CA-00140-BKS

Booster Verification Tests
Environmental Assessment
Vandenberg Air Force Base, California
March 1999

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1.0 BACKGROUND

1.0 INTRODUCTION

This Environmental Assessment (EA) analyzes the potential environmental impacts for the activities associated with two booster verification (BV) test flights proposed at North Vandenberg Air Force Base (AFB) beginning as early as the year 2000. The EA covers all pre-flight, in-flight and post-flight operational activities, modifications of the existing Minuteman (MM) II silo at Launch Facility 21 (LF-21), minor modifications to the communications and launch control buildings, and installation of a temporary aboveground fiber-optic communication line connecting LF-21 to the base communication system.

The BV test flights at Vandenberg AFB represent one phase in the development and deployment of the National Missile Defense (NMD) system. This system is designed to provide protection in the event of a limited ballistic missile attack against the United States. The next phase would include additional tests that would be conducted at the United States Army Kwajalein Atoll (USAKA) facilities in the Pacific. The USAKA tests would include a BV test flight and follow-on integrated flight tests involving use of both the defensive missile and targets designed to measure the NMD system's ability to intercept and destroy incoming missiles. The Department of Defense (DOD) Ballistic Missile Defense Organization (BMDO) has given the NMD Joint Program Office the responsibility of developing the NMD system.

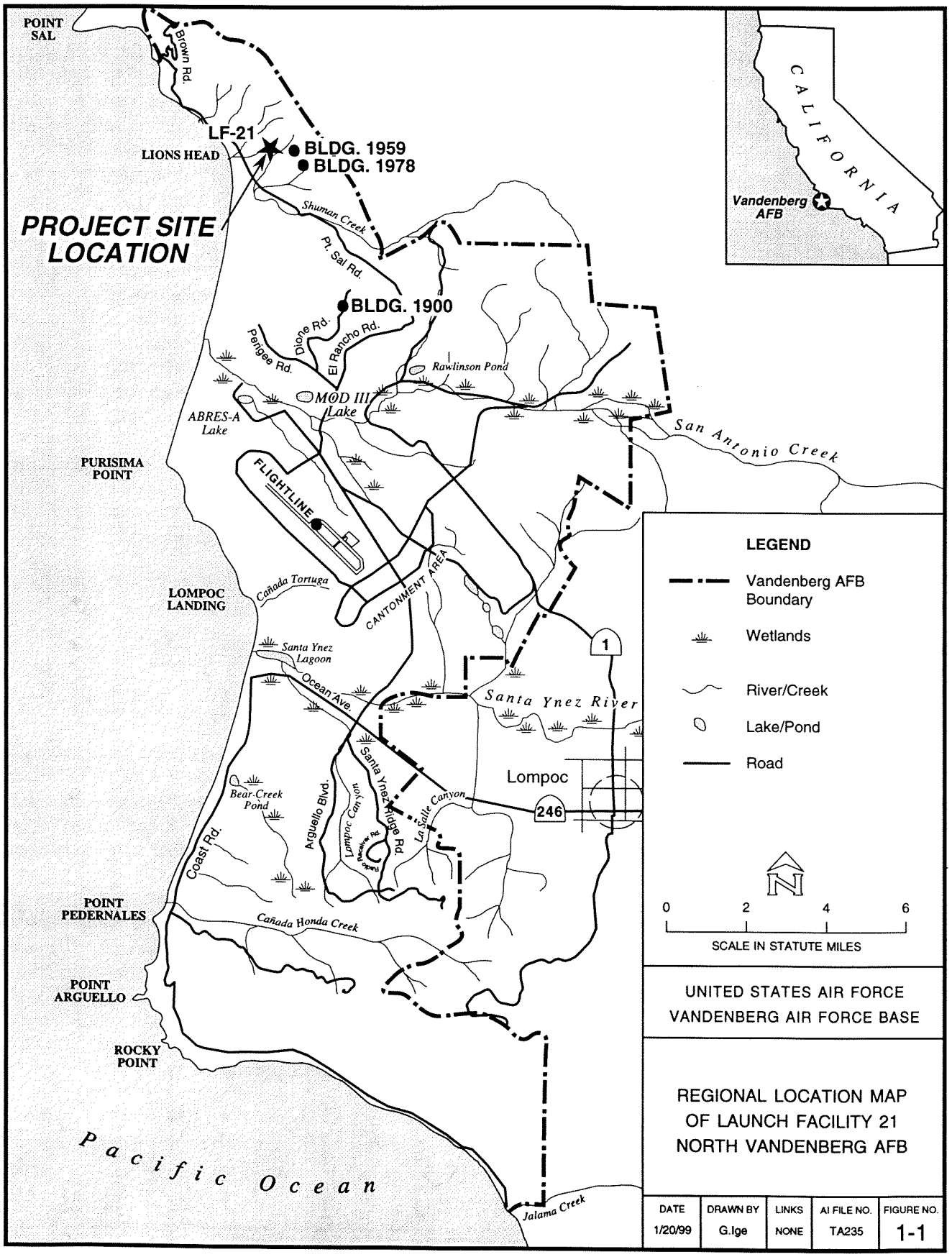
The National Environmental Policy Act (NEPA) and implementing regulations issued by the Council on Environmental Quality (CEQ) require the lead agency to prepare an EA for federal actions not qualifying for categorical exclusion and that may not require an environmental impact statement (EIS). The NMD/JPO is the lead agency for NEPA compliance on the proposed BV flight test project.

This EA has been prepared in accordance with the NEPA of 1969, as amended, 40 U.S. Code (U.S.C). 4321 *et seq.;* the CEQ regulations implementing NEPA, 42 Code of Federal Regulations (CFR) 1500-1508; and Air Force Instruction (AFI) 32-7061, Environmental Impact Analysis Process, dated 24 January 1995 and BMDO Environmental, Safety, and Health Directive 6050.

1.1 PROJECT LOCATION

Vandenberg AFB is located on approximately 98,000 acres on the south-central coast of California in Western Santa Barbara County. Vandenberg AFB is headquarters for the 30th Space Wing. The primary missions at Vandenberg AFB are to launch and track satellites in space, test and evaluate America's intercontinental ballistic missile (ICBM) systems, and support aircraft operations in the western range. As a nonmilitary facet of operations, Vandenberg AFB is also committed to promoting commercial space launch ventures.

Figure 1-1 shows the regional location of the launch and support facilities for the BV tests. The following facilities, located on Vandenberg AFB, would be used under the Proposed Action. Building 1900, located on Dione Road and El Rancho Oeste Road, would be used for temporary storage of the BV flight vehicle when it arrives at Vandenberg AFB. The Vandenberg AFB Flightline would be the site where BV test vehicles would be delivered to Vandenberg AFB. Both BV tests would be conducted from a modified MMII silo at LF-21. The BV test Launch Control Center (LCC) and the communication center would be located approximately 3/4 mile east of LF-21 in Buildings 1978 and 1959, respectively.


POINT SAL
Brown Rd.
LF-21
LIONS HEAD
BLDG. 1959
BLDG. 1978
PROJECT SITE LOCATION
Shuman Creek
Pt. Sal Rd.
BLDG. 1900
Dione Rd.
Perigee Rd.
El Rancho Rd.
Rawlinson Pond
MOD III Lake
ABRES-A Lake
San Antonio Creek
PURISIMA POINT
FLIGHTLINE
CANTONMENT AREA
Cañada Tortuga
LOMPOC LANDING
Santa Ynez Lagoon
Ocean Ave.
Santa Ynez River
Lompoc
246
1
Bear Creek Pond
Arguello Blvd.
Santa Ynez Ridge Rd.
La Salle Canyon
Lompoc Canyon
Coast Rd.
POINT PEDERNALES
Cañada Honda Creek
POINT ARGUELLO
ROCKY POINT
Pacific Ocean
Jalama Creek
CALIFORNIA
Vandenberg AFB
LEGEND
Vandenberg AFB Boundary
Wetlands
River/Creek
Lake/Pond
Road
N
0 2 4 6
SCALE IN STATUTE MILES
UNITED STATES AIR FORCE
VANDENBERG AIR FORCE BASE
REGIONAL LOCATION MAP
OF LAUNCH FACILITY 21
NORTH VANDENBERG AFB
DATE 1/20/99
DRAWN BY G.Ige
LINKS NONE
AI FILE NO. TA235
FIGURE NO. 1-1

1.2 PROJECT PURPOSE AND NEED FOR ACTION

The purpose of the BV tests is to confirm booster and silo designs, demonstrate canister and silo egress, test the booster under operationally representative conditions, demonstrate vehicle maneuverability (control limits, vehicle response), demonstrate representative aero-thermo loads, demonstrate guidance algorithms, and conduct stressing maneuvers. The BV tests are needed if a decision is made to deploy the system for protection against limited ballistic missile attack against the United States. Locations for BV tests are limited because of the requirement for long-range and high-velocity testing capabilities. Vandenberg AFB allows 10,000 kilometers (km) of open water flight space westward over the Pacific Ocean and is the only site at this time where full aerodynamic profile and stressing performance parameters may be achieved.

1.3 DECISION TO BE MADE

The BMDO will be the agency responsible for making the decision of whether to proceed with the BV tests at Vandenberg AFB based on the findings of the EA. The EA provides decision makers an analysis of the potential impacts associated with conducting these tests on the central coast of California using Vandenberg AFB facilities, and gives them means by which to either support a finding of no significant impact (FONSI) or prepare an EIS.

1.4 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

This EA analyzes and describes the potential environmental impacts that could result from the proposed project and identifies all required environmental permits. As appropriate, the affected environmental consequences of the action are presented in terms of a regional overview or a site-specific description.

Chapter 2.0 of this EA describes the Proposed Action, alternatives eliminated from further study, and the No-Action Alternative. In addition to providing project information, this section describes the general site setting of the Proposed Action and outlines proposed pre-flight, in-flight, and post-flight launch activities and operations.

Chapter 3.0 provides regional and site-specific existing conditions related to air quality; biological resources; cultural resources; geology, soils, and seismic; hazardous materials and waste management; health and safety (including airspace); infrastructure; land and water use; noise; pollution prevention; socioeconomics; solid waste management; utilities; and water resources. The regional information included in this section provides background for understanding the context of the site-specific existing conditions that could affect or be affected by the Proposed Action.

Chapter 4.0 addresses the potential effects of the Proposed Action and the No-Action Alternative on the resource areas analyzed. Alternatives considered, but eliminated from further analysis are discussed in Section 2.2.1. The significance of each impact is identified for each resource area, and mitigation measures are stated, where applicable. The mitigation measures are designed to ensure that none of the potential effects of the Proposed Action significantly impact the environment.

Chapter 5.0 presents a list of applicable federal, state, local, and Air Force regulations requiring compliance prior to construction and operation of the Proposed Action.

Chapters 6.0 through 9.0 identify report references, persons and agencies contacted, preparers of this EA, and acronyms and abbreviations, respectively.

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2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This section describes the Proposed Action of launching two BV test flights from Vandenberg AFB. Alternative actions considered but eliminated from further study and the No-Action Alternative are also discussed in this section.

2.1 PROPOSED ACTION

The Proposed Action would include all aspects of the two BV tests including silo and facility modification, flight vehicle transportation and storage, and all pre-flight, in-flight, and post-flight activities and operations. Both BV test flights would be launched from LF-21, located on north Vandenberg AFB. The BV interceptors would be transported to Vandenberg AFB in a sealed canister and placed at Building 1900 for storage, preliminary testing, and checkout. Buildings 1959 and 1978, located approximately 3/4 mile east of LF-21, are proposed for communication support and an LCC, respectively. Under the Proposed Action, LF-21 and Buildings 1959, 1978, and 1900 would be used for their intended purpose and current use. Minor to no modifications would be made to these facilities. Aboveground fiber-optic cable would be installed between Building 1959 and LF-21. This cable would be removed at the completion of the BV test flights.

Minor modifications and site preparation would be required at the LF-21 Launch Silo Site. The Launch Silo Site would include the launch silo, silo interface vault (SIV) located within the existing Minuteman launch equipment room (LER), silo access roadways, site utility distribution, and any auxiliary mechanical support equipment or junction boxes required to support the launch operation (Bechtel 1998). Details regarding modifications or site preparation of these launch components and other launch support facilities are described in the following sections.

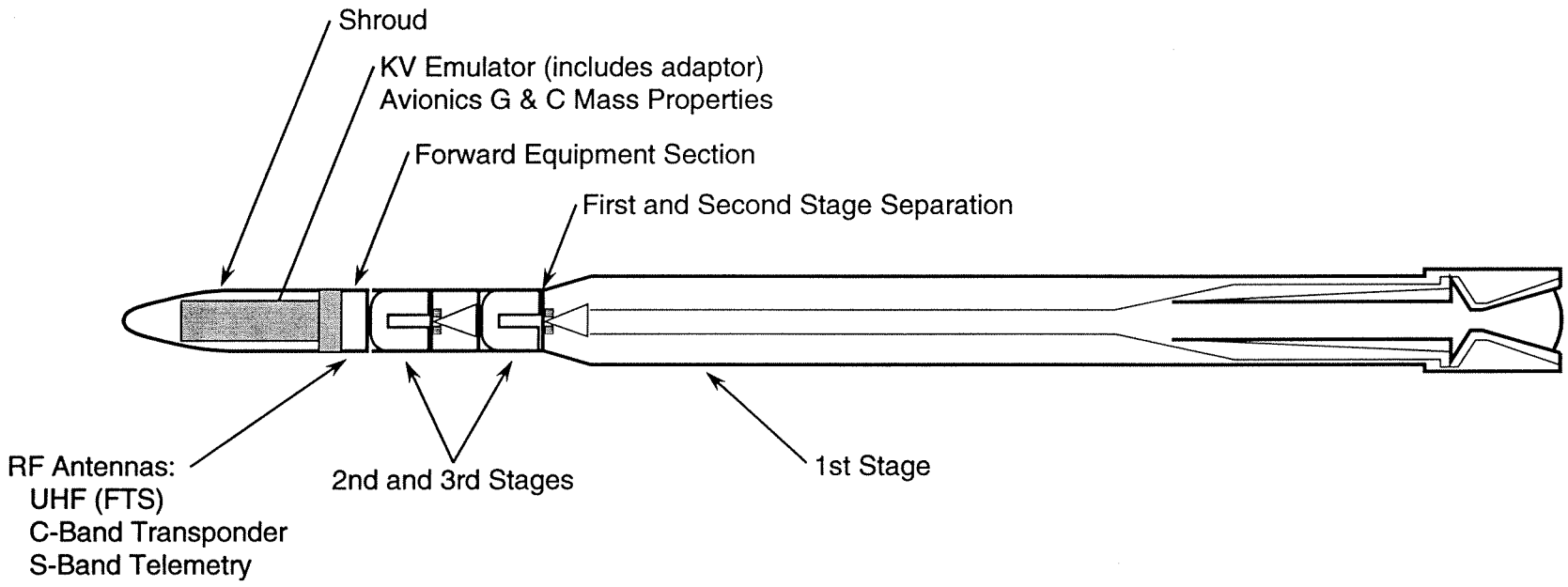
2.1.1 Booster Vehicle Description

The BV vehicle shown in Figure 2-1 consists of a three-stage, solid propellant booster and a kill vehicle (KV) emulator. The KV is typically the part of the missile that intercepts and impacts incoming enemy warheads. For these BV tests the KV emulator would contain the missile's guidance and control equipment.

The BV vehicle would be enclosed in a sealed canister that would house the BV components for transportation and insertion into the launch silo for the flight test. The BV flight vehicle is composed of a three-stage booster stack of commercial off-the-shelf components. This three-stage BV missile configuration has not been previously flight-tested. A comparison of the relative size of the BV Missile to other Peacekeeper and Minuteman missiles is shown in Figure 2-2.

The three-stage booster would contain no more than 67,000 pounds of a hydroxyl-terminated polybutadiene (HTPB) solid rocket fuel propellant as contained in the Minuteman III. The proposed booster propellant weight would be less than the Minuteman III missiles previously flown in this area. The BV missile has a flight termination system (FTS) that, when activated, detonates an explosive charge that ruptures the solid rocket motor casing, resulting in loss of pressure and termination of thrust.

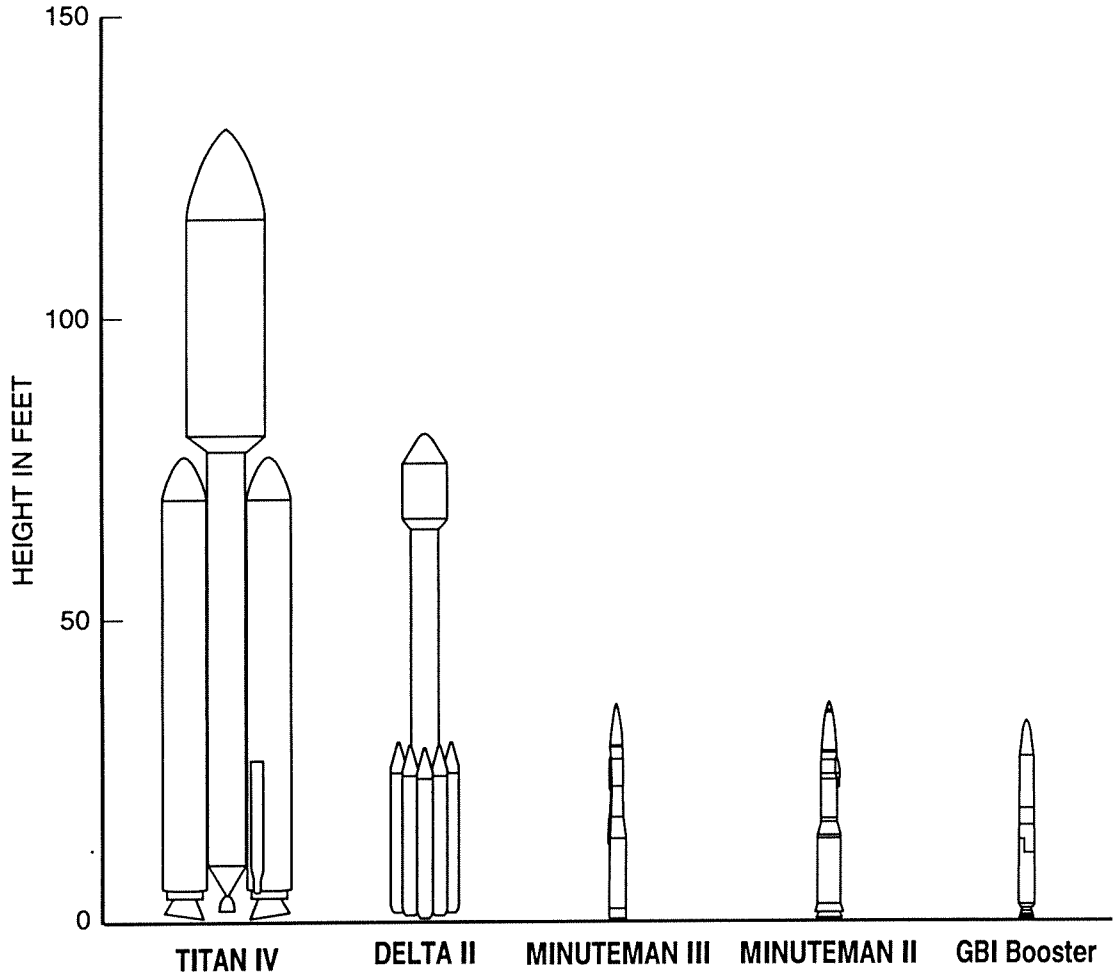
The BV flight vehicle would travel approximately 6,500 kilometers west over the open ocean with a proposed termination point north of USAKA. There would be no target intercepts over the ocean for the two BV tests.



UNITED STATES AIR FORCE
VANDENBERG AIR FORCE BASE

BV-1, -2 CONFIGURATION

TASK NO.	DATE	DRAWN BY	LINKS	AI FILE NO.	FIGURE NO.
Boost EA	02/15/99	G. Ige	NONE	2-1.ai	2-1



UNITED STATES AIR FORCE VANDENBERG AIR FORCE BASE					
COMPARISON OF LAUNCH VEHICLES					
TASK NO. Boost EA	DATE 02/15/99	DRAWN BY G. Ige	LINKS NONE	AI FILE NO. 2-2.ai	FIGURE NO. 2-2

2.1.2 Silo Modification and Site Preparation

There are four facilities located on north Vandenberg AFB that are required for the BV test: LF-21 and Buildings 1959, 1978, and 1900. The existing launch silo at LF-21 would require the most extensive modification and site preparation for the BV tests. The proposed communication support facility, Building 1959, and the LCC in Building 1978 would require only minor modifications to prepare for the BV tests. Building 1900, used for temporary storage of the BV canister prior to the launch, would not require modification or site preparation. Testing and checkout equipment for the BV missile would be brought into Building 1900 with the canistered missile. Nothing inside the facility would be altered.

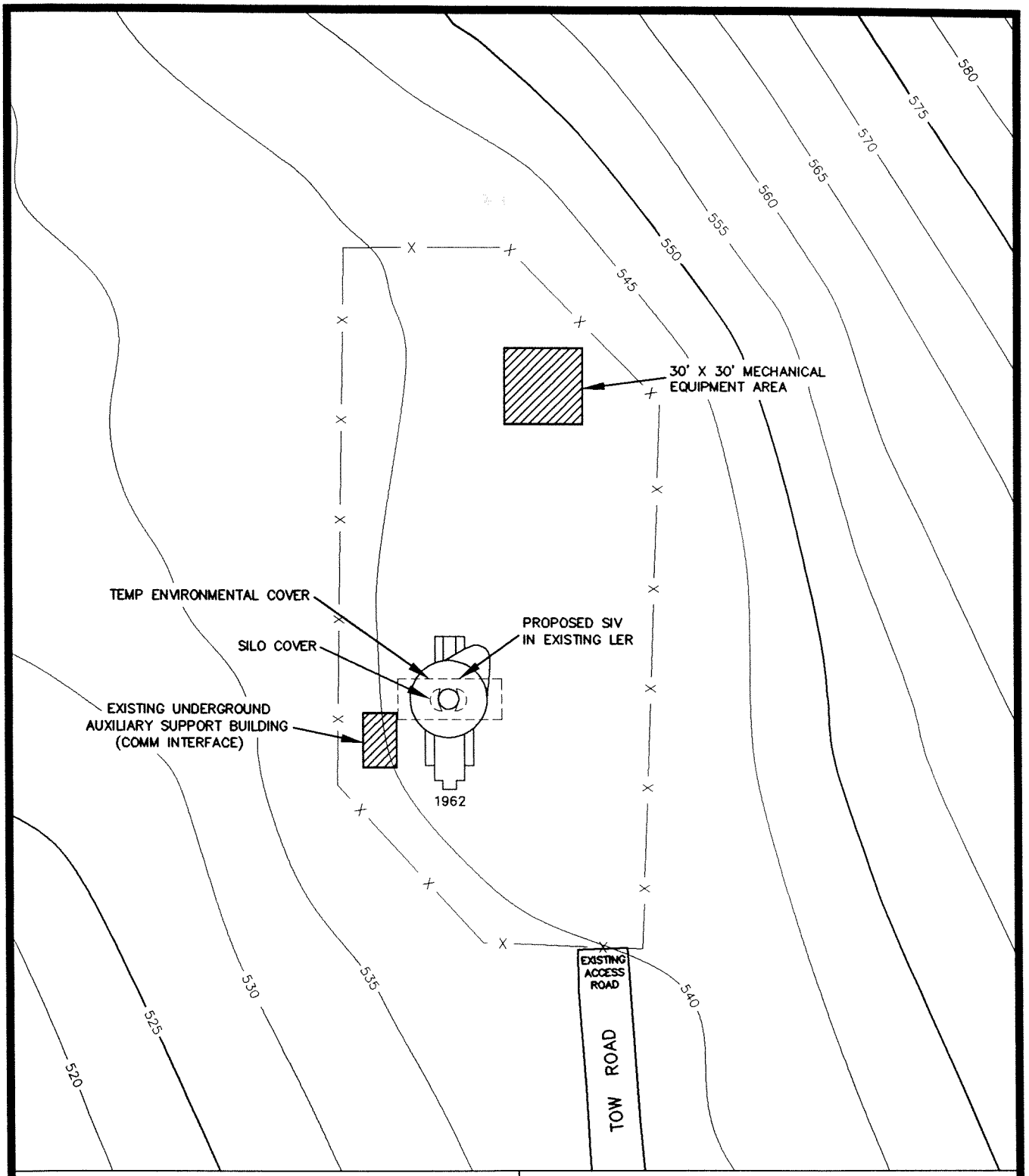
The conceptual site plan for use of LF-21 for BV launches is shown in Figure 2-3. Site preparation would include modifying the existing silo to receive a new prefabricated launch station that will accommodate installation of the BV canister. Other modifications would include preparation of the existing launch equipment room for installation of SIV equipment. A "headworks" consisting of a foundation and silo top block would provide a pylon or other interface for insertion and removal of the canister (Bechtel 1998). A launch silo environmental cover (non-operational) would be installed and removed with a crane or similar equipment. A total of 15 workers would be required for the silo modification phase of the Proposed Action.

The SIV would be located in an existing underground LER, which surrounds the launch silo and serves as an access to the silo from an underground position. It would provide access to the interior of the silo and the side of the canister near the top for connecting and disconnecting utilities, command launch equipment (CLE), or other interface needs. The SIV would remain unoccupied except to install or remove the canistered interceptor or for maintenance of the launch silo, SIV, or other site equipment. The SIV would be designed to accommodate a maximum of two people. Figure 2-4 shows the silo plan view.

The LF-21 facility has only one offsite power source that feeds through an existing transfer switch. A permitted diesel generator would be used as a backup power source. This arrangement would provide the LF-21 test facility with two power sources without having to install a new distribution line to LF-21 to serve as the second offsite power source (Bechtel 1998). The Launch Silo Site would have area lighting, telephone communications, and a public address system. The Launch Silo Site would remain unoccupied except to install and remove the canistered missile or for maintenance of the launch silo or other site equipment.

Building 1978 is a previous MM alert facility that is no longer used. Only minor modifications inside the building would be required so this facility could be used as the LCC for the BV tests. Consoles would be installed in the building for testing, ground safety, telemetry, vehicle monitoring and mission evaluation. No other modifications would be required.

Installation of approximately 3/4 mile of aboveground fiber-optic cable placed in polyvinyl chloride (PVC) conduit would be required to connect LF-21 to the communications facility, Building 1959. The fiber-optic cable would be laid using a utility truck and would be removed upon completion of the BV tests. Building 1959 would require only minor modifications for installation of the required launch support communication equipment. Minor excavation would be required for locating the fiber-optic cable under a portion of the road near LF-21.



LEGEND

- CONTOUR LINE, 5 – FOOT INTERVALS (FEET ABOVE MSL, NAVD 1988)
- FENCE
- PAVED ROAD OR STREET
- BUILDING

N

0 30' 60'

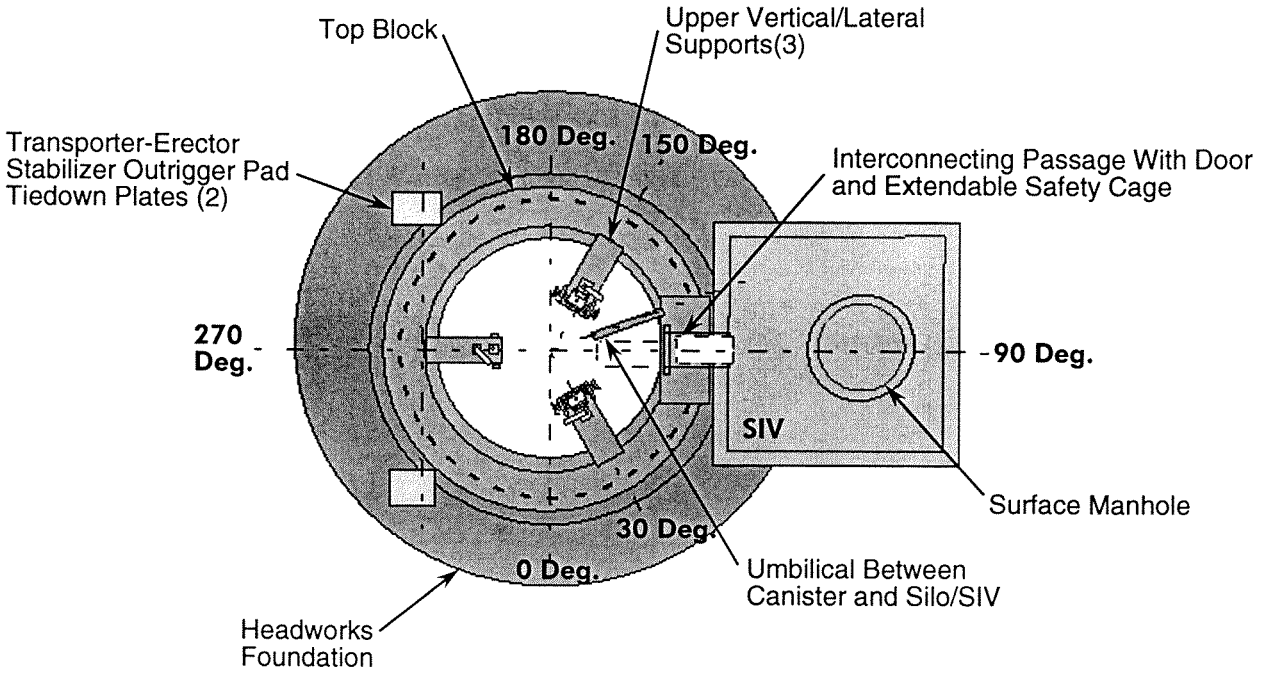
SCALE

UNITED STATES AIR FORCE

VANDENBERG AIR FORCE BASE

LF–21 CONCEPTUAL SITE PLAN

DATE	DRAWN BY	MADE FROM	ACAD FILE #	Figure
3/4/99	RANDALL	TAB5	2663	2–3



NOTE: There is no TE planned for use at VAFB. However, our concept is a "whitetail". One headworks design for all sites to simulate the deployed site configuration.

UNITED STATES AIR FORCE
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PLAN VIEW CONCEPT
VIEW FROM ABOVE TOP MAIN CANISTER SUPPORT BEAMS

TASK NO.	DATE	DRAWN BY	LINKS	AI FILE NO.	FIGURE NO.
Boost EA	02/16/99	G. Ige	NONE	2-4.ai	2-4

2.1.3 Pre-Flight Activities

Each BV missile would be transported separately to Vandenberg AFB by military aircraft carrier (C-5 or C-17) or on road by a common carrier truck from Redstone Arsenal. The BV missile in its sealed canister would be loaded in a specially configured trailer (strongback) (Boeing 1998). Both transportation methods, by air or road, would be in accordance with Department of Defense (DOD) and Department of Transportation (DOT) rules and regulations. Each method of transportation is evaluated separately in this EA.

Upon arrival at Vandenberg AFB, the BV missile would be transported to Building 1900, the Integrated Refurbishment Facility (IRF), for storage and required inspections and checks; the missile would remain at Building 1900 until launch preparation begins. Approximately 4 to 6 weeks prior to launch, the missile would be moved to LF-21 where it would be transferred to the missile transport trailer prior to placement into the silo. After placement, range operators would ensure all missile range systems, communication, and utilities function properly. Applicable safety regulations would be followed in the transport and handling of hazardous materials. An appropriate explosive safety quantity distance (ESQD) would be established and maintained around facilities where missiles or other ordnance are stored or handled including Building 1900 in accordance with all applicable federal, state, local, and Air Force regulations.

Approximately, 20 people would be on site during canister placement and launch preparation for both BV launches for a period of 4 to 6 weeks prior to the launch (Boeing 1998). Immediately prior to the launch there would be 4 to 5 people at the launch site, and 12 people at the LCC. During the launch there would be no one at the launch site, and up to 20 at the LCC. During periods between BV-1 and BV-2 tests, 3 to 4 people would remain at Vandenberg AFB. The BV-2 would arrive approximately 1 month after the BV-1 launch and the BV-2 would be launched approximately 1 month after its arrival.

2.1.4 Flight Activities

BV-1 and BV-2 are scheduled for launch from LF-21 beginning in the year 2000. An ESQD would be established around all explosive operations. Established procedures to evacuate or protect personnel would be followed. The areas involved would include (U.S. Air Force 1997):

- The impact limit line (ILL), a boundary demarcating the protection line for all non–mission-essential personnel;
- The launch caution corridor, an area limited to essential personnel;
- The launch hazard area (LHA), an area about the launch point limited to essential personnel in hardened facilities; and
- The stage impact area.

Launch Facility-21 approved azimuth boundaries are 264–286 degrees (U.S. Air Force 1995). The azimuth is limited to ensure that potential missile failure would not result in debris outside the azimuthal boundary. Final launch azimuth boundaries would be established after all vehicle performance data and areas of endangerment are reviewed, and FTS requirements are established.

The Flight Safety Analyst from 30 SW/SE (Wing Safety Office) would define which airspace areas would be affected and the Chief of Range Operations would coordinate with the Federal Aviation Administration and the U.S. Coast Guard to address any issues of concern.

Blast residue generated by the BV tests would be contained within the silo and canister, removed, and containerized. Blast residue would be properly disposed of as hazardous waste, according to local, state, and federal regulations. Hazardous materials used on site would include cleaners, solvents, lubricants, motor fuel (MOGAS), and diesel.

2.1.4.1 Debris

Launch scenarios would be planned to ensure that any debris from a mishap would fall within the Western Range and the open ocean area off Vandenberg AFB. Test mishaps would be defined in terms of three scenarios: missile failure on the launch pad, termination of a flight shortly after liftoff, and termination of a flight after the missile has left the vicinity of the launch pad.

Termination of a flight on the launch pad would be characterized by either a detonation of the booster or a conflagration in which the propellant burns but does not explode. An ESQD surrounding the launch pad would be calculated based on the equivalent explosive force of all propellant and pyrotechnic materials contained in the flight vehicle. During all launch activities, provisions would be made in accordance with EWR 127-1, *Range Safety Requirements,* dated 31 March 1995, to maintain a stand-by emergency response team (consisting of fire fighting, safety, medical, and bioenvironmental engineering personnel) near the launch site to ensure immediate response and rapid control in the event of an accident. Termination of a flight shortly after liftoff would result in containment of all hazardous debris within the impact limit line (ILL). Non-essential mission personnel would be excluded from this area during launch operations.

Vandenberg AFB safety personnel would ensure that debris from termination of a flight would fall into areas cleared prior to the launch. Areas such as oil rigs and shipping lanes would be cleared in accordance with existing Vandenberg AFB Standard Operating Procedures (SOPs). Any debris falling on Vandenberg AFB lands would be handled in accordance with Vandenberg AFB emergency response plans.

2.1.5 Post-Flight Activities

Minor maintenance would occur after the BV-1 launch to ensure the Launch Site would be operational for the BV-2 test. After BV-1, post-flight procedures would include canister removal, silo inspection, removal of blast residue, and minor silo refurbishing including minor touch-up painting on the top side of the silo. Approximately 4 to 8 people would be at the launch site for inspection, canister removal, silo brush down, and refurbishing.

2.2 ALTERNATIVES TO THE PROPOSED ACTION

2.2.1 Alternatives Eliminated from Further Study

Along with LF-21, three additional alternatives were initially evaluated as potential launch sites for the BV tests: the Titan II Launch Complex (LC 395-B), LF-06, and LF-07. The impacts associated with refurbishment of LC 395-B would be greater than the other alternatives considered. Both LF-06 and LF-07 are located within proximity to and in an environment similar to that of LF-21. These two LFs were eliminated from further study because of scheduling issues and structural damage, respectively. Based on the environmental data available for LF-06, -07, and -21, the level of impacts associated with the BV tests from LF-21 would be either equal to or less than impacts from the use of LF-06 or LF-07.

2.2.1.1 Titan II Launch Complex 395-B

Launch Complex 395-B is located at the end of Watt Road off of 13th Street on North Vandenberg AFB. This site was a Titan II hard silo launch facility that has since been decommissioned and stripped of all real property. The current facility is in very poor condition and the area is overgrown with vegetation. The site contains open pits and underground buildings that are hidden by vegetation. The cost to refurbish LC 395-B would far exceed the cost of refurbishing other facilities, and therefore the site is not considered a reasonable alternative for the Proposed Action. In addition, the environmental impacts that would be caused by this alternative would be more extensive than with the Proposed Action. Since the silo has been stripped of real property and is overgrown with vegetation, significant construction would be necessary potentially causing impacts to air quality, biological resources, and solid waste.

2.2.1.2 Launch Facility-06

Launch Facility-06 (Building 1980) is located on Mira Road off Point Sal Road on north Vandenberg AFB. Launch Facility-06 is currently in use to launch MM II vehicles (U.S. Air Force 1995a). This facility was eliminated from further study due to scheduling issues.

2.2.1.3 Launch Facility-07

Launch Facility-07 (Building 1981) is located on Armar Road off Point Sal Road on north Vandenberg AFB. Launch Facility-07 is currently an inactive MM II launch facility. All usable parts have been removed and the site will be placed in caretaker status (U.S. Air Force 1995a). Launch Facility-07 would not be a satisfactory location for the BV tests due to structural damage of the silo, therefore it was eliminated from further study.

2.2.2 No-Action Alternative

The No-Action Alternative would be to not perform the BV testing. Current operations at Vandenberg AFB would continue and the BV tests would not be performed at any launch facility on base. Under the No-Action Alternative the Vandenberg AFB Flightline would not be used to receive the military aircraft carrying the BV test missiles and Building 1900 would not be used to store the missiles. There would be no modifications to LF-21 and no temporary aboveground fiber-optic cable would be laid between LF-21 and Building 1959. No changes would be made to Building 1978. No launch control equipment would be installed and the facility would be left in its existing condition.

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3.0 AFFECTED ENVIRONMENT

3.0 AFFECTED ENVIRONMENT

This chapter provides information on the environmental setting for the proposed BV Tests in relation to each of the resource areas addressed in this EA. Information for this chapter was gathered through available literature including EAs, EISs, and other environmental documentation. Appropriate personnel at Vandenberg AFB and at federal, state, and local regulatory agencies were contacted. Cited literature, telephone interviews, and referenced material are presented in subsequent chapters. Each of the following sections provides regional information related to the environment at Vandenberg AFB and site-specific information directly related to the project location and potentially sensitive environmental resources.

The BV test project area is located at LF-21, Buildings 1959 and 1978, and the open space between the facilities. The area is located along the north coast of Vandenberg AFB. The project area is accessed by Point Sal Road to Globe Road, which terminates at Buildings 1959 and 1978. Point Sal lies approximately 5 miles north of LF-21. Shuman Creek lies approximately 1 mile south of the project area. Building 1900, located east of the proposed project area, would be used for temporary storage of the BV missile.

The hills in the project area range in elevation from 300 to 1,300 feet above mean sea level (msl). Vegetation is grassland with scattered coastal sage scrub shrubs. Two drainages traverse the proposed fiber-optic cable route. The drainage west of Building 1959 is perennial and supports wetland indicator plants. The second drainage, further to the west and approximately 1/4 mile east of LF-21, is intermittent and does not possess wetland characteristics. No rare, threatened or endangered species occur in the project area. The project area is located in a region of archeological sensitivity: there are several recorded archeological sites south of the project area. The coast west of LF-21 comprises sandy beaches, cliffs, and rocky outcrops. These areas provide habitat for cliff dwelling birds as well as several threatened and endangered birds and marine mammals.

This section provides a brief description of the environmental resources being evaluated, the region of influence (ROI) for these resources, and a presentation of existing resource conditions within the ROI. This baseline environmental condition provides a context for understanding and assessing the significance of any potential impacts resulting from Proposed Action activities.

3.1 AIR QUALITY

The ambient air quality in a given location is described by the concentration of various pollutants in the atmosphere expressed in parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). The significance of impacts on ambient air quality, measured in terms of ground-level pollutant concentrations is determined by comparison with federal and state air quality standards. Standards represent allowable pollutant concentrations for a reasonable margin of safety for public health and welfare. The factors that affect ambient air quality are pollutant emission rates, emission parameters, topographic features, cumulative effects of other emission sources, chemical reactions, and meteorological conditions. The meteorological parameters most affecting pollutant dispersion are wind speed, wind direction, atmospheric stability, mixing height, temperature, and relative humidity.

3.1.1 Region of Influence

Vandenberg AFB is located within the South Central Coast Air Basin, which consists of San Luis Obispo, Santa Barbara, and Ventura counties. With respect to air quality, Santa Barbara County is divided into North County and South County. Vandenberg AFB is located within North County in the Santa Barbara Air Basin.

Air quality within the Santa Barbara Air Basin is described by the concentration of various pollutants in the atmosphere. The amount of pollutants in the atmosphere is affected by the interaction of three basic factors: the physical characteristics of the air basin, the prevailing meteorological conditions within the basin, and the amount of pollution emitted into the atmosphere. The interrelationship of these three factors determines the measurable concentration of pollutants in the atmosphere.

The portion of the Santa Barbara Air Basin that would be affected by emissions form the Proposed Action would include Vandenberg AFB and the surrounding portions of Santa Barbara County north of the Santa Ynez Mountains.

3.1.2 Regional Climate and Meteorology

The climate at Vandenberg AFB is Mediterranean, or dry summer subtropical. The weather is typically cool and wet from November through April and warm and dry from May through October. The Pacific Ocean, which borders Vandenberg AFB on the west and south, has a moderating effect on temperature fluctuations. The mean temperature ranges from 53 to 62 degrees Fahrenheit (°F). Vandenberg AFB monthly temperature data for the 10-year period from November 1987 to October 1997 are presented in Table 3-1.

Table 3-1
Temperature Means and Extremes (1987 to 1997)

Data (°F)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Highest	83	83	87	97	93	98	95	96	100	99	87	87	100
Mean Max.	61	61	61	62	62	64	65	67	68	68	65	62	64
Mean Temp.	53	54	54	55	56	58	60	61	62	61	57	54	57
Mean Min.	45	46	47	49	50	52	54	55	55	52	49	45	50
Lowest	25	30	31	34	37	40	43	44	41	35	32	26	25

Source: Vandenberg AFB 1999.

Vandenberg AFB lies within the zone of mid-latitude prevailing westerlies from approximately November to April. During the rest of the year the semi-permanent Eastern Pacific subtropical high-pressure cell creates a northwesterly to westerly flow direction. Locally, winds are usually light during the nighttime hours, reaching moderate speeds of approximately 12 miles per hour by the afternoon. Winds at Vandenberg AFB most often are northwesterly on north base and north to northeasterly on south base. The strongest winds are associated with rainy season storms.

Vandenberg AFB experiences early morning and afternoon temperature inversions about 96 and 87 percent of the time, respectively. The effect of the inversion is to act like a lid and restrict the vertical dispersion of pollutants and thus increase local pollutant concentrations. Pollutants can be "trapped" in the inversion layer until heat lifts the layer, or strong surface winds disperse the pollutants.

The principal meteorological conditions that control dispersion are winds and turbulence (or mixing ability) of the atmosphere. The wind direction determines which locations would be affected by a given source. The wind speed, along with the degree of turbulence, controls the volume of air available for pollutant dilution. Atmospheric stability is a measure of the mixing ability of the atmosphere and, therefore, its ability to disperse pollutants. Greater turbulence and mixing are possible as the atmosphere becomes less stable, and thus pollutant dispersion increases. In general, stable conditions occur most frequently during the nighttime and early morning hours.

3.1.3 Affected Environment

The Clean Air Act (CAA) required the U.S. EPA to establish ambient ceilings for certain criteria pollutants. Subsequently, the U.S. EPA promulgated regulations that set National Ambient Air Quality Standards (NAAQS). Two classes of standards were established: primary and secondary. Primary standards prescribe the maximum permissible concentration in the ambient air required to protect public health. Secondary standards specify levels of air quality required to protect public welfare, including materials, soils, vegetation, and wildlife, from any known or anticipated adverse effects. The criteria pollutants for which the NAAQS have been established include sulfur dioxide (SO_2), oxides of nitrogen (NO_x), carbon monoxide (CO), ozone (O_3), particulate matter 10 microns or less in diameter (PM_{10}), and lead (Pb).

California has also established its own air quality standards, known as the California Ambient Air Quality Standards (CAAQS). The CAAQS are generally more stringent than the NAAQS and have incorporated additional standards for sulfates (SO_4), hydrogen sulfide (H_2S), vinyl chloride, and visibility-reducing particulate matter. The NAAQS and CAAQS are presented in Table 3-2.

The U.S. EPA classifies air quality within each Air Quality Control Region (AQCR) with regard to its attainment of federal primary and secondary NAAQS. According to U.S. EPA guidelines, an area with air quality better than the NAAQS for a specific pollutant is designated attainment for that pollutant. Any area not meeting ambient air quality standards is classified nonattainment. When there is a lack of data for the U.S. EPA to define an area, the area is designated unclassified and treated as an attainment area until proven otherwise. Pollutant concentrations within the Santa Barbara Air Basin atmosphere are assessed relative to the federal and state ambient air quality standards.

Santa Barbara County Air Pollution Control District (SBCAPCD) is required to monitor air pollutant levels to ensure federal and state ambient air quality standards are met. If ambient air quality standards are not met, SBCAPCD must develop a plan to meet them. If air quality in Santa Barbara County meets or exceeds government standards, the area is classified as an "attainment" area. If regional air quality contains pollutant levels violating these standards, the area is classified as a "nonattainment" area.

Santa Barbara County is in attainment for all standards except the federal and state O_3 standards, and the state standard for PM_{10}. The following text addresses Santa Barbara County's air quality nonattainment for these two pollutants and the environmental and source factors contributing to this nonattainment status.

3.1.3.1 Ozone Nonattainment

Ozone is not produced directly by any pollutant source but instead is formed by a reaction between NO_x and ROC in the presence of sunlight. A reduction in O_3 is dependent on a reduction in NO_x and ROC emissions. Reduction of these pollutants has the added benefit of also reducing the concentration of PM_{10}.

Ozone is a photochemical process and very temperature dependent, therefore, its concentrations are generally highest during the summer months and coincide with atmospheric inversions. During their maximum, O_3 concentrations tend to be regionally distributed. This is due to the localized dispersion of the precursor emissions in the atmosphere. Hence, when an inversion occurs, the mixing of the precursor pollutants is within a much smaller volume of air. In 1996, Santa Barbara County reported four days during which the NAAQS standard was exceeded at various monitoring stations throughout the County; however, the more stringent CAAQS standard was exceeded on 23 days. In 1997, the federal standard was exceeded once and the California standard was exceeded 10 times.

Table 3-2
National and California Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[1]	National Standards[2]	
			Primary[3]	Secondary[4]
Ozone (O_3)	1-Hour	0.09 ppm (180 $\mu g/m^3$)	0.12 ppm (235 $\mu g/m^3$)	Same as Primary Standard
	8-Hour	-	0.08 ppm	-
Carbon monoxide (CO)	8-Hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	-
	1-Hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	-
Oxides of nitrogen (NO_x)	Annual	-	0.053 ppm (100 $\mu g/m^3$)	Same as Primary Standard
	1-Hour	0.25 ppm (470 $\mu g/m^3$)	-	-
Sulfur dioxide (SO_2)	Annual	-	0.03 ppm (80 $\mu g/m^3$)	-
	24-Hour	0.04 ppm (105 $\mu g/m^3$)	0.14 ppm (365 $\mu g/m^3$)	-
	3-Hour	-	-	0.5 ppm (1,300 $\mu g/m^3$)
	1-Hour	0.25 ppm (655 $\mu g/m^3$)	-	-
Suspended particulate matter at 2.5 microns ($PM_{2.5}$)	Annual	-	15 $\mu g/m^3$	-
	24-Hour	-	50 $\mu g/m^3$	-
Suspended particulate matter at 10 microns (PM_{10})	Annual	30 $\mu g/m^3$	50 $\mu g/m^3$	Same as Primary Standard
	24-Hour	50 $\mu g/m^3$	-	-
Sulfates	24-Hour	25 $\mu g/m^3$	-	-
Lead	30-Day	25 $\mu g/m^3$	-	-
	Quarterly	-	1.5 $\mu g/m^3$	Same as Primary Standard
Hydrogen sulfide	1-Hour	0.03 ppm (42 $\mu g/m^3$)	-	-
Vinyl chloride	24-Hour	0.010 ppm (26 $\mu g/m^3$)	-	-
Visibility reducing particles[5]	8-Hour (10 a.m. to 6 p.m.)	In sufficient amount to produce an extinction coefficient of 0.23 per km due to particles when the relative humidity is less than 70%.	-	-

Notes:
1 - California standards for O_3, CO, SO_2 (1-hour and 24-hour), NO_2, PM_{10}, and visibility reducing particles are not to be exceeded. The standards for sulfates, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded.

2 - National standards other than O_3 and those based on annual averages, are not to be exceeded more than once a year. The O_3 standard is attained when the expected number of days per calendar year with a maximum hourly average concentration above the standard is equal to or less than one.

3 - National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

4 - National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects from a pollutant.

5 - This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range when relative humidity is less than 70%.

Santa Barbara County's air quality has historically violated both NAAQS and CAAQS O_3 air quality standards. The severity of the O_3 violation for the County is presently classified as "serious," although improvement has been made over the last 2 years.

3.1.3.2 PM_{10} Nonattainment

Production of PM_{10} is either by direct emission of particulates from a source or by formation of aerosols as a result of chemical reactions in the atmosphere involving precursor pollutants. The sources of PM_{10} can also be categorized as natural (geogenic) or resulting from human activity (anthropogenic). The largest source of PM_{10} emissions in the county is entrained paved road dust. Other sources of PM_{10} emissions include dust from construction and demolition, agricultural activities, entrained road dust from unpaved roads, natural dust, and particulate matter released during combustion.

As previously mentioned, Santa Barbara County exceeds the CAAQS PM_{10} standard for 24-hour and annual standards. Exceedances of the annual standard predominantly occur at the downtown Santa Maria monitoring station. Exceedances of the 24-hour standard are more widespread across the county, although they do not occur as frequently.

3.1.3.3 Baseline Air Quality

A new Clean Air Plan (CAP) is under development by the SBCAPCD and was submitted to the U.S. EPA in January 1999. The CAP is a multi-faceted air quality planning document that takes into consideration the Rate of Progress (ROP) Plan, demonstration that the federal O_3 standards will be attained by November 1999, and a maintenance plan to show that the federal O_3 standard will continue to be attained through 2005. When assessing the short-term and cumulative impacts for any Vandenberg AFB construction project, the CAP 1996 forecasted emission inventory, emission activity forecasting, and maintenance plan were compared to the expected project emissions.

3.2 BIOLOGICAL RESOURCES

Biological resources consist of native or nonnative plants and animals and their associated habitats. They include plant populations and their relationship to habitat, and aquatic, wetland, and riparian ecosystems. Also included are species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS), species having equivalent status at the state level, and species under consideration for listing as threatened or endangered. Prior to conducting the site surveys, information was collected on special status species that would potentially be found at the project site.

Biological resources at Vandenberg AFB have been described in previous EAs prepared for projects in the surrounding area. These EAs include inventories of vegetation, reptiles and amphibians, birds, mammals, and special status species. The available literature and maps of natural resources present at Vandenberg AFB were reviewed (U.S. Air Force 1996a), including updates from 1997 that incorporated sensitive species and habitat information from the California Natural Diversity Data Base (CNDDB) and the California Native Plant Society (CNPS). Any recent changes to federal status were included.

3.2.1 Region of Influence

The ROI for biological resources includes the areas around LF-21 and Buildings 1959 and 1978, the area for aboveground fiber-optic cable installation between LF-21 and Building 1959, and the shoreline area west of LF-21.

3.2.2 Affected Environment

Species diversity is high at Vandenberg AFB. The base provides habitat for federal- and state-listed threatened, endangered, candidate, and special concern plant and animal species. Fourteen major vegetation and habitat types have been described and mapped on the base (U.S. Air Force 1996a). Among these vegetation types, coastal sage scrub and native and nonnative grasslands are the major communities found in the proposed project area. Marine mammals are also present along the Vandenberg AFB shoreline and located in the ROI.

The project area has been subject to past disturbance from past launches, grazing, and mowing. Twenty-nine launches have occurred in the past from LF-21. Cattle grazing has disturbed the area between LF-21 and Building 1959. Complete documentation of the biological resources in the project area is based on a field survey conducted in January 1999 and provided in a separate survey report in Appendix B. A description of the biological resources found in the project area and their extent on Vandenberg AFB is provided below.

3.2.2.1 Botanical Resources

The primary vegetation type in the project area is nonnative grassland with coastal sage scrub and native grassland. Veldt grass (*Erharta calycina)* is the dominant species covering the open area scattered with patches of native needlegrass (*Nassella* spp.) and an occasional coastal sage scrub shrub. Native shrubs include saw-toothed goldenbush (*Hazardia squarrosa var. squarrosa)*, California sagebrush (*Artemesia californica*), coyote brush (*Baccharis pilularis*), and encelia (*Encelia californica*). Other associated species include blue dicks (*Dichelostemma capitatum var. capitatum*), California poppy (*Eschscholzia californica*), and fiddleneck (*Amsinkia spectabilis var. spectabilis*). Patches of nonnative black mustard (*Brassica nigra*), curly dock *(Rumex crispus*), and poison hemlock (*Conium maculatum*) were also observed. A complete list of plants observed and expected in the project area is provided in Appendix B.

Coastal Sage Scrub

Coastal sage scrub, often referred to as soft chaparral, is a diverse vegetation type dominated by the shrub coastal sagebrush (*Artemisia californica*). Unlike chaparral, it contains species that are mesophyllous and shallow-rooted, and often are entirely or partially drought-deciduous and summer-dormant. Plant growth is concentrated in winter and spring, when soil moisture is readily available. The community occurs on dry slopes and soils near the coast to the interior foothills. In disturbed or more mesic areas, the dominant species may be coyote brush (*Baccharis pilularis*). Coastal sage scrub frequently occurs associated with annual grasslands, and at the margins of dunes, chaparral, and woodlands. On Vandenberg AFB, it is a variable community, and is found on North Base on the Casmalia Hills and Burton Mesa, and also in the southern part of the base near Cañada Honda Creek, Bear Creek, and Tranquillon Ridge.

Native Grassland

Small isolated patches of native perennial grasses occur on Vandenberg AFB. They are found primarily on terraces with fine clay soils, but they have not been studied or mapped in detail, and their extent is not well documented. Bunch-forming needlegrasses (*Nassella* spp.), approximately 0.75 meter tall, are among the most common components of native grassland, and therefore, the term native grassland often is synonymous with valley needlegrass grassland. These grasslands occur on fine-textured, deep soils, or sometimes on rocky soils, that are moist to wet in the winter but dry in the summer. Valley needlegrass grassland has been recorded near Point Sal at the northwestern boundaries of Vandenberg AFB, and occurs in scattered locations throughout the base.

Nonnative Grassland

This community is dominated by introduced annual and perennial grasses. Annual grasslands are found on varying slopes, aspects, and substrates, and species composition also is variable. Dominant species include bromes (*Bromus* spp.), wild oats (*Avena* spp.), and fescues (*Vulpia* spp.). At Vandenberg AFB, grazing is the primary use of this community. The perennial exotic species veldt grass (*Ehrharta calycina*) also often dominates grassland areas on the base, and has invaded and degraded many native scrub communities. Grasslands, both native and nonnative, occupy a large areal extent on the base.

3.2.2.2 Wildlife Resources

Bird species observed in the project area included house finch (*Carpodacus mexicanus*), white-crowned sparrow (*Zonotrichia leucophrys*), Brewer's blackbird (*Euphagus cyanocephalus*), bushtit (*Psaltriparus minimus*), Western meadowlark (*Sturnella neglecta*), loggerhead shrike (*Lanius ludovicianus*), black phoebe (*Sayornis nigricans*), and Say's phoebe (*Sayornis saya*). Grasshopper sparrow (*Ammodramus savannarum*), a relatively uncommon and regionally declining species, may also be located in this area. Observed raptors included red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), marsh hawk (*Circus cyaneus*) and turkey vulture (*Cathartes aura*). Owl pellets were observed at the base on utility poles along the northern boundary of the cable installation area (Figure 3-1). Near the drainage to the west of Building 1959, American water pipit (*Anthus rubescens*), common yellowthroat (*Geothlypis trichas*), and California towhee (*Pipilo crissalis*) were observed. Abandoned swallow nests were also observed on an antenna tower at Building 1959.

Other wildlife species observed in the project area were deer mouse (*Peromyscus maniculatus*), mule deer (*Odocoileus hemionus)*, California ground squirrel (*Spermophilus beecheyi*), and western fence lizard (*Sceloporus occidentalis*). Sign was noted for coyote (*Canis latrans*), broad-footed mole (*Scapanus latimanus)*, pocket gopher (*Thomomys bottae*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), and feral pig (*Sus scrofa*). A complete list of wildlife species observed and expected is provided in Appendix C.

3.2.3 Sensitive Plant Communities and Wildlife Habitats

Among the communities in the project area, native grassland is designated sensitive by the California Department of Fish and Game. The distribution of these communities and habitats in the project area are shown in Figure 3-1.

3.2.3.1 Native Grassland

The CDFG ranks valley needlegrass grassland as S3.1 (somewhat restricted, very threatened). In this report, native grassland includes this community, which therefore is considered sensitive. Valley needlegrass grassland is an important community because many native perennial bunchgrasses have disappeared from their former extensive ranges in the San Joaquin and Salinas valleys and in the Los Angeles Basin of California, and now are replaced by introduced annual grasses. Loss of native grasslands has been attributed to a variety of factors, including the planting of annual grasses, cultivation, drought, and introduction of cattle and overgrazing. Few areas of native perennial grasses still remain on Vandenberg AFB. Important sensitive species found in this habitat include Gaviota tarplant (*Hemizonia increscens* ssp. *villosa*, a federally proposed endangered species (FPE), CNPS List 1C) and dune larkspur (*Delphinium parryi* ssp. *blochmaniaei,* a federal species of concern (FSC), CNPS List 1C). Native grassland is found in the project area.

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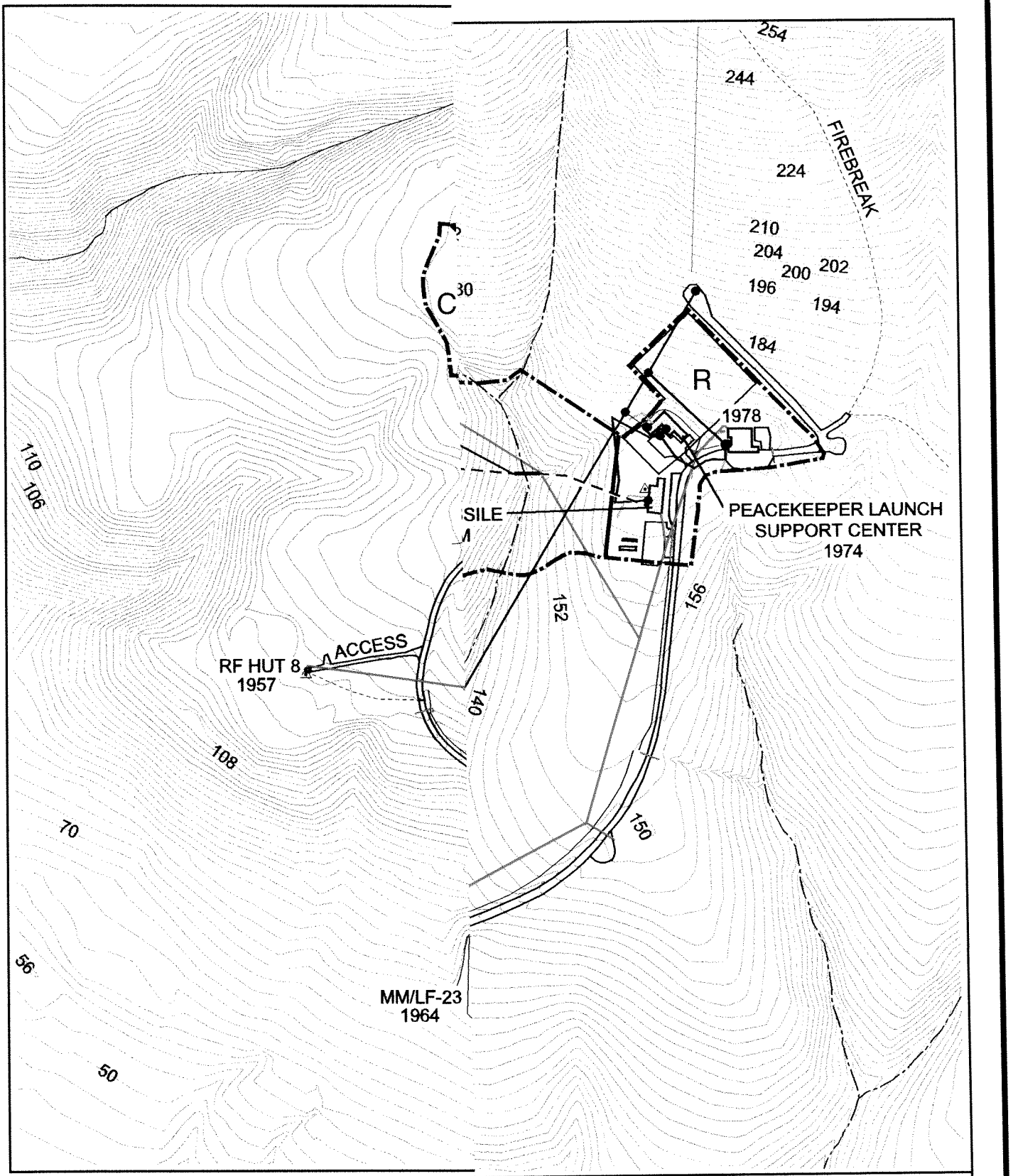


LEGEND

- Buildings
- Paved Road or Street
- Parking Lot or Driveway
- Surface Water Drainage
- Survey Area
- Vegetation
- Contour Line
- Storm Drain
- Channel
- Water Line
- Sewer Line
- Electrical Line
- Proposed Condu

ENGINEER SCDN

ing, January 1999

BIOLOGICAL RESOURCE AREAS

DATE	DRAWN BY	MADE FROM	GIS FILE #	FIGURE
2/12/99	Vance Hoyt Randall	VAFB	R:/ARMYEA/ 3-1	3-1

snowy plover (*Charadrius alexandrinus nivosus*) and California red-legged frog (*Rana aurora draytonii*) are federally threatened or endangered; all the other species described are species of concern. None of these species were observed during field surveys in the proposed project area.

Peregrine Falcon (*Falco peregrinus*). One nesting pair of this federally endangered species inhabits the rocky cliffs along the coast of South Vandenberg AFB. The closest other known nesting pairs are at the Channel Islands to the south and one nesting pair to the north near Arroyo Grande; historical sightings have been reported in the Point Sal area (U.S. Army 1997). High, rocky outcrops and high cliff ledges provide nesting habitat for this species. Approximately 60 acres of such suitable habitat is estimated to be on the base.

California Brown Pelican (*Pelecanus occidentalis californicus*). The federally endangered brown pelican roosts on the rocky cliffs and coastal bluffs of Vandenberg AFB; offshore kelp beds provide excellent feeding areas. Pelican numbers peak from June through January as they migrate north from Mexico. They have been sighted at numerous locations along the coast, including near Point Sal, near the mouths of Shuman Creek, San Antonio Creek, and the Santa Ynez River, as well as at Purisima Point, and the Boat House breakwater. Their nearest known nesting site is on Anacapa Island in the Santa Barbara Channel. This species is found at the coast and would be subject to launch noise.

Western Snowy Plover (*Charadrius alexandrinus nivosus*). This federally threatened species occurs on the sandy beaches west of LF-21. Critical habitat has been proposed for all suitable habitat on Vandenberg AFB (*Federal Register* 1995). Vandenberg AFB provides important nesting and wintering habitat along the sandy beach and dune area of north Vandenberg AFB. This small shorebird forages on invertebrates in the intertidal zone and sandy beach above the tide line and nests near tidal waters. Nesting and chick rearing occur between 1 March and 30 September. The Western snowy plover has experienced widespread loss of nesting habitat and reduced reproductive success at nesting locations due to urban encroachment and human activities. No suitable habitat for Western snowy plovers is located in the project area; however, the suitable habitat on the coast of Vandenberg AFB lies within the flight path of the launch vehicle.

California Least Tern (*Sterna antillarum browni*). The federally endangered California least tern is found on the coast of Vandenberg AFB near the mouths of creek and estuaries that provide habitat for foraging. These birds arrive on the California coast from Mexico and South America in April or May. Nesting takes place in small depressions in the sand. Threats to this species are similar to the Western snowy plover. No suitable habitat for California least terns is located in the project area, however, the mouth of Shuman Creek is included in the range of this species on Vandenberg AFB. This area potentially lies within the flight path of the launch vehicle.

Two-Striped Garter Snake (*Thamnophis hammondii*). This primarily aquatic species usually is found in summer near permanent fresh water, but has been recorded up to 180 meters from water bodies. The snakes mate in March, and young are born from August through November. The species is most common on the base in Cañada Honda Creek, and has been reported from San Antonio Creek and Jalama Lagoon (Christopher 1996). This species was not observed in the current field survey but a suitable habitat may be present in the perennial drainage west of Building 1959. However, this species has not been found north of San Antonio Creek.

Coast Horned Lizard (*Phrynosoma coronatum frontale*). This reptile species occurs in most habitats on Vandenberg AFB, and appears to prefer open areas for basking, and loose substrates for burrowing. Adults are most active in April and May, and juveniles emerge in July and August. Its distribution on base is not well documented. The biological survey was conducted when the coast horned lizard is not

3.2.4 Sensitive Plant Species

A list of rare plants that potentially could be present in the proposed project area is provided in Appendix B. Descriptions are given below for species that are federally listed and for species of concern that have been observed on the base and potentially could occur in the project vicinity. No sensitive plant species were found during field surveys in the proposed project area.

Dune Larkspur (*Delphinium parryi* ssp. *blochmaniae*). This perennial plant in the Ranunculaceae has a root less than 10 centimeters (cm) and no basal leaves in the flowering plant. Leaves and lower stems are curled-puberulent. Lower leaves have lobes less than 5 mm wide, and cauline leaves have 5 to 15 lobes. The blue-purple sepals generally are reflexed, with the lateral sepals 16 to 25 mm long, and the spur 11 to 16 mm. The lower petal blades are 7 to 10 mm and paler than the sepals. Dune larkspur (*Delphinium parryi* ssp. *blochmaniae*) has larger flowers than other subspecies in the taxon. It occurs associated with herbs and grasses in coastal chaparral, and in sand in dune vegetation, at elevations below 200 meters. It is found from San Luis Obispo to Ventura counties, and possibly is threatened by road maintenance and competition with weeds. On Vandenberg AFB, this plant has been recorded along Coast Road north of the boathouse, and in Lake Canyon, and northwest of the airstrip.

Gaviota Tarplant *(Hemizonia increscens ssp. villosa).* This species, in the family Asteraceae, is a gray-green, soft-hairy annual 0.3 to 0.9 meters tall, with stems generally branched near the base. Its inflorescence is rounded to flat-topped, and the bracts are glandular. The plant has 13 yellow ray flowers and 18 to 31 disk flowers. Two other subspecies, *H.i.* ssp. *i.* and *H.i.* ssp. *foliosa*, differ from it by their deep green, stiff-bristly foliage. Gaviota tarplant (*Hemizonia increscens* ssp. *villosa*) is found in coastal fields or grasslands and on bluffs at elevations below 50 meters, and is associated with grasslands that intergrade with coastal sage scrub. Its known distribution is highly localized to one extended population in western Santa Barbara County near Gaviota, on a narrow, uplifted marine terrace between the Santa Ynez Mountains and the ocean. Small, narrowly separated colonies are found in this population. This taxon recently was proposed for listing as federally endangered (*Federal Register* Vol. 63, No. 60, March 30, 1998). It has been subject to significant habitat degradation, fragmentation, and loss in the past, resulting in a restricted distribution and a general population decline. Its habitat and populations continue to be threatened from development. Gaviota tarplant (*Hemizonia increscens* ssp. *villosa*) has been reported on Vandenberg AFB south of and along Point Sal Road.

Black-Flowered Figwort (*Scrophularia atrata*). This perennial herb in the family *Scrophulariaceae* can grow up to 2 meters tall. Flowers are found in a long, glandular, puberulent inflorescence. It is characterized by an urn-shaped corolla that is colored blackish in the upper half and dark maroon in the lower half. The shape and color of the corolla distinguish it from the more common California figwort (*Scrophularia californica*) with which it intergrades, and whose corollas are more spheric and lighter in color, varying from yellow-green to dark maroon. Black-flowered figwort (*Scrophularia atrata*) is found from southern San Luis Obispo County to northern Santa Barbara County, and occurs in coastal scrub, chaparral, and woodlands in calcareous or diatomaceous soils, at elevations less than 500 meters. It is relatively common on the base in coastal scrub, riparian and oak woodlands, and in chaparral.

3.2.5 Sensitive Wildlife Species

A list of federally endangered and threatened animal species and other species of concern potentially occurring in the proposed project area is provided in Appendix B. Descriptions are given below for species that are federally listed and for species of concern that have been observed on the base and potentially could occur in the project vicinity. The peregrine falcon (*Falco peregrinus*), California brown pelican (*Pelecanus occidentalis californicus*), California least tern (*Sterna antillarum browni*), western

typically active; therefore, presence or absence of this species in the project area was not confirmed. This species was not observed in the current field survey, although sandy soils occur west of LF-21.

Pacific Townsend's (Western) Big-Eared Bat (*Plecotus townsendii townsendii*). This bat is a cave roosting species but will also utilize mines and buildings. Unlike many other bats, they are unable to crawl into crevices and usually roost in enclosed areas where they are vulnerable to disturbance. Great fidelity exists for a roost site and if undisturbed, the bats will use the same roost for many generations. This bat is colonial during the maternity season, typically from spring through the summer. The biological survey was conducted during the bat's winter hibernation, so presence or absence of the bats in the project area was not determined. Caves or man-made structures that would provide suitable roost sites for these bats are located on North Base and abandoned chromite mine caves are located in or near the project area but no bats were observed in the project area.

3.2.6 Waters of the United States and Wetlands

General observations for wetland indicators were noted in January 1999, but no protocol wetland surveys were carried out within the project area due to the lack of potential to disturb any wetlands. One potential wetland in the drainage west of Building 1959 area was observed. Wetland hydrology was apparent with inundated soils and flowing water. Other wetland hydrology indicators, including physical evidence of water lines impressed on the bank, sediment deposits, and algae within the drainage, were observed. Plant species observed within the drainage included algae with salt grass (*Distichlis spicata*), a facultative wetland species, along the banks. A second drainage further to the west, southeast of Building 1956, did not possess any wetland indicators.

3.2.7 Marine Mammals

Marine mammals that could be present on and around the Vandenberg AFB coastline include 6 species of pinnipeds (i.e., seals and sea lions) and 29 species of cetaceans (i.e., whales and dolphins). In addition, the southern sea otter (*Enhydra lutris nereis*), a member of the weasel family, occurs in the area.

Pinnipeds are the most commonly observed inhabitants of Vandenberg AFB coastal areas. The area of highest offshore pinniped concentrations varies seasonally and is centered around the northern Channel Islands, approximately 45 miles south of Vandenberg AFB. The Channel Islands support a diverse assemblage of pinnipeds that also move within the study area. California sea lions (*Zalophus californianus californianus*), Pacific harbor seals (*Phoca vitulina richardsi*), northern elephant seals (*Mirounga angustirostris*), and northern fur seals (*Callorhinus ursinus*) breed on the Channel Islands, with the largest rookeries on San Miguel Island (Stewart *et al.* in press). Until 1977, a small rookery of Steller sea lions (*Eumetopias jubatas*) existed on San Miguel Island (NMFS 1993). However, there has been no breeding there since 1981, and there have been no sightings since 1984 (Stewart *et al.* in press). Guadalupe fur seals (*Arctocephalus townsendi phillippii*) breed only on Isla de Guadelupe off Baja California, Mexico, but occasionally some are seen on the Channel Islands (NMFS 1993).

Pinnipeds are dependent on both land and water habitats and, although each species may differ in the amount of time spent on land, must periodically exit the water (i.e., haul out) for rest and breeding. Pinnipeds prefer undisturbed sections of the mainland coast and offshore islands or rocks as haulout and breeding grounds.

Although all of the species listed here can occur along the coastline of Vandenberg AFB, certain species are more prevalent in this area than others. Individual harbor seals, California sea lions, or elephant seals can be seen along almost any area of the Vandenberg AFB coastline. However, particular areas are used

more frequently by specific species than others. Figure 3-2 shows the general haulout sites on the Vandenberg AFB coastline. Haulout sites on North Base are concentrated near Purisima Point. This area is primarily used by Pacific harbor seals. In addition, the area surrounding Point Sal, just north of Vandenberg AFB, is a haulout area for California sea lions. Along the Vandenberg AFB coastline, the population between 1993 and 1995 ranged from a low of 124 individuals (recorded in September 1994) to a high of 680 individuals (recorded in May 1994) (U.S. Air Force 1996a).

3.2.7.1 Pinnipeds

The following describes pinniped occurrence on Vandenberg AFB.

Pacific Harbor Seal. Harbor seals are widely dispersed in the Atlantic, Arctic, and Pacific Ocean basins. The Pacific harbor seal ranges from the eastern Aleutian Islands to Baja California (NMFS 1994a). On the coastline of Vandenberg AFB, Pacific harbor seals regularly haul out in the vicinity of two major coastal features: Purisima Point and Rocky Point (NMFS 1995). Most harbor seal pupping occurs in March, followed by a 4- to 6-week weaning period (Reeves *et al.* 1992).

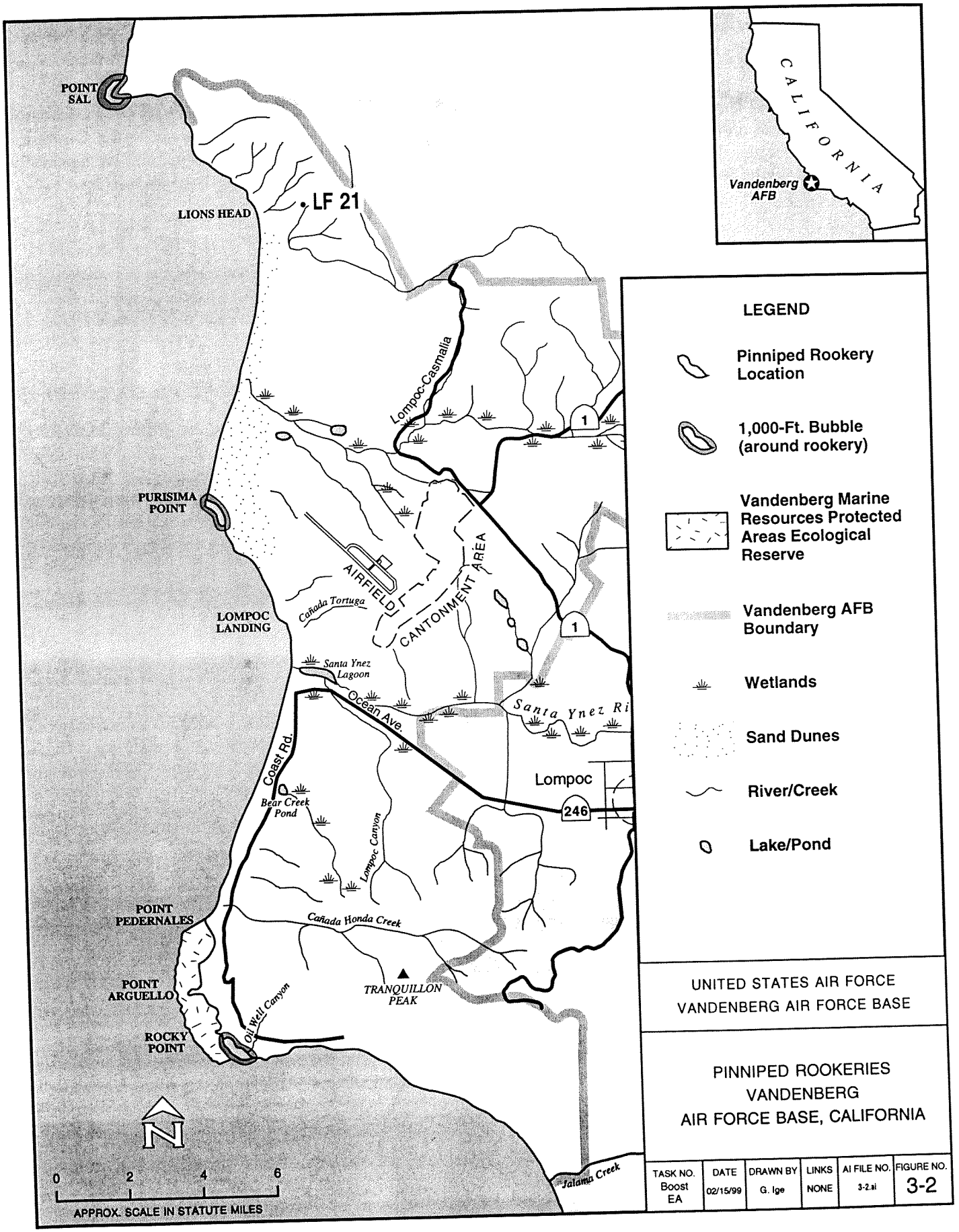
Harbor seals on Vandenberg AFB haul out at a total of 19 sites between Point Sal and Jalama Beach. Some of the sites are used regularly by large numbers of harbor seals, some are used only seasonally, while others are used sporadically by very small numbers of harbor seals (Roest 1995). The most consistently utilized sites are concentrated in Purisima Point, however Lion's Head is the closest site to LF-21. Counts of harbor seals on Vandenberg AFB performed at nine main hauling sites from 1993 to 1995 showed an average basewide count of 327 seals. The total number of seals hauled out can more than double during the annual molt in June, for an average of 611 seals (Roest 1995), a pattern that is characteristic of harbor seals throughout California (Allen *et al.* 1980; Stewart 1994).

Lion's Head has been documented as a haul out area for a small number of seals, but not for pupping (Roest 1995). The greatest number of seals occurs at Lion's Head between September and January. This pattern is similar to that of Spur Road in the Purissima Point area located approximately 6.0 miles south of the LF-21 project site (Roest 1995). No other significant harbor seal hauling sites were identified on North Base (Roest 1995).

California Sea Lion. Three subspecies of the California sea lion range from the Galapagos Islands to Baja California to British Columbia. The subspecies that comprises the United States stock ranges from southern Mexico to southwestern Canada (Barlow *et al.* 1995). The California population breeds along the Channel Islands and oceanic islands off Mexico (NMFS 1993). The species does not breed on Vandenberg AFB, but is present along the base coastline during the summer months. Point Sal, which lies just to the north of the base boundary is the area closest to the base that is most intensely utilized as a haulout by the California sea lion.

California sea lions use Lion Rock, a prominent feature 0.4-mile southeast of Point Sal. At least 100 California sea lions can be observed during any season at this site (Roest 1995). Lion Rock is considered a resting site for sea lions during their seasonal migrations to and from the breeding grounds (Chambers 1979). Lion Rock has never been considered a significant sea lion rookery (Roest 1995).

Each year, small groups of sea lions have been observed heading south along the Vandenberg AFB coastline in April and May. Starting in August, large groups of sea lions can be seen moving north, in groups varying in size from 25 to more than 300 (Roest 1995). This concurs with previously established migration patterns (Reeves *et al.* 1992; Roest 1995). Starving and exhausted subadult sea lions are fairly common on central California beaches during the months of July and August (Roest 1995).


POINT SAL
LIONS HEAD
LF 21
PURISIMA POINT
LOMPOC LANDING
POINT PEDERNALES
POINT ARGUELLO
ROCKY POINT
Lompoc-Casmalia
AIRFIELD
CANTONMENT AREA
Cañada Tortuga
Santa Ynez Lagoon
Ocean Ave.
Coast Rd.
Bear Creek Pond
Lompoc Canyon
Cañada Honda Creek
TRANQUILLON PEAK
Oil Well Canyon
Jalama Creek
Santa Ynez Ri
Lompoc
246
1
CALIFORNIA
Vandenberg AFB
LEGEND
Pinniped Rookery Location
1,000-Ft. Bubble (around rookery)
Vandenberg Marine Resources Protected Areas Ecological Reserve
Vandenberg AFB Boundary
Wetlands
Sand Dunes
River/Creek
Lake/Pond
N
0 2 4 6
APPROX. SCALE IN STATUTE MILES
UNITED STATES AIR FORCE
VANDENBERG AIR FORCE BASE
PINNIPED ROOKERIES
VANDENBERG
AIR FORCE BASE, CALIFORNIA
TASK NO. Boost EA
DATE 02/15/99
DRAWN BY G. Ige
LINKS NONE
AI FILE NO. 3-2.ai
FIGURE NO. 3-2

Other Pinnipeds

Records show that elephant seals have been observed periodically on Vandenberg AFB beaches since 1981. These animals are most likely associated with breeding and molting grounds in the Channel Islands. Northern fur seals do not haul out regularly on Vandenberg AFB. One fur seal carcass was retrieved by the Santa Barbara Museum of Natural History in 1989. A recent survey uncovered no reports of Guadalupe fur seals on Vandenberg AFB (Roest 1995).

Recent surveys of pinniped occurrence on or near Vandenberg AFB indicated no incidence of stranded or dead Steller sea lions on base, either through direct observation or literature search. No such occurrences are documented in the files of the Santa Barbara Museum of Natural History. Approximately 50 Steller sea lions were observed in October 1993 feeding about 1.5 miles offshore from Spur Road (Roest 1995).

3.2.7.2 Southern Sea Otter

The southern sea otter (*Enhydra lutris nereis*) is also present in waters off North Base. They occur primarily off the Spur Road harbor seal haulout site and in the area immediately south of Purisima Point, in kelp beds approximately 1 to 2 kilometers offshore. Numbers of animals counted during one study ranged from 0 to a maximum of 14 sea otters, with an average of 8 animals. The sea otter numbers peak in April through May and again in July through August (Roest 1995). Numbers of pups peaked during those periods also, which correlates with an established pattern for sea otter pupping seasons (Reidman 1990; Roest 1995). Numbers of pups usually ranged from 1 to 3 (Roest 1995). Sea otters have been observed all along the Vandenberg AFB shoreline, however, breeding and pupping have only been observed in the Purisima Point area.

3.2.7.3 Cetaceans

The 29 cetacean (whale and dolphin) species known to occur near the Vandenberg AFB coastal area include odontocetes (toothed whales and dolphins) and mysticetes (baleen whales). The gray whale (*Eschrichtius robustus*) is a baleen whale that occurs off the coast of Vandenberg AFB. The majority of the California gray whale stock migrates through the waters off Vandenberg AFB twice each year. They migrate from feeding grounds to breeding lagoons offshore Baja California from November through December, calve from January through March, then return northbound from April through May (NMFS 1993).

3.3 CULTURAL RESOURCES

Cultural resources that would be affected by the Proposed Action include prehistoric-archaeological, historic, architectural, and American Indian resources. Prehistoric-archeological resources are defined as physical remnants of human activity that predate the advent of written record in a particular culture and geographic region. They include archaeological sites, structures, artifacts, and other evidence of prehistoric human behavior.

Historic resources consist of physical properties or locations postdating the advent of written records in a particular culture and geographic region. They include archeological sites, structures, artifacts, documents, and other evidence of human behavior. Historic resources also include locations associated with events that have made a significant contribution to history, or that are associated with the lives of historically significant persons.

Architectural resources include prehistoric or historic structures, buildings, and other objects related to past human use. American Indian resources may be prehistoric sites and artifacts, historic areas of occupation and events, historic and contemporary sacred areas, materials used to produce implements and sacred objects, hunting and gathering areas, and other botanical, biological, and geological resources of importance to contemporary American Indian groups.

An archaeological site record and literature search was conducted at the Central Coast Information Center, UCSB, and at the 30th CES/CEVPC, Vandenberg AFB, California. The research included a review of literature, archaeological base maps, and cultural resource records. Previous archaeological studies within 1.0 mile of the Area of Potential Effect (APE) and archaeological sites within a 0.25-mi radius of the proposed cable route were identified during the record search. Maps consulted at 30 CES/CEVPC included Vandenberg AFB C-1 series (66 map survey coverage set), the Base Comprehensive Plan (BCP) GIS, and United States Geologic Survey (USGS) topographic maps.

3.3.1 Region of Influence

The placement of aboveground fiber-optic cable would be the only potentially ground-disturbing activity associated with the proposed project. Because an exact route for the aboveground cable has not yet been established, the APE for the proposed project was designated as the area within a 200-meter (650-foot) radius of the proposed east-west fiber-optic cable line connecting LF-21 and Building 1959. This is larger than the usual 60-meters (200-foot) radius APE to allow project planners leeway in finalizing the cable route. The APE also includes the four buildings that will be used for the proposed project: Buildings 1900, 1959, 1978, and 1962 (at LF-21).

3.3.2 Cultural Setting

Prehistory

The prehistory of Vandenberg AFB, which is considered part of the south central coast region of California, is uncommonly rich, spanning at least 9,000 years. The following summary draws largely from Erlandson (1993), which synthesizes current research in the area. The prehistory of the central coast region can be divided into four broad periods based on changes in economy and technology, social organization, and population size (King 1990; Rogers 1929; Wallace 1955; Warren 1968). While claims have been made for earlier occupation of the area, the earliest well documented remains are associated with Paleoindian peoples (12,000 to 9,000 years ago).

The presence of chipped stone tools and a lack of the milling stones common in later periods characterize Paleoindian sites in coastal California. A single fluted projectile point fragment found on a coastal plain east of Point Conception, and characteristics of site SBA-931, located at the mouth of the Santa Ynez River north of Point Conception, appear to indicate occupation of the Vandenberg AFB area 9,000 years ago (Erlandson *et al.* 1987; Glassow 1991).

Sites of the later periods are more common, probably reflecting both better preservation and increasing population size. In Millingstone sites (9,000 to 5,000 years ago), grinding stones for processing seeds and other plants are relatively more common than projectile points and other formal chipped stone tools. This period saw reliance more on gathered resources, such as seeds and shellfish, than on fishing and hunting.

Mortars and pestles (probably for processing acorns), projectile points, and diverse land- and sea-animal remains become prevalent in sites of 5,000 to 2,000 years ago. These hunting peoples intensified and

expanded upon their earlier subsistence strategies, and sites show increases through time in population size, density, and settlement diversity.

About 2,500 years ago, sites began gradually to reflect the "sophisticated and fully maritime culture" of the coastal Chumash or Canalino (2,500 to 200 years ago) (Erlandson 1993). The Chumash of this period were characterized by well-organized towns of up to 1,000, hierarchical social organization, occupational specialization, a money economy and extensive trade, the use of plank boats (south of Point Conception), and a proliferation of material goods of all kinds.

Ethnohistory

The Chumash living in the Vandenberg AFB area have been grouped with the Purisimeno Chumash (Greenwood 1978; King 1984), whose range along the coast was from Point Conception to the Santa Maria River area (Osland 1993). Their material culture, social organization, traditions and rituals, and cosmology are described in Blackburn (1975), Hudson *et al.* (1977), Hudson and Underhay (1978), and Johnson (1988).

The era of Chumash contact with Europeans began with initial Spanish exploration in 1542 (Landberg 1965). In 1769, the Portola expedition passed through the Vandenberg AFB area, traveling overland from San Diego to Monterey, and again on their return voyage in 1770. Juan Bautista de Anza and his 240 companions camped in the area on their 1775–6 trip from Mexico to San Francisco.

The Mission of San Luis Obispo was founded in 1772, the first Spanish establishment in Chumash Territory (King 1984), followed with Mission la Purisima Conception in 1788, in the present-day city of Lompoc, and Mission Santa Ynez in 1804. By 1803 La Purisima had removed most of the Chumash from the surrounding area, and by the time of secularization in 1834 missionization and disease had virtually eliminated the Chumash and their culture (Greenwood 1978).

History

The Vandenberg AFB area became Mission lands after the people of the surrounding villages and camps were recruited to La Purisima in 1803. The main economic activity of the mission was cattle ranching. After secularization, the Alta California government granted and sold former mission lands to Mexican citizens for ranching and farming. Rancho Jesus Maria, covering 42,184 acres including the San Antonio Terrace and Burton Mesa, was granted to members of the Olivera family in 1837. Rancho Jesus Maria included lands from just south of Shuman Canyon (northern boundary) to the Santa Ynez River (southern boundary), and from the Pacific Ocean to a few kilometers east of San Antonio Terrace and Burton Mesa on the east (U.S. Air Force 1988).

As the Rancho passed through additional owners, the area continued to be used primarily for cattle ranching. The federal government acquired it in 1941. The army training facility of Camp Cooke was built in 1941 on approximately 90,000 acres along the coast that included the Rancho Jesus Maria. Camp Cooke was deactivated at the end of World War II, then reactivated for training during the Korean War. It was put into caretaker status from 1953 to 1956. At that time, the northern part of the base became the Air Force's West Coast Missile Center. In 1958 the base had its first missile launch, the Thor, and was renamed Vandenberg AFB. The southern section of the current base was transferred to the Air Force from Army and Navy control in 1964 (U.S. Air Force 1992). Post-transfer use of both North and South Vandenberg AFB has related primarily to the construction and operation of missile launch and support facilities. Specific activities include management of the launch, testing, and evaluation of ballistic missile

and space systems for the DOD, and operation of the Western Range (U.S. Air Force 1992; Science Applications International Corporation [SAIC] 1995).

3.3.3 Affected Environment

An archaeological site record and literature search was conducted using the methods described in Section 3.3 above. No pedestrian survey was conducted. The results of the record search indicate that numerous surveys have been conducted within the project vicinity and the entire APE has been surveyed for cultural resources (Chambers, Inc. and SAIC 1997 [maps]). One previously recorded site, Building 1900, is located within the APE. Building 1900 is a Cold War era facility eligible for the National Register of Historic Places (NRHP). Six prehistoric sites are located outside of the APE but within a 0.25-mi radius of the line connecting LF-21 and Building 1959. These are CA-SBA-733, -734, -735, -942, -2324, and -3039. These sites are within the San Antonio Terrace National Register District (District) (U.S. Air Force 1988) and are therefore assumed to be eligible for inclusion on the NRHP.

3.3.3.1 Historic Resources

Four existing buildings on Vandenberg AFB will be utilized in support of the proposed project. These are Building 1900, which will be used as an area for preflight storage and inspections of the BV, and Buildings 1959, 1978, and 1962 (at LF-21), whose various uses are described in Section 2.1.2.1 of this EA. None of these structures is over 50 years old.

Ordinarily, properties less than 50 years old are not considered eligible for the NRHP unless they are of exceptional importance (36 CFR 60.4), having specific associations making them potentially NRHP-eligible. This class of buildings has been previously evaluated for NRHP eligibility as part of a DOD (CERL) Cold War era properties evaluation of Vandenberg AFB (CERL 1997).

During the site record check, the four buildings listed above were checked against the list of Vandenberg AFB properties that are NRHP-eligible as Cold War facilities. One building, Building 1900, is listed as eligible for the NRHP. None of the other buildings are considered NRHP-eligible.

Building 1900 (the Integration Refurbishment Facility) is part of a complex of seven buildings and features that also include Building 1819, the Missile Assembly Building; Building 1862, the Rail Garrison Launch Site; Building 1886, the Rail Transfer Facility; Building 1894, the Test Igloo; the Rail Spur; and the Test Loop. Taken together, these seven elements constitute the only remaining example of the original Peacekeeper weapons system siting plan. This siting plan was never actually used, and Peacekeeper missiles are now launched from refurbished Minuteman missile silos. Nevertheless, Building 1900 is one element of a complex that is eligible for the NRHP under both criteria (a) and (d); that is, for unique architectural engineering and also for function (Carucci 1999; CERL 1997).

3.3.3.2 Prehistoric Resources

CA-SBA-733, -734, and 735 are located immediately adjacent to one another. CA-SBA-733 is described as a moderate- to heavy-density surface scatter of shellfish and chipped stone with bone and ground stone also observed. Chert outcrops/quarries were noted on the southern and northern portions of the site. Artifacts described on the site form include one triangular bladed projectile point and a black steatite European-style pipe bowl. CA-SBA-734, also called the Hartman Site, was first recorded by L. Spanne in 1969. Bulldozing in the 1960s destroyed a major portion of the site. The site contained a cemetery from which about 50 burials were excavated by Spanne as well as numerous other independent collectors. Associated artifacts included numerous carved stone bowls, beads, bone tools, and other grave goods.

CA-SBA-735 was recorded but not described by Spanne in 1969 and again by Neff in 1982 with the comment that the site should be considered in context with CA-SBA-734 and CA-SBA-939, immediately to the south.

CA-SBA-942 is described as a light surface density shell and chipped stone scatter with serpentine and chert outcrops near the site, and a possible house pit location or living terrace at its east edge. CA-SBA-2324, also known as the Dam Creek Site, is a high-density lithic scatter with some historic debris, and is noted as containing ten biface fragments, three contracting stemmed projectile points, a hammerstone, retouched flakes, preforms, and cores. Cattle bones, deer bones, fire-altered rock, and shellfish remains were also present. Recent debris included glass, ceramics, metal, and wood, with a glass bottle dating to post-1930. CA-SBA-3039 (CG-283) is described as a lithic scatter containing one primary flake, four secondary flakes, and two pieces of shatter in a 59-square-meter area.

3.4 GEOLOGY, SOILS, AND SEISMIC

The geologic resources of an area comprise all soils and bedrock materials. Existing information on geologic, soil, and seismic activity was obtained from existing geologic maps, reports, and documents published for the area that includes the site location. A site reconnaissance visit was conducted to field-check the mapped data.

3.4.1 Region of Influence

The ROI for geologic concerns includes an area 1/2 mile from the LF-21 project area.

3.4.2 Regional Geologic Setting

Vandenberg AFB is situated within the Coast Ranges to the north of the Santa Ynez River and Transverse Ranges Geomorphic Provinces of California to the south. The project site is located in the northern portion of Vandenberg AFB in the Santa Maria Basin of the Coast Ranges Geomorphic Province. The Coast Ranges Geomorphic Province is characterized by northwest-southeast trending folds and faulting that are expressed as elongate valleys and ranges (Norris and Webb 1990). The Santa Maria Basin is a westward-widening lowland area between the Santa Ynez mountains of the Western Transverse Ranges, and the San Rafael and Santa Lucia mountains of the Coast Ranges that extend offshore to the west (Woodring and Bramlette 1950). Major physiographic features of the land within the Santa Maria Basin on Vandenberg AFB include the Casmalia and Purisima Hills; San Antonio Terrace; Barka Slough; Lompoc Valley; Burton Mesa; and beaches, rocky headlands, and points.

Vandenberg AFB is underlain by marine sedimentary rocks of Late Mesozoic age and Cenozoic age. The basal unit underlying the entire area is the Franciscan Assemblage of upper Jurassic age (Dibblee 1950). The Franciscan Assemblage consists of pervasively sheared marine sedimentary rock and metamorphosed igneous rock with numerous serpentine intrusions (Dibblee 1988). Table 3-3 lists the general stratigraphic section for the Santa Maria Basin. Extensive folding and faulting throughout the Vandenberg AFB area has created four structural regions: the Santa Ynez range, the Lompoc lowland, the Los Alamos syncline, and the San Rafael Mountain uplift (Reynolds Smith and Hills, Inc. [Reynolds] 1985).

Table 3-3
General Stratigraphic Section for the Santa Maria Basin

Geologic Age	Formation	Thickness in Feet	General Lithology
Recent	Dune Sand	0-100+	Sand, coarse to fine, well rounded, and in part actively drifting. Hardpan.
	Alluvium	0-230+	Gravel, sand, silt, and clay of fluvial origin except locally near the coast where marine clays and sands interfinger.
Pleistocene	Terrace Deposits	0-150	Gravel, sand, silt, and clay of fluvial origin.
	Orcutt Sand	0-300	Tan to rusty brown, poorly consolidated to locally indurated, aeolian and fluvial sand; locally pebbly at base.
	Paso Robles Formation	0-4,500	Weakly consolidated, light greenish-gray to reddish gravel, sand, clay, and silt occurring in discontinuous, lenticular bodies underlying the alluvium and Orcutt Sand throughout most of the area. Occasional thin beds of limestone; conglomerate composed largely of Monterey Shale pebbles.
Pleistocene	Careaga Sand	100-1,500	Grayish-yellow to tan-yellow, medium grained to fine-grained, marine sand with some silt, indurated in surface exposures, locally pebbly, locally fossiliferous, and contains few gravel and sand lenses.
	Foxen Mudstone	0-900	Light-gray massive claystone and siltstone.
	Sisquoc Formation	2,800-5,000	White to cream-white, punky, laminated diatomite and diatomaceous mudstone or shale and light gray, diatomaceous claystone and shale, with splintery to spheroidal fracture.
Miocene	Monterey Shale	1,000-4,500	White-weathering, thin-bedded, hard, platy, brittle porcelaneous, and siliceous shale with flinty black laminae.
	Point Sal Formation	150-1,500	Tan-weathering, soft, thin bedded silty shale, with thin strata of sandstone and a few beds of yellowish-brown hard dolomite.
	Lospe Formation	0-300	Reddish to greenish-gray claystone, sandstone, and pebbly sandstone; white, hard, rhyolitic tuff-breccia; green to reddish conglomerate and sandstone composed primarily of Franciscan rock detritus. Early Miocene to late Oligocene in age.
Cretaceous	Espada Formation or Knoxville Formation	4,000-5,800	Dark gray, hard but fractured micaceous shale with thin interbeds of hard, olive-gray arkosic sandstone, minor pebble conglomerate, and thin, dark-gray carbonate strata; locally pebbly at base.
Jurassic	Franciscan Assemblage	500-	Metamorphic and igneous rocks of serpentine, quartzite, glaucophane schist, and green banded and red banded chert associated with fine-grained green sandstone, locally pyritiferous and altered, and green to black shale. The Point Sal Ophiolite is a portion of the Franciscan Assemblage.

Sources: Dibblee 1950, 1989; Science Applications International Corporation (SAIC) 1990; Woodring and Bramlette 1950.

3.4.2.1 Local Geologic Setting

Geomorphology and Structure

The project site is situated in the northern portion of the northwest-southeast trending Casmalia Hills, which range in elevation from 300 to 1,300 feet above mean sea level (msl) with moderate to steep slopes. These hills are gently rounded slopes with drainage southwest to the Pacific Ocean and northeast to the Santa Maria Valley. The highest elevation in the Casmalia Hills (Mount Lospe, at approximately 1,650 feet) lies just within the northernmost base boundary. The Casmalia Hills formed along uplifted anticlinal structures between the Santa Maria Valley Syncline to the north and the Los Alamos Syncline to the south (Woodring and Bramlette 1950). The geology of the proposed project site area is shown in Figure 3-3. Erosion has produced rounded hills in areas underlain by unconsolidated sedimentary rocks, and sharp ridges and steep canyons in areas underlain by consolidated rocks (U.S. Air Force 1996a).

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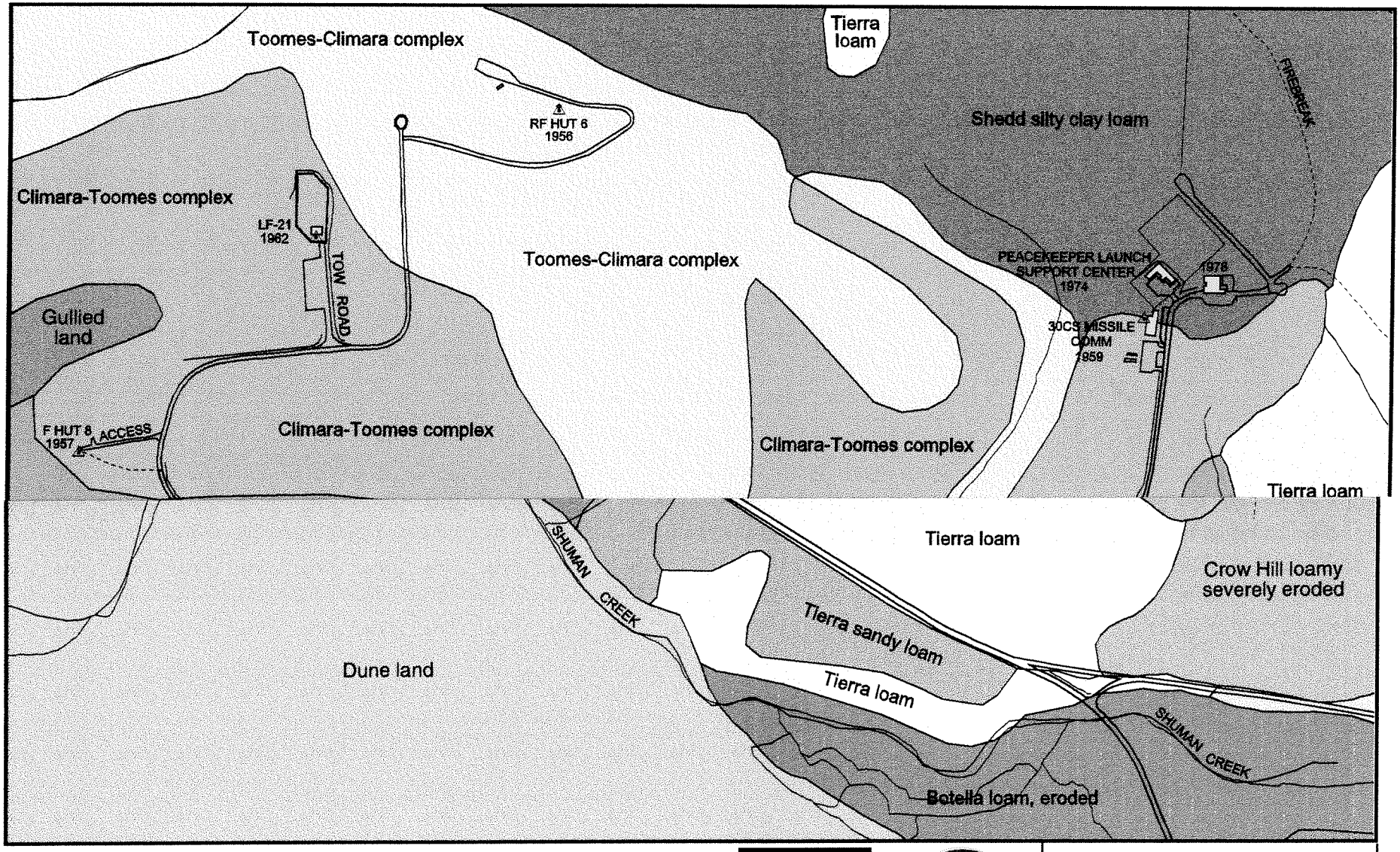

LEGEND

- Buildings
- Paved Road or Street
- Parking Lot or Driveway
- Surface Water Drainage
- Survey Area

300 0 300 600 FEET

Base map 30th CES CECB Base Planning, January 1999

SOILS MAP
VANDENBERG AFB

DATE	DRAWN BY	MADE FROM	GIS FILE #	FIGURE
2/12/99	Vance Hoyt Randall	VAFB	Q:/AMRYEA/ 3-3	3-3

Bedrock Formations

Bedrock underlying most of site consists of the Jurassic Point Sal Ophiolite of the Franciscan Assemblage (Figure 3-4). The Point Sal Ophiolite comprises a serpentinized peridotite and pyroxenite assemblage of slightly metamorphosed or altered mafic to ultramafic rocks (Dibblee 1989). In the eastern portion of the site, near Buildings 1974 and 1978, bedrock consists of the Tertiary Oligocene-Miocene Lospe Formation, reddish to greenish-gray claystone, sandstone, and pebbly sandstone; white, hard, rhyolitic tuff-breccia; green to reddish conglomerate; and sandstone composed primarily of Franciscan rock detritus (Dibblee 1989).

3.4.3 Surficial Deposits

Surficial deposits exposed in most of the project area consist of weathered ophiolitic bedrock that formed a mixture of silt, sand, gravel, and cobbles (Figures 3-3 and 3-4). In the eastern portion of the site, at Buildings 1959, 1974, and 1978, along Globe Road, surficial deposits consist of weakly-consolidated stream terrace and alluvial fan deposits of silt, sand, and gravel (Dibblee 1989).

3.4.3.1 Soils

Soils in the immediate vicinity of the project locations include the Climara-Toomes and Toomes-Climara complexes (soil mapping units) and (Figures 3-3 and 3-4). The Climara-Toomes complex is strongly sloping to steep soils that occur on slopes of 15 to 45 percent. This mapping unit is composed of about 70 percent Climara Clay and 30 percent Toomes clay loam. The Toomes-Climara complex is steep and very steep soils occurring on slopes of 30 to 75 percent. About 70 percent of the mapping unit are Toomes clay loam and about 30 percent are Climara clay. Both the Toomes and Climara soils have rapid to very rapid surface runoff and the erosion hazard is high to very high. The Toomes soil is somewhat excessively drained and is moderately permeable. The Climara soil is well drained, slowly permeable, and has moderate fertility (USDA 1972).

3.4.4 Geologic Hazards

3.4.4.1 Seismicity

The principal tectonic force in coastal central California is the horizontal or lateral shearing associated with the displacement of the Pacific and North American plates. In the region, generally northwest-trending faults and folds (Fugro West 1998; U.S. Air Force 1986) absorb this shearing. The proposed project site lies between two northwest-to-southeast trending faults (Dibblee 1989). The Lion's Head fault is about 800 feet south of LF-21 (Building 1962). A second, unnamed, northwest-southeast trending fault lies about 1,000 feet north of LF-21. The area between the two the faults, which includes the project area, has been uplifted relative to the areas north of the unnamed fault and south of the Lion's Head fault (Dibblee 1989). Dibblee has also mapped a third, unnamed northwest-southeast trending fault approximately 1,400 feet south of the project site (Dibblee 1989). The area north of this fault has been uplifted relative to the area south of the fault. Other faults in surrounding area include the Point Sal fault zone, located approximately 3.4 miles northwest of the project area; and an unnamed fault, located about 2 miles northeast of the project area (Dibblee 1989).

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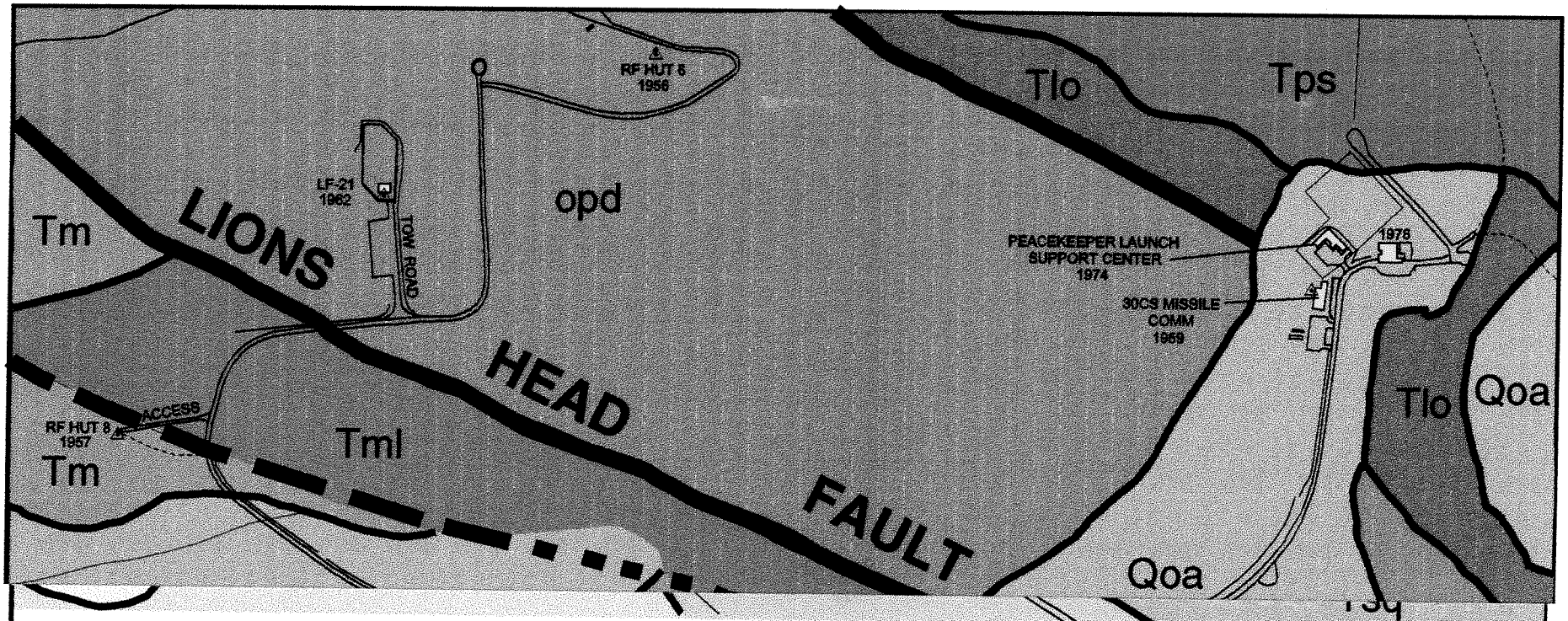

Qds	dune sand deposits	Tm	upper shale unit: white-weathering, thin bedded, hard, platy, porcelaneous siliceous shale
Qa	valley and floodplain alluvium deposits	Tml	lower shale unit: white-weathering, thin bedded, fissile to platy, simi-siliceous shale with thin, hard limestone strata
Qos	dune sand deposits, in places weakly consolidated	Tps	tan-weathering, soft, thin bedded silty shale, with thin strata of sandstone and a few beds of yellowish-brown, hard dolomite
Qoa	remnants of weakly consolidated stream terrace and alluvial fan deposits of silt, sand and gravel	Tlo	reddish to greenish-gray clay stone, sand stone and pebbly sand stone
Qo	Orcutt Sand: tan to rusty brown, poorly consolidated to locally indurated, wind-deposited sand; pebble gravel at base locally	opd	peridotite and pyroxenite, in part serpentinized
Tsq	light gray claystone and slightly diatomaceous or siliceous clay shale		

SOURCE: Dibblee Geological Foundation Map #DF-24 First Printing, May 1989

LEGEND

- Buildings
- Paved Road or Street
- Parking Lot or Driveway
- Surface Water Drainage
- Survey Area

300 0 300 600 FEET

Base map 30th CES CECB Base Planning, January 1999

30TH CIVIL ENGINEER SQDN

GEOLOGIC BEDROCK MAP VANDENBERG AFB

DATE	DRAWN BY	MADE FROM	GIS FILE #	FIGURE
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The Lion's Head fault is a reverse fault that offsets Quaternary terrace deposits near the coast (Woodward Clyde Consultants [Woodward-Clyde] 1985). Photographs of the Lion's Head Fault trace in the vicinity of the proposed project area are shown in Figure 3-5. Evidence of movement during Quaternary time (within the last 35,000 years) indicates that the fault is potentially active (Hart 1992). In the seismic study for Launch Complex 6 at Vandenberg AFB, Woodward-Clyde (1985) estimated the length of the Lion's Head fault based upon a length of fault that connects two segments of surface faulting, and that extends for about 25 miles southeast from the shoreline. Woodward-Clyde (1985) estimated the rupture length to be 50 per cent of the length of the fault. The estimated maximum earthquake for this length of rupture is magnitude 7 (Gutenberg and Richter scale). The slip rate of the Lions Head fault is not known. However, based upon information on the slip rates of faults in the region, a slip rate of 0.1 millimeter per year (mm/yr) was estimated for this fault (Woodward-Clyde 1985).

The Lion's Head Fault may be an extension of the Baseline/Los Alamos Fault system, which extends westward from Lake Cachuma to the San Antonio Valley, about 23 miles southeast from the project location (Sylvester and Darrow 1979). The Sylvester and Darrow study of the Lions' Head fault inferred that although the fault was mapped for a length of about 5 miles, this fault is along a zone that may represent a continuous zone of tectonic deformation at depth extending into the Los Alamos/Baseline Fault (Woodward-Clyde 1985). The Los Alamos/Baseline Fault is considered to be active due to evidence that it has offset Pleistocene-age (within the last 11,000 years) soil deposits (Woodward-Clyde 1980, 1985). The Los Alamos/Baseline Fault is a special studies zone (SSZ) as defined in the Alquist-Priolo Special Studies Zone Act of 1972 (Hart 1992). The purpose of this act is to prohibit the location of structures for human occupancy across traces of active faults and to mitigate thereby the hazard fault rupture. Under the Act, the State Geologist is required to delineate SSZs along known active faults in California. Cities and counties affected by the zones must regulate certain development projects within the zones by withholding development permits until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting.

Another known active fault, the Pacifico fault, crosses the southern tip of Vandenberg AFB at Jalama Beach County Park, approximately 17 miles southeast of the project location. Other known active faults in Santa Barbara County include the Big Pine, Graveyard-Turkey Trap, Mesa, More Ranch, Nacimiento, Hosgri, Santa Cruz Island, Santa Rosa Island, and Santa Ynez faults. Movement of any of these known active faults would potentially affect the project area, as would activity along the regional San Andreas Fault system (Fugro West 1998; U.S. Air Force 1987). Inactive faults including the offshore Lompoc fault, located in the Santa Barbara Channel, and local faults currently considered inactive, such as the Honda and Point Sal faults, also have the potential to affect the project area.

In Santa Barbara County, the recurrence interval for major earthquakes (magnitudes 5.2 to 7.0 on the Gutenberg and Richter scale) is wide ranging, from every 14 to 115 years (U.S. Air Force 1987). Between 1932 and 1975, an average of three earthquakes per year was reported for the Vandenberg AFB area. Magnitudes for the earthquakes reported during this period ranged from 2.5 to 4.9 on the Gutenberg and Richter scale. The California Division of Mines and Geology has estimated maximum earthquake intensities for the Vandenberg AFB area would range from VII to IX on the Modified Mercalli Intensity Scale. Earthquakes with intensities of VII to VIII cause moderate to considerable structural damage. Earthquakes with an intensity of IX destroy most masonry and frame structures. Although Vandenberg AFB is located in an area subject to earthquakes, the base has not reported damage to its facilities from earthquakes (U.S. Air Force 1987).

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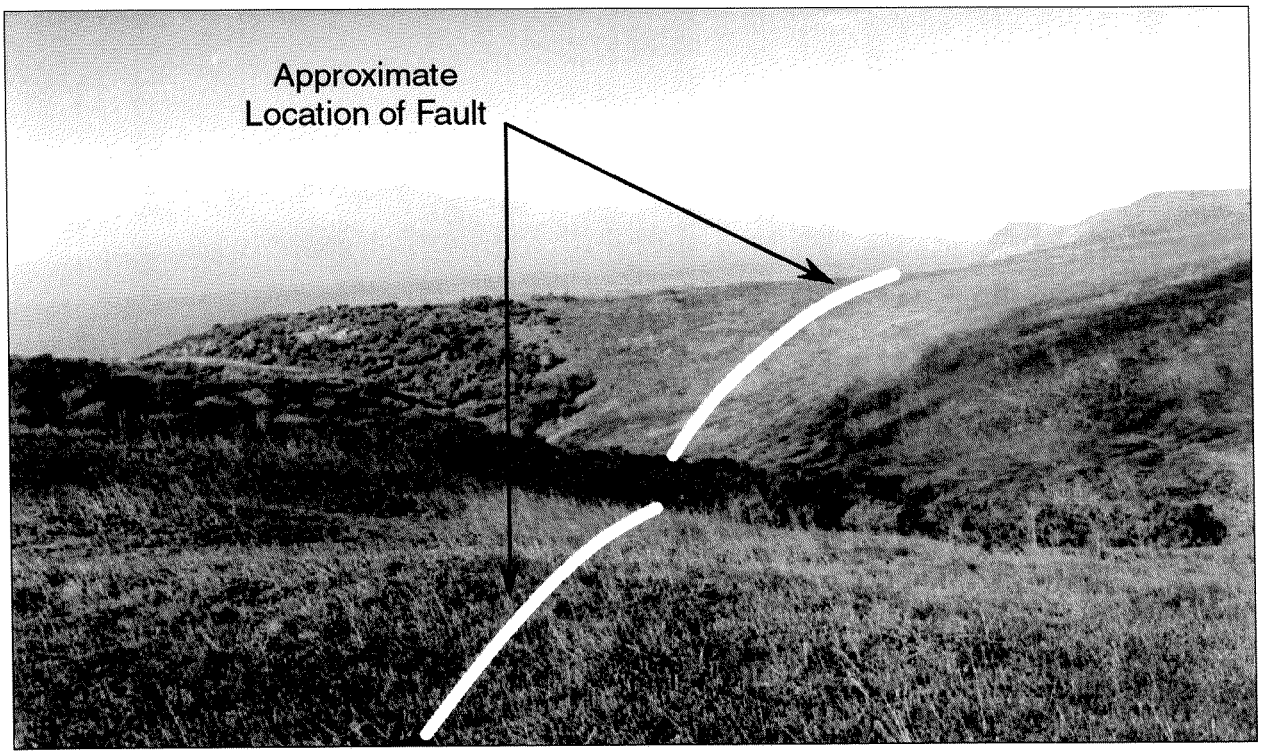


Figure 3-5a
View to the West Along the Lion's Head Fault Just South of the Site

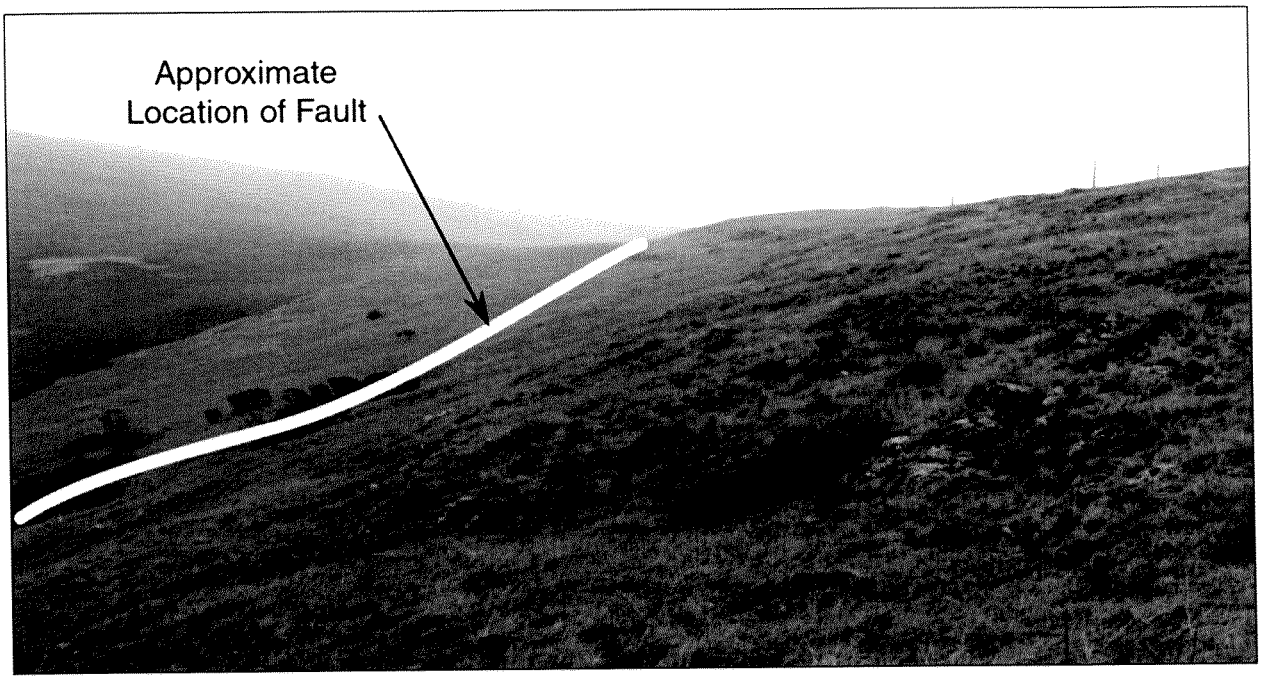


Figure 3-5b
View to the East Along the Unnamed Fault Just North of the Site

In addition to potential structural damage, landslides, tsunamis, surface fault ruptures, and liquefaction are related to regional earthquake activity. In the event of a tsunami reaching the coast of Vandenberg AFB, it is unlikely the proposed project location would be affected due to its elevation above sea level and distance from the ocean. The potential for surface fault rupture on Vandenberg AFB is generally considered to be low (U.S. Air Force 1987). However, because the Lion's Head Fault may be part of an active fault system, the potential for surface fault rupture in the project area is greater than for other areas on Vandenberg AFB.

At present, there are no known areas on Vandenberg AFB where liquefaction has occurred. There is the potential that liquefaction has occurred as a result of regional seismic activity; however, no areas of liquefaction have been mapped or identified to date. The areas most prone to liquefaction on Vandenberg AFB are those near San Antonio Creek and the Santa Ynez River (or wherever there is a sandy to silty soil), where the water table is within 50 feet of the surface. However, the potential for liquefaction occurring on Vandenberg AFB is still considered low (U.S. Air Force 1987). San Antonio Creek is approximately 5.3 miles south of the project area, and therefore, the closest area potentially prone to liquefaction.

3.4.4.2 Landslides

Geologic maps reviewed for this assessment do not indicate landslide deposits at the project site or on the adjacent slopes above and below the site. No overt visual evidence of landslides, such as hummocky topography or slide scarps, was observed at or surrounding the site during the site reconnaissance conducted in January 1999.

3.5 HAZARDOUS MATERIALS/WASTE MANAGEMENT

Hazardous materials and wastes are those substances defined as hazardous by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. 9601-9675), the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. 6901-6992), and Title 22 of the California Code of Regulations (CCR). In general, this includes substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, would present substantial danger to public health and welfare or to the environment when released into the environment. Executive Order 12088, under the authority of U.S. EPA, ensures that necessary actions are taken for the prevention, management, and abatement of environmental pollution from hazardous materials or hazardous waste caused by federal facility activities.

Existing information on hazardous materials and waste was obtained by reviewing Vandenberg AFB hazardous materials/waste management practices, spill contingency plan, and hazardous waste management plan, and Installation Restoration Program (IRP) documents, and through telephone interviews with 576th FLTS personnel at Vandenberg AFB.

3.5.1 Region of Influence

The ROI for hazardous materials and waste at Vandenberg AFB encompasses the entire base and areas within several miles of the base boundary.

3.5.2 Hazardous Materials Management

Vandenberg AFB uses numerous hazardous materials to accomplish mission and mission support activities. These materials range greatly in hazard potential. Vandenberg AFB uses highly

explosive/toxic fuels to launch rockets and their payloads into space. However, more common and less toxic materials like house paint are also classified as hazardous. Vandenberg AFB requires all organizations using hazardous materials on base to submit a hazardous materials spill contingency plan prior to starting work on base. Management of hazardous materials obtained from offbase suppliers is now coordinated through Vandenberg AFB's Hazmart Pharmacy. A base supply contractor runs the hazmart and inventories all hazardous materials, whether purchased by the Air Force or its contractors. Before releasing hazardous materials to the user, the base supply contractor prepares a printed copy of the Material Safety Data Sheet (MSDS) and provides it to the user. By providing handling and use information, Vandenberg AFB is attempting to control the potential misuse of hazardous materials.

3.5.3 Hazardous Waste Management

Management of hazardous waste at Vandenberg AFB must comply with RCRA Subtitle C (40 CFR Part 261) regulations administered by U.S. EPA, unless otherwise exempted through CERCLA actions. The California Environmental Protection Agency (CAL EPA) Department of Toxic Substances Control (DTSC) also regulates hazardous wastes at Vandenberg AFB under the California Health and Safety Code, Sections 25100 through 67188. These regulations require that wastes be handled, stored, transported, disposed of, or recycled according to defined procedures. A base Hazardous Waste Management Plan outlines the procedures to be followed for hazardous waste disposal. The CERCLA process requires its own waste management plan, very similar to the base plan except that storage and onsite disposal is not regulated by RCRA.

3.5.4 Asbestos Abatement Management

Buildings that were constructed before 1980 most likely contain asbestos in the building materials. Asbestos is the common name for a naturally occurring mineral group that forms small but strong fibers when crushed. When asbestos is friable, or easily crumbled, it can become airborne and cause a serious health threat. The U.S. EPA and Occupational Safety and Health Administration (OSHA) define asbestos-containing material as any material or product that contains greater than one percent asbestos. Cal OSHA defines asbestos-containing construction material as any manufactured construction material that contains more than 0.1 percent asbestos (CCR Title 8, Section 1529, Article 4).

The AFI 32-1052, Facilities Asbestos Management (March 22, 1994), establishes requirements and assigns responsibilities to incorporate facility asbestos management principles and practices into all Air Force asbestos programs (U.S. Air Force 1997b). This AFI ensures compliance with the U.S. EPA National Emission Standards for Hazardous Air Pollutants (NESHAPs), 40 CFR 61.140, and the OSHA Asbestos Construction Standards, 29 CFR 1926.58. The Vandenberg AFB Asbestos Management Plan (AMP), and the Asbestos Operating Plan are the base's primary documents for implementing the objectives of facility asbestos management and to ensure the base complies with applicable federal, state, and local regulations. Procedures for asbestos abatement are outlined in the AMP.

3.5.5 Lead-Based Paint Management

Many of the buildings constructed before 1978, and especially those constructed before 1960, contain quantities of lead-based paint. Identification and mitigation of lead-based paint hazards are done by medical screening, visual facility inspection, risk assessment, and a comprehensive facility survey. The Vandenberg AFB Lead-Based Paint Management Plan (LBPMP) provides specific direction in lead-based paint abatement (U.S. Air Force 1997c). The LBPMP contains strategies to identify, evaluate, and eliminate lead, pursuant to lead-based paint standards, protect facility occupants and workers from lead-based paint hazards, and properly dispose of lead-containing waste.

3.5.6 Polychlorinated Biphenyls

PCBs are occasionally found in transformers, building insulation, old fluorescent lighting fixtures, and electrical devices or appliances with PCB capacitors. PCBs are regulated under the Toxic Substance Control Act (TSCA), 40 CFR 761; CCR Title 22, Environmental Health; and the U.S. EPA "PCB Final Ruling" (*Federal Register* 29172, July 17, 1985). PCB management at Vandenberg AFB is regulated through the Vandenberg AFB *Polychlorinated Biphenyls Management Plan* (PBMP) SW Plan 32-7045D(U), 4 December 1998 (U.S. Air Force 1998a).

3.5.7 Installation Restoration Program

In response to CERCLA and the Superfund Amendments and Reauthorization Act (SARA) of 1986 requirements, DOD established the Defense Environmental Restoration Program (DERP). DERP funding is used to clean up past disposal and spill sites on federal military installations nationwide. Hazardous release investigations conducted under the Installation Restoration Program (IRP) are DERP-funded actions. These investigations have identified IRP sites, where proof exists of hazardous material releases to the environment, areas of concern (AOCs), where potential hazardous materials releases are suspected, and areas of interest (AOIs), areas with the potential for use/or presence of hazardous substances. Activities such as demolition, excavation, or grading at an IRP site, AOC or AOI could increase the potential for release of hazardous substances in these areas.

3.5.7.1 IRP Sites Near the Proposed Project Site

No IRP sites are in the vicinity of the proposed project site. However, Building 1900 is designated as AOC-26 (U.S. Air Force 1995b). The potential source identified at AOC-26 was discharge from an outfall drain pipe that collected runoff from the wash rack at Building 1903 and from the paved areas surrounding Building 1900 (U.S. Air Force 1998a). One surface water sample and one soil sample (from a depth of 5 feet below ground surface) from the discharge area were analyzed. The lead analytical result for the surface water sample was above the groundwater background threshold value and also above the Water Quality Objective of 30 micrograms per liter (µg/L) from the California Water Quality Control Board (RWQCB) Basin Plan (1989). Further investigation of AOC-26 was recommended (U.S. Air Force 1998).

Several AOIs were also found in the project area and nearby (U.S. Air Force 1995). Building 1962 (LF-21) was designated AOI-46 due to discharges of post-launch washdown water to grade prior to 1977; and the removal of an underground fuel storage tank (UST) in 1991. Building 1978, the proposed launch control center, was designated AOI-412 due to the removal of a UST in 1992. Building 1974, located about 100 feet west of Buildings 1978, was designated AOI-258 due to electrical equipment containing PCBs, a waste water sump, and the removal of a UST in 1991. Facility 1956, located about 1,000 feet northeast of LF-21, was designated AOI-145 due to transformers containing PCBs.

3.5.8 Blast Residue

Blast residue accumulates on the walls of the launch silo after the launch of a flight vehicle using solid rocket fuel. After each launch the walls of the silo are brushed down manually to remove the blast residue from the silo walls. The blast residue is then collected and placed in drums and transported to the CAP for characterization and disposal.

3.6 HEALTH AND SAFETY

Existing information on health and safety procedures at Vandenberg AFB was obtained from the Vandenberg AFB Flight Safety Handbook and from interviews with base personnel in 30 SW/SE. The existing conditions for basewide health and safety and ballistic launch safety are discussed in the following section.

3.6.1 Region of Influence

The ROI for health and safety includes the LHA and locations off base that may require evacuation and have the potential to be impacted by the Proposed Action.

3.6.2 Basewide Health and Safety

Health and safety requirements on Vandenberg AFB include industrial hygiene and ground safety. Industrial hygiene is the joint responsibility of Bioenvironmental Engineering, 30 SW Safety, and contractor safety departments. Responsibilities include monitoring of worker exposure to workplace chemicals and physical hazards, hearing and respiratory protection, medical monitoring of workers subject to chemical exposures, and oversight of all hazardous or potentially hazardous operations.

Ground safety includes protection from hazardous situations and hazardous materials. If personal protective equipment must be used, safety requires a general description of the commodity in use; the hazardous qualities of the material; and data showing compliance with allowable limits for airborne vapors for workplace, workplace emergencies, and public exposures.

3.6.3 Ballistic Launch Safety

The 30 Space Wing Commander, Chief of Safety, Flight Safety Analysis, and Mission Flight Control Officer are responsible for ensuring safety during ballistic and space launches at Vandenberg AFB. The Eastern and Western Range (EWR) 127-1 *Range Safety Requirement* establishes Eastern and Western Range safety policy and defines requirements and procedures for obtaining Wing Safety approval for ballistic and space vehicle operations on the two ranges. Operating Procedures for U.S. Military Aircraft and Firings Over the High Seas (DODD 4540.1) defines policy and operating procedures for operating U.S. military aircraft and for firings into airspace over the high seas (U.S. Air Force 1999).

Responsibility and final authority for the safe conduct of ballistic and space vehicle operations on the Western Range lies with the 30 Space Wing Commander per DOD Directive 3200.121. Establishing and managing the overall safety program at Vandenberg AFB is the responsibility of the Chief of Safety, 30 SW/SE (U.S. Air Force 1999).

A Flight Safety Analyst (FSA) from 30 SW/SEY develops long-term plans concerning the flight safety of ballistic and space boosters. Prior to a launch at Vandenberg AFB, the FSA reviews and analyzes data concerning the safety of ballistic vehicles, and other test vehicles, formulates flight safety criteria and develops the appropriate flight safety displays and parameters, performs analyses and hazard studies, establishes mission constraints to minimize risks, coordinates with range users to formulate mission planning, issues necessary safety approvals regarding all aspects of flight safety, coordinates and issues all notices regarding sheltering and evacuation for uprange and downrange areas on land and at sea, and supports launch and test countdown and other operations at the Western Range (U.S. Air Force 1999).

The Mission Flight Control Officer develops operations safety requirements for all launch vehicle programs, evaluates launch-associated hazards and support instrumentation status during countdown, provides a final range safety "clear-to-launch" when safety criteria are satisfied, and assumes full responsibility for evaluating in-flight vehicle performance, including flight termination, if required to protect people and property.

There are three public beaches on or near Vandenberg AFB, including Point Sal Beach State Park, Ocean Beach County Park, and Jalama Beach County Park (U.S. Air Force 1997a). During missile launches these beaches and the associated access roads are closed under agreement between the base and Santa Barbara County (Evacuation Agreement, No. SPCVAN/1/93/0006). The evacuation must not begin more than 48 hours before a launch and only two beaches may be closed at one time.

Evacuation procedures for offshore oil platforms are discussed in 30 SWI-91-105 (U.S. Air Force 1999). Range Offshore and Airspace Management (30 RANS/DOUN) is responsible for conveying evacuation and sheltering requirements to the Minerals Management Service (MMS) and other agencies if necessary. Evacuation is required for Vandenberg AFB operations when a platform lies within the LHA or when the risk for personnel remaining on the platform during a launch is greater than the risk for taking them off the platform.

3.7 INFRASTRUCTURE

Infrastructure addresses services provided by public or private entities and utility companies. For this analysis infrastructure refers to transportation (roads and highways) and utilities (electricity, water, and sewer). Storm drainage is addressed in the water resources section of this document.

3.7.1 Region of Influence

The ROI for the roadways analysis includes the key road network that provides access to Building 1900, LF-21, and Buildings 1959 and 1978. The ROI also includes the Vandenberg AFB Flightline, which would be used during the arrival of the BV test missile via military aircraft to Vandenberg AFB.

3.7.2 Transportation

Access to roads and to the airfield would be necessary as part of the Proposed Action. Information on roads and the Vandenberg AFB airfield was obtained through base maps and interviews with airfield personnel.

3.7.2.1 Regional Roadways

Vandenberg AFB is accessible by U.S. Highway 101, a divided, four-lane, major arterial, which connects the base with San Francisco on the north and Santa Barbara on the south. State Highways 1, 135, and 246 provide access to the base from U.S. 101.

Highway 246 leads to two base gates, the South Vandenberg AFB Gate and the Solvang Gate. Highway 246 is a two-lane rural highway connecting Lompoc to U.S. 101. Highway 246 becomes Ocean Avenue within the City of Lompoc and is one of the main transportation routes connecting Lompoc with Vandenberg AFB

3.7.2.2 Local Roadways

The majority of workers and other related support services providers for Vandenberg AFB reside within the unincorporated area of Santa Barbara County, and in the cities of Lompoc, Santa Maria, Guadalupe, Buellton, Solvang, and Santa Barbara. The key local roads providing access to Vandenberg AFB include Highways 1, 135, and 246, Santa Lucia Canyon Road, and Ocean Avenue (Figure 3-6).

Vandenberg AFB is accessible through the northeast at the Santa Maria Gate by Highway 1, which is a two-lane rural highway extending primarily along the coastal region of California. Highway 1 connects with Highway 135 south of Santa Maria.

Highway 246, Central Avenue, and Santa Lucia Canyon Road provide eastern access from Lompoc to Vandenberg AFB. Ocean Avenue is a major east-west four-lane divided road running through southern Lompoc. The other western gate is Lompoc Gate, north of the City of Lompoc, and is accessible through Santa Lucia Canyon Gate, a two-lane undivided highway. Santa Lucia Canyon Road runs north south, connecting Ocean Avenue with Lompoc Gate.

The major roads on Vandenberg AFB that provide access to the proposed project area are Ocean Avenue, 13th Street, and El Rancho and Point Sal Roads. Of these, 13th Street is a four-lane road that provides access to North Vandenberg AFB from the Solvang Gate. El Rancho Road, a two-lane arterial, becomes Point Sal Road. Point Sal Road is an access road to north base launch facilities East of Point Sal Road, Globe Road provides access to and terminates at Buildings 1959 and 1978. North of Globe Road, Solado Road provides access to LF-21.

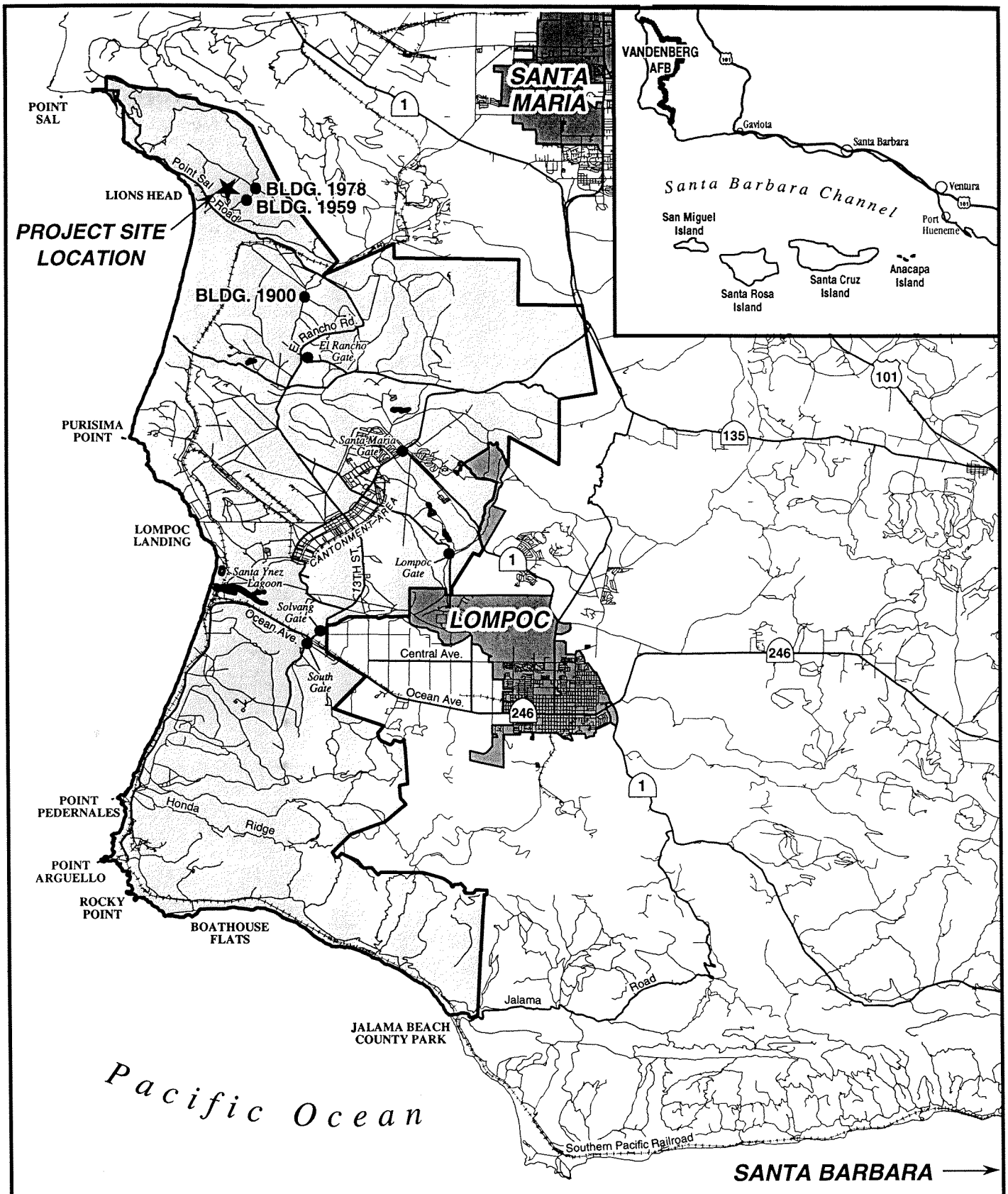
Major roads that provide access to Building 1900, the proposed storage building for the BV missile are Ocean Avenue, 13th Street, and El Rancho and El Rancho Oeste Roads. From the airport, major access roads to Building 1900 are 13th, and El Rancho and El Rancho Oeste Roads.

3.7.3 Vandenberg AFB Flightline

The flightline at Vandenberg AFB is located on north base with an airstrip of approximately 15,000 feet. The flightline handles all of the air traffic for the base; there were a total of 484 takeoffs and landings in 1996 and 618 in 1997. The Vandenberg AFB Flightline would be fully equipped to handle the C-5 and C-17 aircraft carriers that would transport the missiles, although they are not commonly used at Vandenberg AFB (Dietrich 1999).

3.7.4 Utilities

Electrical, communication, water, sewer, and storm drain lines are all located in the project vicinity (Figure 3-7). There are no natural gas lines in the project vicinity. Electricity is provided to Vandenberg AFB by Pacific Gas & Electric (PG&E). Communication lines are also present in the proposed project vicinity. Communication utilities at Vandenberg AFB include both copper cable and fiber-optic systems. Underground lines extend around LF-21, branching off into many directions and provide a communication link to other buildings within proximity. Communication to Buildings 1959 and 1978 is supported by a large number of lines.


VANDENBERG AFB
SANTA MARIA
POINT SAL
LIONS HEAD
Point Sal Road
BLDG. 1978
BLDG. 1959
PROJECT SITE LOCATION
BLDG. 1900
El Rancho Rd.
El Rancho Gate
PURISIMA POINT
Santa Maria Gate
LOMPOC LANDING
CANTONMENT AREA
13TH ST.
Lompoc Gate
Santa Ynez Lagoon
Solvang Gate
Ocean Ave.
LOMPOC
Central Ave.
South Gate
Ocean Ave.
POINT PEDERNALES
Honda Ridge
POINT ARGUELLO
ROCKY POINT
BOATHOUSE FLATS
Jalama Road
JALAMA BEACH COUNTY PARK
Pacific Ocean
Southern Pacific Railroad
SANTA BARBARA
Gaviota
Santa Barbara
Santa Barbara Channel
Ventura
Port Hueneme
San Miguel Island
Santa Rosa Island
Santa Cruz Island
Anacapa Island
1
101
135
246
LEGEND
VAFB Base Boundary
Town Boundaries
U.S. Highway
State Highway
0 2 4 6
SCALE IN STATUTE MILES
UNITED STATES AIR FORCE
VANDENBERG AIR FORCE BASE
REGIONAL AND LOCAL ROADWAYS MAP
TASK NO. Boost EA
DATE 3/4/99
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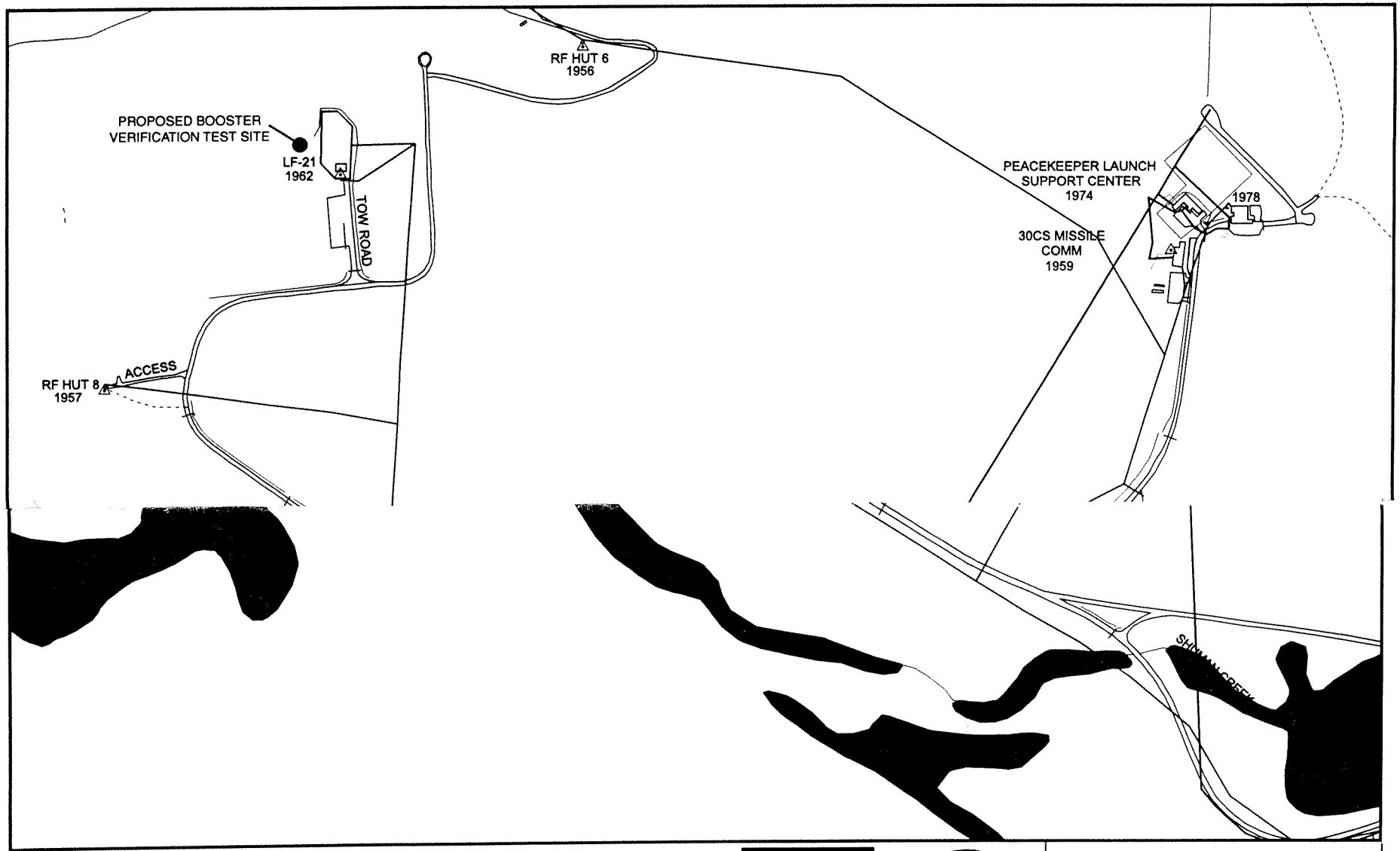

LEGEND

- Buildings
- Paved Road or Street
- Parking Lot or Driveway
- Surface Water Drainage
- Survey Area
- Vegetation
- Storm Drain
- Channel
- Water Line
- Sewer Line
- Electrical Line

N

300 0 300 600 FEET

Base map 30th CES CECB Base Planning, January 1999

INFRASTRUCTURE AND UTILITIES VANDENBERG AFB

DATE	DRAWN BY	MADE FROM	GIS FILE #	FIGURE
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3.8 LAND AND WATER USE/VISUAL RESOURCES

Existing information for land and water use was obtained by review of existing maps, documents, and telephone interviews with respective facility managers. A field survey was conducted to evaluate the current visual character of each facility and surrounding areas.

3.8.1 Region of Influence

The ROI for the land and water use environment include North Vandenberg AFB and the open ocean area in the Pacific Ocean off the coast of Vandenberg AFB.

3.8.2 Regional Land and Water Use on Vandenberg AFB

Vandenberg AFB is physically divided into two parts by State Highway 246. The area north of the highway is commonly referred to as North Base; to the south is South Base. The urbanized cantonment area, the main administrative area, includes various administrative, industrial, commercial, and residential land uses and is located on North Base. Space launch, missile test, telemetry, and tracking facilities are scattered on both North and South Base. A total of 65,220 acres of land on base (about 67 percent) is open space, primarily due to security or safety buffer zone requirements. This open space is outleased to the Lompoc Federal Penitentiary for cattle grazing when the topography and resources are suitable. [Improved land on base (i.e., land covered by buildings, helipads, runways, driveways, roads, recreation areas, and slabs) comprises a total of 33,180 acres, or about 33 percent. The majority of improved lands are within the cantonment area; the remainder of improved and semi-improved areas are scattered throughout the base (U.S. Air Force 1997a)].

Development and land use at Vandenberg AFB are managed by 30 CES/CECB, Base Planning. The primary document that outlines development goals and constraints is the Base Comprehensive Plan (BCP) or General Plan (U.S. Air Force 1989). An updated BCP is scheduled for completion in 1999.

Vandenberg AFB includes 35 miles of coastline along the Pacific Ocean. Therefore, activities on base can affect coastal and offshore areas, which are used for commerce (fishing, oil, and gas development) and recreation (sport fishing, surfing, and swimming).

3.8.3 Affected Environment

The proposed project area is located on North Base and includes LF-21 (Building 1962), Building 1959, 1978, and 1900. Launch Facility-21 is currently under caretaker status, meaning it is maintained for potential upgrade or modifications. Building 1959, located at the end of Globe Road, currently supports the Follow-on Operational Test & Evaluation (FOT&E) Program for MM, Peacekeeper, and the Rocket Systems Launch Program (RSLP). Housing a microwave and T-1 switching center, it is also equipped to provide analog and digital signal interfacing and processing for the Microwave Backbone System.

Currently, one half of Building 1978 is an older MM alert facility that is no longer in use. The remaining half is primarily office space that was once used for consoles and an administrative office to monitor launches (U.S. Air Force 1997b). Building 1900, near the intersection of North Road and El Rancho Oeste Road, is used for various activities associated with equipment maintenance, including pouring of American Rocket Corporation motor casing, Det 41 restoration of Peacekeeper elevator brakes, and refurbishing of Canister Assembly Launch Test Program launch tubes. Other potential uses for this facility are spacecraft processing and TMD booster and Transporter Erector Launcher processing.

Launch Facility-21 is located approximately 1 mile from the coast. Point Sal Beach is the nearest public beach located approximately 3.8 miles from LF-21. Platform Irene is located off the coast of South Vandenberg AFB, approximately 25 miles southeast down the coast from LF-21.

3.8.4 Coastal Resources

The California Coastal Commission (CCC) is responsible for issuing a Coastal Consistency Determination and is the only state agency in California with regulatory authority over federal projects that could potentially impact coastal resources. This authority, called federal consistency review, comes from the federal Coastal Zone Management Act (CZMA) of 1972. Under the CZMA, a federal agency is required to conduct activities in a manner consistent with the state's programs upon certification of a state's coastal management program. All federal activities affecting California coastal zone resources became subject to CCC approval when the National Oceanic and Atmospheric Administration (NOAA) approved the California Coastal Management Program (CCMP) in 1977. Policies on the coastal zone conservation and development decisions are as follows:

- Providing for maximum public access to and recreational use of the coast, consistent with private rights and environmental protection;
- Protecting marine and land resources including wetlands, rare and endangered habitat areas, environmentally sensitive areas, tidepools, and stream channels;
- Maintaining productive coastal agricultural lands;
- Directing new housing and other development to urbanized areas with adequate services rather than allowing scattered, sprawling, wasteful patterns of subdivision;
- Protecting the scenic beauty of the coastal landscape; and
- Locating any needed coastal energy and industrial facilities where they will have the least adverse impact.

3.8.5 Visual Setting

3.8.5.1 Regional Visual Setting

Visual resources at Vandenberg AFB include natural and man-made features. The environment at Vandenberg AFB incorporates a number of diverse visual elements. The 35-mile stretch of coastline includes rocky headlands, coastal bluffs, and sandy beaches. A large dune complex, rolling hills, erosional valleys, and a broad sweeping mesa are found on North Base while the Transverse Range is a major mountain feature on South Base. Man-made elements are scattered throughout the base. Space and missile launch complexes are located near the coast, and radar towers, telemetry stations, and supporting utilities are distributed widely.

Base boundaries begin with the Casmalia Hills to the north of the Santa Ynez Mountains and Sudden Flats to the south. Between these two ranges are the broad and generally flat areas of San Antonio Terrace, Burton Mesa, and Lompoc Terrace on which the majority of Vandenberg AFB missions occur.

3.8.5.2 Site Visual Setting

The proposed project site is located on North Base and is mostly surrounded by open space, with the only development consisting of underground launch facilities, communication buildings, and access roads. The dominant vegetation is open grassland and chaparral, and the topography in the area is characterized by gentle rolling hills. Views from the area include the Pacific Ocean, shoreline, and dune complexes to the west of LF-21 and Shuman Creek to the southeast of LF-21.

LF-21 contains telephone lines and electricity within the building; there are no water or sewer lines (Nentwig 1999). This facility has only one offsite power source that feeds through an existing transfer switch. Utilities within Building 1959 include water, electricity, telephone lines, sewage lines, and fiber-optic lines (Tilley 1999). Building 1978 contains water lines, electrical lines, sewer lines, and storm water drains. Chemical toilets would be located at LF-21 and at Building 1978 for use by temporary personnel. Building 1900 also contains water, electrical, and sewer lines and storm water drains.

3.9 NOISE

Noise is most often defined as unwanted sound that is heard by people or wildlife and interferes with normal activities or otherwise diminishes the quality of the environment. Sources of noise may be transient (e.g., the passing of a train or aircraft through a particular area) or continuous (e.g., the hum of distant traffic or the operation of air conditioning equipment). Sources of noise also may have a broad range of sounds and be generally nondescript (e.g., traffic) or have a specific, readily definable sound (e.g., an auto or train horn). They may be steady (e.g., a fan, motor, or generator) or impulsive (e.g., a pneumatic impact wrench or pile driver). These characteristics all bear on the perception of the acoustic environment (URS Corp. 1986).

The following section describes how noise impacts are evaluated, describes the ROI, and provides information on ambient noise levels in environments impacted by noise from operations at Vandenberg AFB. The existing noise environment at Vandenberg AFB will be described in Section 3.10.3. This will include a description of the potential noise receptors. Types of sound produced by the launch vehicle will also be described.

This section will define noise parameters and how they are described in common practice. The approach to evaluating potential noise impacts from the Proposed Action will then be described. Noise contours have not yet been developed for the launch vehicles to be tested under Proposed Action, since BV tests of this system have not yet been performed. Noise contours of similar missiles will be provided to assist in the evaluation of potential noise impacts.

Characteristics of sound include amplitude, frequency, and duration. Sound waves, traveling outward from a source, exert a sound pressure, which is commonly assigned a sound pressure level (SPL). Sound pressure level is measured in decibels (dB). Due to the extremely large range of measurable sound pressures, the dB is expressed in a logarithmic scale.

The human ear is not equally sensitive to all frequencies throughout the spectrum. Sound levels adjusted for frequency-dependent amplitude are called "weighted" sound levels (American National Standards Institute [ANSI] 1983). Weighted measurements emphasizing frequencies within human sensitivity are called A-weighted decibels (dBA). When high-intensity impulsive sound is evaluated to determine its effects on human populations, C-weighted sound levels are used. This applies weighting to low-frequency effects.

Because environmental noise levels typically fluctuate over time, different types of noise descriptors are used to account for their variability. The most commonly used descriptor in environmental reports is LDN (day-night noise levels: a 24-hour average noise assessment with "penalty" decibels added to the quieter nighttime levels). The LDN descriptor is typically used in assessment of vehicular traffic noise and aircraft noise.

The State of California has implemented an additional measurement, the Community Noise Equivalent level (CNEL). CNEL is similar to the LDN, but the adjustment factors are slightly different for different time periods. In most instances, however, CNEL is approximately equal to LDN, and the two descriptors can be considered equivalent and interchangeable within this report. Both measurements are weighted averages with penalty decibels added for noises occurring during the quieter evening and nighttime hours.

The major shortcoming of both the LDN and the CNEL is that the 24-hour averaging tends to obscure high-noise, short-term events, such as missile launches. In these cases, the maximum sound level (Lmax) is required. Since it is used predominantly to gauge high noises of short duration, Lmax measures the greatest level occurring during a single noise event.

3.9.1 Region of Influence

Under CFR Title 29, part 1910.95, employers are required to monitor employees whose exposure to noise could equal or exceed an 8-hour time-weighted average of 85 dBA. Therefore, the ROI for noise analysis at Vandenberg AFB is defined as the area within the Lmax 85 dB contours generated by the proposed project activities.

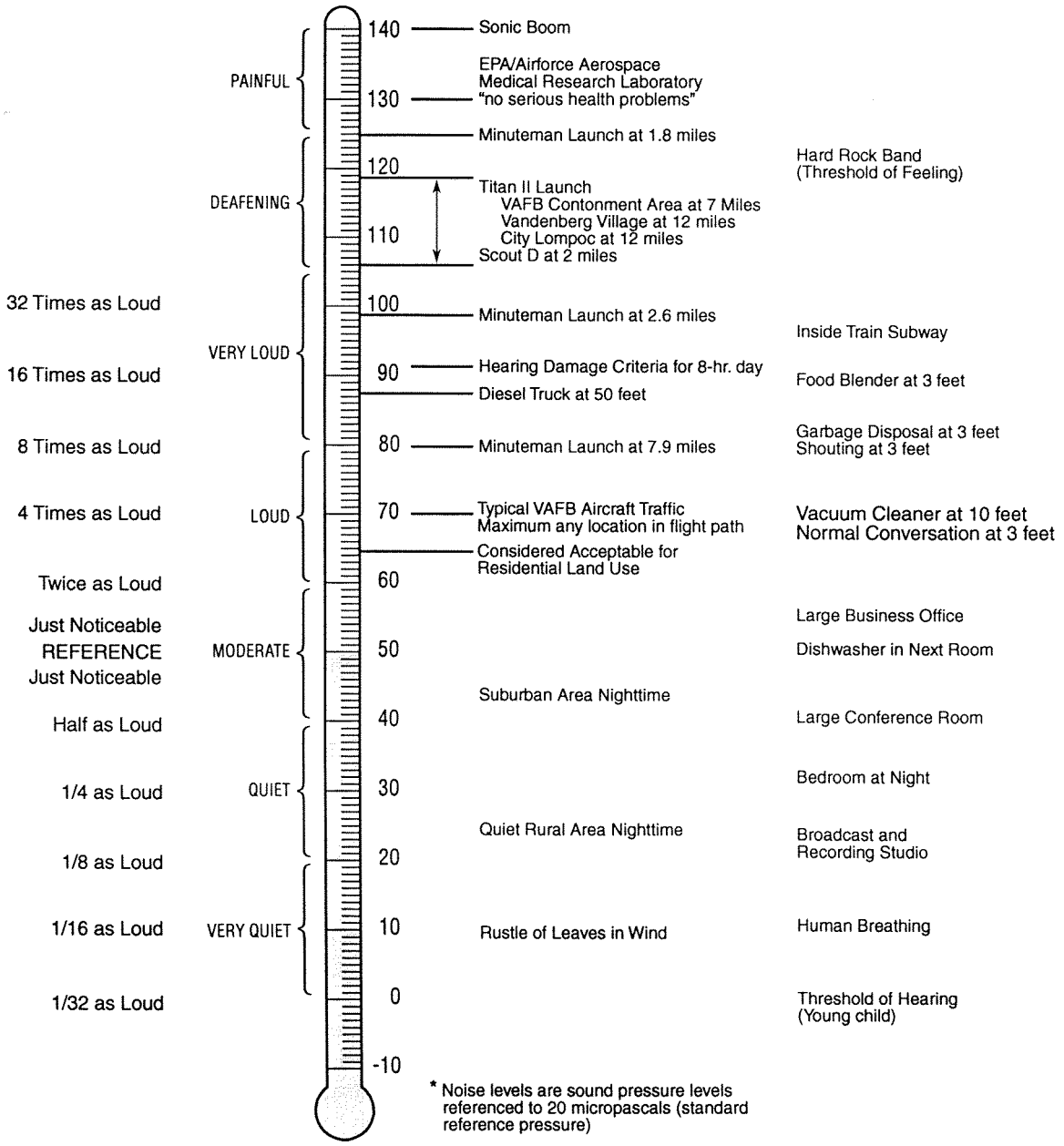
3.9.2 Affected Environment

The area immediately surrounding Vandenberg AFB is mainly undeveloped and rural, with some unincorporated residential areas within the Lompoc and Santa Maria valleys. The two urban areas in the region are the cities of Lompoc and Santa Maria, which support a few localized industrial areas. Sound levels measured for most of the region are normally low, with higher levels appearing in industrial areas and along transportation corridors. Rural areas in the Lompoc and Santa Maria valleys would be expected to have low overall CNEL levels, normally about 40 to 45 dBA. Infrequent aircraft flyovers and rocket launches from Vandenberg AFB would be expected to increase noise levels for short periods of time (City of Lompoc 1996).

Existing noise levels on Vandenberg AFB are generally quite low; higher noise levels occur near industrial facilities and transportation routes. The LDN at Vandenberg is usually at or below 65 dBA, which is the generally accepted limit for outdoor noise levels in residential areas (Departments of the Air Force, Army, and Navy 1978; U.S. Department of Housing and Urban Development 1978). As a "rule of thumb," modern residential building shells will generally yield interior noise levels that are approximately 20 dBA lower than exterior levels (windows and doors closed).

Typical noise sources on base include automobiles, trucks, and trains. Aircraft and helicopter overflights and rocket launches are less frequent noise sources. The Vandenberg AFB Flightline follows state regulations concerning noise and maintains a CNEL equivalent to 65dBA or lower for offbase areas.

Other less frequent, but more intense, sources of noise in the region are rocket launches from Vandenberg AFB. Currently, Minuteman missiles and Delta II rockets are launched from North Base, and Titan and Atlas rockets are launched from South Base. Typical noise levels for familiar sources and Vandenberg AFB launch vehicles are shown in Figure 3-8.



(SOURCE: Parsons Engineering Science, U.S. Air Force 1975, 1978, no date [n.d.])

UNITED STATES AIR FORCE
VANDENBERG AIR FORCE BASE

ENVIRONMENTAL ASSESSMENT
PROPOSED BASEWIDE
DEMOLITION PROGRAM
RELATIVE NOISE LEVELS

DATE	DRAWN	LINKS	AI FILE NO.	FIGURE NO.
3/4/99	G.Ige	NONE	ACAD:\ArmyEA\ 3-8Noise.ai	3-8

3.9.3 General Principles of Launch Noise Production

Three distinct noise events are associated with the launch and ascent of a launch vehicle: on-pad noise, in-flight and sonic boom. It is common to depict noise over an area by means of noise contours. Noise contours for Minuteman missiles launched from a north base coastal launch are provided in Figure 3-9.

Sound production upon rocket or missile launch is highly dependent on the type of first-stage booster and the fuel used to propel the vehicle. The vehicles can be classed according to size based on these aspects, with a great similarity in launch noise production within the size class.

On-Pad Noise. On-pad noise occurs when engines are firing while the vehicle is on the pad. The vehicle exhaust is usually turned horizontally by deflectors or an exhaust tunnel. Noise is highly directional, with maximum levels in lobes that are about 45 degrees from the main direction of the deflected exhaust. Noise levels at the vehicle and within the launch complex are high. Because the sound source is at or near ground level, propagation from the vehicle to offsite locations grazes along the ground and tends to attenuate significantly over distance. On-pad noise levels are typically much lower than in-flight noise levels because sound propagates in close proximity to the ground and undergoes significant attenuation when the vehicle is on or near the pad.

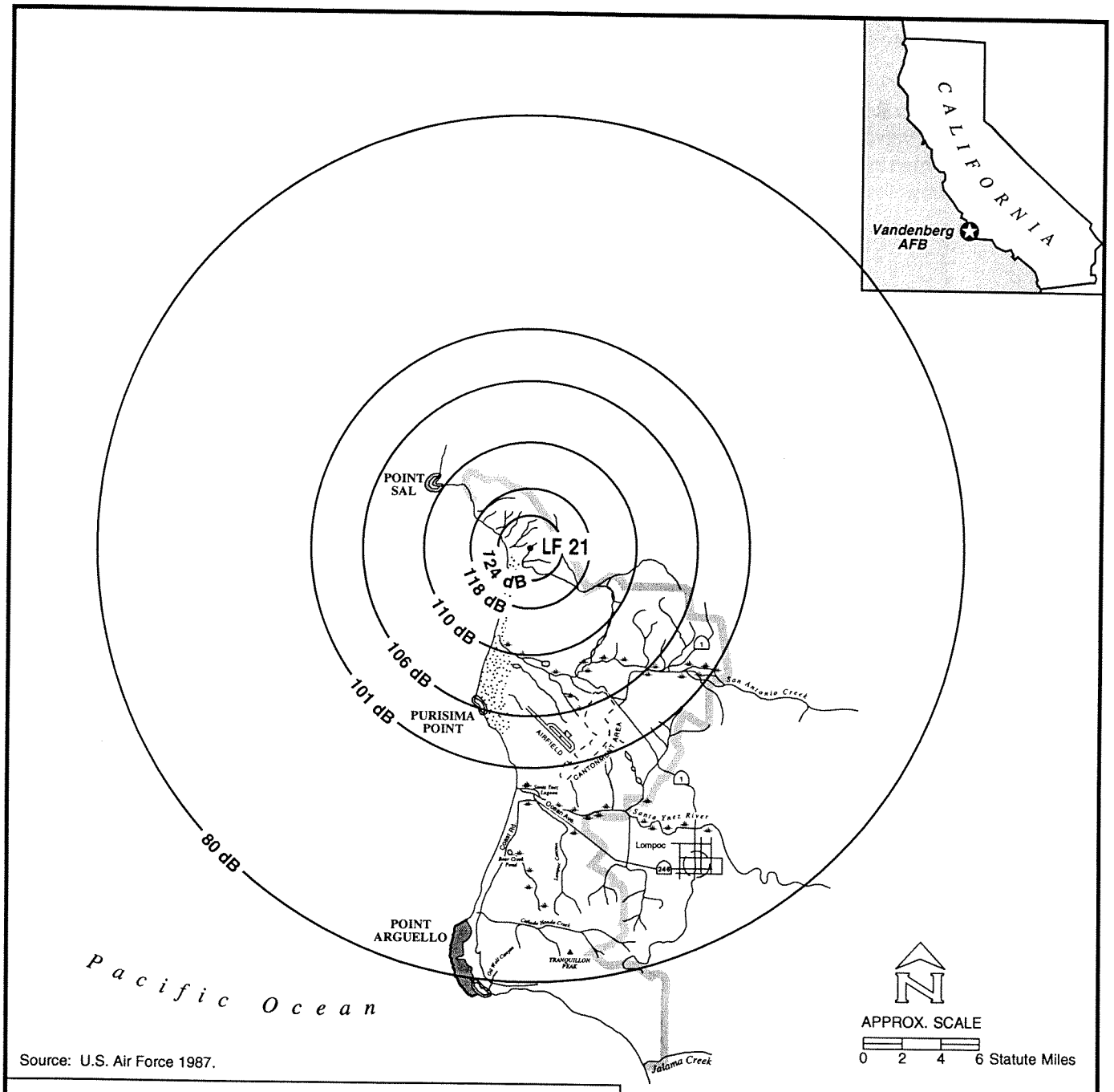
In-Flight Noise. In-flight noise occurs when the vehicle is in the air, clear of the launch pad, and the engine exhaust plume is in line with the vehicle. In the early part of the flight, when the vehicle's motion is primarily vertical, noise contours are circular. The sound source is also well above the ground and therefore undergoes less attenuation as it propagates to long distances. The shapes of the contours for the launch vehicle ascent are approximately circular, particularly for the higher levels near the center. Because the contours are approximately circular, it is often adequate to summarize the noise by providing the sound levels at various distances from the launch site.

On-pad noise contours are much smaller than in-flight contours. Because in-flight noise is much greater than on-pad noise, analysis of the Proposed Action will focus on in-flight noise.

The major source of in-flight noise is from mixing the exhaust flow with the atmosphere, combustion noise in the combustion chamber, shock waves and turbulence in the exhaust flow, and occasional combustion noise from the post-burning of fuel-rich combustion products in the atmosphere. The emitted acoustic power from a rocket engine and the frequency spectrum of the noise can be calculated from the number of engines, their size and thrust, and their flow characteristics.

Sonic Boom. Another noise characteristic of launch vehicles is that they reach supersonic (faster than the speed of sound) speeds and will generate sonic booms. A sonic boom, the shock wave resulting from the displacement of air in supersonic flight, differs from other sounds in that it is impulsive and very brief (up to several seconds for launch vehicles). Sonic booms are generally described by their peak overpressure in pounds per square foot (psf).

Sonic booms can vary from inconsequential to severe, depending on the physical aspects of the launch vehicle, the trajectory of the launch, and the weather conditions at the time of the launch. Physical features of the launch vehicle that influence the occurrence and intensity of sonic booms include the vehicle's overall length and width, the length of each stage, and the shape of the nose cone. Trajectory criteria that affect sonic booms include the time from the launch, the angle of the flight path from the horizontal, velocity of the launch vehicle, altitude of the launch vehicle, range from the launch site, and the position at which stage separation occurs (Chappel 1980; Habor 1981; NASA 1989; Talty 1988; U.S. Air Force 1995b).



Source: U.S. Air Force 1987.

LEGEND

- Pinniped Rookery Location
- 1,000-Ft. Bubble (around rookery)
- Vandenberg Marine Resource Protection Area Ecological Reserve
- Vandenberg AFB Boundary
- Wetlands
- Sand Dunes
- River/Creek
- Lake/Pond
- 124 dB — Noise Level Contours

NOTE: This modeling depicts a worst-case scenario that does not account for variations in weather or terrain.

UNITED STATES AIR FORCE
VANDENBERG AIR FORCE BASE

PREDICTED MAXIMUM NOISE LEVEL CONTOURS FOR MINUTEMAN MISSILES FROM A COASTAL LAUNCH SITE, VANDENBERG AFB, CALIFORNIA

TASK NO.	DATE	DRAWN BY	LINKS	AI FILE NO.	FIGURE NO.
Boost EA	3/4/99	G. Ige	NONE	3-9.ai	3-9

The initial shock wave propagates along a path that grazes the earth's surface due to the angle of the vehicle and refraction of the lower atmosphere. As the vehicle pitches over, the direction of propagation of the shock wave becomes more perpendicular to the earth's surface. These direct and grazing shock waves can intersect to create a focused sonic boom. The focused sonic boom is typically narrow, about 1 mile of intense focus, followed by a larger region of multiple sonic booms (Versar 1991).

3.10 POLLUTION PREVENTION

Existing information on pollution prevention was obtained from the 30 Space Wing Pollution Prevention Management Plan, 30 Space Wing Solid Waste Management Plan and applicable federal and state regulations.

3.10.1 Region of Influence

The ROI for pollution prevention at Vandenberg AFB encompasses the entire base, and the proposed project location at LF-21.

3.10.2 Affected Environment

The federal Pollution Prevention Act (PPA), enacted in 1990, established pollution prevention as a national objective. Previous legislation emphasized pollution control (treatment and disposal) and a multi-media approach (separate legislation for air, water, and other impacted media). The PPA turned the focus of environmental protection toward pollution prevention (P2), which emphasizes source reduction and recycling to reduce impacts to all media (U.S. Air Force 1996b). The PPA hierarchy of waste management includes the following:

- Source reduction to prevent the creation of waste;
- Recycling of waste or used material that cannot be prevented at the source;
- Treatment of waste, in an environmentally safe manner, that cannot be prevented or recycled; and
- Environmentally compliant disposal only as a last resort.

The P2 program at Vandenberg AFB consists of various policies aimed at achieving 30th Space Wing goals and objectives for reducing pollution through revised practices, procedures, and operational requirements. These policies are written in the Vandenberg AFB Pollution Prevention Management Plan (PPMP). The Air Force has developed a P2 program to implement the requirements of RCRA Hazardous Solid Waste Amendments as well as the PPA. The Vandenberg AFB P2 program mandates a 50 percent reduction of generated solid waste disposed of in the base landfill by 31 December 2000, using a 1992 baseline.

The PPMP establishes the overall strategy, delineates responsibilities, and sets forth specific objectives for reducing pollution of the ground, air, surface water, and groundwater. All installation organizations must abide by the policies and programs set forth in the PPMP. The purpose of the PPMP is to provide sufficient guidance for pollution prevention management on Vandenberg AFB. Specific goals include implementation of management practices that eliminate or reduce the use of hazardous materials, increase efficiency in the use of raw materials, protect natural resources, and encourage source reduction through recycling, treatment, and disposal practices (U.S. Air Force 1996b).

3.11 SOCIOECONOMICS

Socioeconomics comprises such interrelated resources as population, employment, income, temporary housing, and public finance. Temporary housing refers to the availability of hotel and motel rooms within the local area of the project. Impacts on permanent housing supplies are expected to be negligible, since no permanent population change would result from the project.

3.11.1 Region of Influence

The influence of Vandenberg AFB on population and employment varies widely within Santa Barbara County. Vandenberg AFB generally influences the north region of Santa Barbara County, which encompasses the area north of Lompoc. Although Vandenberg AFB draws commuters from southern San Luis Obispo County, commuters from this region are estimated to comprise fewer than 5 percent of the total San Luis Obispo County labor force. Therefore, the assessment of Vandenberg AFB's socioeconomic role focuses on northern Santa Barbara County, especially the Lompoc and Santa Maria valleys.

3.11.2 Affected Environment

The 1997 Census estimated Santa Barbara County's population at approximately 398,000 (California Department of Finance 1997). In 1990, Santa Barbara County population was 369,608 (U.S. Bureau of the Census 1990). Santa Barbara County's population is expected to grow to 416,700 by the year 2000.

Santa Maria, with 69,300 residents in 1997 and Lompoc, with 41,650 residents in 1997, are the principal communities within the northern portion of the county (California Department of Finance 1997). The population in Santa Maria is expected to reach 75,152 by the year 2000; that of Lompoc is projected to be 44,208 (Santa Barbara County Association of Governments 1994).

Vandenberg AFB is a major source of employment in northern Santa Barbara County and the Lompoc Valley. There were approximately 9,408 jobs in the Santa Barbara County construction employment sector in 1994, down from 12,352 in 1990 (California Department of Finance 1997; U.S. Bureau of the Census 1990). Most of this decline was probably due to a decrease in residential, commercial, and industrial building permits activity. However, there are a number of approved, but unbuilt residential, commercial, and industrial construction projects in the region, and the construction sector is expected to grow.

A total of 15 construction workers would be required for the silo modification phase of the Proposed Action (Mullins 1998). Sixty percent of these workers would be local, while 40 percent would be from nonlocal sources. During the operational phase of the project, approximately 20 people would be needed onsite for LF canister emplacement and for LCC operations.

3.12 SOLID WASTE

Existing information on solid waste management at Vandenberg AFB was compiled from the Vandenberg AFB Solid Waste Management Plan (SWMP) (U.S. Air Force 1997d) and through interviews with 30 CES/CEVCC personnel.

3.12.1 Region of Influence

The ROI for solid waste would encompass modification and dismantling at LF-21, and any activity at Buildings 1959, 1978, and 1900 that would generate solid waste. The ROI also encompasses the Vandenberg AFB Sanitary Landfill.

3.12.2 Affected Environment

The Vandenberg AFB Sanitary Landfill (landfill) is a Class III permitted landfill occupying approximately 187 acres. The landfill is operating pursuant to Solid Waste Facility Permit #42-AA-0012 issued to the Air Force on 15 November 1994, by the Santa Barbara County Environmental Health Services Department (U.S. Air Force 1997d). The permit currently allows the landfill to accept a daily maximum of 400 tons of waste. The landfill is also operating pursuant to Waste Discharge Requirement (WDR) Order No. 94-26 issued by the California Regional Water Quality Control Board (CRWQCB) on June 3, 1994. The average daily volume of solid waste received at the landfill is 40 to 70 tons. However, to comply with the California Integrated Waste Management Act (CIWMA) of 1989 (California Assembly Bill 939), by the year 2000 Vandenberg AFB must reduce the amount of waste accepted into the base landfill to 50 percent of the total waste generated at Vandenberg AFB in 1990.

The landfill accepts municipal and commercial solid waste. Construction debris, green waste, used tires, and recyclables, including scrap metal, concrete, and asphalt, are segregated and diverted for reclamation. Special wastes, such as nonfriable asbestos and dead animals, are disposed of in separately designated sites. The landfill is prohibited from accepting any designated liquid wastes, including grease, sewage sludge (from septic tank pumping), burning waste, hot ashes, and untreated medical waste.

3.13 WATER RESOURCES

Water resources include surface water and groundwater and their physical, chemical, and biological characteristics. Existing information on regional water resources was compiled by reviewing hydrogeology reports and environmental investigation reports for Vandenberg AFB. Site drainage was evaluated by reviewing base C-tab maps and by visiting the project study area. Installation personnel and United States Geological Survey (USGS) personnel were contacted, when applicable, to identify water resources that could be affected by the proposed activities.

3.13.1 Region of Influence

The ROI for the proposed project site, with respect to water resources, is defined as the San Antonio Creek Basin watershed. Site drainage, groundwater, and flood hazard information are discussed below.

3.13.2 Regional Setting

Vandenberg AFB encompasses portions of two major drainage basins, San Antonio Creek basin and Santa Ynez River basin. Five minor drainage basins associated with smaller creeks, and several ponds are also contained within base boundaries. Aquifers capable of yielding large quantities of water usable for water supply are generally restricted to the deeper portions of the Santa Ynez River and the San Antonio Creek (Evenson and Miller 1963; Hutchinson 1980; Jacobs Engineering Group [JEG] 1994). The drainage divide between the San Antonio Creek basin and the Santa Ynez River basin occurs in the southern portion of Burton Mesa. San Antonio Creek flows west, has a drainage area of approximately 154 square miles, and discharges into a lagoon impounded behind the coastal dunes on north Vandenberg AFB. The Santa Ynez River flows west, has a drainage area of approximately 900 square miles, and

discharges into the Pacific Ocean. Upstream, damming of the Santa Ynez River limits its wet season flow. Withdrawal of water from both upstream drainage basins for irrigation affects the flow volume of San Antonio Creek and the Santa Ynez River. The presence of high levels of total dissolved solids, sulfates, chlorides, and iron causes poor water quality in San Antonio Creek and the Santa Ynez River (U.S. Air Force 1987).

Approximately 85 to 90 percent of the water currently used by Vandenberg AFB comes from within the state, according to the 30th Aerospace Medical Squadron, Bioenvironmental Engineering Flight (Spear 1998). Additional water for north Vandenberg AFB is pumped from the San Antonio Creek groundwater basin by an array of wells installed in the San Antonio Creek Valley. Groundwater on Vandenberg AFB occurs mainly in unconsolidated alluvial deposits beneath the river and stream channels in the valleys and canyons.

3.13.2.1 Site Drainage

Storm water generated within the boundaries of the proposed project area is primarily sheet flow (diffuse flow on paved surfaces). Most drainage is diverted around the area by earthen or concrete-lined ditches that convey drainage towards unnamed perennial ephemeral tributaries of Shuman Creek. The proposed aboveground, fiber-optic cable line will cross over on of these unnamed tributaries, which is located between LF-21 and LF-1A. All of the tributaries within the project study drain southeast to Point Sal Road, where they pass beneath Point Sal Road via culverts that convey storm water into Shuman Creek. Shuman Creek meanders through sand dunes westward towards the Pacific Ocean, where most flow infiltrates or is or is impounded by the dunes and dense vegetation approximately 0.2 miles east of the ocean. In periods of high flow, Shuman Creek discharges into the Pacific Ocean.

3.13.2.2 Groundwater

No groundwater supply wells or monitoring wells are located within the proposed project area's watershed, based on United States Geologic Survey well inventory (1998), and Vandenberg AFB Installation Restoration Program (IRP) personnel interview (Martinez 1998). However, groundwater resources are likely to exist in the project area.

3.13.2.3 Flood Hazards

The 100-year floodplain is located in low-lying areas bordering Shuman Creek (U.S. Air Force 1987). The proposed project area, ranging in elevation from approximately 520 feet to 580 feet above mean sea level, is not within the 100-year floodplain of Shuman Creek.

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4.0 ENVIRONMENTAL CONSEQUENCES AND CUMULATIVE IMPACTS

4.0 ENVIRONMENTAL CONSEQUENCES AND CUMULATIVE IMPACTS

This section presents the results of the analysis of potential environmental effects associated with the Proposed Action and No-Action alternatives. Changes to natural and human environmental that may result from the Proposed Action were evaluated relative to the existing environmental conditions described in Chapter 3.0.

4.1 AIR QUALITY

Air quality impact issues include both policy and physical air quality changes, which are discussed in Chapter 3.0 of this EA. Air quality impacts are judged to be significant if the action being evaluated causes or contributes to a violation of state or federal ambient air quality standards; causes pollutant or pollutant precursor emissions in excess of local air quality management agency impact significance thresholds; or violates federal, state, or local emission limitations for specific pollutants or emission sources.

Current federal and SBCAPCD regulations require that the Proposed Action not have a significant impact on regional air quality, as reflected by the estimated long- and short-term impacts from the direct and indirect emission sources associated with the action. Standard SBCAPCD mitigation measures for PM_{10}, NO_x, and ROC are included to reduce PM_{10} and O_3 impact in Santa Barbara County areas of nonattainment and protect regional air quality.

This document describes all the equipment used, its operational methods and procedures, and the estimated pollutant emissions. Technical assumptions, calculations, emission factors, and constants used to estimate the site preparation and operation emissions are provided in Appendix A. In addition, atmospheric condition impacts from the launch vehicle are presented in Appendix A.

4.1.1 Pollutant-Emitting Activities

The pollutant emitting activities, sources of emissions, and resulting pollutants that would occur under the Proposed Action are listed in Table 4-1.

The following considerations were used in determining the air quality impacts of the proposed project and pollutant-emitting activities:

- Emissions from site preparation are calculated, and included in the General Conformity Analysis;
- Emissions from facility operation are not expected to increase at Buildings 1978 and 1959, however, emissions from painting operations are calculated, and included in the General Conformity Analysis;
- Emissions from mobile source operations were quantified, and included in the total emission estimate for general conformity analysis; and
- Emissions from the launch vehicles were estimated and included in the total emission estimate for the general conformity analysis.

Table 4-1
Proposed Action Emissions

Emission Activity	Source	Pollutant
Site Preparation	Silo headwork placement and removal Pre- and post-launch fiber-optic cable placement	PM_{10}
Facility Operation	Post-launch coating operations	ROC
Mobile Source[1]	Construction vehicles Operation vehicles	NO_x SO_x PM_{10} CO ROC
Canister Transportation	C-5/C-17 aircraft carrier or carrier truck	NO_x SO_x PM_{10} CO ROC
Launch[2]	Launch vehicle	Al_2O_3 HCl CO CO_2

Notes: 1 - Gaseous pollutant emissions from mobile sources, including emissions from mobile equipment and motor vehicles during site preparation, as well as the pre- and post-launch commuter vehicles.
2 - For this study, Al_2O_3 is expressed as PM_{10}, and represents a worst-case scenario.

4.1.2 General Air Quality

Santa Barbara County, which has jurisdiction over the Proposed Action, is in attainment for all ambient air quality standards except the federal and state O_3 standards and the state PM_{10} standard. Current federal and SBCAPCD regulations require that the Proposed Action not have a significant impact on regional air quality, as reflected by the estimated long- and short-term impacts from the direct and indirect emission sources created by the action. Appendix A presents all the assumptions and calculations used in assessing impacts of the Proposed Action on air quality. Standard SBCAPCD mitigation measures for PM_{10} and ROC are included to reduce PM_{10} and O_3 impacts in Santa Barbara County areas of nonattainment and to protect regional air quality.

The site preparation and operation activities of the Proposed Action must follow SBCAPCD rules and regulations. The SBCAPCD rules and regulations applicable to this project are listed in Table 4-2.

Table 4-2
SBCAPCD Air Quality Compliance Rules

Rule 101	Compliance by Existing Facilities: Conflicts
Rule 201	Permits Required
Rule 202	Exemptions to Rule 201
Rule 205	Standards for Granting Applications
Rule 206	Conditional Approval of Authority to Construct or Permit to operate
Rule 210	Fees
Rule 301	Circumvention
Rule 302	Visible Emissions
Rule 303	Nuisance
Rule 304	Particulate Matter – Northern Zone
Rule 309	Specific Contaminants
Rule 311	Sulfur Content of Fuels
Rule 323	Architectural Coatings
Rule 333	Control of Emissions from Reciprocating Internal Combustion Engine
Rule 702	General Conformity[1]
Rule 1001	National Emission Standards for Hazardous Air Pollutants

Note: 1 - General Conformity is addressed within this EA.

4.1.3 Project Emissions and General Air Quality Compliance

The total project emissions are summarized in Table 4-3, and are considered to have insignificant impacts to the regional air quality. A more detailed tabulation of the estimated emissions from various project activities is provided in Appendix A. As shown in these tables, the maximum annual project emissions are well below the U.S. EPA threshold levels used to evaluate general conformity applicability, and are dispersed throughout 1 year and along the material transport routes. The associated air quality impacts are therefore not expected to cause or contribute to a violation of any NAAQS or CAAQS.

4.1.4 Site Preparation

For the Proposed Action, emissions generated during this activity are entrained PM_{10} from passenger vehicle and truck travel during the operation. PM_{10} emissions are calculated and summarized in Appendix A (Table A-5). Additionally, standard measures to reduce PM_{10} emissions are also listed in Appendix A.

4.1.5 Facility Operation

Buildings 1978 and 1959 will be used as communication centers in support of the launch efforts. Since both buildings are currently in use, existing support equipment is included in the Vandenberg AFB comprehensive emissions inventory and in the Santa Barbara County 1994 Clean Air Plan, no emission increase is expected. However, at the launch site, painting activities are the only new source of emissions and will be performed using post-launch operations. ROC emissions will be generated during this activity and are listed in Appendix A (Table A-6).

Table 4-3
Total Annual Emissions for Proposed Project (tons per year)

Activity	NO_x	SO_x	CO	PM_{10}	ROC
Site Preparation[1]	0.00000	0.00000	0.00000	0.8403	0.00000
Facility Operation[2]	0.00000	0.00000	0.00000	0.00000	0.01402
Mobile Source[3]	0.08950	0.00000	0.8066	0.01230	0.06130
Canister Transportation[4]	0.04397	0.00308	0.10120	0.00006	0.03457
Launch Vehicle[5]	0.00000	0.00000	7.1530	10.8012	0.00000
Total	0.13347	0.00308	8.0608	11.65386	0.10989

Notes: 1 - Entrained emissions from vehicle travel on paved and unpaved roads and are summarized in Appendix A (Table A-5).

2 - Facility operations at Building 1978 and 1959 are included in Vandenberg AFB's comprehensive emission inventory; no net emission increase is expected. Painting operations emissions associated with post-launch activities are included in Appendix A (Table A-6).

3 - Exhaust emissions from mobile sources, including emissions from mobile equipment and motor vehicles during site preparation, as well as the pre- and post-launch phase activities, which are summarized in Appendix A (Table A-10).

4 - Since C-5 aircraft carrier generate the largest amount of estimated emissions compared to C-17 or carrier truck, it is used to calculate emissions for canister transportation. C-5 and carrier truck emissions are summarized in Appendix A (Table A-8 and A-9).

5 - For this study, Al_2O_3 is expressed PM_{10}, and represents a worst-case scenario. Emissions are summarized in Appendix A (Table A-7).

4.1.6 Mobile Source

Exhaust emissions from mobile equipment and commuting vehicles were calculated and quantified for the Proposed Action. Emission calculations and technical assumptions are presented in Appendix A (Table A-10).

4.1.7 Canister Transportation

The two BV canisters would be transported to Vandenberg AFB separately via a C-5/C-17 aircraft carrier or by carrier truck. Travel via C-5 aircraft carrier represents a worst case scenario. Estimated C-5 emissions are summarized in Appendix A (Table A-8).

4.1.8 Launch Vehicle

The launch emissions from the Proposed Action were estimated based on those of the Lockheed Launch Vehicle 2 (LLV2) (U.S. Air Force 1994). The LLV2 emissions were used as the basis for launch emission calculations because the vehicle's booster configuration is similar to that of the BV: three-stage booster, solid rocket fuel propellant, and hot-start ignition. The LLV2 will provide a worst-case scenario since its booster capacity of 375,000 pounds of solid rocket fuel is approximately 5.6 times larger than the BV capacity, which is estimated at less than 67,000 pounds. The BV launch emission calculations and technical assumptions are presented in Appendix A.

4.1.9 Proposed Action Emissions and General Conformity Applicability Analysis

A formal air conformity analysis is required for the Proposed Action to ensure that the site preparation and operation at LF-21 would be in compliance with the implementation of the CAA and the SBCAPCD Rule 702, General Conformity. For Santa Barbara County, the federal regulations establish that the total annual emissions of O_3 precursors (NO_x and ROCs) associated with the Proposed Action cannot exceed 50 tons per year (tpy) for a *de minimis* threshold for applicability.

Appendix A contains a detailed air conformity analysis that includes the regulatory summary and a detailed description of the estimation of criteria pollutant emissions associated directly and indirectly with the Proposed Action activities. The estimated criteria pollutant emissions are summarized in Table 4-3 and are compared to conformity thresholds in Table A-3 and A-4. The estimated annual emissions are *de minimis* and well below 10 percent of the SBCAPCD 1990 base year emission inventory level for each criteria pollutant. Therefore, the emissions from the Proposed Action are well below the *de minimis* threshold values and are not regionally significant.

4.1.10 No-Action Alternative

Under the No-Action Alternative, there would be no impacts to air quality.

4.1.11 Mitigation Measures

Under the Proposed Action, no mitigation measures would be required for the Proposed Action.

4.2 BIOLOGICAL RESOURCES

Facilities refurbishment, cable installation and noise and debris generated by launch activities all would create potential adverse impacts to biological resources. Impacts to biological resources would be considered significant if special status species (endangered, threatened, rare, or candidate) or their habitats, as designated by federal, state, or local agencies, affected directly or indirectly by project-related activities. In addition, impacts to biological resources would be considered significant if substantial loss, reduction, degradation, disturbance, or fragmentation occurs in native species habitats or in their populations. These can be short- or long-term impacts; for example, short-term or temporary impacts would occur during project implementation, and long-term impacts would result from the loss of vegetation and thereby loss of the capacity of habitats to support wildlife populations.

Informal consultation was conducted with the United States Fish and Wildlife Service (USFWS) regarding the Proposed Action and it was determined that formal consultation would not be required. Federal agencies are required by Section 7 of the ESA to assess the effect of any project on federally listed threatened and endangered species. Under Section 7, formal consultation with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) is required for federal projects if such actions directly or indirectly would potentially affect listed or proposed species. In the case of species proposed for listing, Section 7 requires a conference with the USFWS or NMFS. It also is Air Force policy to follow management goals and objectives specified in Integrated Natural Resources Management Plans, and to consider sensitive species, communities, and habitats recognized by state and local agencies when evaluating impacts of a project.

Impacts to jurisdictional waters of the United States and wetlands are considered significant if the project results in net loss of wetland area or habitat value, either through direct or indirect impacts to wetland vegetation, loss of habitat for wildlife, degradation of water quality, or alterations in hydrological

functions. The COE and U.S. EPA have been given jurisdiction to implement Section 404 of the Clean Water Act (CWA), which regulates activities that would impact waters of the United States and wetlands and Section 10 of the Rivers and Harbors Act. All projects that would involve discharge or fill into jurisdictional waters or wetlands require a Section 404 permit from the COE. Under Section 10, the construction, excavation, or depositing of material in navigable waters of the United States from the high tide line to the outer continental shelf requires a Section 10 permit from the COE. Such projects also require water quality certification under Section 401 of the CWA by the CRWQCB. In addition, as specified in AFI 32-7064, any action affecting a wetland, or occurring within a floodplain, must be preceded by the preparation and signing of a Finding of No Practicable Alternative (FONPA).

4.2.1 Proposed Action

4.2.1.1 Biological Resources

Modification of Existing Facilities and Fiber Optic Cable Installation

During modification of the existing facilities and installation of the fiber-optic communication cable, no impacts to biological resources would be anticipated in the project area. At the time of the surveys, the most important botanical resources identified in the project area were the plant communities of coastal sage scrub and native grassland. Native grassland is designated as sensitive by the CDFG but would not be impacted by the fiber-optic cable installation. The fiber-optic cable will be installed through an existing conduit over the drainage area west of Building 1959, thus avoiding any potential impacts to wetland areas. The structural modifications would occur within disturbed areas of existing facilities. Installation of the fiber-optic cable would not disturb the ground surface other than vehicle movement between LF-21 and Building 1959. Vegetation in the areas affected by these activities has been disturbed by mowing, grazing, and from past launches. Therefore, no mitigation would be required.

No significant direct or indirect impacts to listed threatened and endangered wildlife species, or to any species of concern, are would occur in the project area during facility modifications and fiber-optic cable installation. Disturbance resulting from project activities would be restricted to ruderal areas surrounding existing facilities and grasslands in the project vicinity. Coast horned lizard, (*Phrynosoma coronatum frontale*), although not well documented on base or observed during surveys, may occur at the periphery of LF-21 due to the presence of sandy soils. Associated impacts of project activities during facility modification would be minimal, localized, and temporary, and most wildlife species, including the coast horned lizard that might occur within the disturbance zones would be able to move to suitable habitats away from the project area. There are no known breeding populations of sensitive bird species in the project area and adverse impacts in the form of disturbance-related nest abandonment would be unlikely. Native vegetation removal would not occur during project implementation.

Launch Activities

Debris Generation. Debris from missile launches would be contained within the silo. Launch activities would not produce debris over land and therefore would not adversely affect plant or wildlife species.

Noise. Noise generated by helicopter overflights at the launch site and along the flight path has the potential to impact wildlife. Unexpected noises such as aircraft overflights, sonic booms, and rocket launches cause variable reactions in wildlife, ranging from startling some avian and pinniped species to little or no reaction. The "startle effect" associated with missile ignition and lift-off is considered a short-term negligible effect (U.S. Army 1997).

Peregrine falcons are expected in the project vicinity as a forager, however, potential nests sites would be at Point Sal approximately 5 miles northwest of LF-21. Peregrine falcons would not breed or nest in the project area and due to the distance from LF-21 to appropriate nesting habitat at Point Sal, would not be adversely affected by launch noise. Townsend's big-eared bat is not expected in or near the project area due to lack of appropriate habitat.

Snowy plover, California least tern, and California brown pelicans would be within the audible range of the proposed launches. The BV test launch vehicle is smaller and carries less solid rocket motor propellant than a Minuteman missile that was previously launched from LF-21. Therefore, noise produced from the BV launch vehicle is expected to be less than that produced by a Minuteman. Because of the distance from the launch site to sensitive birds species on the coast and the fact that the proposed missile is smaller than a Minuteman missile, noise impacts to these species would be less than significant.

In addition, the small number of launch tests (two) proposed under the BV test project and the short duration of the launch activities in addition to the lack of appropriate habitat for sensitive species in the project area, would result in less than significant impacts to terrestrial wildlife species.

The EIS/EIR for the San Miguel Project, describing proposed oil and gas exploration operations in the Santa Maria Basin (i.e., the offshore area adjacent to Vandenberg AFB), addressed the potential for helicopter overflights to impact marine mammal populations in the area. It was determined that impacts would be insignificant for this route when flights were at 1,000 feet. Lower-elevation flights could disturb harbor seals and sea lions (URS 1986). Helicopter flights associated with the BV flight tests would be intermittent.

There are a number of ways pinnipeds can be impacted by noise from a missile launch. These include auditory interference by masking; behavioral disruption, including cessation of resting, feeding, or social interactions; increased alertness; departure of a haulout site; and long-term effects on hearing.

Noise contours for a typical ballistic missile launch are provided in Figure 3-10. This figure shows noise levels at various distances from the launch site. Areas where pinnipeds concentrate, and the distances from LF-21 are 2.7 miles from Point Sal and 1 mile from Lions Head.

NMFS indicated a concern that pinnipeds may be hurt as a result of being startled in response to space launches. To address this concern, the Air Force funded several studies on the effects of vehicle launches on marine mammals in anticipation of launching the Space Shuttle from Vandenberg AFB (Bowles and Stewart 1980, Cooper and Jehl 1980). Activity near the rookery caused the most severe and prolonged response in all species. Low-flying helicopters, sonic booms, and boat noise also disturbed the animals (Cooper and Jehl 1980).

Harbor seals were most susceptible to disturbance; California sea lions were slightly less so. Sea lions commonly responded to sonic booms of 80 dBA or more, but the duration of their response to sound stimuli alone was much shorter than to combinations of visual and sonic stimuli, such as from humans, boats, and helicopters. Northern fur seals were reactive, and elephant seals were largely unresponsive. Immature, non-breeding animals were generally more susceptible than adults (Cooper and Jehl 1980).

The timing of a specific launch would dictate what species and population structures (i.e., breeding, pupping, hauled out, at sea) would be subject to potential impacts. The most sensitive period for any species occurring in the area would be pupping season. These seasons are as follows:

- Pacific harbor seal - 1 February through 31 May;

- California sea lion - mid-May through late June;
- Northern elephant seal - late December to mid-February; and
- Northern fur seal - late May through July.

Information gathered during other launches can be used to evaluate the potential for the BV test flights to impact marine mammals. Pinniped monitoring has been performed for numerous launches of larger rockets (Delta II), which is considerably larger than the BV test flight vehicle. Noise from launches of the Delta II rocket has resulted in a startle response in harbor seals hauled out on the coastline along Vandenberg AFB. The effect has been a negligible short-term impact with all harbor seals hauled out near SLC-2W fleeing into the ocean at the time of the Delta II launches. Sea otters with dependent pups have also been observed. Noise from the launches has not affected their use of coastal areas near the launch site. No impacts to marine mammals that may have been in the water at the time of any launch have been observed.

One NMFS concern is that separation of mothers and nursing pups could occur. The only site in the vicinity of LF-21 where dependent pinniped pups are likely to be present is at the Spur Road harbor seal haulout site. This site has been monitored during launches of the Delta II rocket, and no such mother-pup separations have been noted.

Reactions of toothed whales to aircraft have been reported less often than reactions of pinnipeds. This perhaps indicates that the airborne sounds (and visual stimuli) from an aircraft are less relevant to toothed whales and other marine mammals in the water than to pinnipeds hauled out on land or ice. There are no data on received sound levels that do and do not elicit disturbance reactions by toothed whales (Richardson *et al.* 1995). Data on the reactions of baleen whales to aircraft are meager and largely anecdotal (Richardson *et al.* 1995). There is no indication that single or occasional aircraft overflights cause long-term displacement of whales (Richardson *et al.* 1995).

The intermittent launches associated with the BV flight test would not substantially impact marine mammals since the actual duration and frequency of the effects would be low. Activities also would not result in temporary or permanent hearing threshold shifts for marine mammals since the launch noise would be periodic and not of sufficiently high intensity. The startle effect would be a temporary disruption of behavior or physiological activities. The BV test flights would be of a magnitude and frequency similar to or less than that incurred at current active lunch sites, as assessed in the EA supporting the Programmatic Marine Mammal Take Authorization.

In some cases, marine fauna have demonstrated a tendency to react less to aural stimuli than to visual stimuli. The distance from LF-21 to the shoreline is approximately 1 mile. The altitude of a missile once it approaches any established marine mammal haulout site or other coastal area would considerably lessen any harassment. In addition, the negligible impact of overflight from missile launches would create no reduction in the stock of marine mammals.

Emissions. Launch activities during dry conditions would produce Al_2O_3 which would be suspended in the air and dispersed over the area surrounding LF-21. Under natural conditions, this chemical is not a source of toxic aluminum. The U.S. EPA has determined that non-fibrous Al_2O_3 as found in solid rocket fuel exhaust is non-toxic (National Aeronautics and Space Administration 1990). Less than significant impacts to biological resources are therefore expected as a result of Al_2O_3 deposited in the ruderal area surrounding LF-21. The Al_2O_3 is not expected to affect the drainage west of Building 1959 due to its distance from LF-21 (approximately 3/4 mile) and a hill that separates the launch site and the drainage.

Hydrochloric Acid (HCL) is emitted during solid propellant missile launches for large flight vehicles, such as the space shuttle and Titan series, and is known to injure plant leaves and affect wildlife. The BV solid rocket motor launches would produce low-level, short-term HCl emissions that have been determined to have little effect upon vegetation and wildlife. The amount of HCl produced by the smaller BV vehicle would have little effect upon the ruderal vegetation or wildlife in the area surrounding LF-21. In the event that rainfall would occur within 2 hours of the launch, HCl produced by the launch would be deposited in the area surrounding LF-21. The BV launches would not be scheduled during periods of rainfall, therefore, there would be no significant impacts from BV launches on vegetation and wildlife.

Early Flight Termination. Fire, in the event of a launch mishap could impact surrounding vegetation. In the event of a fire resulting from early flight termination, wildlife would be able to respond to a fire as under natural conditions and move away from the area. No sensitive biological resources occur in the area surrounding LF-21 due to past disturbance. In addition, fire fighting personnel would be on stand-by status during launch activities as a precaution. The probability of a spent missile landing on a cetacean or other marine mammal is remote. Previous analysis of impacts of debris fallout upon migrating gray whales, selected as a representative cetacean likely to be in areas of potential impact, has been conducted. Analysis suggests that at a distance of 10 kilometers (6 miles) from the shoreline, the chance of a whale being struck and killed by falling debris during peak migration densities would be 1 in 10,000 per launch (U.S. Air Force 1996). Therefore, BV test flight launches occurring at times other than peak migration would present a significantly lower risk to migrating whales. Therefore, no impacts to biological resources would be expected and additional mitigation would not be required.

4.2.1.2 Waters of the United States and Wetlands

The aboveground fiber-optic cable would cross a drainage to the west of Building 1959. This drainage would be considered a wetland, however, installation of the fiber-optic cable would use an existing conduit to cross the drainage and avoid disturbing the drainage bottom. If necessary, vegetation would be trimmed to accommodate cable installation. Use of the existing conduit would avoid and protect the drainage bottom and also serve to avoid impacts to sensitive wildlife habitats and species potentially residing in the drainage. Therefore, there would be no impacts to wetlands from the Proposed Action. No impacts to the drainage are expected from launch activities since the drainage is approximately 3/4 mile east of LF-21 and is separated by a hill. Informal consultation was conducted with the United States Fish and Wildlife Service (USFWS) regarding the Proposed Action and it was determined that formal consultation would not be required.

4.2.2 No-Action Alternative

4.2.2.1 Biological Resources

Under the No-Action Alternative, no significant impacts to biological resources would occur.

4.2.2.2 Waters of the United States and Wetlands

Under the No-Action Alternative, no significant impacts to jurisdictional waters or potential wetland resources would occur.

4.2.3 Mitigation Measures

4.2.3.1 Biological Resources

Under the Proposed Action, no significant impacts to Biological Resources would occur.

4.2.3.2 Waters of the United States and Wetlands

Under the Proposed Action, no significant impacts to waters of the United States or wetlands would occur.

4.3 CULTURAL RESOURCES

Actions impacting cultural resources would be considered to have an adverse effect if they diminish the integrity of the particular element of the property's location, design, setting, materials, workmanship, feeling or association (unless exempted by law), for which the property qualifies for listing in the National Register of Historic Places (NRHP). For known cultural resource sites, relocating project elements to avoid impacts is typically the recommended option. If project redesign is not possible, subsurface testing is usually recommended to establish the physical relationship of site boundaries with the APE and/or to determine a site's value or data potentials relative to the NRHP.

A Historic Preservation Plan (Plan) guides cultural resources management for sites within the San Antonio Terrace National Register District. Sites within the District are assumed to be eligible for the NRHP. The Plan defines various site types known to exist within the District, and develops treatment plans for each site type. If a site or sites within the District cannot be avoided by a proposed project, it is not necessary to evaluate each site for NRHP eligibility (U.S. Air Force 1988). Instead, sites that might be impacted are tested to determine horizontal and vertical extent, integrity, and site type so the appropriate treatment plan can be applied. Because the proposed project is within the District, any sites it may impact will fall under management guidelines established in the Plan.

4.3.1 Proposed Action

4.3.1.1 Impacts to Historic Resources

One NRHP-eligible historic resource, Building 1900, is within the APE of the proposed project. It will be used for temporary storage and inspection of the BV, and no alterations of any kind are planned for the facility. The building is one element of seven constituting the old Peacekeeper weapon system, which is NRHP-eligible for its unique engineering design and function. In and of itself, however, the building is not architecturally distinctive and neither its character nor its integrity will be altered. Based on these factors, and in consultation with the Vandenberg AFB Cold War cultural resource specialist, no impacts to this historic property are expected from the proposed project. Buildings 1959, 1978, and 1962 (LF-21) are not considered cold war era or NRHP eligible.

4.3.1.2 Impacts to Prehistoric Resources

Although the closest prehistoric resources to the proposed project are approximately 210 meters (700 feet) from the aboveground fiber optic cable line connecting LF-21 and Building 1959, the precise route of the cable has not been determined. For this reason, the Vandenberg AFB Cultural Resources office (30 CES/CEVPN) will establish the location where excavation will occur for the portion of the road where the fiber-optic cable will be laid. Any work will be conducted at least 60 meters (200 feet) from any

previously recorded site boundaries. If these recommendations are followed, no impacts to prehistoric cultural resources are expected from the cable placement portion of the proposed project.

4.3.2 No-Action Alternative

Under the No-Action Alternative, there would be no impacts to cultural resources.

4.3.3 Mitigation Measures

No impacts to cultural resources are expected from the proposed project and no mitigation measures are recommended. However, the project is within an area with the potential for as-yet undiscovered cultural resources. In the event that previously undocumented cultural resources are discovered during construction or other project-related activities, the 36 CFR 800 regulations of Section 106 of the NHPA and all other applicable laws, implementing regulations and guidelines shall be adhered to. All project planning and regulatory compliance for this action will be also be conducted in compliance with the requirements of the NHPA and AFI 32-7065.

4.4 GEOLOGY AND SOILS

A project would result in a significant geologic impact if it increased the likelihood of, or resulted in exposure to, earthquake damage, slope failure, foundation instability, land subsidence, or other severe geologic hazards; or if it resulted in the loss of mineral resources, or caused severe erosion or sedimentation.

4.4.1 Proposed Action

The Proposed Action would have no impacts on geology and soils because it would not involve new excavation, construction, or grading at the project site. Existing facilities and access roads would be used. Additional communication cables would be temporarily placed on the ground surface between the existing facilities. These facilities and roads have been maintained in good condition since being constructed in the 1960s. Their construction and continued presence does not appear to have caused geologic hazards at the site. Although the project site is near the Lion's Head fault, which may be an active fault, and several other faults whose potential for activity is unknown, the existing facilities and roads have not shown evidence of earthquake-related damage during their 30-year life span. LF-21 (Building 1962) is an underground, reinforced concrete facility constructed to withstand the forces of a missile launch. Additional launches from LF-21 are not likely to create geologic hazards in the eastern portion of the site.

4.4.2 No-Action Alternative

Under the No-Action Alternative, there would be no impacts to site geology and soils.

4.4.3 Mitigation Measures

Because the Proposed Action does not involve altering the existing geologic conditions, no mitigation measures are anticipated.

4.5 HAZARDOUS MATERIALS/WASTE MANAGEMENT

A project would result in a significant impact on hazardous material/waste management if it increased the potential for exposure to hazardous material or waste or increased the likelihood of a hazardous material or waste release to the environment. Impacts to hazardous materials/waste management would also be considered significant if they resulted in noncompliance with applicable regulatory guidelines, including 42 CFR and CCR Title 22, or increased the amounts generated beyond available waste management practices.

4.5.1 Proposed Action

The proposed launches of BV-1 and BV-2 from LF-21 are not expected to substantially increase the volume of hazardous materials used, or hazardous waste generated, at Vandenberg AFB. Hazardous materials that may be used on site include cleaners, solvents, lubricants, motor fuel, and diesel. These materials would be consumed during use, generating minimal waste. The use of standard spill prevention procedures would ensure that the impact would be less than significant. Blast residue generated from the launch would be contained within the launch silo and the missile canister, removed, containerized in 55-gallon drums, and properly disposed of according to 40 CFR, CCR Title 22, and the Vandenberg AFB Hazardous Waste Management Plan (HWMP) (U.S. Air Force 1996c). There would be no impact from the volume of waste generated. The Vandenberg AFB CAP would be able to properly handle and ultimately dispose of the hazardous waste generated by the Proposed Action.

The impact of working near the AOC and AOIs located within the project area would be considered less than significant because the project does not involve excavation or grading. All project activities would take place on existing roads or inside existing facilities and would not physically disturb the AOC and AOI sites. Therefore, the Proposed Action would not be expected to increase the probability of a release of a potentially hazardous substance.

Existing equipment located at LF-21 or Building 1978 would potentially contain lead-based paint or PCB residue. These facilities were constructed in a period which lead-based paint was used as exterior and interior coating. Some of the equipment, such as old consoles and other electrical equipment would contain PCBs. Minor modifications to both of these facilities would result in minimal disturbance of exterior or interior surfaces, and former electrical equipment such as consoles. Therefore, impacts to lead-based paint and PCBs would be less than significant.

An emergency response team, consisting of fire fighting, safety medical, and bioenvironmental engineering personnel would be on hand at Vandenberg AFB in the event of early flight termination such as an explosion on the launch pad.

4.5.2 No-Action Alternative

The No-Action Alternative would create no additional hazardous materials and waste management; therefore, no impacts would occur.

4.5.3 Mitigation Measures

Compliance with federal and state regulations and the Vandenberg AFB HWMP will ensure that there are no significant hazardous waste management impacts and therefore, no mitigation measures would be required. Standard procedures outlined in the HWMP will ensure that all equipment is maintained properly and free of leaks during operation, and all necessary repairs are carried out in controlled paved

areas to minimize the risk of accidental spillage and that all blast residue is handled and properly disposed according to federal, state, local, and Air Force rules and regulations. All construction staging areas will be located on paved areas. All appropriate measures will be taken to perform surveys, sampling, and abatement for, lead-based paint and PCBs. Standard procedures for lead based paint are outlined in the Vandenberg AFB Lead Based Paint Management Plan. PCB abatement is managed through 30 CES/CEOIUE, Exterior Electric. These guidelines ensure that proper health and safety precautions, and abatement and waste handling procedures are followed.

4.6 HEALTH AND SAFETY

An impact would be considered significant if it involved materials or operations that posed a potential public or occupational health hazard.

4.6.1 Proposed Action

4.6.1.1 Silo Modification Activities

Activities involving silo modification are required to comply with the Occupational Safety and Health Act, the U.S. Air Force Occupational Safety and Health regulations, the U.S. Army Corps of Engineers Safety and Health Requirements Manual (EM 385-1-1), *Range Safety Requirements* and other recognized standards for operations that involve construction or facility modifications. Restricted public access to the proposed project site would be ensured through use of signs and fencing. A health and safety plan would be prepared by the contractor and submitted to the base to ensure the health and safety of onsite workers. A formally trained individual would be appointed to act as safety officer. The appointed individual would be the point of contact on all problems involving job site safety. During performance of work, the contractor must comply with all provisions and procedures prescribed for the control and safety of construction team personnel and visitors to the job site. Compliance with regulations would ensure that no health and safety impacts would result from the silo modification phase of the Proposed Action.

4.6.1.2 Ballistic Launch Safety

Compliance with ballistic launch safety regulations would be provided through 30th Space Wing Commander, 30 SW/SE, FSA, and Mission Flight Space Control Officer. A written procedure for all explosive pre-flight activities is required and must be approved by 30 SW/SE.

Because there is a potential for missile malfunction during a launch, launch hazard areas (LHAs), where access would be restricted during launch operations, must be defined (U.S. Air Force 1999). Launch hazard areas are based upon the probability of potential hazards involved with malfunction during test flights. This would limit exposure of launch hazards to essential personnel; these personnel are protected to further reduce the risk of injury during launches. For ILLs that extend out of Vandenberg AFB boundaries, an agreement would be made with the appropriate landowners to control the use of these areas during launches. 30 SW/SE and 30 RANS/DOUN (for offshore oil rigs) would oversee evacuations of surrounding land and water users.

An emergency response team, consisting of fire fighting, safety, medical, and bioenvironmental engineering personnel, would be near the proposed project site during launching activities. Additional Vandenberg AFB personnel and resources would be called out if needed. Emergency response would also be provided through local county entities.

With the implementation of the appropriate safety regulations and approvals and coordination with 30 SW/SE, the launches associated with the Proposed Action would not be expected to present a significant impact to health and safety of workers and the public.

4.6.1.3 Airspace

The BV test launches would take place in either existing restricted areas or warning area airspace that would be cleared of non-participating aircraft. The launches would be short-term events, after which joint-use airspace would be released to other users; advance scheduling would obviate impacts. There would be no change in airspace designation therefore, no land use compatibility conflicts would occur. Responsibilities and safety requirements regarding airspace use are discussed in Section 3.6.3. The Flight Safety Analyst from 30 SW/SE would define which airspace areas would be affected and the Chief of Range Operations would coordinate with the Federal Aviation Administration and the U.S. Coast Guard to identify any issues of concern. Therefore, no impacts would occur to airspace as a result of the Proposed Action.

4.6.2 No-Action Alternative

Under the No-Action Alternative, the BV test launches and associated construction activities would not occur and there would be no health and safety concerns.

4.6.3 Mitigation Measures

With appropriate regulatory compliance, the project would have no significant impacts on public health and safety and no mitigation measures would be required.

4.7 INFRASTRUCTURE

4.7.1 Transportation

An impact to transportation would be considered significant if it resulted in deterioration of the roadway system, a significant increase in traffic, or a disruption in Vandenberg AFB flightline operations. Thresholds of significance for traffic and circulation analyses for NEPA environmental reports have not been standardized. Santa Barbara County has officially adopted an environmental thresholds and guidelines manual, which includes thresholds for transportation resources. These threshold criteria are intended to provide a basis for improved analysis of the potential traffic impacts of proposed projects and are used as guidelines for the following impact analysis.

4.7.1.1 Proposed Action

Impacts to transportation from transport of the BV missile or commutes from personnel during silo preparation and launch operations would be minimal. The circulation on Vandenberg AFB is minimal and most roads operate with relatively free-flowing traffic. In addition, traffic generated during the silo modification phase of the Proposed Action would involve few vehicles and would be temporary. Before each launch, the transportation of the missile from Building 1900 to LF-21 would be necessary. If the BV missiles are shipped via military aircraft through the Vandenberg AFB Flightline, arrangements would have to be made to ensure that transportation of the BV test missiles would not disrupt operations, such as flight scheduling. Because the number of flight operations at the flightline is low, there would be no significant impacts to the operations. Transportation of the BV missile would constitute additional trips on area roads, which would be a minimal and temporary impact to traffic.

4.7.1.2 No-Action Alternative

Under the No-Action Alternative, there would be no significant impacts to transportation.

4.7.1.3 Mitigation Measures

Because there would be no significant impacts on transportation as a result of the Proposed Action, no mitigation measures will be required. During the site preparation phase, equipment will be moved to a staging area at the end of each working day to further reduce impacts to traffic.

4.7.2 Utilities

A project may have significant effects on infrastructure if it increases demand in excess of utility system capacity to the point that substantial expansion would be necessary. Significant environmental impacts could also result from system deterioration due to improper maintenance or extension of service beyond its useful life.

4.7.3 Proposed Action

The Proposed Action would require use of the existing utilities, including electricity, communication lines, and water. A permitted diesel generator already located on site would be used as a backup power source for the project site. This would provide the facility with two power sources without having to install new power lines (Bechtel 1998). Under the Proposed Action, an aboveground fiber-optic cable would be installed between Building 1959 and LF-21. This would provide for communication needs between these two facilities during launch operations. The cable would be approximately 3/4 mile long and would be placed in PVC conduit to avoid potential damage to the cable. Any impacts to the utility system as a result of the Proposed Action would be temporary. Therefore, no significant impacts to utilities would occur.

An Air Force Form 103 (Work Clearance Request) would be needed for the project site prior to any silo modification or road excavation. This permit requires the notification and approval of the Utilities Shop, the Communication Squadron, and the Explosive Ordinance Disposal (EOD) Flight to avoid impacting existing utilities, telephone cables, and fiber-optic lines, or unexpected encounters with EOD. Upon notification, these divisions would flag the location of the lines at the project site. The Electrical Division would be consulted for the identification and location flagging of underground electric lines on site. Chemical toilets would be used for septic waste from onsite personnel at LF-21 and at Building 1978.

4.7.4 No-Action Alternative

Under the No-Action Alternative, there would be no impacts to utilities.

4.7.5 Mitigation Measures

Because the Proposed Action would cause no significant impacts to utilities, no mitigation measures would be required.

4.8 LAND AND WATER USE/VISUAL RESOURCES

Impacts to land and water use would be considered significant if they resulted in conflict with established land and water uses in the area; disrupted or divided established land use configurations; represented a

substantial change in existing land and water uses, such as conversion of prime agricultural land to other uses and/or a decrease in its productivity; conflicted with environmental plans or goals; or were inconsistent with adopted land use plans, Air Force regulations, or permit requirements. Prior to the construction and operation of any proposed facility on Vandenberg AFB, siting approval must occur through Vandenberg AFB Comprehensive Planning.

A visual resource impact would be considered significant if it interfered with the existing scenic views, blocked visibility, or produced light and glare inconsistent with existing area uses.

4.8.1 Proposed Action

The Proposed Action would result in temporary closure of Pt. Sal Beach, the nearest public beach to the project site (approximately 3.8 miles), and therefore would cause a temporary impact to public access and recreation. The Proposed Action would comply with all federal Coastal Zone Management Act regulations and California Coastal Commission requirements; therefore, there would be no significant impacts to land use and coastal resources.

The Proposed Action would not disrupt land use configurations, substantially change land and water uses in a long-term manner, conflict with environmental plans or goals, or be inconsistent with land use plans, Air Force regulations, or permit requirements.

Because the Proposed Action would not substantially change the visual setting of the project area on a long-term basis, there would be no significant impacts to visual resources.

4.8.2 No-Action Alternative

Under the No-Action Alternative, there would be no significant impacts to land and water use or visual resources.

4.8.3 Mitigation Measures

Notice will be given to private landowners and affected government agencies in the on-land ILLs, as well as the offshore users, such as commercial fishing organizations and associations, including the California Sports Fishing Association, and offshore oil platforms. Adequate notice will allow fishing boats to schedule their trips to avoid the ILL and affected oil platforms to make arrangements to evacuate personnel.

4.9 NOISE

Noise impact criteria are based partly on land use compatibility guidelines and partly on factors relating to the duration and magnitude of noise level changes. An impact would be considered significant if it substantially increased the ambient noise levels for adjoining areas with noise sensitive uses. Sensitive noise receptors are facilities or areas that require low noise levels, such as hospitals, schools, or office buildings. There are three areas of concern for the Proposed Action: noise effects on the local populace, launch personnel, and local wildlife. Noise impacts to wildlife is discussed in Section 4.2.1.1.

4.9.1 Proposed Action

To evaluate the potential noise impacts associated with BV test launch and ascent, it is necessary to consider not only the overall sound level but also the frequency spectrum and the duration of the

exposure. High noise levels can cause annoyance and hearing damage. OSHA has established noise limits to protect workers at their work places. According to these standards, no worker can be exposed to noise levels higher than 115 dBA. The exposure level of 115 dBA is limited to 15 minutes or less during an 8-hour work shift (U.S. Air Force 1992). The OSHA standards are the maximum allowable noise levels for the personnel in the vicinity of the launch pad.

Missile and certain types of rocket launches produce the highest levels of noise on north Vandenberg AFB. This can range from 60 to 100 dBA in the vicinity of the launch including areas near Lompoc and Santa Maria. However, because the launches occur infrequently, the resulting noise has little impact on the Ldn or CNEL in these areas. Therefore, ambient noise levels would not be affected significantly on an annual basis from the proposed BV tests.

The BV flight test launch noise would fall within or below the noise level measurements of previously approved Minuteman launch vehicles as shown in Figure 3-8. Noise impacts would also be short of duration. Since the flight pattern of the BV test missile would be over the open ocean to the west, the flight would not cross populated areas such as nearby Lompoc or Santa Maria; therefore, impacts from noise to populated areas would be less than significant.

4.9.2 No-Action Alternative

Under the No-Action Alternative, no BV flight test would be performed, and no missile launches would occur. Therefore, there would be no changes in ambient noise levels.

4.9.3 Mitigation Measures

The maximum noise levels for the BV flight tests during a launch have not been measured, but would be less than the noise from the larger Minuteman missile which is approximately 125 dB at 1.8 miles from the launch site (Figure 3-8). To mitigate direct impacts to personnel working at the LCC (Building 1978) or within the vicinity of the launch site, the following measures will be instituted:

- All non-essential personnel will be excluded from the launch area;
- Personnel who must work close to the launch site will be required to wear hearing protection that would reduce the noise levels to prescribed health and safety levels.

4.10 POLLUTION PREVENTION

An impact would be considered significant if it resulted in nonconformance with approved P2 management plans, such as the Vandenberg AFB PPMP.

4.10.1 Proposed Action

The Proposed Action would comply with the Vandenberg AFB PPMP. During the facility modification activities and operations associated with the proposed launches, methods to reuse or recycle materials and reduce the production of waste would be used. Those materials that cannot be reused or recycled would be properly disposed of in the Vandenberg AFB Sanitary Landfill. The types of pollution that would be generated during the silo modification and operation phases are discussed in Section 4.1 (Air Quality), Section 4.5 (Hazardous Materials/Waste Management), and Section 4.12 (Solid Waste), and Section 4.13 (Water Resources).

Vandenberg AFB P2 goals would be met during the implementation of the Proposed Action by requiring the separation of materials that could be reused or recycled. Methods would be evaluated that would reduce the amount of solid waste going to the landfill during operation. In addition, procurement of products with recycled material and substitution of hazardous materials with environmentally friendly products would be evaluated. Disposal is the final and least preferred option in the P2 hierarchy. Therefore, disposal would only occur when all other options have been exhausted. Disposal methods would comply with regulatory requirements and good management practices to prevent pollution by controlling impacts on human health and the environment.

4.10.2 No-Action Alternative

Under the No-Action Alternative, there would be no effect on P2.

4.10.3 Mitigation Measures

Compliance with the Vandenberg AFB PPMP will ensure that the project causes no significant impacts on pollution prevention programs; therefore, no mitigation measures would be required.

4.11 SOCIOECONOMICS

A project may result in a significant impact in the study area of socioeconomics if it alters substantially the location and distribution of the ROI population, causes the population to exceed historic growth rates, decreases jobs so as to substantially raise the regional unemployment rates or reduce income generation, substantially affects the local housing market and vacancy rates, or results in the need for new school services, the impact could be identified as significant.

4.11.1 Proposed Action

The Proposed Action would require an installation and facility modification crew of 15 workers during the site preparation for the launches, including approximately 40 percent non-local workers. In addition to the installation crew, 6 other personnel would be onsite for safety and general oversight. Two of these six people would be Vandenberg AFB personnel. Personnel coming from out of the area would be required to either commute or live temporarily in motel/transient facilities during the workweek.

During the operational phase of the Proposed Action (pre-launch, launch, and post-launch activities), up to 20 people would be needed for LF canister emplacement and LCC operations. A total of 20 people would be required for canister placement. Prior to the launch 5 people would be at LF-21 and 15 people would be at the LCC (Building 1978). During the launch all 20 people would be at the LCC. These people would return to LF-21 after the launch. The Proposed Action is a relatively short-term project and these workers would not be needed after the launches; therefore, there would be no permanent increases in population or need for permanent housing.

The labor requirement and materials associated with the proposed project represent a potential benefit to the economies of the adjacent communities. Although a small number of workers would be needed, the potential for labor to be supplied for silo modification represents potential direct benefits to the regional economy.

4.11.2 No-Action Alternative

The No-Action Alternative would not create any socioeconomic impacts. In addition, no new jobs would be created.

4.11.3 Mitigation Measures

No significant impacts to socioeconomic resources are anticipated from the proposed project. Therefore, no mitigation measures are required.

4.12 SOLID WASTE MANAGEMENT

Impacts to solid waste management would be considered significant if they resulted in noncompliance with applicable regulatory guidelines or increased the amounts of waste generated beyond available waste management capacities.

4.12.1 Proposed Action

Solid waste produced during the silo modification phase of the Proposed Action would include concrete, cardboard, scrap metals such as wire and rebar, shipping/packing materials, waste electrical equipment such as consoles, and other items used during construction and site preparation. The missile canister would be considered solid waste after the launch. Concrete, equipment, and other discarded debris generated from dismantling the silo during post-launch activities would also be considered solid waste.

No significant solid waste management impacts have been identified and therefore no mitigation measures would be required. However, recoverable solid waste generated by this project would be reused or recycled to meet AB 939 and Air Force solid waste reduction goals, in accordance with the Vandenberg AFB Solid Waste Management Plan (SWMP) (U.S. Air Force 1997). Once the missile canister is cleaned and characterized as "nonhazardous," it would be brought to DRMO to be recycled as scrap metal. Other recyclable materials generated by the Proposed Action would be taken to an offsite recycling facility. Non-recyclable wastes will be brought to the base landfill.

4.12.2 No-Action Alternative

Under the No-Action Alternative, there would be no impact on solid waste management.

4.12.3 Mitigation Measures

No significant impacts to solid waste are anticipated from the Proposed Action, therefore, no mitigation measures are required.

4.13 WATER RESOURCES

A project would have a significant impact on water resources if it caused substantial flooding or erosion; adversely affected any significant body of water, such as a stream, lake, or bay; exposed people to reasonably foreseeable hydrologic hazards such as flooding; or adversely affected surface water or groundwater quality or quantity. An impact to water resources would also be considered significant if it contributed to a water supply shortage at Vandenberg AFB.

4.13.1 Proposed Action

National Missile Defense Program industrial activities are not listed in 40 CFR, Part 122, Appendix A, which lists activities subject to National Pollutant Discharge Elimination Program (NPDES) requirements. Therefore, the Proposed Action is not subject to the requirements of the General Industrial Activities Storm Water Permit (General Permit No. CAS000001, Water Quality Order No. 92-03-DWQ). Particulates generated from the launch activities would potentially impact the quality of storm water discharge if conducted during a period of rain. Since the launch would not occur when it is raining, impacts to storm water would be less than significant.

The proposed project would require minimal water for operations. Therefore, the proposed project would not significantly affect the Vandenberg AFB water supply system.

The proposed project is not located within a 100-year floodplain, or tidal flood hazard area. Therefore, significant impacts due to tsunami or flooding would not be likely.

Septic waste would be contained in portable toilet facilities, and would therefore not affect groundwater resources. Blast residue would be contained within the launch silo, removed, and properly disposed of according to federal, state, local, and Air Force rules and regulations, and would not contact groundwater resources. Since the proposed project would not involve new excavation, withdrawal, or discharge to groundwater, there would be no significant impacts to groundwater resources.

4.13.2 No-Action Alternative

Under the No-Action Alternative, there would be no effects on water resources.

4.13.3 Mitigation Measures

Mitigation measures discussed in Sections 4.1.3 (Air Quality), 4.5.3 (Hazardous Materials/Waste Management), and 4.7.5 (Utilities) will ensure that there are no impacts to water resources.

4.14 CUMULATIVE IMPACTS

Cumulative impacts refer to two or more individual impacts that, when considered together, are significant, or compounds or increases other environmental impacts. The cumulative impact of several projects is the change in the environment that results from the incremental impact of the project when added to other closely related past, present, or reasonably foreseeable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.

4.14.1 Proposed Action

There are ongoing construction and renovation projects proposed on various sections of Vandenberg AFB on a regular basis during each year. Proposed projects include road repairs, and refurbishment and demolition of various structures on base. Also, launch activity at Vandenberg AFB occurs on a regular basis each year. Impacts to solid waste, infrastructure, and air quality would potentially occur if all of these projects and launches were to happen concurrently. However, due to the temporary, short-term nature of the Proposed Action and the staggered construction and launch schedule for future projects on the base, as well as the scattered locations of projects throughout the base, no significant cumulative impacts are anticipated.

4.15 ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

Adverse environmental effects that cannot be avoided include minor noise impacts to wildlife, disturbance of vegetation, minor increased generation of hazardous and solid waste, closure of public beaches and limited restriction to recreational areas, and increased levels of noise at the launch site. However, through implementation of the recommendations described within this document, these effects can be minimized.

4.16 CONFLICTS WITH FEDERAL, STATE, AND LOCAL LAND USE PLANS AND POLICIES, AND CONTROLS FOR THE AREA CONCERNED

Land use planning would follow the Base Comprehensive Plan. In addition, BV missile testing would comply with all federal, state, local, and Air Force rules and regulations.

The BV flight tests from an existing launch site on Vandenberg AFB would have no impact on land use itself and would present no conflicts with federal, regional, state, local, or American Indian land use plans, policies, or controls since Vandenberg AFB has been designated and devoted to supporting missile test and development programs.

4.17 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Anticipated energy requirements of the Proposed Action can be accommodated within the energy supply of the region. Energy requirements would be subject to any established energy conservation practices.

4.18 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

The amount of materials and energy required for the Proposed Action would be small. Although the Proposed Action would result in some irreversible and irretrievable commitment of resources such as various metallic materials, minerals, and labor, this commitment of resources is not significantly different from that necessary for many other defense research and development programs. It is similar to the activities that have been carried out in previous defense programs over the past several years.

4.19 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE HUMAN ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Activities at the proposed project location would take advantage of existing facilities and infrastructure with minor facility modifications required; therefore, the Proposed Action does not eliminate any options for future use of the environment for the location of the Proposed Action.

4.20 FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS (EXECUTIVE ORDER 12898)

The BV tests would be conducted in a manner that would not substantially affect human health or the environment. The environmental assessment has identified no adverse effects that would result in disproportionately high or adverse effect on minority or low-income populations offbase or within the proposed project vicinity. The activities would also be conducted in a manner that would not exclude persons from participation in, deny persons the benefits of, or subject persons to discrimination under the test program because of their race, color, or national origin. Heavily populated areas in Santa Barbara

County within vicinity of the proposed project area such as the Vandenberg AFB cantonment area, and the Cities of Lompoc and Santa Maria do not have disproportionate minority populations that would be impacted by Environmental Justice, therefore, these areas would not be affected by the Proposed Action.

5.0 APPLICABLE REGULATIONS AND AGENCY COORDINATION

5.0 APPLICABLE REGULATIONS AND AGENCY COORDINATION

This section provides a list of the federal, state, local, and Air Force regulations with which Vandenberg AFB staff and all test programs at Vandenberg AFB must comply prior to implementing the Proposed Action.

5.1 FEDERAL REGULATIONS

Archaeological and Historic Preservation Act (AHPA) (16 U.S.C. 469a *et seq.*). The AHPA is directed toward the preservation of historic and archaeological data that would otherwise be lost as a result of federal construction or other federally licensed or assisted activities. The Act authorizes the Department of the Interior (DOI) to undertake recovery, protection, and preservation of archaeological or historic data.

The *Clean Air Act (CAA)* (42 U.S.C 7401 to7671) states that all applicable state and national ambient air quality standards must be maintained during the operation of any emission source. The NAAQS include both primary and secondary standards for various pollutants. Primary standards are mandated by the CAA to protect public health, while secondary standards are intended to protect the public welfare from adverse impacts of pollution, such as materials soiling, vegetation damage, and visibility impairment.

The *Clean Air Act Amendments of 1990 (CAAA)* established new federal nonattainment classifications, new emission control requirements, and new compliance dates for areas in nonattainment. The nonattainment classifications are based on a design day value. The design day value is the fourth highest pollutant concentration recorded in a 3-year period. The requirements and compliance dates are based on the nonattainment classification.

The *CAAA* generally require O_3 nonattainment areas to demonstrate a reduction in volatile organic compound (VOC) emissions by 15 percent for the first 6 years (by 15 November 1996), and 3 percent annually thereafter, until attainment is reached. This plan to reach attainment is included in a State Implementation Plan (SIP) and shows current emission inventories and control measures that will lead to a reduction in future emissions.

The *Clean Water Act (CWA)* (33 U.S.C. 1251 *et seq.)* prohibits the discharge of pollutants from a point source into navigable waters of the United States, except in compliance with a NPDES (40 CFR Part 122) permit. The navigable waters of the United States are considered to encompass any body of water whose use, degradation, or destruction will affect interstate or foreign commerce.

The *Coastal Zone Management Act (CZMA)* of 1972 (16 U.S.C. 1421 to 1464) authorizes a state-federal partnership to ensure the protection of coastal resources. While federal facilities are excluded from the state's coastal zone, as required by Sections 305(b)(1) of the CZMA, the Act requires that federal activities directly affecting the coastal zone and federal development projects located in or directly affecting the coastal area be consistent "to the maximum extent practicable" with the state Coastal Management Program.

The *Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)* of 1980 (42 U.S.C. 9601 to 9675) responds to the immediate clean up of hazardous waste contamination from accidental spills or from waste disposal sites that may result in long term environmental damage. The term "Superfund" is used to refer to this law and the cleanup program it mandates.

The *Emergency Planning and Community Right-to-Know Act (EPCRA)* (42 U.S.C. 11001-11050) provisions of *Superfund Amendments and Reauthorization Act (SARA)* of 1986 establishes standards for community right-to-know programs and requires the reporting of releases of certain toxic chemicals. Local planning committees, comprising government, news media, industry, environmental organizations, and medical representatives, receive right-to-know information from facilities. Facilities with Standard Industrial Classification codes between 20 and 39 that manufacture, process, or otherwise use listed toxic chemicals, must report a release of these toxic chemicals to the environment, in greater than reportable quantities, on a Form R.

Executive Order 12856. Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements (1993). This Executive Order requires federal agencies to develop comprehensive pollution prevention strategies and to attempt reduction of their emissions of toxic chemicals or toxic pollutants by 50 percent by 1993. It also requires compliance with the reporting requirements of Sections 301-313 of *EPCRA.*

Executive Order 12088, under the authority of U.S. EPA, ensures that necessary actions are taken for the prevention, management, and abatement of environmental pollution from hazardous materials or hazardous waste caused by federal facility activities.

For all *Federal Communication Commission (FCC)* -regulated transmitters and facilities, the *FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields* (FCC OET Bulletin 65) requires that an Environmental Assessment be submitted if FCC approval to construct or operate a facility would likely result in a significant health hazard due to exposure to RF radiation.

The *Federal Aviation Administration (FAA)* is charged with the overall management of airspace and has established certain criteria and limits for use of various sections of airspace according to Federal Aviation Regulations, Part 71. The FAA requires NEPA documentation when a project would involve creation of new or expanded airspace, substantial increase in the use of airspace, or changes in airspace procedures.

National Environmental Policy Act (NEPA) (Public Law [P.L.] 91-190, 42 U.S.C. 4321-4347 as amended) requires federal agencies to analyze the potential environmental impacts of major federal actions and alternatives and to use these analyses as a decision making tool on whether and how to proceed with the Proposed Action.

National Historic Preservation Act (NHPA) (16 U.S.C. 470 *et seq.*). The *NHPA* is the key federal law establishing the foundation and framework for historic preservation in the United States. The Act authorizes the Secretary of the Interior to expand and maintain a National Register of Historic Places (NRHP); it establishes an Advisory Council on Historic Preservation as an independent federal entity; it requires federal agencies to take into account the effects of their undertakings on historic properties, and to afford the Advisory Council an opportunity to comment upon any undertaking that may affect properties listed, or eligible for listing, in the NRHP; and it makes the heads of all federal agencies responsible for the preservation of historic properties owned or controlled by their.

The *Occupational Health and Safety Act* (1970) OSHA was passed to develop and enforce mandatory job safety and health standards. OSHA provides mandatory health and safety guidelines for all workplace hazards.

The *OSHA Nonionizing Radiation Safety and Health Standard* (29 CFR 1910.97) establishes mandatory exposure limits for workers potentially exposed to RF radiation. It also establishes mandatory guidelines for RF hazard reduction such as warning signs and awareness training for workers.

The *National Pollution Prevention Act (PPA)* of 1990 (42 U.S.C 13101 to 13109) established a hierarchy declaring that pollution should be prevented or reduced at the source, whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner when feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner; and as a last resort disposal or release into the environment should be employed and be conducted in an environmentally safe manner.

The *Resource Conservation Recovery Act (RCRA)* of 1974 (42 U.S.C. 6901 *et seq.)* was designed to control the handling and disposal of hazardous substances by responsible parties. Hazardous waste, as defined by *RCRA*, is a "waste that may cause or significantly contribute to serious illness or death, or that poses a substantial threat to human health or the environment when improperly disposed." The treatment, storage, and disposal of solid waste (both hazardous and nonhazardous) is regulated under the *Solid Waste Disposal Act* as amended by *RCRA* and the Hazardous Solid Waste Amendments of 1984.

49 CFR Section 170 contains Department of Transportation (DOT) requirements for the shipment of hazardous materials. This section specifies the proper container type, shipping name, and labeling requirements for the transportation of hazardous materials.

5.2 STATE OF CALIFORNIA REGULATIONS

The *California Coastal Commission (CCC)* is responsible for reviewing proposed federal and federally authorized activities to assess their consistency with the approved state coastal management program. Any federal activity affecting the land or water uses or natural resources of the coastal zone is subject to the same substantive and procedural requirements under the consistency review provisions of *CZMA*. A Coastal Consistency Determination (CCD) may be required for any activity affecting the coastal zone. A federal agency planning to undertake an activity likely to affect the coastal zone must notify the Commission of the proposal at least 90 days before final approval of the federal action. The federal agency notification must include a statement indicating that the Proposed Action will be undertaken in a manner that is consistent to the maximum extent practicable with the California Coastal Management Plan (CCMP). The CCD must include a detailed description of the proposed activity, its associated facilities, and their combined coastal effects; and any information necessary to support the federal agency's conclusion. Federal agencies are strongly encouraged to obtain the assistance of the Commission staff in preparing a consistency determination.

In cases where the activity is the same as or similar to a past activity previously approved by the Commission, the federal agency should submit a Negative Determination and supporting information to the Commission at least 90 days before final approval of the activity (California Coastal Commission, 1992).

The *California Clean Air Act of 1988 (CCAA)* develops and implements a program to attain the California Ambient Air Quality Standards (CAAQS) for O_3, CO, NO_2, SO_2, PM_{10}, lead, SO_4, H_2S, and vinyl chloride. Similar to the federal nonattainment rating system, the state ozone nonattainment rating system is based on the design day concentration. Attainment is reached when the design day concentration falls below 0.09 ppm.

Serious nonattainment areas, such as Santa Barbara County, are required to implement new emission control measures. These control measures include an indirect and area source control program, application of Reasonably Available Control Technology (RACT) to existing stationary sources, a modification to the permitting program to achieve no net increase of emissions from new or modified stationary sources that have the potential to emit at least 25 tons per year of nonattainment pollutants or

their precursors, and consideration of reasonable transportation control measures. Vandenberg AFB will comply with the rules and regulations of the SBCAPCD.

The *CAA, 40 CFR Part 51,* gives state and local agencies the authority to establish air quality rules and regulations. Rules adopted by the local air pollution control districts and accepted by the Air Resources Board (ARB) are included in the SIP. When approved by the U.S. EPA, these rules become federally enforceable. The SBCAPCD, having received the necessary approvals, regulates stationary sources of air pollution in the county.

The *California Integrated Waste Management Act (CIWMA)* of 1989 specifies waste reduction mandates for municipal solid waste facilities. All California landfills, including the Vandenberg AFB Class III Landfill, must reduce the amount of solid waste received by 50 percent in the year 2000 from a baseline waste generation survey conducted in 1990. Construction and demolition debris accounted for nearly 50 percent of the total landfilled waste stream in calendar year 1995.

The *California Hazardous Waste Control Law (HWCL)* imposes obligations on facilities regarding the generation of hazardous waste. California's HWCL applies to federal facilities insofar as the law requires permitting, inspections, and monitoring. State waste disposal standards, reporting duties, and submission to state inspections are required of federal facilities.

California Administrative Code, Sections 66001 through 67181 contains California's hazardous materials regulations.

California Code of Regulations (CCR) Title 22 identifies wastes that are subject to regulation as hazardous wastes under this division and which are subject to the notification requirements of Health and Safety Code section 25153.6. It gives the criteria used by the Department of Toxic Substances Control (DTSC) to identify characteristics of hazardous wastes, identifies characteristics of hazardous waste, and lists particular hazardous wastes. It includes sampling procedures and requires the use of the best available technology.

Safe Drinking Water and Toxic Enforcement Act of 1986 (Prop. 65). This regulation deals with chemicals and substances determined by California to cause cancer or reproductive toxicity. This regulation and a list of chemicals/substances involved is published in Division 2 of Title 22 beginning with section 12000 of the CCR. It is also published in Title 26, which contains the regulations on toxic substances.

5.3 OTHER REGULATIONS

The *Air Force Occupational Health and Safety Regulations* provide mandatory health and safety standards and guidelines for the protection of Air Force personnel.

The *Air Force Radio Frequency Radiation (RFR) Safety Program* (AFOSH 48-9) establishes standards to prevent possible harmful effects to personnel from exposure to potentially hazardous levels of RFR. The Program also provides guidelines for RF hazard control and measurement surveys.

The *Air Force Instruction 32-7065*, Cultural Resources. This AFI establishes guidelines for analysis of cultural resource preservation.

Air Force Explosives Safety Standards (AFMAN 91-201) identifies hazards and states safety precautions and rules when personnel are working with explosives. It provides safe power densities and safe separation distances for storage, transport, and handling of EEDs near RF emitters.

The *Air Force Technical Manual T.O.31Z-10-4*, regarding electromagnetic radiation hazards, provides safe power densities for fuel handling near RF emitters.

5.4 FEDERAL, STATE, AND COUNTY REGULATORY REQUIREMENTS

The single point of contact for all project correspondence with environmental regulatory agencies and environmental permit applications is the Vandenberg AFB Environmental Management Office.

The following regulatory coordination is required:

- The project will comply with the requirements of the Coastal Zone Management Act.
- The requirements of Section 106 of the National Historic Preservation Act will be fully complied with prior to and during project implementation.

5.5 AIR FORCE APPROVALS AND REVIEWS

The following approvals, reviews, and other actions are required by Vandenberg AFB, prior to implementation of the Proposed Action:

- Completion of AF Form 103 (Civil Engineering Work Clearance Request) and field clearance of work site for natural and cultural resources, underground utilities, and ordnance prior to commencement of construction;
- Coordination with and approval from the Wing Safety Office (30 SW/SE) and Range Offshore and Airspace Management Office (30 RANS/DOUN); and
- Coordination with 30 CES Fire Department.

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6.0 REFERENCES

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Abrams, L., and R.S. Ferris
1940 Illustrated Flora of the Pacific States. Stanford University Press, Stanford.

Air Quality Management District (AQMD)
1998 http://www.aqmd.gov.

Allen, S.G., D.G. Ainley, and G.W. Page
1980 *Haul out Patterns of Harbor Seals in Bolinas Lagoon, California.* U.S. Marine Mammal Commission Report MMC-78/10. National Technical Information Service.

American Ornithologists' Union
1983 *Check-list of North American Birds. 6th edition.* American Ornithologists' Union, Washington D.C.

Barlow, J., R. Brownell, D. DeMaster, K. Forney, M. Lowry, S. Osmek, T. Ragen, R. Reeves, and R. Small
1995 *U.S. Pacific Marine Mammal Stock Assessment*, NOAA Technical Memorandum. NMFS, Publication Number NOAA-TM-NMFS-SWFSC-219. July.

Bechtel
1998 National Missile Defense Weapon System Test Support Vendor Interface Document for Vandenberg AFB LF-21. Vandenberg AFB, California.

Boeing
1998 National Missile Defense presentation. Boeing presentation at Vandenberg AFB organized by Valerie Coffey, Earth Tech, Hunstville, AL. December 9, 1998. Vandenberg AFB, California.

Blackburn, Thomas C.
1975 *December's Child: A Book of Chumash Oral Narratives.* University of California Press, Berkeley.

Brown, Patricia E., Ph.D.
1995 A Survey for Bats of the Soledad Mountain Project. Soledad Mountain Project EIR/EIS. Mojave, Kern County, California.

California Air Resources Board (CARB)
1998 http://www.arb.ca.gov.

California Department of Finance
1997 http://www.dof.ca.gov.

California Department of Fish and Game (CDFG)
1998 California Natural Diversity Data Base. Natural Heritage Division

California Regional Water Quality Control Board
1989 *Water Quality Control Plan, Central Coast Basin. Region 3.* San Luis Obispo, California.

Carucci, James
1999 Personal communication with J. Caruuci. Historic Structures Specialist/Environmental Planner, Vandenberg AFB, California. 12 February 1999.

CERL
1997 Cold War Properties Evaluation-Phase 2, Volume 2. June 1997.

Chambers Group, Inc. and Science Applications International Corporation
1997 Draft Technical Report, Phase I, II, and III Archaeological Survey for Cultural Resources Inventory, Vandenberg Air Force Base, Santa Barbara County, California. March 1997. Report available from National Technical Information Services, Operation Division, 5285 Port Royal Road, Springfield, Virginia 22161.

Chambers, J.R.
1979 The Natural History and Population of the California Sea Lion on Islands in the Vicinity of Diablo Canyon. Master's Thesis, California State Polytechnic University.

Chappell, M.A.
1980 Possible Physiological Effects of Space Shuttle Sonic Booms on Marine Mammals. In *Potential Effects of Space Shuttle Sonic Booms on the Biota and Geology of the California Channel Islands: Research Reports*, edited by J.R. Jehl and C.F. Cooper. Prepared by the Center for Marine Studies, San Diego State University and Hubbs Marine Research Center for the U.S. Air Force Space Division, on Contracts F-04701-78-C-0060 and F-04701-78-C-0178, CMS Technical Report 80-1. Pp. 195-228.

Christopher, S.V.
1996 *Reptiles and Amphibians of Vandenberg Air Force Base, Santa Barbara County, California, 1995.* Report No. 4, Museum of Systematics and Ecology, University of California, Santa Barbara, in cooperation with National Biological Service. San Simeon, California.

Collins, J.T.
1990 Standard Common and Current Scientific Names for North American Amphibians and Reptiles, 3rd Edition. Herpetological Circular No. 19. Society for the Study of Amphibians and Reptiles.

County of Santa Barbara
1995 Environmental Thresholds and Guidance Manual (uploaded as of January 1995. Santa Barbara County Planning and Development Department.

Dibblee, T.W., Jr.
1950 *Geology of the Southwestern Santa Barbara County, California.* California Division of Mines Bulletin 150.

Dibblee, T.W., Jr.
1988 *Lompoc/Surf Quadrangles, Santa Barbara County, California.* Department of Conservation, Division of Mines and Geology and U.S.G.S. map #DF-20.

Dibblee, Thomas W., Jr.
1989 *Geologic Map of the Casmalia and Orcutt Quadrangles, Santa Barbara County, California.* Dibblee Geological Foundation, Santa Barbara, California.

Dietrich, Don
1999 Personal communication with D. Dietrich, Aircraft Reporting Office, Vandenberg AFB, California

Erlandson, Jon M.
1993 Cultural Setting. In *Archaeological Investigations at CA-SBA-1731: A Transitional Middle-to-Late Period Site on the Santa Barbara Channel*, pp. 19–27. Prepared by Dames & Moore, Santa Barbara, California, for Exxon Company, U.S.A.

Erlandson, Jon, T. Cooley, and R. Carrico
1987 A Fluted Projectile Point Fragment from the Southern California Coast: Chronology and Context at CA-SBA-1951. *Journal of California and Great Basin Anthropology* 9:120–128.

Evenson, R.E., and G.A. Miller
1963 Geology and Groundwater Features of Point Arguello Naval Missile Facility, Santa Barbara County, California. U.S.G.S. Water Supply Paper 1619-F.

Federal Register
1995 *Proposed Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover.* March 1995; 41:11796.

Fugro West, Inc.
1998 *Geotechnical Study, Honda Ridge Road Repairs, Vandenberg Air Force Base, Santa Barbara County, California.* Prepared for Penfield & Smith, Santa Barbara, California.

Glassow, Michael
1991 Early Holocene Adaptations on Vandenberg Air Force Base, Santa Barbara County. In *Hunter-Gatherers of Early Holocene Coastal California*, edited by J. M. Erlandson and R. H. Colten, pp. 113–124. Perspectives in California Archaeology 1. Institute of Archaeology, University of California, Los Angeles.

Greenwood, Roberta S.
1978 Obispeno and Purisimeno Chumash. In *California*, edited by R.F. Heizer, pp. 520–523. Handbook of North American Indians, vol. 8, W.C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Haber, J.M.
1981 *Parametric Evaluation of Sonic Booms Resulting From the Ascent Phase of STS Launches From VAFB.* Department of the Air Force WSMC/SEY. Vandenberg Air Force Base, California. Technical Report No. 81-3076-1. Prepared by J.H. Wiggins Company, Redondo Beach, California.

Halliburton NUS Corporation (Halliburton)
1993 *Final EA for a Commercial Payload Processing Facility at Vandenberg AFB, California.*

Hart, Earl W.
1992 (revised) *Fault Rupture Hazard Zones in California - Alquist-Priolo Special Studies.* Zones Act of 1972 with Index to Special Studies Zones Maps. California Department of Conservation, Division of mines and Geology, Special Publication 42, Sacramento.

Hickman, J.C. (Ed.)
1993 *The Jepson Manual, Higher Plants of California.* University of California Press, Berkeley.

Holland, R.F.
1986 Preliminary Descriptions of the Terrestrial Natural Communities of California. Unpublished Report. State of California, The Resources Agency, Department of Fish and Game, Natural Heritage Division, Sacramento.

Holmgren, M.A., and P.W. Collins (Eds.)
1997 Draft Report on Distribution and Habitat Associations of Six Bird Species of Special Concern at Vandenberg Air Force Base, Santa Barbara County, California. Environmental Report No. 5, Museum of Systematics and Ecology, University of California, Santa Barbara, and Volume 1, Santa Barbara Museum of Natural History Regional Biodiversity Series. Santa Barbara, California.

Hudson, D.T., T. Blackburn, R. Curletti, and J. Timbrook (editors)
1977 *The Eye of the Flute: Chumash Traditional History and Ritual, as told by Fernando Librado Kitsepawit to John P. Harrington.* Malki Museum Press, Banning.

Hudson, D. T., and E. Underhay
1978 *Crystals in the Sky: An Intellectual Odyssey Involving Chumash Astronomy, Cosmology, and Rock Art.* Ballena Press Anthropological Papers 10. Socorro.

Hutchinson, C.B.
1980 Appraisal of Groundwater Resources in the San Antonio Creek Valley, Santa Barbara, California. U.S. Geological Survey Open-File Report 80-750.

Jacobs Engineering Group, Inc. (JEG)
1994 *Basewide Background Sampling Report.* Volumes I & II, Installation Restoration Program, Vandenberg AFB, California. JEG, Pasadena, California.

Johnson, John
1988 *Chumash Social Organization: An Ethnohistoric Perspective.* Ph.D. dissertation, Department of Anthropology, University of California, Santa Barbara. University Microfilms, Ann Arbor.

King, Chester
1984 Ethnohistoric Background. In *Archaeological Investigations on the San Antonio Terrace, Vandenberg Air Force Base, California, in Connection with MX Facilities.* Appendix I. Chambers Consultants and Planners, Stanton.

King, Chester
1990 *Evolution of Chumash Society.* Garland, New York.

Landberg, Leif
1965 *The Chumash Indians of Southern California.* Southwest Museum Papers No. 19. Los Angeles.

Lehman, P.E.
1994 *The Birds of Santa Barbara County, California.* Vertebrate Museum, University of California, Santa Barbara. Santa Barbara, California.

Martinez, Pablo
1998 Personal communication with P. Martinez. Environmental Restoration, 30 CES/CEVCR, personal communication, Vandenberg AFB, California.

Minerals Management Service (MMS)
1996 Outer Continental Shelf Oil and Gas Leasing Program: 1997-2002. *Final Environmental Impact Statement, August, Volume 1-2.* U.S. Department of the Interior, Washington, DC. MMS 96-0043.

Mullins, Lori
1998 Lead System Integrator (LSI) D&S IPT, Environmental, personal communication, Huntsville, Alabama.

Munz, P.A.
1974 *A Flora of Southern California.* University of California Press, Berkeley.

Munz, P.A., and D.D. Keck
1968 *A California Flora and Supplement.* University of California Press, Berkeley.

National Aeronautics and Space Administration (NASA)
1989 *Final Environmental Impact Statement, Space Shuttle Advanced Solid Rocket Motor Program.* John C. Stennis Space Center, George C. Marshall Space Center, National Aeronautics and Space Administration, Washington, DC.

National Geographic Society
1987 *Field Guide to the Birds of North America.* National Geographic Society, Washington D.C.

National Marine Fisheries Service (NMFS)
1993 *Environmental Assessment on Proposed Regulations Governing the Taking of Marine Mammals Incidental the Underwater Detonation of Conventional Explosives in the Offshore Waters of the Outer Test Range of the Naval Air Warfare Center, Pt. Mugu, California.* Department of Commerce, National Oceanic and Atmospheric Administration. October.

National Marine Fisheries Service (NMFS)
1994a *Supplemental Environmental Assessment on Issuing Letters of Authorization for the Taking of Marine Mammals Incidental to the Underwater Detonation of Conventional Explosives in the Offshore Waters of the Outer Sea Test Range of the Naval Air Warfare Center, Pt. Mugu, California.*

National Marine Fisheries Service (NMFS)
1994b Informal Section 7 consultation letter pursuant to the Endangered Species Act for the proposed launching of the Lockheed Launch Vehicle from Space Launch Complex 6 at Vandenberg Air Force Base, California. NMFS, Southwest Region, Long Beach, California. 23 March.

National Marine Fisheries Service (NMFS)
1995 Small Takes of Marine Mammals Incidental to Specified Activities; McDonnell Douglas Aerospace Delta II Vehicles at Vandenberg Air Force Base, California. *Federal Register* Volume 60, No. 160, 18 August 1995, p. 43120.

Nentwig, Mike
1999 Personal communication with M. Nentwig, 576 FLTS, personal communication, Vandenberg AFB, California.

Norris, R.M., and R.W. Webb
1990 *Geology of California, Second Edition.* John Wiley & Sons, Inc. New York.

Osland, Karen
1993 Archaeological Survey and Test Report for the Dix Road Upgrade Project, Vandenberg Air Force Base, California. Ms. on file, 730 CES/CEVPC, Vandenberg Air Force Base, California.

Reed, P.B., Jr.
1988 National List of Plant Species That Occur in Wetlands: California (Region 1). Biological Report 88(26.10). United States Fish and Wildlife Service, Washington, DC.

Reeves, R.R., B.S. Stewart, and S. Leatherwood
1992 The Sierra Club Handbook of Seals and Sirenians. Sierra Club Books, San Francisco. 359 p.

Reidman, M.
1990 *Sea Otters.* Monterey Bay Aquarium Foundation, Monterey, CA.

Reynolds, Smith and Hills, Inc. (Reynolds)
1985 *Installation Restoration Program, Phase I: Records Search, Vandenberg Air Force Base, California.* Prepared for HQ SAC/DEPV, Offut AFB, Nebraska, with the assistance of U.S. Air Force, HQ AFESC/DEVP, Tyndall AFB, Florida.

Richardson, W.J., C.R. Greene, C.I. Malme, and D.H. Thomson.
1995 *Marine Mammals and Noise.* Academic Press Inc., San Diego, California.

Roest, Michele
1995 *Final Report - Harbor Seals, Sea Otters and Sea Lions at Vandenberg Air Force Base, California.* Prepared for Vandenberg Air Force Base, California, under contract to The Nature Conservancy, San Luis Obispo, California. December.

Rogers, David Banks
1929 *Prehistoric Man of the Santa Barbara Coast.* Santa Barbara Museum of Natural History, Santa Barbara.

Santa Barbara County Association of Governments
1994 *Forecast 94.* Santa Barbara County, California.

Scheithauer, Chuck
1998 Personal communication with C. Sheithaur. Advance Plans and Analysis Directorate Western Operations, ITT Federal Services, Vandenberg AFB, California.

Science Applications International Corporation (SAIC)
1995 *Final Environmental Assessment, Family Housing Management Office, Vandenberg Air Force Base, California.* Prepared for the United States Air Force. On file, Vandenberg Air Force Base, California.

Skinner, M.W., and B.M. Pavlik
1994 *Inventory of Rare and Endangered Vascular Plants of California.* Fifth Edition. California Native Plant Society, Sacramento, California.

Smith, C.F.
1998 *A Flora of the Santa Barbara Region, California.* Second Edition. Santa Barbara Botanic Garden and Capra Press, Santa Barbara, California.

Spear, Michael
1998 30 CC/SGPB, personal communication, Vandenberg AFB, California.

Stebbins, R.C.
1985 A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Company, Boston.

Stewart, B.S.
1984 Diurnal Hauling Patterns of Harbor Seals at San Miguel Island, California. *J. Wildl. Manage.* 48(4) 1459–1460.

Stewart, B.S., J.K. Francine, and P.H. Thorson
1994 Taurus Launch at Vandenberg AFB, 13 March 1994; Sound Levels and Behavioral Responses of Harbor Seals (Phoca vitulina richardsi) at Purisima Point and Rocky Point, Final report to the U.S. Air Force/SMC/CEW. Hubbs/Sea World Research Institute Technical Report 94–252. 30 p.

Swift, C.C., P. Duangsitti, C. Clemente, K. Hasserd, and L. Valle
1997 *Biology and Distribution of Tidewater Goby,* Eucyclogobius newberryi, *on Vandenberg Air Force Base, Santa Barbara County, California.* Department of Biology, Loyola Marymount University, in cooperation with national Biological Service. San Simeon, California.

Sylvester, A.G. and A.C. Darrow
Structure and Neotectonics of the Western Santa Ynez Fault System in Southern California. *Tectonophysics,* v. 52, p. 389–405.

Talty, J.T. (ed.)
1988 *Industrial Hygiene Engineering*, 2nd edition. Noyes Data Corporation, Park Ridge, New Jersey.

Tan, Ron
1999 Personal communication with R. Tan. Santa Barbara County Air Pollution Control District, personal communication, Santa Barbara, California.

Tilley, Robert
1999 Personal communication with R. Tilley. UTEK, personal communication, Vandenberg AFB, California.

TRW
1998 *North Vandenberg AFB Facilities Report.* Prepared for the United State Air Force. Vandenberg AFB, California.

URS Corporation
1986 *San Miguel Project and Northern Santa Maria Basin Area Study - Final Environmental Impact Statement/Environmental Impact Report.* Prepared for County of San Luis Obispo, Minerals Management Service, State Lands Commission, County of Santa Barbara, California Coastal Commission, and California Office of Offshore Development. October.

U.S. Air Force
1986 Mineral Resource Management Plan (Final), Potential Exploration, Development, and Production of the Oil and Gas. Vandenberg AFB, California.

U.S. Air Force
1987 Mineral Resource Management Plan (Final), Potential Exploration, Development, and Production of the Oil and Gas. Vandenberg AFB, California.

U.S. Air Force
1988 *Historic Preservation Plan, San Antonio Terrace National Register District, Vandenberg Air Force Base, California.* Prepared by Tetra Tech, Inc., San Bernardino, California. Prepared for United States Air Force, AFRCE-BMS, Norton Air Force Base, California (VAFB-1988-14).

U.S. Air Force
1989 Vandenberg Air Force Base Comprehensive Plan. Vandenberg AFB, California.

U.S. Air Force
1992 *Land Management Plan for Vandenberg Air Force Base, California, for Plan Period 1992 to 1997.* National Resources and Comprehensive Planning Division, Michael McElligott, Ecologist.

U.S. Air Force
1994 *EA, Lockheed Launch Vehicle.* Vandenberg AFB, California.

U.S. Air Force
1995a *North Vandenberg AFB Facilities Study.* Prepared by 576th Flight Test Squadron and TRW. Prepared for the 30th Space Wing, Vandenberg AFB, California.

U.S. Air Force
1995b *Supplemental Preliminary Assessment Final Report, Installation Restoration Program.* Prepared by Tetra Tech, Inc. Prepared for Vandenberg Air Force Base, California.

U.S. Air Force
1996a *Integrated Natural Resource Management Plan, Management.* Prepared by Tetra Tech, Inc. Prepared for 30 CES/CEV, Vandenberg AFB, California.

U.S. Air Force
1996b *30th Space Wing Pollution Prevention Management Plan (PPMP).* Prepared by Tetra Tech, Inc. Prepared for Vandenberg AFB, California.

U.S. Air Force
1996c 30th Space Wing Hazardous Waste Management Plan (HWMP). Prepared for Vandenberg AFB, California.

U.S. Air Force
1996d *Draft Environmental Impact Statement for the Program Definition and Risk Reduction Airborne Laser Phase.* September.

U.S. Air Force
1997a *Final Integrated Natural Resources Management Plan.* Prepared by Tetra Tech, Inc., Santa Barbara. Prepared for 30th Space Wing, Vandenberg AFB, California.

U.S. Air Force
1997b *Asbestos Management Plan.* 30 SW Plan 32-1052-A. Prepared for Vandenberg AFB, California.

U.S. Air Force
1997c *Lead-Based Paint Management Plan.* 30 SW Plan 32-1002. Prepared for Vandenberg AFB, California.

U.S. Air Force
1997d *30th Space Wing Solid Waste Management Plan (SWMP).* Prepared by Tetra Tech, Inc. Prepared for Vandenberg AFB, California.

U.S. Air Force
1998a *Polychlorinated Biphenyls Management Plan (PCB).* 30 SW Plan 32-7045D(U) 4 December 1998.

U.S. Air Force
1998b *Work Request 10 Final Technical Report.* Prepared by Tetra Tech, Inc. Prepared for Vandenberg Air Force Base, California.

U.S. Air Force
1998c http://afpubs.hq.af.mil.

U.S. Air Force
1999 30th Space Wing Safety Reference Disk, Flight Safety Analysis Handbook, 30 SW/SE. Vandenberg AFB, California.

U.S. Army Space and Strategic Defense Command (U.S. Army)
1997 *Theatre Ballistic Missile Targets Programmatic EA.* Prepared for Vandenberg AFB, California.

U.S. Army Space and Strategic Defense Command (U.S. Army)
1998 *Preliminary Draft Integration, Assembly, Testing and Checkout Activities EA.*

U.S. Bureau of the Census
1990 http://www.census.gov

U.S. Department of Agriculture
1958 *Soil Survey, Santa Barbara Area, California.* Soil Conservation Service in Cooperation with the University of California Agricultural Experiment Station, Washington, DC.

U.S. Geologic Survey (USGS)
1998 Vandenberg AFB Well Inventory Database (unpublished EXCELL file).

Vandenberg AFB
1999 Weather Squadron, Vandenberg AFB, California.

Versar, Inc.
1991 *Environmental Assessment - Vandenberg Air Force Base Atlas II Program.* Versar Project No. 73-5164-06. Prepared for TRW Systems Integration Group. 2 August.

Wallace, William
1955 A Suggested Chronology for Southern California Coastal Archaeology. In *Southwest Journal of Anthropology* 11:214–230.

Warren, Claude N.
1968 Cultural Tradition and Ecological Adaptation on the Southern California Coast. In *Archaic Prehistory in the Western United States*, edited by C. Irwin-Williams, pp. 1–14. Eastern New Mexico University Contributions in Anthropology 1(3).

Woodring, W.P., and M.N. Bramlette
1950 *Geology and Paleontology of the Santa Maria District, California.* U.S.G.S. Prof Paper No. 222.

Woodward-Clyde Consultants (Woodward-Clyde)
1980 *Surface Fault Traces and Historical Earthquake Effects Near Los Alamos Valley, Santa Barbara, California.* Final Technical Report. Prepared for the U. S. Geological Society

Woodward-Clyde Consultants (Woodward-Clyde)
1985 *Seismic Study–Launch Complex C, Vandenberg AFB.* Prepared for Space Transportation Systems Division, Rockwell International Corporation by Englekirk and Hart Consulting Engineers Inc. and Woodward-Clyde Consultants.

7.0 PERSONS AND AGENCIES CONTACTED

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The following individuals were consulted during preparation of this EA:

Brown, MSgt. Jerry
576 Flight Training Squadron, Vandenberg Air Force Base, California

Garcia, Gilbert
Flight Safety Analyst, 30 SW/SEY, Vandenberg Air Force Base, California

Goldberg, Jane
30 CES/CECB, Vandenberg Air Force Base, California

Hoyt, Vance
30 CES/CECB, Vandenberg Air Force Base, California

Hutton, Paul
Cable Affairs, Vandenberg Air Force Base, California

Hunt, Staff Sgt.
Flight Medicine, Vandenberg Air Force Base Flightline, Vandenberg Air Force Base, California

Johnston, Jim
30 CES/CEVP, Vandenberg Air Force Base, California

Mullins, Lori W.
LSI D&S IPT, Environmental, Huntsville, Alabama

Nentwig, MSgt. Michael
576 Flight Training Squadron, Vandenberg Air Force Base, California

Scheithauer, Arthur Charles
Advance Plans and Analysis Directorate, Western Operation, ITT Federal Services, Vandenberg Air Force Base, California

Smalls, Freezy
Environmental Coordinator, Defense Reutilization Marketing Organization, Vandenberg Air Force Base, California

Tan, Ron
Santa Barbara County Air Pollution Control District, Santa Barbara, California

Tilley, Robert
Communications Technician, UTEK, Vandenberg Air Force Base, California

White, Sgt. James
576 Flight Training Squadron, Vandenberg Air Force Base, California

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8.0 LIST OF PREPARERS

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Bach, Margaret, Staff Geologist, Tetra Tech, Inc.
B.A., 1991, Geology, Mount Holyoke College
Years of Experience: 7

Cushing, Kenneth, Word Processor III, Tetra Tech, Inc.
Chemistry, Georgia Institute of Technology, Atlanta, Georgia
Years of Experience: 3

Eldridge, Jacqueline C., Publications Manager, Tetra Tech, Inc.
B.S., 1971, Biology, Fairleigh Dickinson University, Teaneck, New Jersey
M.S., 1978, Marine Science, Long Island University, Greenvale, New York
M.B.A., 1983, Business Administration, National University, Vista, California
Years of Experience: 22

Emery, Angela D., Associate Environmental Scientist, Tetra Tech, Inc.
B.S., 1998, Environmental Studies (concentration Biological Sciences), University of California, Santa Barbara
Years of Experience: 1

Fowler, Sarah, Intern Environmental Scientist, Tetra Tech
B.S.c., 1998, Geology, Russian, University of Canterbury, New Zealand
Years of Experience: 1

Gard, Scott W., Senior Environmental Program Manager, Tetra Tech, Inc.
B.A., 1965, Economics, University of Missouri, Kansas City
M.A., 1970, Economics, University of Missouri, Kansas City
Years of Experience: 27

Gerber, Joyce L., Archaeologist, Applied EarthWorks
B.A., 1979, Anthropology, Ohio State University, Columbus
M.A., 1992, Archaeology, University of California, Santa Barbara
Years of Experience: 16

Green, Alice V., Project Scientist, Tetra Tech, Inc.
B.A., 1976, Biology (concentration Marine Biology), University of Pennsylvania, Philadelphia
M.S., 1978, Management (concentration Marine Resources Management), Texas A&M University, College Station
Years of Experience: 14

Ige, Geri K., Graphics Designer, Tetra Tech, Inc.
Fine Arts, University of California, Irvine
Years of Experience: 19

Kefauver, Kathleen, Senior Biologist, Tetra Tech, Inc.
B.A., 1987, Biological Sciences, University of California, Santa Barbara
Years of Experience: 15

Knight, Tricia, Associate Environmental Scientist, Tetra Tech, Inc.
B.A., 1995, Environmental Studies, University of California, Santa Barbara
Years of Experience: 4

Lum, Luanne, Environmental Scientist, Tetra Tech, Inc.
B.A., 1985, Environmental Design and Planning, University of Colorado
Years of Experience: 12

McGinnis, Christina E., Environmental Planner, Tetra Tech, Inc.
B.A., 1991, History, University of California, Los Angeles
M.A., 1994, Urban Planning, University of Oregon, Eugene
Years of Experience: 6

Parsons, Francesca, Hydrologist, Tetra Tech, Inc.
B.S., 1987, Geology, University of Idaho
M.S., 1990, Hydrology-Hydrogeology, University of Nevada, Reno
Years of Experience: 7

Randall, Diane, GIS Specialist, Tetra Tech, Inc.
Technical Certificate, Computer Programming, Sawyers College, Ventura, California
Technical Certificate, Program Management, Moorpark College, California
Years of Experience: 12

Steele, James, R.G., Engineering Geologist/Hydrologist, Tetra Tech, Inc.
B.A., Geological Sciences and Geography, University of California, Santa Barbara
Years of Experience: 8

Wellhausen, Nancy, Air Quality Specialist, Tetra Tech, Inc.
Chemical Engineering, University of California, Santa Barbara
Years of Experience: 10

Wilbarger, Shari L., Staff Environmental Scientist, Tetra Tech, Inc.
B.A., 1992, Environmental Studies, University of California, Santa Barbara
M.A., 1997, City and Regional Planning, California State Polytechnic University, San Luis Obispo
Years of Experience: 5

Yan, Michael, Associate Engineer, Tetra Tech, Inc.
B.S., 1998, Environmental Engineering, California Polytechnic State University, San Luis Obispo
Years of Experience: 3

9.0 ACRONYMS AND ABBREVIATIONS

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30 CES/CEVP	30th Civil Engineering Squadron, Environmental Management Flight, Program Planning
AB	Assembly Bill
ACHP	Advisory Council on Historic Preservation
AFB	Air Force Base
AFOSH	Air Force Occupational Safety and Health
AFPPP	Air Force Pollution Prevention Program
AHPA	Archaeological and Historic Preservation Act
Al_2O_3	aluminum oxide
AOC	Area of Concern
AOI	Area of Interest
APE	area of potential effects
AQCR	Air Quality Control Region
ARB	Air Resources Board
BCP	Base Comprehensive Plan
BHPO	Base Historic Preservation Officer
bgs	below ground surface
BMDO	Ballistic Missile Defense Organization
BMP	Best Management Practices
BOA	broad ocean area
BV	Booster Verification
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAAQS	California Ambient Air Quality Standards
Cal EPA	California Environmental Protection Agency
Cal OSHA	California Occupational Health and Safety Act
CAP	Clean Air Plan
CAP	Collection Accumulation Point
CARB	California Air Resources Board
CCAA	California Clean Air Act
CCA	California Coastal Act
CCC	California Coastal Commission
CCMP	California Coastal Management Plan
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and liability Act
CFR	Code of Federal Regulations
CIWMA	California Integrated Waste Management Act
CLE	Command Launch Equipment
CNDDB	California Natural Diversity Data Base
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	carbon monoxide
COPC	Chemical of Potential Concern

CRWQCB	California Regional Water Quality Control Board
CZMA	Coastal Zone Management Act
dB	decibel(s)
dBA	A-weighted decibels
DERP	Defense Environmental Restoration Program
DOD	Department of Defense
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Organization
DTSC	Department of Toxic Substances Control
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-know Act
ESA	Endangered Species Act
ESQD	Explosive Safety Quantity Distance
EWR	Eastern and Western Range
°F	degrees Fahrenheit
FAA	Federal Aviation Administration
FM	Fine Particulate Matter
FOT&E	Follow-on Operational Test & Evaluation
FPE	federally proposed endangered species
FSA	Flight Safety Analyst
FSC	federal species of concern
ft	feet
FTS	Flight Termination System
HAP	Hazardous Air Pollutant
HSWA	Hazardous and Solid Waste Amendments
HWMP	Hazardous Waste Management Plan
HWCL	Hazardous Waste Control Law (California)
ICBM	intercontinental ballistic missile
IFT	Integrated Flight Test
ILL	impact limit line
IRP	Installation Restoration Program
JPO	Joint Program Officer
LCC	Launch Control Center
L_{DN}	day-night average sound level
L_{eq}	time-averaged equivalent noise level
LF	Launch Facility
MM	Minuteman
MMS	Minerals Management Service

MOA	Memorandum of Agreement
msl	mean sea level
MSDS	Material Safety Data Sheet
MRPA	Marine Resources Protection Area
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMD	National Missile Defense
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
O_3	ozone
OSHA	Occupational Safety and Health Act
P2	pollution prevention
Pb	lead
PG&E	Pacific Gas & Electric
PM_{10}	particulate matter 10 microns or less in diameter
PPA	Pollution Prevention Act
ppm	parts per million
PPMP	Pollution Prevention Management Plan
psf	ponds per square foot
RANS/DOUN	Range Operations Flight – Airspace Management 30 RANS/DOUN
RCRA	Resource Conservation and Recovery Act
ROC	Reactive Organic Compounds
ROI	Region of Influence
ROP	Rate of Progress
RSLP	Rocket Systems Launch Program
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act
SBCAPCD	Santa Barbara County Air Pollution Control District
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SOP	Standard Operating Procedure
SPL	Sound Pressure Level
SSZ	Special Studies Zone
SWFP	Solid Waste Facility Permit
SWMP	Solid Waste Management Plan
USAKA	United States Army Kwajalien Atoll
U.S.C.	U.S. Code
USDA	United States Department of Agriculture
USGS	United States Geologic Survey

USFWS	United States Fish and Wildlife Service
UST	underground storage tank
VOC	volatile organic compound
WDR	Waste Discharge Requirement

A AIR CONFORMITY ANALYSIS

APPENDIX A
AIR CONFORMITY ANALYSIS

1.0 CONFORMITY DETERMINATION

1.1 INTRODUCTION

Vandenberg Air Force Base (AFB) is located on the central coast of California about 150 miles northwest of Los Angeles. Covering more than 98,000 acres, it is the third largest U.S. Air Force installation. It is operated by the 30th Space Wing, and is the only military installation in the United States from which satellites are launched into polar orbit and from which intercontinental ballistic missiles are launched to verify weapon system performance. Military operations at Vandenberg AFB date back to 1941, when, known as Camp Cooke, it served as an Army training facility for armored and infantry troops.

1.2 REGULATION BACKGROUND AND RULE SUMMARY

The U.S. Air Force is required to make a formal conformity analysis whether the Proposed Action at Vandenberg AFB complies with general conformity guidance and requirements set forth by Congress in section 176 (B)(4) of the Clean Air Act (CAA) and regulations under 40 Code of Federal Regulations (CFR), part 51, subpart W.

The conformity analysis will include:

- Applicability analysis;
- Emission estimates based on reasonably foreseeable impacts of federal action;
- Quantification of direct and indirect criteria pollutants and precursor emissions, including stationary and mobile emission sources;
- *De minimis* evaluation; and
- Reporting requirements (if a conformity determination is required).

General conformity is a two-step process comprising applicability analysis and a conformity determination if *de minimis* levels are exceeded. An applicability analysis is performed according to Subpart 93.153 of the federal regulation. This requires the total direct and indirect project emissions to be compared with the *de minimis* thresholds based on the region's nonattainment status and regional emission levels. As required by the CAA, states establish State Implementation Plans (SIPs) to demonstrate how nonattainment areas plan to come into compliance with National Ambient Air Quality Standards (NAAQS).

The proposed federal action must not:

- Cause a violation of NAAQS;
- Contribute to an increase in the frequency or severity of violations of existing NAAQS; or

- Delay the timely attainment of any NAAQS interim milestones to achieve attainment.

The conformity analysis considers whether the project conforms to the guidelines of the most recent federally approved SIP, as stated in section 176(B) of the CAA. The most recent federally approved SIP for Santa Barbara County is based on the 1982 Clean Air Plan (CAP) requiring Santa Barbara County to demonstrate attainment for nonattainment criteria pollutants; however, the county was unable to meet the emission conditions specified in the CAP. In order to show a rate of progress to the U.S. Environmental Protection Agency (U.S. EPA), the Santa Barbara County Air Pollution Control District (SBCAPCD) and the Santa Barbara County Association of Governments (SBCAG) submitted the 1994 CAP to the U.S. EPA. This updated plan complies with the requirements of the CAA, which outlines Santa Barbara County's milestones with respect to the Rate of Progress Plan (ROP); a demonstration that the federal O_3 standard will be attained by 1996 using computer modeling techniques; and a maintenance plan showing that the federal O_3 standards will remain in attainment through 2006. In addition, the plan specifies a "growth allowance" for projects that are subject to positive conformity review.

1.2.1 Emission Thresholds and Quantification

The emission threshold for analyzing conformity is based on the NAAQS attainment standard for Santa Barbara County. The NAAQS classification for Santa Barbara County is serious nonattainment for ozone (O_3). Particulate matter 10 microns or less in diameter (PM_{10}), oxides of sulfur (SO_x), carbon monoxide (CO), and lead (Pb) are classified as in attainment. The serious nonattainment status and corresponding threshold of 50 tons per year for O_3 precursor emissions will be used to determine general conformity.

Emission quantification is defined as the sum of all direct and indirect criteria pollutants and precursor emissions, including stationary and mobile emission sources. Direct and indirect emissions are distinguished by timing and location rather than the type of emission source. Direct emissions occur at the same time and place as the federal action. Indirect emissions include those that may occur later or at a distance from the federal action. General conformity limits the scope of indirect emissions to those that can be quantified and are reasonably foreseeable by the federal agency at the time of analysis, and those for which the federal agency can practicably control and maintain control of through its continuing program responsibility.

1.2.2 Evaluating Conformity and Reporting Requirements

The general conformity rule applies to federal actions that are not covered by the transportation conformity rule, with several listed exceptions. Other than the listed exemptions and presumptions of conformity, general conformity applies to actions in which projected emissions exceed applicable conformity *de minimis* thresholds. However, if the emissions from a federal action do not equal or exceed *de minimis* thresholds but do represent 10 percent or more of a nonattainment or maintenance area's total emissions of any criteria pollutant, the action is considered "regionally significant" and the requirements of conformity determination apply.

The reporting requirements for the conformity analysis are not required if the Proposed Action's direct and indirect emissions are less than the established *de minimis* thresholds and are not considered regionally significant.

1.3 PROPOSED ACTION

The Proposed Action will include reactivation and minor site preparation of LF-21 silo, minor modification of Building 1978 and 1959, BV launches, and post-launch activities. The site preparation

and refurbishment phase of the project will take phase over a 4-month period, with the BV test launches taking place as early as the year 2000.

1.4 AIR QUALITY JURISDICTION AND ATTAINMENT STATUS

The Proposed Action is subject to SBCAPCD rules, regulations, and jurisdiction. NAAQS classification for SBCAPCD is serious nonattainment for O_3. PM_{10}, SO_x, CO, and Pb are classified as in attainment. The serious nonattainment status and corresponding threshold for O_3 will be used to determine general conformity. U.S. EPA threshold limits used to determine general conformity are listed in Table A-1.

Table A-1
U.S. EPA Threshold Limits Used to Determine General Conformity

Criteria Pollutant	Attainment Levels	Threshold Level (tons/yr)
Ozone (volatile organic compound [VOC] or NO_x)	Serious	50
	Severe	25
	Extreme	10
	Other ozone nonattainment areas outside of ozone transport region	100
VOC	Marginal/moderate nonattainment within ozone transport region	50
NO_x	Marginal/moderate nonattainment within ozone transport region	100
CO	All Non-Attainment Areas	100
PM_{10}	Moderate	100
	Serious	70
SO_2 or NO_2	All Non-Attainment Areas	100
Pb	All Non-Attainment Areas	25

Source: 40 CFR 93.135 (b).

1.5 SBCAPCD EMISSIONS SUMMARY

The SBCAPCD 1990 Base Year Emission Inventory, as listed in the 1994 CAP, was compared with the total emissions generated from operations at LF-21 at Vandenberg AFB. This comparison was performed to determine whether the proposed federal action is "regionally significant." The SBCAPCD 1990 Base Year Emission Inventory is listed in Table A-2.

Table A-2
1990 Base Year Emission Inventory
SBCAPCD Summary of Emissions, Major Source Categories

Source	NO_x	ROC
Stationary Source Area and Point Sources (tons/yr)	4,946.27	42,999.70
Mobile Sources (tons/yr)	8,015.37	13,275.99
Outer Continental Shelf Stationary and Mobile Sources (tons/yr)	8,059.17	2,908.41
Total	**21,020.81**	**59,184.1**

Source: SBCAPCD 1994 Clean Air Plan.

Outer Continental Shelf (OCS) sources are part of SBCAPCD jurisdiction and the county emission inventory; therefore, OCS emissions sources were included in the total emissions when determining whether a federal action is regionally significant.

1.6 PROPOSED ACTION EMISSIONS AND CONFORMITY DETERMINATION

The serious nonattainment status of Santa Barbara County and the corresponding threshold of 50 tons per year for O_3 should be used to determine general conformity. Table A-3 shows a comparison of the estimated annual project emissions with the threshold levels.

Table A-3
Proposed Project Emissions
at Vandenberg AFB

Emissions	NO_x (tons/yr)	ROC (tons/yr)
Project emissions[1]	0.13347	0.10989
Conformity threshold	50	50
Significance	No	No

Notes: 1 - Project emissions are summarized in Table 4-3.

A comparison among the SBCAPCD 1990 Base Year Emission Inventory Levels, the Proposed Action emissions, and the percentage of emissions contributed by the Proposed Action is shown in Table A-4. Results show the proposed project emissions will be less than 1 percent of the SBCAPCD 1990 Base Year Emission Inventory.

Table A-4
Comparison of SBCAPCD 1990 Base Year Emission Inventory
and Proposed Project Emissions to 10 Percent *de minimis* Threshold

Source Summary	NO_x	ROC
SBCAPCD 1990 Base Year Emission Inventory (tons/yr)	21,020.81	59,184.1
Proposed Project Emissions (tons/yr)	0.13347	0.13689
Percent of SBCAPCD 1996 Forecast Planning Emission Inventory (%)	<1.0	<1.0
Percent Conformity Threshold (%)	10	10
Significance	No	No

2.0 TECHNICAL ASSUMPTIONS

Based on estimates provided by the project proponent, the following assumptions were made regarding the required labor, site preparation equipment, work duration, materials, and motor vehicle travel for the BV tests. In most cases, these technical assumptions represent worst-case scenarios.

2.1 LABOR AND DURATION

It is estimated that a maximum of 20 workers will be required to perform the various site preparations and operational related tasks. In addition it is assumed that the entire site preparation takes four months and the launches will occur as early as the year 2000. As a worst case scenario, the project, including site preparations, the BV launches, and post-launch activities, will occur within the same year.

2.2 SITE PREPARATION EMISSIONS

Site preparation emissions would be the result of commuting vehicles and construction vehicle traveling on paved and unpaved roads. The PM_{10} emissions would be the emissions of significant for this phase and are summarized in Table A-5.

2.3 SITE PREPARATION PM_{10} SUPPRESSION MEASURES

Although no significant PM_{10} emissions are anticipated, standard measures to reduce PM_{10} emissions to avoid potentially significant air quality impacts, including the effect of residual impacts, are described below. A 50 percent reduction in fugitive dust would be achieved through proper implementation of the following measures:

- During operation, water trucks or sprinkler systems will be used to keep all areas of vehicle movement damp enough to prevent dust from leaving the site. At a minimum, this mitigation will include wetting down such areas in the late morning and after work is complete for the day. Increased watering frequency will take place whenever the wind speed exceeds 15 miles per hour. This practice will also ensure compliance with SBCAPCD Rule 302 Visible Emissions.

- Vehicle speed on the disturbed area will be no more than 15 miles per hour.

- Any imported, exported, and stockpiled fill material will be covered. All trucks transporting material will be tarped from the point of origin.

- The contractor's foreman will be responsible for implementing and monitoring the mitigation measures. The mitigation measures will also be noted on the grading and building plans.

2.4 FACILITY OPERATION EMISSIONS

Buildings 1978 and 1959 are currently active, therefore, it is assumed that existing support facilities source equipment is accounted for in Vandenberg AFB's comprehensive emissions inventory and included in the Santa Barbara County 1994 Clean Air Plan.

Table A-5
Site Preparation PM10 Emission

Vehicle Type	Travel Route	Duration (days)	Number of Units (#)	VMT/day	Emission Factor (lbs/VMT)1	PM10 (lbs/day)	PM10 (lbs/project)	PM10 (tons/project)	Emission Factor Criteria	Reference to Table Number
Passenger	**surface road**	30	20	60	0.018	21.6000	648.0000	0.3240	passenger vehicle on paved road with street cleaning	A 9-9B
Passenger	**highway**	30	20	60	0.018	21.6000	648.0000	0.3240	passenger vehicle on paved road with street cleaning	A 9-9B
Utility Truck	**unpaved road**	2	1	0.75	23	17.2500	34.5000	0.0173	trucks on unpaved roadway	A 9-9D
Utility Truck	**surface road**	2	1	5	0.4	2.0000	4.0000	0.0020	trucks on paved roadways with street cleaning	A 9-9D
Contractor Truck	**surface road**	15	3	5	0.4	6.0000	90.0000	0.0450	trucks on paved roadways with street cleaning	A 9-9D
Flatbed Truck	**surface road**	15	2	5	0.4	4.0000	60.0000	0.0300	trucks on paved roadways with street cleaning	A 9-9D
Concrete Truck	**surface road**	1	1	60	0.4	24.0000	24.0000	0.0120	trucks on paved roadways with street cleaning	A 9-9D
Utility Truck	**highway**	2	1	60	0.4	24.0000	48.0000	0.0240	trucks on paved roadways with street cleaning	A 9-9D
Contractor Truck	**highway**	15	3	10	0.4	4.0000	60.0000	0.0300	trucks on paved roadways with street cleaning	A 9-9D
Flatbed Truck	**highway**	15	2	10	0.4	4.0000	60.0000	0.0300	trucks on paved roadways with street cleaning	A 9-9D
Concrete Truck	**highway**	1	1	10	0.4	4.0000	4.0000	0.0020	trucks on paved roadways with street cleaning	A 9-9D
	Total PM 10 Emissions					**132.4500**	**1680.5000**	**0.8403**		

Notes: 1 - Emission Factors are from South Coast Air Quality Management District CEQA Air Quality Handbook Table A9-9 (default values)

In addition, four gallons of high-temperature industrial maintenance coatings will be used for corrosion maintenance after each launch on the silo; a total of eight gallons of coating will be used for the Proposed Action. The ROC emissions resulting from the painting operations are summarized on the following Table A-6:

Table A-6
Painting Operation Emissions

Pollutant	Project Coating Usage (gal/yr)	Emission Factor (g VOC/L)[1]	ROC (tons/yr)
ROC	8	250	0.01402

Note: 1 - High-Temperature Industrial Maintenance Coating Emission Factor from SBCAPCD Rule 323- Architectural Coatings.

2.5 LAUNCH VEHICLE EMISSIONS

Launch vehicle emissions are based on Table D-4a, Exhaust Products to the Lower Atmosphere from 0 to 5,000 feet, of the LLV-EA (See attachment A-1 pg. 53). Resulting emissions from solid rocket fuel propellant combustion are Al_2O_3, HCl, CO_2, and CO. To obtain the emissions for the two BV launches under the Proposed Action, the emissions for each pollutant from Table D-4a were multiplied by two. Proposed Action launch vehicle emissions are presented in Table A-7.

Table A-7
Proposed Action Launch Vehicle Emissions

Pollutant	Emission (tons)
Al_2O_3 (PM_{10})[1]	10.8012
HCl	5.7579
CO_2	0.6241
CO	7.1530

Notes: 1 - Based on worst-case scenario, Al_2O_3 combustion by-products will form particulate matter equal or less than 10 microns.

2.6 MOBILE SOURCE EXHAUST EMISSIONS

Mobile source exhaust emissions associated with this project include emissions from canister transport, mobile source equipment, and worker commuting.

2.6.1 Canister Transportation

The two canisters would be transported to Vandenberg AFB separately, via a C-5 or C-17 carrier aircraft or carrier truck. The C-5 has a larger engine than the C-17, it is used to estimate the emissions. The C-5 emissions are presented in Table A-8.

Table A-8
C-5 Carrier Aircraft Emissions

Engine Setting	Number of Operation (#)	Duration (hr)1	NOx Emission Rate (lb/hr/Operation)2	NOx (ton/yr)3	SOx Emission Rate (lb/hr/Operation)2	SOx (ton/yr)3	CO Emission Rate (lb/hr/Operation)2	CO (ton/yr)3	PM Emission Rate (lb/hr/Operation)2	PM (ton/yr)3	VOC Emission Rate (lb/hr/Operation)2	VOC (ton/yr)3
Taxi/Idle-Out	2	0.153	3.40	0.00208	1.13	0.00069156	75.71	0.04633452	0.02	0.00001224	26	0.015912
Take-Off	2	0.007	355.32	0.00995	12.69	0.00035532	8.88	0.00024864	0.32	0.00000896	2.54	0.00007112
Climbout	2	0.02	355.32	0.02843	12.69	0.0010152	8.88	0.0007104	0.32	0.0000256	2.54	0.0002032
Approach	2	0.085	5.85	0.00199	1.50	0.00051	58.80	0.019992	0.02	0.0000068	19.8	0.006732
Taxi/Idle-In	2	0.112	3.40	0.00152	1.13	0.00050624	75.71	0.03391808	0.02	0.00000896	26	0.011648
Total				**0.04397**		**0.00308**		**0.10120**		**0.00006**		**0.03457**

Notes: 1 - Duration for each engine setting is in Appendix C of 1995 US Air Force Air Conformity Applicability Applicability Model Version 1.1

2 - Emissions Rates for each engine setting is in Appendix E of 1995 US Air Force Air Conformity Applicability Applicability Model Version 1.1

3 - C-5 carrier aircraft contains 4 engines; therefore to obtain emissions, the number of engine must be factor into the calculation. The equation for emission calculation is as follow:

Emissions = (Number of Operation)(Duration)(Emission Rate)(4 engines)(1 ton/2000 lbs)

In comparing to the estimated C-5 carrier aircraft emissions with the carrier truck emissions, presented in Table A-9, C-5 would represent of the worst case scenario. Therefore, estimated C-5 emissions are used in the conformity analysis.

2.6.2 Mobile Source Equipment

The following equipment will be used to complete this project (number and type):

- (1) Utility truck;
- (3) Contractor trucks;
- (2) Flatbed trucks; and
- (1) Concrete truck.

2.6.2.1 Truck Travel

The utility truck will travel 0.75 mile for fiber-optic cable placement and removal.

The contractor and flatbed truck will be used for material transport from Building 1900 to LF 21. The emissions from the contractor truck are considered the same as emissions from the flatbed truck.

The concrete truck will travel 60 miles from Santa Maria to the base and will also travel 60 miles on base.

2.6.2.2 Worker Commutes

A maximum of 20 light-duty, gasoline-powered vehicles will be used by workers to commute to the job site each working day during the pre- and post-flight site refurbishment, canister placement and site preparation, and the operation phase of Proposed Action. The average commute for each worker is estimated at 30 miles off base and 60 miles on base.

2.6.2.3 Estimation of Mobile Equipment and Worker Commutes Exhaust Emissions

Estimated mobile equipment and worker commutes exhaust emissions are presented on Table A-10.

Table A-9
Carrier Truck Emissions

Activity/Source	Emission Type	Fuel	Units	Days/ Project	VMT/day	VMT/ Project	NOx (g/VMT)	NOx lbs/day	NOx lbs/project
BV-1 and BV-2 Transport									
Carrier Truck	VMT-On Base	Diesel	2	2	15	30	12.01	0.79	1.59
	VMT Highway	Diesel	2	2	180	360	13.69	10.87	21.73
	Cold Start	Diesel					0.00	0.00	0.00
	Hot Soak	Diesel					0.00	0.00	0.00
	Diurnal	Diesel					0.00	0.00	0.00
Total (lbs/day and lbs/project)								**11.66**	**23.32**
Total (tons/day and tons/project)								**0.00583**	**0.01166**

Table A-9
Carrier Truck Emissions

SO_x			CO			PM			HC			
(g/VMT)	lbs/day	lbs/project	(g/VMT)	lbs/day	lbs/project	(g/VMT)	lbs/day	lbs/project	(g/VMT)	lbs/day	lbs/project	Notes
0.00	0.00	0.00	11.03	0.73	1.46	2.63	0.17	0.35	2.78	0.18	0.37	a
0.00	0.00	0.00	6.73	5.34	10.68	2.63	2.09	4.17	1.60	1.27	2.54	a
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	0.00	**0.00**		**6.07**	**12.14**		**2.26**	**4.52**		**1.45**	**2.91**	
	0.00000	**0.00000**		**0.00304**	**0.00607**		**0.00113**	**0.00226**		**0.00073**	**0.00145**	

Table A-9
Carrier Truck Emissions

Notes:	a	-	EMFAC7F (emission factor in grams /mile).
	b	-	EMFAC7F (emission factor in grams /mile).
	c	-	EMFAC7F (emissions in grams/start).
	d	-	EMFAC7F (emission factor in grams/day).
	CO	-	Carbon monoxide.
	g	-	Grams.
	HC	-	Hydrocarbon.
	NO_x	-	Oxides of nitrogen.
	PM	-	Particulate matter.
	SO_x	-	Sulfur oxides.
	VMT	-	Vehicle miles traveled.

Table A-10
Mobile Equipment and Worker Commuter Exhaust Emissions

Activity/Source		Emission Type	Fuel	Units	Days/ Project	VMT/day	VMT/ Project	NOx (g/VMT)	NOx lbs/day	NOx lbs/project	SO_x (g/VMT)	SO_x lbs/day	SO_x lbs/project
Fiber-Optic Cable													
Utility Truck		VMT Surface Road	Diesel	1	2	0.75	2	12.01	0.02	0.04	0.00	0.00	0.00
		VMT Highway	Diesel	1	2	0.75	2	13.69	0.02	0.05	0.00	0.00	0.00
		Cold Start	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
		Hot Soak	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
		Diurnal	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal								**0.04**	**0.09**		**0.00**	**0.00**
Construction Material Transport													
Contractor Truck		VMT Surface Road	Diesel	3	15	5	75	12.01	0.40	5.96	0.00	0.00	0.00
		VMT Highway	Diesel	3	15	10	150	13.69	0.91	13.58	0.00	0.00	0.00
		Cold Start	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
		Hot Soak	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
		Diurnal	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal								**1.30**	**19.54**		**0.00**	**0.00**
Flatbed Truck		VMT Surface Road	Diesel	2	15	5	75	12.01	0.26	3.97	0.00	0.00	0.00
		VMT Highway	Diesel	2	15	10	150	13.69	0.60	9.05	0.00	0.00	0.00
		Cold Start	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
		Hot Soak	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
		Diurnal	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal								**0.87**	**13.03**		**0.00**	**0.00**
Concrete													
Concrete Truck		VMT-On Base	Diesel	1	1	60	60	12.01	1.59	1.59	0.00	0.00	0.00
		VMT-Off Base	Diesel	1	1	60	60	13.69	1.81	1.81	0.00	0.00	0.00
		Cold Start	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
		Hot Soak	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
		Diurnal	Diesel					0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal								**3.40**	**3.40**		**0.00**	**0.00**
Pre and post- launch operations commuter vehicles													
Operation	VMT Surface Road (25 mph)	VMT-On Base	Gas	20	30	60	1,800	0.90	0.88	71.43	0.00	0.00	0.00
	VMT Highway (55 mph)	VMT-Off Base	Gas	20	30	60	1,800	0.60	1.25	47.62	0.00	0.00	0.00
		Cold Start	Gas	20	30	4	120	2.77	2.90	14.66	0.00	0.00	0.00
		Hot Start	Gas	20	30	4	120	1.76	1.68	9.31		0.00	0.00
		Hot Soak	Gas	20	30	4	120	0.00	0.00	0.00	0.00	0.00	0.00
		Diurnal (g/veh/day)	Gas	20	30	1	30	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal								**6.71**	**143.02**		**0.00**	**0.00**
Total on-road mobile source emissions from Proposed Activity (lbs/day and lbs/project)									**12.32**	**179.08**		**0.00**	**0.00**
Total on-road mobile source emissions from Proposed Activity (tons/day and tons/project)									**0.0062**	**0.0895**		**0.0000**	**0.0000**

Table A-10
Mobile Equipment and Worker Commuter Exhaust Emissions

Activity/Source		CO (g/VMT)	CO lbs/day	CO lbs/project	PM (g/VMT)	PM lbs/day	PM lbs/project	HC (g/VMT)	HC lbs/day	HC lbs/project	Notes
Fiber-Optic Cable											
Utility Truck		11.03	0.02	0.04	2.63	0.00	0.01	2.78	0.00	0.01	a
		6.73	0.01	0.02	2.63	0.00	0.01	1.60	0.00	0.01	a
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	Subtotal		**0.03**	0.06		**0.01**	**0.02**		**0.01**	**0.01**	
Construction Material Transport											
Contractor Truck		11.03	0.36	5.47	2.63	0.09	1.30	2.78	0.09	1.38	a
		6.73	0.45	6.68	2.63	0.17	2.61	1.60	0.11	1.59	a
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	Subtotal		**0.81**	**12.15**		**0.26**	**3.91**		**0.20**	**2.97**	
Flatbed Truck		11.03	0.24	3.65	2.63	0.06	0.87	2.78	0.06	0.92	a
		6.73	0.30	4.45	2.63	0.12	1.74	1.60	0.07	1.06	a
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	Subtotal		**0.54**	**8.10**		**0.17**	**2.61**		**0.13**	**1.98**	
Concrete											
Concrete Truck		11.03	1.46	1.46	2.63	0.35	0.35	2.78	0.37	0.37	a
		6.73	0.89	0.89	2.63	0.35	0.35	1.60	0.21	0.21	a
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	b
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	c
	Subtotal		**2.35**	**2.35**		**0.70**	**0.70**		**0.58**	**0.58**	
Pre and post- launch operations commuter vehicles											
Operation	VMT Surface Road (25 mph)	8.87	23.47	703.97	0.11	0.29	8.73	0.91	2.41	72.22	d
	VMT Highway (55 mph)	4.09	10.82	324.61	0.11	0.29	8.73	0.12	0.32	9.52	d
		93.49	16.49	494.66	0.00	0.00	0.00	5.21	0.92	27.57	d
		12.74	2.25	67.41	0.00	0.00	0.00	1.38	0.24	7.30	d
		0.00	0.00	0.00	0.00	0.00	0.00	2.11	0.00	0.14	d
		0.00	0.00	0.00	0.00	0.00	0.00	5.01	0.01	0.33	d
	Subtotal		**53.03**	**1,590.65**		**0.58**	**17.46**		**3.90**	**117.08**	
Total on-road mobile source emissions from Proposed Activity (lbs/day and lbs/project)			**56.76**	**1,613.30**		**1.72**	**24.70**		**4.82**	**122.62**	
Total on-road mobile source emissions from Proposed Activity (tons/day and tons/project)			**0.0284**	**0.8066**		**0.0009**	**0.0123**		**0.0024**	**0.0613**	

Table A-10
Mobile Equipment and Worker Exhaust Emissions

Notes:	a	-	EMFAC7F (emission factor in grams /mile).
	b	-	EMFAC7F (emission factor in grams /mile).
	c	-	EMFAC7F (emissions in grams/start).
	d	-	EMFAC7F (emission factor in grams/day).
	CO	-	Carbon monoxide.
	g	-	Grams.
	HC	-	Hydrocarbon.
	NO_x	-	Oxides of nitrogen.
	PM	-	Particulate matter.
	SO_x	-	Sulfur oxides.
	VMT	-	Vehicle miles traveled.

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ATTACHMENT A-1

ENVIRONMENTAL ASSESSMENT
LOCKHEED LAUNCH VEHICLE
VANDENBERG AIR FORCE BASE, CALIFORNIA
APRIL 22, 1994

REFERENCE TABLE D-4a on Page 53

The maximum number of LLV launches in a year is estimated at 10. Currently, the only scheduled launch is in November, 1994. Impacts from closure of the beaches during LLV launches would be less than or equal to the Space Shuttle program, which postulated 10 launches per year from SLC-6.

4.3 Atmospheric Resources

This section describes the potential impacts of the activities related to launching of the LLV from SLC-6. Section 4.3.1 describes the exhaust products of the rocket motors. Section 4.3.2 discusses the potential environmental impacts of the emissions.

4.3.1 Rocket Motor Exhaust

The LLV first stage is a solid rocket motor which burns approximately 80 seconds. The launch vehicle leaves the launch stand at SLC-6 within a second of the start of the first stage rocket motor. The exhaust products are discussed here to assist in understanding the discussions relative to other natural resources. The LLV 2 is used as the representative vehicle for these discussions because it is the slowest ascending of the three Lockheed launch vehicles.

4.3.1.1 Products of the First Stage Motor (CASTOR 120™)

The CASTOR 120™ motor is a solid fueled rocket engine. The rocket engine burns at a rate of 620 kg (1,367 lb) of fuel per second. The LLV 2 would require approximately 23 seconds to reach 1525 m (5,000 ft) altitude and a total of 31 seconds to attain 3050 m (10,000 ft). After 3050 m (10,000 ft) altitude, the LLV is moving rapidly and climbing through air that is generally undisturbed by surface conditions.

The chemical composition of the exhaust is relatively constant throughout the period that the rocket is firing. This results from a standard fuel mixture contained in a preset rocket design. With respect to the rocket design and the fuel mixtures, there is no mitigation option available.

The primary constituents of the rocket exhaust are listed in Table 4-1. The dispersion of these compounds into the lower atmosphere are discussed in Section 4.3.1.3. The compositions of the exhaust plume would not pose a hazard to humans or to wildlife. It would be present for approximately 40 minutes after each launch. There would be no cumulative impacts to air quality due to the dispersive qualities of the atmosphere.

There are many other trace compounds in the exhaust plume that

Table 4-1. Exhaust to the Lower Atmosphere (Lb/Launch)

Elevation above msl	Carbon Dioxide (CO_2)	Carbon Monoxide (CO)	Hydrogen Chloride (HCl)	Aluminum Oxide (Al_2O_3)
0 - 5000 ft	624	7,153	5,758	10,801
5000 - 10,000 ft	210	3,410	1,939	3,639

produce only a few pounds of material (Appendix D). In addition, small amounts of pure helium are released through the pressurization of the hydraulic thrust vector control system that steers the main booster nozzle. Any leaked hydraulic fluid is vented into the rocket plume, where it is burned instantly.

During a ground abort or incident near the ground, the chemical composition of the burning rocket fuel is different. The amount of fuel consumed would depend on the type of incident and whether or not a fire occurs, and when it is quenched. The products of burning of the rocket fuel are also listed in Appendix D.

If a booster is completely burned, approximately 15.5 percent of 49,000 kg (108,000 lb) would remain in either a liquid or solid form. The remaining 41,400 kg (91,280 lb) would become a gas or free particulate matter.

The LLV 3 includes two to six strap-on CASTOR 4A™/4XL™ solid rocket boosters which use the same solid propellant as the CASTOR 120™. The CASTOR 4A™ contains approximately 10,433 kg (23,000 lb) of fuel which is burned at the rate of 192 kg (424 lb) per second during a nominal launch. The CASTOR 4XL™ contains approximately 11,790 kg (26,000 lb) of fuel which burns at a rate of 192 kg (424 lb) per second. For the case where four CASTOR 4A™/4XL™ are strapped onto the launch vehicle, an additional 770 kg (1,696 lb) of exhaust per second would be discharged along with the main CASTOR 120™ booster's discharge of 620 kg (1,367 lb). The distribution of chemical species in the total exhaust of the LLV 3 at launch remains the same.

The LLV 3 behavior in a ground or near ground abort is the same as the case discussed above for LLV 2. The fuel in the CASTOR 4A™/4XL™ would burn in the open atmosphere as described above for the LLV 2, only the amount of potential remaining fuel to be consumed by a fire would change.

Table 4-2. Attitude Control System Chemical Reaction Products

Chemical	Mass Fraction
N_2	0.581
H_2	0.065
NH_3	0.354

4.3.1.2 Products of the Attitude Control System

The Attitude Control System (ACS) on the LLV is used to roll the rocket and make fine corrections to maintain the proper course. The system consists of four very small rocket engines, called thrusters, which fire intermittently as required by the navigation systems on the LLV. The thruster system uses hydrazine (N_2H_4) as fuel. The products of the reaction which provides the thrust are listed below (Table 4-2).

The ACS would begin to operate after the LLV has climbed approximately 305 m (1,000 ft) above SLC-6. When operating at maximum thrust, the ACS converts 0.23 kg (0.5 lb) of hydrazine per second into exhaust products (Table 4-2).

During a ground abort or incident near the ground, the chemical composition may be different if a fire occurs. Besides reduction to nitrogen, hydrogen, and ammonia, oxides of nitrogen may also be expected to form.

4.3.1.3 Dispersion of the Rocket Exhaust After Launch

The exhaust plume that forms during the launch of the LLV would drift downwind and disperse. The dispersion is influenced by the stability of the atmosphere at the time of launch. Using the LLV 2 as a representative vehicle for discussion, the Air Force Rocket Exhaust Effluent Diffusion Model (REEDM) has been applied to identify the hazardous or toxic potential of the exhaust plume (Nyman 1993).

The objectives of this toxic hazards assessment were to estimate the location and concentration of airborne chemical vapors produced as the result of normal launch operations and plausible accident scenarios (Nyman 1993). This was done by assuming a variety of meteorological conditions which might occur in the region around SLC-6 and chemical releases that are representative of the LLV 2. "Best case", "worst case" and average atmospheric conditions were considered. In addition, both normal and aborted

launch scenarios were considered. The outputs were referenced to several guidelines for exposures of toxic chemicals; the Recommended Exposure Limit (REL), the Permissible Exposure Limit (PEL), the Threshold Limit Value (TLV), and the Short-term Public Emergency Guidelines (SPEGL).

Results from the normal launch scenarios indicate that hydrogen chloride concentrations are not expected to exceed the current launch hold criteria of 2 ppm, based on a 30 minute time-weighted average concentration. Similarly, the distance to the maximum concentrations of Al_2O_3, less than 6850 particles per m^2, would be 3.0 km (1.9 mi) to 6.0 km (3.7 mi). These particles will pose no health risk, as they will be mostly much greater than 10 microns in diameter. With respect to this, launches of the LLV will be conducted in accordance with safety zones and safety regulations established by Vandenberg AFB.

The azimuth of the LLV 2 exhaust plume, under typical weather conditions, would range from 153° to 186° and the plume width would be less than 2.8 km (1.6 mi). The total duration of this event would be less than 40 minutes. The localized and transient nature of the exhaust plume and its location over ocean water would not present a significant hazard to the population centers or recreation areas.

In the event of an aborted launch, the 3 ppm 30 minute time weighted average concentration was not expected to be exceeded under any weather conditions. The 1 ppm HCl SPEGL was likely to be exceeded under all weather conditions, including those most favorable to rapid dispersion. Instantaneous peak HCl concentrations as high as 33 ppm, at a point 2 km (1.25 mi) downwind from the pad, was predicted as a reasonable worst case for an on pad explosion.

4.3.1.4 Fugitive Hazardous/Toxic Material

Fugitive solid rocket fuel is not anticipated during normal launch activities. In the event of an aborted launch, the rocket propellants would be converted to combustion products. These products and their potential impacts are discussed in Section 4.3.2.1.

Fugitive hydrazine may occur during the making and breaking of the connections between the supply line at the Hypergolic Strategic Storage Facility (HSSF) and the hydrazine service cart, or between the hydrazine service cart and the storage bottles in the attitude control section of the launch vehicle. The HSSF is subject to PTO 7987, issued September 28, 1992. As such VAFB must document *de minimis* increases in the fugitive emissions.

Activities related to the LLV program will rely on existing

hydrazine transfer equipment. No additional hydrazine carts or accessories will be introduced to VAFB. Vandenberg Air Force Base retains control of all hydrazine movements and transfers. The LLV program will abide by all VAFB regulations in this regard. It is expected that hydrazine emissions will be well within the *de minimis* levels.

In addition to liquid-free cleaning methods, small amounts of isopropyl alcohol (IPA) would be used to clean the rocket shrouds for launches of dust-sensitive payloads. The wipe rags would be stored in sealed containers and disposed of properly. The handling of solvents, waste rags, and used containers would be in accordance with the regulations of Vandenberg AFB and its agreements with state and Federal regulators. This use of IPA will result in atmospheric emissions of less than 0.1 pound per hour.

4.3.2 Potential Impacts to Air Quality

4.3.2.1 Impacts from Accidental Open Burn of Rocket Fuel

The solid rocket motors for the first and second stage would be received with a canvas cover place over the nozzle. There would be no internal maintenance on the motors at SLC-6. Only in an incident would there be solid fuel exposed to the environment. Since the reliability of each major component is near unity, the combined failure rate for the complete missile system would be very low. Experience to date has been 27 successful firings of the CASTOR 120™ boosters without a failure.

Paragraph 4.3.1.1 discussed the constituents of the fuel when it burns in the open atmosphere. The solid fuel will not spontaneously ignite in the atmosphere. Open burning of all the fuel in the booster would release 6,434 kg (14,185 lb) of aluminum oxide (Al_2O_3). However, this would primarily occur in a slag-like form that will not effect the atmosphere. The impact on air quality of the open burning of the rocket fuel is discussed below.

If one complete solid rocket booster, CASTOR 120™, burns in the atmosphere at standard atmospheric pressure, the primary products will include carbon monoxide (CO), carbon dioxide (CO_2), nitric oxide (NO) and hydrogen chloride (HCl). Table 4-3 summarizes the results of a complete burn of 49,033 kg (108,100 lb) of propellant. The products of combustion are in different ratios than those resulting from a normally operating launch vehicle.

The release of hydrogen chloride would be at a much lower level than if the rocket were operating normally. The hydrogen chloride would combine with moisture in the air to the extent that moisture is available. This combining action results in

Table 4-3. Predicted Products from Open Burn of LLV Booster

Combustion Product	Quantity (lbs)
CO_2	7768
HCl	7065
CO	5997
NO	1212

hydrochloric acid. The vapor may exist in hazardous concentrations in the immediate downwind region of the fire. Dissipation to concentrations not immediately hazardous would result quickly if the wind is greater than 6.5 km per hour (4.0 miles per hour) or if there is strong sunshine. The hydrogen chloride would eventually washout with rain.

Under the assumption of a 10-minute fire that consumes an entire booster motor containing 49,033 kg (108,100 lb) of fuel, 550 kg (1212 lb) of nitric oxide (NO) would be released. Nitric oxide degrades air quality as it is a contributor to smog and ozone generation. The NO would be released as a gas into the atmosphere.

Oxygen and nitrogen would be released if the solid fuel of the main booster burns. Both of these gases exist generally as common molecules in the atmosphere (O_2 and N_2). The atmosphere is 21 percent oxygen and 78 percent nitrogen. The release of O_2 and N_2 from a fire consuming solid rocket fuel would be lost in the atmosphere almost immediately.

4.3.2.2 Freon Systems

There are no anticipated releases of fluorocarbons to the atmosphere. Ozone depleting chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) are commonly used for both cooling systems and fire suppression systems. Support services for payloads on the LLV may require provision of a cooling system for the period immediately before launch. An electromechanical compressor/condenser unit would be used. There is no planned free venting of the system to the atmosphere. The LLV program would comply with all U.S. Air Force regulations that apply to the use of ozone depleting chemicals.

Installed fire suppression systems on the MST and SAB that use CFCs, typically Halon™ 1211 and Halon™ 1301, are not expected

to be charged. Tests and large system leaks that could occur would not be sources for releases.

4.3.3 Stationary Sources

The LLV program does not expect to use internal combustion engine driven stationary equipment. No releases of potential pollutants are anticipated for this category of sources.

4.3.4 Mobile Sources

All mobile sources would be equipped with pollution abatement systems and operated in accordance with the requirements of the State of California. Rather than engine driven mobile cranes, the electric cranes that are integral to the MST and SAB would be used. Material handling equipment would conform to the requirements of the State of California. There is no anticipated construction. Therefore, emissions from construction equipment are not anticipated.

4.3.5 Air Impacts from Temporary Modifications of SLC-6

Required fixtures and jigs would be fabricated outside of Vandenberg AFB, at suppliers' facilities. Equipment that would be clamped or bolted to the launch mount at SLC-6 would not require welding or other construction services. Touch-up painting before or after a launch would be performed using nontoxic, water-based paint. No emissions are expected.

4.3.6 Upper Atmosphere and Global Atmospheric Impacts

Potential contributions to the upper atmosphere include materials and activities on the ground as well as the launch vehicles flight. There are no major pollution producing ground activities at Vandenberg AFB caused by the LLV. The program would have ground support systems which use fluorocarbons (CFCs or HFCs) in closed systems. No venting of the CFCs or HFCs is anticipated so there are no upper atmosphere impacts.

The primary constituents of the LLV rocket exhaust are HCl, CO_2, CO, and AL_2O_3 (Table 4-4). The hydrogen chloride (HCl) exists as a gas in the rocket exhaust. The LLV 2 is estimated to produce 14.02 metric tons (15.7 tons) of HCL in its climb to approximately 45 km (150,000 feet). The chlorine plays a role in depleting ozone by breaking the chemical bonds that hold the ozone molecule together (EPRI 1988). The chlorine atom then combines with an oxygen atom. Another free molecule of oxygen breaks the bond between the chlorine and oxygen. This last action releases the chlorine atom to combine with another oxygen atom from an ozone molecule.

Table 4-4. Rocket Exhaust Per Launch[1]

Constituent	Quantity (tons)
HCl	15.7
CO_2	1.7
CO	19.5
Al_2O_3	29.5

[1]Ground level to 150,000 feet above sea level. Data are derived from "Theoretical Rocket Performance Assuming Equilibrium Composition During Expansion". Computation for rocket exhaust at point just beyond end of expansion bell on the rocket nozzle. Pressure = 1093.2 PSIA, Temperature = 6414° R, Exhaust velocity = 762 ft/sec.

As a measurement of the greenhouse gas emission activity of chlorine, an estimated 20 million metric tons (22 million tons) of carbon equivalents of HFCs are released each year (Clinton and Gore 1993). This number does not include chlorine produced in other forms for water purification, bleaches, and intermediate chemical processes. The 14.2 metric tons (15.7 tons) of HCL released by a launch of an LLV is an insignificant contribution to the world climate discussion.

The aluminum oxide (Al_2O_3) is the visible plume as the launch vehicle rises from the launch pad. The LLV 2 would produce 26.8 metric tons (29.5 tons) of Al_2O_3 in its climb to 45,720 m (150,000 ft). The aluminum oxide becomes a small particle which is heavier than air and would eventually settle out of the atmosphere or be washed out by rain in the lower atmosphere.

The aluminum oxide can be compared to the fine particles of ash that are exhausted from volcanos during eruptions. As a comparison to a volcano, such as the eruption of Mt Agung, Bali, in 1963 (Gates 1985), the product of a volcano dwarfs the output of a launch vehicle. In the case of the Mt Agung eruption, particles launched in the eruption could still be detected by photometers in Mauna Loa, Hawaii, in 1973. To the extent that there is dust in the atmosphere from the launch of an LLV, the dust may contribute to heating of the atmosphere but the

influence would be undetectable.

Carbon, in the form of carbon monoxide and carbon dioxide, from the LLV is a relatively small percentage of the total pollutant output of the rocket engine. The LLV's contribution to the atmospheric load of carbon products is insignificant when compared to the estimated total load of over 1,400 million metric tons (1543 million tons) produced each year (Clinton and Gore 1993).

The attitude control system contains a maximum load of 354 kg (780 lb) of hydrazine (N_2H_4). If the entire load were eventually converted to ammonia, hydrogen, and nitrogen, the products would participate in the chemical exchanges in the upper atmosphere. The comparison to the world's output of pollutants indicates that the contributions made by the exhaust of the attitude control system are inconsequential.

4.3.7 Clean Air Act Conformity

The Clean Air Act, as amended in 1990, requires Federal actions to conform to any State implementation plan approved or promulgated under Section 110 of the Act. The Final Rule, 51 CFR Subpart W, provides regulatory guidelines and *de minimis* levels in tons/per year. The guidelines specify requirements for conformity analyses. However, federal actions which do not contribute pollutants above the specified, *de minimis* levels are exempt from the conformity analysis requirements. Table 4-5 provides a comparison with the estimated exhaust emissions and the *de minimis* values provided by the Conformity Rule. The relevant data for this analysis is taken from Table 4-1. Table 4-5 demonstrates that the primary exhaust emissions associated with rocket launches will be less than the annual *de minimis* levels.

Secondary emissions, resulting from LLV launches, will be primarily associated with ground transportation for the estimated 25 support personnel. An additional 75 persons may be temporarily associated with specific launches. This increased traffic would not be significantly different from the current level of more than 16,000 vehicles per day on H Street, in Lompoc. Intersections along the H Street route generally have very low delay ("A" level of service). Statistics are not available for the route from the Vandenberg AFB south gate to SLC-6, however, the level of service has been observed to be very good due to lack of appreciable traffic in the area (USAF 1989).

There would be no new construction which would generate fugitive dust or solvent emissions. Minor repairs and installations of temporary fixtures within the SAB would result in minute levels of emissions.

Table 4-5. Clean Air Act Conformity Comparison

Constituent	Emissions per flight	Total Annual Emissions	*De Minimus* Levels
Al_2O_3 PM_{10}	7.22 Tons[1]	72.19 Tons	100 Tons/Yr
CO	4.78 Tons	47.81 Tons	100 Tons/Yr
O_3	Trace	Trace	50 Tons/Yr
VOC	Trace	Trace	50 Tons/Yr
NO_x	Trace	Trace	100 Tons/Yr

[1]Al_2O_3 is emitted in particulate form which averages 115-870 microns in mean aerodynamic diameter (Nyman 1993). Only a small fraction of these particles would measure less than 10 microns in mean aerodynamic diameter.

4.4 Soils and Water Resources

The LLV program would not require new construction at SLC-6, or in the surrounding area. As a result, there would be no related impacts to the ground water, surface water or wastewater processing systems.

Normal launches of the LLV would produce exhaust emissions as described in Section 4.3 above. Catastrophic failures during early phases of the launch are highly improbable. In the event of an incident, runoff and residue from the site would be contained, retrieved, and disposed of in accordance with emergency planning in effect at Vandenberg AFB. Any runoff would be held from joining a surface water course or allowed to enter the groundwater.

While the exhaust plume of the LLV rocket motor contains HCl, deposition of the HCl on the ground would not significantly alter the state of the natural surface water courses. The soils on South Vandenberg contain a substantial amount of organic matter. In addition, the water quality data is high in total hardness (see Appendix B). In the event that rain water adsorbs HCl which might then be deposited on the ground, the natural buffering capacity of the soils and streams would result in minimal or no change in water quality.

At SLC-6, rain and wash water are collected into catchments that are tested before release. If the water in the catchment requires treatment, the water would be pumped to the industrial

Air Quality Data

The following data are extracted from theoretical models for reactions that occur within the CASTOR 120™ rocket motor. Three different models have been applied to obtain estimates of the chemical content of the exhaust plume.

a.) To estimate the content of the plume after the exhaust has started to mix with the atmosphere, we used the JANNAP Standard Plume Flowfield Model, Gas/Particle Nonequilibrium Version (Released May, 1986). The model estimates the exhaust constituents at a distance of 3,300 feet behind the nozzle of the booster. Air entrainment and afterburning of the exhaust in the atmosphere was included in the model. The input conditions are as follows:

Motor:	CASTOR 120™
Mach No:	1.26
Nozzle Radius:	0.2488 ft
X Initial:	0.2488 ft
X Final:	3,300 ft
Altitude:	11,345 ft
Pressure:	0.51 atmospheres

A summary of the results of the model are included for the constituents of interest under the specified conditions (Table D-1).

Table D-1. Exhaust Constituents; 3300 Feet Behind the Vehicle.

Constituent	Mole Fraction	Mole Weight	Mass/Mole Propellant	Mass Fraction
Al_2O_3	0.0	101.946	0.0	0.0014
CO	0.000001	28.005	0.000031	0.000001
CO_2	0.0011	44.000	0.0484	0.0017
Cl	0.000002	35.453	0.000056	0.000002
Cl_2	0.000048	70.906	0.0034	0.00012
H	0.0	1.008	0.0	0.0
H2	0.0	2.016	0.0	0.0
H_2O	0.0165	18.010	0.2975	0.0104
HCl	0.00067	36.461	0.0245	0.00086
N_2	0.7909	28.014	22.1559	0.7728
OH	0.0	28.093	0.0	0.0
O	0.0	15.999	0.0	0.0
O_2	0.1907	31.999	6.1009	0.2128
Totals			28.6307	1.0000

b.) The NASA-LEWIS Thermochemistry Program (SDA03) 03/20/84 (Thiokol Corp. Version) was used to estimate the chemical species in the smoke from an uncontrolled open burn of the solid propellant (Table D-2). The initial conditions of this model assumed the propellant of the CASTOR 120™, an atmospheric pressure of 14.7 PSIA, and an unrestricted air supply.

Table D-2. Chemical Constituents Resulting from Open Burning of Propellant.

Constituent	Mole Fraction	Mole Weight	Mass/Mole Propellant	Mass Fraction
Al_2O_3	0.0453	101.946	4.6243	0.1542
CO	0.0594	28.005	1.6649	0.0555
CO_2	0.0490	44.000	2.1564	0.0719
Cl	0.0219	35.453	0.7754	0.0259
Cl_2	0.00001	70.906	0.0007	0.00002
H	0.0163	1.008	0.0165	0.0005
H2	0.0276	2.016	0.0556	0.0019
H_2O	0.1590	18.010	2.8633	0.0955
HCl	0.0538	36.461	1.9612	0.0654
N_2	0.4919	28.014	13.7787	0.4596
OH	0.0287	28.093	0.8054	0.0269
O	0.0104	15.999	0.1669	0.0056
O_2	0.0242	31.999	0.7760	0.0259
NO	0.0112	30.006	0.3367	0.0112
Totals			29.9819	1.0000

c.) To estimate the exhaust content for input to the Rocket Exhaust Environmental Diffusion Model (REEDM), we used the model: Theoretical Rocket Performance Assuming "Equilibrium" Composition During Expansion (Table D-3). The estimates used were for constituents outside of the nozzle bell (i.e., pressure = 1093.2 PSIA, temperature = 6414° R). The resulting estimates in Table D-3 best fit the input parameters of the REEDM. Inconsequential constituents were not included in these calculations.

Table D-3. Chemical Constituents Immediately After Exit from Booster

Constituent	Mole Fraction	Mole Weight	Mass/Mole Propellant	Mass Fraction
Al_2O_3	0.0886	101.946	9.0294	0.3348
CO	0.2135	28.005	5.9796	0.2217
CO_2	0.0119	44.000	0.5217	0.0193
Cl	0.0125	35.453	0.4416	0.0164
Cl_2	0.00003	70.906	0.0019	0.00007
H	0.0392	1.008	0.0395	0.0015
H2	0.2747	2.016	0.5537	0.0205
H_2O	0.1243	18.010	2.2380	0.0830
HCl	0.1320	36.461	4.8134	0.1785
N_2	0.0800	28.014	2.2424	0.0831
O	0.0007	15.999	0.0114	0.0004
O_2	0.0001	31.999	0.0040	0.0001
OH	0.0087	17.007	0.1480	0.0055
NO	0.0007	30.006	0.0206	0.0008
Totals			26.0452	0.9657

The following two tables contain the calculation used to develop the estimates of pollutants placed in the atmosphere during launch. The first table shows the pollutants of interest in two increments, 0 to 5000 feet and 5001 to 10000 feet above sea level. The first increment is of interest because the launch vehicle is moving slowly and is generally still within the atmosphere below inversion levels and mixing heights. The second increment provides a complete picture of the effects on the lower atmosphere.

Table D-4a. Exhaust Products to the Lower Atmosphere, 0 to 5000 feet.

Constituent	Mass Fraction	Burn Rate (lb/sec)	Burn Time (sec)	Exhaust Mass (lb)
Al_2O_3	0.3348	1367	23.6	10801.2
CO	0.2217	1367	23.6	7153.0
CO_2	0.0193	1367	23.6	624.1
HCl	0.1785	1367	23.6	5757.9

Table D-4b. Exhaust Products to the Lower Atmosphere, 5000 to 10000 feet.

Constituent	Mass Fraction	Burn Rate (lb/sec)	Burn Time (sec)	Exhaust Mass (lb)
Al_2O_3	0.3348	1367	7.95	3638.5
CO	0.2217	1367	7.95	2409.6
CO_2	0.0193	1367	7.95	210.2
HCl	0.1785	1367	7.95	1939.6

For emissions which may influence the upper atmosphere, an estimate was made for rocket exhaust from 35,000 feet to 150,000 feet above sea level. This estimate of exhaust constituents was taken for the first shockwave in the exhaust after the rocket nozzle bell. The major constituents are noted in Table D-3 above.

Table D-5. Exhaust Products to the Upper Atmosphere, 35000 to 150,000 feet.

Constituent	Mass Fraction	Burn Rate (lb/sec)	Burn Time (sec)	Exhaust Mass (lb)
Al_2O_3	0.3348	1367	69.0	27460.7
CO	0.2217	1367	69.0	18185.6
CO_2	0.0193	1367	69.0	1586.6
HCl	0.1785	1367	69.0	14638.7

B NATURAL RESOURCES SURVEY REPORT

APPENDIX B

Natural Resources Survey Report

Booster Verification Tests
Environmental Assessment

Vandenberg Air Force Base, California

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1.0 INTRODUCTION

This natural resources survey report provides supporting documentation for an Environmental Assessment (EA) prepared the Booster Verification Tests on north Vandenberg Air Force Base (AFB), California. Vandenberg AFB supports polar-orbiting space satellite and operational intercontinental ballistic missile launches. The scope of the survey includes vegetation and wildlife resources, as well as potential wetland resources. The proposed project would include modifications to existing structures Building 1962 (LF-21) and Building 1978, installing a fiber-optic communication cable in conduit and placing it along the ground surface between the two facilities, and the launch activities. The project area is identified on Figure B-1.

2.0 METHODS

2.1 BIOLOGICAL SURVEYS

The project area is defined as LF-21, Buildings 1959 and 1978, and the open space between the facilities. The area between LF-21 and Buildings 1959 and an approximately 50-meter area around each facility were surveyed on foot for biological resources in January 1999. The area surveyed for cable installation was flagged to avoid any sensitive biological resources and considered routes utilizing areas of past disturbance and less steep slopes. For the biological surveys, dominant plant species and vegetation types were identified; and wildlife was observed by sight, sound, tracks, or other sign. The potential occurrence of other species was examined by identifying the documented or known habitat preferences of species.

Many plant species, particularly sensitive species and annuals, can be identified definitively or observed only during their blooming periods in spring and summer, and the results of the botanical surveys conducted in January cannot be considered comprehensive. The seasonal nature of migration, wintering, and breeding behaviors in animal populations precludes observation of the full component of fauna in an area at a particular time, and therefore wildlife species data collected in January also cannot be considered comprehensive.

In this report, plant taxa nomenclature follows Hickman (1993). Species nomenclature for birds follows the American Ornithologist's Union (1983); for other animals, sources include Stebbins (1985), Jones *et al.* (1986), Jameson and Peeters (1988), and Collins (1990).

2.2 SENSITIVE RESOURCES SURVEYS

Surveys for sensitive species potentially occurring in the area were conducted concurrently with the biological field surveys. The available habitat information from the California Natural Diversity Data Base (CNDDB) and the California Native Plant Society (CNPS) were consulted.

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), requires the U.S. Fish and Wildlife Service (USFWS) to identify species of wildlife and plants that are endangered (FE) or threatened (FT), based on the best available information. Prior to 1996, species that were being considered for listing, and for which there was sufficient information on biological vulnerability, were known as Category 1 candidates. Category 2 candidates were those taxa for which information indicated that proposing to list them as endangered or threatened was appropriate, but for which sufficient data were lacking to support federal listing. In 1996, the USFWS issued a notice to present an updated list of plants and animals regarded as candidates for possible addition to the list of endangered and threatened species under the ESA (50 CFR Part 17). Under the revised list, only those species for which information

is available to support a listing proposal are called "candidates" (FC). These were formerly known as Category 1 candidates. The USFWS no longer maintains a list of species formerly known as Category 2 candidates. They are now called "species of concern" (FSC).

The California Department of Fish and Game (CDFG) ranks plant communities by evaluating their overall condition throughout their range (S-ranks 1 through 5, 1 being most restricted) and their threat status (subranks .1 through .3, .1 being most threatened, and .3 being those for which no current threats are known). A state rank of S1.1, therefore, designates a community with a very restricted occurrence (S1) and a very threatened status (.1). S4 and S5 communities are considered secure by the CDFG and have no threat rank. In this report, one sensitive plant community, native grassland, is ranked S3.1 and is considered very threatened.

Plant species are listed sensitive by the CNPS (Skinner and Pavlik 1994) in five categories. List 1A species are presumed extinct in California; List 1B species are rare or endangered in California and elsewhere. List 2 species are rare or endangered in California but are more common elsewhere. List 3 species include those for which more information is needed. List 4 plants are those with limited distribution.

2.3 WETLAND SURVEYS

Potential waters of the United States and wetlands in the project area were investigated in January 1998. The U.S. Army Corps of Engineers (COE) is responsible for determining jurisdictional boundaries of waters of the United States and wetlands for regulatory and permitting purposes under Section 404 of the Clean Water Act. The jurisdictional limit of waters of the United States is identified by the extent of the ordinary high water mark. For delineating wetlands, the COE has developed a field method using a "three-parameter test" that considers hydrophytic vegetation, wetland hydrology, and hydric soils. Under the COE definition, an area is considered a wetland only if indicators of all three parameters are present, except for wetland types designated as "problem areas" or conditions considered to be "atypical" (Environmental Laboratory 1987).

One potential wetland within the project area was observed. For this project, the COE routine onsite method of wetland determination was used as a guide to determine the presence or absence of potential jurisdictional wetland resources. No soil pits were dug, but hydrophytic vegetation and wetland hydrology indicators of two parameters for determining wetlands were observed. Following COE methodology, hydrophytic vegetation is indicated when more than 50 percent of the dominant species at a station are obligate wetland (OBL), facultative wetland (FACW), or facultative species (FAC) (Reed 1988; USFWS 1996). Wetland hydrology typically is indicated when soils are inundated or saturated within 12 inches of the surface for at least 2 to 3 weeks during the growing season. Other wetland hydrology indicators include physical evidence of such conditions, indicated by the presence of water lines impressed on the bank, shelving, water marks or stains, drift lines (destruction or flattening of vegetation, litter, and debris deposition), sediment deposits such as algal mats, and mudcracks (U.S. Department of Agriculture 1958).

3.0 AFFECTED ENVIRONMENT

3.1 REGIONAL SETTING

Vandenberg AFB is located in a transitional ecological region that lies at the northern and southern distributional limits of many species, and contains diverse biological resources of considerable importance. The base provides habitat for many federal- and state-listed threatened, endangered,

candidate, and special concern plant and animal species. Fourteen major vegetation and habitat types have been described and mapped on the base (U.S. Air Force 1996). Among these vegetation types, coastal sage scrub and native and nonnative grasslands are found in the Booster Verification/Integrated Flight Tests project area. Areas adjacent to the facilities are dominated by ruderal vegetation and have been disturbed in the past by cattle grazing, launch activities around LF-21, and mowing within and around the fenced areas of each facility. The project area lies within the Casmalia Hills geomorphic or ecological management area (U.S. Air Force 1996).

3.2 PLANT COMMUNITIES AND WILDLIFE HABITATS

Three major plant communities are found in the area: coastal sage scrub and native and nonnative grasslands. A general description of the two major communities is given below.

Coastal Sage Scrub

Coastal sage scrub, often referred to as soft chaparral, is a diverse vegetation type dominated by the shrub coastal sagebrush (*Artemisia californica*). Unlike chaparral, it contains species that are mesophyllous and shallow-rooted, and often are entirely or partially drought-deciduous and summer-dormant. Plant growth is concentrated in winter and spring, when soil moisture is readily available. The community occurs on dry slopes and soils near the coast to the interior foothills. In disturbed or more mesic areas, the dominant species may be coyote brush (*Baccharis pilularis*). Coastal sage scrub frequently occurs associated with annual grasslands, and at the margins of dunes, chaparral, and woodlands. On Vandenberg AFB, it is a variable community, and is found on North Base on the Casmalia Hills and Burton Mesa, and also in the southern part of the base near Cañada Honda Creek, Bear Creek and Tranquillon Ridge.

Native Grassland

Small isolated patches of native perennial grasses occur on Vandenberg AFB. They are found primarily on terraces with fine clay soils, but they have not been studied or mapped in detail, and their extent is not well documented. Bunch-forming needlegrasses (*Nassella* spp.), approximately 0.75 meter tall, are among the most common components of native grassland, and therefore, the term native grassland often is synonymous with valley needlegrass grassland. These grasslands occur on fine-textured, deep soils, or sometimes on rocky soils, that are moist to wet in the winter but dry in the summer. Valley needlegrass grassland has been recorded near Point Sal at the northwestern boundaries of Vandenberg AFB, and occurs in scattered locations throughout the base.

Nonnative Grassland

This community is dominated by introduced annual and perennial grasses. Annual grasslands are found on varying slopes, aspects, and substrates, and species composition also is variable. Dominant species include bromes (*Bromus* spp.), wild oats (*Avena* spp.), and fescues (*Vulpia* spp.). At Vandenberg AFB, this community forms the resource base for grazing leases. The perennial exotic species veldt grass (*Ehrharta calycina*) also often dominates grassland areas on the base, and has invaded and degraded many native scrub communities. Grasslands, both native and nonnative grassland often intergrades with each other and occupies a large areal extent on the base.

3.2.1 Results of Biological Survey

The primary vegetation type in the project area is nonnative grassland with coastal sage scrub and native grassland. Veldt grass (*Erharta calycina)* is the dominant species covering the open area scattered with

patches of native needlegrass (*Nassella* spp.) and an occasional coastal sage scrub shrub. Native shrubs include saw-toothed goldenbush (*Hazardia squarrosa var. squarrosa)*, California sagebrush (*Artemesia californica*), coyote brush (*Baccharis pilularis*), and encelia (*Encelia californica*). Other associated species include blue dicks (*Dichelostemma capitatum var. capitatum*), California poppy (*Eschscholzia californica*), and fiddleneck (*Amsinkia spectabilis var. spectabilis)*. Patches of nonnative black mustard (*Brassica nigra*), curly dock *(Rumex crispus*), and poison hemlock (*Conium maculatum*) were also observed. A complete list of plant species observed and expected is provided in Table B-1.

Bird species observed in the project area included house finch (*Carpodacus mexicanus*), white-crowned sparrow (*Zonotrichia leucophrys*), Brewer's blackbird (*Euphagus cyanocephalus*), bushtit *(Psaltriparus minimus*), Western meadowlark (*Sturnella neglecta*), loggerhead shrike (*Lanius ludovicianus*), black phoebe (*Sayornis nigricans*), and Say's phoebe (*Sayornis saya*). Grasshopper sparrow (*Ammodramus savannarum*), a relatively uncommon and regionally declining species may also be located in this area. Observed raptors included red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), marsh hawk (*Circus cyaneus*), and turkey vulture (*Cathartes aura*). Owl pellets were observed at the base on utility poles along the northern boundary of the cable installation area near the drainage to the west of Building 1959, American water pipit (*Anthus rubescens*), common yellowthroat (*Geothlypis trichas*), and California towhee (*Pipilo crissalis*) were observed. Abandoned swallow nests were also observed on Building 1959.

Other wildlife species observed in the project area were deer mouse (*Peromyscus maniculatus*), mule deer (*Odocoileus hemionus)*, California ground squirrel (*Spermophilus beecheyi*), and western fence lizard (*Sceloporus occidentalis*). Sign was noted for coyote (*Canis latrans*), broad-footed mole (*Scapanus latimanus)*, pocket gopher (*Thomomys bottae*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela fernata*), and feral pig (*Sus scrofa*). A complete list of wildlife species observed and expected is provided in Table B-2.

3.3 SENSITIVE RESOURCES

3.3.1 Sensitive Plant Communities and Wildlife Habitats

Among the communities in the project area, native grassland is designated sensitive by the CDFG. The distribution of these communities and habitats along the project area is shown in Figures B-3.

3.3.1.1 Native Grassland

The CDFG ranks valley needlegrass grassland as S3.1 (somewhat restricted, very threatened). In this report, native grassland includes this community, which therefore is considered sensitive. Valley needlegrass grassland is an important community because many native perennial bunchgrasses have disappeared from their former extensive ranges in the San Joaquin and Salinas valleys and in the Los Angeles Basin of California, and now are replaced by introduced annual grasses. Loss of native grasslands has been attributed to a variety of factors, including the planting of annual grasses, cultivation, drought, and introduction of cattle and overgrazing. Few areas of native perennial grasses still remain on Vandenberg AFB. Important sensitive species found in this habitat include Gaviota tarplant (*Hemizonia increscens* ssp. *villosa*, FPE, CNPS List 1B) and dune larkspur (*Delphinium parryi* ssp. *blochmaniaei,* FSC, CNPS List 1B). Native grassland is found in the project area.

3.3.2 Sensitive Plant Species

A list of rare plants that potentially could be present in the project area is provided in Table B-3. Descriptions are given below for species that are federally listed and for species of concern that have been observed on the base and potentially could occur in the project vicinity. No sensitive plant species were found during field surveys in the project area.

Dune Larkspur (*Delphinium parryi* ssp. *blochmaniae*). This perennial plant in the family Ranunculaceae has a root less than 10 centimeters (cm) long and no basal leaves in the flowering plant. Leaves and lower stems are curled-puberulent. Lower leaves have lobes less than 5 mm wide, and cauline leaves have 5 to 15 lobes. The blue-purple sepals generally are reflexed, with the lateral sepals 16 to 25 mm long, and the spur 11 to 16 mm. The lower petal blades are 7 to 10 mm and paler than the sepals. Dune larkspur (*Delphinium parryi* ssp. *blochmaniae*) has larger flowers than other subspecies in the taxon. It occurs associated with herbs and grasses in coastal chaparral, and in sand in dune vegetation, at elevations below 200 meters. It is found from San Luis Obispo to Ventura counties, and possibly is threatened by road maintenance and competition with weeds. On Vandenberg AFB, this plant has been recorded along Coast Road north of the boathouse, in Lake Canyon, and northwest of the airstrip.

Gaviota Tarplant (*Hemizonia increscens ssp. villosa*). This species in the family Asteraceae is a gray-green, soft-hairy annual 0.3 to 0.9 meter tall, with stems generally branched near the base. Its inflorescence is rounded to flat-topped, and the involucre is glandular. The plant has 13 yellow ray flowers and 18 to 31 disk flowers. Two other subspecies, *H.i.* ssp. *i.* and *H.i.* ssp. *foliosa*, differ from it by their deep green, stiff-bristly foliage. Gaviota tarplant (*Hemizonia increscens* ssp. *villosa*) is found in coastal fields or grasslands and on bluffs at elevations below 50 meters, and is associated with grasslands that intergrade with coastal sage scrub. Its known distribution is highly localized to one extended population in western Santa Barbara County near Gaviota, on a narrow, uplifted marine terrace between the Santa Ynez Mountains and the ocean. Small, narrowly separated colonies are found in this population. This taxon recently was proposed for listing as federally endangered (*Federal Register* Vol. 63, No. 60, March 30, 1998). It has been subject to significant habitat degradation, fragmentation, and loss in the past, resulting in a restricted distribution and a general population decline. Its habitat and populations continue to be threatened from development. Gaviota tarplant (*Hemizonia increscens* ssp. *villosa*) has been reported on Vandenberg AFB south of and along Point Sal Road.

Black-Flowered Figwort (*Scrophularia atrata*). This perennial herb in the family *Scrophulariaceae* can grow up to 2 meters tall. Flowers are found in a long, glandular, puberulent inflorescence. It is characterized by an urn-shaped corolla that is colored blackish in the upper half and dark maroon in the lower half. The shape and color of the corolla distinguish it from the more common California figwort (*Scrophularia californica*) with which it intergrades, and whose corollas are more spheric and lighter in color, varying from yellow-green to dark maroon. Black-flowered figwort (*Scrophularia atrata*) is found from southern San Luis Obispo County to northern Santa Barbara County, and occurs in coastal scrub, chaparral, and woodlands in calcareous or diatomaceous soils, at elevations less than 500 meters. It is relatively common on the base in coastal scrub, riparian and oak woodlands, and in chaparral.

3.3.3 Sensitive Wildlife Species

A list of federally endangered and threatened wildlife species and other species of concern potentially occurring in the project area is provided in Table B-3. Descriptions are given below for species that are federally listed and for species of concern that have been observed on the base and potentially could occur in the project vicinity. The peregrine falcon (*Falco peregrinus*), California least tern (*Sterna antillarum browni*), western snowy plover (*Charadris alexandrinus nivosus*), and California red-legged frog (*Rana*

aurora draytonii) are federally threatened or endangered; all the other species described are species of concern. None of these species was observed in the current surveys.

Peregrine Falcon (*Falco peregrinus*). One nesting pair of peregrine falcons inhabits the rocky cliffs along the coast of South Vandenberg AFB. The closest other known nesting pairs are on Channel Islands to the south and one nesting pair to the north near Arroyo Grande; historical sightings have been reported from the cliffs near Gaviota. High, rocky outcrops and high cliff ledges provide nesting habitat for this species. Approximately 60 acres of such suitable habitat is estimated to be found on the base.

California Brown Pelican (*Pelecanus occidentalis californicus*). The federally endangered brown pelican roosts on the rocky cliffs and coastal bluffs of Vandenberg AFB; offshore kelp beds provide excellent feeding areas. Pelican numbers peak from June through January as they migrate north from Mexico. They have been sighted at numerous locations along the coast, including near Point Sal, near the mouths of Shuman Creek, San Antonio Creek, and the Santa Ynez River, as well as at Purisima Point, and the Boat House breakwater. Their nearest known nesting site is on Anacapa Island in the Santa Barbara Channel. This species is found at the coast and would be subject to launch noise.

Western Snowy Plover (*Charadrius alexandrinus nivosus).* This federally threatened species occurs on the sandy beaches west of LF-21. Critical habitat has been proposed for all suitable habitat on Vandenberg AFB 60 Federal Register 41:11796 1995). Vandenberg AFB provides important nesting and wintering habitat along the sandy beach and dune area of north Vandenberg. This small shorebird forages on invertebrates in the intertidal zone and sandy beach above the tide line and nests near tidal waters. Nesting and chick rearing occur between 1 March and 30 September. The Western snowy plover has experienced widespread loss of nesting habitat and reduced reproductive success at nesting locations due to urban encroachment and human activities. No suitable habitat for Western snowy plovers is located in the project area, however, its range on the coast of Vandenberg lies within the flight path of the launch vehicle.

California Least Tern (*Sterna antillarum browni).* The federally endangered California least tern is found on the coast of Vandenberg AFB near the mouths of creek and estuaries that provide habitat for foraging. These birds arrive on the California coast from Mexico and South America in April or May. Nesting takes place in small depressions in the sand. Threats to this species are similar to the Western snowy plover. No suitable habitat for California least terns is located in the project area, however, the mouth of Shuman Creek is included in the range of this species on Vandenberg AFB. This area potentially lies within the flight path of the launch vehicle.

Two-Striped Garter Snake (*Thamnophis hammondii*). This primarily aquatic species usually is found in summer near permanent fresh water, but has been recorded up to 180 meters from water bodies. The snakes mate in March, and young are born from August through November. The species is most common on the base in Cañada Honda Creek, and also has been reported from San Antonio Creek and Jalama Lagoon (Christopher 1996). This species was not observed in the current field survey but a suitable habitat may be present in the perennial drainage west of Building 1959. However, this species has not been found north of San Antonio Creek.

Coast Horned Lizard (*Phrynosoma coronatum frontale*). This reptile species occurs in most habitats on Vandenberg AFB, and appears to prefer open areas for basking, and loose substrates for burrowing. Adults are most active in April and May, and juveniles emerge in July and August. Its distribution on base is not well documented. This species was not observed in the current field survey, although sandy soils occur west of LF-21.

Pacific Townsend's (Western) Big-Eared Bat (*Plecotus townsendii townsendii*). This bat is a cave roosting species but will also utilize mines and buildings. Unlike many other bats, they are unable to crawl into crevices and usually roost in enclosed areas where they are vulnerable to disturbance. Great fidelity exists for a roost site and if undisturbed, the bats will use the same roost for many generations. This bat is colonial during the maternity season, typically from spring through the summer. The biological survey was conducted during the bat's winter hibernation therefore presence or absence of the bats in the project area was not determined. Caves or man-made structures that would provide suitable roost sites for these bats are be located on North Base and abandoned chromite mine caves are located in or near the project area but no bats were observed in the project area.

3.3.4 Waters of the United States and Wetlands

General observations for wetland indicators were noted in January 1999, but no protocol wetland surveys were carried out within the project area. One potential wetland within the drainage west of Building 1959 area was observed (Figure B-1). Wetland hydrology was apparent with inundated soils and flowing water. Other wetland hydrology indicators including physical evidence of water lines impressed on the bank, sediment deposits, and algae within the drainage were observed. Plant species within the drainage included algae with salt grass (*Disticlis spicata*), a facultative wetland species, along the banks. A second drainage further to the west, just southeast of Building 1956 did not possess any wetland indicators.

4.0 PROJECT IMPACTS

Impacts to biological resources would be considered significant if substantial loss, reduction, degradation, disturbance, or fragmentation occurred in native species habitats or in their populations. These could be short- or long-term impacts. For example, short-term or temporary impacts may occur during construction, and long-term impacts may result from the loss of vegetation and thereby loss of the capacity of habitats to support wildlife populations.

Informal consultation was conducted with the United States Fish and Wildlife Service (USFWS) regarding the Proposed Action and it was determined that formal consultation would not be required. Federal agencies are required by Section 7 of the ESA to assess the effect of any project on federally listed threatened and endangered species. Under Section 7, formal consultation with the USFWS is required for federal projects if such actions could directly or indirectly affect listed or proposed species. It also is Air Force policy to consider sensitive species, communities, and habitats recognized by state and local agencies when evaluating impacts of a project. Impacts to biological resources would be considered significant if special status species (endangered, threatened, rare, or candidate) or their habitats, as designated by federal, state, or local agencies, were affected directly or indirectly by project-related activities.

Impacts to jurisdictional waters of the United States and wetlands would be considered significant if the project resulted in net loss of wetland area or habitat value, either through direct or indirect impacts to wetland vegetation, loss of habitat for wildlife, degradation of water quality, or alterations in hydrological functions. The COE and the U.S. EPA have been given jurisdiction to implement Section 404 of the Clean Water Act, which regulates development that would impact waters of the United States and wetlands. All projects that would impact jurisdictional waters or wetlands require a permit from the COE.

4.1 PROPOSED ACTION

4.1.1 Biological Resources

Modification of Existing Facilities and Fiber-Optic Cable Installation. During modification of the existing facilities and installation of the fiber-optics communication cable, no impacts to biological resources would be anticipated in the project area. At the time of the surveys, the most important botanical resources identified in the project area were the plant communities of coastal sage scrub and native grassland. Native grassland is designated as sensitive by the CDFG but would not be impacted by the fiber-optic cable installation. The structural modifications would occur within disturbed areas of existing facilities. Installation of the fiber-optic cable would not disturb the ground surface other than vehicle movement between LF-21 and Building 1959. Vegetation in the areas affected by these activities has been disturbed by mowing, grazing, and, at LF-21, past launches. Therefore, no mitigation would be required.

No significant direct or indirect impacts to listed threatened and endangered wildlife species, or to any species of concern, are expected to occur in the project area during facility modifications and fiber-optic cable installation. Disturbance resulting from project activities would be restricted to ruderal areas surrounding existing facilities and grasslands in the project vicinity. Coast horned lizard, (*Phrynosoma coronatum frontale*) although not well documented on base or observed during surveys, may occur at the periphery of LF-21 due to the presence of sandy soils. Associated impacts of project activities during construction would be minimal, localized, and temporary, and most wildlife species, including the coast horned lizard that might occur within the disturbance zones would be able to move to suitable habitats away from the project area. There are no known breeding populations of sensitive bird species in the project area and adverse impacts in the form of disturbance-related nest abandonment would be unlikely. Native vegetation removal would not be expected to occur during project implementation.

Launch Activities

Debris Generation. Debris would be produced with missile launches, however debris would be contained in the silo. Launch activities are not expected to produce debris over land and therefore will not adversely effect plant or wildlife species. Additionally, debris produced over the Pacific Ocean will have no impacts on vegetation and, under normal launch conditions, would not result in impacts to terrestrial or aquatic wildlife.

Noise. Noise at the launch site and along the flight path has the potential to impact wildlife. Unexpected noises such as aircraft overflights, sonic booms and rocket launches cause variable reactions in wildlife, ranging from startling some avian and pinniped species to little or no reaction. The "startle effect" associated with missile ignition and lift-off is considered a short-term negligible effect (U.S. Army 1997).

Peregrine falcons are expected in the project vicinity as foragers, however, potential nest sites would be at Point Sal, approximately 5 miles northwest of LF-21. Peregrine falcons are not expected to breed or nest in the project area and due to the distance from LF-21 to appropriate nesting habitat at Point Sal, would not be adversely affected by launch noise. Townsend's big-eared bat is not expected in or near the project area due to lack of appropriate habitat.

Snowy plover and California least tern habitat and California brown pelicans would be within the audible range of the proposed launches. However, because of the distance from the launch site to these habitat

areas and the fact that the proposed missile is smaller than a Minuteman III missile, noise impacts to these species would be less than significant.

In addition, the small number of launch tests (two) proposed under the BV test project and the short duration of the launch activities in addition to the lack of appropriate habitat for sensitive species in the project area, would result in less than significant impacts to terrestrial wildlife species. Therefore, no mitigation is required.

Emissions. Launch activities during dry conditions would produce aluminum oxide (Al_2O_3), which would be suspended in the air and dispersed over the area surrounding LF-21. Under natural conditions, this chemical is not a source of toxic aluminum. The U.S. Environmental Protection Agency (U.S. EPA) has determined that non-fibrous Al_2O_3 as found in solid rocket fuel exhaust is non-toxic (National Aeronautics and Space Administration 1990). Less than significant impacts to biological resources are therefore expected as a result of Al_2O_3 deposited in the ruderal area surrounding LF-21. The Al_2O_3 is not expected to affect the drainage to the west of Building 1959 due to its distance (approximately 3/4 mile) and a hill that separates LF-21 and the drainage.

Hydrochloric acid (HCl) produced by the launch would be deposited in the area surrounding LF-21 in the event that rainfall occurs within 2 hours of the launch. This chemical is emitted during solid propellant missile launches for large flight vehicles, such as the space shuttle and Titan series, and is known to injure plant leaves and affect wildlife. However, launch vehicles such as the strap-on booster is expected to produce low-level, short-term HCl emissions that have been determined to have little effect upon vegetation and wildlife (U.S. Army 1997). The amount of HCl produced by the strap-on booster is smaller than the space shuttle or Titan rockets and little effect is expected upon vegetation or wildlife in the area surrounding LF-21. Additionally, impacts would not occur to the ruderal vegetation surrounding LF-21.

Early Flight Termination. Fire, as a result of a launch mishap could impact surrounding vegetation. The baseline first stage booster is a variant of the strap-on booster used in Delta II program. The Delta II launches utilizing the strap-on-booster have a 98 percent success rate in over 200 Delta launches (American Institute of Aeronautics and Astronautics, Inc. 1998) and the probability of an incident would be considered low. In the event a fire did occur as a result of early flight termination, wildlife would be able to respond to a fire as under natural conditions and move away from the area. No sensitive biological resources occur in the area surrounding LF-21 due to past disturbance. In addition, Fire-fighting personnel are on stand-by status during launch activities as a precaution. Therefore, no impacts to biological resources are expected.

4.1.2 Waters of the United States and Wetlands

The aboveground fiber-optic cable would cross a drainage to the west of Building 1959. This drainage would be considered a wetland, however, installation of the fiber optic cable would use an existing conduit to cross the drainage and avoid disturbing the drainage bottom. If necessary, vegetation would be trimmed to accommodate cable installation. Use of the existing conduit would avoid and protect the drainage bottom and also serve to avoid impacts to sensitive wildlife habitats and species potentially residing in the drainage. No impacts to the drainage are expected from launch activities since the drainage is approximately 3/4 mile east of LF-21. Informal consultation was conducted with the United States Fish and Wildlife Service (USFWS) regarding the Proposed Action and it was determined that formal consultation would not be required.

4.2 NO-ACTION ALTERNATIVE

4.2.1 Biological Resources

Under the No-Action Alternative, no significant impacts to biological resources would occur.

4.2.2 Waters of the United States and Wetlands

Under the No-Action Alternative, no significant impacts to jurisdictional waters or potential wetland resources would occur.

4.3 MITIGATION MEASURES FOR THE PROPOSED ACTION

4.3.1 Biological Resources

No significant impacts to biological resources would occur, therefore, no mitigation measures are required.

4.3.2 Waters of the United States and Wetlands

Under the Proposed Action, no significant impacts to waters of the United States or wetlands would occur.

4.4 MITIGATION MEASURES FOR THE NO-ACTION ALTERNATIVE

Since no significant impacts to biological resources or to jurisdictional waters of the United States or potential wetlands would occur under the No-Action Alternative, no mitigation measures would be required.

5.0 LIST OF PREPARERS

Kefauver, Kathleen, Senior Biologist, Tetra Tech, Inc.
B.A., 1987, Biological Sciences, University of California, Santa Barbara
Years of Experience: 15

Lum, Luanne, Environmental Scientist, Tetra Tech, Inc.
B.A., 1985, Environmental Design and Planning, University of Colorado
Years of Experience: 12

6.0 REFERENCES

Abrams, L., and R.S. Ferris
1940 *Illustrated Flora of the Pacific States.* Stanford University Press, Stanford.

American Ornithologists' Union
1983 *Check-list of North American Birds. 6th edition.* American Ornithologists' Union, Washington D.C.

Brown, Patricia E., Ph.D.
1995 *A Survey for Bats of the Soledad Mountain Project. Soledad Mountain Project EIR/EIS.* Mojave, Kern County, California.

California Department of Fish and Game (CDFG)
1998 California Natural Diversity Data Base. Natural Heritage Division.

Christopher, S.V.
1996 *Reptiles and Amphibians of Vandenberg Air Force Base, Santa Barbara County, California, 1995.* Report No. 4, Museum of Systematics and Ecology, University of California, Santa Barbara, in cooperation with National Biological Service. San Simeon, California.

Collins, J.T.
1990 *Standard Common and Current Scientific Names for North American Amphibians and Reptiles, 3rd Edition.* Herpetological Circular No. 19. Society for the Study of Amphibians and Reptiles.

Hickman, J.C. (Ed.)
1993 *The Jepson Manual, Higher Plants of California.* University of California Press, Berkeley.

Holland, R.F.
1986 Preliminary Descriptions of the Terrestrial Natural Communities of California. Unpublished Report. State of California, The Resources Agency, Department of Fish and Game, Natural Heritage Division, Sacramento.

Holmgren, M.A., and P.W. Collins (Eds.)
1997 *Draft Report on Distribution and Habitat Associations of Six Bird Species of Special Concern at Vandenberg Air Force Base, Santa Barbara County, California.* Environmental Report No. 5, Museum of Systematics and Ecology, University of California, Santa Barbara, and Volume 1, Santa Barbara Museum of Natural History Regional Biodiversity Series. Santa Barbara, California.

Lehman, P.E.
1994 *The Birds of Santa Barbara County, California.* Vertebrate Museum, University of California, Santa Barbara. Santa Barbara, California.

Munz, P.A.
1974 *A Flora of Southern California.* University of California Press, Berkeley.

Munz, P.A., and D.D. Keck
1968 *A California Flora and Supplement.* University of California Press, Berkeley.

National Geographic Society
1987 *Field Guide to the Birds of North America.* National Geographic Society, Washington D.C.

Reed, P.B., Jr.
1988 National List of Plant Species That Occur in Wetlands: California (Region 1). Biological Report 88(26.10). United States Fish and Wildlife Service, Washington, DC.

Skinner, M.W., and B.M. Pavlik
1994 *Inventory of Rare and Endangered Vascular Plants of California.* Fifth Edition. California Native Plant Society, Sacramento, California.

Smith, C.F.
1998 *A Flora of the Santa Barbara Region, California.* Second Edition. Santa Barbara Botanic Garden and Capra Press, Santa Barbara, California.

Stebbins, R.C.
1985 *A Field Guide to Western Reptiles and Amphibians.* Houghton Mifflin Company, Boston.

U.S. Department of Agriculture
1958 *Soil Survey, Santa Barbara Area, California.* Soil Conservation Service in Cooperation with the University of California Agricultural Experiment Station, Washington, DC.

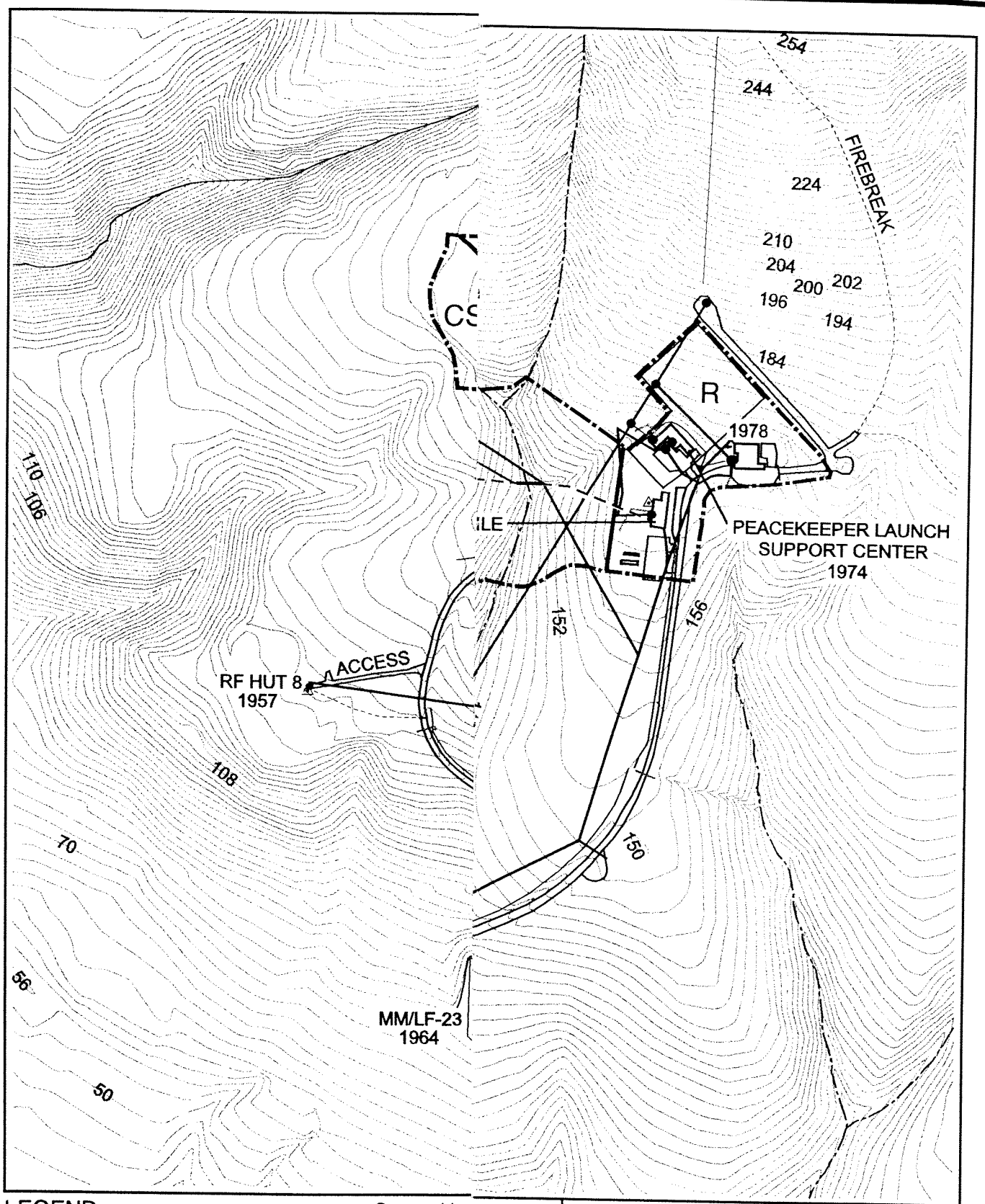
U.S. Air Force
1996 *Integrated Natural Resources Management Plan.* Prepared by Tetra Tech, Inc. for 30 CES/CEV, Vandenberg AFB, California.

U.S. Army
1997 *Theater Ballistic Missile Targets Programmatic Environmental Assessment.* Space and Strategic Defense Command, Huntsville, Alabama.

U.S. Fish and Wildlife Service (USFWS)
1996a *National List of Vascular Plant Species That Occur in Wetlands.*

U.S. Fish and Wildlife Service (USFWS)
1996b National Summary. http://www.nwifws.gov/ecology.htm.

Vandenberg Air Force Base (Vandenberg AFB)
1989 *Vandenberg Air Force Base Comprehensive Plan, Santa Barbara County, California.*



LEGEND

- Buildings
- Paved Road or Street
- Parking Lot or Driveway
- Surface Water Drainage
- Survey Area
- Vegetation
- Contour Line
- Storm Drain
- Channel
- Water Line
- Sewer Line
- Electrical Line
- Proposed Condu

, January 1999

BIOLOGICAL RESOURCE AREAS

DATE	DRAWN BY	MADE FROM	GIS FILE #	FIGURE
2/22/99	Vance Hoyt Randall	VAFB	R:/ARMYEA/ B-1	B-1

Table B-1
Plant List for Vandenberg AFB, California
Booster Verification Tests EA
Habitat: Nonnative Grassland and Coastal Sage Scrub

Family	*Scientific Name*	Common Name	N = Native I = Introduce	Habitat	O = Observed E = Expected	Wetland Status
	.	Algae	U		Od	
Aizoaceae	*Carpobrotus edulis*	Iceplant	I	Shrub, subshrub	Or	
Apiaceae	*Conium maculatum*	Poison hemlock	I	Biennial, herb	Os	FAC
	Petroselinum crispum	Parsley	I	Annual, biennial herb	Or	
Asteraceae	*Artemesia californica*	California sagebrush	N	Shrub	Os	
	Baccharis pilularis	Coyote brush	N	Shrub	Os	
	Cirsium occidentale var. occidentale	Cobwebby thistle	N	Biennial, herb	Or	
	Coreopsis gigantea	Giant coreopsis	N	Shrub	O1	
	Encelia californica	Encelia	N	Shrub	Or	
	Hazardia squarrosa var. squarrosa	Saw-toothed goldenbush	N	Shrub	Or	
	Hazardia stenolepis	Hazardia	N	Shrub	Or	
	Picris echioides	Bristly ox-tongue	I	Annual/ Biennial, herb	Or	FAC
Boraginaceae	*Amsinkia spectabilis var. spectabilis*	Fiddleneck	N			FACU
Brassicaceae	*Brassica nigra*	Black mustard	I	Annual/ Biennial, herb	Os	
	Lepidium oblongum var. *oblongum*	Peppergrass	N	Annual	Os	
Convolvulaceae	*Calystegia macrostegia* spp. *macrostegia*	Morning glory	N	Perennial	Os	
Fabaceae	*Astragalus curtipes*	Locoweed	N	Perennial	Or	
Liliaceae	*Dichelostemma capitatum var. capitatum*	Blue dicks	N	Perennial	Oc	FACa
Nyctaginaceae	*Mirabilis californica*	Wishbone bush	N	Perennial, subshrub	Or	
Papaveraceae	*Eschscholzia californica*	California poppy	N	Annual, herb	s	
Poaceae	*Disticlis spicata*	Salt grass	N	Grass	Od	FACW
	*Erharta calycina**	Veldt grass	I	Grass	Oc	
	Nasella spp		N	Grass	Or	
Polygonaceae	*Eriogonum parvifolium*	Wild buckwheat	N	Shrub	Or	
	Rumex crispus	Curly dock	I	Perennial	Os	FACW-
Urticaceae	Urtica dioica *spp.holosericea*	Hoary Nettle	N	Perennial, herb	Or	FACW

Table B-1 (continued)
Plant List for Vandenberg AFB, California
Booster Verification Tests EA
Habitat: Nonnative Grassland and Coastal Sage Scrub

Notes:
* = Dominant species.
U = unknown.

Observed & Expected Notes:
1 = One individual.
c = Common.
d = Within drainage area west of Building 1978.
r = Rare.
s = Scattered.

California Wetland indicator Status (USFWS 1996):
OBL = Obligate Wetland.
FACW = Facultative Wetland.
FAC = Facultative.
FACU = Facultative Upland.
a = Indicates tentative assignment.
+ = Indicates a frequency toward the higher end of the category.
- = Indicates a frequency toward the lower end of the category.

References:
Hickman 1996; USFWS 1996.

Table B-2
List of Wildlife Species for
Vandenberg AFB, California
Booster Verification Tests EA

Scientific Name	Common Name	O = Observed, E = Expected
Mammals		
Spermophilus beecheyi	Ground squirrel	O
Thomomys bottae	Pocket gopher	E
Scapanus latimanus	Broad-footed mole	E
Peromyscus maniculatus	Deer mouse	O
Plecotus townsendii townsendii•	Townsend's (western) big-eared bat	E
Sylvilagus bachmani	Brush rabbit	O
Mephitis mephitis	Striped skunk	O
Mustela frenata	Long-tailed weasel	E
Sus scrofa	Feral pig	E
Odocoileus hemionus	Mule deer	O
Canis latrans	Coyote	E
Amphibians		
Pseudacris regilla	Pacific tree frog	E
Reptiles		
Crotalus viridis	Southern Pacific rattlesnake	E
Thamnophis elegans	Coast garter snake	E
Thamnophis hammondii•	Two-striped garter snake	E
Sceloporus occidentalis	Western fence lizard	O
Phyrnosomaa coronatum frontale•	California horned lizard	E
Birds		
Cathartes aura	Turkey vulture	O
Buteo jamaicensis	Red-tailed hawk	O
Falco sparverius	American kestrel	O
Circus cyaneus	Marsh hawk	E
Falco peregrinis•	Peregrine falcon	E
Athene cinicularia	Western burrowing owl	E
Carpodacus mexicanus	House finch	O
Pipilo maculatus	California towee	O
Hirundo pyrrhonota	Cliff swallow	E
Zonotrichia leucophyrs	White-crowned sparrow	O
Melospiza melodia	Song sparrow	O
Sturnella neglecta	Western meadowlark	O
Psaltriparus minimus	Bushtit	E
Anthus rubescens	American water pipit	O
Lanius ludovicianus	Loggerhead shrike	O
Euphagus cyanocephalus	Brewer's blackbird	O
Buteo regalis	Ferruginous hawk	E
Agelaius tricolor	Tricolored blackbird	E
Geothlypis trichas	Common yellowthroat	O
Sayornis nigricans	Black phoebe	O
Sayornis saya	Says phoebe	O
Ammodramus savannarum	Grasshopper sparrow	E

Note:
• = Sensitive species.

Table B-3
Sensitive Plant Species Potentially Occurring at or in the Vicinity of the Booster Verification Tests Project Area Vandenberg AFB, California

Scientific Name	Common Name	Status			Project Area Habitat	Occurrence On VAFB	Blooming Period
		Federal[1]	State[2]	CNPS[3]			
Chorizanthe rectispina	Straight-awned spineflower	FSC		1B	Coastal sage scrub	O	Feb-Jun
Cordylanthus rigidus spp. littoralis	Seaside bird's beak	FSC	SE	1B	Coastal sage scrub		May-Oct
Delphinium parryi var. blochmaniae	Dune larkspur	FSC		1B	Coastal sage scrub, grassland		Apr-May
Hemizonia increscens ssp. villosa	Gaviota tarplant	FPE	SE	1B	Coastal bluff scrub, coastal sage scrub, grassland,	O	Jun-Sep
Hemizonia parryi spp. australis	Southern tarplant	FSC		1B	Coastal sage scrub, grassland		Jun-Nov
Scrophularia atrata	Black-flowered figwort	FSC		1B	Coastal sage scrub		Apr-Jun
Agrostis hooveri	Hoover's bent grass			4	Grassland		Jun-Jul
Baccaris plummerae var. plummerae	Plummer's baccharis			4	Coastal sage scrub	E	Aug-Oct
Calochortus clavatus var. clavatus	Club-haired mariposa lily			4	Grassland	E	May-Jun
Chorizanthe palmeri	Palmer's spineflower			4	Grassland	E	May-Aug
Dichondra occidentalis	Western dichondra			4	Coastal sage scrub, grassland	O	Mar-May
Erigeron sanctarum	Saint's daisy			4	Coastal sage scrub	O	Mar-Jun
Erysimum capitatum var. lompocense	San Luis Obispo wallflower			4	Coastal sage scrub	O	Feb-May
Erysimum insulare var. suffrutescens	Suffrutescent wallflower			4	Coastal sage scrub	O	Jan-Jun
Leptodactylon californicum var. tomentosum	Prickly phlox			4	Coastal sage scrub	O	Mar-Aug
Sanicula hoffmannii	Hoffman's sanicle			4	Coastal sage scrub	O	Mar-May

Table B-3 (continued)
Sensitive Plant Species Potentially Occurring at or in the Vicinity of the Booster Verification Tests Project Area
Vandenberg AFB, California

Notes:
1 = Listed by U.S. Fish and Wildlife Service (USFWS).
2 = Listed by California Department of Fish and Game (CDFG).
3 = Listed by California Native Plant Society (CNPS).

FE = Federally listed Endangered.
FT = Federally listed Threatened.
FSC = Federally listed Species of Concern.
SE = State listed Endangered.
ST = State listed Threatened.
1B = California Native Plant Society listed plants are rare, threatened, or endangered in California and elsewhere.
4 = California Native Plant Society listed plants are of limited distribution or infrequent throughout a broader area in California.

References:
California Department of Fish and Game, Natural Diversity Data Base. April 1998. Special Plants List. Biannual publication, Mimeo., 119 pp.
California Department of Fish and Game, Natural Diversity Data Base. August 1998. State and Federally listed Endangered, Threatened, and Rare Plants of California.

Table B-4
List of Sensitive Wildlife Species for Vandenberg AFB, California Booster Verification Tests EA

Scientific Name	Common Name	O = Observed E = Expected	Status Federal	Status State	CDFG	Habitat	Breeding Season (On VAFB Only)	Additional Comments
Amphibians								
Rana aurora draytoni	California red-legged frog	Oy	FT		CSC	Perennial ponds and streams	Feb – mid-Apr	Nearly all permanent lakes, streams and ponds on VAFB
Spea hammondii	Western spadefoot toad	Oy	FSC		CSC	Grassland, vernal pools	Late Jan–Mar	
Clemmys marmorata pallida	Southwestern pond turtle	Oy	FSC		CSC	Perennial lakes, ponds, streams; eggs laid in upland areas 16-400 meters from water	Can occur year-round; peak May – Jun	Hatchlings overwinter in nest; move to aquatic sites Mar-Apr
Reptiles								
Thamnophis hammondii	Two-striped garter snake	Oy	FSC		CSC	Permanent water bodies; in winter, grassland/coastal sage scrub 50-180 meters from water	Mar; young born Aug-Nov	Primarily inactive in rodent burrows in winter, but may emerge to forage on warm days
Phyrnosomaa coronatum frontale	California horned lizard	Oy	FSC		CSC	Mostly on loose substrates for burrowing	Apr-Aug	
Birds								
Falco peregrinis	Peregrine falcon	Oy,m,,w	FE	SE	FP	Nest on cliffs, forage over all open habitats	Mid-Feb - Jul	
Speotyyto cunicularia hypugea	Western burrowing owl	Om, potential b	FSC		CSC	Open, dry grassland	Apr-Jun	
Buteo regalis	Ferruginous hawk	Om,w	FSC		CSC	Open country		
Agelaius tricolor	Tricolored blackbird	Om,w	FSC		CSC	Dense tule stands, fields, and pastures		
Mammals								
Plecotus townsendii townsendii	Pacific Townsend's (western) big -eared bat	Ey, potential b	FSC			Rocky outcrops and man-made structures	Nov-Feb mating, May-Aug reproduce	

Table B-4 (continued)
List of Sensitive Wildlife Species
for Vandenberg AFB, California
Booster Verification Tests EA

Notes:
m = Migrant.
w = Winter.
b = Breeds.
y = Year-round.

FE = Federally listed Endangered.
FT = Federally listed Threatened.
FSC = Federally listed Species of Concern.
SE = State listed Endangered.
ST = State listed Threatened.
CDFG = California Department of Fish and Game.
CSC = California Special Concern species.
FP = Fully Protected.

References:
California Department of Fish and Game, Natural Diversity Data Base. March 1998. Special Animals.
California Department of Fish and Game, Natural Diversity Data Base. July 1998. State and Federally Listed Endangered and Threatened Animals of California.
Lehman, P.E. 1994. The Birds of Santa Barbara County, California. Vertebrate Museum, University of California, Santa Barbara, CA

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