Recreation, Lisa Featherstone
Las Cruces Parks and Recreation, Alan Pumphrey
El Paso Parks and Recreation, Jose Ortiz

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FAA, Albuquerque Tower Control, Rick Henson

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Apartment Association of New Mexico
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Local, California

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Kern County Air Pollution Control District, Thomas Paxson
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CHAPTER 6

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APPENDIX A

GLOSSARY OF TERMS, ACRONYMS, AND ABBREVIATIONS

APPENDIX B

NOTICE OF INTENT

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GLOSSARY

A-Weighted Sound Level	A number representing the sound level which is frequency weighted according to a prescribed frequency response established by the American National Standards Institute and accounts for response of the human ear.
Accident Potential Zones	Areas immediately beyond the ends of Department of Defense fixed-wing runways that have a higher potential for aircraft accidents than other areas. Specifically, APZs fall into two categories: APZ 1 is the area beyond the runway-clear zone that possesses a significant potential for accidents, and APZ 2 is an area beyond APZl that has a measurable potential for accidents.
Acquire	When applied to acquisition sensors, to detect the presence and location of a target in sufficient detail to permit identification.
Acquisition, Tracking & Pointing	The process of acquiring target (or targets) within a given field-of-view and maintaining a precision track while enabling the pointing of a sensor or weapon at the target so that it may be destroyed.
Active Sensor	A sensor that illuminates a target, producing return-secondary radiation, for tracking and/or identifying the target. An example is radar.
Adaptive Optics	Optical systems that can be modified by controlling the shape of a deformable mirror to compensate for distortions of a laser light passing through the atmosphere. It is used to reduce the dispersive effect of the atmosphere on laser-beam weapons.
Aerospace Ground Equipment	Fixed and mobile systems used for aircraft maintenance, startup, fueling, power, and air conditioning.
Aesthetic	Refers to the perception of beauty.
Airport Traffic Area	Airspace within a radius of 5-statute miles of an airport with an operating control tower, encompassing altitudes between the surface and 3,000 feet above ground level in which an aircraft cannot operate without prior authorization from the control tower.
Alluvial fan	A fan-shaped deposit of sand, gravel, and fine material made by a stream where it runs out onto a level plain or meets a slower stream.

Alluvium	Material (sand, silt, clay, and gravel) deposited by rivers and streams, including sediment laid down in river beds, floodplains, and at the foot of mountain slopes and estuaries.
Altitude	Height, measured as a distance along the extended earth's radius above a given point, such as average sea level.
Ambient	The environment as it exists around people, plants, and structures.
Ambient Air Quality Standards	Standards established on a state or federal level that define the limits for airborne concentrations of designated-criteria pollutants (nitrogen dioxide, sulfur dioxide, carbon monoxide, total-suspended particulates, ozone, and lead) to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).
Anadromous	Fish that spend their adult life in the sea but swim up-river to fresh-water spawning grounds to reproduce.
Apogee	That point in an orbit at which an object (i.e., missile) is most distant from the earth.
Aquifer	The water-bearing portion of subsurface-earth material that yields or is capable of yielding useful quantities of water to wells.
Archeology	A scientific approach to the study of human ecology, cultural history, and cultural process.
Archeological Sites (resources)	Any location where humans have altered the terrain or discarded artifacts during either prehistoric or historic times.
Association (soil)	Two or more soils occurring together in a characteristic pattern.
Atmospheric Dispersion	The process of air pollutants being dispersed into the atmosphere. This occurs by the wind that carries the pollutants away from their source and by turbulent-air motion that results from solar heating of the Earth's surface and air movement over rough terrain and surfaces.
Attainment Area	Region that meets the National Ambient Air Quality Standards for a criteria pollutant under the Clean Air Act Amendments of 1990.
Background Noise	The total acoustical and electrical noise from all sources in a measurement system that may interfere with the production, transmission, time averaging, measurement, or recording of an acoustical signal.
Base Floodplain	Area subject to a one-percent-or-greater chance of flooding in any given year (also termed the 100-year floodplain).

Baseline Conditions	The natural and human environmental conditions that are present prior to implementation of a program and against which impacts are assessed.
Beam Control	Technologies associated with controlling the physical properties of high-energy beams and steering the energy transmitted by those beams to the target vehicle.
Best Management Practices	Practices used for the protection of water quality.
Biota	Living organisms consisting of plants and animals.
By-Product	Material, other than the principal product, that is generated as a consequence of an industrial process.
Boost Phase	The powered-flight portion of a missile from launch to termination of thrust of the rocket's final stage.
Candidate Species	Category 1 or 2 plant or animal species considered for listing as endangered or threatened by the U.S. Fish and Wildlife Service under the Endangered Species Act.
Carbon Dioxide	A colorless, odorless, nonpoisonous gas which results from fossil-fuel combustion and is normally a part of the ambient air.
Carbon Monoxide	A colorless, odorless, highly-poisonous gas formed by the incomplete combustion of carbon or any carbonaceous material, including gasoline. One of six pollutants for which there is a national ambient air quality standard.
Category 1 (Plants and Animals)	Candidate plant and animal species listed under the Endangered Species Act for which the U.S. Fish and Wildlife Service currently has substantial information on hand to support the biological appropriateness of proposing to list them as endangered or threatened.
Category 2 (Plants and Animals)	Candidate plant and animal species listed under the Endangered Species Act for which the U.S. Fish and Wildlife Service possesses information that proposes to list them as endangered or threatened but for which conclusive data on biological vulnerability and threatened are not currently available to support proposed inclusion.
Chemical Oxygen Iodine Laser	A laser in which chemical action is used to produce the laser energy.
Chlorofluorocarbons	A family of inert, nontoxic, and easily liquefied chemicals used in refrigeration, air conditioning, packaging, insulation, or as solvents and aerosol propellants. Because CFCs are not destroyed in the lower atmosphere, they drift into the upper atmosphere where their chlorine components destroy ozone.

Community Noise	A measure of the noise environment over a 24-hour annual average day.
Equivalent Level	It is the 24-hour A-weighted sound level, with a 5 dB weighting for evening (7:00 to 10:00 pm) levels and a 10 dB weighting applied to the nighttime levels.
Coastal Zone	Lands and waters adjacent to the coast that exert an influence on the uses of the sea and its ecology, or, adversely, whose uses and ecology are affected by the sea.
Code of Federal Regulations	All federal regulations in force are published in codified form in the Code of Federal Regulations.
Cold Flow Test	A test of laser-device plumbing, using inert gases; no chemical reactions occur, and there is no extraction of a laser beam.
Concept Design Phase	The initial phase of the system-acquisition process, at which the acquisition strategy is developed, system alternatives are proposed and examined, and the system program requirements document is expanded to support subsequent phases.
Control Zone	Controlled airspace with a normal radius of 5 statute miles from a primary airport plus any extensions needed to include instrument arrival and departure paths, encompassing altitudes between the surface and 14,449 feet above mean sea level.
Council on Environmental Quality (CEQ)	Established by the National Environmental Policy Act (NEPA), the CEQ consists of three members appointed by the President. CEQ regulations (40 CER §§ 1500-1508) describe the process for implementing NEPA, including preparation of environmental impact statements and the timing and extent of public participation.
Cretaceous	The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), covering the span of time between 135 and 65 million years ago; also the corresponding system of rocks.
Criteria Pollutants	The Clean Air Act of 1970 required the U.S. Environmental Protection Agency to set air-quality standards for common and widespread pollutants. Today standards are in effect for six criteria pollutants: ozone, carbon monoxide, sulfur dioxide, lead, nitrogen dioxide, and particulate matter less than 10 microns in diameter.
Critical Action Floodplain	Area subject to a 0.2 percent chance of flooding in any given year (also termed the 500-year floodplain).
Cryogenic	The production and maintenance of very low temperatures, and the study of phenomena at these temperatures.

Cultural Resources	Prehistoric and historic districts, sites, buildings, objects, or any other physical evidence of human activity considered important to a culture, subculture, or a community for scientific, traditional, religious, or any other reason.
Cumulative Impact	The combined impact resulting from all activities occurring concurrently at a given location.
Day/Night Sound Level	U.S. Environmental Protection Agency noise descriptor indicating the average of sound levels throughout a 24-hour day. The 24-hour average-energy sound level is expressed in decibels, with a 10-decibel penalty added to sound levels between 10:00 p.m. and 7:00 a.m. to account for increased annoyance from noise during night hours.
Decibel, A-Weighted	A measure of noise by a logarithmic conversion of air-pressure level variations from Pascal to a unit of measure with a more convenient numbering system, compensated by an "A"-weighted filter which accounts for the limited hearing-response characteristics of the upper and lower frequency bands of humans.
Decibel (dB)	A unit of measurement on a logarithmic scale that describes the magnitude of a particular quantity of sound pressure or power with respect to a standard-reference value.
Dissolved Solids	A general indicator of contamination by inorganic materials.
Effluent	A gas or fluid discharged into the environment.
Emission	Pollution discharged into the atmosphere from smokestacks, other vents and surface areas of commercial or industrial facilities, residential chimneys, and motor vehicle, locomotive, or aircraft exhausts.
Emission Standards	Legally enforceable limits on the quantities and/or kinds of air contaminants that can be emitted into the atmosphere.
Endangered Species	Species of plants and animals that are threatened with either extinction or depletion below sustainable levels in an area and are formally listed by the U.S. Fish and Wildlife Service as endangered.
Environmental Assessment	A written environmental analysis that is prepared pursuant to the National Environmental Policy Act to determine whether a federal action would significantly affect the environment and, thus, require preparation of a more detailed environmental impact statement.
Environmental Impact Analysis Process	The process of conducting environmental studies as outlined in Air Force Instruction 32-7061.

Environmental Impact Statement	A public document required of federal agencies by the National Environmental Policy Act for major projects or legislative proposals significantly affecting the environment. An EIS describes the positive and negative effects of the undertaking, lists alternative actions and is used as a tool for decision-making.
U.S. Environmental Protection Agency	Established in 1970 by Presidential Executive Order, bringing together parts of various government agencies involved with the control of pollution.
Erosion	Wearing away of soil sediment and rock by mechanical and chemical weathering caused by the action of surface water, wind, underground water, and/or by chemical processes.
Evaporation Pond	Area where sewage sludge is discharged and allowed to evaporate.
Exceedance	Violation of environmental protection standards by exceeding allowable limits or concentration levels.
Fauna	Animal life, especially the animal characteristics of a region, period, or special environment.
Floodplain	Lowland area adjoining inland or coastal waters subject to a specified chance of flooding in any given year. Typically defined either as the base floodplain, subject to a 1 percent or greater chance of flooding in a given year, or as the critical-action floodplain, subject to a 0.2 to 1.0 percent chance of flooding in a given year.
Flora	Vegetation; plant life characteristic of a region, period, or special environment.
Fresh Water	Water that generally contains less than 1,000 milligrams per liter of dissolved solids.
Global Climate Change	Alterations in the energy balance of the earth's atmosphere resulting from the burning of fossil fuels.
Greenhouse Effect	The phenomenon in which the sun's energy, in the form of light waves, passes through the air and is absorbed by the earth, which then radiates the energy as heat waves are absorbed in the air. The air thus behaves like glass in a greenhouse, allowing the passage of light but not of heat.
Greenhouse Gases	Atmospheric gases (principally carbon dioxide, water vapor, nitrous oxide, chlorofluorocarbons, and methane) that absorb infrared radiation and contribute to the "greenhouse effect."
Groundwater	Fresh water found beneath the earth's surface, usually in aquifers, which supplies wells and springs.

Groundwater Basin Subsurface structure having the character of a basin with respect to collection, retention, and outflow of water.

Habitat The sum total of environmental conditions of a specific place that is occupied by an organism, population, or community of plants or animals.

Halon Bromine-containing compounds with long atmospheric lifetimes whose breakdown in the stratosphere cause depletion of ozone. Halons are used in firefighting.

Hazardous Air Pollutants Any of the 189 air pollutants identified in the Clean Air Act Amendments of 1990 which could have an adverse health or environmental impact.

Hazardous Material Any material that poses a threat to human health or the environment. Typical hazardous material is toxic, corrosive, ignitable, explosive, or chemically reactive. Use of these materials is regulated by the U.S. Department of Transportation, the Occupational Health and Safety Administration, and the Comprehensive Environmental Response, Compensation and Liability Act of 1980.

Hazardous Waste By-products of society that can pose a substantial or potential hazard to human health or the environment. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appears on special EPA lists. Regulated under the Resource Conservation and Recovery Act.

Holocene Relating to the present or post-Pleistocene geologic epoch or the corresponding system of rocks; approximately 10,000 years ago to the present.

Hot Flow Test An experiment with a laser device in which chemical reactions occur and heat is released into the system; there may or may not be extraction of a laser beam.

Hydrocarbon Any of a vast family of chemical compounds containing hydrogen and carbon. Used loosely to include many organic compounds in various combinations, most fossil fuels are composed predominantly of hydrocarbons. When hydrocarbons mix with nitrogen oxides in the presence of sunlight, ozone is formed.

Hypergolic Two or more substances capable of igniting spontaneously upon contact.

Impacts An assessment of the meaning of changes in all attributes being studied for a given resource. An aggregation of all the adverse effects, usually measured using a qualitative and nominally subjective technique. In this environmental impact statement, as well as in the Council on Environmental Quality Regulations, the word impact is used synonymously with the word effect.

Infrared	A range of electromagnetic-radiation wavelengths longer than visible light and shorter than microwave wavelengths.
Infrastructure	Facilities, utilities, and other entities of the physical plant that support military, civil, and commercial operations.
Instrument Flight Rules	Rules governing the procedures for conducting instrument flight, when the visibility, cloud distances, and cloud ceiling are reduced and do not permit flight under visual-flight rules.
Jitter	Irregular random movement of a laser beam caused by vibration.
Kilovolt	The unit of electrical potential equal to 1,000 volts.
Kilowatt	A unit of electrical-energy use. The kilowatt is used as a measure of the amount of power being used or produced at one moment in time, and as a measure of peak capacity.
Kilowatt-Hour	The amount of energy used over a specified time period, typically one year, measured in kilowatts.
L_{eq}°	The equivalent steady-state sound level, which in a stated period of time would contain the same acoustical energy as time-varying sound level during the same period.
L_{max}°	The highest A-weighted sound level observed during a single event of any duration.
Laser	An active-electron device that converts input power into a very narrow, intense beam of coherent visible or infrared light. The input power excites the atoms of an optical resonator to a higher-energy level, and the resonator forces the excited atoms to radiate in phase. Derived from Light Amplification by Stimulated Emission of Radiation and classified from Class I to Class IV according to its potential for causing damage to the eye.
Launch Azimuth	Missile-launch direction measured in degrees clockwise from the local north-pointing longitude line at the launch site.
Launch Detection	Initial indication by any one of a variety of sensors that a booster has been launched from some point on the surface of the earth, with initial characterization of the booster type.
Loam, loamy	Rich, permeable soil composed of a mixture of clay, silt, sand, and organic matter.
Loudness	The qualitative judgment of intensity of sound by a human being.

Low-Income Population	A population that is classified by the U.S. Bureau of the Census as having an aggregated mean income level for a family of four that correlates to $13,359, adjusted through the property index using a standard of living percentage change where applicable, and whose composition is at least 25 percent of the total population of a defined area or jurisdiction.
Metropolitan Statistical Area	An area with a city of a least 50,000 in population, or an urbanized area of at least 50,000 with a total metropolitan population of at least 100,000.
Military Operations Area	Airspace areas of defined vertical and lateral limits established for the purpose of separating certain training activities, such as air combat maneuvers and air intercepts from other air traffic operating under instrument-flight rules.
Minority Population	A population that is classified by the U.S. Bureau of the Census as African American, Hispanic American, Asian and Pacific American, Native American, Eskimo, Aleut, and other non-White persons, whose composition is at least 25 percent of the total population of a defined area or jurisdiction.
Mitigation	A method or action to reduce or eliminate program impacts.
Nacelle	A separate streamlined enclosure or compartment on an airplane.
National Ambient Air Quality Standards	Nationwide standards set up by the U.S. Environmental Protection Agency for widespread air pollutants, as required by Section 109 of the Clean Air Act. Currently, six pollutants are regulated by primary and secondary NAAQS: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter less than 10 microns in diameter, and sulfur dioxide.
National Emission Standards for Hazardous Air Pollutants	A set of national emission standards for listed hazardous pollutants emitted from specific classes or categories of new and existing sources. These standards were implemented in the Clean Air Act Amendments of 1977.
National Environmental Policy Act	Public Law 91-190, passed by Congress in 1969. The Act established a national policy designed to encourage consideration of the influences of human activities on the natural environment. NEPA also established the Council on Environmental Quality. NEPA procedures require that environmental information be made available to the public before decisions are made. Information contained in NEPA documents must focus on the relevant issues in order to facilitate the decision-making process.

National Pollutant Discharge Elimination System Permit	Federal regulation (40 CFR § § 122 and 125) requires permits for the discharge of pollutants from any point source into the waters of the United States and is regulated through the Clean Water Act, as amended.
National Register of Historical Places	A register of districts, sites, buildings, structures, and objects important in American history, architecture, and culture, maintained by the Secretary of the Interior under authority of Section 2(b) of the Historic Sites Act of 1935 and Section 10l(a)(1) of the National Historic Preservation Act of 1966, as amended.
Native Americans	Used in a collective sense to refer to individuals, bands, or tribes who trace their ancestry to indigenous populations of North America prior to Euro-American contact.
Native Vegetation	Plant life that occurs naturally in an area without agricultural or cultivational efforts. It does not include species introduced from other geographical areas that have become naturalized.
Nitrogen Dioxide	Gas formed primarily from atmospheric nitrogen and oxygen when combustion takes place at high temperatures. $N0_2$ emissions contribute to acid deposition and formation of atmospheric ozone. One of the six criteria pollutants.
Noise	Any sound that is undesirable because it interferes with speech and hearing, is intense enough to damage hearing, or is otherwise annoying (unwanted sound).
Noise Attenuation	The reduction of a noise level from a source by such means as distance, ground effects, or shielding.
Noise Contour	A line connecting points of equal noise exposure on a map. Noise exposure is often expressed using the average day-night sound level.
Noise Receptors	Receptors that are affected by noise; can include people or wildlife.
Nonattainment Area	A geographic area that does not meet one or more of the National Ambient Air Quality Standards for criteria pollutants.
Notice to Airmen	Flight advisory service that provides important safety information which may not be reflected on the most current aeronautical charts.
Offsite	Outside the Base boundary.
Onsite	Within the Base boundary.
Operable Unit	Term for each of a number of separate activities undertaken as part of a Superfund cleanup. A typical operable unit would be removing drums and tanks from a site.

Ostracod	Crustacea containing small, bivalve aquatic forms; the body is unsegmented and there is no true abdominal region.
Oxides of Nitrogen	Product gases, formed primarily by fuel combustion, which are a major contributor to the formation of ozone in the troposphere and acid deposition.
Oxidizer	A substance that supports the combustion of rocket propellant.
Ozone	Found in two layers of the atmosphere, the stratosphere and the troposphere. In the stratosphere (the atmospheric layer from 12 km to 48 km above the earth's surface), ozone is a form of oxygen found naturally and provides a protective layer shielding the earth from ultraviolet radiation's harmful health effects on humans and the environment. In the troposphere (the layer extending from the surface up to approximately 12 km), ozone is a chemical oxidant and major component of photochemical smog. Ozone can seriously affect the human respiratory system and is one of the most prevalent and widespread of all the criteria pollutants for which the Clean Air Act required EPA to set standards. Ozone in the troposphere is produced through complex chemical reactions of oxides of nitrogen, which are among the primary pollutants emitted by combustion sources, hydrocarbons, released into the atmosphere through the combustion, handling and processing of petroleum products, and sunlight.
Ozone Depletion	Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to biological life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons) which break down when they reach the stratosphere and catalytically destroy ozone molecules.
Ozone Layer	A naturally occurring layer of ozone 3,600 to 9,800 feet AGL in the stratosphere above the earth's surface. The ozone layer filters out the sun's harmful ultraviolet radiation.
Particulate Matter of Less Than 10 Microns (PM-10)	Finely-divided solids or liquids less than 10 microns in diameter that, when inhaled, remain lodged in the lungs and contribute to adverse health effects. One of the six pollutants for which there is a national ambient standard.
Passive Sensor	A sensor that detects naturally occurring emissions from a target for tracking and/or identification purposes.
Perched Water	Groundwater separated by an unsaturated zone from an underlying main body of groundwater.
Permeability	The capacity of a rock or sediment to transmit a fluid; measure of relative porosity.

Permian	The last period of the Paleozoic era (after the Pennsylvanian), covering the span of time between 280 and 225 million years ago.
Permit	An authorization license, or equivalent control document issued by EPA or an approved state agency to implement the requirements of an environmental regulation; e.g., a permit to operate a wastewater-treatment plant or to operate a facility that may generate harmful emissions.
Pharmacy Concept	Use of a base central supply location to distribute hazardous materials/products to Air Force organizations. As part of the process, customers are to return unused portions of the materials/products for subsequent use or disposal.
pH	A measure of the acidity or alkalinity of a liquid material.
Pleistocene	An earlier epoch of the Quaternary period during the Ice Age beginning approximately 3 million years ago and ending 10,000 years ago. Also refers to the rocks and sediments deposited during that time.
Point Defense	The defense or protection of special vital elements and installations, such as command and control facilities and air bases.
Polychlorinated Biphenyl (PCBs)	A group of toxic chemicals used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Further sale or new use was banned by law in 1979.
Population	All of the people living in a region.
Porosity	The percentage of the bulk volume of a rock or soil that is occupied by interstices, whether isolated or connected.
Potable Water	Suitable for drinking.
Prehistoric	The period of time before the written record.
Primary Roads	A consolidated system of connected main roads important to regional, statewide, and interstate travel. They consist of rural arterial routes and their extensions into and through urban areas of 5,000 or more population.
Program Definition and Risk Reduction Airborne Laser (PDRR ABL)	The modified B747 aircraft, including the integrated high-energy laser system.
Recent	The time period from approximately 10,000 years ago to the present and the rocks and sediment deposited during that time.
Recharge	The process by which water is added to a zone of saturation, usually by percolation from the soil surface, such as the recharge of an aquifer.

Record of Decision	A public document, based on information disclosed in the final environmental impact statement, that identifies the alternative chosen, mitigation and monitoring measures to be implemented, and other information relative to the decision.
Recreation Visitor Day	A measure of recreation use of an area. One recreation visitor day consists of recreational use of a site or area by one person for 12 hours; can be abbreviated as “visitor day.
Region of Influence	The area where environmental impacts may occur from proposed action. The region of influence may differ for each environmental attribute or location.
Restricted Area	Designated airspace in which aircraft activity, while not prohibited, is subject to certain restrictions.
Riparian	Living or being located on the bank of a natural waterway such as a river, lake, or tidewater.
Salinity	The total quantity of dissolved salts in water, measured by weight in parts per thousand.
Scoping process	Activities used to determine the scope and significance of a proposed action, the level of analysis required, the data needed, and the level of public participation.
Sedimentation	A process through which material is deposited by wind or water.
Seismicity	Relative frequency and distribution of earthquakes.
Site	As it relates to cultural resources, any location where humans have altered the terrain or discarded artifacts.
Socioeconomics	The social and economic condition in the study area.
Soil series	A group of soils having similar parent materials, genetic horizons, and arrangement in the soil profile.
Solvent	A substance that dissolves or is capable of dissolving a substance.
Sound	The auditory sensation evoked by the compression and rarefaction of the air on other transmitting medium.
Sound Exposure Level	A measurement of the intrusiveness of sound, combining sound level and duration.

Sound Level	Ten times the common logarithm of the square of the ratio of the frequency-weighted (and time-averaged) sound pressure to the reference sound pressure of 20 micropascals. Measured in decibel (dB). (See sound pressure)
Sound Pressure	Root mean square of the instantaneous sound pressures in a stated frequency band and during a specified time interval, unless another time-averaging process is indicated. Measured in Pascals (Pa). Instantaneous sound pressure is the total instantaneous pressure in a stated frequency band at a point in the presence of a sound wave minus the atmospheric static pressure at that point.
Sound Receptor	A location, activity, person, or animal that is exposed, or potentially exposed, to acoustic energy.
Species	A reproductively-isolated aggregate of interbreeding populations of organisms.
Spill Prevention Control and Countermeasures Plan	Plan covering the release of hazardous substances as defined in the Clean Water Act.
State Implementation Plan	EPA-approved state plans for the establishment, regulation, and enforcement of air-pollution standards.
Stratigraphy	Division of geology dealing with the definition and description of rocks and soils, especially sedimentary rocks.
Storm Sewer	A system of pipes (separate from sanitary sewers) that carry only water runoff from building and land surfaces.
Stratosphere	The portion of the atmosphere between altitudes of approximately 3,300 feet at the poles or 5,000 feet at the equator to 10,000 feet.
Sulfur dioxide	A toxic gas that is produced when fossil fuels, (coal and oil), are burned. Is the main pollutant involved in the formation of acid rain. Can also irritate the upper-respiratory tract and cause lung damage.
Surface Water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors which are directly influenced by surface water.
Theater	The geographical area outside the continental United States for which a commander of a unified or specified command has been assigned.
Theater Ballistic Missile	A ballistic missile whose target is within a theater or which is capable of attacking targets in a theater.

Theater Missile Defense	The strategies and tactics employed to defend a geographical area outside the United States against attack from short-range, intermediate-range or medium-range ballistic missiles.
Thermosphere	The atmospheric shell extending from the top of the mesosphere to outer space; it is a region of more or less steadily increasing temperature with height, starting at 70 or 80 kilometers. The thermosphere includes, therefore, the exosphere and most or all of the ionosphere.
Threatened or Endangered Species	Animals, birds, fish, plants, or other living organisms threatened with extinction by man-made or natural changes in their environment. Requirements for declaring species endangered are contained in the Endangered Species Act of 1973.
Topography	The general configuration of a surface, including its relief; may be a land or water-bottom surface.
Trichloroethylene (TCE)	A stable, low-boiling colorless liquid, toxic by inhalation. TCE is used as a solvent, metal-degreasing agent, and in other industrial application.
Troposphere	The lower atmosphere, the portion of the atmosphere between 3,600 to 5,300 feet AGL from the Earth's surface where clouds are formed.
Trajectory	The curve described by an object moving through space.
Upper Atmosphere	The portion of the atmosphere that includes the stratosphere, mesosphere, and thermosphere.
Visual Flight Rules	Rules governing the procedures for conducting flight when visibility, cloud distances, and cloud ceiling are insufficient for safe flight without the aid of instruments.
Volatile Organic Compounds	A broad range of organic compounds, often halogenated, that vaporize at ambient or relatively low temperatures, such as benzene, chloroform, and methyl alcohol.
Wastewater	The spent or used water from individual homes, a community, a farm, or an industry that contains dissolved or suspended matter.
Watershed	The drainage area of a stream or other surface water.
Water Table	The level of groundwater.
Wetlands	Areas that are inundated or saturated with surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil. This classification includes swamps, marshes, and similar areas.

ACRONYMS AND ABBREVIATIONS

ABL	Airborne Laser
ACCS	Accumulation Site
ACGIH	American Conference of Governmental Industrial Hygenists
ADIZ	Air Defense Identification Zone
AEHD	Albuquerque Environmental Health Department
AFFTC	Air Force Flight Test Center
AF	Air Force
AFB	Air Force Base
AFFTC	Air Force Flight Test Center
AFI	Air Force Instruction
AFOSH	Air Force Occupational Safety and Health
AFTOX	Air Force Toxic Chemical Dispersion Model
AICUZ	Air Installation Compatibility Use Zone
AIRFA	American Indian Religious Freedom Act
AGE	Aerospace Ground Equipment
AGL	Above Ground Level
AMDS	Aerospace Medical Squadron
AMSL	Above Mean Sea Level
ANSI	American National Standards Institute
AOC	Area of Concern
APCD	Air Pollution Control District
APZ	Air Pollution Zone
AQCB	Air Quality Control Board
AQCR	Air Quality Control Region
ARTCC	Air Route Traffic Control Center
ATA	Airport Traffic Area
ATCAA	Air Traffic Control Assigned Airspace
ATP	Acquisition, Tracking & Pointing
AVEK	Antelope Valley East Kern Water District Agency
B747	Boeing 747
BLM	Bureau of Land Management
BMD	Ballistic Missile Defense
BMDO	Ballistic Missile Defense Organization
BMP	Best Management Practice
BQM-34S	Subsonic Remote-Controlled Target
BRAC	Base Realignment and Closure
CAA	Clean Air Act of 1970
CAAA	Clean Air Act Amendments of 1990
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CASRN	Chemical Abstract Services Registration Number
CCD	Coastal Consistency Determination
CCD	Census County Division
CCR	California Code of Regulations

CDP	Census-Designated Places
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
CIP	Comprehensive Inventory Plan
CNEL	Community Noise Equivalent Level
CO	Carbon Monoxide
COE	U.S. Army Corps of Engineers
COIL	Chemical Oxygen Iodine Laser
CSF	Conforming Storage Facility
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB, dBA	Decibels
DEIS	Draft Environmental Impact Statement
DERP	Defense Environmental Restoration Program
DNL	Day/night sound level
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DRMP	Defense Reutilization and Marketing Program
DTSC	Department of Toxic Substances Control
EA	Environmental Assessment
ECAMP	Environmental Compliance Assessment and Management Program
EFTR	Edwards Flight Test Range
ERS	Extremely Hazardous Substance
ETAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning Community Right-to-Know Act
ER	Environmental Restoration
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FIX	Firing in Extension area
FPPA	Farmland Protection Policy Act
FR	Federal Register
ft	Foot/Feet
FWS	U.S. Fish and Wildlife Service
FY	Fiscal Year
g	Grams
gpm	Gallons Per Minute

HAP	Hazardous Air Pollutant
HAZCOM	Hazardous Communication
HAZWOPER	Hazardous waste operator emergency response
HCFC	Hydrochlorofluorocarbon
HEL	High-Energy Laser
HMTA	Hazardous Materials Transportation Act
HQ	Headquarters
HWMP	Hazardous Waste Management Plan
IAP	Initial Accumulation Point
IDLH	Immediately Dangerous to Life or Health
IFR	Instrument Flight Rules
IRP	Installation Restoration Program
IRFNA	Inhibited Red Fuming Nitric Acid
IRP	Installation Restoration Program
JPL	Jet Propulsion Laboratory
KCAPCD	Kern County Air Pollution Control District
kg	Kilogram
kV	Kilovolt
kW	Kilowatt
kWh	Kilowatt-Hour
LANL	Los Alamos National Laboratory
LCM	Lacey-Cactus-McCloud (grazing allotment)
LHA	Launch Hazard Area
LI	Laser and Imaging Directorate
LF	Launch Facility
m	Meters
MAR	Multifunction Array Radar
MCL	Maximum Contaminant Level
MGD	Million Gallons Per Day
mi	Miles
MIL-STD	Military Standard
MILCON	Military Construction
MOA	Military Operating Area
mph	Mile(s) Per Hour
MSA	Metropolitan Statistical Area
MSL	Mean Sea Level
MVA	Megavolt Amps
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection Act
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NAWC	Naval Air Weapons Center

NAWS	Naval Air Weapons Station
NCA	Noise Control Act
NEPA	National Environmental Policy Act
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NIPDWR	National Interim Primary Drinking Water Regulation
NM	Nautical Mile
NMFS	National Marine Fisheries Service
NO_x	Nitrogen Oxide
NOI	Notice of Intent
NOTAM	Notice to Airmen
NOMTS	Naval Ordnance Missile Test Station
NOTS	Naval Ordnance Test Station
NPDES	National Pollutant Discharge Elimination System Permit
NPL	National Priorities List
NRHP	National Register of Historic Places
NTC	National Training Center
NTSB	National Transportation Safety Board
NWC	Naval Weapons Center
NWS	Naval Weapons Station
0_3	Ozone
ODC	Ozone Depleting Chemicals
OMBFMC	Budget Office of Management and Federal Management Circular
OSHA	Occupational Safety and Health Act
OU	Operable Unit
PCB	Polychlorinated Biphenyl
PDRR ABL	Program Definition and Risk Reduction Airborne Laser
PM_{10} or PM-10	Particulate Matter Less Than 10 Microns in Diameter
PL	Phillips Laboratory; Public Law
POL	Petroleum, Oils, and Lubricant
ppb	Parts per billion
ppm	Parts per million
PRS	Pressure Recovery System
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
ROG	Reactive Organic Gases
SARA	Superfund Amendments and Reauthorization Act
SCS	Soil Conservation Service
SDWA	Safe Drinking Water Act
SEDAB	Southeast Desert Air Basin
SEL	Sound Exposure Level
SGG	Solid Gas Generator
SH	State Highway

SHPO	State Historic Preservation Officer
SIF	System Integration Facility
SIP	State Implementation Plan
SLC	Space Launch Complex
SMC/TM	Space & Missile Center Airborne Laser Program Office
SNL	Sandia National Laboratories
SO_2	Sulfur Dioxide
SOW	Special Operations Wing
SPCC	Spill Prevention Control and Countermeasures
Spec.	Specified
SPO	System Program Office
STEL	Short-term Exposure Limit
SX	Space Experiment Directorate
TA/TS	Target Auxiliary/Augmentation System
TBM	Theater Ballistic Missile
TCE	Trichloroethylene
TDS	Total Dissolved Solid
TEL	Transporter/Erector Launcher
TLV	Threshold Limit Value
TMD	Theater Missile Defense
tpy	Tons per Year
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, and Disposal Facility
TSP	Total Suspended Particulates
UBC	Uniform Building Code
USA	United States Army
USAF	United States Air Force
USN	United States Navy
USC	United States Code
UDMH	Unsymmetrical Di-methyl Hydrazine
VFR	Visual Flight Rules
VOC	Volatile Organic Compound
VRM	Visual Resource Management
W	Watt
WCOOA	West Coast Offshore Operating Area
WPNS	Weapons Division (China Lake NAWC)
WSMR	White Sands Missile Range
WWII	World War II
WWTP	Wastewater Treatment Plant

APPENDIX C

ACCIDENT SCENARIOS
AND
ANALYSIS

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APPENDIX C

ACCIDENT SCENARIOS AND ANALYSIS

INTRODUCTION

During the scoping meetings, the public expressed concern over three safety-related issues: laser-eye safety, aircraft accidents, and storage and handling of laser fuels. The safety analysis of the high-energy laser beam is covered in Appendix F. The purpose of this appendix is to discuss the other issues. Since the ABL Program is in the Concept Design Phase, detailed information on activities in the PDRR ABL Phase have not yet been finalized. The accident scenarios will, therefore, be generalized. The appendix will first discuss the Air Force's approach to insuring that safety issues are incorporated in the design, construction, test and operation of weapon systems. Then, accident scenarios for the aircraft, chemicals used at the Home Base to support the laser-weapon system, and the target missiles at the test ranges will be developed and analyzed.

DoD AND AIR FORCE SYSTEM SAFETY REQUIREMENTS

The DoD and the Air Force take efforts to minimize risk and hazards to workers and the public. Safety is an integral part of all activities in the life cycle of all DoD weapons systems (e.g., research, technology development, design, test and evaluation, production, construction, operation, maintenance and support, modification and disposal). DoD Instruction-5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs and Major Automated Information Systems,* requires that a system-safety program be established as a part of the systems engineering. The system safety-program will identify and evaluate system-safety and health hazards, define risk levels, and establish a program that manages the probability and severity of all hazards associated with development, use, and disposal of the weapon system. The Air Force implements the requirements of DoD Instruction-5000.2-R in AFI 91-202, *The US Air Force Mishap Prevention Program.* MIL-STD-882-C, *Military Standard for System Safety Program Requirements* provides a system-safety program of sufficient comprehensiveness to identify the hazards of a system and to impose design requirements and management controls to prevent mishaps. The PDRR ABL goal would be to eliminate hazards or reduce the associated risk to an acceptable level. The PDRR ABL Program Request for Proposal requires the contractor to use MIL-STD-882-C as a guideline when developing their system safety program.

The system-safety program is intended to answer "what impact would this have on the system if this event occurred." This question forces the system designer to postulate the impacts of failures on the safety of the personnel operating the equipment and the public. The system safety program analyzes hazardous events and accidents to determine how they may occur and what undesired consequences might occur. Each sequence of failures and conditions leading to an accident event is a unique scenario. Table C-I defines the levels of severity the maximum possible consequences, Table C-2 defines the likelihood of the accident occurring, and Table C-3 combines the maximum possible consequence with the likelihood of an accident in a risk-rank matrix.

In the risk-rank matrix, recommendations for mitigation and additional analysis can be made. Risks with rank values of 1 or 2 (shaded area) would be considered unacceptable or undesirable and would be mitigated to values of 3 or greater by changes in system design during the early portion of the PDRR ABL Phase.

Both normal operations and unforeseen conditions can lead to accidents which cannot be prevented or controlled. In such cases, the residual risk must be accepted and managed by preparing emergency response procedures (e.g., use of protective equipment by workers, and evacuation and medical response plans) to lessen the consequences of such accidents. The analyses presented in this appendix are worst-case scenarios and should be used to assess the scope and exposure impacts of improbable hazardous events with high consequences.

Table C-1. Hazard Severity Categories

Category	Maximum Possible Consequences		
	Description	**Worker/Public**	**Environment**
I	Catastrophic	Death	Significant off-site contamination requiring cleanup
II	Critical	Severe injury or long term health effects	Moderate on-site contamination Minor off-site contamination
III	Marginal	Minor injury, irritation or discomfort but no permanent health effects	Minor on-site contamination
IV	Negligible	Less than a minor injury	No on-site contamination

Table C-2. Hazard Probability Levels

Levels	Likelihood	Description
A	1 to 0.1	Frequent, normal operations; frequency as often as once in 10 operations
B	0.1 to 0.01	Probable, anticipated events, frequency between one in 100 operations and once in 10 operations
C	10^{-2} to 10^{-4}	Occasional, unlikely, frequency between one in 10,000 operations and one in 100 operations
D	10^{-4} to 10^{-6}	Remote, very unlikely, frequency between one in a million operations and one in 10,000 operations
E	$<10^{-6}$	Improbable, frequency of less than once in a million operations

Table C-3. Risk-Rank Matrix

Hazard Severity Categories	Hazard Probability Level				
	A	**B**	**C**	**D**	**E**
I	1	1	2	3	3
II	1	2	3	3	4
III	2	3	3	4	4
IV	3	4	4	4	4

1 - Unacceptable. Should be mitigated to a risk rank 3 or lower as soon as possible.
2 - Undesired. Should be mitigated to risk rank 3 or lower within a reasonable time.
3- Acceptable with controls. Verify that procedures, controls and safeguards are in place.
4- Acceptable as is. No action is necessary.

AIRCRAFT ACCIDENT ANALYSIS

It is not the intent of this analysis to examine all possible aircraft-accident scenarios. The B747-400 aircraft is used by many commercial airlines and government agencies. This analysis will focus on the additional impact of the laser fuels on the accident scenario involving the PDRR ABL aircraft. The analysis will discuss the safety record of the B747-400 aircraft, define the accident scenarios to be considered, and analyze the associated hazards and impacts. The analysis will be run on *hull-loss* accidents, which are accidents that cause substantial airplane damages which are beyond economic repair. Since the ABL laser-weapons system would be designed, built and installed to comparable stress and loading levels of the B747-400 aircraft, incidents less violent than hull-loss accidents would not cause catastrophic failure of the laser-fuel tanks in the aircraft. The PDRR ABL aircraft would undergo several FAA air-worthiness tests to ensure that modifications do not adversely affect the flight performance of the aircraft.

The B747-400 has a very good safety record. Accident statistics exclude accidents caused by sabotage, military actions, non-operational events, and experimental test flying. The worldwide hull-loss accident rate for the B747-400 for the period 1959 to 1995 was 0.97 per million departures. During the period 1986 to 1995, there were no hull-loss accidents for B747-400 aircraft in the U.S. commercial jet fleet and only one hull-loss accident in the non-U.S. commercial jet fleet (Boeing, 1996). Again, these statistics exclude sabotage and military actions. These statistics show that the aircraft selected for the ABL program is a safe, reliable aircraft and that the probability of a hull-loss accident is less than one in a million.

In order to select realistic scenarios for accidents which may involve the catastrophic release of laser fuel, the percentage of hull-loss accidents in each phase of an aircrafts' flight (takeoff, initial climb, climb, cruise, etc.) were examined. Figure C-l shows the percentage of accidents and the percentage of flight time in each phase of a typical three-hour flight (example: 9.5 percent of the hull-loss accidents occurred in the initial climb which lasts 0.7 percent of the three-hour flight). These statistics are for the worldwide, commercial jet fleet. The vast majority of accidents (80 percent) occur during the takeoff, initial climb, initial approach, final approach, and landing phases of the flight. However, these phases last a total of only 10 percent of the flight time (about 18 minutes of the three hours). These two phases can be further divided into accidents occurring during the initial climb and approach while the aircraft is off the ground, and during takeoff and landing while the aircraft is on the runway. Plausible causes of accidents while the aircraft is on the ground and moving at high speed are collision with another aircraft or vehicle and main-gear failure. Plausible causes of accidents during initial climb or approach are wind shear and bird ingestion.

The preliminary design of the aircraft places a pressure bulkhead between the chemicals in the rear of the aircraft and the crew in the front. The design also includes sensors to notify the flight crew of a chemical release and release mechanisms to dump chemicals from the storage containers in the aircraft. The release of chlorine or ammonia in the rear of the aircraft would not cause a problem for the crew. However, the release of hydrogen peroxide has the potential to cause a fire if there are simultaneous releases of hydraulic or jet fuel in the rear of the aircraft. Hydraulic and jet fuel are not normally present in sufficient quantities to cause any aircraft emergencies. Therefore, this class of accident will not receive any additional analysis.

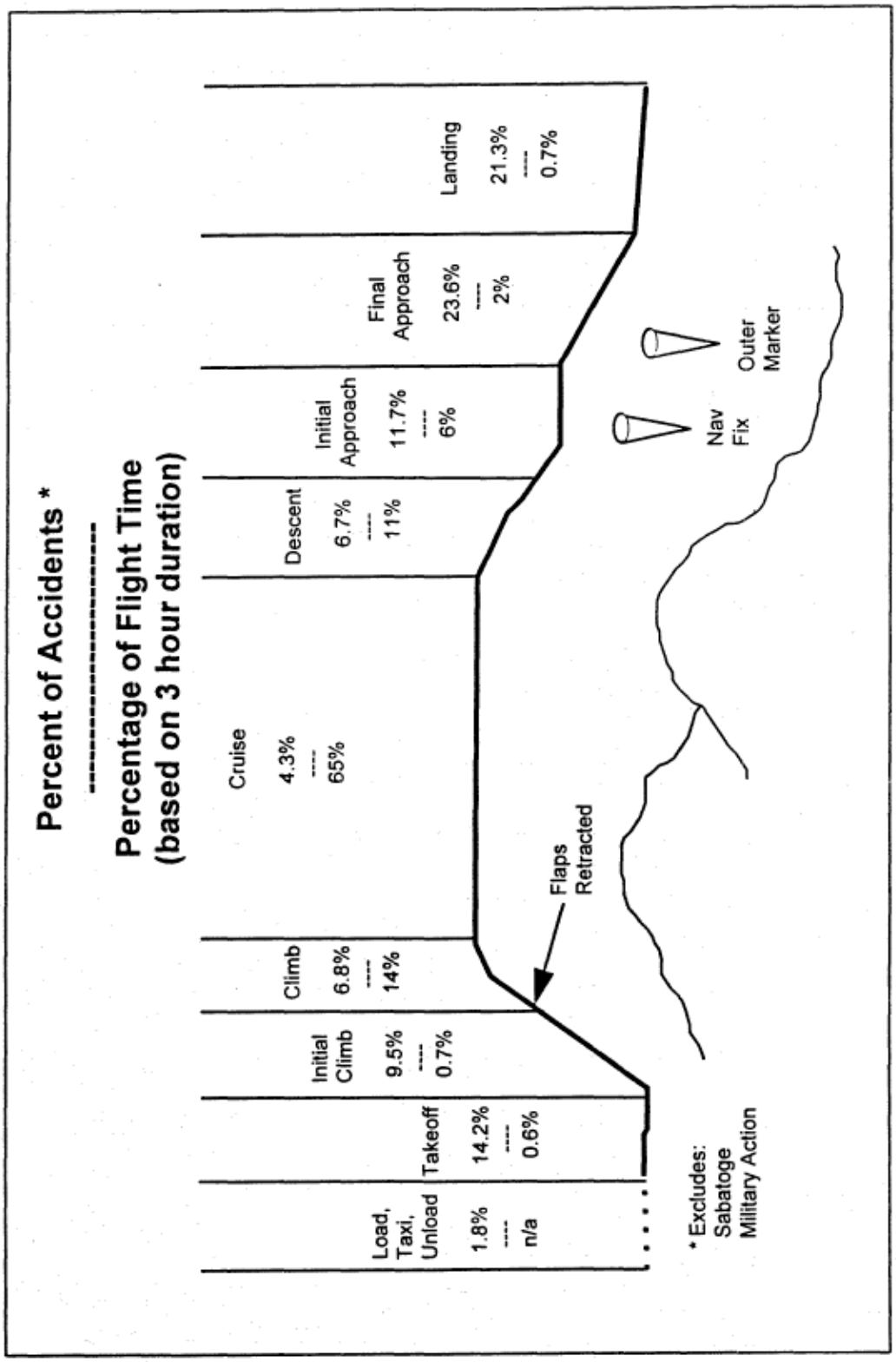

Figure C-1. Hull-Loss Accidents, Worldwide Commercial Jet Fleet Between Years 1959 to 1995 (Boeing, 1996)

Analysis of military-aircraft accident data (Kuchta and Clodfelter, 1985) showed that the "angle of impact is most crucial in the damage sustained by aircraft in a crash type situation." For shallow-angle impacts, they found aircraft breakup begins at the initial point of impact. Aircraft parts will be scattered along the ground path, and fire is a probable outcome if the fuel tanks are ruptured. Steep-angle impacts generally resulted in a short duration, intense fireball, and aircraft parts scattered around the impact crater (Tieszen, 1995). Two types of aircraft accidents were selected for analysis, a shallow-angle impact and a steep-angle impact.

Therefore, on a typical PDRR ABL mission, a large percentage of the hazardous laser fuels would be consumed in the test and exhausted from the aircraft prior to returning to the Home Base. Therefore, catastrophic accidents during the landing phase generally would involve smaller quantities of both jet fuel and laser fuel than during the takeoff phase, The possible exception would be in the unlikely event of an aborted mission with the aircraft returning to Home Base with near full-fuel storage. The selected scenarios will not include accidents occurring during approach and landing at the Home Base. Three scenarios selected for analysis are:

- Main gear fails during initial, low-speed portion of takeoff, resulting in fuselage contact with the runway. Fuel tanks may rupture, but fuselage does not breakup or separate. This crash may result in a limited fire but not an explosion.

- Main gear fails during high-speed portion of takeoff, resulting in impact with the runway, rupture of fuel tanks, and fuselage breakup/separation. This crash would result in an explosion and fire.

- Bird ingestion during the initial climb-out results in the aircraft plunging into the ground. This crash would result in an explosion and fire.

The first two accidents occur on the runway where fire and emergency vehicles can respond to an accident quickly. The accident in the third scenario cannot be accurately predicted. At Edwards AFB, there is a very high probability that the accident would occur on one of the dry lake beds located on the Base. At Kirtland AFB, however, the community bounds the airport to the north and west. Ranches/farms are located to the south and the Manzanita Mountain wilderness area is to the east. There is a possibility that an accident at Kirtland AFB could occur on those adjacent properties.

For the first accident scenario, the fuselage does not breakup or separate, and there is no explosion. Therefore, any accidental release of laser fuel would be confined to the rear of the aircraft behind a bulkhead, preventing gases from entering the forward compartment where the laser-weapon system operators and flight crew are located. Flight crew and PDRR ABL laser-weapon system operators would be able to evacuate the aircraft without loss of life. Once the threat of a fire has been removed, the gases could either be vented in a controlled manner, preventing the formation of toxic concentrations, or pumped into containers for disposal. The probability of this scenario is less than one in a million; the public is not involved with the crash; there is no loss of worker life; and there would be only minor on-site contamination.

The second scenario involves a catastrophic accident, when all laser-fuel containers rupture and contribute to afire/explosion. The probability of this accident is less than one in a million; however, there is a very high probability of loss of life for the personnel onboard the aircraft. Since the second accident scenario occurs on the runway, the public may be affected only by the uncontrolled release or formation of toxic chemicals as a result of the crash and fire.

The third scenario also involves a catastrophic accident. As in the second scenario, all laser-fuel containers rupture and contribute to the fire/explosion. The probability of this accident scenario is also less than one in a million, although the probability of loss of life is high for personnel onboard the aircraft.

The addition of the ABL laser-weapons system on the aircraft would not greatly increase the physical damage to the immediate surroundings under any of the scenarios. The ABL laser-weapons system does not significantly increase either the size or weight of a B747-400 freighter aircraft. Therefore, only the potential release of toxic vapors will be analyzed.

The B747-400 weighs over 177,000 kg (391,000 lbs) and has a maximum fuel capacity of approximately 174,000 kg (384,000 lbs). With the ABL laser-weapons system installed, the aircraft would be weight-limited and would not takeoff with a full load of fuel. This presents no operational constraints since the aircraft will be modified to add air-to-air refueling capability. Therefore, for this analysis, Table C-4 shows the quantities of aircraft and laser-system fuel/chemicals assumed to be onboard at takeoff. This is approximately half of the maximum jet fuel capacity.

Table C-4. Laser System Fuel/Chemicals Onboard During Takeoff

Fuel/Chemical	kg	lbs
Aircraft Fuel (JP-8)	90,700	200,000
Basic Hydrogen Peroxide Mixture	4,500	10,000
Ammonia	820	1,800
Chlorine	680	1,500
Helium	450	1,000
Nitrogen	*230*	500
Iodine	45	100
TOTAL	97,425	214,900

Sandia National Laboratories (Tieszen, 1995 and Tieszen and Attaway, 1996) analyzed crash scenarios involving Air Force C-141 aircraft to determine fuel dispersal models. These studies divided the aircraft impact with the ground into three impact-velocity regimes. At low impact velocities, minimal structural damage occurs to wing fuel tanks and insignificant amounts of fuel leak from the tanks. At intermediate impact velocities, structural damage is significant but insufficient to cause complete structural failure of the fuel tank. In this regime, fuel will leak at a rate proportional to the damage to the tank. At high impact velocities, complete structural failure of the wing fuel tank occurs. The boundary between the intermediate- and high-impact velocity regimes could not be completely specified with the existing data. A distributed load wing impact between 60 and 72 in/sec would devastate wing tanks, while concentrated load (such as a telephone pole) wing impact of only 33 to 41 in/sec would achieve similar results. Approximately two-thirds of the fuel would be atomized and consumed in the initial fireball. The remaining fuel would pool in the crater caused by the aircraft impact and burn at a much slower rate. Since hydrogen peroxide and ammonia are oxidizers, and chlorine, helium and nitrogen are gases, these would be consumed in the initial fireball. The initial fireball would last approximately five minutes (Majiawala, 1996), however the pool fire could last up to several hours (Moya, 1996).

The Chemical Equilibrium Analysis (CEA) computer code (NASA, 1994 and 1996) was used to calculate the combustion products of a high-intensity fire as a result of an aircraft accident. It was assumed that there was sufficient air to provide the required oxygen for complete combustion. The results of the analysis are shown below in Table C-S. The primary components in the plume from the fire are nitrogen, oxygen, argon (components in air), carbon dioxide, carbon monoxide and nitrogen oxide. There are trace percentages (less than 0.05 percent by weight) of hydrogen chloride, chlorine, and oxides of nitrogen. There are no unusual or toxic chemicals in the plume in sufficient concentrations to cause health problems (0.10 ppm of hydrogen chloride and 0.012 ppm of chlorine). As anticipated in a fire, oxygen in the atmosphere is consumed and there are increased levels of carbon dioxide and carbon monoxide.

Table C-5. Chemical Composition of Plume Resulting from Aircraft Crash

Chemical	Without Laser Fuels		With Laser Fuels	
	Weight (kg)	Percent	Weight (kg)	Percent
Nitrogen	997,747	70.2	997,010	69.9
Oxygen	14,812	1.0	14,850	1.0
Water	104,538	7.4	108,500	7.6
Carbon Dioxide	223,505	15.7	223,580	15.7
Carbon Monoxide	40,399	2.8	40,340	2.8
Nitrogen Oxide	15,466	1.1	15,460	1.0
Argon	17,200	1.2	17,170	1.2
Other	7,833	0.6	9,160	0.8
TOTAL	1,421,500	100.0	1,426,070	100.0

The energy released in the fire will cause the plume to rise rapidly into the atmosphere. The characteristics of the plume rise are dependent on the rate of energy released in the fire, the wind velocity and the atmospheric turbulence. Using the approach recommended by G.A. Briggs, analysis shows that the plume will rise to a height of above 3,000 ft above the crash site and continue to rise to above 10,000 ft as the plume moves downwind away from the crash site (Briggs, 1969; Roughton and DeLaurentis, undated). Figure C-2 shows an example of predicted plume trajectories formed by the effects of wind velocity on the plume. The plume quickly rises above the crash site and then the wind pushes the plume away. Once the plume is above the local mixing height, the combustion products will be diluted in the very large volume of air in the troposphere before they are slowly transported down to ground level. The EPA generally uses 3,000 ft above ground level as the default mixing height across the United States. Therefore, an accident of the B747-400 with an integrated laser weapon system does not create an additional toxic hazard as a result of the chemicals being carried onboard.

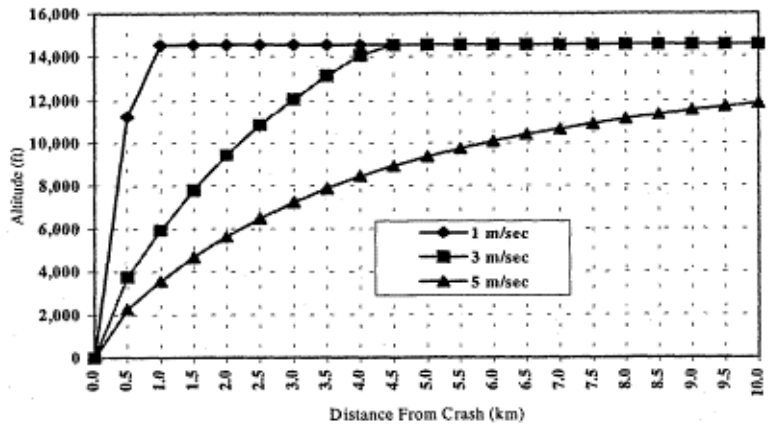

Figure C-2. Height of Plume at Selected Wind Velocities

RELEASE OF CHEMICALS AT HOME BASE

During the ground and flight-test activities, chemicals used by the laser-weapon system would be stored at the Home Base. The quantities and type of chemicals which are considered extremely hazardous substances, as defined by the Clean Air Act, Section 112(r) or by the Superfund Amendments Reauthorization Act (SARA) of 1986, are shown in Table C-6.

If an accidental release of one of the chemicals listed in Table C-6 exceeded the reportable quantity shown in Table C-5. the release must be immediately reported to the National Response Center in Washington, D.C. A comparison of the Home Base storage quantities and the threshold quantities listed in the last two columns of Table C-6 shows that only the "Threshold Planning Quantity" would be exceeded. Therefore, the owner or operator must provide to the State or local emergency planning agency any information necessary for the development or implementation of local emergency plans (40 CFR **§** *355).* Since the "Threshold Quantity" would not be exceeded, the development of a risk management plan would not be required (40 CFR **§** 68).

Table C-6. Chemical Storage Requirements at Home Base

Chemical Name	CASRN Number	Home Base Storage Quantity (Ibs)	Reportable Quantity' (Ibs)	Threshold Planning Quantity' (Ibs)	Threshold Quantity2 (Ibs)
Ammonia	7664-41-7	5,000	100	500	10,000
Chlorine	7782-50-5	2,000	10	100	2,500
Hydrochloric Acid (liquid)	7647-01-0	8,000	Not Listed	Not Listed	15,000
Hydrogen Peroxide	7722-84-1	7,000	1	1,000	Not Listed

[1] 40 CFR § 355, Emergency Planning and Notification
[2] 40 CFR § 68, Chemical Accident Prevention Provisions
CASRN - Chemical Abstract Services Registration Number

Since the ABL Program is still in the Concept Design Phase, the detailed design of the chemical-storage containers and piping to transfer the chemicals from the storage containers to the laser-weapon system have not been completed. Once detailed designs are completed, a comprehensive hazard analysis and risk assessment would be accomplished in accordance with Air Force system safety practices. Additionally, this equipment would be designed and built in accordance with standard industrial practices and spill prevention programs of the DoD, Air Force, State and local agencies. Emergency response personnel would be properly trained, and personnel working in the area would be trained to respond correctly to an accidental release.

The most probable accident scenario would be the release of chemicals during transfer operations. Chemical storage-tank facilities would be designed to prevent the accidental impact of vehicles with the storage tanks by the use of barriers, and the tanks would be tested to ensure that they are capable of withstanding the internal pressures without rupturing (Crojack, 1996; AICE, 1988). The accident scenario analyzed for this section will be a release of 450 kg (1,000 lbs) of each of the chemicals over a five-minute interval. This accident scenario assumes that a connection would be improperly made or that the connector has a mechanical failure, and that the shut-off valve cannot be closed for five minutes.

A release of liquid hydrochloric acid will not be analyzed. The EPA has recently concluded that non-aerosol forms of hydrochloric acid do not meet the statutory criterion of 40 USCA § 11023 (d)(2)(A) regarding acute human health effects; specifically, “chemical is known to cause or can reasonably be anticipated to cause significant adverse-acute human-health effects at concentration levels that are reasonably likely to exist beyond facility boundaries as a result of continuous, or frequently recurring releases.” (61 ER 38600) Hydrochloric acid is not listed in 40 CFR § 355 as a hazardous substance whose release must be reported as part of the Emergency Planning and Community Right-to-Know Act. Only hydrogen chloride in the gaseous state is listed.

The analysis in this EIS is based on concentration of the toxic chemical as it is dispersed in the atmosphere. The toxic chemical would be transported by the prevailing winds to form a vapor cloud. There are two main types of vapor clouds:

- Plume - an elongated cloud whose leading edge travels with the wind while the trailing edge remains attached to the source of the vapors. While the cloud is attached to the source, it has the general shape of a tear drop.

- Puff - an approximately spherical cloud where both the leading and trailing edges move together downwind.

The extent of the toxic cloud from the accidental chemical release was calculated using toxic exposure limits defined by the American Conference of Governmental Industrial Hygienists and by the National Institute for Occupational Safety and Health. The Short Term Exposure Limits (STEL) are defined by the American Conference of Governmental Industrial Hygienists (ACGIH, 1995) as:

> “...the concentration to which workers can be exposed continuously for a short period of time without suffering from 1) irritation, 2) chronic or irreversible tissue damage, or 3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue or materially reduce work efficiency... A STEL is defined as a 15-minute, time-weighted average exposure which should not be exceeded at any time during a workday ..."

Appendix C

The Immediately Dangerous to Life or Health (IDLH) limit is defined by the National Institute for Occupational Safety and Health (NIOSH, 1994) as a concentration that a worker can be exposed to for a 30-minute period without suffering injury or irreversible health effects in the event of respiratory protection equipment failure.

The STEL, IDLH, and the lowest published lethal-dose values for each of the chemicals are shown in Table C-7. These toxic exposure limits should provide wide safety margins for personnel exposed to the vapor cloud. Recent amendments to 40 CFR **§** 68, *Accidental Release Prevention Requirements: Risk Management Programs Under Clean Air Act Section 112(r)(7),* 20 June 1996, defined the toxic endpoints for 77 toxic substances. The toxic endpoint is used to define the distance from the release beyond which environmental receptors would not be affected by the toxic substance. Note that the toxic endpoint concentrations are between the STEL and IDLH values. EPA acknowledges that very little, if any, data exists on the potential acute environmental impacts. Additionally, the consequence distances estimated using human acute-toxicity effects may not be directly relevant to environmental effects (61 FR 31668).

Table C-7. Toxic Exposure Limits (ppm)

Chemical Name	**STEL[1]**	**TE**	**IDLH[3]**	**LCLo[4]**
Ammonia	35	197	300	30,000
Chlorine	1	3	10	858
Hydrogen Peroxide	Not Listed	Not Listed	75	Not Listed

[1] STEL - Short Term Exposure Limit (ACGIH, 1995)
[2] TE - Toxic Endpoint (40 CFR § 68, Appendix A, 1996)
[3] ILDH - Immediately Dangerous to Life and Health (NIOSH, 1994)
[4] LCLo - Lowest Published Lethal Concentration (Sax and Lewis, 1989)

The Air Force Toxic Chemical Dispersion Model (AFTOX 4.1) (USAF, 1991) was used to calculate the extent of the toxic cloud. Wind velocities of 1, 3, and 5 m/sec (2, 7, and 12 mph) were used to determine the extent of the toxic cloud's area of influence. Tables C-8 through C-10 show the maximum size of the affected area or toxic corridor and the duration of the toxic cloud for an accidental chemical release. The duration of the toxic cloud is the time from the initiation of the release to the time the maximum concentration level in the cloud falls below a toxic threshold limit. During the initial phase of the release, the cloud is of the plume type. But once the release is stopped, the chemical will evaporate, the cloud will detach from the release point, and move down the toxic corridor as a puff-type cloud (Figure C-3). After release, it initially assumes an oval shape which gradually changes to a sphere as it diminishes in size until it is dispersed to below toxic threshold limits. The toxic corridor shown in the tables is the length and maximum width of the toxic cloud. The length is measured from the source of the release to the furthest point reached by the leading edge of the cloud. Thus, personnel along the outer edges of the toxic corridor would not be exposed to concentrations above the toxic exposure limit, and personnel in the center of the corridor would only be exposed for the time it takes the cloud to pass.

These tables show that the accidental release of these substances would affect a limited area for a relatively short period of time. A release of chlorine would be the most hazardous to biological resources downwind of the release.

Table C-B. Toxic Corridor Parameters—Ammonia

Wind Velocity (m/sec)	STEL (35 ppm)		IDLH (300 ppm)	
	Toxic Corridor[1] (m)	Duration[2] (min)	Toxic Corridor (m)	Duration (min)
1	550x200	13	220x100	8
3	950x180	10	315x60	7
5	1060x140	9	325x55	6

[1] Toxic Corridor is length by width.
[2] Duration is the time from when the chemical is first released until the concentration in the cloud falls below either the STEL or IDLH limits

Table C-9. Toxic Corridor Parameters—Chlorine

Wind Velocity (m/sec)	STEL (1 ppm)		IDLH (10 ppm)	
	Toxic Corridor[1] (m)	Duration[2] (min)	Toxic Corridor (m)	Duration (min)
1	1070x400	21	510x180	12
3	1080x340	11	415x140	7
5	2360x360	11	660x100	8

[1] Toxic Corridor is length by width.
[2] Duration is the time from when the chemical is first released until the concentration in the cloud falls below either the STEL or IDLH limits

Table C-10. Toxic Corridor Parameters—Hydrogen Peroxide

Wind Velocity (m/sec)	IDLH (75 ppm)	
	Toxic Corridor (in)	Duration (mm)
1	300x100	9
3	325x80	7
5	375x80	7

[1] Toxic Corridor is length by width.
[2] Duration is the time from when the chemical is first released until the concentration in the cloud falls below either the STEL or IDLH limits

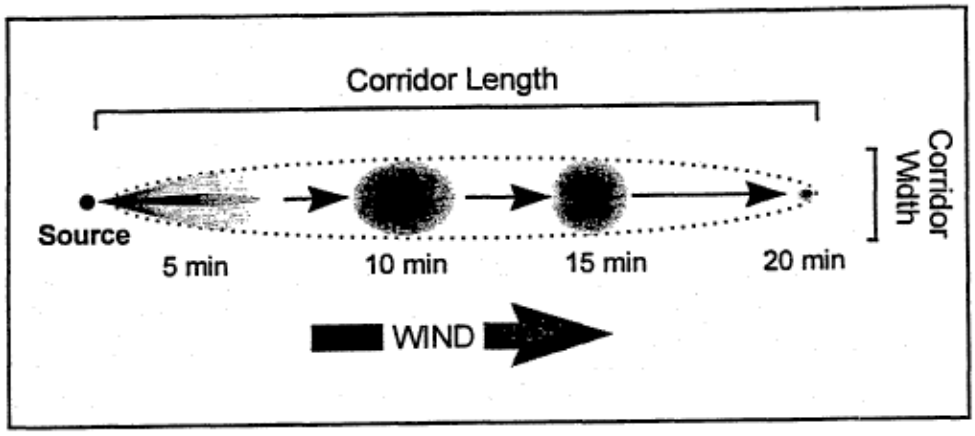

Figure C-3. Toxic Cloud Life Span

RELEASE OF CHEMICALS AT TEST RANGES

The only extremely hazardous substances of sufficient quantity to warrant analysis at the test ranges are the fuel (unsymmetrical dimethylhydrazine, UDMH) and oxidizer (inhibited red-fuming nitric acid, IRFNA) used in the Lance missile. The solid propellants from the Terrier, Orion, and Black Brant missiles would not affect a widespread area in an accident scenario.

Since the Lance missile is shipped to the range prefueled, there would be no local refueling operations. Opportunities for an accident would be during the assembly of the missile, and mounting the missile on the Zero Length Launcher. Inflight accidents will not be analyzed. Personnel would be cleared from the area surrounding the launch location; thus, the accident would have minimal effect on humans. The scenario that has the greatest risk is a release of either UDMH (170 kg) or IRFNA (502 kg) during assembly and mounting of the missile. However, the likelihood of this occurring is very small. In the entire history of the Lance missile program (1972 to 1996), there have been no leaks or spills from Lance missile fuel or oxidizer tanks in field environments or during firing operation (Campbell, R., 1996).

UDMH is a clear, colorless, hygroscopic (capable of absorbing moisture from the air) liquid with an ammonia or fishy odor. UDMH is highly explosive and reacts vigorously with heat, strong oxidizers, and air. IRFNA is a brown liquid with a pungent, acrid odor. It is not explosive and is considered stable. However, when it is exposed to water, the reaction generates considerable heat and violent spattering occurs. UDMH and IRFNA are hypergolic (i.e., they ignite upon contact) and the combustion products are primarily nitrogen, carbon dioxide and water. The toxic exposure limits for UDMH and IRFNA are listed in Table C-l1.

Table C-11. Toxic Exposure Limits—(ppm)

Chemical Name	STEL[1]	IDLH[2]
UDMH	None Listed	15
IRFNA	4	25

[1] STEL - Short Term Exposure Limit (ACGIH, 1995)
2 LDH - Immediately Dangerous to Life and Health (NIOSH, 1994)

A five minute total release of each chemical in the missile was analyzed using the AFTOX 4.1 model. The analysis assumes that no action would be taken to neutralize or cleanup the release. The results of the AFTOX analysis are presented in Tables C-12 and C-13. These tables show that the toxic corridors are relatively small in size and would not extend beyond the restricted area cleared of all non-essential personnel prior to launch. Both UDMH and IRFNA are liquids and do not evaporate quickly as can be seen by the long durations of the toxic corridors. Because of the relatively small size of the toxic corridor, neither release would pose a significant risk to human health.

Table C-12. **Toxic Corridor Parameters—Unsymmetrical Dimethyihydrazine**

Wind Velocity (m/sec)	IDLH (15 ppm)	
	Toxic Corridor (m)	Duration (min)
1	87x40	65
3	112x40	34
5	155x40	23

[1] Toxic Corridor is length by width.
[2] Duration is the time from when the chemical is first released until the concentration in the cloud falls below either the STEL or IDLH limits

Table C-13. Toxic Corridor Parameters—Inhibited Red-Fuming Nitric Acid

Wind Velocity (m/sec)	STEL (4 ppm)		IDLH (25 ppm)	
	Toxic Corridor[1] (m)	Duration[2] (min)	Toxic Corridor (m)	Duration (min)
1	114x40	502	45x24	502
3	192x60	127	68x25	127
5	290x60	78	100x30	77

[1] Toxic Corridor is length by width.
[2] Duration is the time from when the chemical is first released until the concentration in the cloud falls below either the STEL or IDLH limits

The effect of the release of either UDMH or IFRNA on the surrounding soils and water is dependent on the surface of the launch area and the method used to clean the spill. If the Lance missile launcher is on a concrete or asphalt surface the spill may be contained on the surface, and no chemicals would reach the surrounding soil. If the spill is not contained, then UDMH or JFRNA could interact with the surrounding soil and water.

UDMH may ignite in the event of contact with porous earth, or it could form dimethylamine and other oxides of nitrogen, all of which are soluble in water. Dimethylamine oxidizes into amino substances in soils and would serve as a fertilizer. Airborne nitrogen dioxide would return to the earth as nitric acid in rainfall and would react with soils to create nitrites, which would also serve as a fertilizer. However, if the UDMH or its by-products reached water resources, it could degrade water quality.

IRFNA that reached the surface would react with the calcium in the soil to form calcium nitrite. Calcium nitrite is a strong oxidizer that is a fire risk if it were to come in contact with organic material and it could explode if shocked or heated. It is also water-soluble and could degrade water quality.

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APPENDIX D

TARGETS FOR AIRBORNE LASER TESTS

Introduction

Appendix D provides an overview of targets that may be used to support the airborne laser tests. Two of the targets, the BQM-345 and the QF-4 (Figure D-l), fall into the category of remote-controlled (drone) recoverable vehicles. The BQM-34S is subsonic while the QF-4 is capable of speeds up to Mach 2.0. Both vehicles provide considerable mission profile flexibility with a variety of Target Auxiliary/Augmentation Systems (TA/AS).

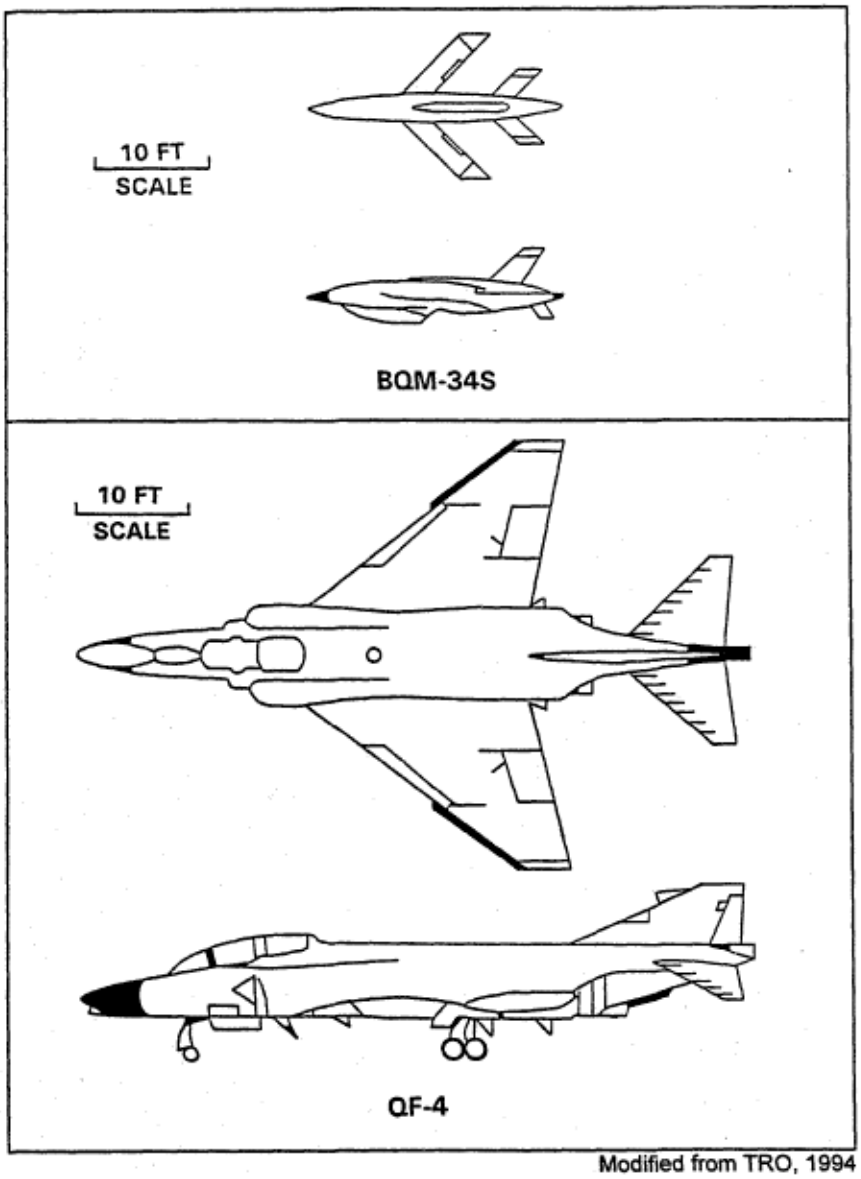


Figure D-1. BQM-34S QF-4 and Drone Aircrafts

The other three targets are of the rocket/missile type including single and multi-stage booster, solid or liquid propellant, as well as guided and unguided vehicles (Figure D-2). The Terrier serves as the first stage (solid propellant) booster for the unguided Black Brant IX (solid propellant) target vehicle. The Orion is a single-stage unguided, solid-propellant rocket, which can be mated to a first-stage Terrier booster. Finally, there is the Lance which is a guided, liquid-propellant missile.

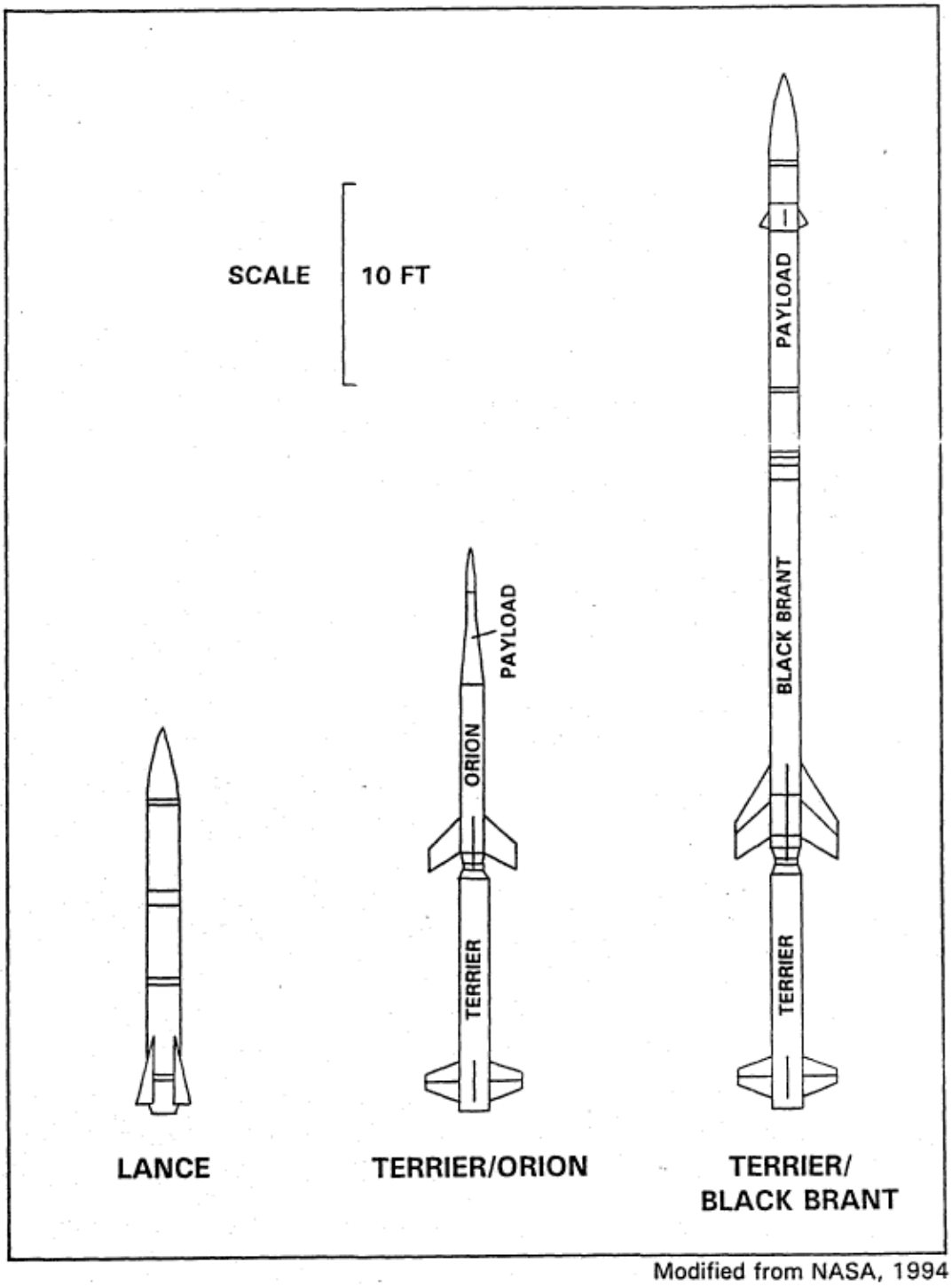


Figure D-2. Rocket/Missile Targets Proposed For Use in Airborne-Laser Tests

BQM-34S Drone

The following data were extracted from the *U.S. Army, Navy, Air Force and Ballistic Missile Defense Organization Compendium of Target Systems* (TRO, 1994), with only minor adaptations for the purpose of clarification:

> The BQM-345 drone (missile target) is a recoverable, remote-controlled subsonic target capable of speeds up to Mach 0.9 (Mach 1 = 761.2 mph at sea level) and altitudes from 0.003 to 15 km (10 to 50,000 ft). The drone is 7 m (23 ft) in length with a wing span of 4 m (12.8 ft). It is propelled by a single J-69 turbojet engine which produces 871 kg (1,920 lb) of thrust at full throttle at sea level. The drone is designed to be launched from short-rail or zero-length ground launchers utilizing a single jet assisted takeoff bottle and from a DC-l 30 aircraft. The drone is controllable through normal flight maneuvers with the capability of performing 5G turns. The Integrated Target Control System transmits target telemetry on the tracking downlink signal. When recovery is made at sea, the drone can be retrieved by boat or helicopter. The BQM-345 can accommodate a variety of Target Auxiliary/Augmentation Systems that include radar and infrared augmentation, threat emitters, countermeasures, scoring, location and navigation, and visual augmentation. See Table D-l for BQM-345 emissions per takeoff and landing and Figure D-3 for performance data.

Table D-1. BQM-34S Drone Aircraft Exhaust Emissions per Takeoff and Landing

Drone Aircraft	Emissions (Ib)			
	Carbon Monoxide	Nitrogen Oxide	Hydrocarbon	Sulfur Dioxide
BQM-34S	16.07	0.31	2.21	0.15
Data Source: NAWC, 1996				

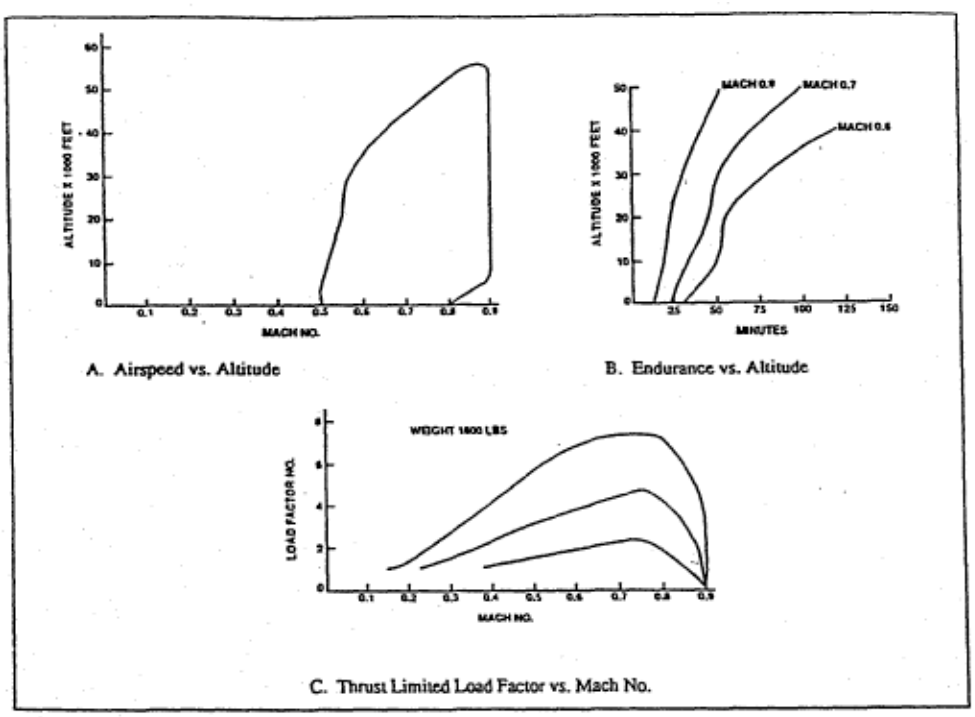


Figure D-3. BQM-34S Performance Data

QF-4 Drone Aircraft

The following data were extracted directly from *U.S. Army, Navy, Air Force and Ballistic Missile Defense Organization Compendium of Target Systems* (TRO, 1994), with only minor adaptations for the purpose of clarification:

> The QF-4 drone aircraft is a supersonic, high altitude, remote-controlled version of the Navy F-4 Phantom aircraft. The aircraft is capable of speeds up to Mach 2.0 and altitudes of 17 km (57,000 ft). The drone is 18 m (58.25 ft) in length and has a wing span of 12 m (38.4 ft). The QF-4 can be remotely controlled using the Integrated Target Control System and employs a nose-mounted television system for remote takeoff/landing. The remote control pilot flies the aircraft from a universal-control console which closely duplicates the aircraft cockpit with control stick, rudder pedals/brakes, throttle control and instrumentation. The aircraft retains its manned configuration and is, in fact, flown much of the time with a flight crew onboard for remote-pilot training and other manned missions. The QF-4 can accommodate a variety o:f auxiliary systems for unique or special missions including scoring, towing, tracking, missile/target launch, and visual augmentation. See Table D-2 for emissions per takeoff and landing, and Figure D-4 for performance data for the QF-4 drone aircraft.

Table D-2. QF-4 Drone Aircraft Exhaust Emissions Per Takeoff and Landing

Drone Aircraft	Emissions (Ib)			
	Carbon Monoxide	**Nitrogen Oxide**	**Hydrocarbon**	**Sulfur Dioxide**
QF-4	88.05	7.28	29.30	0.83
Data Source: NAWC, 1996				

Terrier Booster Rocket

The following data were extracted directly from *the Draft Supplemental Environmental lmpact Statement for Sounding Rocket Program* (NASA, 1994), with only minor modifications for the purpose of clarification:

> For purposes of this environmental impact statement the Terrier is considered a first-stage booster. The propellant weighs 535 kg (1,182 lb) and is of the nitrocellulose/nitroglycerin family with added lead compounds and aluminum. Exhaust emissions are mainly carbon monoxide, carbon dioxide, nitrogen, water and aluminum oxide. These emissions occur during the 4.4-second burn time from ground level to 1.5 km (1 mi). The spent booster impacts about 0.5 km (0.6 mi) from the launch pad and weighs approximately 300 kg (660 lb). See Table D-3 for Terrier exhaust emissions per launch and Table D-4 for launch design information.

(Note: The Terrier may be used as a first-stage booster for several target systems, including the Terrier/Orion, the Terrier/Malamute, the Terrier/Black Brant IX, and the Terrier/Black Brant X.)

Table D-3. Terrier Exhaust Emissions per Launch

Compound	Total Emissions	
	kg	lb
Carbon dioxide	160	353
Carbon monoxide	228	504
Hydrogen	10	23
Lead	10	22
Nitrogen	73	161
Water	54	119
TOTAL	535	1,182
Data Source: NASA, 1994		

Table D-4. Terrier Launch Vehicle Design Information

Rocket	Dimensions				Weight					
	Diameter		Length		Total		Propellant		Impact	
	m	ft	m	ft	kg	lb	kg	lb	kg	lb
Terrier	0.46	1.51	4.27	14	837	1850	535	1182	302	668
Data Source: NASA, 1994										

Black Brant IX

The following data were extracted directly from the *Draft Supplemental Environmental Impact Statement for Sounding Rocket Program* (NASA, 1994), with only minor adaptations for the purposes of clarification:

> Black Brant IX ("nine") is a two-stage, unguided, solid-propellant rocket system with a Terrier first stage (see Terrier Booster Rocket) and a Black Brant VC (BBVC) second stage. This vehicle is capable of carrying a 159 kg (351 lb) payload to 540 km (336 mi), or a 500 kg (1,102 lb) payload to 230 km (143 mi). Impact ranges vary from 50 to 150 km (31 to 90 mi). The diameters are 0.46 meter (1.5 ft) for the Terrier, and 0.44 m (1.4 ft) for the Black Brant VC with standard payload configuration. The vehicle length is 9.3 m (30 ft) to which a payload length of typically 4 meters (13 ft) is added.
>
> The Black Brant propellant weighs 997 kg (2,203 lb) and is of the ammonium/perchlorate/aluminum/lactic binder type with small amounts of carbon black, iron, and sulfur. The rocket-exhaust emissions are mainly aluminum oxide, carbon monoxide, hydrogen chloride, water, and nitrogen. They occur during the 32.4-second burn time over the altitude span from 5 to 44 km (3.1 to 27 mi). The spent-rocket weight is 268 kilograms (591 lbs) at final impact. Tables D-5 and D-6 summarize the basic data.

Table D-5. Black Brant Exhaust Emissions Per Launch

Compound	Total Emissions	
	kg	lb
Aluminum oxide	357	789
Carbon dioxide	14	31
Carbon monoxide	288	636
Hydrogen	30	66
Hydrogen chloride	187	412
Nitrogen	76	168
Sulfur	0.9	2
Water	40	88
Other	4	9
TOTAL	997	2,203
Data Source: NASA, 1994		

Table D-6. Black Brant Launch Vehicle Design Information

Dimensions					Weight					
Rocket	Diameter		Length		Total		Propellant		Impact	
	m	ft	m	ft	kg	lb	kg	lb	kg	lb
Black Brant VC	.44	1.416	5.30	17	1,265	2,796	997	2,203	268	592
Data Source: NASA, 1994										

Orion Rocket

The following data were extracted directly from *DRAFT: Supplemental Environmental Impact Statement for Sounding Rocket Program* (NASA, 1994), with only minor adaptations for the purposes of clarification:

> Orion is a single-stage, unguided, solid-propellant rocket system for lifting payloads to altitudes below 100 km (61 mi). The vehicle is capable of carrying a 38-kg (84 lb) payload to 88 km (53 mi), or a 68-kg (150 lb) payload to 71 kilometers (43 mi). Impact ranges vary from 25 to 50 km (15 to 30 mi). The rocket and payload diameter is 0.36 m (1.18 ft), and the payload length of from 1.8 to 2.5 m (5.9 to 8.2 ft) is added to the booster.
>
> The Orion propellant weighs 278 kg (614 lb) and is a mix of ammonium perchlorate, polyurethane, and nitroguanadine with an aluminum additive. The rocket-exhaust emissions are mainly hydrogen chloride, water, carbon monoxide, carbon dioxide, and aluminum oxide. They occur during the 32.5-second burn time over the altitude span of 25 km (15 mi). Tables D-7 and D-8 summarize the basic data for the Orion launch vehicle.

Table D-7. Orion Emissions Per Launch

Compound	Total Emissions	
	kg	lb
Aluminum oxide	31	68
Carbon dioxide	44	97
Carbon monoxide	50	110
Copper	1	2
Hydrogen	4	9
Hydrogen chloride	64	141
Nitrogen	26	57
Water	58	128
TOTAL	278	612
Data Source: NASA, 1994		

Table D-8. Orion Launch Vehicle Design Information

Rocket	Dimensions				Weight					
	Diameter		Length		Total		Propellant		Impact	
	m	ft	m	ft	kg	lb	kg	lb	kg	lb
Orion	.36	1.18	2.68	8.8	481	924	278	614	140	309
Data Source: NASA, 1994										

(Note: During PDRR ABL Phase activities, the Terrier will be used as a first-stage booster for the Orion.)

Lance Missile

The following data were extracted directly from *U.S. Army, Navy, Air Force and Ballistic Missile Defense Organization Compendium of Target Systems* (August, 1994) with only minor adaptations for the purposes of clarification.

The Lance (MGM-52) is a mobile, surface-to-surface, battlefield support missile in nuclear and conventional warhead versions. There were 2,391 manufactured before production ended in 1980. The Lance uses a liquid propellant motor that can be stored fully fueled and ready for use. It was originally designed to have a shelf life of 12 years. However, recent test firings of Lance missiles at WSMR have shown that there is no degradation of the missiles' operation after storage of up to 15 years.

The Lance missile contains an integrated two-stage motor known as a P8E6. The high-thrust booster portion burns for 5.52 seconds and the lower-thrust sustainer for approximately 120 seconds (varies with level of thrust). The Lance has been used as a target for the Patriot interceptor. The missile fuel, unsymmetrical dimethylhydrazine (UDMH), weighs 170 kg (375 lb) and is a clear colorless, highly-toxic liquid. The oxidizer, inhibited red-fuming nitric acid (IRFNA), weighs 502 kg (1,106 lb) and is a highly corrosive and toxic reddish-brown liquid. These two liquids are hypergolic (burn spontaneously) when combined. The exhaust emissions are mainly carbon dioxide, water, and nitrogen.

The Lance missile was originally fielded as a single-stage, non-separating field artillery missile, deployed with the U.S. Army in the continental U.S. and Europe and later sold to U.S. allies in Europe. The Lance was designed to accommodate either a conventional or a nuclear warhead, and intended to be employed against targets ranging from 8 to 130 km from the launch point. The Lance is capable of varying boost-phase duration, which determines the apogee and range of the missile. The flight profile of the missile consists of an ignition phase in which the solid-gas generator (SGG) is ignited. The SGG provides propellant-tank pressurization as well as initial missile-spin stabilization. The boost phase can have a duration of up to 5.52 seconds. The maximum thrust generated in the boost phase is approximately 20,865 kg (46,000 lb). Directional control during the boost phase is provided by thrust vector control. Following the termination of the boost phase, the missile enters a variable-length, sustained flight phase. Sustained thrust during this period is provided by a sustainer-thrust chamber. At the end of the sustainer phase, the missile enters an uncontrolled ballistic-coast phase to the intended impact point (Figure D-5). Tables D-9 and D-10 summarize the basic data for the Lance missile.

The Lance missile is typically launched from a mobile launcher, Launcher Zero Length (LZL) M740. The LZL consists of the basic launch fixture and an adaption kit that includes the stabilizing jacks, wheels, trailing arms, towbar, and other items. The LZL is designed to be highly mobile and can be towed by a 2 1/2-ton vehicle. The launch fixture incorporates manuallyoperated elevation and traverse mechanisms to aim the missile. Prior to launch and for the first 5 inches of travel after ignition, the missile is supported by two rear guide-rails and a rotating forward support. After 5 inches of travel, the missile leaves the rear guide-rails and the forward support rotates out of the way, leaving the missile in free flight. The Launch Hazard Area (LHA) for the Lance missile is shown in Figure D-6, and Table D-11 shows the width of the clear zone as a function of distance from the launch point.

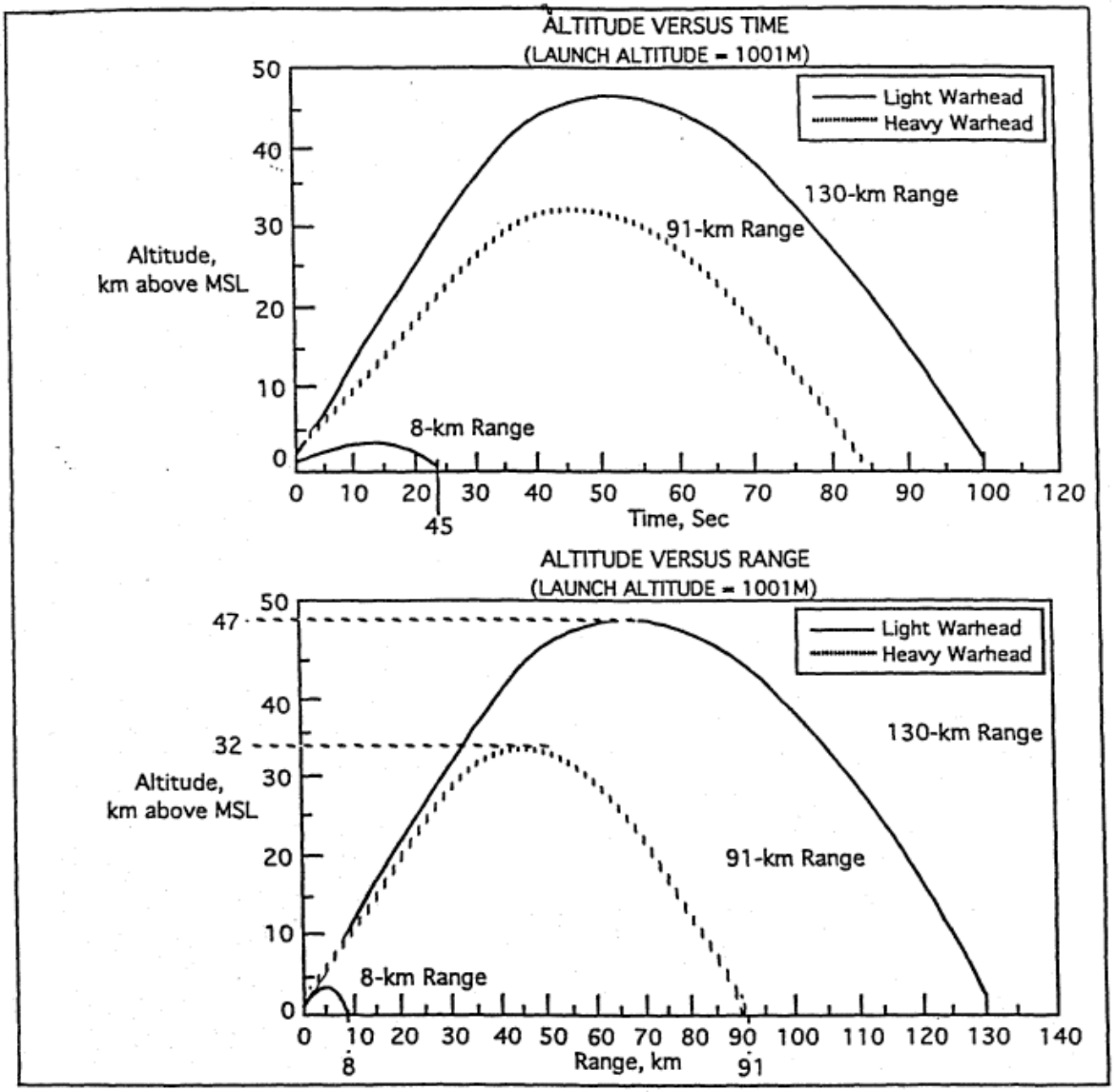


Figure D-5. Typical Lance Mission Profile Data

Table D-9. Lance Missile Total Exhaust Emissions per Launch

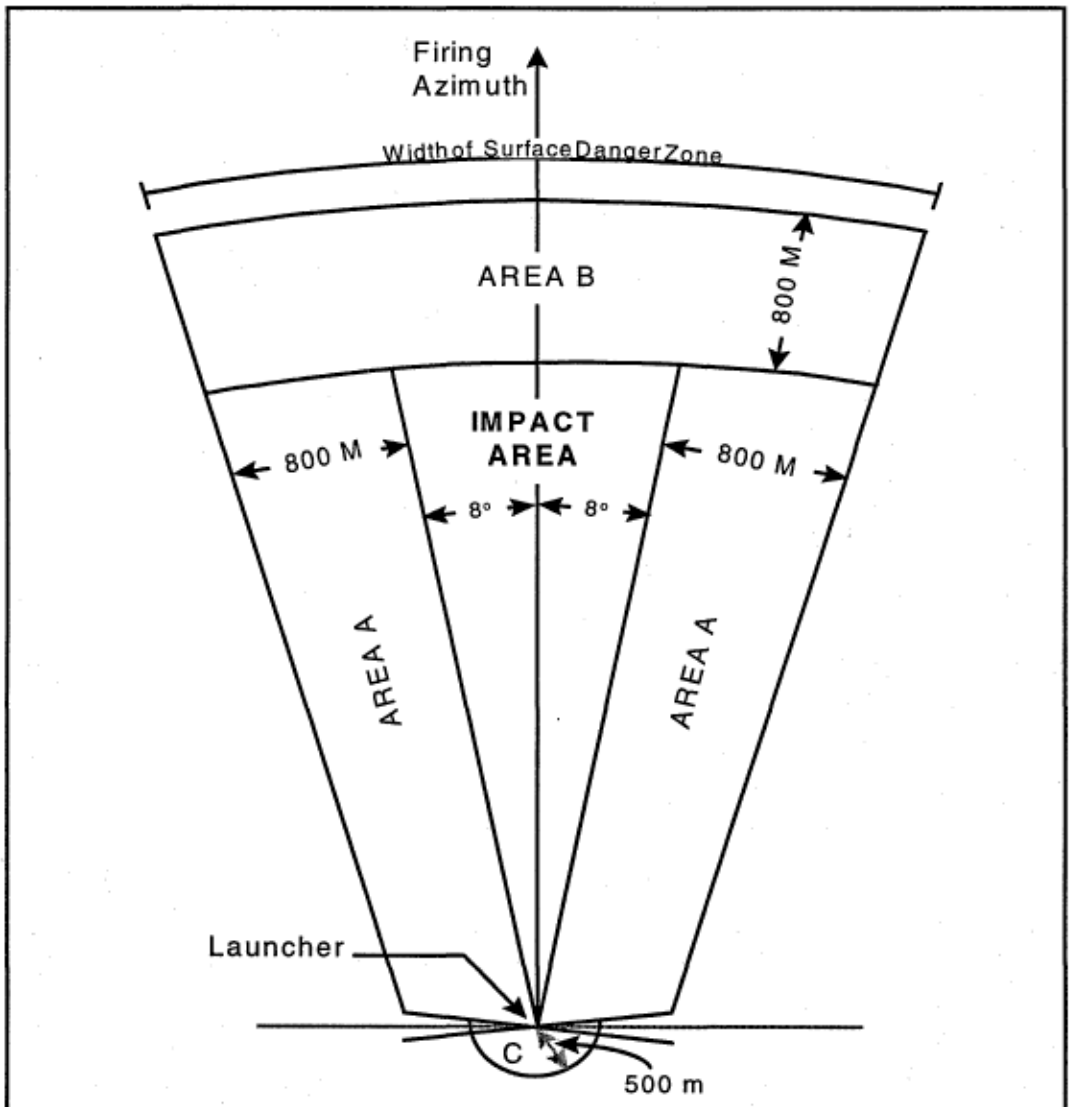
Combustion Product	Emissions (Ib)			
	Igniter	**SPGG'**	**Rocket Motor**	**Total**
Carbon	-	3.65	-	3.65
Carbon dioxide	0.110	14.79	450.27	465.17
Carbon monoxide	0.080	16.26	27.43	43.77
Hydrogen	0.010	1.32	-	1.33
Hydrogen chloride	0.100	-	-	0.100
Hydrogen fluoride	-	-	8.01	8.01
Hydrogen peroxide	-	-	6.67	6.67
Iron chloride	0.010	-	-	0.010
Lead	-	0.40	-	0.400
Methane	-	0.64	-	0.640
Nitric oxide	-	-	3.57	3.57
Nitrogen	0.040	5.24	415.28	420.56
Oxygen	-	-	14.97	14.97
Water	0.050	3.68	555.09	558.82
Other	0.004	-	1.33	1.33
TOTAL	0.404	45.98	1,482.69	1,529.00

[1] Solid-Propellant Gas Generator - Provides positive pressure to force the propellants into the thrust chamber. Data Source: USACE, 1992

Table D-1O. Lance Missile Launch Vehicle Design Information

Rocket	Dimensions				Weight					
	Diameter		**Length**		**Total**		**Propellant**		**Impact**	
	m	**ft**	**m**	**ft**	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**
Lance	.56	1.8	6.14	20	1,292	2,855	692	1,529	600	1,326

Data Source: NASA, 1994



Area A is the Lateral Danger Area which is considered adequate to contain the impact of any errant missiles and associated debris.

Area B is the Maximum Secondary Danger Area and is considered adequate to contain the forward debris from the impacting missile.

Area C is the Launcher Danger Area, which receives the direct heat and stream of missile exhaust gases, is subject to blast effects from flying debris (i.e. dirt, dust, rocks) and acoustical hazards.

Source: System Description for Lance Guided Missile System, Technical Manual, TM 9-1425-485-10-1, Department of the Army, August 1974

Figure D-6. Plan View of Launch Hazard Areas for the Lance Missile

Table D-11. Clear Zone for Lance Missile Launches

Distance From Launcher (kin)	Width of Surface Danger Zone (kin)
1.0	1.88
1.5	2.02
2.0	2.16
2.5	2.30
3.0	2.44
3.5	2.58
4.0	2.72
4.5	2.86
5.0	3.00

Source: System Description for Lance Guided Missile System, Technical Manual, TM 9-1425-458-10-1, US Army, August 1974

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APPENDIX E

1990 CLEAN AIR ACT AMENDMENTS CONFORMITY ANALYSIS FOR THE PROGRAM DEFINITION AND RISK REDUCTION AIRBORNE LASER

APPENDIX E

PRELIMINARY
1990 CLEAN AIR ACT AMENDMENTS
CONFORMIITY ANALYSIS FOR THE
PROGRAM DEFINITION AND RISK REDUCTION
AIRBORNE LASER

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APPENDIX E

PRELIMINARY 1990 CLEAN AIR ACT AMENDMENTS CONFORMITY ANALYSIS FOR THE PROGRAM DEFINITION AND RISK REDUCTION Al ORNE LASER

Introduction

As shown by the following conformity analysis, activities conducted during the PDRR ABL Phase would be exempt from any further requirements under the conformity rule [40 CFR § 93.153(c)(1)].

The 1990 Clean Air Act Amendments (CAAA) (Public Law 101-549) prohibit federal agencies from engaging in, supporting, licensing, or approving any action that does not conform to an approved state or federal implementation plan. This requirement was levied to ensure federal activities do not hamper local efforts to control air pollution and more specifically to meet the National Ambient Air Quality Standards (NAAQS) emission reduction requirements in nonattainment or maintenance areas (Section 176, 1990 CAAA).

Conformity to a state implementation plan (SIP) means: conformity to the SIP's purpose of elimination or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards; and that such activities will not:

- Cause or contribute to new violations of the NAAQS
- Increase the frequency or severity of an existing violation
- Delay the timely attainment of a standard, interim emission reduction, or milestone.

The EPA developed two major rules for determining conformity of federal activities: conformity requirements for transportation plans, programs, and projects (transportation conformity) and all other federal actions (general conformity) (U.S. Navy, 1994). The ABL Program falls exclusively in the latter category.

Conformity Analysis Process Overview

Completing the conformity analysis requires several detailed steps. The steps are summarized below and are depicted in the logic-flow diagram in Figure E-1 (USAF, 1995). Note: the Conformity Analysis performed for this BIS only requires a subset of the steps identified in Figure E-1and the following discussion is limited to the necessary subset of steps. See the references for additional information.

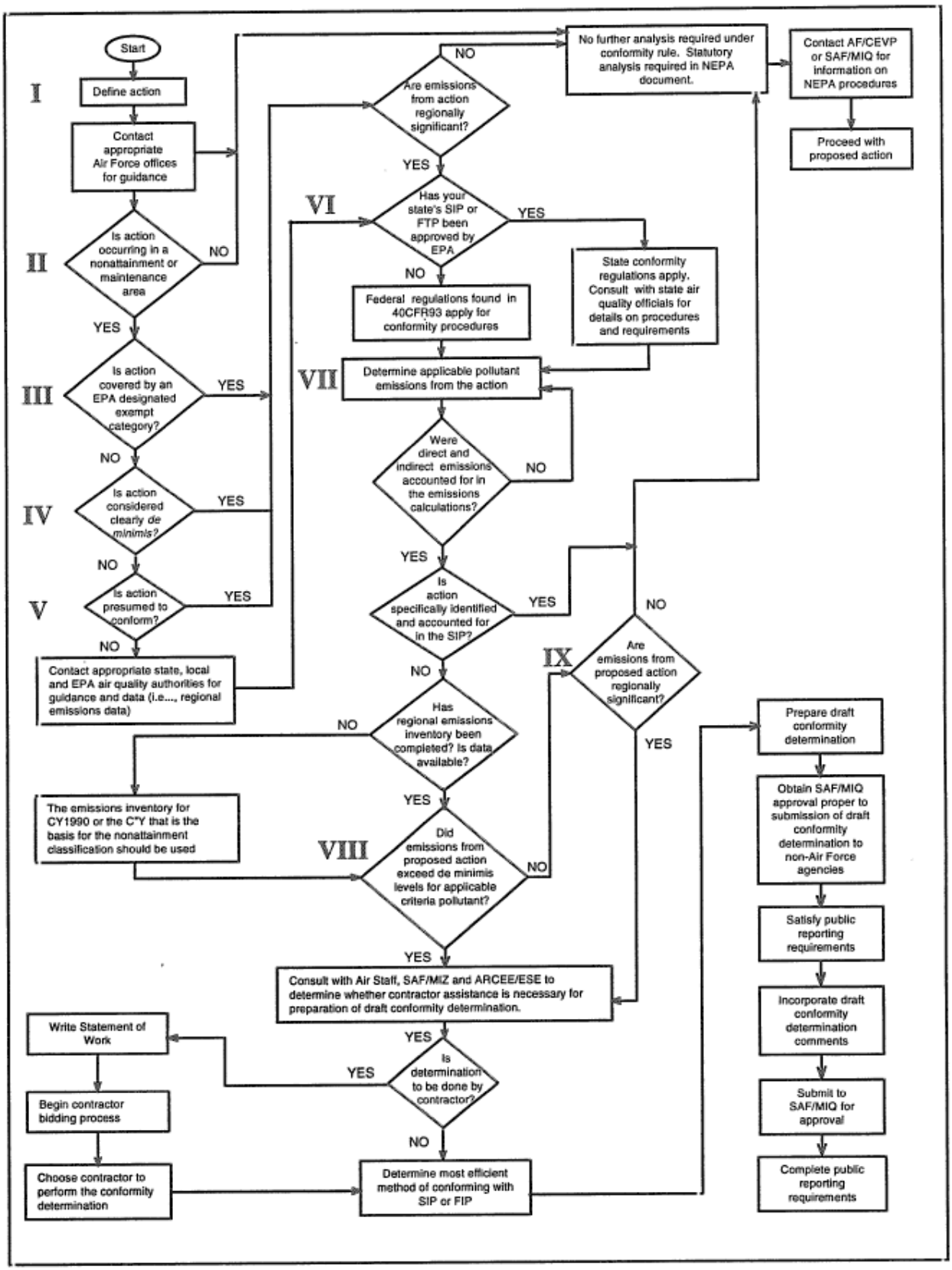

Figure E-1. Logic Flow Diagram (Source: USAF, 1995)

I. **Define the action**. Each phase of the action must be fully defined, including scope (aircraft, construction, people), classification, time (to include arrivals and departure schedules), and locations.

II. **Determine if action is occurring in a nonattainment or maintenance area**. Conformity analysis is only required in these areas and is only an issue for the specific criteria pollutants that caused the nonattainment.

III. **Determine if action is exempt**. The EPA conformity regulations include a list of exempt categories, for example, actions requiring a permit under the New Source Review and actions in response to emergencies.

IV. **Determine if the action is clearly *de minimis***. The EPA has defined certain categories of federal actions that are clearly *de minimis*, for example, judicial proceedings and routine, recurring transportation of material and personnel.

V. **Determine if the action is presumed to conform**. The EPA conformity regulations permit agencies like the USAF to create (with appropriate documentation) "presumed to conform" categories. The USAF has not created any categories.

VI. **Determine if the appropriate SIP has been approved.**

VII. **Determine the applicable pollutant emissions from the action**. Estimate the nonattainment/maintenance criteria pollutants emissions from the proposed action.

VIII. **Determine if the emissions from the action exceed the *de minimis* levels**. Compare the emissions estimates against the *de minimis* emissions levels for applicable criteria pollutants determined by attainment status of the region (see **Table E-1**).

IX. **Determine if the emissions from the action are regionally significant**. A regionally siguificant action is defined as a general federal action representing 10 percent or more of a nonattainment or maintenance area's total emission of any criteria pollutant. The purpose behind the concept is to capture those actions falling below *de minimis* emission levels but having the potential to impact the air quality of a region.

Table E-1. *De Minimis* Threshold Quantities

Criteria Pollutant			Threshold Quantity (tons per year)
Nonattainment Areas	Ozone (VOCs or NO_x)	Extreme	10
		Severe	25
		Serious	50
		Other ozone outside an ozone transport region	100
	Carbon monoxide	All	100
	PM-10	Serious	70
		Moderate	100
Maintenance Areas	Ozone	VOCs outside an ozone transport region	100
		NO_x	100
	Carbon monoxide		100
	PM-10		100

NAA - nonattainment area VOC - volatile organic compound
PM-10 - particulate mailer less than 10 microns in diameter
Data Source: 40 CFR§ 93.153 (b)(1) and (2)
ata Source: 40 CFR 93.153 (b)(1) and (2)

Conformity Analysis for the PDRR ABL Phase

I. Define the Action at Each Location

PDRR ABL Phase activities at each location that have the potential to generate relevant emissions are discussed below. The specific activitiesare divided into calendar-year groupings.

EDWARDS AFB

Facility Modification/Equipment Installation Activities (1999). The proposed PDRR ABL Complex is located southeast of the main base complex at the Birk Flight Test Facility. Facility modification would occur at Edwards AFB, including construction or modification of existing buildings for use as laboratory and chemical storage, mixing, transfer, and waste storage facilities, and modification of an existing hangar to house the B747 aircraft and integration facilities. Approximately 50 locally-hired construction workers would be employed during the modification phase, which would last approximately 12 to 15 months. Activities would occur on previously disturbed land.

A ground pressure recovery system would be installed at Edwards AFB within the fenced PDRR ABL Complex, near the aircraft apron and hangar. The pressure recovery system would consist of an electric-or natural gas-fired steam plant to power steam ejectors, a series of mechanical turbo-pumps, or a vacuum-bottle system. Several options exist for storage of laser fuel. The exact desigu of the storage facility has not yet been completed. However, existing facilities at Edwards AFB would be considered. Laser fuel would be transported to the aircraft from the laser fuel storage area by tanker truck or other ground support equipment. Mixing, transfer, and waste storage equipment installation would occur within the fenced PDRR ABL Complex.

Five government personnel assigned to the PDRR ABL Phase would be on-site during the facility modification/equipment installation phase. In addition, five temporary PDRR ABL contractor personnel would be located at Edwards AFB during this phase.

- Duration: 12 months total

- 50 construction personnel per day (36 light-duty gasoline passenger vehicles and 14 light-duty gasoline trucks), 60 miles per day

- Site preparation/demolition (1 month)
  2 heavy-duty gasoline trucks, 60 miles per day
  10 heavy-duty diesel trucks, 60 miles per day
  Motor grader: 170 hours of use
  Front-end loader: 100 hours of use
  Roller: 60 hours of use
  Water distribution truck: 30 hours (2 hours per day for 15 days)
  Size of site: 1 acre

- Facility modification/equipment installation (11 months)
  2 heavy-duty gasoline trucks, 60 miles per day
  5 heavy-duty diesel trucks, 60 miles per day
  4 welding units, 8 hours per day, 4 months.

System Integration/Ground Test Activities (2000 and 2001). The system integration and ground test activities, involving laboratory and aircraft integration, and testing of the laser weapon system, would last approximately 24 months. Two hundred people would be associated with these activities.

- Duration: 24 months total

- 200 personnel per day (146 light-duty gasoline passenger vehicles and 54 light-duty gasoline trucks), 60 miles per day

- 1 heavy-duty diesel truck, 60 miles per day

- B747-400F aircraft engine operational time 1 takeoff and landing

- External Pressure Recovery System Operation
  30 tests (steam generator requires 24 hours of operation per test)
  1.5 MBtu/hour natural gas-fired steam generator.

Ground Activities During Flight Tests (2002). The ground activities during the flight test of the PDRR ABL would last approximately nine months. Personnel working at the Home Base during the system integration and ground tests would continue through these tests.

- Duration: 9 months total

- 200 personnel per day (160 light-duty gasoline passenger vehicles and 40 light-duty gasoline trucks), 40 miles per day

- 1 heavy-duty diesel truck, 40 miles per day

- B747-400F aircraft
  - 30 takeoffs and landings
  - Fueling operations (heavy-duty diesel trucks, 20 miles/refueling operation)
  - AGE support (75 hp, 4 hours per day, 3 days/mission, 3 pieces of AGE)

- External Pressure Recovery System Operation
  - 5 tests (steam generator require 24 hours of operation per test)
  - 1.5 MBTU/hour natural gas-fired steam generator.

KIRTLAND AEB

Facility Modification/Equipment Installation Activities (1999 & 2000). The proposed PDRR ABL Complex at Kirtland AFB is located near the southeast end of the east-west runway just south of South Gate Avenue (Bldg. 760 complex).

Facility modification would occur at Kirtland AFB, including modification of existing buildings for use as laboratories and chemical storage, mixing, transfer, and waste-storage facilities; and modification of an existing hangar to house the B747 aircraft and integration facilities. Activities would occur on previously disturbed land. Site preparation and facility modification would be considerably more extensive at Kirtland AEB than at Edwards AFB. A pressure-recovery system would be installed at Kirtland AFB within the fenced PDRR ABL Complex, near the aircraft apron and hangar. The pressure-recovery system would consist of an electric- or natural gas-fired steam plant to power steam ejectors, a series of mechanical turbo-pumps, or a vacuum bottle system.

A laser fuel farm would be constructed at Kirtland AEB within the PDRR ABL Complex. Laser fuel would be transported to the aircraft from the laser-fuel storage area by tanker truck or other ground-support equipment. Installation of mixing, transfer, and waste storage equipment would also occur within the fenced PDRR ABL Complex.

Since the ABL SPO is already located at Kirtland AFB, only five temporary PDRR ABL contractor personnel would be located at Kirtland AEB during this phase.

- Duration: 15 months total
- 60 personnel per day (42 light-duty gasoline passenger vehicles and 18 light-duty gasoline trucks), 30 miles per day

- Site preparation/demolition (4 months)
  - 4 heavy-duty gasoline trucks, 50 miles per day
  - 10 heavy-duty diesel trucks, 30 miles per day
  - Motor grader: 670 hours of use
  - Front-end loader: 380 hours of use
  - Roller: 250 hours of use
  - Water distribution truck: 100 hours (2 hours per day for 50 days)
  - Size of site: 6 acres

- Facility modification/equipment installation (11 months)
  3 heavy-duty gasoline trucks, 50 miles per day
  5 heavy-duty diesel trucks, 50 miles per day
  4 welding units, 8 hours per day, 4 months.

System Integration/Ground Test Activities (2000 and 2001). Same as Edwards AFB.

Ground Activities During Flight Tests (2002). Same as Edwards AFB.

WHITE SANDS MISSILE RANGE

Ground Activities to Support Flight Tests (2001). No facility or infrastructure modifications or construction would be required to support the PDRR ABL flight tests. However, administrative actions would be accomplished during the year before the flight tests.

- Duration: 12 months total

- 2 government personnel per day (1 light-duty gasoline passenger vehicle and 1 light-duty gasoline truck), 25 miles per day.

Ground Activities to Support Flight Tests (2002). Continued support from local personnel would be required during the launching of targets. PDRR ABL government and contractor personnel would visit the ranges to coordinate with local personnel and assist in the preparation, launch, and recovery (if required) of targets.

- 4 government personnel per day (2 light-duty gasoline passenger vehicles, 1 light-duty gasoline truck, and 1 heavy-duty gasoline truck), 25 miles per day, 9 months

- 10 PDRR ABL personnel per day (5 light-duty gasoline passenger vehicles and 2 light-duty gasoline trucks), 25 miles per day, 15 days per month, 5 months

- 1 heavy-duty gasoline truck, 20 miles per day, 10 days per month, 5 months

- 4 QF-4 drone flights

- 6 missile launches

- Missile debris recovery operations (2 light-duty gasoline trucks and 1 heavy-duty gasoline truck).

CHINA LAKE NAWC

Ground Activities to Support Flight Tests (2001). Same as White Sands Missile Range.

Ground Activities to Support Flight Tests (2002). Continued support from local personnel would be required during the launching of targets. PDRR ABL government and contractor personnel would visit the ranges to coordinate with local personnel and assist in the preparation, launch, and recovery (if required) of targets.

- 2 government personnel per day (1 light-duty gasoline passenger vehicle and 1 light-duty gasoline truck), 25 miles per day, 6 months
- 10 PDRR ABL personnel per day (5 light-duty gasoline passenger vehicles and 2 light-duty gasoline trucks), 25 miles per day, 15 days per month, 4 months
- I heavy-duty gasoline truck, 20 miles per day, 10 days per month, 4 months
- 4 QF-4 drone flights.

VANDENBERG AFB

Ground Activities to Support Flight Tests (2001). Same as White Sands Missile Range.

Ground Activities to Support Flight Tests (2002). Continued support from local personnel would be required during the launching of targets. PDRR ABL government and contractor personnel would visit the ranges to coordinate with local personnel and assist in the preparation, launch, and recovery (if required) of targets.

- 4 government personnel per day (3 light-duty gasoline passenger vehicles and 1 light-duty gasoline truck), 25 miles per day, 12 months
- 10 PDRR ABL personnel per day (5 light-duty gasoline passenger vehicles and 2 light-duty gasoline trucks), 60 miles per day, 15 days per month, 9 months
- I heavy-duty gasoline truck, 20 miles per day, 15 days per month, 9 months
- 16 missile launches.

SAN NICOLAS ISLAND (POINT MUGU NAWS)

Ground Activities to Support Flight Tests (2001). Same as White Sands Missile Range.

Ground Activities to Support Flight Tests (2002). Same as Vandenberg AEB except for the addition of the drone flights.

- 4 QF-4 drone flights.

II. Determine if action is occurring in a nonattainment or maintenance area

All of the proposed locations for the PDRR ABL Phase activities are in nonattainment or maintenance areas except for the testing being done at White Sands Missile Range, New Mexico. Table E-2 shows the federal air quality status for each of the proposed locations. Since White Sands Missile Range is in an attainment area, no further analysis is required for this location under the conformity rule.

Table E-2. Federal Air Quality Status

Location	Nonattainment Criteria Pollutant[1]
Kirtland AFB	Maintenance attainment - carbon monoxide[2]
Edwards AFB[3]	Severe nonattainment - ozone
China Lake NAWC[3]	Severe nonattainment - ozone moderate nonattainment - PM-i 104
White Sands Missile Range5	None attainment for all NAAQS
Vandenberg AFB	Moderate nonattainment - ozone
San Nicholas Island (Pt Mugu NAWS)	Severe nonattainment - ozone

[1] EPA Designations listed in 40 CFR 81,1995.

[2] 61 FR 29970

[3] All PDRR ABL Phase ground- and near-ground-level activities are projected to take place in the Kern County portion of Edwards AFB and China Lake NAWC.

[4] The PM-10 nonattainment status is for the Searles Valley Planning Area. This area encompasses portions of Kern, lnyo, and San Bernardino Counties (40 CFR § 81).

[5] All PDRR ABL Phase ground- and-near-ground level activities are projected to take place in the EPA El Paso-Las Cruces- Alamogordo Interstate AQCR 153.

Ill., IV., V. Determine if action is exempt, clearly *de minimis*, or presumed to conform

The PDRR ABL Phase activities are not covered by an EPA designated exempt category, cannot be considered clearly de minimis, or presumed to conform.

VI. Determine if the appropriate SIP has been approved

Both New Mexico and California have approved State Implementation Plans.

VII. Determine the applicable pollutant emissions from the action.

PDRR ABL Phase activity emissions can be divided into four general categories: vehicles, construction activities, ground support equipment, and flight activities. The spreadsheets in Attachment I show the emissions factors and calculations of the estimated emissions inventories for each of the home bases and test ranges. The primary sources of emissions data were the *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Source, AP-42 Fifth Edition, (EPA, 1995) and Volume II*: *Mobile Sources, AP-42 Fourth Edition (EPA, 1985).* Both volumes of AP-42 were the most current editions from EPA. Additional emission factor data were obtained from a variety of sources, which are shown on the spreadsheets. The Califomia vehicle-emission factors (BURDEN-7F) were obtained from the Air Resources Board, Technical Support Division, Mobile Source Emission Inventory Branch, Transportation Activity Section, Sacramento, California (Attachment 2) (CARB, 1996).

New Mexico vehicle-emission data were obtained from Table in the *1994 Transportation/Air Quality Conformity Finding*, Middle Rio Grande Council of Governments of New Mexico, TR-l19, September 1993 (MRGCOG, 1993). The projected emissions for White Sands Missile Range were also calculated to ensure that emissions levels would not be significant. The results of the emissions calculations are summarized in the final spreadsheet of Attachment 1 and are presented in Table E-3.

Table E-3. Estimated Total Emissions fro all on-Exempt Sources

Location	**Year**	**Estimated Emissions (tons per year)**			
		VOC	**CO**	**NO_X**	**PM-10**
Edwards AFB	1999	2.85	17.55	2.98	2.24
	2000	7.80	27.07	4.09	0.92
	2001	7.41	30.84	4.31	1.00
	2002	5.65	40.05	13.29	3.12
Kirtland AFB	1999	0.88	28.00	0.620.	10.84
	2000	0.01	35.93	0.09	0.01
	2001	0.01	35.97	0.09	0.01
	2002	0.73	49.12	10.60	2.44
White Sands Missile Range	2001	0.03	0.09	0.01	<0.01
	2002	0.29	2.12	0.17	0.19
China Lake NAWC	2001	0.01	0.04	0.01	<0.01
	2002	0.16	0.50	0.05	0.06
Vandenberg AFB	2001	0.04	0.17	0.02	0.01
	2002	0.18	1.06	0.13	0.02
Point Mugu NAWS	2001	0.02	0.10	0.01	<0.01
	2002	0.27	1.30	0.14	0.13

VIII. Determine if the emissions from the action exceed the *de minimis* levels

The estimated relevant criteria emissions from the PDRR ABL Phase activities at each of the proposed locations summarized in Table E-3 are well below the conformity threshold emission rates shown in Table E-1. Therefore, the emissions from the PDRR ABL Phase activities would be below the *de minimis* threshold levels for the applicable criteria pollutant.

IX. Determine if the e missions from the action are regionally significant

Emissions inventories are available for each of the locations that are in either nonattainment or maintenance status. Table E-4 summarizes these emissions inventories. The estimated emissions levels from PDRR ABL Phase activities would be much less than 10 percent of the area's emissions inventory for criteria pollutants.

Conclusion

As shown in this conformity analysis, emissions from the activities at the home base and test range locations would be below *de minimus* levels and would not be regionally significant; thus, activities conducted during the PDRR ABL Phase would be exempt from any further requirements under 40 CFR 93.153(c)(l).

Table E-4. Criteria Pollutant Emissions Inventory

County	Location	Criteria Pollutant	Tons per Year
Kern County[1]	Edwards AFB	VOCs	4979
	China Lake NAWS	NO_x	14,812
Albuquerque/Bernalillo County[2]	Kirtland AFB	CO	34,564
Santa Barbara County[3]	Vandenberg AFB	ROG	51,015
		NO_x	18,222
Ventura County[4]	Point Mugu NAWS	ROG	54,627
		NO_x	28,603

ROG Reactive organic compounds VOC - Volatile organic compounds
1 Kern County Air Pollution Control District (APCD), 1994.
2 2 AEHD, 1995.
3 Santa Barbara County APCD, 1994.
4 Johnson, 1996.

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ATTATCHMENT 1

AIR CONFORMITY ANALYSIS CALCULATIONS

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A systematic approach is taken in this appendix to calculate the estimated emissions at each proposed location from PDRR ABL Phase activities. The analysis is divided into several sections. First the incremental emissions for various sources were calculated using established sources of emissions data. The primary sources used were the *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Source, AP-42 Fifth Edition,* and *Volume II: Mobile Sources, AP-42 Fourth Edition.* Both volumes of AP-42 were the most current editions from EPA. Other sources of emissions data are listed below:

- B747 Aircraft Engine (CF6-80C2B 1F) Emissions Data: Harry S. Titus, Manager CF6 Military and VIPPrograms, General Electric, 30 November 1995 (Titus, 1995)

- QF-4 Drone Aircraft Engine (J79-GE-8) Emissions Data: China Lake NAWC, Test Planning Branch, 14 February 1996 (NAWC, 1996)

- BQM-345 Drone Aircraft Engine (CAE J69-T-25) Emissions Data: China Lake NAWC, Test Planning Branch, 14 February 1996 (NAWC, 1996)

- Lance Missile: *Environmental Assessment for Static Firing of The Lance Missile Propulsion System*, January 1992 (USACE, 1992)

- Terrier, Black Brant IX, and Orion Missiles: *Draft Supplemental Environmental Impact Statement for Sounding Rocket Program,* August 1994 (NASA, 1994)

- Carbon Monoxide Emissions from Motor Vehicles in Albuquerque/Bernalillo County, NM: 1994 *Transportation/Air Quality Conformity Finding, Middle Rio Grande Council of Governments of New Mexico,* TR-1 19, September 1993 (MRGCOG, 1993)

- Vehicle Emissions for California: BURDEN-7F. (CARB, 1996)

The calculations of emissions from construction equipment, Aerospace Ground Equipment (AGE), the ground pressure recovery system, and the missiles are straightforward. The sources of emissions data shown above define the emissions per unit of operation (e.g., pounds per hour, grams per horsepower hour, pounds per launch). Yearly emissions were calculated by multiplying the emissions per unit of operation by the number of operations per year and converting the results into tons of pollutants per year.

Motor vehicle emission calculations were more complex. The EPA model MOBILE 5A was not used. It is a large, complex model used for entire vehicle fleet emission calculations for an entire air basin or city. Since the PDRR ABL Phase would be of limited duration with relatively few vehicles, a simpler approach was used to estimate vehicle emissions. The data used to calculate the emission factors for vehicles (tons of pollutant per 1,000 vehicle miles traveled, VMT) in California and New Mexico were different. The California Air Resources Board provided a computer program, BURDEN-7F, that was able to provide predicted vehicle emissions data for any county for any year by vehicle type (Attachment 2). An explanation of the calculations to obtain tons of pollutant per 1,000 VMT is shown in Attachment 2.

The emissions factor calculations for Kirtland AFB followed the ones used in the *Clean Air Act Conformity Analysis, Proposed Air Force Space Test And Experimentation Program Office Relocation,* 14 March 1994, Phillips Laboratory, Safety and Environmental Quality Office (USAF, 1994). This method provides a conservative estimate of the carbon monoxide produced by PDRR ABL Phase vehicles. The source of emissions data was the *1994 Transportation/Air Quality Conformity Finding,*

Middle Rio Grande Council of Governments of New Mexico (MRGCOG, 1993). Table 3 of this report provides carbon monoxide emissions and VMT given for two options: “Build” and “No-Build”. The “Build” option accounts for new roadway construction projects desigued to relieve congestion. The “No-Build” option is the more conservative of the two for estimating emissions. The carbon monoxide emission factor was calculated by dividing the tons of emissions by the VTM for each year (1995 and 2015). A straightline interpolation was then used to calculate the emission factor for the years 1999 to 2002. This emission factor was used for all types of vehicles.

Since there were no vehicle emission factors data available from the State of New Mexico, Kern County emission factors were used to estimate the quantity of emissions at WSMR. WSMR and Edwards AFB have similar climates and topography and both are located long distances from local communities.

Vehicle miles per year were estimated for each type of vehicle at each of the proposed locations. The daily VTM (units per day) estimate included an estimate of the distance from home to office and return as well as on-base and lunch trip mileage. Daily VTM estimates for heavy duty trucks were based on one round trip from the work location on-base to the nearest local community. A conservative estimate for the number of work days per month was used. This was calculated by multiplying the number of weeks in a year (52) by the number of work days in a week (5) and dividing by the number of months in a year (12). The result (21.67) was rounded up to 22 work days per month.

The annual estimated emissions were calculated by multiplying the emission factors by the annual usage.

CONSTRUCTION EQUIPMENT AND AGE EMISSIONS

EMISSIONS	VOC	CO	NOX	PM-10			
	(AP 42, Table II-7.1 and II-7.2)						
Construction Equipment (Tons per Hour of Operation)	(1)						
Motor Grader (gasoline)	2.79E-04	6.05E-03	1.60E-04	1.04E-05			
Wheeled Loader (gasoline)	3.59E-04	7.80E-03	2.59E-04	1.49E-05			
Roller (gasoline)	3.98E-04	6.70E-03	1.81E-04	1.30E-05			
Off Highway Truck (diesel)	9.60E-05	8.97E-04	2.08E-03	1.28E-04			
Scraper (diesel)	1.41E-04	6.29E-04	1.92E-03	2.03E-04			
	(1) Sum of Exhaust, Evaporative, and Crankcase Hydrocarbons						
	(AP 42, 13.2.3 Heavy Construction Operations)						
Dust Emissions (tons/acre/month)				1.2			
	(AP 42, 12.19 Electric Arc Welding)						
Electrodes for Arc Welding (lbs/1000 lbs of electrodes)					Cr	Mn	Ni
SMAW - Electrode Type: 14Mn-4Cr				81.600	1.390	23.200	1.710
SMAW - Electrode Type: E6011				38.400	0.005	0.998	0.005
GMAW - Electrode Type: ER1260				20.500	0.004	0.000	0.000
GMAW - Electrode Type: ER5154				24.100	0.010	0.245	0.226
Electrode Type 14Mn-4Cr was selected for use in this analysis because it has the highest level of emissions							
Electrical Power for Arc Welding	(AP 42, Table II-7.2, Miscellaneous)						
Generator (tons/hour)	1.61E-04	2.35E-03	5.71E-05	3.58E-06			
Generator Kw	8						
Aerospace Ground Equipment (AGE)	(AP 42, Table II-7.2, Miscellaneous)						
AGE Motor (tons/hour)	7.99E-04	2.18E-02	5.28E-04	3.34E-05			
average hourse power rating	100						

FLIGHT VEHICLE EMISSIONS

Aircraft: Boeing 747-400F			Engines: 4 - CF6-80C2B1F							
Number of Engines			4		Emissions (lbs)					
Mode	Throtle Setting	Time in Mode (min)	Engines Fuel Flow (lbs/min)	Fuel Used (lbs)	HC	CO	NOX	SO2	PM-10	
Takeoff	100%	0.70	1,281.49	897.04	0.10	0.08	49.32	0.00	17.40	
Climbout	86%	2.20	1,049.21	2,308.27	0.25	0.20	54.55	0.00	22.90	
Approach	30%	4.00	343.92	1,375.67	0.33	6.46	37.82	0.00	0.00	
Idle	7%	26.00	104.76	2,723.83	9.85	115.48	28.40	0.00	0.00	
Total for one mission					10.54	488.87	680.39	0.00	161.21	
Data obtained from Harry S. Titus, Manager CF6 Military and VIP Programs, General Electric, 30 Nov 95										

Aircraft: QF-4			Engines: 2 - J79-GE-8							
					Emissions (lbs)					
Mode	Throtle Setting	Time in Mode (min)	Engines Fuel Flow (lbs/min)	Fuel Used (lbs)	CO	CO2	NOX	HC	SO2	PM-10
Warm up	Idle	30.00	40.17	1,205.00	67.12	3,866.85	2.86	23.67	0.48	23.04
Idle Out	Idle	6.50	40.17	261.08	14.54	837.82	0.62	5.13	0.10	4.99
Takeoff	A/B	0.40	1,143.83	457.53	6.06	1,458.12	2.16	0.48	0.18	0.00
Climbout	Military	0.50	314.50	157.25	0.33	515.60	1.64	0.03	0.06	1.68
Total for one mission					88.05	6,678.38	7.28	29.30	0.83	29.71
Data obtained from China Lake NAWC, Test Planning Branch, 14 Feb 96										

Aircraft: BQM-34S			Engines: 1 - CAE J69-T-25							
					Emissions (lbs)					
Mode	Throtle Setting	Time in Mode (min)	Engine Fuel Flow (lbs/min)	Fuel Used (lbs)	CO	CO2	NOX	HC	SO2	PM-10
Warm up	Idle	30.00	3.85	115.50	14.90	0.00	0.18	2.20	0.12	0.07
Climbout	Military	2.00	18.33	36.67	1.17	0.00	0.13	0.02	0.04	0.00
Total for one mission					16.07	0.00	0.31	2.21	0.15	0.07
Data obtained from China Lake NAWC, Test Planning Branch, 14 Feb 96										

FLIGHT VEHICLE EMISSIONS

Missile: Lance

Combustion Product	Exhaust Emissions (lbs/launch) Ignitor	SPGG	Rocket Motor	Total
C		3.65		3.65
CH4		0.64		0.64
CO	0.08	16.26	27.43	43.77
CO2	0.11	14.79	450.27	465.17
FeCl2	0.01			0.01
H2	0.01	1.32		1.33
HCl	0.1			0.1
HF			8.01	8.01
HO			6.67	6.67
H2O	0.05	3.68	555.09	558.82
N2	0.04	5.24	415.28	420.56
NO			3.57	3.57
O2			14.97	14.97
Pb		0.4		0.4
Other	0.004		1.33	1.334
TOTAL	0.404	45.98	1482.62	1529.004

Data obtained from "Environmental Assessment for Static firing of the Lance Missile Propulsion System", Jan 92

Missile: Terrier, Black Brant IX and Orion

Combustion Product	Exhaust Emissions (lbs/launch) Terrier	Black Brant IX	Orion
CO	502.65	634.92	110.23
CO2	352.74	30.86	99.21
H20	119.05	88.18	127.87
N2	160.94	167.55	57.32
H2	22.05	66.14	8.82
PB	22.05		
HCl		412.26	141.1
Al oxide		787.04	68.34
Sulfer		2.2	
Cu		8.82	2.2
Other			
TOTAL	1179.48	2197.97	615.09

Data obtained from the "Supplemental Environmental Impact Statement for Sounding Rocket Program", Aug 94

GROUND PRESSURE RECOVERY SYSTEM EMISSIONS

		Units			
Gas Boiler Size	1500	K Btu			
Time to generate Hot Water	24	Hours			
Heat Content of Gas	1	K Btu/cu ft			
Efficiency of Boiler	0.95				
Gas Consumption per Test	37,894.74	cu ft			
	3.79E-02	M cu ft			
	(AP 42, Table 1.4-1 and 1.4-2)				
Pollutant	CO	NOX	PM-10	SO2	
Emissions (lbs/M cu ft)	21	100	12	0.6	
Emissions per Test (lbs)	7.96E-01	3.79E+00	4.55E-01	2.27E-02	
Emissions per Test (tons)	3.98E-04	1.89E-03	2.27E-04	1.14E-05	
	PM is sum of Filterable and Condensable				
	Boiler is a Commercial Boiler with Uncontrolled Burners				

EDWARDS AFB ACTIVITIES

	Work Days per month	Number of Vehicles	Number of Months	Units per Day	Total Operations	Units
			Facility Mod/Equip Installation (1999)			
Light Duty Passenger Vehicle	22	36	12	71	674,784	VMT
Light Duty Gasoline Truck	22	14	12	71	262,416	VMT
			Demolition/Site Preparation			
Heavy Duty Gasoline Truck	22	2	1	71	3,124	VMT
Heavy Duty Truck (diesel)	22	10	1	71	15,620	VMT
Motor Grader					170	HRS
Front End Loader					100	HRS
Roller					60	HRS
Water Delivery Truck					30	HRS
Size of Site			1	1	1	Acre-Mo
			Facility Mod/Equip Installation			
Electrical Power for Welding	22	4	4	8	2,816	HRS
Pounds of Welding Rods	22	4	4	40	14,080	Lbs
Heavy Duty Gasoline Truck	22	2	11	71	34,364	VMT
Heavy Duty Truck (diesel)	22	5	11	71	85,910	VMT
			System Integration & Ground Tests (2000 and 2001)			
Light Duty Passenger Vehicle	22	146	12	71	2,736,624	VMT
Light Duty Gasoline Truck	22	54	12	71	1,012,176	VMT
Heavy Duty Gasoline Truck	22	1	12	71	18,744	VMT
Heavy Duty Truck (diesel)	22	1	12	71	18,744	VMT
Aircraft		1			1	TOL
AGE	1	3	30	3	270	
Ground PRS					30	Tests
			Ground Activities during Flight Tests (2002)			
Light Duty Passenger Vehicle	22	146	9	71	2,052,468	VMT
Light Duty Gasoline Truck	22	54	9	71	759,132	VMT
Heavy Duty Gasoline Truck	22	1	9	71	14,058	VMT
Heavy Duty Truck (diesel)	22	1	9	71	14,058	VMT
Aircraft		1			30	TOL
Ground PRS					5	Tests
Refueling Operations (HDDT)		1	30	20	600	VMT
AGE support	2	3	30	4	720	HRS

EDWARDS AFB ESTIMATED EMISSIONS CY 1999

PREDICTED CALIFORNIA VEHICLE EMISSIONS (tons)
Kern County CY 1999 (BURDEN-7F OUTPUT DATA)

TYPE	DAILY VMT (1000 mi)	Total Exhaust	Total TOG Emission	Total CO Emission	Total NOX Emission	Total PM-10 Emission
Light Duty Passenger Vehicle (NON-CAT)	21.00	0.18	0.25	1.38	0.10	0.01
Light Duty Passenger Vehicle (CAT)	1430.00	0.85	1.56	9.27	1.24	0.33
Light Duty Truck (NON-CAT)	5.00	0.01	0.01	0.07	0.01	0.00
Light Duty Truck (CAT)	535.00	0.41	0.66	4.60	0.67	0.12
Heavy Duty Truck (NON-CAT)	34.00	0.07	0.09	2.26	0.35	0.02
Heavy Duty Truck (CAT)	126.00	0.07	0.11	1.22	0.73	0.06
Heavy Duty Truck (diesel)	280.00	0.55	0.55	2.45	4.13	0.60
	CAT	NON-CAT		Diesel		
Conversion Factors	0.8325	0.9147		0.9760		
	EMISSION FACTORS (Tons per 1000 VMT)					
	VOC	CO	NOX	PM-10		
Light Duty Passenger Vehicle	2.04E-03	7.34E-03	9.24E-04	2.34E-04		
Light Duty Gasoline Truck	2.65E-03	8.65E-03	1.26E-03	2.22E-04		
Heavy Duty Gasoline Truck	9.93E-04	2.18E-02	6.75E-03	5.00E-04		
Heavy Duty Truck (diesel)	1.92E-03	8.75E-03	1.48E-02	2.14E-03		
	VOC	CO	NOX	PM-10		
Facility Modification/Equipment Installation	Total Emissions by Source					
Light Duty Passenger Vehicle	1.38E+00	4.95E+00	6.23E-01	1.58E-01		
Light Duty Gasoline Truck	6.97E-01	2.27E+00	3.30E-01	5.83E-02		
Heavy Duty Gasoline Truck	3.72E-02	8.15E-01	2.53E-01	1.87E-02		
Heavy Duty Truck (diesel)	1.95E-01	8.88E-01	1.50E+00	2.18E-01		
Motor Grader (gasoline)	4.74E-02	1.03E+00	2.72E-02	1.76E-03		
Wheeled Loader (gasoline)	2.79E-02	6.05E-01	1.60E-02	1.04E-03		
Roller (gasoline)	1.67E-02	3.63E-01	9.60E-03	6.21E-04		
Water Truck (Off Highway Truck, diesel)	2.88E-03	2.69E-02	6.25E-02	3.84E-03		
Dust Emissions				1.20E+00		
Electrical Power for Welding	4.52E-01	6.61E+00	1.61E-01	1.01E-02		
Electrodes for Welding				5.74E-01		
Estimated Total Emissions (tons)	2.85	17.55	2.98	2.24		
Mobile Sources	2.40	10.95	2.82	0.46		
Stationary Sources	0.45	6.61	0.16	0.58		

APPENDIX G

LANCE MISSILE DEBRIS IMPACT ANALYSIS

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APPENDIX G

LANCE MISSILE DEBRIS IMPACT ANALYSIS

Introduction

The goal of the PDRR ABL Phase is the destruction of a theater ballistic missile (TBM) during boost phase, using a high-energy laser. The ABL weapon system is currently scheduled to use 16 missiles during the PDRR ABL Phase. Only six missiles would be destroyed in flight. The remaining missiles would be used for acquisition, trackmg and pointing (ATP) experiments and would continue their programmed flight pattern, impacting the earth or ocean as a monolithic structure. Destruction of TBMs would be attempted only at the Western Range during the Expanded-Area Test Range sequence of tests. The debris-impact analysis will be divided into two sections: monolithic impact and destruction of the missile at high altitude.

Monolithic Impact

During the majority of the flight test program at the Diagnostic and Expanded-Area Test ranges, the target missiles would not be destroyed in flight but would be the target for acquisition, trackmg and pointing lasers. In-flight destruction of the target missile would only occur during the final several flights at the Expanded-Area Test range. The target missiles (Terrier-Orion, Terrier-Black Brant, and Lance at White Sands Missile Range [WSMR] and Lance at the Western Range) would impact monolithically at the end of their ballistic trajectory.

All of the proposed target missile are routinely launched at WSMR and would terminate their flight at existing, approved impact sites. At impact, all of the solid propellant in the Terrier-Orion and Terrier-Black Brant missiles has been consumed and there would be no unspent fuel, toxins or hazardous materials onboard. However, the Lance missile has small amounts of propellant remaining. The effects of missile operations have been extensively documented in several other environmental documents. The Directorate of Environment and Safety at WSMR recently completed a Range-Wide Environmental Statement (March 1996) which included analysis of the existing, approved impact areas. Additionally, analysis of the environmental consequences of the Terrier-Orion, Terrier-Black Brant, and Lance missiles were specifically documented in *Supplemental Environmental Impact Statement for Sounding Rocket Program* (Terrier-Orion and Terrier-Black Brant), and *Lance Missile Target Environmental Assessment.* Each of these studies found no significant effects on soils, water or biological resources from these missile operations at WSMR.

At WSMR, probable impact areas for the Lance missile include nine Lance Marker (LM) sites, all the G sites, all the WITs (excluding Pup) and near the Rowl site. The approval to establish these impact sites was documented by the U.S. Army in their *Life Cycle Environmental Assessment for the Lance Missile Test Program,* and *Lance Missile System, Addendum 1: Site-Specific Environmental Assessment for White Sands Missile Range.* Both were published in 1989. Upon impact, the Lance missile would produce a crater approximately 3 - 4.5 m wide and 2.2 - 3.6 m deep, and the missile would bury itself up to 6 m below the surface. The crater would remain open for six months allowing the residual propellants to dissipate. After six months, the crater would be filled and the missile would remain in place (US Army, 1996).

Terrier-Orion and Terrier-Black Brant missiles would also land in approved impact sites at WSMR. The first stage Terrier burns for 5 seconds and impacts the ground approximately 1 km from the launch pad. The second stage (Orion or Black Brant) would impact at one of the approved sites farther down range.

The 50, 70 or 90 mile debris recovery areas, Figure 3.3-8, are typically used for these missiles. In general, radar data would locate the impact site of the spent missiles, and recovery would be accomplished by the use of helicopters and ground crews to minimize ground disturbance and facilitate recovery operations (NASA, 1994).

At the Western Range, the Lance missile would impact with the ocean and the fuel and oxidizer tanks would break open. Small quantities of UDMH and IRFNA remaining onboard would rapidly disperse into the surrounding seawater. UDMH is completely miscible with water and would react with water and oxygen to form nitrogen, water and hydrocarbon molecules (methane, ethane, etc.). The half-life in water is between 8 and 12 days (USAF, 1998). IRFNA has a strong reaction when exposed to water. Violent spattering, an increase in the water temperature, and a substantial lowering in the pH value would occur in the local water. However, the small quantity of chemicals released and the natural buffering capacity of seawater combined with ocean currents, would neutralize the reaction in a relatively short period of time.

High Altitude Destruction

This analysis provides a preliminary estimate of the debris-impact range and scatter pattern. A generic scenario has been selected for analysis in this EIS, since the launch complex, flight pattern of the target missile, engagement geometry of the PDRR ABL aircraft and target missile, and time/date of the test have not yet been selected. This preliminary analysis does not take into account wind effects which would alter the debris impact location and the scatter pattern. Since wind direction and velocity varies throughout the year, inclusion of these effects would not provide any additional meaningful data.

Conducting a detailed mission-hazards analysis to quantify the risks associated with the test is one of the most important aspects in preparation of a missile flight. The Range Safety offices at both Vandenberg AFB and Point Mugu Naval Air Warfare Center Weapons Division require that a detailed safety analysis of each test be prepared and submitted for review and approval as a part of the pre-test documentation. Both safety and environmental personnel at each range would analyze the documentation to ensure that risks to personnel and environmental resources are minimized.

Test Scenario

Assume that a Lance missile would be launched from Space Launch Complex 6 at Vandenberg AFB and that the flight path would be due west into the Pacific Ocean. The PDRR ABL aircraft would be located approximately 250 km (155 mi) west of the launch point flying at an approximate altitude of 40,000 ft. The ABL weapons system would initially begin to track the missile with passive infrared sensors. Once the missile's altitude is greater than that of the aircraft (approximately 17 seconds after launch), the active ATP system would acquire the missile, and the high energy laser (HEL) beam would destroy the missile shortly afterwards. The boost phase of the Lance missile lasts approximately 30 seconds. Therefore, missile destruction times of 20, 25, and 30 seconds were selected for debris analysis.

Debris Analysis

The footprint analysis for the above test scenario was conducted using a computer simulation program, *Debris Analysis Workstation, Version 1.1,* developed by the U. S. Air Force's Phillips Laboratory (USAF, 1995). The computer simulation uses IMPACT 4.0, a semi-empirical fragmentation model. The study was conducted by simulating the fragmentation of the Lance missile after being lased by the HEL. The Lance missile was assumed to be an all aluminum boost type vehicle. The debris from the missile's breakup falling to the ocean's surface was simulated using a propagator model that included the effects of atmospheric drag. It was also assumed that the warhead section of the missile would not fragment.

The main source of energy for the fragmentation event would be the pressurized gas (1,200 psi) used to maintain propellant pressure in the motors. This energy would be released through a rupture in the pressurized body of the missile created by the HEL beam. A secondary source of energy, the remaining hypergolic fuel, was also considered. The analysis concluded that the chemical-energy release from the fuel remaining onboard the missile was only one-tenth the amount of energy in the pressurized gas. The results of the IMPACT 4.0 model predicted that the Lance missile would break up into 72 fragments. The model groups the fragments into bins by weight (Table G-l). The distribution of fragment weights is not uniform, which confirms intuitive expectations of the Lance missile's breakup. Since the HEL beam would be focused on the fuel tanks located in the middle of the missile, the warhead and nozzle (located at each end of the missile) would remain intact and account for most of the mass in the debris cloud. When the fuel tanks rupture, aerodynamic forces would rip apart the center section of the missile causing the fuel tanks and other internal systems to break up into a limited number of smaller fragments.

Table G-1. Lance Missile Debris Cloud

Mass of Fragments (kg)	Number of Fragments	Characteristic Size (m)
Greater than 200	2	1.9
lOOto200	2	1.4
5 to 10	2	0.3
.01 to .1	26	0.03 to 0.1
Less than .01	40	loss than 0.03

To determine the sensitivity of the final debris footprints to the amount of energy released during the breakup event, several test scenarios were examined using above nominal energy releases up to eight times the energy of the pressurized gas. The results indicated that the size and location of the debris footprint were not significantly affected by an increase in energy. The reason for the small footprint and the short distance from the initial breakup location to the impact footprint is that the breakup events occur in the dense portion of the atmosphere at relatively low altitudes. Atmospheric drag in the dense portion of the atmosphere consumes the additional kinetic energy received by fragments in the more energetic breakups. The same breakup event was used for each of the scenarios analyzed. Therefore, the debris cloud shown in Table G-1 is common to the three scenarios.

A portion of the falling debris from the missile breakup presents an impact hazard to exposed personnel and biological resources on the ground or at sea. Fragment lethality can be defined by the kinetic energy of the fragments on impact. The kinetic energy is proportional to the mass and velocity of the falling object. According to a study conducted at Sandia National Laboratories (Cole and Wolfe, 1996), a person struck by a fragment with a mass between 0.02 and 3.0 kg (0.04 and 6.63 lbs) and 79 joules of kinetic energy would have a 10 percent chance of being killed and a 90 percent chance of sustaining serious injury. The study recommended that for all flight-test range safety analyses an impact kinetic energy level of 15 joules be used as the kinetic energy level below which the fragments are no longer hazardous. Once the fragments hit the ocean, the kinetic energy is rapidly absorbed by the water and the risk to marine life is greatly diminished and can be assumed to be zero within a few meters of the ocean's surface.

The final debris footprints (Table G-2 through G-4) and kinetic energy levels (Figures G-1 through G-3) show the results for the destruction of the missile at 20, 25, and 30 seconds after launch. Only fragments having impact kinetic energy levels above 15 joules are included (six fragments). In each of the three cases, the kinetic energy of the next largest fragment (approximately 0.1 kg) is only 7.4 joules. The impact points "x" and "y" coordinates are referenced to the launch point. The missile's flight path is along the "x" axis.

Table G-2. Debris Impact Location and Distance From Launch Point (20 seconds)

Fragment Mass (kg)	Kinetic Energy (joules)	Impact Location		Distance from Launch Point (km)
		x (km)	y (km)	
200	89,366	14.14	0.18	14.14
200	56,829	13.18	-0.27	13.18
100	44,148	12.88	-0.36	12.88
100	39,283	13.88	0.82	13.90
5	1,206	12.96	-0.76	12.99
5	1,566	13.47	0.92	13.50
Missile is destroyed 11.74 km from the launch point at an aititude of 49,000 ft.				

Table G-3. Debris Impact Location and Distance From Launch Point (25 seconds)

Fragment Mass (kg)	Kinetic Energy (joules)	Impact Location		Distance from Launch Point (km)
		X (km)	y (km)	
200	89,363	18.09	0.13	18.09
200	56,829	16.91	-0.25	16.91
100	44,150	17.73	-1.01	17.75
100	39,281	16.95	0.51	16.95
5	1,206	16.30	-0.77	16.32
5	1,525	17.86	1.46	17.82
Missile is destroyed 15.04 km from the launch point at an attitude of 61,500 ft.				

Table G-4. Debris Impact Location and Distance From Launch Point (30 seconds)

Fragment Mass (kg)	Kinetic Energy (joules)	Impact Location		Distance from Launch Point (km)
		x (km)	y (km)	
200	89,365	23.36	0.25	23.36
200	56,830	21.21	-0.38	21.21
100	44,150	22.83	-1.46	22.88
100	39,282	22.96	1.54	23.01
5	1,206	22.05	-0.69	22.06
5	1,525	22.05	2.20	22.16
Missile is destroyed 18.33 km from the launch point at an altitude of 73,400 ft				

Note that the kinetic energy of the six heaviest fragments does not vary significantly between the test scenarios. The reason for this is that the falling fragments reach terminal velocity well before impacting the ocean's surface. Generally, the later the destruction time, the farther the impact points are from the launch location and the larger the footprint size. The six largest fragments are in an area of 2.12, 4.41, and 7.85 square km (0.82, 1.70, and 3.04 square mi) for the 20-, 25-, and 30-second destruction times, respectively. The probability of a fragment landing at a point in the debris footprint is approximately 5.34×10^{-6} percent for the 20-second scenario, 2.57×10^{-6} percent for the 25-second scenario, and 1.44×10^{-6} percent for the 30-second scenario. This was calculated by assuming that the fragments were square shapes, then calculating the ratio of the sum of the areas of the fragments to the area of the footprint.

The risk to migratory gray whales caused by the impact of missile debris falling approximately 10 km (6 mi) off the shore of Vandenberg AFB was analyzed. Gray whales were selected as a representative species due to their relative high numbers within approximately 35 km (22 miles) of the shore near Vandenberg AFB during peak migratory periods. Other species that may be similarly impacted are typically found in lower densities (e.g., other whales and seals), or they spend a significant portion of time on or near shore and man-made structures which would not be in the missile trajectories.

The density (number of gray whales per square km) was calculated using data from the *Gray Whale Monitoring Study* (DOI, 1989). The maximum one-day count of gray whales sighted in the entire study area (approximately 28 km north-south by 30 km east-west) was 76 whales (DOI, 1989). The whale count was taken using aerial observations. The maximum one-day count was divided by the length of shore line observed to determine the number of whales expected per kilometer of shoreline. This value was weighted by the most common distance-from-shore interval for sighting whales that was at least 1 km (0.6 mi) from shore. The maximum percentage of whales observed in a single distance-from-shore interval was 44 percent (DOI, 1989) for a 5 km-wide (3 mi-wide) band centered 10 km (6 mi) from shore. Assuming whales were distributed evenly within this band, then approximately 8.8 percent of the whales would have been within a 1 km-wide band centered 10 km from shore. This analysis results in a conservatively high estimate of the maximum expected whale density, 0.24 whales per square kilometer. This density is over five times the highest whale density reported from any single distance-from-shore interval (0.055 whales per square kilometer, DOI, 1989) in the study.

Using the following assumptions, the probability of any gray whale being hit by a fragment with sufficient energy to cause injury can be calculated.

- Hazardous kinetic energy levels of fragments for humans and whales are equal.
- The size of each debris fragment is equal to the square of its characteristic size (Table G-1).
- Each gray whale can be represented by a cylinder 13.7 m by 3.0 m (45 ft by 10 ft) in size and each whale spends 100 percent of its time on the surface; therefore, each whale occupies approximately 41.1 square m of area on the surface of the ocean.

Using the above assumptions and the debris impact data in Tables G-2, G-3, and G-4, there is a 1 in 8,934 chance of a debris fragment hitting a gray whale with sufficient kinetic energy to cause injury during the peak migration season.

This analysis was developed specifically for Vandenberg AFB, but it is expected to also provide a conservative bounding estimate for proposed activities at San Nicolas Island. San Nicolas Island is located in the offshore portion of the gray whale migratory route and geographic distribution of other coastal species at risk of impact from falling missile debris. Once more definitive flight paths and launch dates are developed, these estimates would be revised.

Note that debris from missiles not targeted by the HEL—those that fly their full trajectory—falls relatively far from shore (130 km), in sparsely populated waters. It is improbable that any organisms, other than planktonic species, would be impacted by such missiles.

Conclusion

Western Range safety procedures require that the area beneath the missile's flight path be cleared of all personnel. While the largest fragments are hazardous to biological resources, the probability of being hit by a hazardous fragment is low.

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FINAL
ENVIRONMENTAL IMPACT STATEMENT
FOR THE
PROGRAM DEFINTIION AND RISK REDUCTION
PHASE OF THE AIRBORNE LASER PROGRAM

VOLUME 2
Public Comments and Responses

APRIL 1997

FOREWARD

Introduction

The USAF has complied with the National Environmental Policy Act mandate of public participation for the Program Definition and Risk Reduction Phase of the Airborne Laser Program in two primary ways:

> Public hearings were held in Albuquerque and Las Cruces, New Mexico, and in Lompoc and Lancaster, California during December 1996. The USAF presented the findings of the Draft Environmental Impact Statement (EIS) and invited public comments.
>
> The Draft EIS was made available for public review and comment from October 25, 1996 to January 10, 1997.

Public comments received both verbally at the public meeting in writing during the Response period have been reviewed and are addressed by the Air Force in this volume.

Organization

Written comments are reproduced in this document in their original form, with USAF Responses shown on facing pages.

For verbal comments offered at public hearings, the entire transcript of each hearing is reproduced in the document, with comments identified in the margins. Answers to the comments are provided at the end of each hearing transcript.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105.3901
January 13, 1997

Captain Andrew Butts
PL/TM (ABL SPO)
3550 Aberdeen Avenue, SE, Building 760
Kirtland Air Force Base, New Mexico 87117—5776

Dear Captain Butts:

The Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (EIS) for the Program Definition and Risk Reduction Airborne Laser Phase. Our review is based on the National Environmental Policy Act (NEPA), and the Council on Environmental Quality (CEQ) NEPA Implementation Regulations (40 CFR Parts 1500—1508), and Section 309 of the Clean Air Act (CAA).

The Airborne Laser (ABL) Acquisition program is intended by the U.S. Air Force (USAF) to defend against theater ballistic missile (TBM) attacks. This system would employ a high-energy, chemically induced laser on board a specially outfitted B747 aircraft to detect, target and destroy enemy TBMs. Although the TBMs would be destroyed at high altitude, the ABL system is designed to target TBMs in their initial boost phase so that missile debris would fall back upon the aggressor.

The EIS evaluates the potential environmental impacts of the Program Definition and Risk Reduction (PDRR) phase of the AEL program. The PDRR phase would include selection of one contractor to proceed with verifying preliminary design and engineering, and construction of a prototype ABL aircraft for testing. If the demonstration tests of the prototype are successful, two phases would follow: the “Engineering Manufacturing and Development” (EMD) phase, which would include full—system integration and operational performance tests; and the “Production” phase, which would include the procurement and modification of seven aircraft. The latter two phases are outside of the scope of this EIS.

The PDRR Phase will require the following facilities to be selected and developed for the testing program: a Home Base, where ground tests of the laser, laser integration into the aircraft, and various other maintenance functions will be housed; a Diagnostic Test Range, where initial airborne tests of the laser weapon system, aircraft, and tracking of missile and drone targets would occur (up to 20 flights of the PDRR ABL aircraft and a maximum of six missiles and four drones would be launched and recovered at the Diagnostic Test Range); and, an Expanded— Area Test Range, where the PDRR ABL laser weapon system would track and destroy up to six TBM missiles. The USAF’s preferred

EPA DEIS COMMENTS, USAF, PROGRAM DEFINITION AND RISK REDUCTION AIRBORNE LASER PHASE. JANUARY 10, 1997

NEPA

1. Page ES—l: The Draft EIS reports that successful completion of the PDRR phase would lead to "Engineering Manufacturing and Development" (EMD) and "Production" phases of the ABL project. The Final EIS should specify whether NEPA documentation would be prepared for those project phases, and whether such NEPA analysis would be programmatic, tiered or project-specific.

   In addition, the USAF should discuss whether and how it would address programmatic issues regarding the overall ABL project. For example, if the ABL system is successfully developed, the USAF should state whether the environmental impacts associated with the ultimate ABL production, deployment, maintenance and training would be disclosed in a future NEPA document.

Air Quality

1. Page ES-5: The Draft EIS reports that the amount of chlorine—containing gases exhausted during a space shuttle launch is 800 times the amount released during a PDRR ABL phase missile launch. A PDRR ABL phase missile launch is estimated to expel between 15 and 90 kg of hydrogen chloride per launch. If the USAF chooses to use the space shuttle comparison in the Final EIS, it should clarify whether the "800 times" figure is based on the 15 kg or 90 kg hydrogen chloride PDRR estimate.

2. Page 2—4: The Draft EIS reports that the ground-based pressure recovery system (PRS) "would operate at a scrubbing efficiency of approximately 85 percent; therefore, the steam cloud (released) would be mostly water and carbon dioxide." The Final EIS should include an estimate for the remaining constituents, and their relative amounts, of the PRS steam cloud.

3. Pages 2—5, 2—7: The Draft EIS reports that 950 pounds of ammonia "would be removed from the laser-device cooling system on the aircraft after each ground test and recycled in a closed—loop system for reuse in subsequent tests. During flight tests, the ammonia would be exhausted from the aircraft at an altitude of 40,000 feet AMSL." The Final EIS analysis should include an explanation as to why the flight tests would not include the closed—loop system to recapture and recycle ammonia. The USAF should also discuss why chlorine and iodine would also not be captured and recycled during flight tests.

Response to Comment 1

The USAF expects to prepare an Environmental Assessment to cover the Engineering, Manufacturing, and Development Phase of the Airborne Laser Program and a full Programmatic EIS to cover production, deployment, maintenance and training for the system.

Response to Comment 2

Section 3.7 has been rewritten and the “800 times” comparison was deleted.

Response to Comment 3

Table 2-5 has been revised to show estimate of remaining constituents of the PRS cloud and relative amounts.

Response to Comment 4

Ammonia is used to cool the laser device during firing operations. Capturing the ammonia during flight operations was considered during the Concept Design Phase of the ABL Program, but the idea was discarded because of weight considerations. The operation of the laser device requires a pressure recovery system to generate the low pressure in the laser beam generation area, generate the flows of reacting gases through the supersonic mixing nozzles, and recover the pressure of the gas flow to expel the gases overboard at 40,000 feet. The balance of the pressure recovery system to perform these three tasks precludes recovery or trapping of any of the gases to remove chlorine or iodine. Any recovery of gases would have too great a weight penalty to be practical for an aircraft application. On the ground, the ground pressure recovery system simulates the conditions at 40,000 ft. The weight of the ground pressure recovery system is well over 100 tons, and it is almost as large as the 747. A closed-loop system cannot be placed on the aircraft because of these constraints. Text on page 2-6 has been modified to reflect these limitations. The ongoing pollution prevention program will continue to look for cost-effective and efficient ways of reducing these emissions

Response to Comment 5

Section 3.7 has been extensively rewritten. The impacts on the upper atmosphere have been divided into two broad categories, normal and emergency operations. The combined impacts of both categories are discussed in the Conclusions paragraph to the section.

Response to Comment 6

This EIS is intended to cover the broader issues associated with the selection of key installations (e.g., Home Base, Diagnostic Test Range, and Expanded-Area Test Range). The U.S. Fish and Wildlife Service (USFWS) was contacted during the consequence analysis phase of the EIS, and their concerns have been incorporated into the Final EIS. However, because the USAF chose to begin environmental planning at the earliest possible time in the ABL life-cycle, detailed construction design and test plans have not yet been prepared. A biological survey will be conducted as a part of the facility-modification and equipment installation design effort at the Home Base. Similarly, the draft plan for each of the test flights detailing the launch location and time, flight path geometry, engagement scenario and predicted impact locations will be used to survey the affected biological resources at the test ranges. Once these designs, plans, and surveys have been prepared, they will be evaluated by the environmental specialist at each of the DoD installations. If necessary, additional environmental documentation will be prepared which will include formal consultation with USFWS pursuant to the Endangered Species Act.

Response to Comment 7

Text was added to Section 3.1.4, Affected Environment and Environmental Consequences, to clarify the likelihood of encountering a desert tortoise in the South Base Area and to identify mitigation measures which would be taken if a tortoise is encountered. The Biological Opinion for Routine Operations and Facility Construction Within the Cantonment Areas of Main and South Bases, Edwards Air Force Base, California, prepared by the U.S. Fish and Wildlife Service in response to a request for a formal consultation pursuant to section 7 of the Endangered Species Act, serves as the basis for conducting preconstruction surveys and mitigation measures.

Response to Comment 8

According to Mr. Chris Rush, NEPA coordinator for Edwards AFB, there are currently no areas designated as wetlands on Edwards AFB. The Waterways Experiment Station, U.S. Army Corps of Engineers, is performing field work to identify areas on Edwards that should be classified as “Waters of the U.S.,” of which wetlands are a subset. Their report is due in April 1997.

Response to Comment 9

Edwards AFB: According to Mr. Chris Rush, NEPA coordinator for Edwards AFB, there are currently no areas designated as wetlands on Edwards AFB. The Waterways Experiment Station, U.S. Army Corps of Engineers, is performing field work to identify areas on Edwards that should be classified as "Waters of the U.S.," of which wetlands are a subset. Their report is due April 1997.

Kirtland AFB: The locations of six wetlands were obtained from Mr. Robert Dow, Natural Resources Specialist for Kirtland AFB. Although all of the wetlands are to the east of the region of influence and would not be affected by PDRR ABL Phase activities at Building 760, the locations of the two principal wetlands were added to Figure 3.2-6. There are no vernal pools at Kirtland.

Response to Comment 10

Text has been revised in Section 3.2.4, Affected Environment and Environmental Consequences, to delete the reference to Fugate's amsonia which is located only in the County of Socorro, New Mexico, and to indicate that there are no Wright's fishhook cactus located in the area of the Hangar 760 Complex. Prior to construction, a survey would be conducted, in conjunction with the U.S. Fish and Wildlife Service, for endangered and threatened plant and animal species. Appropriate action would be taken if any are identified.

Response to Comment 11

Changes were made to Section 3.3.5 Environmental Consequences, and to the Monolithic Impact section in Appendix G. No target missiles are planned to be destroyed in flight at White Sands Missile Range (WSMR), but would complete the powered portion of their flight, consuming the onboard propellant. At the completion of their ballistic trajectory, the missiles would impact the ground as a monolithic structure, creating a hole up to 4 meters in diameter and several meters in depth. Therefore, there would be no debris dispersed beyond the immediate vicinity of the impact point. Since the fuel would be consumed during the powered portion of the flight, there would be no burning debris. The effects of missile operations have been extensively documented in several other environmental documents. The Directorate of Environment and Safety at WSMR recently completed a Range-Wide Environmental Impact Statement (March 1996) which included analysis of the existing approved impact areas. Additionally, analysis of the environmental consequences of the Terrier-Orion, Terrier-Black Brant, and Lance missiles were specifically documented in *Supplemental Environmental Impact Statement for Sounding Rocket Program* (Terrier-Orion and Terrier-Black Brant), and *Lance Missile Target Environmental Assessment*. Each of these studies found no significant effects on soils, water or biological resources from these missile operations at WSMR

Response to Comment 12

Section 2.0, Selection of Alternatives, (page 2-2) as been revised to show that Western Range was the only facility which could meet operational criteria.

Response to Comment 13

The discussion of residual chemicals onboard the Lance target missile has been revised and expanded in sections 3.5.3 and 3.5.4, Environmental Consequences, and in Appendix G, Monolithic Impact, to show that debris from the destruction and monolithic impact of the target missiles does not present a significant threat to biological resources.

Response to Comment 14

Proposed mitigation measures were added to the cultural and paleontological resource Environmental Consequence sections (3.2.6, 3.3.6, 3.4.6, and 3.6.6). These mitigation measures include a requirement that activity be halted until the Base Historic Preservation Officer is notified and consulted if any unforeseen cultural or paleontological resources are encountered during the operation of the project.

Response to Comment 15

Reference to sonic booms and missiles has been removed (Sections 3.1.15, and 3.2.15, Cumulative Impacts). Missile launches and sonic booms will not occur at Home Base.

Response to Comment 16

Section 2.3.2, Laser Systems, has been revised to show that mature technology refers to technology which is past the applied-research phase and ready for incorporation into the weapons system.

Response to Comment 1

The areas designated as “Extension Areas” in the White Sands Missile Range figures in Section 3.3 have been re-designated as “Call-Up Areas.”

Response t Comment 2

Text in Section 3.3 has been revised to accurately reflect the status of “Call-Up Area” lands adjacent to White Sands Missile Range.

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Response to Comment 1

Table 1-2, Environmental Permits Licenses and Entitlements, has been changed to reflect the appropriate regulatory agency.

Response to Comment 2

Changes were made to Section 3.5.2, Affected Environment, to reflect the new information,

Response to Comment 3

Changes were made to Section 3.5.2, Environmental Consequences, to delete references to the conformity "growth allowance."

Response to Comment 4

Potential cumulative impacts for all attributes are discussed in Section 3.5.16. According to Air Quality personnel in the Vandenberg AFB Environmental Office, no projections of emissions have been made for the years 2001 and 2002. Therefore, it is not possible to analyze the cumulative impact of ABL emissions and other projected emissions. Comparing ABL emissions to the 1996 actual emissions shows that ABL activities would increase e emissions by less than 0.1 percent. Additional environmental documentation will be prepared as activities are further defined.

Response to Comment 5

Changes were made to Table 3.5-4 to reflect the correct *de minimis* levels.

California Coastal Commission
James Raives
Page 2 of 2

Response to Comment 1

This requirement is shown in Table 1-2, Environmental Permits Licenses and Entitlements, and is cited in Sections 3.5.9 and 3.6.9, Land Use, Environmental Consequences.

Response to Comment 2

Should Vandenberg AFB be chosen as the Expanded-Area Test Range, public access to Vandenberg area beaches would be closed a maximum of 10 times during the course of a four-month period of ABL flight testing activity. Only beaches which are in the direct flight path of the missile would be closed. Currently the launch locations have not been chosen for the ABL project. When the locations are defined, each missile launch would be evaluated in terms of mission-specific information before any decision is made to close a public beach. In all cases, the beaches would be opened shortly after the launch.

Response to Comment 3

No coastline habitat will be destroyed under the proposed action. Impacts from missile-debris fallout would occur 10 km (6 mi. offshore). An analysis is contained in Appendix G.

City of
Albuquerque

Environmental Health Department

Martin J. Chavez. Mayor

Sarah B. Kotchian,Director
768-2600 (phone)
768-2617 (fax)

January 8, 1996

Ms. Michelle Hedrick
Phillips Laboratory /SE
3550 Aberdeen Avenue SE
Kirtland AFB, NM 87117-5776

Dear Ms. Hedrick:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE AIRBORNE LASER PROGRAM DEFINITION AND RISK REDUCTION PHASE

The City of Albuquerque Environmental Health Department, Air Pollution Control Division has completed our review of the subject document dated September 1996. We offer the following comments and appreciate the opportunity to do so.

Please call me at 768-2624 if you have any questions or need further clarification.

Sincerely,

Leticia P. Segovia
Environmental Health Scientist

Good for You. Albuquerque!
P.O. Box 1293 Albuquerque, New Mexico 87103
One Civic Plaza. Albuquerque, New Mexico 87102

Response to Comment 1

It is not feasible to capture and scrub the laser produced gases or a ammonia at altitude. Ammonia is used to cool the laser device during firing operations. Capturing the ammonia during flight operations was considered during the Concept Design Phase of the ABL Program, but the idea was discarded because of weight considerations. The operation of the laser device requires a pressure recovery system to generate the low pressure in the laser beam generation area, generate the flows of reacting gases through the supersonic mixing nozzles, and recover the pressure of the gas flow to expel the gases overboard at 40,000 feet, The balance of the pressure recovery system to perform these three tasks precludes recovering or trapping of any of the gases to remove chlorine or iodine. Any recovery of gases would have too great a weight penalty to be practical for an aircraft application. On the ground, the ground pressure recovery system simulates the conditions at 40,000 ft. The weight of the ground pressure recovery system is well over 100 tons, and it is almost as large as the B747. A closed-loop system cannot be placed on the aircraft because of these constraints. Page 2-6 has been revised to reflect these limitations. The ongoing pollution prevention program will continue to look for cost effective and efficient ways of reducing these

Response to Comment 2

Table 1-2, Environmental Permits, Licenses and Entitlements, has been changed to reflect the appropriate regulatory agency. Requirement for Surface Disturbance Permit has been added to Table 1-2.

Response to Comment 3

Table 1-2. Environmental Permits Licenses and Entitlements, has been changed to reflect the appropriate regulatory agency.

Response to Comment 4

Changes were made to Table 3.2-3 to include Station ID

Response to Comment 1

Section 3.7, Upper Atmosphere, has been extensively rewritten and a more comprehensive analysis of the effect of chlorine released into the stratosphere has been included. The PDRR ABL aircraft does not release any ozone depleting chemicals defined in the Montreal Protocol of 1987 or by any US regulatory standards. There fore, it is difficult to compare PDRR ABL emissions to known standards. The new analysis should fully justify the conclusion that the small amount of chlorine and chlorine compounds released by PDRR ABL activities would not have a measurable, long term affect on the level of stratospheric ozone.

This document addresses PDRR ABL Phase activities only. Since activities in future phases (Engineering, Manufacturing and Development, and Production/Operational Basing) of the ABL program have not been defined, no analysis is possible at this time. The ABL System Program Office anticipates that environmental documentation will be prepared as activities in future phases are defined.

The operation of the laser device requires a pressure recovery system to generate the low pressure in the laser beam generation area, generate the flows of reacting gases through the supersonic mixing nozzles, and recover the pressure of the gas flow to expel the gases overboard at 40,000 feet. The balance of the pressure recovery system to perform these three tasks precludes recovery or trapping of any of the gases to remove chlorine or iodine. Any recovery of gases would have too great a weight penalty to be practical for an aircraft application. On the ground, the ground pressure recovery system simulates the conditions at 40,000 ft. The weight of the ground pressure recovery system is well over 100 tons, and it is almost as large as the B747. Currently it is not technically feasible to place a closed-loop system onboard the aircraft. The ABL System program Office has an ongoing pollution-prevention program and is actively seeking cost effective ways to reduce emissions from the operation of the HEL weapon system and to replace the halon in the fire suppression systems with non-ODC compounds.

Response to Comment 1

Evaluation of the expected level of startle response of marine mammals hauled out on San Nicolas Island or Vandenberg AFB area beaches is dependent on the specific launch site(s) that would be used under the proposed action. This EIS is intended to cover the broader issues associated with the selection of key installations (e.g., Edwards AFB, White Sands Missile Range, and the Western Range; including Vandenberg AFB and Pt. Mugu). However, specific launch facilities that may be used at Vandenberg AFB and San Nicolas Island have not been selected. Once specific launch facilities are selected, additional NEPA documentation will be developed. The development of this additional documentation will include discussion of startle response in harbor seals and other species and potential mitigation measures, if necessary. The USAF will also work with the National Marine Fisheries Service to obtain any necessary authorizations under the Marine Mammal Protection Act.

Response to Comment 2

References to all of these species have been added to the Final EIS. The USAF agrees that gray whales are not the only marine mammals that would potentially be impacted by the debris fall-out resulting from the proposed action. However, while other marine mammal species are present in the waters off of Vandenberg AFB, the gray whale has one of the highest peak, one-day densities in the zone of the proposed debris impact (approximately 12 km to 23 km from shore). The assumed density of gray whales used in the analysis in Appendix G was based on a maximum one-day sighting of 76 whales and assumed that all 76 whales were simultaneously off the coast of a single Vandenberg AFB launch facility at precisely the time of the ABL test. Supplementary text has been added to EIS Section 3.5.4, Environmental Consequences, in order to emphasize this point. This text is similar to that contained in Appendix G.

Response to Comment 1

Based on ongoing consultation with the U.S. Fish and Wildlife Service (USFWS), the USAF plans to conduct the proposed activity in a manner consistent with the existing USFWS Biological Opinion (BO) covering the desert tortoise. Text has been added to the EIS (Section 3.1.4, Affected Environment) to clarify this point.

Response to Comment 2

The USAF agrees that measures for protecting both listed and migratory species at these sites is appropriate prior to the launching of target vehicles from Vandenberg AFB. This EIS is intended to cover the broader issues associated with the selection of key installations (e.g., Edwards AFB, White Sands Missile Range, and the Western Range; including Vandenberg AFB and Pt. Mugu). However, specific launch facilities that may be used at Vandenberg AFB have not been selected. Part of the evaluation process for selecting launch facilities will include analysis of potential impacts to protected species. Once specific launch facilities are selected, separate NEPA documentation will be developed if necessary. The development of this additional documentation will include consultation with the U.S. Fish and Wildlife Service regarding protected species and development of mitigation measures if necessary.

Response to Comment 3

Reference to Parish's alkali grass was removed from the EIS (Section 3.1.4, Affected Environment). Based on consultation with the U.S. Fish and Wildlife Service and Edwards AFB, *P. simplex* is not identified as a protected species. Therefore, reference will not be made to this species in the EIS.

Response to Comment 4

Reference to this species has been added to Table 3.5-6.

Response to Comment 5

Reference to these species (least Bell's vireo and coho salmon) has been added to Table 3.5-7.. However, information from other sources suggests the presence of either the least Bell's vireo or the coho salmon at Vandenberg AFB is very unlikely.

The name of the "arroyo southwestern toad" has been changed in the text to "arroyo toad." However, information from other sources suggests this species is not present at Vandenberg AFB.

Reference to the species steelhead trout has been added to the EIS.

Reference to the species western snowy plover and unarmored three spine stickleback is included in the text in the Biological Resources section.

Response to Comment 1

Thank you for your review of the Draft EIS.

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Response to Comment 1

The Public Hearing for the Airborne Laser Draft Environmental Impact Statement was advertised in the *Albuquerque Journal* on November 15, 1996. The Phillips Laboratory Public Affairs Office issued a news release regarding the hearing on November 26, 1996. Copies of the Draft EIS (DEIS) were mailed on October 25, 1996 to those who requested them during scoping. Mr. Anderson was among those who received a copy of the DEIS along with a letter informing him of the times and locations of public hearings.

Response to Comment 2

Although no Draft Environmental Impact Statements were available at the hearing, Executive Summaries were provided. In addition, the names and addresses of those who wished copies mailed to them were taken. Prior distribution had been made to those who had requested copies, as well as to public libraries in the areas where ABL activities were proposed.

Response to Comment 3

Mr. Anderson remains on the mailing list for the Airborne Laser Program's environmental documentation.

Response to Comment 4

Thank you for your comment. It is beyond the scope of this EIS to consider moving or reducing activities at the Albuquerque Sunport. The addition of 30 flights of the ABL B747 aircraft during a nine month period compared to the 200,000 aircraft operations in 1995 indicates that the incremental increase in activity is insignificant.

Eye safety issues are addressed in Appendix F and aircraft crashes are addressed in Appendix C.

The HEL weapon system would be turned off and the turret ball positioned in the stowed configuration until the aircraft has reached the proposed location (in the DoD controlled airspace above the test range). This would make it impossible for a misfire of the HEL weapon system outside the boundaries of the test range. During all firings of the HEL weapon system, the aircraft will be flying at approximately 40,000 ft AGL and the laser would be pointed in a horizontal or upwards direction. Software interlocks will prevent the HEL beam from being inadvertently directed towards the earth's surface. Ground tests of the laser would be completely enclosed in a beam dump, presenting no hazards to the public.

The Kirtland Underground Munitions Storage Area is not within the approach/departure corridors for any of the runways at Albuquerque Sunport. The likelihood of a Boeing 747-400 crashing into the Kirtland Underground Munitions Storage Area during the initial climb or final approach is than less than 1 in 650 million.

Response to Comment 5

Thank you for your comment.

Response to Comment 6

Software interlocks will preclude the high-energy laser from operating at other than a horizontal or upward angle during the PDRR ABL Phase. There are no test scenarios for this phase that call for the laser to be operated at any other angle. The range of the COIL laser for effective target destruction is hundreds of kilometers.

Response to Comment 7

Thank you for your comment.

Response to Comment 1

The flight path of the Lance missile and the HEL engagement time analyzed in the DEIS were selected simply to determine the boundaries of the debris pattern and the distance from the shore line, and no consideration was given at this time to the location of the oil platforms. The example shown in Appendix G uses a launch azimuth of 270°. At Vandenberg AFB, normal ballistic launch azimuths range from 239° to 275°. ABL target missile launches are not scheduled to begin until 2002, and detailed test plans have not yet been developed. Prior to any target missile launches, the ABL Program office would be required to submit detailed data packages on the proposed test to the 30th Space Wing's Safety Office. A hazard and assessment is integral part of the data package. The range safety approval process would insure that the test is within an acceptable launch risk (typically, 1 in 33,333). A launch azimuth and engagement scenario would be selected to preclude debris from falling on or near any of the oil platforms.

Response to Comment 1

Thank you for your comment

Response to Comment 1

Thank you for your comment

Response to Comment 2

Thank you for your comment

Response to Comment 1

Public hearings were held in readily accessible locations in those communities potentially most affected by PDRR ABL activities.

Response to Comment 2

All economic analysis was done in the socioeconomic sections of the various locations. Economic data was appropriately included in the description of activities in Chapter 2.

The purpose of this EIS is to assist the decision makers in the selection of sites at which to perform various PDRR phase activities. If the decision is made that none of the alternatives offered in the EIS are acceptable for those purposes, the Air Force will continue the selection process, reviewing other possible sites.

The Missile Defense Act of 1991 mandated the development of a theater missile defense (TMD) program to defend United States personnel and assets against the threat of theater ballistic missiles. Various elements of the TMD program were delegated to the Army, Air Force, Navy, and Marine Corps. The Ballistic Missile Defense Organization (BMDO) was designated as the management office, and it prepared the Final Theater Missile Defense Programmatic Life-Cycle Environmental Impact Statement (U.S. Army, 1993). It addressed the potential environmental impacts of the proposed research, development, and testing of the various TMD program elements. The USAF concluded that a deficiency in boost-phase missile defense should be addressed and made the decision to build on its experience with high-energy lasers and fund the early ABL concept-design phases. The USAF prepared this EIS to study the potential impacts of PDRR ABL activities on alternative locations where the weapons system might be tested and assist the decision makers in the site selection process. The EIS followed the initial programmatic environmental documentation prepared by BMDO and will be supplemented by additional environmental documentation as required. The USAF expects to prepare an Environmental Assessment to cover the Engineering Manufacturing and Development Phase of the Airborne Laser Program and a full Programmatic EIS to cover production, deployment, maintenance and training for the system.

Response to Comment 3

All test activities at WSMR will take place within range boundaries and are similar to the range activities routinely performed at White Sands. The EIS includes a summary of expected activities at the range and allows an appropriate evaluation of potential impacts. The document was also prepared early in the ABL program to proactively meet the requirements of NEPA by including environmental considerations in the Concept Design phase.

Response to Comment 4

The goal of NEPA is to insure early public participation in the review of any potential impacts a major federal program (the Airborne Laser Program) might have on the human environment. NEPA and Air Force policies require environmental planning to start "at the earliest possible time" in the system life-cycle. The Air Force was bound by its own policy and by both the letter and the spirit of the law to begin the process. If the USAF had postponed the preparation of an EIS until a later phase, large resource expenditures would have occurred and decisions would have been made without consideration for the environment. The USAF selected the most comprehensive review possible for its initial documentation, with full recognition that subsequent phases of the Airborne Laser Program will require supplemental environmental documentation when detailed activities are identified.

Response to Comment 5

The USAF believes the NEPA process is appropriate for this action because of the requirement of USAF policies to include environmental planning "at the earliest possible time" in the system life-cycle. Although it would be more efficient to prepare NEPA documentation when all facets of a program are defined, Congress and the DoD do not release funds for the full program. Typically, the development of a weapon system is broken out into phases to ensure that technology meets the threat and user needs. Funding is also phased to follow a weapon system's development so that funding is focused on those systems that prove viable. Additional environmental documentation will be prepared as more detailed test plans and activities at each location are developed.

Response to Comment 6

Text has been revise to accurately reflect the status of “Call-Up Area” lands adjacent to White Sands Missile Range.

The Wilderness Study Areas (WSA) shown in Figures 3.3-8 (land use) and 3.3-9 (recreation) on pages 3.3-24 and 3.3-28, respectively, were taken from the Draft White Sands Missile Range-Wide EIS dated June 1994. The WSMR Final EIS, dated March 1996, shows no additional WSAs. Neither document designates the location of Areas of Critical Concern ACCs. Mr. Bill Gilbert of the BLM's Las Cruces office was contacted on January 21, 1997 in regards to this comment. He indicated that there have been no additions to the list of WSAs since 1994. He did indicate that there are six proposed ACCs, although none are located within WSMR or the two Call-Up Areas.

Because there are no ground-based PDRR ABL Phase activities occurring in the Call-Up Areas, neither established trails, livestock fences, improvements in the two Call-Up Areas nor private lands leased by TMD [U.S. Army] are applicable to this EIS. PDRR ABL Phase activities would have no adverse effect on private property owners or home sites in the Call-Up Areas.

The outline of the proposed Spaceport has been added to Figure 3.3-10.

Response to Comment 7

Section 3.7 has been rewritten to address this and other comments. Both the immediate and long term cumulative impact of PDRR ABL activities on ozone depletion are discussed in Section 3.7. The impact of the PDRR ABL activities on global w warming and acid rain are too insignificant to measure when compared to other sources. PDRR ABL activities would add 0.000006 percent to the total U.S. annual emissions of acid rain producing chemicals and 0.0000000007 percent to the anthropogenic sources of greenhouse gases.

Response to Comment 8

PDRR ABL Phase activities do not include the destruction of any missiles at WSMR. Drone aircraft would return to the runway, and missiles would fall intact in the debris recovery areas which are currently in use at WSMR. These areas do not include La Luz, or Ruidoso, NM. No new recovery areas are anticipated.

The Lance missile is the only missile proposed for ABL activity at this time. Should THAAD missiles be used instead of the Lance missile, the Air Force will prepare an analysis based on potential impacts to the environment of the THAAD missile.

Response to Comment 9

Population data was used in the analysis of the socioeconomic impacts as appropriate. All test activities will take place within range boundaries and would have no impact on the population outside those confines.

Response to Comment 10

Based on current operations at White Sands Missile Range (WSMR), the potential ten missile launches and four drone flights associated with the PDRR ABL Phase over a five-month period would result in an increase of only 6 percent in the number of missiles launched and an increase of approximately 1 percent in the number of drone missions. However, WSMR is working on a Cumulative Impact Statement which is expected to include PDRR ABL activities. The report is not yet complete, and no specific information regarding activities which may be scheduled at WSMR in the year 2002 is currently available for analysis. A more detailed analysis will be done as the information becomes available and as system test details are defined,

Response to Comment 11

Department of Defense Regulation 5000.2-R, *Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs*, March 15, 1996, defines Phase I: Program Definition and Risk Reduction as: "During this phase, the program shall become defined as one or more concepts, design approaches, and/or parallel technologies are pursued as warranted. Assessments of the advantages and disadvantages of alternative concepts shall be refined. Prototyping, demonstrations, and early operational assessments shall be considered and included as necessary to reduce risk so that technology, manufacturing, and support risks are well in hand before the next decision point. Cost drivers, life-cycle cost estimates, cost-performance trades, interoperability and acquisition strategy alternatives shall be considered to include evolutionary and incremental software development." In the context of the title of this document, risk reduction applies to the successful completion of the weapon system acquisition.

Since all PDRR ABL Phase activities would be within the boundaries of WSMR and similar to existing weapons test programs already being conducted at WSMR, there would be no incremental increase in risk to the public.

Response to Comment 12

Ms. Thaeler is on the mailing list for future environmental documentation associated with the Airborne Laser Program. Documentation prepared by the Ballistic Missile Defense Organization should be available through that agency or through local libraries.

Response to Comment 13

(1) The PDRR ABL is designed to operate at elevations above 40,000 ft AMSL. This is not a design deficiency. It is an appropriate attitude at which to operate, because it is above the cloud deck and atmospheric attenuation of the beam is less.

(2) Rocket motors in theater ballistic missiles to be targeted in the PDRR ABL Phase are burning at 40,000 ft AMSL. This is not a design limitation. The laser weapon system was purposely designed to engage targets at that altitude.

Response t Comment 13 (continue)

(3) Even though the B747 aircraft may be weight limited with the laser weapon system and a full laser fuel load onboard, the aircraft is air-to-air refuelable, and fully capable of performing its mission while maintaining 24-hour coverage of a theater of operations.

(4) The PDRR ABL laser weapon system has been designed to operate only when the nose of the aircraft is at a horizontal or upward angle.

(5) The laser can be fired through clouds but is not as effective due to scattering of the beam. However, the PDRR ABL is designed to operate at an altitude of 40,000 feet AMSL, which is above the cloud deck.

(6) Appendix F shows that laser reflections off targets will not harm humans and wildlife on the ground.

(7) The impact of the PDRR ABL activities on global warning and acid rain are too insignificant to measure when compared to other sources. PDRR ABL activities would add 0.000006 percent to the total U.S. annual emissions of acid rain producing chemicals and 0.0000000007 percent to the anthropogenic sources of greenhouse gases.

(8) The aircraft will have a 20-40 shot magazine.

(9) The analysis in the EIS shows that PDRR ABL tests can be performed safely at White Sands Missile Range, without putting humans at risk.

Although the analysis in this document justifies the above finding, additional environmental documentation will be prepared, if required, once test plans are more fully defined.

Response to Comment 14

The USAF believes the NEPA process is appropriate for this action because of the requirement of USAF policies to include environmental planning “at the earliest possible time” in the system life-cycle. Additional environmental documentation will be prepared if necessary as more detailed test plans and activities at each location are developed.

Dorelen Bunting
Page 2 of 2

Response to Comment 1

Ms. Bunting has been added to the mailing list for the Final EIS and future environmental documentation for the Airborne Laser Program.

Response to Comment 1

There will be no fallout from chlorine in Lompoc as a result of the PDRR ABL flight tests. During the tests, the ABL aircraft will be flying approximately 200 km offshore (to the west of Lompoc), at an altitude of 40,000 feet and at a velocity of about 80-percent of the speed of sound. The small amount of chlorine emissions in the laser weapon system discharge would be rapidly dispersed in the turbulent air flow behind the aircraft, then further dispersed to below measurable levels by the high winds at this altitude.

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Response to Comment 1

Col. Richard Tebay provided a satisfactory Response to Ms Cummings during the Public Hearing. Col. Tebay' s Response stated that the chlorine emissions from the ABL aircraft at 40,000 ft would not "fall to the ground," but would be dissipated to undetectable levels in the upper atmosphere.

Response to Comment 2

Since the gray whale has one of the highest, documented, single-day densities, it was used as the bounding species to calculate the maximum potential risk to any marine mammal species. The text in Section 3.5.4, Environmental Consequences and Appendix G, Debris Analysis, has been supplemented to emphasize this point. The analysis in Appendix G was not used to identify "low" or "high" risk periods but to determine the "worst" case condition during the period of maximum potential risk to marine mammal species.

Response to Comment 3

The statistical analysis does adequately address the potential hazard to marine mammals from Lance missile debris fragments. According to the *Gray Whale Monitoring Study*, most of the pods consisted of only one or two whales. Generally, the two-whale pods were identified as cow-calf pairs and the cow-calf pairs were more likely to be found close to the shore, not in the debris scatter area. Using the information presented in Tables G-2, 3 and 4, the average distance between impact locations was calculated to be between 1 and 1.5 km. Therefore, only one debris fragment is likely to impact in the vicinity of a single pod.

The flight test plans have not yet been finalized. Consideration of impact on the biological resources in the immediate vicinity will be included in the selection of launch location and debris impact area.

Response to Comment 4

The flight path of the Lance missile and the HEL engagement time analyzed in the DEIS were selected to determine the boundaries of the debris pattern and the distance from the shore line, and no consideration was given to the location of the oil platforms. The example shown in Appendix G uses a launch azimuth of 270°. At Vandenberg AFB, normal ballistic launch azimuths range from 239° to 275°. ABL target missile launches are not scheduled to begin until 2002 and detailed test plans have not yet been developed. Prior to any target missile launches, the ABL Program office would be required to submit detailed data packages on the proposed test to the 30th Space Wing's Safety Office. A hazard assessment is an integral part of the data package. The range safety approval process would insure that the test is within acceptable launch risk (typically, 1 in 33,333). A launch azimuth and engagement scenario would be selected to preclude debris from falling on or near any of the oil platforms.

Response to Comment 5

There will be no degradation of the air quality in the Lompoc Valley from the destruction of the Lance missile. The Lance missile would have less than 175 lbs. of propellant onboard, would be more than 10 km offshore, at an altitude of more than 50,000 ft. and would be traveling at more than 2,000 miles per hour, The little propellant remaining onboard would be vaporized when the missile is destroyed and then dispersed to below measurable levels by the high winds at this altitude.

Response to Comment 6

We intend to schedule tests when migrating birds and marine mammals are not migrating. This would minimize potential risks to the aviation and marine mammal populations. Appendix G contains a conservative analysis of risk to migratory gray whales during peak season.

Another environmental impact analysis will be conducted when site locations for the ABL activity are chosen. This will include specific launch areas, number of flights, impact areas etc.

We look forward to reviewing your letter detailing your concerns.

Response to Comment 7

Thank you for your comment.

Response to Comment 8

Thank you for your comment.

Response to Comment 1

Thank you for your comment.

Response to Comment 2

Thank you for your comment.

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UNITED STATES DEPARTMENT OF DEFENSE
US AIR FORCE

RECORD OF DECISION

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE PROGRAM DEFINITION AND RISK REDUCTION PHASE OF THE AIRBORNE LASER PROGRAM

Pursuant to section 102(2)(C) of the National Environmental Policy Act of 1969, Public Law 91-90 (as amended) and the regulations promulgated by the Council on Environmental Quality at 40 CFR § 1505.2, the Department of Defense, US Air Force, has prepared the following Record of Decision on the Final Environmental Impact Statement for the Program Definition and Risk Reduction Phase of the Airborne Laser Program (PDRR ABL). The Record contains the statement of decision, identifies the alternatives considered, and discusses the factors on which the decision was based and any mitigating measures deemed necessary to avoid or minimize environmental impacts.

OVERVIEW

The Airborne Laser Acquisition Program has completed the Concept Design Phase, with two competing contractors developing a proposed system design. The next acquisition phase is the PDRR, for which the Final Environmental Impact Statement was prepared. The selected contractor will proceed with verifying preliminary design and engineering and building a prototype ABL aircraft that can be tested. If the demonstration tests of the prototype are successful, two phases will follow. Engineering, Manufacturing and Development (EMD) will include building a second full-scale ABL aircraft and conducting operational performance tests. Production will involve procuring an additional five aircraft.

The PDRR ABL is a modified Boeing 747 aircraft that would accommodate a laser-weapon device and laser-fuel storage tanks. The aircraft would also incorporate a low-powered acquisition, tracking and pointing laser, a laser-beam control system designed to focus the beam on target, and a beam director (telescope) enclosed in a turret at the front of the aircraft. A Battle Management Command Center provides computerized control of all aspects of the laser-weapon system, communications, and intelligence systems onboard the aircraft.

The PDRR ABL would orbit at an altitude of 40,000 feet above mean sea level (AMSL) in friendly airspace and would detect and track launches of theater ballistic missiles (TBMs) using onboard sensors. Active tracking of the missile would begin when the TBM breaks clear of the clouds at approximately 40,000 feet. The high-energy laser (HEL) would then be directed horizontally or in an upward position toward the missile. The energy from the laser would heat the missile's booster components and cause a stress fracture, which would destroy the missile. The geometry of the tests would preclude operation of the laser except at a horizontal or upward angle.

NEED AND PURPOSE

The United States needs a more accurate and effective defense against mobile TBMs. By destroying the missiles during boost phase, just after launch, the debris would fall back on the aggressor. Currently, the U.S. and its allies are limited to defense of troops or high-value assets within a small area of a theater of operations as the missile nears its target. Improvements in missile range and accuracy, the rapid increase in the number of missile-capable nations, and the absence of arms limitation treaties increase the TBM threat. TBM launchers are difficult to detect because the launchers and support equipment are highly mobile.

The purpose of the PDRR ABL Phase is to demonstrate under operational conditions that the Air Force can use a high-energy chemical oxygen iodine laser (COIL) onboard an aircraft to acquire and destroy TBM targets. The PDRR ABL is being designed to engage and destroy the targets at long ranges, while the aircraft stays within friendly airspace. PDRR ABL Phase test activities will take place at appropriate locations whose selection is based on the Final Environmental Impact Statement for tile PDRR ABL Program which was prepared to assist in that decision.

DECISION

The US Air Force will proceed with PDRR ABL Phase test activities at the following locations:

> Home Base activities, including weapon system integration, ground tests and initial aircraft flight tests, will take place at Edwards Air Force Base, California.
>
> Diagnostic test activities for initial short-range PDRR ABL equipment tests with low- and high-power laser operations will take place at White Sands Missile Range, New Mexico.
>
> Expanded-area test activities for long-range PDRR ABL equipment checks with low- and high-power laser operations and firing of the high-energy laser will take place at the Western Range (Vandenberg Air Force Base and Point Mugu Naval Air Warfare Center, California).

PROPOSED ACTION AND ALTERNATIVES

Proposed Action. The proposed action consists of the selection of three sites: 1) Home Base at Edwards Air Force Base, California, 2) Diagnostic Test Range at White Sands Missile Range, New Mexico, and 3) Expanded-Area Test Range at the Western Range in California. The alternatives to the proposed action are the no-action alternative or the selection of alternate sites where PDRR ABL Phase activities could occur.

Alternative Actions. After a lengthy screening process, a number of candidate locations were chosen which met a threshold of operational considerations necessary to conduct the program. Through the application of specific selection criteria, the final candidate list was narrowed to include Edwards Air Force Base, California (the preferred alternative) and Kirtland Air Force Base, New Mexico for Home Base activities; White Sands Missile Range, New Mexico (the preferred alternative), China Lake Naval Air Warfare Center, California and the Western Range, California for Diagnostic Test Range activities; and the Western Range, California (including the operational area on San Nicolas Island) for Expanded-Area Test Range activities. No alternative locations were identified for the Expanded-Area test activities.

No-Action Alternative. Selection of the no-action alternative would mean that PDRR ABL Phase activities would not take place at any of the candidate locations.

Basis for the Decision. After investigation at all six alternative sites was completed, it was determined that no significant adverse environmental impacts would result at any site. Minor adverse impacts would occur in the areas of air quality, hazardous materials/waste storage and handling, and biological resources, but any effects would be minimized through the application of existing Air Force regulation and policy. There would also be minor beneficial socioeconomic impacts at all the locations.

In the absence of significant environmental concerns at any location, operational considerations became the dominant selection factor. Edwards Air Force Base, California has an existing state-of-the-art facility to support flight testing and data collection and analysis. The B-2 program, currently housed at Edwards, will

be substantially reduced, if not concluded, before PDRR ABL Phase activities begin. The reduction of the B-2 program will vacate existing office and hangar space which meet PDRR ABL Phase requirements with minimum modification effort and expenditure. In addition, Edwards is located in close proximity to the preferred location for expanded-area testing. White Sands Missile Range has the capability and experience in launching a large complement of missile types and has extensive experience launching the Lance missile, specifically. The Lance is one of the primary targets for PDRR ABL test activities. White Sands can provide a minimum 150 kIn (94 mi) separation between the orbiting PDRR ABL aircraft and the target launch point, all within Range boundaries. White Sands also has experience with high-energy lasers at its High Energy Laser Test Facility, including prior support for lethality tests for the ABL Program.

The Western Range (including Vandenberg Air Force Base and Point Mugu Naval Air Warfare Center), located in close proximity to the preferred location for Home Base activities, can provide a minimum 300 kIn (187 mi) separation between the PDRR ABL aircraft and the target launch point, all within Range boundaries. It is the only test site in the Western United States that can fulfill that operational requirement.

Measures to Minimize Impacts. All practicable means to avoid and minimize harm to the environment will be taken at the appropriate time. Because of the negligible impacts that PDRR ABL Phase activities would have on most environmental attributes and the additional measures already taken by the USAF, no separate mitigation plan beyond adherence to all laws, regulations, and USAF guidelines is currently deemed necessary. Evacuation plans, booster-recovery plans, and emergency response plans will be developed and implemented, as required. Emergency planning documents will be fully updated and government and community emergency response personnel trained and equipped prior to introduction of significant amounts of new ABL hazardous materials or a significant increase in the quantity of existing ABL related hazardous materials at the selected sites. Prior consultation with all appropriate federal and state agencies will occur. Notice of launch activities will be given to any and all concerned parties, including agencies, local communities and recreational users in the areas. Activities will be scheduled, to every degree possible, to avoid major events, holidays and community activities.

Biological resource concerns include some level of startle response in marine mammals who might be on area beaches at San Nicolas Island or Vandenberg Air Force Base. However, there are several launch-site options available to the ABL Program at those locations. Once the specific launch facilities are selected, additional evaluation and subject to consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service will occur to obtain any necessary authorizations under the Marine Mammal Protection Act.

The Final Environmental Impact Statement used the gray whale, with one of the highest documented, single-day densities, to determine the "worst case" condition for maximum potential risk to marine mammal species and found the risk to be minimal. Nevertheless, migratory patterns of any animal species which could be impacted by PDRR ABL test activities at any location will be of ongoing concern and consultation with all appropriate federal and state agencies. Desert species at both Edwards Air Force Base and White Sands Missile Range will also be the subject of further consultation and evaluation, and the USAF will conduct its activities in a manner consistent with all existing regulations, guidelines and biological opinions.

Conclusion. The factors and considerations offered above justify the selection by the USAF of the alternative known as the Proposed Action in the Final Environmental Impact Statement for the Program Definition and Risk Reduction Phase of the Airborne Laser Program.

Signed 9/16/97
HELMUT HELWIG
Deputy Assistant Secretary (Science, Technology and Engineering)