

HD-A138 227

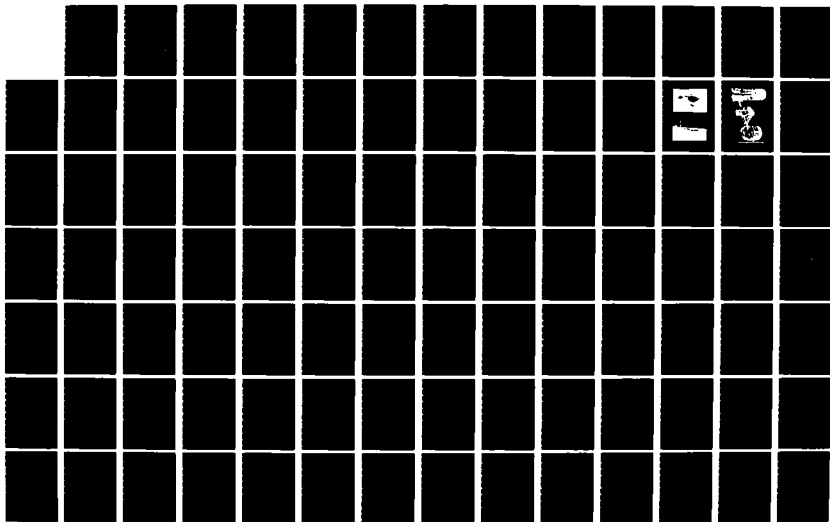
ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED DEACTIVATION
OF THE TITAN II MISSILE SYSTEM(U) TETRA TECH INC
JACKSONVILLE FL AUG 82 F08637-80-G-0007

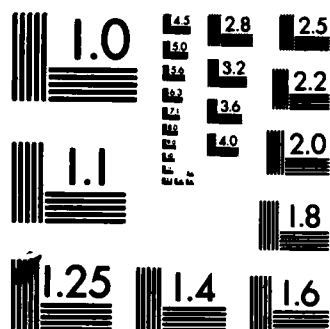
1/2

UNCLASSIFIED

F/G 16/1

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

1

AUGUST 1982

AD A138227

ENVIRONMENTAL ASSESSMENT
FOR THE
PROPOSED DEACTIVATION
OF THE
TITAN II MISSILE SYSTEM

DTIC
ELECTE
S FEB 23 1984
A

DTIC FILE COPY



This document has been approved
for public release and sale; its
distribution is unlimited.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, STRATEGIC AIR COMMAND
OFFUTT AIR FORCE BASE, NEBRASKA

84 02 21 07

Unclas

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A138227	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Environmental Assessment for the Proposed Deactivation of the Titan II Missile System		5. TYPE OF REPORT & PERIOD COVERED Final Report - Aug 82
7. AUTHOR(s) Tetra Tech, Inc		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS Tetra Tech, Inc Center Bldg, Suite 321B, Deerwood Center 7825 Baymeadows Way Jacksonville, FL 32216		8. CONTRACT OR GRANT NUMBER(s) Task 4.7 of Air Force Contract No. F08637-80- G0007-6U01
11. CONTROLLING OFFICE NAME AND ADDRESS HQ SAC/DEP Offutt AFB NE 68113		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE August 1982
		13. NUMBER OF PAGES 178
		15. SECURITY CLASS. (of this report) Unclas
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release, distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Environmental Analyses Titan II Missile		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) An environmental analysis was accomplished to determine the impacts of deactivating the Titan-II Missile System. The document studied three phases of the action: deactivation of missile sites; transportation of components to destination sites; and disposition of components at destination sites. Deactivation of support functions were studied in an ancillary phase. The analysis supported a finding that the deactivation would have little or no effect on the biophysical environment and minor impact on the socioeconomic environment.		

DD FORM
1 JAN 73

1473A

EDITION OF 1 NOV 65 IS OBSOLETE

Unclas

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DIRECTOR/
 APR 2 1968
 APR 2 1968
 SPECIAL
 A-1

3.2 The no-action alternative means retention of a portion of the ICBM force that does not meet the changing strategy and guidance for strategic weapon systems in the late 1980's as well as newer systems which will eventually replace it.

Section 4.0 Summary of Environmental Impacts

4.1 Phase I Impacts

4.1.1 Atmospherics: The impact of the proposed action on air quality will be negligible. Vehicle-generated emissions and dust compose the greatest contribution. Small amounts of propellant vapors usually generated during propellant transfer may result in localized temporary exceedence of air quality standards for these substances. These are normal to existing operations and will have insignificant impact on the biophysical environment. Severe spills or propellant losses which would have a detectable effect on the biota are very unlikely for the entire program schedule, based on a record of two major accidents in 20 years, and the resulting safety measures introduced to prevent recurrence of these type accidents.

4.1.2 Hydrology: The impact of the proposed action on the hydrology will be positive. Water consumption at the missile sites will be greatly reduced in caretaker status. No planned action will result in discharges to the ground or surface waters. Unlikely worst case accidents resulting in spilled products reaching sensitive waters would be improbable.

4.1.3 Biology: Operations associated with missile site deactivation will have no impact on threatened or endangered species. No plant or animal life in those categories have been found near the missile sites. Transient birds and mammals would tend to avoid the area of human activity.

4.1.4 Aesthetics: No permanent changes to visual aesthetics would be associated with the planned action.

4.1.5 Demography and Economics: Demographic changes will occur in the vicinity of the Titan II operational bases as a result of Air Force manpower reductions. These are insignificant in the larger population areas of Tuscon, Arizona, and Wichita, Kansas. The city of Jacksonville, Arkansas will experience more of an impact on its population, school enrollment, and employment because of its smaller population. The regional impact on Pulaski County Arkansas will be minor, however.

4.1.6 Land Use: No immediate land use impacts will be caused by conversion of the sites to caretaker status.

4.1.7 Cultural Resources: No effect.

4.2.8 Local Transportation: Air Force vehicle usage of local roads will increase in the short term and decrease in the long term. Both will have insignificant effects.

4.1.9 Noise: Insignificant vehicle and equipment noise usually associated with a construction site will occur.

4.2 Phase II Impacts

4.2.1 Atmospherics: Transport of missile and missile site components will have insignificant vehicle emission impacts. The unlikely event of a propellant spill could have severe local impacts, but the probability of a spill is low. The estimated probability of a major or minor propellant spill is less than one in fifty thousand per shipment.

4.2.2 Hydrology: The planned action will have no environmental effect on hydrology. The unlikely event of an accident induced propellant spill multiplied by the low probability of such a spill occurring within reach of a sensitive body of water make this risk insignificant.

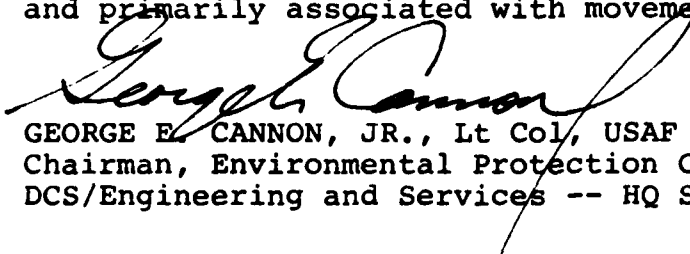
4.2.3 Biology: The planned action will have no effect on biological species, except in the unlikely event of an accident-induced propellant spill. The improbability of a spill, compounded with the improbability of threatened or endangered species being within the spill affected area, results in a negligible impact. A greater danger exists to human populations in the event of a propellant spill during transport. Although the probability of experiencing a spill during the deactivation is very low, the consequences of any spill could be serious. However, the propellants would require eventual movement in any alternative including the no-action alternative. If it were feasible to neutralize these chemicals in place, similar amounts of new propellants would require cross country transport to support space programs. Rail shipment of propellants would probably be less safe in the long run. The safety record and experience of the Air Force contracted propellant carriers is significantly better than the average highway carrier. The use of a highway carrier reduces the number of transfer operations compared with rail transport and also provides a full-time knowledgeable monitor of the load in the person of the driver. Response measures disseminated by the Air Force in coordination with the Federal Emergency Management Agency would considerably mitigate impacts of a spill. Anticipated impacts, combined with the probability of events, are considered insignificant.

4.2.4 Aesthetics, demographics, land use and cultural resources are unaffected in this phase of the deactivation.

6.0 Conclusions

6.1 The environmental assessment supports a conclusion that the proposed action will have little or no effect on the biophysical environment except in the event of a major propellant-spill accident. Missile Site (Phase I) spill accident impacts as a result of the proposed action are considered insignificant based on the record of only two severe propellant spills in twenty years of operation, extensive procedural and equipment modifications by the Air Force to prevent recurrence and/or mitigate the severity of these type accidents, and the relative isolation of the missile sites. Over the road transport (Phase II) propellant spill accidents have the potential for significant biophysical impact but the low probability of any accident involving any spill make the risk insignificant. The probability of a vehicle accident which could result in a major or minor spill is approximately one in fifty thousand per propellant shipment, and the probability of a major spill with significant impact is a fraction of that (only one spill of hazardous material is known to have occurred in the 80,000,000 carrier transport miles). Based on the probability of a severe propellant spill, the risk is considered insignificant. Propellant operations in Phase III (disposition) would be similar to Phase I in biophysical effect and risk and is also considered insignificant.

6.2 The socioeconomic impacts of the proposed action are minor and primarily associated with movement of military personnel.


GEORGE E. CANNON, JR., Lt Col, USAF
Chairman, Environmental Protection Committee
DCS/Engineering and Services -- HQ SAC

31 Aug 82

SUMMARY

An environmental analysis was conducted to evaluate the impacts of the proposed deactivation of the Titan II Missile System. The proposed action is a part of a strategic force improvement program announced by the President of the United States and includes a plan to modernize the intercontinental ballistic missile (ICBM) force by retiring older, less cost-effective Titan II missiles and deploying systems that are more advanced.

The Titan II ICBM force presently includes 52 operational missile sites located near the support installations of Davis-Monthan AFB, Tucson, Arizona; McConnell AFB, Wichita, Kansas; and Little Rock AFB, near Little Rock, Arkansas. Other installations affected by the deactivation include component destination bases, civilian facilities, a logistic support depot and training bases. The component destination bases and civilian facilities are at Hill AFB, Utah (ordnance); Nellis AFB, Nevada and Kelly AFB, Texas (reentry vehicles); Department of Energy facilities (warheads); various depots (hardware components); Vandenberg AFB, California, Aerojet at Nimbus, California and Holston Army Ammunition Plant, Tennessee (oxidizer propellant); Vandenberg AFB, California, Aerojet at Nimbus California, Rocky Mountain Arsenal, Colorado and Cape Canaveral AFS, Florida (fuel mix); and Norton AFB, California (missile boosters). Hill AFB, Utah is the logistics support depot. The training bases are at Vandenberg AFB, California and Sheppard AFB, Texas.

Several deactivation schedules were considered during the analysis. The schedule for the proposed action alternative involves sequential deactivation that proceeds from one installation unit (Wing) to the next at a rate of approximately one missile per 1½ months. This program would begin

in October 1982 and be completed by the end of 1987, barring unforeseen delays. Other deactivation schedule alternatives include delayed deactivation, partial deactivation, prolonged deactivation, and several forms of accelerated deactivation.

The proposed action and all but the no-action alternative will occur in four phases. This process begins with progressive deactivation of missile sites in Phase I, transportation of components to destination points in Phase II, disposition of components at destination points in Phase III, and deactivation of support functions in the fourth or Ancillary Phase. The ultimate disposition of missile site real estate is not a part of this program.

Potential impacts for each of the phases of the proposed action were determined in the areas of atmospheric, hydrology, biology, aesthetics, demography, economics, housing, institutions, land use, cultural resources, local transportation and noise. Fuel transfer and missile removal in Phase I are nearly identical to the well established procedures used in normal missile operations and maintenance. Only the rate of operation will change.

Phase I impacts for all considered issues will vary. A local impact of 10.1 percent in housing vacancy is projected for the City of Jacksonville which is located near Little Rock AFB. Air quality impacts at the operational bases are expected to be negligible for dust and vehicle emissions. Potential hydrological and biological impacts could occur in the improbable event of a spill. Very minor temporary aesthetic impacts are expected at missile sites near the three operational bases. Demographic impacts at both Davis-Monthan and McConnell AFBs will be insignificant. The most serious demographic impact is expected to occur at Jacksonville, near Little Rock AFB where a 6.5 percent population decrease is projected. Minor employment reductions

and economic decline in the vicinity of Titan operational bases are likely. Local housing impacts in all affected areas (except for previously mentioned Jacksonville, Arkansas) will be less than 2.0 percent. Negligible school impacts are anticipated near Davis-Monthan and McConnell AFBs, and less than 5.0 percent enrollment decline in Little Rock AFB area schools is likely. Minor positive energy and water use impacts at the operational bases will develop. Minor local transportation impacts as well as temporary minor noise impacts can be expected during Phase I near the three operational bases.

Impacts associated with the transportation of components to destination points in Phase II will be insignificant with respect to vehicle emissions. Adverse impacts could result from an improbable propellant spill or fire. Such an event could produce serious impacts on air quality, hydrology, biology, special interest areas, land use, transportation, cultural resources, and noise. Minor temporary positive economic impacts may result from increases in spending and tax revenues generated by truckers and trucking companies.

Component disposition impacts at destination bases during Phase III will be insignificant with respect to air quality during off-loading of propellants. Air quality, hydrological, and biological impacts due to a spill or fire may develop but should be less than in Phase II due to the closer proximity of equipment and trained personnel which generally exist at destination bases. Air Force storage and reuse of propellants in lieu of new purchases will result in an economic savings to the government. Transportation and noise impacts during Phase III should be minor, local, and of short duration. Destination point procedures, in most cases, are well established in handling propellants or similar items.

Ancillary phase impacts were determined for demographics, economics, housing, institutions, and traffic. Insignificant impacts due to personnel reductions are expected at Vandenberg AFB, Sheppard AFB, and Hill AFB. These reductions can be expected to produce regional unemployment level increases of less than 0.5 percent at Vandenberg AFB, less than 1.8 percent at Sheppard AFB, and less than 0.2 percent at Hill AFB. Annual regional payrolls will be reduced by \$4.5 million at Vandenberg AFB, \$11.9 million at Sheppard AFB, and \$2.6 million at Hill AFB. Minor housing and school enrollment impacts are likely at the three bases. In addition, very minor positive impacts would develop during the Ancillary Phase at Vandenberg, Sheppard and Hill Air Force Bases due to reduced vehicular activity.

Existing Titan support activities are operating with a number of current environmental permits. Activities associated with the proposed action are not expected to differ significantly; as a result, only those activities to be conducted at the Holston Army Ammunition Plant as well as those that require the construction of new storage tankage may require new or modified environmental permits.

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
SUMMARY	i
TABLE OF CONTENTS	v
LIST OF TABLES	viii
LIST OF FIGURES	x
LIST OF PLATES	x
 I OVERVIEW OF PROPOSED ACTION AND ALTERNATIVES	 1
A. Purpose, Need, and Organization	1
B. Description of Proposed Actions and Alternatives	2
1. Proposed Action Alternative	5
a. <u>Phase I</u> --Deactivation of Missile Installation	7
b. <u>Phase II</u> --Transportation of Components to Destination Points	22
c. <u>Phase III</u> --Disposition of Components at Destination Points	25
d. <u>Ancillary Phase</u> --Deactivation of Other Support Functions	28
2. Alternatives to the Proposed Action	30
a. No-Action Alternative	32
b. Accelerated Deactivation Alternative	33
c. Modified Deactivation Alternative	33
d. Other Alternatives	34
 II AFFECTED ENVIRONMENT	 37
A. Natural Environment	41
1. General Physiography	41
2. Atmospheric Environment	44
3. Hydrologic Environment	48
4. Biotic Environment	53
5. Special Interest Areas	57
6. Natural Hazards	58

TABLE OF CONTENTS
(continued)

<u>SECTION</u>	<u>PAGE</u>
B. Socioeconomic Environment	59
1. Demographic Environment	60
2. Economic Characteristics	63
3. Housing Characteristics	67
4. Institutional Characteristics	71
5. Land Use Characteristics	73
6. Cultural Resource Characteristics	77
7. Transportation Environment	79
8. Noise Environment	82
9. Security and Safety Characteristics	84
III. RISK, ANALYSIS AND SPILL SCENARIO	86
A. Risk Analysis	86
B. Spill Scenarios	90
IV. ENVIRONMENTAL CONSEQUENCES	97
A. Impacts of Proposed Action Alternative	97
1. Potential Impacts of Deactivation Missile Installations (Phase I)	98
a. <u>Phase I--Atmospheric Impacts</u>	98
b. <u>Phase I--Hydrologic Impacts</u>	99
c. <u>Phase I--Biologic Impacts</u>	100
d. <u>Phase I--Aesthetic Impacts</u>	102
e. <u>Phase I--Demographic Impacts</u>	102
f. <u>Phase I--Economic Impacts</u>	107
g. <u>Phase I--Housing Impacts</u>	108
h. <u>Phase I--Institutional Impacts</u>	109
i. <u>Phase I--Land Use Impacts</u>	112
j. <u>Phase I--Cultural Resource Impacts</u>	113
k. <u>Phase I--Local Transportation Impacts</u>	114
l. <u>Phase I--Noise Impacts</u>	115
2. Potential Impacts of Transporting Components to Destination Points (Phase II)	115
a. <u>Phase II--Atmospheric Impacts</u>	116
b. <u>Phase II--Hydrologic Impacts</u>	117
c. <u>Phase II--Biologic Impacts</u>	118
d. <u>Phase II--Special Interest Area Impacts</u>	118
e. <u>Phase II--Economic and Institutional Impacts</u>	119

TABLE OF CONTENTS
(continued)

<u>SECTION</u>	<u>PAGE</u>
f. <u>Phase II--Land Use Impacts</u>	120
g. <u>Phase II--Transportation Network Impacts</u>	120
h. <u>Phase II--Cultural Resource Impacts</u>	121
i. <u>Phase II--Noise Impacts</u>	122
3. Potential Impacts of Component Disposition Activities at Destination Points (Phase III)	122
a. <u>Phase III--Atmospheric Impacts</u>	123
b. <u>Phase III--Hydrologic Impacts</u>	124
c. <u>Phase III--Biologic Impacts</u>	125
d. <u>Phase III--Special Interest Area Impacts</u>	125
e. <u>Phase III--Economic and Institutional Impacts</u>	125
f. <u>Phase III--Transportation Network Impacts</u>	126
g. <u>Phase III--Noise Impacts</u>	127
4. Potential Impacts of Deactivating Other Support Functions	128
a. Ancillary Demographic Impacts	128
b. Ancillary Employment Impacts	129
c. Ancillary Housing Impacts	131
d. Ancillary Institutional Impacts	131
e. Ancillary Traffic Network Impacts	132
B. <u>Potential Impacts of Reasonable Alternatives</u>	132
1. Potential Impacts of No-Action	133
2. Potential Impacts of Accelerated Deactivation	134
3. Potential Impacts of the Modified Deactivation Scenario	135
C. Relationship of Proposed Action and Alternatives to Land Use Plans, Policies and Controls	136
D. Mitigation Measures	137
V. LIST OF PREPARERS	140
VI. OFFICES, AND AGENCIES CONSULTED	141
VII. LIST OF REFERENCES AND OTHER RELATED SOURCES	145

LIST OF TABLES

<u>TABLE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
I-1	Current Distribution of Titan II Operational Missile Sites	3
I-2	Characteristics of Titan II Hypergolic Propellants	13
I-3	Distribution of Estimated Manpower Reductions at Deactivated Titan II Missile Installations	20
I-4	Scheduled Destination Point(s) and Mode of Transportation of Principal Items Removed From Deactivated Titan II Missile Installations	23
I-5	Estimated Personnel Reductions Associated with Deactivating Titan II Training and Depot Logistics Support Functions	29
I-6	Summary of Candidate Alternatives	31
II-1	Selected Climatological Statistics	46
II-2	Population Growth in the Davis-Monthan AFB Region	61
II-3	Population Growth in the McConnell AFB Region	62
II-4	Population Growth in the Little Rock AFB Region	62
II-5	Population Growth in the Vandenberg, Sheppard, and Hill AFB Regions	63
II-6	Employment Characteristics in the Davis-Monthan AFB Region	64
II-7	Employment Characteristics in the McConnell AFB Region	65
II-8	Employment Characteristics in the Little Rock AFB Region	66
II-9	Employment Characteristics in the Vandenberg, Sheppard, and Hill AFB Regions	67

LIST OF TABLES
(continued)

<u>TABLE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
II-10	Housing Characteristics in the Davis-Monthan AFB Region	68
II-11	Housing Characteristics in the McConnell AFB Region	69
II-12	Housing Characteristics in the Little Rock AFB Region	70
II-13	Housing Characteristics in the Vandenberg, Sheppard, and Hill AFB Regions	70
III-1	Miscellaneous Truck Accident Statistics	87
III-2	Propellant Truck Mileage and Accident Probabilities	89
III-3	Wind Effect on Atmospheric Dispersion of UDMH Propellant Vapor from a 150 Square Meter Spill of Aerozine-50 at Various Liquid Temperatures	92
III-4	Wind Effect on Atmospheric Dispersion of UDMH Propellant Vapor from a 66 Square Meter Spill of Aerozine-50 at Various Liquid Temperatures	93
III-5	Wind Effect on Atmospheric Dispersion of Propellant Vapor from a 107 Square Meter Spill of Nitrogen Tetroxide at Various Liquid Temperatures	94
III-6	Wind Effect on Atmospheric Dispersion of Propellant Vapor from a 45 Square Meter Spill of Nitrogen Tetroxide at Various Liquid Temperatures	95
IV-1	Estimated Worst-Case Population Losses Resulting from the Proposed Titan II Deactivation at Davis-Monthan AFB	103
IV-2	Estimated Worst-Case Population Losses Resulting from the Proposed Titan II Deactivation at McConnell AFB	105
IV-3	Estimated Worst-Case Population Losses Resulting from the Proposed Titan II Deactivation at Little Rock AFB	106

LIST OF FIGURES

<u>FIGURE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
I-1	Location of Installations Involved in the Proposed Titan II Missile System Deactivation	4
I-2	Titan II Missile Site Sample Deactivation Chart	10
II-1	Titan II Missile Deployment Area in the Davis-Monthan Air Force Base Vicinity	38
II-2	Titan II Missile Deployment Area in the McConnell Air Force Base Vicinity	39
II-3	Titan II Missile Deployment Area in the Little Rock Air Force Base Vicinity	40

LIST OF PLATES

<u>PLATE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
I-1	Aerial View of a Titan II Missile Site	8
I-2	Ground Elevation View of a Titan II Missile Site	8
I-3	Subsurface View of a Titan II Missile Complex	9

ENVIRONMENTAL ASSESSMENT FOR THE
PROPOSED DEACTIVATION OF THE
TITAN II MISSILE SYSTEM

I. OVERVIEW OF THE PROPOSED ACTION AND ALTERNATIVES

The purpose of this section is to provide an overview of the policy, guidance, and proposed alternative plans associated with the proposed deactivation of this nation's Titan II missile system. Introductory details focusing on the background and need for the action are first presented. This is followed by a discussion of the various activities and schedules associated with the planned deactivation under a proposed action alternative. Finally, information relevant to several considered alternatives to the proposed action alternative is presented.

The information presented in this section is limited to that necessary for either defining and/or understanding certain or potential impacts discussed later in this document (Sections III and IV). A more exhaustive treatment of the many elements of the proposed deactivation is contained in a US Air Force document entitled "Titan II Deactivation Management Plan." [219] No other weapon system deployments or deactivation, planned or otherwise, are discussed in this Environmental Assessment (EA).

A. Purpose, Need, and Organization

In order to deter nuclear aggression against our nation and its allies, the United States maintains a "triad" of strategic forces--land based intercontinental ballistic missiles (ICBMs), manned bombers, and fleet ballistic missile submarines. In recent years, a steady buildup of Soviet nuclear forces has upset the strategic balance to such an extent that US forces must now be strengthened to redress that

imbalance. To that end, the President of the United States has announced a multi-faceted strategic force improvement program.

The strategic force improvement program includes a plan to modernize the ICBM leg of the triad by retiring older, less cost-effective Titan II missiles and deploying systems that are more advanced. The savings associated with the Titan II retirement will partially offset the costs of developing and fielding the newer systems.

A Titan II deactivation management plan^[219] has been developed in response to a Deputy Secretary of Defense Program Decision Memorandum, dated 2 October 1981, which directed that Titan II missiles be retired as soon as possible. The plan describes the methods for management of the Titan II deactivation, outlines management and support responsibilities, and defines specific actions, schedules, and alternatives for accomplishing a safe and orderly deactivation program. The Director of Programs at the Strategic Air Command Headquarters, Offutt Air Force Base (AFB), Nebraska has been designated the program manager with primary responsibility for the Titan II deactivation. This organization shall serve as the focal point for intercommand direction and decisions. The current Titan II Integration Section of Missile Systems Management Division (OOALC/MMGMT) at the Air Logistics Center (ALC), Hill AFB, Utah will serve as the focal point for coordination, control, and accomplishment of AFLC actions detailed in the deactivation management plan.

B. Description of Proposed Action and Alternatives

The US Air Force proposes to deactivate the Titan ICBM system. This system presently includes 52 operational missile sites located around the support installations of

Davis-Monthan AFB, near Tucson, Arizona; McConnell AFB, near Wichita, Kansas; and Little Rock AFB, near Little Rock, Arkansas. Figure I-1 shows the locations of these three installations as well as the locations of other installations whose role in the deactivation program will be defined later in this document. The distribution of the missile sites is indicated below in Table I-1.

Table I-1. CURRENT DISTRIBUTION OF TITAN II OPERATIONAL MISSILE SITES

INSTALLATION	NO. OF OPERATIONAL MISSILE SITES
Davis-Monthan AFB, Arizona	18
McConnell AFB, Kansas	17
Little Rock AFB, Arkansas	<u>17</u>
ALL THREE INSTALLATIONS	52

Details associated with the proposed deactivation of the Titan II missile system are presented in the following subsections. Deactivation under the proposed action alternative is to proceed sequentially from one installation unit (wing) to the next. Under this scenario, the first unit's missiles will be withdrawn over a 24-month period beginning in the first quarter of fiscal year (FY) 1983 (i.e., October 1982). Although subsequent unit deactivation will tentatively proceed at a rate of approximately one missile per month (equivalent to a total withdrawal period of approximately 18 months per remaining unit), each deactivation will ultimately be based upon the experience gained from the first missile wing. Hence, the deactivation program under the proposed action alternative would be

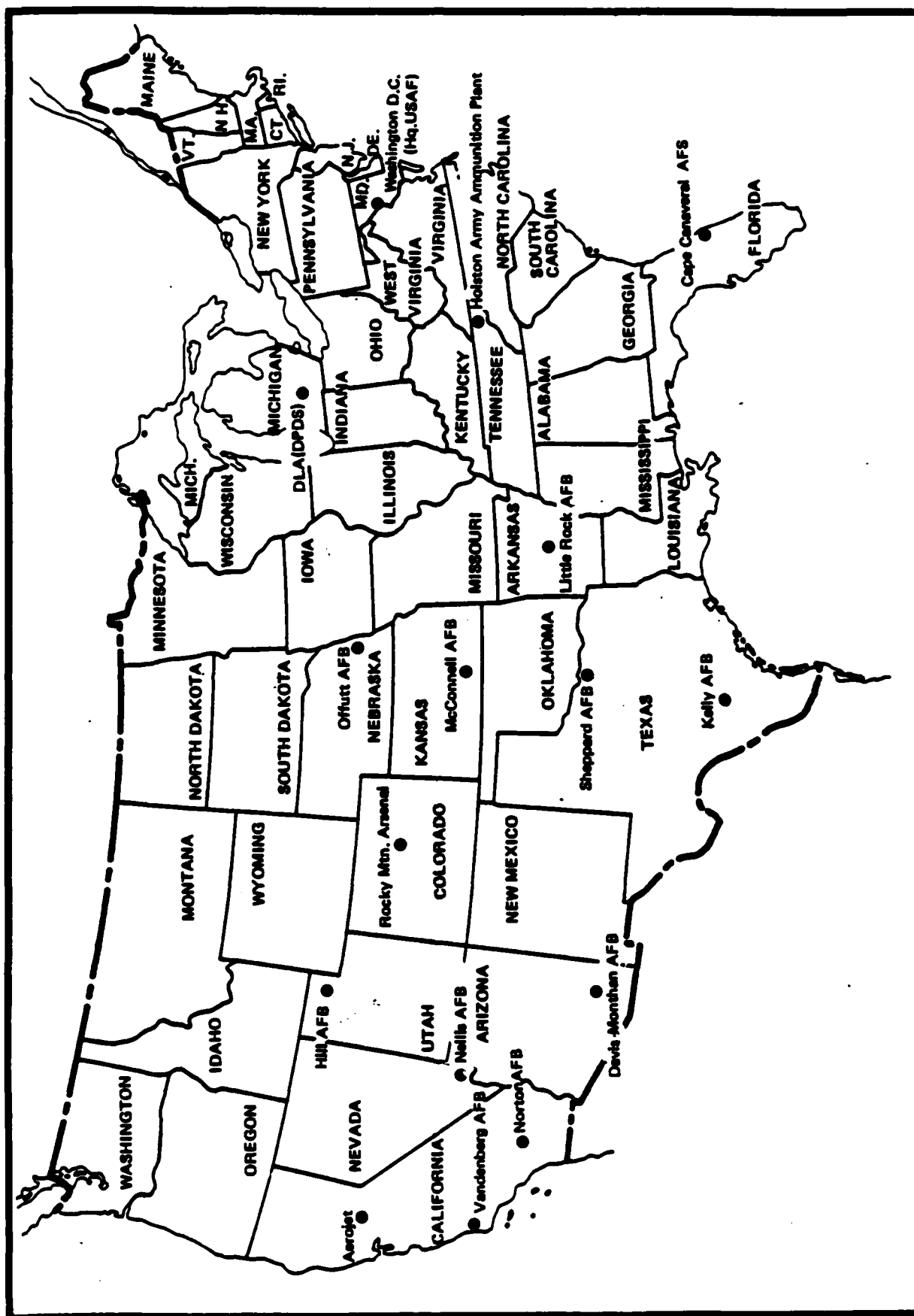


FIGURE I-1. Locations of Installations Involved in the Proposed Titan II Missile System Deactivation

completed by the end of 1987, barring unforeseen delays.

Details associated with other alternatives to the proposed action alternative will then be discussed. Such alternatives will include the no-action alternative; an accelerated deactivation alternative; a modified deactivation scenario; and various alternatives involving prolonged, delayed, or partial deactivation scenarios. Each will be categorically discussed within the context of being either reasonable or unreasonable for consideration.

1. Proposed Action Alternative

As previously mentioned, the proposed deactivation of the Titan II Missile system is scheduled to take place over a 5-year period beginning October 1982, and deactivation of each of the three Titan II installations will proceed along a sequential schedule leading to the withdrawal of the first installation unit over the first 24-months and the withdrawal of the second and third installation units over two successive 18-month periods (tentative rate). This schedule takes into account a conservative estimate of slippages which may be encountered due to such things as personnel availability, weather conditions, or equipment breakdown. Under the proposed action alternative the Titan II operational unit at Davis-Monthan AFB, Arizona will be deactivated first. The order for deactivation of the remaining two Titan installations at McConnell AFB, Kansas and Little Rock AFB, Arkansas has not been officially announced.

Deactivation of the Titan II missile system under the proposed action alternative comprises many project activities and/or actions which categorically fall within the purview of one of three major work phases. Phase I includes activities (and actions taken) at the missile installations which

focus on the deactivation of individual missile sites and the phasing out of host base involvement in the Titan II program. Missile site deactivation involves off-loading missile propellants and removing the missile and associated ancillary equipment from each silo, all of which are normal maintenance actions which will increase in frequency during deactivation. In addition, each missile site will be placed in caretaker status. Personnel reductions will occur at each host base as the Titan program is phased out. Phase II activities focus on the transportation of propellants, missile components and equipment to various other installations throughout the country. Finally, Phase III encompasses those activities pertinent to the interim or final disposition of propellants and missile components at their respective destination points.

Deactivation of the Titan II missile system will also involve the cessation of certain Titan II training activities and logistic support functions. These are currently being carried out at Air Force installations other than the operational bases. Associated personnel reductions, which will accompany the phasing out of these activities, can be considered as an ancillary phase of the proposed action because they do not fall within the purview of the principal phases (i.e., Phases I, II, and III) of the Titan II deactivation.

Missile on-base support facilities, when no longer required, will revert to the Base Civil Engineer for redesignated use or demolition as part of ongoing Base Real Property operation, separate from this action. Energy savings from reduction in base facility requirements is an additional benefit of the proposed action.

a. Phase I--Deactivation of Missile Installations

Titan II missile sites associated with each of the three AFB installations are typically located several miles from the host base (and from each other) and are relatively inconspicuous when viewed at ground level from nearby surroundings. Typifying the configuration of each missile site are the aerial and ground views of two Titan missile sites shown in Plates I-1 and I-2. An underground view of typical Titan II launch complex is depicted in Plate I-3.

A sample milestone chart for the deactivation of an individual Titan missile site is provided in Figure I-2. This chart assumes that certain site-deactivation preparatory activities will be accomplished prior to the first day of the deactivation scheduled for each missile site. The chart also assumes optimum conditions for all deactivation tasks and does not take into account (1) slippages which may occasionally be encountered due to weather conditions, equipment breakdown, holidays, or perhaps strikes; or (2) delays associated with the necessity to implement equipment service life, component age or surveillance procedures that may be required by internal Air Force technical orders. (Delays of the latter type could add approximately five additional days to the sample milestone schedule.) Under the proposed action, individual detailed deactivation schedules for each missile site will be prepared by missile wing personnel and will take into account the particular circumstances associated with each site.

The sample milestone chart (Figure I-2) denotes that certain site preparation activities will precede the onset of actual deactivation activities at each missile site, including, for example, performing a system checkout of the radio network system; prechecking the operability of onsite hazards reaction equipment and setting up any additional equipment simi-

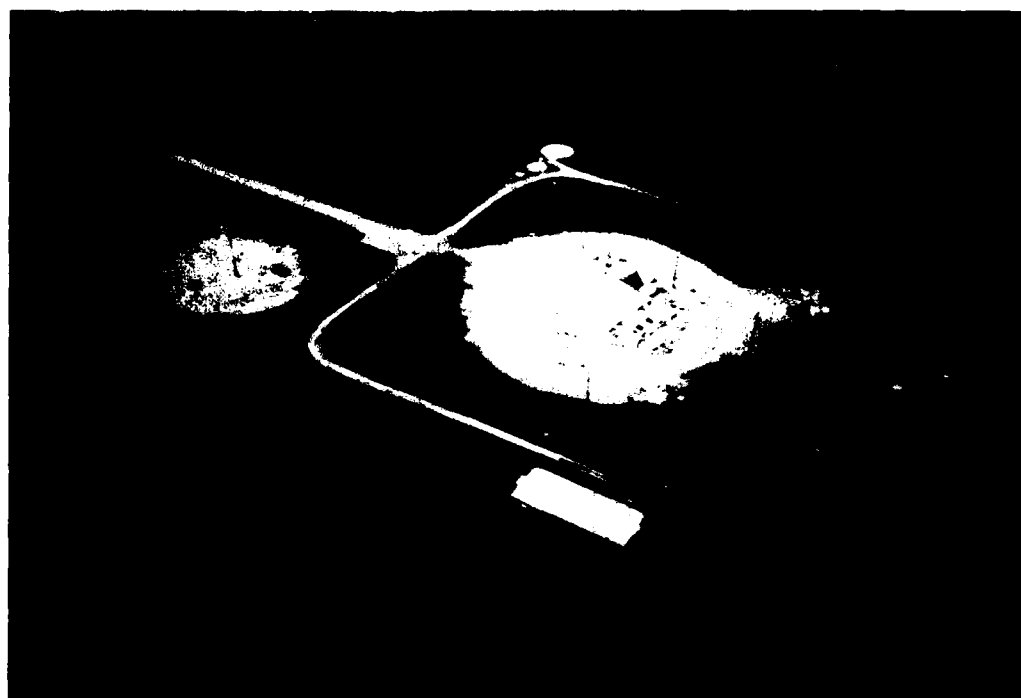


PLATE I-1. Aerial View of a Titan II Missile Site



PLATE I-2. Ground Elevation View of a Titan II Missile Site

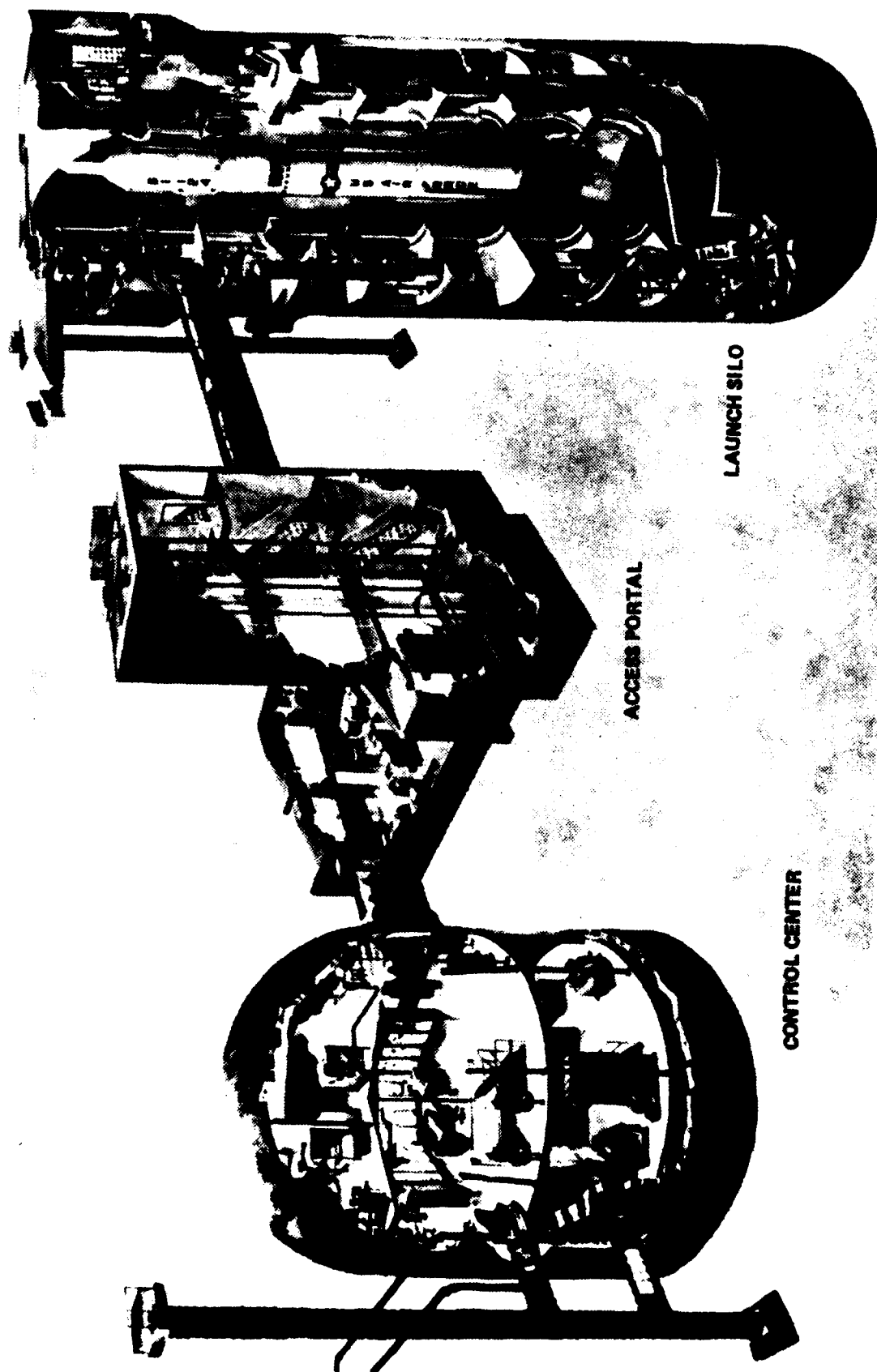


PLATE 1-3. Subsurface View of a Titan II Missile Complex

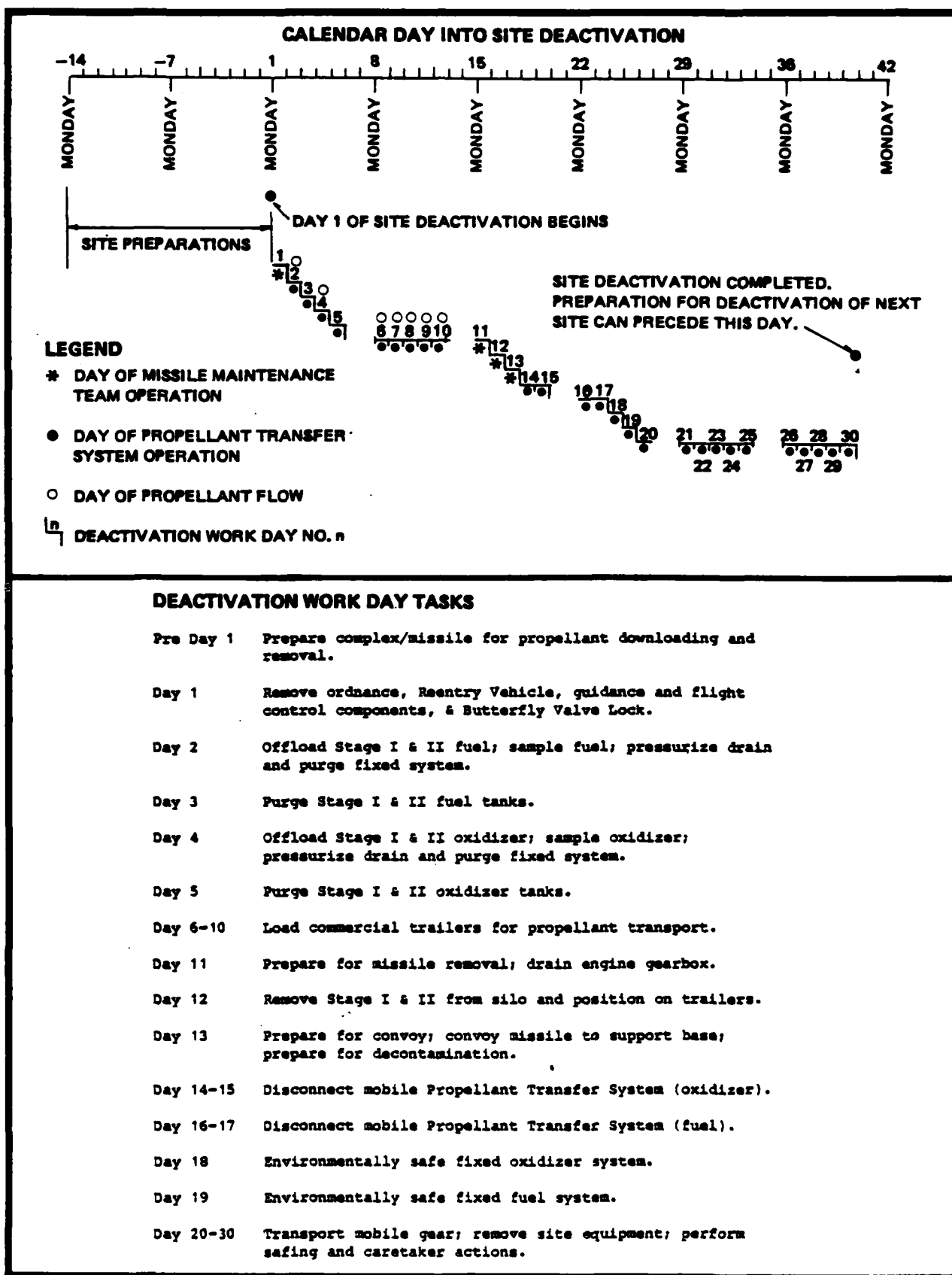


FIGURE I-2. Titan II Missile Site Sample Deactivation Chart

larly needed; prechecking the operability of fixed equipment (i.e., pumps, valves, etc.), readying hardstands, and bringing in and setting up mobile equipment (i.e., holding, conditioning, nitrogen, and control trailers) associated with the Propellant Transfer System; and bringing in and setting up a large long-boomed crane for lifting missile components and other heavy equipment from the silo. Mobile equipment associated with the Propellant Transfer System is mounted on wheeled vehicles and towed from the support base (or between missile sites) over the local road network. The self-propelled missile lift crane will be brought in as each site is being prepared for deactivation.

Site deactivation will begin with the removal of ordnance from the Reentry Vehicle, the missile, and the Butterfly Valve Lock. A total of 65 ordnance items will be removed from each missile site. These items will subsequently be transported to the host base munitions area, inspected for condition, and turned over to Air Force Supply for reuse, interim storage prior to either local disposal by destruction, or shipment to Hill AFB, Utah for final disposition. Air Force ordnance handling procedures and safety regulations will be followed during these activities.

Following ordnance removal at each site, the Reentry Vehicle will be lifted from the missile and transported to the host base munitions area. The warhead will then be removed from the Reentry Vehicle and turned over to Air Force Supply for interim storage and subsequent packaging for shipment transfer to designated Department of Energy facilities. Each Reentry Vehicle will then be inspected to determine its serviceability and corresponding candidacy for shipment to either of two locations--Nellis AFB, Nevada (for storage) or Kelly AFB, Texas (for parts reclamation, demilitarization, and disposal).

Following the removal of the Reentry Vehicle at each missile site, the missile will be powered down for subsequent removal of the guidance and flight control components and the Butterfly Valve Lock. Initially, these items will be turned over to the Missile Inspection and Maintenance Squadron at the respective host base and evaluated for serviceability. All items will then be turned over to Air Force Supply for interim storage and subsequent packaging for component distribution to supply channels, repair depots, or declassification/salvaging locations. As an option, guidance and flight control components may be containerized for direct shipment to the Military Aircraft Storage and Disposition Center (MASDC) at Norton AFB, California.

The removal of small ordnance devices, Reentry Vehicle, guidance and flight control components, and Butterfly Valve Lock from the missile site is planned for the first day (Day 1) of deactivation at each site. Activities planned for Deactivation Work Days 2 thru 10 at each site will focus on off-loading (from the missile) and site removal of propellants. Titan II propellants consist of a fuel and an oxidizer. The fuel is called Aerozine 50 (or UDMH-mix; mix; A-50) and is a mixture of hydrazine (N_2H_4) and unsymmetrical dimethyl hydrazine [$(CH_3)_2N_2H_2$] in approximately equal quantities. The oxidizer is nitrogen tetroxide (N_2O_4). The fuel and oxidizer are hypergolic with one another and are therefore hazardous by nature. Both are extremely toxic to personnel and highly corrosive to some materials. Some characteristics of these propellants (i.e., the fuel mix and the oxidizer) are given in Table I-2.

As previously mentioned, five types of mobile equipment (i.e., two holding, conditioning, nitrogen, and control trailers) are to be used in the propellant transfer operations at each missile site. These are described below:

Table I-2. CHARACTERISTICS OF TITAN II HYPERGOLIC PROPELLANTS [80,122,219]

FACTOR	PROPELLANT	
	Nitrogen Tetroxide	Aerozine 50*
Molecular Description	N ₂ O ₄	(CH ₃) ₂ N ₂ H ₂ + N ₂ H ₄
Color	Reddish-brown liquid	Clear, colorless liquid
Odor	Acrid (mild nitric acid smell)	Ammoniacal, fishy
Boiling Point	70.1°F @ 1 Atmo.	158.2°F @ 1 Atmo.
Freezing Point	11.8°F	18°F to 21°F
Flash Point	N/A	5°F (closed cup)
Weight	12.44 lb/gal. @ 0°C	7.5 lb/gal. @ 25°C
Auto Ignition Temperature	N/A	482°F
Compatible Metals	Aluminum, stainless steels (mild steel restricted)	Aluminum, stainless steels (mild steel prohibited)
Hazards	Hypergolic with hydrazine-based fuels, spontaneous ignition with many combustibles (ex., paper, cloth, leather, wood). Normally not temperature, pressure, or shock sensitive.	Flammable; hypergolic with some oxidants (ex., acids); spontaneous combustion with many combustibles (ex., rags, wool, sawdust, excelsior) and some metal oxides (ex., rust); explosive in presence of spark or open flames. Not shock sensitive.
Other Characteristics	Corrosive oxidizing agent; highly soluble and reactive with water; vapors can cause skin/eye burns and lung damage.	Stable liquid with low viscosity; strong reducer; weakly alkaline; very hygroscopic; classed as hepatotoxic and convulsigenic agent; a suspected carcinogen; skin irritant upon direct exposure to liquid; vapors can damage eyes and irritate respiratory tract; inhalation or absorption through skin can cause systemic effects (ex., effects on central nervous system).

*Aerozine 50: A mixture of hydrazine, N₂H₄, and unsymmetrical dimethyl hydrazine (UDMH), (CH₃)₂N₂H₂, in approximately equal quantities.

- Holding Trailers--Two distinct types of holding tank trailers will provide a storage capacity for the missile propellants when off-loaded. One is designated for the Aerozine 50 fuel and one is designated for the oxidizer. The fuel holding trailer is placed on a hardstand which has a water deluge system for fire protection and for trailer and hardstand washdown in the event of a large spill. The water deluge system is activated at the control panel in the control trailer. Because of the corrosive properties of the oxidizer in the presence of water, the oxidizer trailer is placed on a hardstand which does not use a deluge system.
- Conditioning Trailer--The propellant conditioning trailer consists of a refrigeration unit, a heating unit, a conditioning medium (water glycol), and a circulation system.
- Nitrogen Trailer--The nitrogen trailer is used for pressure transfer of propellants and pressure draining and purging of the propellant system.
- Control Trailer--The control trailer is used as the above ground control point for all propellant transfers.

Off-loading of the propellants from the missile will begin with the transfer of the Aerozine 50 fuel mix to its designated holding trailer. Samples of the fuel mix will then be taken and forwarded to a designated laboratory for immediate analysis for contamination. Subsequently, the missile's fuel system will be pressure drained and purged of the fuel mix. Propellant off-loading will then continue with the transfer of oxidizer from the missile to the designated oxidizer holding trailer. Sampling of the oxidizer propellant and subsequent pressure draining and

purging of the missile's oxidizer fuel system will then be accomplished.

Propellants transferred to each holding trailer will be subsequently loaded onto commercial tank trailers for transport from the missile site. Six commercial tank trailers will be required to accommodate the oxidizer download from each missile; an additional three will be required to accommodate the associated fuel mix. These commercial carriers will be brought onto each site at a rate of three per day. Those designated to transport the oxidizer will be brought in first.

Each commercial tank trailer will be weighed on certified scales prior to arriving at a missile site (i.e., when empty). Upon arrival, a carrier vehicle will be directed to a waiting area, inspected, and subsequently spotted for propellant loading when needed. Driver will then depart from the immediate loading area. Air Force personnel will subsequently load the commercial tank trailer, water-flush and neutralize any product spillage from the trailer's exterior, and call the driver back to retrieve the loaded trailer from the loading site. Following receipt of dispatch instructions, each commercial tanker unit will proceed to offsite certified weighing scales to determine the official loaded weight and to verify that the transport unit is not over legal weight limits nor underloaded to an unacceptable extent (such as to prevent the remaining trailer(s) from accommodating any remaining propellant product at the site). If the product weight is satisfactory, the carrier will be released for interstate movement to its prescribed destination point. If the product weight is unsatisfactory, the tanker trailer will be returned to the missile site for additional loading or unloading (in accordance with the above described procedures) and then redirected back to the certified scales for reweighing.

The total amount of propellants presently loaded on the 52 Titan II missiles is approximately 754,000 gallons of fuel mix and 884,000 gallons of oxidizer. Each missile is normally loaded with approximately 14,500 gallons of fuel and 17,000 gallons of oxidizer. Based on the number of commercial tank trailers required to accommodate the propellant download from each missile site, those carrying the fuel mix will each be loaded with an average of 4,900 gallons (36,750 lbs) of product; units carrying the oxidizer will each be loaded with an average of 2,800 gallons (34,832 lbs) of that propellant. The Titan II deactivation schedule under the proposed action will insure that less than one-fourth of the total amount of each propellant in the Titan II system will be off-loaded in any 12-month period.

Following the dispatch of propellants from a complex, site deactivation efforts will focus on the removal of Stage I and Stage II missile boosters. Initially, the missile's engine gearbox will be drained and flushed. The booster stages (with engines attached) will then be lifted one at a time from the silo, placed on individual transporter trailers, and prepared for convoy to the host base. Also, other support equipment, including miscellaneous Aerospace Vehicle Equipment, will be gathered for removal from the site. The boosters and above mentioned equipment will then be transported to the Missile Inspection and Maintenance Squadron area at the host base.

At the host base, the booster fuel tanks will be purged and inspected. Any required or specified booster maintenance will be performed at this time. Certain booster components and associated support equipment will be reclaimed, tagged, and turned over to Air Force Supply for reuse as spare parts or shipment to MASDC, Norton AFB, California. The missile booster stages will then be prepared for interstate transportation to Norton AFB.

The boosters will normally be shipped by rail with engines attached. Preparation for this mode of shipment will involve the loading of each booster (in its ground transporter) onto a 60-foot long, hydro-cushion flat car. Each load will be secured on the rail car with appropriate tie-downs and blocks. Protective covers and dessicant will be installed on the booster engines.

Booster shipment to Norton AFB via highway will be carried out under emergency circumstances only (ex., in the event of a prolonged rail strike). Preparation for this mode of shipment will involve the readying of Air Force booster transport trailers for the trip and the installation of booster protection gear.

In the event that a booster engine must be shipped separately from a booster stage, it will be placed in a mobiltainer (an engine transporter) following the installation of dessicant and protective covers. Normally, the mobiltainer will then be loaded onto a commercial highway transport vehicle and appropriately secured with tie-downs in preparation for interstate highway transport to Norton AFB. Shipment of the mobiltainerized booster engine via air, however, would be carried out as a backup measure only.

Following removal of the booster stages and associated equipment from a missile site, site deactivation will proceed with the disconnecting and safing of the Propellant Transfer System. First, the oxidizer holding trailer will be disconnected and purged. The fuel mix holding trailer will then be disconnected and similarly safed. Finally, environmental safing of the fixed equipment associated with the Propellant Transfer System will be carried out.

The remaining ten days of deactivation efforts at each missile complex will focus on (1) the removal of mobile deactivation gear and equipment (ex., the mobile Propellant

Transfer System, the crane, etc.) from the site to the base (or to another missile site for use in its deactivation), (2) the removal of any additional hardware or equipment deemed salvageable for reuse or deemed necessary for disposal, and (3) the shutdown of site systems to a minimum considered necessary to support periodic caretaker status inspections. Filters containing hazardous polychlorinated biphenyls (PCBs) will be removed from the missile complex to comply with Defense Property Disposal Service and environmental requirements. Systems such as the fixed vapor sensing system; the standby power generation system; all hydraulic systems; the launch duct fire protection and prevention system; the silo and control center air conditioning systems; the sanitary wastewater system; the domestic, chilled, and cooling water systems; the compressed air systems; and the water supply, treatment, and storage systems will all be shut down. The only equipment that will remain operational will be the silo equipment area and access portal elevators, the exhaust fans, the silo sump pumps, and the lighting in the complex. Also, all communications systems will be shut down with the exception of Intra-Base Radio (IBR) repeaters and one telephone circuit in the control center to be installed by the commercial telephone company. The IBR Repeaters will be removed after deactivation of the entire wing. With the completion of all of the above, a missile site will be considered as having been safed, secured, and placed in a minimum cost caretaker status.

Maintenance of the caretaker status of each missile installation unit will be the responsibility of the Base Civil Engineer at the associated host base. During caretaker status, deactivated complexes will be unattended, although each will be periodically inspected. Above-ground portions of vacated complexes will be inspected on a random basis; underground portions will be inspected weekly.

Periodic inspection activities will involve the routine maintenance of equipment remaining operational in the complex, as well as occasional access road maintenance and surface vegetation (weed) control. The Base Civil Engineer will control all dispatches and access to vacated missile complexes during caretaker status.

An Emergency War Order capability will be maintained at each missile complex until its deactivation. Generally, if a missile is removed from strategic alert (for example, because of a maintenance requirement) prior to its scheduled deactivation date, it will be returned to alert status. However, if the missile that is removed from strategic alert is within the wing that is undergoing deactivation and if that missile requires propellant downloading because of a propellant leak or other maintenance problem, it will not be returned to alert status. Rather, the wing deactivation schedule will be adjusted so that the problem site can be deactivated early. Crew member staffing and operations support will be provided for a safe deactivation in conjunction with maintaining an Emergency War Order posture. Launch complexes will be continuously staffed by complete missile combat crews until the sites are turned over to the Base Civil Engineer for system shutdown and rendering to caretaker status.

Manpower reductions associated with the deactivation of the three Titan II installations will total an estimated 4,107 military personnel and 137 civilians. The distribution of the estimated personnel reductions is presented in Table I-3. Because Davis-Monthan AFB will be the first Titan II installation to be deactivated, it will also be the first base to experience personnel reductions. The phasing of personnel reductions at each of the remaining two Titan installations will be dependent on the actual deactivation sequence of each installation.

Table I-3. DISTRIBUTION OF ESTIMATED MANPOWER
REDUCTIONS AT DEACTIVATED TITAN II
MISSILE INSTALLATIONS

INSTALLATION	MANPOWER REDUCTIONS	
	Military	Civilian
Davis-Monthan AFB, Arizona	1,369	47
McConnell AFB, Kansas	1,369	45
Little Rock AFB, Arkansas	<u>1,369</u>	<u>45</u>
ALL THREE INSTALLATIONS	4,107	137

Normal security measures will be maintained throughout the site deactivation period at each Titan II missile installation. A Restricted Area environment will be maintained for the weapon systems until (1) their deactivation and transportation from the missile field to the host support base, and (2) their final removal from the support base itself. A prompt security capability will be maintained for response to any alarms from a complex containing priority resources or critical components. Missile complexes will become Controlled Areas once critical components, propellants, and boosters have been removed.

While the types of activities required to remove the Titan II missiles are well-established, and are presently in use on an as-required basis, the magnitude of the complete system deactivation dictates special consideration of public safety implications. The frequency of reentry vehicle and missile airframe convoys and propellant transportation activities will increase.

Deactivation activities at each Titan II complex and operational support base will be carried out under the Titan II Management Plan including a comprehensive Air Force System Safety Program designed to minimize or eliminate accident

risks, and to protect deactivation personnel, missile components, parts/equipment, adjacent property, and the environment. This Plan identifies and requires adherence to standard safety practices, as well as regulations and standards associated with hazardous material control. When hazardous materials are handled, stored, shipped or discarded, the Air Force will comply with all regulatory requirements, such as those of the Resource Conservation and Recovery Act, pertaining to that phase of the operation. Transporters will be licensed as required, and movement of hazardous material will be monitored by hazardous waste manifests. The deactivation program will insure the expeditious availability of optimally functioning safety and hazard response equipment at all times during an installation's deactivation period. The program will include requirements for monitoring and surveillance of deactivation activities and weather conditions, updating of potential toxic hazard corridors, reporting of problems, implementing corrective actions, and safety training. Measures will be implemented to foster safety motivation and compliance with local, state, and federal regulations including safety, security, and traffic control measures. Special safety procedures are already in effect at those sites with significant nearby civilian populations, and will continue throughout the deactivation period. Warning sirens for the civilian population have recently been installed at all Titan II sites, and each installation has existing emergency plans which were developed in concert with state and local officials. In the event of an inadvertent propellant release during propellant handling, on-site deactivation personnel will notify the Wing Command Post and initiate corrective actions and/or evacuation procedures. Local authorities will be notified of the accident in accordance with existing agreements. While no major changes are anticipated in existing procedures, ongoing review will be necessary, and further contingency plans will be prepared as required.

Air Force Public Affairs Offices will be required to support the Titan II deactivation program at each missile installation wing. Accordingly, public affairs officers will be assigned to the units for the duration of the deactivation process at each wing. Local communities will be briefed on planned actions at each Titan II installation, the time phase of the project, and the various safety factors the Air Force will be employing. Emergency Notification Teams will be available to assist in notifying local residents in the unlikely event that evacuation is required.[219] Air Force personnel will be kept aware of scheduled deactivation activities and how such actions will affect them. Also, public affairs officers will be prepared to address this environmental assessment and any relevant programmatic or environmental issue of concern.

b. Phase II--Transportation of Components to Destination Points

Deactivation activities at Titan II missile installations located at Davis-Monthan AFB, Arizona, McConnell AFB, Kansas, and Little Rock AFB, Arkansas will result in the need to transport missile components, propellants, and other associated parts and equipment to other installations (destination points) throughout the country. Table I-4 lists the principle missile items and the manner of transportation of each to scheduled destination point(s).

As noted in Table I-4, most of the items removed from the missile sites during deactivation will be transported to their scheduled destination point(s) on a commercial highway transport vehicle. Missile booster stages will normally be transported by rail; however, highway transportation of missile boosters will be relied upon in emergency situations. In the event that a booster engine is to be shipped separately (i.e., unattached to a booster),

Table I-4. SCHEDULED DESTINATION POINT(S) AND MODE OF TRANSPORTATION OF PRINCIPAL ITEMS REMOVED FROM DEACTIVATED TITAN II MISSILE INSTALLATIONS.

MISSILE ITEM	SCHEDULE DESTINATION POINTS*	MODE OF TRANSPORT
Ordnance	Hill AFB, Utah	HWY Carrier
Reentry Vehicle	Nellis AFB, Nevada and Kelly AFB, Texas	HWY Carrier
Warhead	Department of Energy facilities	HWY Carrier
Guidance & Flight Control Components, and Butterfly Valve Lock	Miscellaneous supply channels, repair depots, declassification/salvaging locations; and Norton AFB, Calif.	HWY Carrier
Oxidizer Propellant	Vandenberg AFB, Calif. Aerojet at Nimbus, Calif. Holston Army Ammunition Plant, Kingsport, TN	HWY Carrier
Fuel Mix Propellant	Vandenberg AFB, Calif. Aerojet & Nimbus, Calif. Rocky Mountain Arsenal, Colorado Cape Canaveral Air Force Station, Florida	HWY Carrier
Missile Boosters (with or without engines attached)	Norton AFB, Calif.	Rail Carrier (normally) HWY Carrier (emergency backup only)
Booster Engines (when unattached to booster)	Norton AFB, Calif.	HWY Carrier (normally) Air Carrier (emergency backup only)

* See Figure I-1 for location on map.

transportation will be accomplished by commercial highway carrier; air carrier transport will be relied upon as a contingency backup only. Additionally, shipment of some relatively small subcomponent pieces of missile hardware may be shipped by air in lieu of highway transport (ex., Inertial Measurement Units, Missile Guidance Controls).

Except for the propellants, all of the items to be shipped to respective destination point(s) will have been safed prior to dispatch from a host base. Therefore, no dangerous or hazardous situations will exist while these items are in transit. Transit of the warhead to Department of Energy facilities will be accomplished under provisional direction from Strategic Air Command Headquarters in accordance with Air Force Regulation 136-2 entitled "The Logistics Movement Handling of Nuclear Cargo." Dispatched propellants, however, represent a potentially threatening situation while in transit simply because (1) each propellant, by nature, possesses hazardous properties (refer to Table I-2 in the preceding subsection) and (2) there exists a possibility for a tanker transport vehicle to become involved in a traffic accident. Any spill of a propellant poses a hazard, and therefore would require immediate response.

Under the proposed action, specific highway routes of movement of both the fuel and oxidizer will be proposed by the commercial carrier(s) using such criteria as road distance, pavement integrity and consistency, type of access, avoidance of population centers, abundance and characteristics of tunnels/bridges, etc., and consideration of US Department of Transportation and Federal Hazardous Material Regulations. Proposed routes will be reviewed and evaluated by SA-ALC (San Antonio Air Logistics Center) as part of the ongoing environmental and hazard analysis process.

Commercial carriers of all deactivation shipments will be responsible for all loss or damage to the product being shipped and for safe delivery of each product to the consignee. If an off-site propellant spill occurs, appropriate federal, state, and local agencies will assume legal authority over the matter and will be in charge of response actions at the accident site. Air Force and Department of Defense personnel will respond as requested. The Air Force may extend necessary technical assistance and aid considered in connection with moving, salvage, demolition, neutralization, or other disposition of government-owned propellants. This assistance, however, will be provided from within existing capabilities. When requested, Air Force personnel will act and perform in these instances as the commercial carrier's agent.[219]

Public Affairs Office actions will be implemented in conjunction with the interstate transportation of propellants to alternative destination points. Procedures will be developed to ensure that up-to-date information on the movement of fuel mix and oxidizer, whether planned or in progress, is immediately available in the event of an off-site mishap. Propellant transportation awareness data and accident response coordination guides will be provided to each involved state through the Federal Emergency Management Agency.

c. Phase III--Disposition of Components at Destination Points

The disposition of components from deactivated missile sites will vary in accordance with the type and condition of a component as well as its need for other uses. It must be stressed that one of the principal goals of the proposed action is to maximize the reuseability of Titan II hardware and components in order to recoup as much as possible of the government's investment.

Although missile site ordnance items may be stored or disposed of locally at a host base, some Titan II ordnance will be shipped to Hill AFB, Utah and stored. Stored ordnance items will be used as spares to support on-going Titan reliability testing programs. Even upon completion of the proposed Titan II deactivation future reuse of some ordnance assets will continue. Ordnance items which cannot be reused after deactivation will be destroyed at Hill AFB in accordance with well-established practices that are presently in use.

Nine Reentry Vehicles (minus warhead), spacers, and associated equipment removed during the deactivation of missile installations at Davis-Monthan AFB, Arizona will be stored at Nellis AFB, Nevada; the remaining nine Reentry Vehicles, spacers, and associated equipment from Davis-Monthan AFB installations will be placed in interim storage at Kelly AFB, Texas for subsequent testing, removal of spare parts and components, demilitarization, and disposal. Spare parts and salvaged components will be retained for the continued support of remaining Reentry Vehicles postured at active missile sites within the Titan II system. Upon completion of the Reentry Vehicle deactivation at Davis-Monthan AFB, the Reentry Vehicle Trainer will be shipped to Kelly AFB for onsite disposal unless otherwise directed by the Directorate of Special Weapons. As Reentry Vehicle deactivation subsequently proceeds to missile installations at McConnell AFB, Kansas and Little Rock AFB, Arkansas, storage and/or disposal direction will be provided by the Directorate of Special Weapons. All Reentry Vehicles, spacers, and associated equipment stored at Nellis AFB, Nevada will remain logistically supportable for potential future reuse in Titan II operations until the completion of the total Titan II deactivation program.

Alternative destination points for propellants dispatched from Titan II missile sites undergoing deactivation are denoted in Table I-4. Consignees at the various destination points will be informed of the estimated time of arrival of a propellant load soon after trailer departure from its origin. Loaded tank trailers may therefore arrive at their product destination points at any hour of the day. Each will be provided a safe holding area pending acceptance of the transported product for off-loading. Each trailer load of propellant going into storage will be sampled prior to off-loading. Off-loading will be accomplished using well-established nitrogen pressurization techniques which bring about pressure transfer of the propellant product from the tank of a transport vehicle to fixed storage tanks at the receiving facility. The transportation units will be weighed before and after loading and unloading to assure that all of the propellant product has been off-loaded. Any product spillage which may have occurred on a transport vehicle will be neutralized and water flushed. The unloaded transport vehicle will then be released for off-site movement in accordance with carrier home-base directions.

Propellants which are off-specification due to contamination will be deemed unsuitable for reuse and will be disposed. The Defense Property Disposal Service will make arrangements for sale or disposal. Disposal will be accomplished under contract by a disposal contractor capable of handling propellant quantities of 15,000 gallons (or more) at one time.

Propellant spills at a contracted storage facility will be managed in accordance with the contractor's accident response plan. Spills occurring at an Air Force or Army storage facility will be the responsibility of appropriate military personnel at the location. Potential hazards identified in conjunction with the off-loading and storage of propellant loads at a destination storage site will be evaluated and resolved prior to propellant delivery.

Boosters, Aerospace Vehicle Equipment (other than the Reentry Vehicle), and other associated equipment will be stored at Norton AFB, California for possible future use by Air Force System Command's Space Division. Components shipped by highway or military air carrier will be delivered directly to the base. Boosters shipped by rail will be off-loaded at the railhead and locally transported to the base. Upon arrival at Norton AFB, boosters and associated equipment will be inspected for damage and subsequently placed in storage. Booster transporter trailers, mobiltainers, and other reuseable shipping containers and transportation items will then be prepared for turnaround shipment to the host base of the Titan II installation undergoing deactivation. Components in storage at Norton AFB will be maintained, protected, and periodically inspected in order to assure that corrosion and storage environmental effects are minimized.

d. Ancillary Phase--Deactivation of Other Support Functions

Under the proposed action alternative, Titan II training activities at Vandenberg AFB, California and Sheppard AFB, Texas as well as Titan II depot logistic support functions at Hill AFB, Utah will be phased out. Based on current missile site deactivation projections, the phasing out of training activities will commence in the autumn of 1984 and will be completed around the end of 1985. Logistic support functions will be phased out in 1987, near the end of the proposed deactivation.

Cessation of Titan II training activities will involve the deactivation of Titan simulation trainers. Spare parts and other needed items will be removed from the trainers. These will be inspected and tagged as to condition and subsequently will be turned over to Air Force Supply for interim storage pending shipment into Air Force Supply chan-

nels. All unuseable trainer parts and other items will be disposed in accordance with normal procedures.

Personnel reductions associated with the deactivation of Titan II training and depot logistic support functions will total an estimated 964 individuals. Reductions in permanently-assigned personnel will total about 242 individuals. Of these, approximately 22 percent will be civilians. Reductions in temporary-duty personnel will total about 722 military personnel. The distribution of these estimated personnel reductions is presented in Table I-5. Personnel drawdown at Titan II training installations will be phased in accordance with progressive cessation of the training pipelines. Personnel associated with Titan II operations training would be drawn down first. Subsequent personnel reductions will occur with the phasing out of Titan maintenance training activities.

Table I-5. ESTIMATED PERSONNEL REDUCTIONS ASSOCIATED WITH DEACTIVATING TITAN II TRAINING AND DEPOT LOGISTIC SUPPORT FUNCTIONS

INSTALLATION	FUNCTION	PERSONNEL REDUCTION		
		Permanently Assigned	Temporary Duty	Total
Vandenberg AFB, California	Training	93*	160	253
Sheppard AFB, Texas	Training	99*	562	661
Hill AFB, Utah	Depot Logistic Support	50**	--	50
ALL INSTALLATIONS		242	722	964

* About 4 percent will be civilian personnel

** About 90 percent will be civilian personnel

2. Alternatives to the Proposed Action

Prior to the initiation of this Environmental Assessment process, the Air Force carried out an evaluation of alternatives to the proposed action. This evaluation determined that resources would be more effectively applied to modernizing U.S. strategic forces than to continue operation of older systems such as the Titan II.

Strategic planning for our nuclear forces is a matter of national policy established at the highest levels of our government. It is beyond the scope of this assessment to review that policy. Rather, discussion of alternatives included herein is based on the fact that deactivation activities are a part of an overall plan to improve our strategic forces. Alternatives to the proposed action must be considered within this framework.

Prior evaluation of candidate alternatives served to separate those that were unacceptable from those that could be reasonable with respect to the proposed action. Table I-6 presents the major advantages and disadvantages of alternatives to the proposed action.

Table I-6. SUMMARY OF CANDIDATE ALTERNATIVES

ALTERNATIVE	MAJOR ADVANTAGE	MAJOR DISADVANTAGE
Delay of Deactivation	None	Substantial cost impact
Partial Deactivation	None	Significant cost impact and public safety concerns
Prolongation of Deactivation	None	Cost impact: Relative to Schedule Duration
No Action	None	Cost impact: Prolonged system support required Force modernization requires
Accelerated Deactivation	Prolonged system support not required	Overload available Deactivation Equipment
Modification of Deactivation Schedule	None	Cost Impact: Delay of Wing Phase-Out

Within the constraints of objectives set for required modernization of our strategic nuclear forces, only three practical alternatives to the proposed action exist; a no-action scenario; an accelerated deactivation program; and a modified deactivation scenario. These three alternatives are discussed in further detail in the following subsections. Other alternatives that were considered but rejected are also discussed.

a. No-Action Alternative

A no-action alternative would be inconsistent with national policy decisions on strategic force modernization. Assuming, however, that other more advanced systems were developed and deployed with Titan II system operations continuing for the foreseeable future, substantial additional cost impacts could occur. One aspect of the proposed action is to gradually phase out existing activities and channel resources formerly dedicated to Titan II operations into new programs. A no-action option would require continuing funding, and other sources of funds would have to be found for procurement and operation of more advanced systems. An associated aspect of this problem is that the cost of maintaining the aging Titan II system is increasing and would continue to increase. Spare parts and training pipelines would also have to remain open. This, too, would consume further critical resources that might be used more productively in other programs.

One final effect of the no-action scenario relates to the cost of procuring additional propellant supplies. Expensive propellants made available from deactivated missiles are, in part, targeted for use in other existing or planned programs. If this alternative were implemented, the government would be required to increase propellant buys to support these other programs.

The no-action alternative could provide supplementary strategic missile force capabilities as new systems become operational. For this reason, it remains a reasonable alternative. However, the cost of this option in terms of available funding and personnel resources compares unfavorably with the proposed action.

b. Accelerated Deactivation Alternative

Accelerated deactivation of the Titan II system would result in potential cost savings and could free materials and personnel for other programs. Assuming that the schedule for deactivation could be substantially accelerated (without a negative strategic impact), operational costs would cease earlier than planned.

Early deactivation would, however, severely strain the available equipment required for site deactivation. It would be difficult to obtain sufficient transport equipment (special trailers for fuel and components) and storage facilities for propellants. This is an important consideration since the high acquisition cost of these propellants warrants their storage for future planned uses. If sufficient transport equipment were unavailable, additional equipment would have to be acquired at additional cost. Lack of propellant storage space would dictate the surplus sale of these missile fuels and their subsequent unavailability for other programs. New expensive government fuel buys would later be required to support these other programs.

c. Modified Deactivation Alternative

The modified deactivation scenario is a variation involving a five year deactivation period. As with the proposed action, this alternate calls for the deactivation of the Davis-Monthan wing to occur first, over a 24-month period. Rather than continuing in a sequential manner at the other missile wings, this alternative involves the simultaneous deactivation of the remaining two wings over a 36-month period. Such a scenario would require the support of both missile wings over a longer time period relative to the proposed action, since both wings would remain in operational status until nearly the end of the entire deactivation

sequence. Consequently, all normal operations support would have to be maintained throughout the entire period. As a result of these factors, this alternative would result in higher overall program costs than either the proposed action or an accelerated deactivation scenario.

d. Other Alternatives

Other alternatives such as startup delays, schedule prolongation and partial system deactivation have been considered. In addition, within the general limits of the proposed action, certain options exist with respect to materiel disposition. These are discussed in the following paragraphs.

Delay in the initiation of system deactivation activities would cause a cost impact due to an increase in the duration of planned operations. Cost impacts associated with additional operations could result in the delay of procurement and deployment of more modern systems due to funding availability. For this reason, a substantial delay is not considered practical at this time.

Extension of the duration of system deactivation activities would also result in impacts associated with longer Titan II systems operations life cycle costs. These costs would be incurred for reasons similar to those associated with delaying the startup of planned deactivation activities. Further, some public concern does exist over the safety aspects of the aging Titan II missile system. Any delays will serve to increase public concern. Another aspect of deactivation schedule delays would be possible staffing problems. For example, if training facilities are closed on schedule, it can be expected that there will be a shortage of operations personnel. Substantial extension of the existing schedule is not considered necessary (or probable)

since the planned program has ample consideration for contingencies.

Partial deactivation of the system is a third alternate that has been considered. Under the assumption that the proposed action was initiated and for some reason was discontinued, a situation would exist similar to the no-action alternative. Strategic issues aside, this alternate would require continuing support of a smaller number of Titan II missile sites and other facilities. However, the support requirements (and costs) for a smaller Titan II force could not be expected to decrease proportionately to the number of sites. In other words, retaining training facilities, spares, communications, security, and many other support functions could cost nearly as much as it now does. Public concern with system safety would also continue in those areas where operations would go on. This alternative is not considered cost effective relative to the proposed action.

Within the proposed action, there are alternatives that exist with respect to the disposition of certain materials. This environmental assessment has been prepared to address the consequences of these alternatives. Discussion of impacts associated with material disposition options is presented in Section IV. Major airframe components and missile propellants are the two items of greatest importance because they both are substantial parts of the system with a high potential for reuse. Other items have limited or only classified military applications and are not of public interest. The alternatives associated with the disposition of boosters relates to the location and usage rate for other programs. For example, boosters delivered for storage at Norton AFB could ultimately be shipped to either Vandenberg AFB or Cape Canaveral AFS for reuse as necessary.

Since the Aerozine 50 fuel mix is used in other Air Force and National Aeronautics and Space Administration programs, there will be continuing usage of that commodity, although at times the usage rate may not keep up with the download rate from the missile sites. In such cases storage quantities of Aerozine 50 will temporarily increase. Download rates and usage rates will be determined as soon as possible. Oxidizer is less expensive than fuel, and as a result, it may prove to be more economical to sell or otherwise dispose of this commodity rather than to store it. An economic analysis of various propellant disposition options has been completed by the Air Force San Antonio Air Logistics Center in Texas.[124] Destination options for fuel and oxidizer are shown on Table I-4. A determination of which fuel will be sold as surplus and where the remaining fuels will be stored is to be determined as an ongoing process during the deactivation program.

II. AFFECTED ENVIRONMENT

The location of various categories of bases/depots which will be affected by the proposed action are shown in Figure I-1. An examination of this figure reveals that these installations are widely distributed over the southern two-thirds of the United States. Portions of eleven states and the District of Columbia are involved.

The Davis-Monthan Air Force Base region is depicted in Figure II-1. Davis-Monthan AFB is located southeast of the City of Tucson in southcentral Arizona. The associated Titan missile sites are about equally distributed north and south of the base and are located in Pinal, Pima, Cochise and Santa Cruz Counties. Tucson, a community with a population of about 333,000, is the only large city in the SMSA (Standard Metropolitan Statistical Area) which includes a total regional population of more than 550,000.

The McConnell Air Force Base vicinity is illustrated in Figure II-2. This base is located southeast of the City of Wichita in southcentral Kansas. Titan missile sites associated with McConnell AFB are about evenly distributed over portions of the six surrounding counties of Reno, Kingman, Sedgwick, Butler, Sumner and Cowley. Wichita, with a population of over a quarter million, is the only major urban center in the region.

The Little Rock Air Force Base vicinity is shown in Figure II-3. This base is located about twenty miles northeast of the City of Little Rock in central Arkansas. The City of Jacksonville, with a population of approximately 27,000, is situated just to the east of the base. Other smaller towns in the region include Morrilton (population 6,800), Conway (population 15,500), and Searcy (population 9,040). The Little Rock AFB missile sites are all located to the north of the base. The deployment area includes portions of

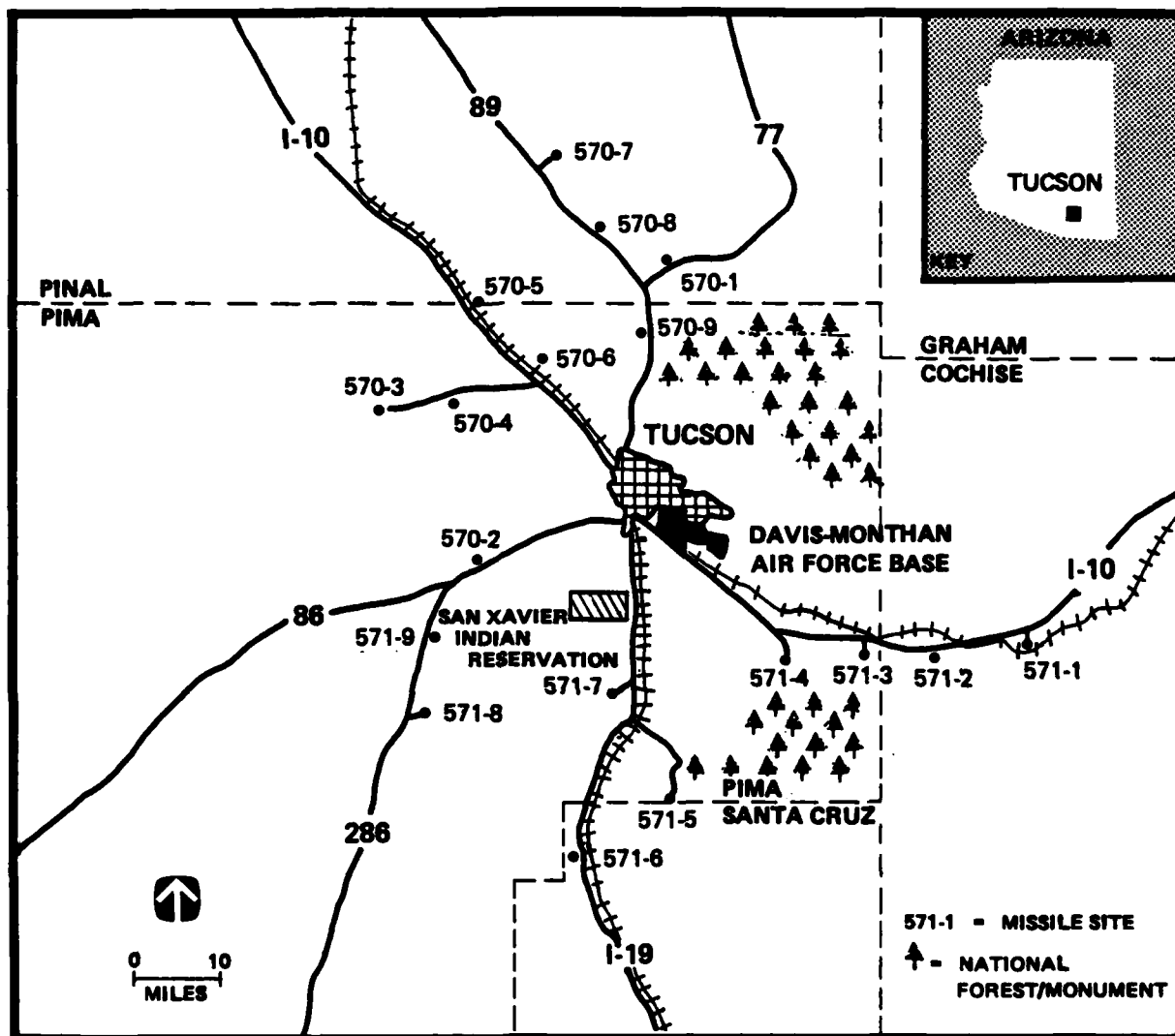


FIGURE II-I. Titan II Missile Deployment Area In The Davis Monthan Air Force Base Vicinity

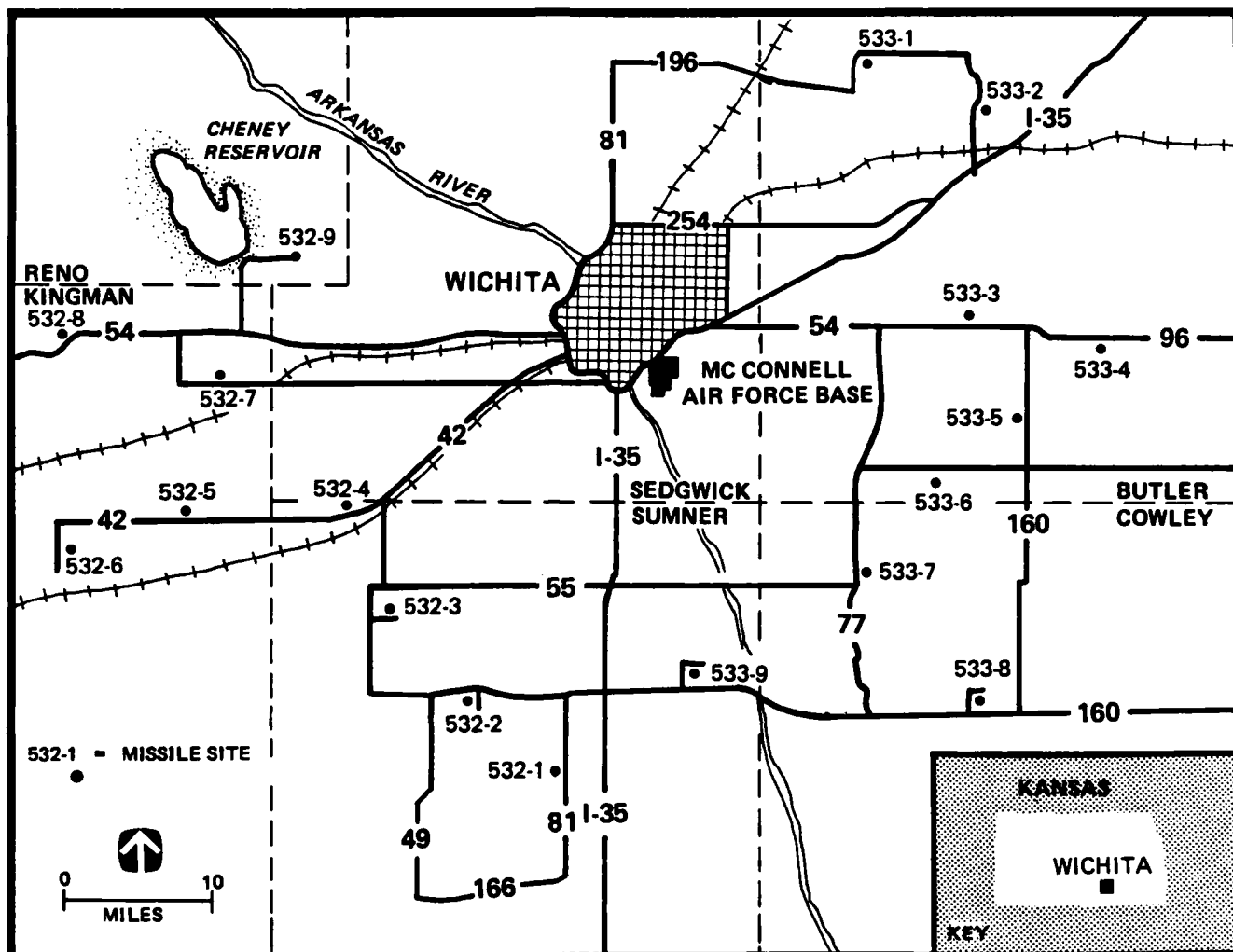


FIGURE II-2. Titan II Missile Deployment Area in the McConnell Air Force Base Vicinity

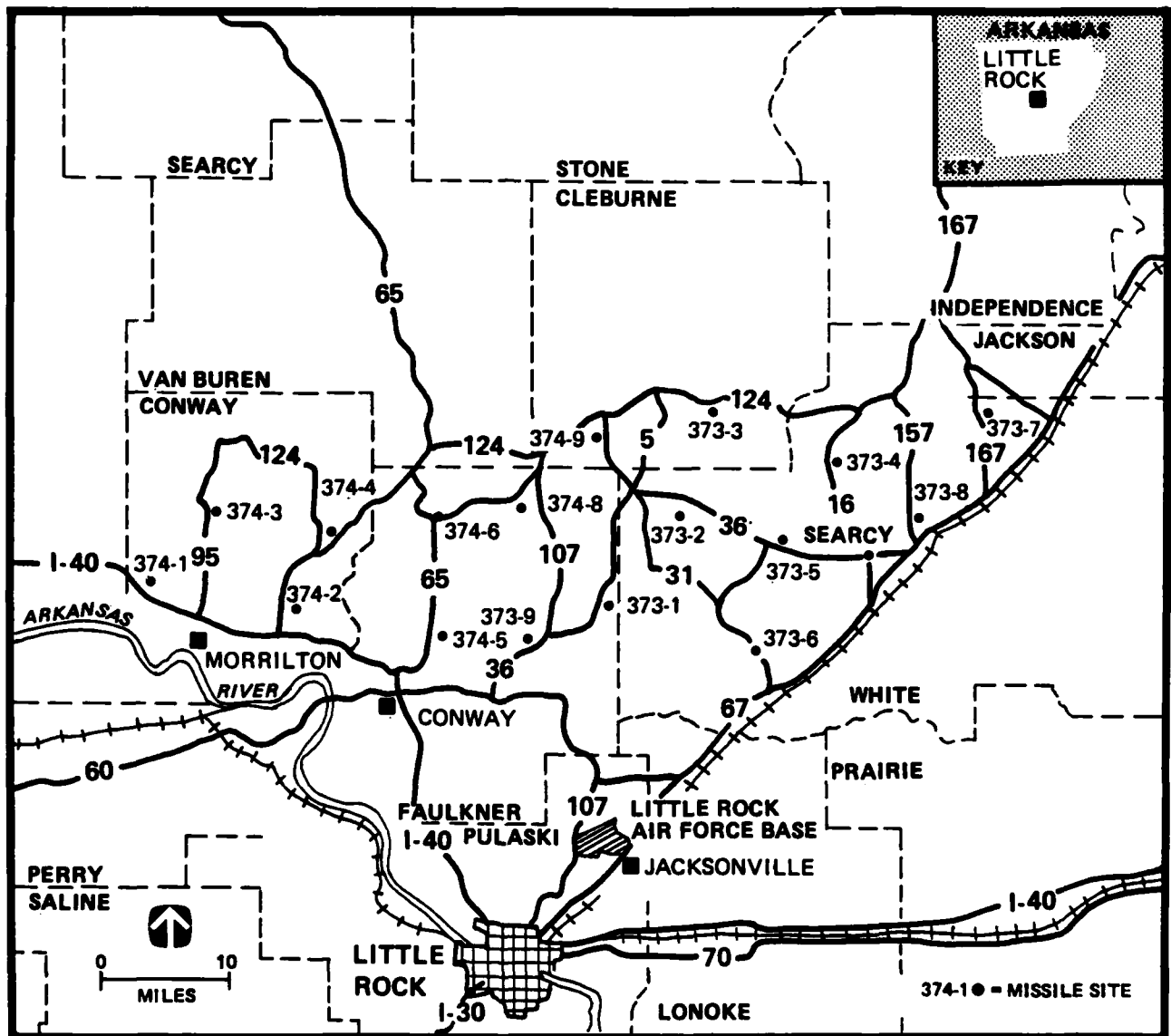


FIGURE II-3. Titan II Missile Deployment Area in the Little Rock Air Force Base Vicinity

Conway, Van Buren, Cleburne, Faulkner and White Counties. Little Rock, the state capital and largest city, has a population of about 150,000. North Little Rock has a population of 62,000.

The remainder of Section II deals with impacts resulting from the proposed action upon the natural and socioeconomic environments of Titan bases and all associated receiving and support facilities. Environmental factors considered include: general physiography, atmospherics, hydrology, biology, special interest areas and natural hazard areas. Additional factors include demographics, housing, socioeconomic elements, cultural resources, transportation, and safety and risk characteristics.

A. Natural Environment

A number of elements of the natural environment may be impacted by the proposed action or alternatives and are discussed at a level of detail sufficient to define and/or explain them.

1. General Physiography

Davis-Monthan AFB is located in the Basin and Range Physiographic Province. This province is characterized by northerly trending ranges of rocky mountains which are separated by broad, partially debris-filled valleys. Elevations vary from about 2,500 feet above mean sea level (MSL) in the valley bottoms to over 9,000 feet MSL in the Coronado National Forest north of Tucson. Bedrock geology is complex in the missile deployment area. Quarternary sedimentary deposits of fluvial origins are interspersed with volcanic masses that are of Cenozoic and Mesozoic age.[101] Soils in the region are of the Aridisol Order,

gray or red in color with surface organic layers thin or absent.[69]

McConnell AFB is located in the Arkansas River Lowlands Division of the Interior Lowland Physiographic Province. This province is characterized by little elevation and a general lack of topographic relief. The subsurface geological structure is commonly masked by layers of alluvial deposits. Some outcrops of limestone can be seen in areas where the local soils are not well developed. Bedrock in the McConnell AFB area is of sedimentary origin and of Upper Paleozoic age.[101] Elevations range from about 1,350 feet MSL in Kingman County to 1,250 feet MSL in southern Cowley County. Soils in the region are classified in the Mollisol Order and are dark in color, have an organic-rich surface layer and are well suited to agriculture.[69]

Portions of three major physiographic provinces meet in the Little Rock AFB area. As a result, the local topography changes dramatically from the uplands in the Ozark Plateau and Ouachita Provinces, northwest of the base, to the Coastal Plain Province which is located east and south of Little Rock AFB. The upland regions are characterized by folded ridge and valley topography. The area bedrock is sedimentary (i.e., sandstone and shale) and is of Upper and Lower Paleozoic age. Ridge elevations in Conway County may exceed 2,000 feet MSL. Valley bottoms range from 300 to 600 feet MSL.[167] Soils tend to be thinnest on the ridges and become deeper and better developed in the alluvial valleys. In contrast, the Coastal Plain area is characterized by flat terrain and lack of relief. Soils in this portion of the area are in the Ultisol Order. They are red-yellow in color, have low organic matter and are of moderate to low agricultural value.

Vandenberg AFB lies in the Pacific Border Physiographic Province. This region has a complex mountain and valley topography which parallels the Pacific Ocean in the Coast Range subdivision and trends east-west in the Transverse Range subdivision. Some mountain elevations are over 4,000 feet MSL.[247] Extensive folding and faulting of sedimentary materials of Cretaceous age has occurred in the region. Soils at Vandenberg AFB are extremely variable; however, silty sand predominates over much of the region.

The Aerojet Corporation facility at Nimbus, California is located in the Central Valley portion of the Pacific Border Physiographic Province. The region is a structural trough situated between the Sierra Nevada and Coast Ranges. Sediments cover the basement rock to a depth of over 3 miles in most of the area.[101] The topography is very level except for a sloping zone along the Sacramento River. Most elevations in this portion of the Central Valley are below 100 feet MSL. Soils in the region are of the Alfisol Order and are red to brown in color, have a subsurface clay layer and yield well under small grain and irrigated crop agriculture.[69]

The Rocky Mountain Arsenal is adjacent to the City of Denver, Colorado and is located on the western edge of the Great Plains Physiographic Province. Local topography is level, sloping eastward from an elevation of about 5,500 feet MSL. Geologic formations are nearly all of horizontal Mesozoic sediments which were originally washed from the Rocky Mountains. Soils in the region are Aridisols and are reddish to brown in color, possess a zone of clay accumulation and support grazing and irrigated crops.

The Holston Army Ammunition Plant is located southwest of Kingsport, in eastern Tennessee. The region is a part of the Ridge and Valley Physiographic Province which runs

parallel to the centerline of the Appalachian Mountains. As its name implies, northeast-southwest trending ridges and valleys are the predominant topography in the region. Folded shale, sandstone and limestone are the main rock materials found in the local mountains. Elevations may occasionally exceed 4,000 feet MSL.[101] Soils in the Holston Army Ammunition Plant area are thin along ridges and thicker and better developed in the valleys. Valley soils are of the Ultisol Order and are of moderate to low fertility.[69]

The Cape Canaveral AFS is located on the Atlantic Coast of Central Florida. This area is an elevated former sea bottom that forms a portion of the Coastal Plain Physiographic Province.[101] The topography is level and marshy with elevations seldom exceeding 50-100 feet MSL. Surficial materials are of Quarternary marine limestone, sand and gravel. Soils near the Cape Canaveral AFS are part of the Spodosol Order and are acidic, brown in color and have a subsurface amorphous layer.[69]

2. Atmospheric Environment

The two aspects of the atmospheric environment pertinent to the present study are climatic conditions and existing air quality at a given site. Climatic conditions are of interest not only because of their influence on the fate of pollutants accidentally discharged to the atmosphere, but also because of the potential hazard they may pose during propellant handling operations. Thus in the latter category, thunderstorms, hail, tornadoes and other destructive phenomena assume importance because of the potential hazards they may pose during propellant handling operations.

From an air quality standpoint, atmospheric decomposition products from either fugitive releases or spilled amounts of Aerozine 50 and nitrogen tetroxide may include nitrogen oxides and ammonia. Associated vehicular activity (automobiles; trucks) may influence emissions and ambient levels for the criteria pollutants (carbon monoxide, CO; nitrogen dioxide, NO₂; ozone, O₃; hydrocarbons, HC; sulfur dioxide, SO₂; lead, Pb; and particulates) in the standard way.

In the discussion which follows the climatic factors and air quality at each of the Titan complexes and destination points is discussed. Selected representative climatological statistics at the various loading and destination facilities are summarized in Table II-1. The significance of these statistics will be discussed in the sections which follow.

As may be seen from Table II-1, adverse weather is not likely to hamper loading operations at Davis-Monthan AFB where over the course of a year the precipitation averages about 10 inches, the number of days with thunderstorm, hail, and fog average 40, 2 and 5 respectively, and where the air temperature is greater than 80°F about 27% of the time.

The base is located in an area classified non-attainment for CO and particulates. However, CO problems occur primarily along congested urban centers such as in Tucson and a large proportion of the particulates are derived from natural sources.[2] Air quality standards for the remaining non-criteria pollutants are consistently maintained.

The relatively high incidence of thunderstorms (53 days of the year) at McConnell AFB could be a potential problem at this base. The other climatological parameters are normal for the area and should not hamper the operation.

A review of the existing air quality data conducted by the Air Force shows the area air quality to be "very good,"

with air quality standards being met 99% of the time.[173]

Table II-1. SELECTED CLIMATOLOGICAL STATISTICS [87, 169]

FACILITY LOCATION	PRECIP. (in/yr)	PERCENTAGE OF TIME AIR TEMPERATURE EXCEEDS 80°F	NUMBER OF DAYS PER YEAR WITH		
			Thunder storms	Hail	Fog
Davis- Monthan	10	27	40	2	5
McConnell	32	15	53	4	96
Little Rock	51	17	60	2	132
Vandenberg	14	1	3	1	207
Norton	13	15	8	1	127
Aerojet	20	10	5	1	25
Nellis	4	30	12	1	4
Rocky Mountain	16	7	49	5	68
Kelly	37	23	34	1	107
Holston	47	11	45	3	>45
Cape Canaveral	45	22	75	1	54

Little Rock AFB experiences on the average about 60 thunderstorms and 51 inches precipitation per year. Weather-related problems could therefore be anticipated at this site. Potential adverse impacts will be mitigated by the normal procedure of scheduling propellant transfer operations on a weather forecast basis.

A review of air quality data collected by the Department of Pollution Control and Ecology of the State of Arkansas shows

relatively clean air in and around Little Rock AFB. Since 1978 the Federal primary 24-hour standard of 260 micrograms of particulates per cubic meter has not been exceeded at Jacksonville, a station close to the base. Likewise, SO₂ and NO₂ data at two stations in Little Rock over the period 1973-1980 show that the Federal annual standards were not exceeded. Ozone measurements for 1980 at the North Little Rock Airport show a relatively "clean year," except for July when the Federal 1-hour ozone standard of 0.12 ppm was equalled or exceeded at least four times.

Of the destination sites (listed after Little Rock in Table II-1) Holston Army Ammunition Depot, Kingsport (Tennessee), and Cape Canaveral AFS (Florida) are the sites most likely to encounter weather-related propellant transfer problems. At Holston, annual precipitation of 47 inches could be expected with 45 days of thundershowers and more than 45 days with fog; at Cape Canaveral AFS the analogous figures are 50 inches precipitation, 65 days of thundershowers and 33 days of fog.

Santa Barbara County has been designated as a nonattainment area for photochemical oxidants. Moreover, the western portion, wherein Vandenberg AFB is situated, exceeds national ambient standards for suspended particulates. The southern coastal area from Point Conception to the Ventura County Line is nonattainment for carbon monoxide and oxidants.[51]

Aerojet and Rocky Mountain Arsenal are located just outside of large urban complexes in which ozone and carbon monoxide standards are routinely exceeded. Air quality data obtained for Holston from the Division of Air Pollution Control, Department of Public Health, shows the ambient air quality levels for the criteria pollutants to be well within Federal and state standard. The Holston area, located in Hawkins County, has been classified as attainment for all criteria pollutants except ozone.

Air quality data obtained from the Brevard County Environmental Engineering Department shows Cape Canaveral's ambient air quality levels to fall within Federal and County standards for the most part. There are exceedances of the Federal ozone standard of 0.12 ppm during the summer and occasional high levels of SO₂ during stable periods associated with northwesterly winds. The former has been attributed to naturally occurring ozone and the latter to the presence of power plants located just north of the Cape.

Travel routes from Davis-Monthan AFB to destinations in California (Vandenberg AFB and Aerojet Corporation) are not likely to experience much weather variability. Between Davis-Monthan AFB and the Rocky Mountain Arsenal in Colorado, however, icing conditions can be expected during the winter season. The route from Davis-Monthan AFB to Holston Army Ammunition Depot (Tennessee) and several of the routes from McConnell and Little Rock AFBs are likely to experience greater weather variability. All of the latter routes have essentially an east-west orientation. Travel along the westbound routes will in general experience progressively fairer weather with destination points in California. However, some winter storms may be expected in the southern Rocky Mountains. The routes terminating at Holston and Cape Canaveral may experience progressively poorer weather along the way, primarily in the form of thunderstorms.

3. Hydrologic Environment

The Davis-Monthan AFB and most of its Titan silo sites are located in the Upper Santa Cruz River Basin and are drained through numerous washes.[15] Due to the low annual rainfall (10 inches) and the seasonality of the rains, the washes are dry most the the year and subject to flooding during the

rainy season.[147] Several of the site access roads are subject to flooding, but this is not considered a serious problem. No major natural waterbodies are found proximate to any of the sites, with the exception of dry washes. The upper soil horizons are highly permeable.[15]

Ground water supplies are sufficient at 16 sites to provide water for silo consumption, although at one site water is brought in due to the poor quality of the well water. Three sites, including some with wells, buy commercial water (refer to II.B.4).

Surface and ground water are controversial topics in Arizona.[147] Since September of 1981, the Tucson Area Management Authority (TAMA) has regulated surface water withdrawal and ground water drilling rights in the 4800 square miles around Tucson. Any wells larger than 35 gallons per day (gpd) must be permitted, and the rights to any retired well can be sold by the holder subject to restrictions from TAMA.[117] Three missile sites (570-4, -5, -7) may be close to the boundaries of the Central Arizona Water Diversion Project (CAP) planned for the late 1980's.

Due to the dry air, and since the Davis-Monthan AFB silos were the first to be installed, the original silo evaporative cooling systems have been replaced by commercial recirculation refrigerant systems. This has significantly reduced water consumption and obviated the need for treatment chemicals in the coolant waters.

Sanitary waste from the silos is treated on site using septic tanks and leach fields. No significant problems have been encountered.[199]

McConnell AFB and most of the associated Titan silos lie in the Arkansas River Basin. Cheney Reservoir, northwest of

Wichita, is the other major water resource in the region. Flooding is a recurrent problem in the area, although none of the missile sites are involved. Flood water management has alleviated some of the impact of flooding.[103]

Ground water is plentiful in the McConnell AFB area, as are surface waters. However, much of the ground water has a high content of solids and sulfates and requires treatment before use. Wells supply water to 13 sites, and commercial water to the other four. Well water is filtered, softened, chlorinated and conditioned on each site.[230] The water table is quite high at a few sites requiring in some cases constant sump pumping.

Sanitary sewage is treated at each site using a septic tank/leach field system. No significant problems have been encountered.[230]

Little Rock AFB and its Titan missile sites lie within the Arkansas River Basin. Due to the topography, geology and the average 50 inches of rainfall annually, the area is rich in water resources. The area is subject to periodic flooding, although flood intensities have lessened somewhat in recent years.[273]

Ground water is the water source for nine sites, while the remaining eight use public water supplies. The ground water is quite hard, and therefore, must be treated at each site before use. Specific treatment depends upon the water quality at each site; however, the basic treatment consists of filtration, iron removal, softening, and corrosion conditioning. Water is stored at each site in two separate 100,000 gallon tanks. These are the sources of the domestic and make-up water for the site. Ground water infiltration is a problem at some sites, requiring pumping to prevent silo flooding.

Both the Little Rock AFB and the McConnell AFB sites have open cooling towers for two separate systems. These two systems (1-375 gal; 1-300 gal) are treated with either Calgon or with chemical water conditioning agents. These chemicals are oxygen scavenging, conditioning treatments that contain nitrites and/or borax. Algicides are also authorized for use in these systems. Depending upon the concentrations of the chemicals in the system, large quantities of boron and nitrites could be present in the water.

Sanitary sewage is treated at each site using either lagoons or septic tanks and leach fields. Given the volume of discharge at these sites, both systems appear adequate.[224]

Storm water from the fuel storage and transfer areas at Vandenberg AFB drain into the Santa Ynez River, one of the few surface water sources in this portion of southern California. Most of the water used on base comes from wells in three separate ground water basins: San Antonio; Lompoc Upland; and Lompoc Terrace. Recent studies indicate that past and predicted future ground water overdrafts will cause supply problems in the near future [71]. However, the question of the severity of overdrafting in this area continues to be controversial.

The fuel transfer areas at Cape Canaveral Air Force Station drain into the Banana River. The area is characterized by having abundant water sources; however, much of its is protected or highly regulated. Surface sediments near the site are very permeable with a high water table and poor quality water. Deeper artesian water from the Hawthorn Formation (-100 MSL to -400 MSL) is the preferred source of potable water. Withdrawal from and discharge into this aquifer is highly regulated. The Banana River is considered by the State of Florida to be an Aquatic Preserve, requiring highest discharge protection.

The Holston Army Ammunition Plant is located in Kingsport, Tennessee in the Holston River Basin (South Fork). This hilly area receives approximately 47 inches of rain per year. The Holston River has very poor water quality, receiving pollutants (including mercury) from current and abandoned upstream sources.

At the site to be used for the oxidizer transfer operation, the ground water lies about ten feet below the surface. Preliminary samples indicate that the ground water is not contaminated, but it does not meet state standards for drinking water. This water is not intended for use in the transfer operations. While flooding has occurred in the area, the transfer site is located above the 200 year flood contours.

Holston has a number of different treatment facilities for spills, including interceptor sewers, and settling/mixing and dilution ponds. Since detailed operational directives have not yet been produced for the transfer operations, it is not known what quantities of water, and their subsequent quality, will be used in the transfer operation.[132]

The Rocky Mountain Arsenal is located in the South Platte River Basin, northeast of Denver. The Arsenal has 17,200 acres of gently rolling former prairie land. It is encroached on the south and west sides by urban development and on the north and east by rural uses. The area is moderately dry, averaging 16 inches of rain per year.

Shallow ground water is present, and the water table may coincide with the bottoms of some of the four lakes located on the Arsenal grounds. Both the ground water and the lakes are contaminated from Arsenal and tenant activities. The ground water is treated before it leaves the north end of the site.

The four lakes form a chain and collectively cover approximately 238 acres. Two (Mary and Ladora) exhibit relatively stable water levels, while the remaining two (Lower Derby, Upper Derby) have fluctuating levels and sometimes dry out. Water from these lakes is used as process water at some of the facilities. Some of the lakes and sediments are contaminated with organic compounds and heavy metals from insecticide production from tenants at the Arsenal.[121]

The transfer site at the Aerojet Company near Sacramento, California occupies the 15 acre "F" zone at the 8000 acre installation. The complex is located in the American River Drainage Basin of the Sacramento River, downstream from the Folsom Lake (Nimbus/Folsom Dam) Reservoir. The average annual rainfall is approximately 20 inches, falling mostly from October to April.

The complex uses surface water as supply. Ground water is not used on the complex, and Aerojet is currently assessing the ground water quality around the site.

The hydrologic environment along any proposed transportation corridor is likely to vary from one hydrologic extreme to the other. For example, the corridor west from Davis-Monthan AFB to Vandenberg AFB and Aerojet is likely to be through arid to semi-arid regimes where little or no surface water is probable during much of the year. The route east from Davis-Monthan AFB to Holston Army Depot may proceed through rich and lush temperate areas with abundant surface and sub-surface water. The exact routing will, of course, determine the hydrologic regimes to be encountered.

4. Biotic Environment

The natural vegetation surrounding the missile sites at Davis-Monthan AFB is influenced by the topography and the

varied land uses found in this area.[147,148] Vegetation varies from scrub desert forms to dense stands of trees in the higher and moister elevations of the nearby mountains. Natural vegetation around the missile sites is dominated by cacti and desert species (e.g. cholla, snakeweed, mesquite) typical of the Sonoran desert-creosote bush, bursage communities.[148]

Virtually all native vegetation is protected by the Arizona Native Plant Law.[13] The Arizona Commission of Agriculture and Horticulture is currently deriving a list of protected cacti in the state.[13] At the present time, over 140 threatened or protected plants are on the list, scheduled for publication late in 1982.

There is no evidence of unique or prime farm land proximate to any Davis-Monthan AFB Titan sites. Some land in the area is used for grazing and poultry farming.[148]

No wetlands are close to these Titan sites. Due to the dry habitats and the lowering of the water table, aquatic and associated riparian habitats are declining in numbers and acreage.[148]

Threatened and endangered species lists are generated both by the Federal government and the State of Arizona. Federally listed species such as the masked bobwhite and the Yuma clapper rail could inhabit areas near the sites; however, the small size and disturbed quality of the sites make it unlikely that threatened and endangered species occur frequently on the sites, except as transients.

The natural vegetation surrounding the McConnell AFB Titan sites is described as a short grass prairie, dominated by blue stem, buffalo, indian, rye and side oats grama grasses. The primary cultivated crop is wheat.[103]

Neither wetlands nor prime agricultural lands are located

near the missile sites. Threatened or endangered species such as the prairie chicken and the gray bat are known to occur in the general area of the base, but none have been identified on any of the Titan sites, although transients may occur.[230]

Aquatic resources are common in the McConnell AFB area, and the Cheney Reservoir and the Cheyenne Bottom National Wildlife Reserve (wetlands) are both within a 75-mile radius of Wichita. Neither are affected by the Titan system.

The area around Little Rock AFB and the Titan sites is gently rolling, with few remnants of the natural vegetation left. Most of the land is cultivated in hay, sorghum, wheat and rice.[273] Dairy and beef cattle are common grazers near the missile sites. Prime agricultural land does occur in the area, but none is known to exist proximate to any sites.[224] Residual natural vegetational areas include hardwood forests, wetlands, grasslands and pine stands.[102, 224]

Nine Federally listed threatened or endangered species, including the red-cockaded woodpecker and the Indiana bat are known to occur in habitats similar to those found near some of the Titan sites, but none are known to occur on the sites themselves. However, occasional transients or migrants may occur.[94,102,224]

The natural environments of Vandenberg AFB have undergone many disruptions in recent years, especially in the area surrounding the fuel transfer sites. Grassland, chaparral and wetlands are close to some of these transfer sites. Eight species of animals found on the State of California and the Federal threatened and endangered species lists are known to occur in the Vandenberg AFB area. None are expected to occur at the transfer sites, except as transients.

Aerojet Corporation is located in gently rolling formerly mined land. The mining activity and tailings have left permeable soils and a scrub oak-chapparral vegetative community. Urban/suburban encroachment is evident at the periphery of the installation, and grazing lands border the northern boundary. Wildlife is common on the grounds, including deer, coyote and small mammals. No threatened or rare species are known to exist in the immediate vicinity.

The Rocky Mountain Arsenal is situated in an area of Colorado where the plains of the eastern section meet the mountains of the western section. Although much of the site has been disturbed by Arsenal activities, wildlife is still present, including mule and white-tailed deer, coyote, rabbits, prairie dogs and other small mammals. Birds, including raptors, are present in large numbers. The Arsenal lies within a major inland bird flyway.

No comprehensive survey for threatened and rare species has been done for this region, and an accurate statement cannot be made regarding those species on the Arsenal grounds. Wetlands are found on the Arsenal around some of the lakes, and these areas abound with migrating and resident waterfowl. Barr Lake State Park, a wildlife refuge, is located just north of Rocky Mountain Arsenal.[121]

The area around the Holston Army Ammunition Plant is rolling to hilly with elevation varying as much as 300 feet above the floodplain. The plant is located in a suburban setting several miles from Kingsport. On the base proper, there are sections of typical natural hardwood forest (oak, hickory, poplar), as well as planted pine. There is a nature reserve on the base (no hunting or fishing) and game are often transferred from this to other areas. No threatened or endangered species are known to occur on the base, and none are expected at the transfer location, which is a managed turf area. No significant wetlands or special interest

areas are found proximate to the Ammunition Plant.

All the fuel storage areas at Cape Canaveral AFS lie within the State of Florida Coastal Zone. The natural environments are variable and include coastal red and white mangroves, bahia, willow, oak, and other species typical of barrier island formations. Many of the habitats are considered sensitive, and all are subject to some regulation from the Coastal Zone Management Act. Many different endangered or threatened species, including the American alligator and the manatee, both from Federal and State lists, are known to occur in habitats similar to those found at Cape Canaveral Air Force Station; however, none are known to occur on the site.

The biotic environments likely to be encountered through the transportation corridors will vary from the desert vegetational complexes of Arizona and California, to the temperate forests of Tennessee, to the lush subtropical growth of Cape Canaveral. Depending upon the initial and final location, one transportation carrier could pass through virtually every vegetational biome found in the United States. Final corridor routing will, of course, determine the major habitats potentially affected.

5. Special Interest Areas

There are many areas of special interest within a 75-mile radius of Davis-Monthan AFB. These include various points of interest such as the San Xavier Del Bac Mission, Kitt Peak National Observatory, Colossal Cave, San Xavier and Papago Indian Reservations, Saguaro National Monument, and Madera Canyon Recreation area in the Coronado National Forest. The Mission, Indian Reservations, National Forest, Monument, and Recreation areas mentioned above are relatively close to several of the missile sites at Davis-Monthan AFB.

In the McConnell AFB region there are numerous special interest areas. These include the Bartlett Arboretum in Belle Plaine, Castle and Monument Rocks, numerous historic military sites, several game preserves and recreational areas such as Lakes Cheney, Bluesteam and El Dorado, the Well Game Preserve, in addition to the Flint and Smoky Hills natural resource areas. Some of the McConnell AFB missile sites are located near or adjacent to these special interest areas.

There are various areas of special interest in the Little Rock AFB region. These include state and national historic sites and memorials, National Forest areas, Corps of Engineers recreational use areas, National Scenic and Wildlife Refuge areas and numerous bayou wildlife management areas. Many of the Little Rock AFB missile sites are located near these areas of special interest.

There are a multitude of potential areas of special interest located all along the available cross-county rail and highway transport routes and in the immediate areas surrounding the destination points. There is tremendous variability in the basic area type, as well as environmental sensitivity associated with these areas. The exact routing will determine the types and number of special interest areas involved.

6. Natural Hazards

Natural hazards include some stationary and somewhat predictable zones, such as flood, ice, and seismic areas. Other natural hazards are not as predictable, such as violent and sudden storms, hurricanes, and tornados. The following is a general discussion of common hazards which may influence each base.

Both Davis-Monthan and McConnell AFBs have identifiable but inactive fault zones near silo sites, and faults are known to occur within 150 miles of Little Rock AFB. However, no seismic problems are known to exist at any of these bases.

Vandenberg AFB lies in an area known for its seismic activity. Although no active faults are known to occur on base, there are nearby faults which are considered active.[122]

Seismic activity at Rocky Mountain Arsenal is not unknown, although it is not common. The Corps of Engineers is currently studying the flood potential of the site. Rocky Mountain Arsenal does experience extreme winds at irregular intervals.[121]

Sinkholes, typical in any limestone area, are found on the Holston Army Ammunition Depot. None are known to exist at or near the transfer location. No seismic activity is expected.

ape Canaveral AFS lies within a hurricane area and much of the location is within the 100 year flood contour. Constructed facilities are elevated to at least seven feet above mean sea level.

A variety of natural hazards will exist along any transportation corridor utilized. Exact routing will permit the analysis of potential natural hazard threats.

B. Socioeconomic Environment

This section identifies the principal socioeconomic factors given consideration in this environmental assessment of the proposed action. The discussion of existing and projected socioeconomic baseline conditions is limited to the extent necessary to support both the definition and a general understanding of the impact section that follows.

Various socioeconomic characteristics considered in this assessment include demographics, economics, housing, institutional/service systems, land use considerations, cultural resource characteristics, transportation systems, noise conditions, and security and safety characteristics. The current location of air base personnel, as determined by residential zip code data, provided initial geographic focus with respect to the environmental baseline data. Additionally, employment and site specific facility environmental factors were also considered in developing the baseline description.

1. Demographic Environment

Population growth rates during the period 1970-80 in the Davis-Monthan AFB region (Pima County) averaged approximately 4.3 percent annually.[145] In comparison, Tucson's average annual growth rate for the same time period was 2.4 percent. However, many other communities in the region have experienced much more rapid growth in recent years, particularly Oro Valley and Green Valley, with average annual increases of more than 15 percent.[76] Population growth rates and projections to 1990 are summarized for the Davis-Monthan region in Table II-2.

Table II-2. POPULATION GROWTH IN THE DAVIS-MONTHAN AFB
REGION [77,145,294]

AREA	POPULATION				ANNUAL % CHANGE (1970-90)
	1970	1980	1985	1990	
Pima County	351,667	536,100	620,000	710,000	3.58
Oro Valley	N/A	1,525	1,718	2,040	2.95*
Marana	N/A	1,735	2,095	2,345	3.06*
S. Tucson	N/A	6,575	6,661	7,253	0.99*
Tucson	262,933	333,035	384,500	424,500	2.42
Green Valley	N/A	7,999	18,220	32,610	15.09*

* Calculated annual percent change based on actual 1980 and estimated 1990 data. N/A=Not available.

Annual population growth rates in the McConnell AFB region ranged from approximately 0.5 percent to more than 3.8 percent during 1970-1980. Percentile population growth rates for the Cities of Derby, Haysville, and Mulvane during the same time period were approximately 1.7, 2.6, and 3.9, respectively.[310] Growth rates and population projections to 1990 for the McConnell AFB region are summarized in Table II-3.

Table II-3 POPULATION GROWTH IN THE MCCONNELL AFB
REGION [307, 308, 309, 310]

AREA	POPULATION				ANNUAL % CHANGE (1970-90)
	1970	1980	1985	1990	
Sedgwick County	350,694	367,088	375,200	400,500	0.67
City of Wichita	276,554	279,835	295,000	320,100	0.73
Derby	7,947	9,786	10,113	11,099	1.68
Mulvane	2,063	2,993	4,076	4,405	3.87
Haysville	6,531	8,006	9,600	11,000	2.64
Butler County	38,6584	41,1184	42,6625	44,1125	0.66

Average annual population growth rates in the Little Rock AFB region during the period 1970-80 ranged from approximately 1.7 percent in Pulaski County to 3.4 percent in the City of Jacksonville. Growth rates and population projections to 1990 for various communities in Pulaski County are summarized in Table II-4.[263]

Table II-4. POPULATION GROWTH IN THE LITTLE ROCK AFB
REGION [263]

AREA	POPULATION				ANNUAL % CHANGE (1970-90)
	1970	1980	1985	1990	
Pulaski County	287,189	340,613	370,905	403,920	1.72
Little Rock	132,483	158,461	173,387	189,657	1.81
N. Little Rock	60,040	64,288	66,563	68,890	0.69
Jacksonville	19,832	27,589	32,558	38,408	3.36
White County	39,253	50,835	57,857	65,844	2.62
Lonoke County	26,249	34,518	39,604	45,424	2.78

Population growth rates and projections to 1990 in the Vandenberg, Sheppard, and Hill Air Force Base regions are summarized in Table 11-5.

Table II-5. POPULATION GROWTH IN THE VANDENBERG, SHEPPARD, AND HILL AFB REGIONS [4, 205]

AREA	POPULATION			ANNUAL % CHANGE (1980-1990)
	1980	1985	1990	
Vandenberg AFB N. Santa Barbara County, CA	127,625	138,656	150,613	1.67
Sheppard AFB Wichita County, TX	121,082	121,000	121,000	-0.01
Hill AFB Weber County, UT	144,616	154,870	165,774	1.37

2. Economic Characteristics

The 1980 civilian labor force in the Davis-Monthan AFB region was estimated at more than 218,000. In the same year, the average annual unemployment rate was approximately 6.0 percent. Tucson's economic growth is projected to increase approximately 4.0 percent annually during the next decade.[14] Predicted growth is based on current expansion of existing high technology manufacturing, including that of IBM, National Semiconductor, Hughes Aircraft, and Gates Lear Jet, as well as attraction potential of new manufacturers.[194] Employment characteristics for the region are summarized in Table II-6. At Davis-Monthan AFB there were 1,420 civilian and 6,173 military employees for an estimated total employment of 7,593 in April 1982. The

total military and civilian payroll for the same time period was \$133.8 million, with average annual military and civilian salaries of \$16,948 and \$20,563, respectively. Davis-Monthan AFB also created an estimated 13,364 jobs with a salary value of \$128.1 million for a total regional economic impact of \$261.9 million.[199]

Table II-6. EMPLOYMENT CHARACTERISTICS IN THE DAVIS-MONTHAN AFB REGION [14]

CHARACTERISTICS	AREA REGION			
	ARIZONA		PIMA COUNTY	
	1980	1981	1980	1981
Civilian Labor	1,149,000	1,182,400	211,400	218,000
Number Employed	1,073,900	1,106,300	199,400	205,500
Number Unemployed	75,400	76,100	12,000	12,500
Unemployment Rate (%)	6.7	6.6	5.9	6.0

In the McConnell AFB region, the civilian labor force was estimated at 226,000 in May 1982. Employment characteristics are summarized in Table II-7. The average annual unemployment rate in May was approximately 7.0 percent. Wichita's current employment projection suggests a slight decline before picking up again; recent layoffs and pending layoffs indicate small employment growth during the next two to four years.[110] At McConnell AFB there were 466 civilian and 3,732 military employees for an estimated total employment of 4,198 in April 1982. The total military and civilian payroll for the same period was \$74.3 million, with an average annual military and civilian salary of \$17,538 and \$18,876, respectively. McConnell AFB also created an estimated 7,766 jobs with a total salary of \$82.2 million for a total regional impact of \$156.5 million.[234]

Table II-7. EMPLOYMENT CHARACTERISTICS IN THE MCCONNELL AFB REGION [110]

CHARACTERISTICS	AREA REGION			
	KANSAS		WICHITA AREA	
	1981	1982	1981	1982*
Civilian Labor	1,190,600	1,198,800	223,600	226,000
Number Employed	1,139,300	1,137,600	212,200	210,200
Number Unemployed	51,300	61,200	8,800	15,800
Unemployment Rate (%)	4.3	5.1	3.9	7.0

* Labor force data reflects monthly average for May

The 1982 civilian labor force in the Little Rock AFB region was estimated at 166,075 for Little Rock-North Little Rock (Pulaski County). In the same year the average annual unemployment rate was approximately 8.0 percent.[28] Although comparative employment data is not available by community, the unemployment rate for the City of Jacksonville is estimated to be approximately 1.0 to 2.0 percent less than that of Pulaski County.[32] Future employment levels are estimated to remain stable with no significant increase until after the nation's economy begins to recover from its present slump.[25] Employment characteristics for the region are summarized in Table II-8. At Little Rock AFB there were 670 civilian and 6,443 military employees for an estimated total employment of 7,113 in April 1982.[226] The total military and civilian payroll for the same period was \$123.2 million, with an average annual military and civilian salaries of \$17,293 and \$17,697, respectively. Little Rock AFB also provided an estimated 13,177 jobs with a total salary value of \$80.7 million for a total regional economic impact of \$203.9 million.[254]

Table II-8. EMPLOYMENT CHARACTERISTICS IN THE LITTLE ROCK AFB REGIONS [25,28,32]

CHARACTERISTICS	AREA REGIONS							
	Arkansas		Little Rock/North Little Rock Area**		White County		Lonoke County	
	1981	1982	1981	1982	1981	1982	1981	1982
Civilian Labor Force	1,006,500	1,001,900	182,753*	166,075	N/A	23,125	N/A	15,550
Number Employed	902,400	887,500	168,420*	152,425	N/A	19,450	N/A	14,225
Number Unemployed	104,100	114,400	14,333*	13,650	N/A	3,675	N/A	1,325
Unemployment Rate (%)	10.3	11.4	7.8	8.2	N/A	15.9	N/A	8.5

* Adjusted for Saline County Data. N/A = Not Applicable.

** Includes Jacksonville, Arkansas.

Civilian labor force characteristics for Vandenberg, Sheppard, and Hill Air Force Base regions are summarized in Table II-9. Total 1981 employment and annual payroll at Vandenberg AFB was 14,320 and \$207 million, respectively; 11,205 and \$147.5 million at Sheppard, AFB; and 19,599 and \$421 million at Hill AFB.[198]

Table II-9. EMPLOYMENT CHARACTERISTICS IN THE VANDENBERG, SHEPPARD, AND HILL AFB REGIONS [52,192,293]

CHARACTERISTIC	AREA REGION					
	Vandenberg AFB		Sheppard AFB		Hill AFB	
	1981	1982	1981	1982	1981	1982
Civilian Labor Force	154,400	158,100	62,250	69,000	65,030	66,040
Number Employed	146,000	146,600	63,350	63,350	59,893	59,965
Number Unemployed	8,500	11,500	1,900	5,450	5,137	6,075
Unemployed Rate (%)	5.5	7.3	2.9	7.9	7.9	9.2

3. Housing Characteristics

There were an estimated total of 219,048 housing units in the Davis-Monthan region in 1980. The United States Census Bureau estimated a 10.7 percent housing vacancy rate in Pima County for 1980.[263] Although various communities in the region experienced recent housing growth, including Oro and Green Valleys, the number of new housing units permitted to date by the City of Tucson and Pima County has declined by 33.0 percent over the 1981 rate. However, it is estimated that more than 6,000 new units will be constructed during

1982.[195] Estimates of total housing units in the Davis-Monthan AFB region are summarized in Table II-10.

Table II-10. HOUSING CHARACTERISTICS IN THE DAVIS-MONTHAN AFB REGION [58]

AREA	TOTAL HOUSING UNITS		ANNUAL PERCENT CHANGE 1970-80
	1970	1980	
Pima County	145,000	219,048	4.21
Oro Valley	N/A	700	--
Marana	N/A	2,321	--
S. Tucson	N/A	2,141	--
Tucson	108,200	134,000	2.16
Green Valley	N/A	6,151	--

N/A = Not Available

In Sedgwick County, which surrounds McConnell AFB, there were an estimated total of 145,848 housing units in 1980. The growth in housing averaged 1.5 to 2.0 percent annually in Wichita and Sedgwick County during 1970-1980. This contrasts with annual rates of 4.0 percent in Derby and Haysville, and 8.5 percent in Mulvane during the same time period. Despite the increasing costs of single family housing, approximately 80.0 percent of Wichita and 81.0 percent of Sedgwick County residents reside in such housing. Although mobile homes currently represent a small portion of the total housing stock in Sedgwick County (4.0%) and Wichita (3.0%), there has been a significant increase in this particular type of housing (approximately 3.7% annually) during the same time period. The overall vacancy rate for Sedgwick County and Wichita was estimated at 4.0 to 6.0 percent in 1982.[307] Estimates of total housing and annual percent change are summarized for the McConnell AFB region Table II-11.

Table II-11. HOUSING CHARACTERISTICS IN THE MCCONNELL
AFB REGION [307, 308]

AREA	TOTAL HOUSING UNITS		ANNUAL PERCENT CHANGE 1970-80
	1970	1980	
Sedgwick County	120,666	145,848	1.91
Wichita	99,920	116,559	1.56
Derby	2,079	3,192	4.38
Mulvane	641	1,450	8.51
Haysville	1,634	2,500	4.34
Butler County	13,905	14,790	0.62

In 1980, there were an estimated total of 132,810 housing units in the Little Rock AFB region (Pulaski County). Of these units, 90,637 were located in the Cities of Little Rock-North Little Rock, with more than 9,000 units in Jacksonville. The annual growth in housing averaged more than 3.0 percent in Pulaski County during 1970-80 in comparison with more than 5.6 percent in Jacksonville during the same time period.[288] However, in 1981 there were 51.0 percent fewer single family units started than in 1980, and 70.0 percent fewer than in 1979. Estimates of total housing units in the Little Rock AFB region are summarized in Table II-12.

Table II-12. HOUSING CHARACTERISTICS IN THE LITTLE ROCK
AFB REGION [262]

AREA	TOTAL HOUSING UNITS		ANNUAL PERCENT CHANGE 1970-80
	1970	1980	
Arkansas	675,620	898,138	2.98
Pulaski County	98,201	132,810	3.07
Little Rock/ N. Little Rock	69,365	90,637	2.71
Jacksonville	5,303	9,172	5.63
White County	13,806	18,482	2.96
Lonoke County	8,910	12,442	3.40

Housing characteristics for Vandenberg, Sheppard, and Hill AFB regions are summarized in Table II-13. The total number of housing units in 1980 was approximately 46,000 in the Vandenberg AFB area, approximately 53,000 in the Sheppard AFB area, and approximately 50,000 in the Hill AFB area.

Table II-13. HOUSING CHARACTERISTICS IN THE VANDENBERG,
SHEPPARD, AND HILL AFB REGIONS[95, 205, 299]

AREA	TOTAL HOUSING UNITS		ANNUAL PERCENT CHANGE 1970-80
	1970	1980	
Vandenberg AFB, N. Santa Barbara County, CA	31,982	45,993	3.7
Sheppard AFB, Wichita Co., TX	45,099	52,746	1.6
Hill AFB, Utah Weber Co., UT	35,458	50,017	3.5

4. Institutional Characteristics

Enrollment in Tucson's six public school districts in the Davis-Monthan AFB region during 1982 is estimated at approximately 86,000.[58] Of this number, approximately 1,000 elementary students are enrolled in on-base schools. In addition, 5,675 student dependents of military and civilian Air Force employees attended Tucson area public schools in 1982. This resulted in contributions of nearly \$2.5 million in Federal School Impact Funds during the 1980-1981 school year.[202] Building new schools, rather than closing them, is a trend in most school districts in Tucson's developing fringe areas. The approximately 6.0 percent current average enrollment growth rate in 1981 is expected to decline somewhat in the next two to four years.[195]

Public school enrollment in Wichita School District #259 of the McConnell AFB region is currently estimated at 45,000. School enrollment in this district area is projected to decline to 44,500 in the 1985-86 school year.[301] During the 1980-81 school year the federal government provided more than \$500,000 in Federal School Impact Funds (PL 81-874) for student dependents of military and civilian Air Force employees. In addition, there are approximately 4,700 dependent students enrolled in the Derby Public School System[104] and more than 3,000 in the Haysville Public Schools.[301] Total Federal School Impact Aid contributed to these school districts in 1981 was more than \$1.2 million.[231]

Enrollment in Pulaski County School Districts in the Little Rock AFB region during 1980-81 was estimated at approximately 67,000. Of this number, approximately 7,200 student dependents of military and civilian Air Force employees attended Pulaski County schools. During the 1980-81 school

year the federal government provided more \$1,374,900 in Federal School Impact Funds (PL 81-874) for student dependents of military and civilian Air Force employees.[89] Although school enrollments in the Little Rock AFB region increased at an average annual rate of about 1.0 percent during 1960-80, enrollments since 1970 have declined at an annual average rate of less than one percent.[292]

Total 1981 water consumption at the Davis-Monthan AFB missile sites was 8.1 million gallons. Of this amount, approximately 25.0 percent or 2.0 million gallons were purchased for use at three sites. The four suppliers included the Arizona and DeLago Water Companies, Annamax Mining, and ASARCO Inc. Water consumption for the other 15 missile sites is supported by nearby or on-site water wells. Total electrical consumption during 1981 was approximately 19.6 million kilowatt-hours.[204]

At the McConnell AFB missile sites the total 1981 annual water consumption was approximately 30.6 million gallons. Of this amount, approximately 24.0 percent, or 7.3 million gallons were purchased for use at four sites. The three area suppliers included Bulter County Water District #2, and the Wellington and Conway Springs Rural Water Districts. Water consumption for the other 13 sites is supported by nearby or on-site water wells. Total 1981 electrical consumption at the missile sites was approximately 20.8 million kilowatt-hours.[237]

The 1981 total water consumption of the Little Rock AFB missile sites was approximately 21.2 million gallons. Of this amount approximately 35.0 percent, or 6.6 million gallons, were purchased for use at six sites. The three area suppliers included the Enola-Mt. Vernon Water Company, Southwest White County Water Association and Mountain-Top Water Company. Although water consumption for the other 11 sites is currently supported by nearby or on-site water

wells, there are plans to discontinue this practice and connect entirely to commercial water usage. Total electrical consumption during 1981 was approximately 21.2 million KWH.[228]

The differences in water consumption between Davis-Monthan AFB and Little Rock/McConnell AFBs are primarily due to the use of closed cooling systems at the former and open cooling systems at the latter.

Davis-Monthan, McConnell, and Little Rock Air Force Bases all provide some community service support functions upon local request. Civilian aid services range from area fire control assistance to emergency medical evacuation, as well as helicopter assisted search and rescue missions.

5. Land Use Characteristics

Urban, agriculture and mining are the three general categories of land use which exist in the Davis-Monthan AFB region. The air base is adjacent to the City of Tucson and has between 8 to 10 percent urban land.[57] This urban area has a complex mix of residential, commercial, light industrial and public uses. Rural land use areas near Tucson are divided among grazing and agriculture (62 percent), urban (8 percent) and mining (one percent), with the remainder in public and other uses.[57] Land ownership in eastern Pima County is apportioned between the Federal government (32 percent) and the State of Arizona (39 percent), with the remaining lands in City, County and private ownership. Federal land holdings in the Tucson area include the Saguaro National Monument, the San Xavier Indian Reservation and portions of the Coronado National Forest which are located both north and south of the City. Missile deployment sites are located, except in a few cases, in open areas away from urban and other sensitive land uses.

About 4,380 acres of land around Davis-Monthan AFB is presently committed to missile basing. A typical Titan site affects an area of 235 acres. Of this total, approximately 12 acres is owned by the Federal government; the remainder is restrictive easements held on renewable five year bases. Encroachment on Titan sites by private development is becoming a problem at several locations. A worst-case example has occurred north of Tucson in the Site 570-9 vicinity. A mobile home development, a State juvenile detention center, and a public elementary school have been constructed within the last eight years. Both the detention center and the school are within a half-mile of the site. Sites 571-7 and 571-5 also have encroachment problems related to housing and recreational development.

Land near McConnell AFB is devoted predominately to urban and agricultural uses. The base proper shares its western and northern boundaries with the City of Wichita. The City has a complex pattern of residential, commercial, industrial and public land uses. The missile deployment areas, in contrast, are situated in open agricultural lands which are generally well away from towns and other built-up areas. Cheney State Park and Reservoir is one of the few special use areas located in the rural McConnell AFB region. It serves Wichita as a recreational and water supply resource.

Approximately 4,600 acres of missile site land are presently in use. A typical missile site affects an area of about 250 acres. Of this, approximately 16 acres are fee owned and the remainder is in easement, license or permit status. Some Titan site encroachment, by persons who have located dwellings within a short distance of site boundaries, has occurred in the missile deployment area. A worst-case example exists at site 532-9, located 25 miles west of Wichita and immediately to the east of Cheney Reservoir. A number of conventional and mobile homes have been erected

both east and west of the site. Distances vary but several inhabited dwellings are within 1,800 to 3,000 feet of the site boundary. Some additional future encroachment may be expected near this site due to its desirable location close to the recreational opportunities at Cheney Reservoir.

Land use in the Little Rock AFB region is predominately rural, but small areas of urban development exist at places such as Jacksonville, North Little Rock, Conway and Searcy. The base is bordered on the southeast and south by the City of Jacksonville, population 27,000, which has a mix of residential, public, commercial and industrial land uses. Residential and public lands account for almost 70 percent of land within City jurisdiction.[130] Rural lands are devoted to growing row crops, grazing and dairy farming. Special land use areas in the region include Camp Robinson near North Little Rock, the Bell Slough Wildlife Management Area at Lake Conway and Woolly Hollow State Park in north-central Faulkner County.

Approximately 4,340 acres of land are currently used at Titan missile sites. A typical missile site in the Little Rock AFB area has an area of 240 acres. Of this total about 10 acres are fee owned and the remainder is in easements and licenses. Structures which encroach on Titan sites exist at several places in the missile deployment area. A local farmer at Site 373-1, located north of the base in east-central Faulkner county, has constructed an animal shelter within the 1800-feet restrictive easement. In addition to this structure, six dwellings are presently located within a half-mile of the site.

Vandenberg AFB is located in a ranching and agricultural region of coastal California. It occupies 5.6 percent of the total area of Santa Barbara County. The City of Lompoc, population 26,000, is located five miles to the southeast and is the nearest urban area. Lompoc has a mix of residen-

tial, commercial, industrial and public land uses, including a maximum security prison. Santa Barbara and Santa Maria are two larger Santa Barbara County cities but are not part of the immediate Vandenberg AFB environment. Special land use areas in the Vandenberg AFB region include several State and one County beach park, the La Purisma Mission State Historic Park and a Native American reservation located east of the base.

Land use in the Aerojet Corporation vicinity is divided into grazing, industrial, commercial and very minor residential categories. The installation covers between 8,000-9,000 acres and is located about 15 miles east of Sacramento, California. The nearest small town is Folsom with a population of 5,800. Special land use in the area includes a State recreation area at Folsom Lake, a State historic park near Placerville, and Mather Air Force Base near Sacramento.

Rocky Mountain Arsenal is located in a rural area adjacent to Denver, Colorado. Land use in the region is a rapidly changing pattern composed of most types of rural and urban land uses. Rocky Mountain Arsenal land is generally open and without extensive development. This openness is partially related to mandatory Army safety distance requirements. Special land use areas in the region include Stapleton Airport, Barr Lake State Recreation Area, Cherry Creek State Recreation Area, and Fitzsimmons Army Hospital.

Land use in the vicinity of the Holston Army Ammunition Plant is primarily rural. A small amount of residential development and agricultural land is dispersed over the rolling forest-covered hills.[132] One of the small residential areas is located 1.5 miles east of Holston Army Ammunition Plant and the other is approximately 2 to 3 miles to the west. The City of Kingsport, population 33,000, is located about eight miles northeast of the Plant. Special land uses in the region include Warriors Path State Park in

Tennessee, and the Jefferson National Forest and Natural Tunnel State Park in Virginia.

A number of diverse land use categories can be found in the Cape Canaveral AFS region. These include agricultural, forestry, residential, commercial, industrial and public uses. Among those of a special nature are the Launch Complex 39 National Historic Site, Merritt Island National Wildlife Refuge and the Canaveral National Seashore. Several communities of over 15,000 population such as Merritt Island, Titusville and Cocoa are situated adjacent to the base. Land uses in these locations are primarily residential and commercial.

6. Cultural Resource Characteristics

Southern Arizona has experienced a rich and lengthy pre-historic cultural past beginning some 12,000 years ago. The earliest people thought to have lived in the Davis-Monthan AFB region are referred to as Paleo-Indians. They were primarily nomadic hunters of large game animals. The most significant evidence of their existence was found in the San Pedro Valley of southern Arizona. Potential artifact discoveries in Eastern Pima County are still possible. Following the advent of the most recent geologic age about 4,000 years ago, a new societal pattern identified as the Western Desert or Cochise culture became firmly established. Most of these cultural sites have been found in the Sonoita Valley (refer to Figure II-1). The development of maize cultivation and irrigation technology, as well as the creation of ceramic bowls which occurred around 2,500 years ago, signifies the disappearance of the Cochise culture and the beginning of the Hohokam tradition. By the time the first Spanish explorers arrived in the early 1500's, the Hohokam cultural tradition had disappeared. The modern day

Pima and Papago Indians are considered by many to be descendants of the Hohokam.[146] No known archaeological or historic sites exist on any of the Davis-Monthan AFB Titan missile sites.

The central Arkansas River Basin and the western portion of the Flint Hills area in the McConnell AFB region were first inhabited by Paleo-Indians approximately 10,000 years ago. They were followed by several prehistoric cultures, forerunners of the Plains Indian tribes known as the Macro-Siouan group that included the Kansa, Pawnee, Osage, and Wichita Indians. These tribes were buffalo hunters and farmers who lived in small permanent communities. Around 1800, they were joined on the western central plains by displaced nomadic hunter tribes of the Kiowa, Commanche, Arapaho, Cheyenne and Apache. Most of the Kansas Indians had been relocated to Indian Territory in what is now Oklahoma by 1880. Kansas was also the mid-nineteenth century way to the West as well as the end of the great Texas cattle drive trails. These included the Abilene, Santa Fe, Chisholm, and California-Oregon Trails.[119] No known archaeological or historic sites exist on any of the McConnell AFB Titan missile sites.

In the central Arkansas area including Little Rock AFB, Paleo-Indian lithic artifacts identified as clovis points have been found in several counties including Logan and Searcy. The Dalton and Archaic culture periods which followed are characterized by a more subsistent and sedentary life. Evidence exists that around 1,000 B.C. significant cultural change appeared including burial mounds and woodland and Mississippian Period agricultural practices. Evidence of historic period indians including the Cherokee and Osage also have been located in riverine areas throughout central Arkansas.[17] No known archaeological or historic sites exist on any of the Little Rock AFB Titan missile sites.

Delivery of propellants to the various planned destination points is part of existing operations. As such, similar operations planned during Titan II deactivation will impart no possible impact to cultural resources at these locations.

7. Transportation Environment

Inter-Regional Transportation. The rail and highway routes connecting each of the three complex areas with component receptor bases extend across most of the southern half of the United States. Major east-west Interstate highways include Interstate 10, Interstate 40, Interstate 70, and Interstate 80. North-south trending interstate highways include Interstate 5, Interstate 15, Interstate 17, Interstate 25, Interstate 35, Interstate 45, Interstate 55 and Interstate 65.

The Titan II host base located at Davis-Monthan AFB is served by Interstate 10 which passes west directly through Tucson and southern Arizona into southern California. Interstate 10 routes east into southern New Mexico and Texas through El Paso, San Antonio, and Houston. It continues east through New Orleans to southern Alabama and, finally, into Florida.

McConnell AFB is situated near Interstate 35 which intersects Interstate 40 to the south in Oklahoma City, Oklahoma and continues into the Fort Worth-Dallas, Texas, continuing from there into San Antonio. Proceeding north from Wichita, Interstate 35 intersects Interstate 70 between Topeka and Kansas City, Kansas and continues north into Missouri and Iowa.

Little Rock AFB is very close to Interstate 40 which routes due west through Oklahoma, northern Texas, New Mexico, Arizona and into California. Interstate 40 routes east into

Tennessee. Little Rock AFB is also situated on Interstate 30 which routes west into Dallas-Fort Worth, Texas.

All three areas are also served by a network of State and County highways. Further, each host base is situated near trunk or main cross-country rail lines. McConnell and Davis-Monthan AFBs also have spur rail lines available into the bases. All component receptor bases are located on or near rail lines. Some bases, like Vandenberg and Norton AFBs in California, possess dedicated spur lines.

At the very least, many highway transportation routings are available from each host base to appropriate receptor bases. Multilane interstates and small county roads are frequently part of the same route. The distances involved can be great. For example, the direct route highway distance for the Little Rock AFB to Vandenberg AFB fuel delivery route is approximately 2,000 miles. Any long cross-country route will pass or cross a substantial number of geographic and political borders. However, routes are available which bypass business and residential areas of most, if not all, large cities. Interstate shipment of missile components and hazardous fuels is part of existing operations; such activities are considered routine and are conducted in accordance with established safety procedures.

Regional Transportation. It is beyond the scope of this report to describe routes and traffic characteristics that exist between the many sites of each complex and their respective host bases. However, certain general information is important to an understanding of the roadway network of each missile wing region and transportation related aspects of existing operations.

The transportation networks serving each of the three Titan base areas can be characterized as well-developed. Further, the roadway network within each complex provides by far the

AD-A138 227

ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED DEACTIVATION
OF THE TITAN II MISSILE SYSTEM(U) TETRA TECH INC
JACKSONVILLE FL AUG 82 F08637-80-G-0007

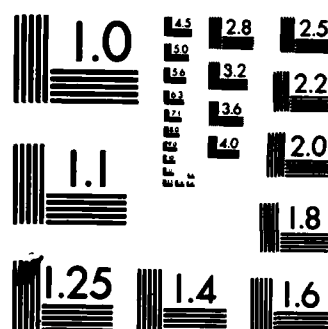
2/2

UNCLASSIFIED

F/G 16/1

NL

END



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

most important means of transportation within each region. The three geographically distinct wings are actually similar with respect to the general accessibility of each missile site via the regional road system.

The roadways serving the complexes consist of major highways, arterials, secondary streets, and local site access roads. The main road network for each complex area is depicted on Figures II-1, II-2, and II-3. Missile sites surround each host base and are generally located adjacent to highways or major county roads.

Almost all traffic directly related to the current operations of a complex consists of trips between the host base and specific sites. It is to be noted from Figures II-1, II-2 and II-3 that are located near major roads which afford good access (i.e., direct routes) to the host base. Further, public access is not restricted along the route to any site.

Most sites are located within about 0.5 mile of a highway. Typically, short access roads connect the site itself with the nearby highway. Such access roads are primarily used by the very light traffic directly associated with site activities. In some areas, these roads do provide improved access to adjacent cropland and may be used by farm vehicles. Infrequent visits by sightseers also contributes to access road traffic.

The public roadways connecting missile sites with bases vary from two lane paved rural country highways to major interstate thoroughfares. Some routes include segments of both. Thus, the physical character of routes (including traffic volume) is highly variable from one site to another and from one route segment to the next. Normal operations at each site generate truck and passenger vehicle traffic estimated at less than 20 movements per day. This light traffic includes crew changes, security patrols,

site/facility maintenance, and missile system servicing, and occurs at non-peak hours. Infrequent heavy truck traffic between a base and a site or from trucks coming from outside the complex region does take place as part of current operations, such as fuel transfer, booster removal/replacement, and Reentry Vehicle servicing activities.

Trucks with heavy and/or hazardous cargoes such as fuel transporters currently use roadways in the complex area. Routings to optimize public safety and to comply with weight limitations over certain highways and bridges are part of normal transport procedures. Current operations pose no known conflict with present local, State or Federal regulations. Transport permits are obtained as required for hazardous substances. Currently, all sites are accessible to trucks hauling missile fuel or components.

8. Noise Environment

Davis-Monthan AFB and the City of Tucson have a strong mutual noise influence due to their close proximity. Major sources of noise within Tucson are auto traffic, Tucson International Airport, the Southern Pacific Railroad and Davis-Monthan AFB.[57] Sources of noise at Davis-Monthan AFB are principally those associated with aircraft runup, testing, taxiing, and flight operations. Typical noise levels for ground operations at a facility like Davis-Monthan AFB range from 90 to 130 decibels (dB) on an A-weighted sound level (i.e., 90-130 dBA).[208] Flying operations may produce noise levels near 80 dB. The noise environment in the missile deployment area varies from place to place but is generally quiet. This is due to the isolated nature of most Titan sites. Each missile installation has recently been equipped with warning sirens to alert the local population of the need to evacuate. Such safety devices may be considered as a source of unwelcome Titan-related noise.

Flight operations at McConnell AFB contribute significantly to the noise environment of Wichita. Day/Night Average Sound Levels (L_{dn}) of 65 to 75 dB have been projected for sparsely developed zones near the McConnell AFB runways.[229] Other noise contributors include aircraft manufacturing companies such as Boeing, Cessna and Beech, the Wichita Mid-Continent Airport, road and rail traffic, and various Wichita industrial plants. The noise environment in the missile deployment area varies from site to site but is generally quiet. This is due to the open, rural nature of this region. Sirens have also been installed at these missile sites and may be regarded as an infrequent but annoying noise source.

Little Rock AFB is located in a semi-rural area that is less densely populated than that of the other two Titan bases. As a result, operations at Little Rock AFB have the lowest potential for affecting the local noise environment. In addition to noise produced at Little Rock AFB, other sources of noise include road and rail traffic and a variety of urban noise generated in Jacksonville. Missile deployment area noise is generally low due to the rural nature of the region. Sirens at the sites may also produce objectionable noise at times.

Component receptor installations such as Rocky Mountain Arsenal, Colorado, the Aerojet Corporation Plant, California and the Holston Army Ammunition Plant, Tennessee are generally located in open, sparsely populated, rural areas with a low potential for noise generation. In addition, individual facilities at a given installation that have a moderate to high potential for noise production have been located so that human disturbance is lowered or equipment is engineered to reduce noise. The major noise producing activities at these installations are produced by vehicle opera-

tion and the use of pumps and compressors.

The noise environments along proposed transportation routes will be highly variable and will include virtually all types and classes of noise conditions common to the United States.

9. Security and Safety Characteristics

Security forces assigned to each of the missile bases will provide protection to the Titan weapon systems during all phases of the deactivation process. Security guidelines for use during on-site missile disassembly, transportation of components to host bases, and the removal and later transportation of components to receiving bases/depots are given in Department of Defense Directive 5210.41m/Air Force Regulation 207-10 and Strategic Air Command Regulation 207-17.[219] Following the removal of critical components from a given missile site as identified in Air Force Regulation 122-22, the site security category will be downgraded from restricted to controlled status. Posted warning signs will then be changed to reflect the lower security status of the site. Likewise, Security Police support services to the caretaker site will be appropriately reduced.

A System Safety Program has been developed by the Air Force under the authority of Air Force Regulation 800-16 and Military Standard 882A. This program includes detailed plans and programs to assure that a safe operational environment will be maintained during all phases of Titan deactivation.[219] Program elements have been developed to deal with: organization and responsibility; personnel and qualifications; mishap prevention, investigation and reporting; operational and maintenance procedures; support equipment procurement and utilization; accident risk assessment; and safety analysis.

A number of safety measures have been taken to protect missile crews, support personnel and the public. The provision of safety equipment and periodic inspections of fuel and oxidizer transport vehicles are typical examples. Each missile silo is equipped with a number of safety devices for human and environmental protection. They include a water washdown system for potential fuel hardstand spills, shower stalls, eye baths, vapor detection system, fire blankets, breathing masks, protective suits, and an exterior siren system designed to warn the public of the need for local evacuation. Fuel and oxidizer transport vehicles are inspected monthly and on a pre-trip basis. Trailers are tested on Department of Transportation specified intervals. Daily standby maintenance charges are paid to carriers to maintain trailers in road-ready condition. Internal pressure-keeping ability, structural integrity, tire condition and overall serviceability are evaluated for each vehicle.

III. RISK ANALYSIS AND SPILL SCENARIO

An evaluation and discussion of the risks associated with the deactivation of the Titan II System and the development of spill scenarios are presented in this section. An assessment of the potential effects from various hypothetical spill scenarios is also included.

A. Risk Analysis

This risk assessment focuses on the number of accidents involving propellant transport trucks likely to occur during Phase II of the proposed Titan deactivation. To determine that risk, statistical data (presented in Table III-1) were used to calculate the accident frequency probability. The significance of these statistics is discussed below.

One set of truck accident statistics--obtained from the National Highway Transportation Safety Administration (NHTSA)--was used to calculate the probable number of accidents for "any accident" and "major accident" categories. The "any accident" statistic (3.72×10^{-6} accidents per vehicle-mile) includes police-reportable truck accidents in the United States and the total truck vehicle mileage during the same time period. This statistic was chosen to represent the probability of any accident, regardless of severity, that would occur in any truck mile. It includes accidents not affecting the integrity of the trailer structure or contents. Since this statistic reflects only truck accidents per mile, it is not biased by non-truck traffic accident statistics. Thus, the "any accident" probability represents potential accident impacts ranging from inconsequential to severe.

The statistic used to assess the "major accident" probability (6.24×10^{-8} accidents per vehicle-mile) reflects

Table III-1. MISCELLANEOUS TRUCK ACCIDENT
STATISTICS [96, 97, 122, 189]

SOURCE	BASIS OF STATISTIC	ACCIDENT STATISTIC	
		Accidents per Vehicle- Mile	Accidents Expected Per 500,000 Truck Miles
National Highway Transport- ation Safety Admin. (NHTSA)	Police Reportable Truck Accidents	3.72×10^{-6}	1.86
NHTSA	Fatal Truck Accidents	6.24×10^{-8}	0.03
Vandenberg AFB Pro- pellant Storage Enviro. Assessment	Major Truck Accidents With and Without Spills.	1.56×10^{-6}	0.78
Ruan Transport	29 Accidents per 32,310,635 Miles	8.98×10^{-7}	0.45
Ellex Trans- portation Co.	14 Accidents per 11,771,868 Miles	1.19×10^{-6}	0.60
Pacific Intermountain Express	34 Accidents per 21,681,688 Miles	1.57×10^{-6}	0.79
W.S. Hatch Co	11 Accidents per 13,121,000 Miles	8.38×10^{-7}	0.42
Lemmon Transport Co.	2 Accidents per 5,110,897 Miles	3.91×10^{-7}	0.20

only those truck accidents involving at least one fatality. This statistic is of some significance in that a major truck accident would most likely involve some vehicular deformation that could result in a propellant spill.

Other statistics were obtained from five major propellant carrier companies (Ruan Transport, Ellex Transportation Company, Pacific Intermountain Express, W.S. Hatch Company, and Lemmon Transport Company). The statistics in some cases include accidents and mileage from other than hazardous material handling. A common definition of an accident was used and includes only those accidents that were reportable to the Department of Transportation. A mean value for these statistics has been determined to be 0.98×10^{-6} , or an expectation of one accident per million miles of propellant transport. This is comparable to the 1.56×10^{-6} value (obtained from the Vandenberg AFB Propellant Storage Environmental Assessment) which was developed to determine the probability of a major accident involving trucks hauling hypergolic propellants from eastern U.S. locations to Vandenberg AFB (on the west coast) in support of future Space Shuttle operations. This statistic considers major truck accidents involving a propellant spill as well as those that do not.

Projected propellant truck mileage figures and accident probabilities (calculated using NHTSA and carrier-furnished accident statistics) associated with proposed propellant transportation activities for each of the three Titan Wings to be deactivated are presented in Table III-2. Also presented are joint accident probabilities for the overall deactivation program. Joint probability values were computed from individual accident probabilities at each wing [e.g., joint probability for the "any accident" situation = $1 - (1-0.56)(1-0.71)(1-0.59)$].

general trucking statistics. Since this accident probability number (0.42) is less than the "any accident" probability number (0.95) derived from NHTSA statistics, it is reasonable to assume that a "major accident" probability number derived for propellant carriers may be correspondingly less than 0.03 (the "major accident" probability derived from NHTSA statistics).

B. Spill Scenarios

This subsection describes the development of spill scenarios and the likely impacts after a spill. Since actual carrier spill experience is very low, hypothetical situations were derived to simulate two possible spill scenarios--one representing a "worst case" spill and one representing a somewhat less severe spill. The analysis does not include consideration of mitigating factors that would be implemented in the unlikely event of any spill. Examples of such mitigating factors include: the controlling effects of terrain; the actions of public emergency agencies; and the implementation of post-accident spill-response procedures[182] developed by the Air Force and coordinated with appropriate Federal, state, and local agencies.[219]

Under the "worst-case" scenario, 95 percent of a carrier's propellant load is assumed to spill. A spill of 40 percent of a carrier's propellant load is assumed for the less severe scenario. It must be emphasized that there is no single, most-likely load-spill percentage to be associated with the probability of any spill. However, empirical studies indicate that, given the spill quantity and considering that spill percolation (into the soil matrix) occurs while the spill spreads radially (or otherwise), the spill area can be estimated by a spill pool having an approximate depth of 5 inches.[233] Based on individual carrier loads of 5,300 gallons maximum for Aerozine-50 propellant and 3,200

Table III-2 PROPELLANT TRUCK MILEAGE AND ACCIDENT PROBABILITIES

TITAN II OPERATIONAL BASE	ESTIMATED PROPELLANT TRUCK MILEAGE	NHTSA "ANY ACCIDENT" PRO- BABILITY	NHTSA "MAJOR ACCIDENT" PRO- BABILITY	ACTUAL CARRIER "REPORTABLE ACCIDENT" PRO- BABILITY*
Davis- Monthan AFB	149,518	0.56	0.01	0.15
McConnell AFB	190,484	0.71	0.01	0.19
Little Rock AFB	159,239	0.59	0.01	0.16
ALL	499,241	0.95**	0.03**	0.42**

* Calculated using mean value (0.98×10^{-6} accident per vehicle mile) of five carrier-furnished accident statistics.

** Joint Probability Accident Values.

The NHTSA derived probability of "any accident" ranges from 0.56 to 0.71 per wing deactivation. Based on this set of statistics, the probability of one accident for the entire deactivation is calculated to be 0.95. The NHTSA derived probability of any "major accident" is 0.01 per wing deactivation, and the probability of one major accident for the entire deactivation is calculated to be 0.03. The calculation of an accident using the mean value of the carrier-furnished statistics shows the probability of a "reportable accident" to be 0.42 for the entire deactivation. Although the carrier statistics are based upon a much smaller data base, it is reasonable to expect that this number is representative of propellant carriers, since carrier and driver experience and transportation regulations are likely to result in a decreased accident probability relative to

gallons maximum for nitrogen tetroxide propellant, the associated "worst-case" and "less-severe" case spill areas would be approximately 150 square meters and 66 square meters (1,614 sq ft and 710 sq ft), respectively, for the Aerozine-50 spills and 107 square meters and 45 square meters (1,151 sq ft and 484 sq ft), respectively, for the nitrogen tetroxide spills.

Summaries of wind effects on atmospheric dispersion of propellant vapor evolving from each of the aforementioned spill scenarios are presented in Tables III-3 through III-6. The tabulated data show the computed source strengths, which represent the rate of vapor formation from the liquid pool (spill) at various pool temperatures, and the resulting corridor parameters defining the area within a 60° wedge [emanating from a point source (i.e., the pool)] containing propellant vapor at concentrations exceeding the 30-minute Short-term Public Emergency Limits (SPEL). Inherent in the methodology used to generate the corridor data is a 90 percent probability that the calculated area is not exceeded. For each spill scenario, the vapor corridor parameters are shown for each of two near-surface vertical temperature differences (i.e., °F at 54 feet above ground minus °F at 6 feet above ground) selected as being a more likely situation (0°F) and a plausible worst-case encounter (4°F).[169]

Table III-3. WIND EFFECT ON ATMOSPHERIC DISPERSION OF UDMH PROPELLANT VAPOR FROM A 150 SQUARE METER SPILL OF AEROZINE-50* AT VARIOUS LIQUID TEMPERATURES [108, 169, 176]

Spill Area = 150 square meters (1,614 sq ft)						
WIND SPEED (knots)	PRO-PELLANT TEMPERATURE (°F)	PRO-PELLANT SOURCE STRENGTH (lbs/min)	CORRIDOR PARAMETERS* DEFINING 30-MINUTE SPEL LIMITS** WHEN THE NEAR-SURFACE VERTICAL TEMPERATURE DIFFERENCE IS			
			0°F***		4°F***	
			Down-wind Dist. (mi)	Corridor Area (sq mi)	Down-wind Dist. (mi)	Corridor Area (sq mi)
5	40	5	0.08	0.01	0.19	0.02
	60	10	0.11	0.01	0.25	0.03
	80	10	0.11	0.01	0.25	0.03
	100	15	0.13	0.01	0.30	0.05
20	40	10	0.11	0.01	0.25	0.03
	60	15	0.13	0.01	0.30	0.05
	80	25	0.17	0.02	0.40	0.08
	100	40	0.23	0.03	0.51	0.14
30	40	10	0.11	0.01	0.25	0.03
	60	20	0.15	0.01	0.36	0.07
	80	30	0.19	0.02	0.44	0.10
	100	50	0.25	0.03	0.57	0.17

* Corridor distances are based on UDMH, the component of Aerozine-50 which evaporates most rapidly.

** SPEL = Short-Term Public Emergency Limits = 50 ppm

*** °F at 54 feet elevation (above ground) less °F at 6 feet elevation (above ground)

Table III-4. WIND EFFECT ON ATMOSPHERIC DISPERSION OF UDMH PROPELLANT VAPOR FROM A 66 SQUARE METER SPILL OF AEROZINE-50* AT VARIOUS LIQUID TEMPERATURES [108, 169, 176]

Spill Area = 66 square meters (710 sq ft)						
WIND SPEED (knots)	PRO-PELLANT TEMPERATURE (°F)	PRO-PELLANT SOURCE STRENGTH (lbs/min)	CORRIDOR PARAMETERS* DEFINING 30-MINUTE SPEL LIMITS** WHEN THE NEAR-SURFACE VERTICAL TEMPERATURE DIFFERENCE IS			
			0°F***		4°F***	
			Down-wind Dist. (mi)	Corridor Area (sq mi)	Down-wind Dist. (mi)	Corridor Area (sq mi)
5	40	5	0.08	0.01	0.19	0.02
	60	5	0.08	0.01	0.19	0.02
	80	10	0.11	0.01	0.25	0.03
	100	10	0.11	0.01	0.25	0.03
20	40	5	0.08	0.01	0.19	0.02
	60	10	0.11	0.01	0.25	0.03
	80	15	0.13	0.01	0.30	0.05
	100	20	0.15	0.01	0.36	0.07
30	40	10	0.11	0.01	0.25	0.03
	60	10	0.11	0.01	0.25	0.03
	80	20	0.15	0.01	0.36	0.07
	100	30	0.19	0.02	0.44	0.10

* Corridor distances are based on UDMH, the component of Aerozine-50 which evaporates most rapidly.

** SPEL = Short-Term Public Emergency Limits = 50 ppm

*** °F at 54 feet elevation (above ground) less °F at 6 feet elevation (above ground)

Table III-5. WIND EFFECT ON ATMOSPHERIC DISPERSION OF PROPELLANT VAPOR FROM A 107 SQUARE METER SPILL OF NITROGEN TETROXIDE AT VARIOUS LIQUID TEMPERATURES [108, 169, 176]

Spill Area = 107 square meters (1,151 sq ft)						
WIND SPEED (knots)	PRO-PELLANT TEMPERATURE (°F)	PRO-PELLANT SOURCE STRENGTH (lbs/Min)	CORRIDOR PARAMETERS DEFINING 30-MINUTE SPEL LIMITS* WHEN THE NEAR-SURFACE VERTICAL TEMPERATURE DIFFERENCE IS			
			0°F**		4°F**	
			Down-wind Dist. (mi)	Corridor Area (sq mi)	Down-wind Dist. (mi)	Corridor Area (sq mi)
5	40	45	1.12	0.65	2.59	3.53
	60	95	1.63	1.39	3.79	7.51
	80	195	2.35	2.89	5.47	15.69
	100	325	3.05	4.87	7.12	26.55
20	40	85	1.53	1.23	3.58	6.71
	60	150	2.05	2.19	4.79	12.02
	80	260	2.71	3.84	6.34	21.08
	100	385	3.31	5.75	7.77	31.57
30	40	105	1.70	1.52	4.00	8.36
	60	185	2.29	2.75	5.34	14.94
	80	285	2.84	4.23	6.65	23.14
	100	415	3.45	6.22	8.07	34.08

* SPEL = Short-Term Public Emergency Limits = 3 ppm

** °F at 54 feet elevation (above ground) less °F at 6 feet elevation (above ground)

Table III-6. WIND EFFECT ON ATMOSPHERIC DISPERSION OF PROPELLANT VAPOR FROM A 45 SQUARE METER SPILL OF NITROGEN TETROXIDE AT VARIOUS LIQUID TEMPERATURES [108, 169, 176]

Spill Area = 45 square meters (484 sq ft)						
WIND SPEED (knots)	PRO-PELLANT TEMPERATURE (°F)	PRO-PELLANT SOURCE STRENGTH (lbs/Min)	CORRIDOR PARAMETERS DEFINING 30-MINUTE SPEL LIMITS* WHEN THE NEAR-SURFACE VERTICAL TEMPERATURE DIFFERENCE IS			
			0°F**		4°F**	
			Down-wind Dist. (mi)	Corridor Area (sq mi)	Down-wind Dist. (mi)	Corridor Area (sq mi)
5	40	25	0.81	0.34	1.91	1.92
	60	40	1.04	0.57	2.44	3.13
	80	90	1.57	1.29	3.69	7.14
	100	145	2.01	2.12	4.72	11.64
20	40	40	1.04	0.57	2.44	3.13
	60	70	1.38	1.00	3.24	5.49
	80	115	1.80	1.70	4.19	9.17
	100	170	2.18	2.49	5.11	13.69
30	40	45	1.12	0.66	2.59	3.53
	60	80	1.50	1.18	3.47	6.29
	80	125	1.88	1.85	4.36	9.94
	100	180	2.25	2.65	5.27	14.52

* SPEL = Short-Term Public Emergency Limits = 3 ppm

** °F at 54 feet elevation (above ground) less °F at 6 feet elevation (above ground)

In summation, the spill scenarios describe possible realistic propellant spills. The scenarios indicate that if a spill should occur, the areas that would need to be placed within a 30-minute SPEL boundary could be significant. A five acre SPEL area may not be difficult to handle in rural lands, but would present logistic difficulties of major pro-

portions in an urban area. Other major logistic problems must be anticipated when the emergency reaction is to be provided by local authorities.

The response to a spill would include mitigation efforts. The use of response procedures disseminated by the Air Force[182] would reduce damage from the spilled product. Effective vapor control techniques would control much of the Aerozine 50; however, nitrogen tetroxide vapor is more difficult to control. Berms could be constructed to restrict surface flow and surface area expansion of the liquid pool. Unspilled product from a continuing leak could be pumped to another container.

The risk analysis shows that the likelihood of an accident is very low, but that the extent of affected corridor area can be large. The methodology used to determine the effects of the chosen spill scenarios is but one of several accepted methods of determining affected corridors. Moreover, it is one of the more conservative methods available. In the event of an actual spill, however, the corridor chosen by the on-scene authority may be determined using a different method.

IV. ENVIRONMENTAL CONSEQUENCES

A detailed evaluation and discussion of the proposed project's impact on the environment is presented in this section. This is followed by a general assessment of environmental impacts associated with three reasonable alternatives to the proposed action alternative; the alternative of no-action; the alternative of an accelerated deactivation scenario; and the modified deactivation scenario. Next, a discussion is presented which focuses on the possible conflicts between the proposed action and alternatives, and the objectives of Federal, State, and local land use plans, policies and controls. Finally, measures to mitigate certain environmental consequences of the proposed action are discussed.

A. Impacts of the Proposed Action Alternative

Physical, biological, and socioeconomic impacts potentially resulting from the proposed deactivation of the Nation's Titan II missile system include those on the atmospheric and hydrologic environments, flora and fauna, aesthetics, demography, employment, housing, certain institutions, land use, local transportation networks, noise, and general safety. Impacts on all of these will possibly occur in one form or another by one or more actions of each phase of the proposed action. Because of the sequential phasing of proposed project activities and the geographic spread of involved project locations, individual occurrences of impacts will, for the most part, vary temporally and/or spatially with respect to one another.

A discussion of each potential environmental consequence is presented in the following subsections. This presentation is organized by project phases in a manner that coincides with the proposed action description presented in Section I of this document.

1. Potential Impacts of Deactivation Missile Installations (Phase I)

The potential impacts associated with deactivation missile installations at Davis-Monthan, McConnell, and Little Rock AFBs include those on the atmosphere, hydrology, biology, aesthetics, demography, economics, housing, certain public services, land use, local transportation, and noise. These are discussed below, in that order. In reviewing these discussions, consideration should be given to (1) the temporary nature of certain described impacts at each specific missile site, and (2) the potential for the diminishing occurrence of some potentially impacting situations as deactivation techniques become better refined while deactivation proceeds from one missile site to the next (and from one missile wing to the next).

- a. Phase I--Atmospheric Impacts

Ground vehicular activity associated with propellant loading and transfer may generate particulates, especially where operations are conducted over unpaved areas. During peak activity associated with deactivation, there may be at any given site between six and twelve active vehicles (including three transport carriers and one trailer each for nitrogen holding, control and conditioning) on a given day. Considering the few vehicles involved and the brevity of their operations it is reasonable to conclude that air emissions from ground traffic will not contribute significantly to air quality in the area.

Small ordnance is removed from the missile in the silo and placed in explosion-proof containers for shipment to the host base. In the unlikely event of an accidental detonation of ordnance, materials released into the air would include the combustion products of small-sized munition explosives and as such would be relatively innocuous. Such

releases would be instantaneous and therefore short-lasting, with insignificant consequences to existing air quality.

b. Phase I--Hydrologic Impacts

Impact upon nearby surface and ground water of potential propellant spills is dependent upon factors such as location, amount and timing of the spill. Some locations are environmentally more sensitive than others and a spill in such an area will produce greater impacts. Locational factors such as surface permeability, drainage patterns, presence or absence of streams/lakes in an area, local water quality, and water supply considerations are also important. The amount of the spill is important because, obviously, small spills produce fewer environmental problems than large spills. Timing is also important as a spill during some periods of the year is less critical than at others. For example, a dry season spill at Davis-Monthan AFB, Arizona, may not affect surface water due to local stream beds being empty.

The likelihood of a spill during Phase I activities is quite low due in part to the experience and skill of the propellant handling personnel. Small propellant losses are possible at valves, seals and quick disconnects during transfer operations. As part of a normal operations, small losses are neutralized and diluted using in-place, onsite systems. Only in an extremely unlikely topside accident would there be a chance of propellants reaching the natural hydrologic environment.

In the event that liquid Aerozine 50 were to reach natural water [Cheney Reservoir, Kansas (see Figure II-2) is the only significant water resource near Phase I deactivation operations], a toxic effect on aquatic organisms is likely. The extent of this effect would depend upon the water constituents, contact time, temperature, pH and other factors. Algal and attached animal groups are killed by hydrazine concentrations of 3.2 parts per million.[153] Freshwater fish are somewhat more tolerant.

Nitrogen tetroxide, depending on the alkalinity of the receiving water, produces toxic and corrosive nitric acid. The local aquatic community would be seriously impaired by significant quantities of this acid. Bound metals could also be liberated from the contaminated water and add to its toxicity.

Contamination of ground water will be dependent on many of the factors previously mentioned. Some natural mitigation of spill effects is possible in areas such as Arizona where soils are often alkaline.

Large amounts of water would be used to fight a propellant fire at a missile site should it occur. The drench water would become contaminated with emissions and combustion products, and would be contained in a sump located at the bottom of the silo until such time as it could be safely disposed.

c. Phase I--Biologic Impacts

- Major impacts to the biological environment are not likely to occur during Phase I activities. Such impacts would only occur in the improbable event of a large spill or an explosion, each of which could potentially affect a wide area surrounding the missile site.

There is a moderate potential for minor adverse biological impacts. Small losses may occur during the off-loading process of the fuel or oxidizer to the holding trailer and during the transfer of these compounds from the holding trailers to the commercial tank trailers. These losses are considered a normal part of existing operations and are mitigated in accordance with established safety procedures. Precautionary measures will be taken to reduce the likelihood of any spilled fuel or residues traveling off the hardstand into surrounding undisturbed areas.

Adverse impacts could be caused by either the fuel/oxidizer itself or the vapors associated with these substances. The degree of the impact would be dependent upon such variables as the type and amount of propellant spilled and its dilution by water spray systems, local hydrology and drainage, duration of the spill, and the characteristics of the affected area including the susceptibility of any flora or fauna present.

Vapor movement into nearby habitats could damage or kill vegetation. Nitrogen tetroxide, a Class A poison, could produce vapors of sufficient strength to cause skin and respiratory problems for cattle, other mammals, birds, or other animals present in the affected area. The constituent components of Aerozine 50 have differing vapor pressures, and upon entering the vapor phase may react with ambient air to produce other compounds. UDMH has been reported to react with oxygen in the air to produce small quantities of nitro-sodimethylamine (NDMA), a substance regulated by the Occupational Safety Health Administration (OSHA) as a suspect carcinogen.

Other activities associated with Phase I, such as vehicle transport, movement of cranes, welding, etc., will be centralized on the silo pad or affiliated roadways, and will not adversely impact the surrounding biological environment.

d. Phase I--Aesthetic Impacts

A description of the aesthetic environment of each Titan site and receiving facilities is included in the Section II.A.1, General Physiography.

Titan II missile site deactivation activities will involve temporary and minor aesthetic impacts at each of the wing missile sites. Some impairment of aesthetic resources at the various missile sites will occur due to the temporary placement and operation of the support crane, military and security vehicles, transport trailers, and other deactivation support equipment. Most of this surface activity is routine and common at each of the sites during periods of normal maintenance activity. The temporary visual impacts are expected to be relatively insignificant with a limited duration of 20 to 45 days at each site. If the UHF and VHF antennas and other surface security and hazard warning systems are disassembled and removed from the sites, some permanent, minor area aesthetic benefits would occur. Some permanent aesthetic impairment associated with the security system (e.g., fence) and concrete surface structures at each site, however, will continue during caretaker status. None of the temporary deactivation and salvage operations are expected to result in any additional impacts or to have any permanent, significant adverse affects on the aesthetic quality of any nearby special interest areas.

e. Phase I--Demographic Impacts

The loss of a total 1,174 positions including 47 civilian at Davis-Monthan AFB would have an insignificant impact on the regional population in general, and a somewhat greater, but still relatively insignificant impact on Tucson in specific, based on 1980 demographic data. The maximum number of persons to be affected by the proposed action, including

military and civilian personnel and their dependents, is estimated to be approximately 2,445. This group is concentrated in the City of Tucson, with the remaining portion widely dispersed throughout Pima county. Department of Defense Placement Program statistics on similar actions indicate that a large percentage of affected employees tend to relocate in an effort to obtain suitable employment. Table IV-1 presents worst-case, regional and local estimates of direct population losses for military, civilian and their dependents as a result of the proposed action. It should be noted that the Tucson region as well as Davis-Monthan AFB itself is projecting a net in-migration.[195] Considering the gradual, 24-month transition in the proposed deactivation, continued in-migration would mitigate the relatively insignificant demographic impacts resulting from a reduction in personnel at Davis-Monthan.

Table IV-1. ESTIMATED WORST-CASE POPULATION LOSSES
RESULTING FROM THE PROPOSED TITAN II
DEACTIVATION AT DAVIS-MONTHAN AFB

AREA	POPULATION 1980	ESTIMATED POPULATION LOSSES	
		Number of Individuals	% of 1980 Population
Davis- Monthan Region	536,100	2,445	0.5%
City of Tucson	333,035	2,290	0.7%
Green Valley	7,999	25	0.3%

Note: For computational convenience the total reduction impacts resulting in 1984 were based on 1980 population data. As a result, the actual impacts are expected to be somewhat less than the insignificant levels reported. This approach is not anticipated to significantly affect the data.

The loss of a total 1,122 positions including 45 civilian jobs at McConnell AFB would have an insignificant impact on the regional population in general, and a somewhat greater, but still relatively insignificant impact on the projected 1985 populations of the Cities of Wichita and Derby. The maximum number of persons to be affected by the proposed action including military, civilian personnel and their dependents are estimated to be approximately 2,450. This group is concentrated in the Cities of Wichita, Derby and Mulvane, with the remaining portion widely dispersed throughout Sedgwick and Butler Counties. Table IV-2 presents worst-case, regional and local estimates of direct population losses for military, civilian and their dependents as a result of the proposed action, assuming McConnell AFB is deactivated second following that at Davis-Monthan AFB. It should be noted that the McConnell AFB area is projecting a regional annual average growth rate of approximately one percent. Considering a more rapid deactivation schedule of 18 months ending in 1986, continued in-migration as projected would mitigate the relatively insignificant demographic impacts resulting from a reduction in personnel at McConnell AFB.

Table IV-2. ESTIMATED WORST-CASE POPULATION LOSSES RESULTING FROM THE PROPOSED TITAN II DEACTIVATION AT MCCONNELL AFB

AREA	POPULATION 1985	ESTIMATED POPULATION LOSSES	
		Number of Individuals	% of 1985 Population
McConnell AFB (Sedgwick Co.)	375,200	2,450	0.7
City of Wichita	295,000	2,082	0.7
Derby	10,113	123	1.2
Mulvane	4,076	37	0.9
Haysville	9,600	12	0.1
Butler County	42,662	74	0.2

Note: For computational convenience the total reduction impacts resulting after 1986 were based on projections for 1985. Actual impacts are expected to be somewhat less than the insignificant levels reported.

Although the loss of a total 1,124 positions including 45 civilian jobs at Little Rock AFB would have an insignificant impact on the regional population in general, it will have a minor impact of approximately 6.5 percent of the total population in the City of Jacksonville. The maximum number of persons to be affected by the proposed action including military, civilian personnel and their dependents are estimated to be approximately 2,596. This group is concentrated in the City of Jacksonville, with the remaining portion widely distributed throughout Pulaski, White and Lonoke Counties. Table IV-3 presents worst-case, regional and local estimates of direct population losses assuming Little Rock AFB is deactivated second following deactivation at Davis-Monthan AFB. It should be noted that the Little Rock AFB area is projecting a regional annual average growth rate of approximately 2 percent and a local (Jacksonville) annual average growth rate of more than 3 percent. Considering a

more rapid deactivation schedule of 18 months ending about 1986, continued in-migration as projected would somewhat mitigate the relatively insignificant regional as well as the relatively minor localized demographic impacts resulting from a reduction in personnel at Little Rock AFB.

Table IV-3. ESTIMATED WORST-CASE POPULATION LOSSES
RESULTING FROM THE PROPOSED TITAN II
DEACTIVATION AT LITTLE ROCK AFB

AREA	POPULATION 1985	ESTIMATED POPULATION LOSSES	
		Number of Individuals	% of 1985 Population
Little Rock AFB Region (Pulaski Co.)	370,905	2,596	0.7
Little Rock	173,387	78	0.04
N-Little Rock	66,563	286	0.4
Jacksonville	32,558	2,129	6.5
White County	57,857	26	0.04
Lonoke County	39,604	26	0.7

Note: For computational convenience the total reduction impacts resulting after 1986 were based on projections for 1985. Actual impacts are expected to be somewhat less than the insignificant levels reported.

The resulting population impacts for whichever Air Force base is deactivated last are expected to be approximately 1 to 2 percent less than the worst-case levels reported above. This is anticipated as both the Little Rock and McConnell AFB regions project continued net in-migration during the proposed deactivation schedule period ending about 1987.

f. Phase I--Economic Impacts

Some minor direct and indirect employment losses will occur as a result of the proposed action. Personnel reductions at military installations generally induce declines in associated government procurement and, hence, personal income. These declines lead to further reductions in local and regional economic output and employment. This has a tendency to create a cycle of indirect job losses in rural and semi-rural counties as well which continues until the local and regional economy stabilizes.

Approximately 1,127 military and 47 civilian positions will be eliminated at Davis-Monthan AFB. These losses, plus those that are expected to be induced indirectly, will result in an increase in 1982 unemployment in the Tucson area labor market of less than one percent. This figure implies a total of about 3,240 direct and indirect employment opportunities throughout the region could be lost as a result of the proposed action. The greatest local service sector employment impacts are expected in the City of Tucson. Based on the overall growth projections of employment in the region as well as that of Davis-Monthan AFB itself, the impacts are likely to be less serious than the figures indicate. The direct employment loss would result in an estimated \$23.9 million reduction in annual Air Force Base payroll spending or approximately 9.1 percent of the total 1982 regional economic impact of \$261.9 million.

Approximately 1,077 military and 45 civilian positions will be eliminated at McConnell AFB. These losses, plus those that are expected to be induced indirectly, will result in an increase in unemployment (based on 1982 statistics) in the Wichita area labor market of less than one percent. This figure implies a total of about 3,197 direct and indirect employment opportunities throughout the region which could be lost as a result of the proposed action. The

greatest local service sector employment impacts are expected in the Cities of Wichita and Derby. Based on the overall growth projection in the McConnell AFB region the impacts are likely to be less serious than the figures indicate. The direct employment loss would result in an estimated \$19.7 million reduction in annual Air Force Base payroll spending, or approximately 12.6 percent of the 1982 total regional economic impact of \$156.5 million.

Approximately 1,079 military and 45 civilian positions will be eliminated at Little Rock AFB. These losses, plus those that are expected to be induced indirectly, will result in an increase in 1982 unemployment in the Little Rock area labor market of about 1.3 percent. This figure implies a total of about 3,203 direct and indirect employment opportunities throughout the region which could be lost as a result of the proposed action. The greatest local service sector employment impacts are expected in the City of Jacksonville. Based on a somewhat lower unemployment rate for the City of Jacksonville than that of the region, the local impacts are likely to be less serious than the worst-case figures indicate. The direct employment loss would result in an estimated \$19.5 million reduction in annual Air Force Base payroll spending, or approximately 9.6 percent of the total regional economic impact of \$203.5 million.

The resulting economic impacts in the region of the last Air Force Base to be deactivated are expected to be relatively less than the worst-case levels reported above. This is anticipated since both the Little Rock and McConnell AFB regions project continued growth in employment during the proposed deactivation schedule period.

g. Phase I--Housing Impacts

An insignificant impact on regional and local housing in the Davis-Monthan AFB area is expected as a result of the pro-

posed action. Worst-case estimates indicate that Pima County as well as the City of Tucson would experience a smaller than one percent increase in housing vacancy rates. Induced vacancies in other communities in the region would be minuscule. The estimated increase in local housing vacancy induced by the proposed action is small considering the potential of 6,000 new units scheduled for development during 1982.

An insignificant impact on regional housing of less than one percent and a minor impact on local housing of less than two percent is expected in the McConnell AFB area. Although the Cities of Wichita and Haysville, and Butler County would experience a less than one percent increase in housing vacancy, the Cities of Derby and Mulvane would experience about 1.8 percent and 1.2 percent increase, respectively. The estimated increase in local housing vacancy induced by the proposed action is relatively minor given the projected regional and local annual average growth rates in housing during 1970-1980.

An insignificant impact on regional housing and a minor impact on local housing in the City of Jacksonville are expected in the Little Rock AFB area. Although the region (Pulaski County) would experience a less than one percent increase in housing vacancy, the City of Jacksonville would experience about a 10.1 percent increase. The estimated increase in local housing vacancy induced by the proposed action would be somewhat smaller than the level estimated if the average annual increase in Jacksonville housing units of 5.6 percent during 1970-1980 continues through the deactivation period.

h. Phase I--Institutional Impacts

As a result of the proposed action, total regional public elementary and secondary school enrollment in the

Davis-Monthan AFB area school districts would decrease by less than 0.2 percent (about 170 students). Financial aid to schools from Federal School Impacts Funds (PL 81-874) and State and local sources would be reduced in proportion to student losses since the aid is based on average daily attendance figures. However, Federal aid would help to mitigate this situation by continuing (within eligible school districts) at 90 percent of the previous fiscal year total for a three-year period. The estimated decrease in school enrollment induced by the proposed action is very insignificant considering the projections for local enrollment increases.

Total regional public elementary and secondary school enrollment in the McConnell AFB area school districts is expected to decrease by 0.8 percent (about 417 students) as a result of the proposed action. The Wichita Unified School District #254 would experience a decrease of approximately 0.8 percent (about 355 students) in comparison with Derby's school district of 0.6 percent (about 27 students). Although Wineteer Elementary School, which is a part of the Derby Unified School District, exclusively serves McConnell's off-base housing area, no net enrollment impacts are expected to this particular school as a result of the proposed action due to the existence of a historically continuous waiting list for on-base housing services. Financial aid to schools in the region would be reduced in proportion to student losses. The relatively insignificant impacts induced by the proposed action would be mitigated somewhat by extended Federal funding.

The proposed action will result in an insignificant decrease in total regional public elementary and secondary school enrollment in the Little Rock AFB area (Pulaski County School District) of approximately one percent (about 727 students). The impact on the Pulaski County Special School

District will be somewhat greater with a relatively minor expected decrease of less than 5 percent (about 600 students). Financial aid to schools in the region would also be reduced in proportion to student losses. The relatively insignificant and minor impacts induced by the proposed action would be mitigated by extended Federal funding. Insofar as operating costs are not reduced in direct proportion with enrollment losses, local school districts may be forced to increase local property tax assessments or reduce current levels of service as a compensatory measure.

Total water consumption in the Davis-Monthan AFB region is expected to decrease by more than 8 million gallons annually as a result of the proposed action. Decreased water consumption in the region will have a beneficial impact on the ground water draw-down, net recharge rates, and water quality, as well as the availability for current and future residential, commercial and industrial developments. Impacts on the relatively few, smaller water suppliers in the region with respect to associated missile site capital improvement (i.e. service lines and pumpage equipment) are expected to be insignificant, as in general, any remaining non-amortized debt service was initially financed under general obligation rather than revenue service bonding. Additionally, water pricing is currently based on distributional cost factors rather than marginal social production cost factors. The proposed action will also result in an annual decrease in electrical consumption of approximately 19.6 million KWH in the region. This decrease will have a beneficial impact on the regions energy consumption rate and peak hour availability of electricity.

As a result of the proposed action, total water consumption in the McConnell AFB region will decrease by more than 30 million gallons annually. Decreased water consumption in the region will have a beneficial impact on the net ground

water recharge and draw-down rates, water quality, and availability for current and future uses. Impacts on the few smaller water suppliers in the region with respect to associated missile site capital improvements are also expected to be insignificant since the initial debt service was financed under general obligation rather than revenue service bonds. Total annual electrical consumption in the region will also be reduced by approximately 21 million KWH, and result in a beneficial impact on the regions energy consumption rate and peak hour availability.

Total water consumption in the Little Rock AFB region will decrease by more than 21 million gallons annually. Decreased water consumption in the region will also have a beneficial impact on net ground water recharge and draw-down rates, water quality, and availability for current and future uses. Impacts on the few smaller water suppliers in the region with respect to associated missile site capital improvements are also expected to be insignificant as the initial debt service was financed under general obligation rather than revenue service bond. Total annual electrical consumption in the region will be reduced by more than 21 million KWH, and result in a beneficial impact on the area's energy consumption rate and peak hour availability.

Davis-Monthan, McConnell, and Little Rock AFBs will continue to provide community service support functions upon request to the extent possible. However, as a result of the proposed action, helicopter assistance for search and rescue missions will no longer be available through the Titan support system. Some potential adverse impacts on local search and rescue activities may be expected in the three Air Force Base regions as a result.

i. Phase I--Land Use Impacts.

Silo deactivation in Phase I will have a slightly posi-

tive impact on land use near the three host bases. This is due to reduced personnel requirements which will lower housing demand and the accompanying demand for urbanization of rural areas. These impacts will be slightly greater in the Davis-Monthan and McConnell AFB areas. Desert grazing land near Davis-Monthan AFB and agricultural land near McConnell AFB will be most affected. Jacksonville agricultural land near Little Rock AFB will be less affected due to lower urbanization pressures in that region.

Land development may remain inhibited in the missile deployment areas, away from the host bases, following establishment of caretaker status. The presence of a caretaker status site in a specific area may continue to discourage land developers from locating residential or commercial properties nearby. Potential concerns regarding Air Force site reactivation could discourage buyers or renters and, in effect, reduce the development value of local land. This minor impact is likely only in a few places such as Titan Site 532-9. This Kansas site is close to Cheney State Park and Reservoir and is a desirable area for vacation home development. It is likely that land development at this site and at other favorable locations may proceed more slowly or not occur due to the presence of a caretaker status site nearby.

j. Phase I--Cultural Resource Impacts

The proposed action will have no foreseeable impacts upon any known historical or archaeological resources in the vicinity of the missile sites at Davis-Monthan, McConnell, or Little Rock AFBs. Future cultural resource inventories at the missile sites are not planned for this project due to the nature of the proposed project activities and lack of identified resource potential at any of the silo areas. Appropriate mitigation measures will be employed in the

event that historical or archaeological sites or artifacts are identified and shown to be impacted by the proposed action.

k. Phase I--Local Transportation Impacts

Potential impacts to the local transportation environment during Phase I activities are considered to be small. These impacts would primarily result from a minor increase in local site traffic and short duration traffic tie-ups that can occur during the transportation of fuel and major missile components to interim destinations.

Combat crews will remain on duty until after a missile is removed and its on-site support systems are properly safed. Until that time, the proposed action would generate traffic increases of limited importance. Such increases would be related to trips made by Air Force technicians directly involved in the physical removal of the missile system, transport truck traffic, and stepped-up security patrols.

Only one site will be deactivated at a time, which will limit and localize transportation impacts to the route between the base and the site or other interim destinations (i.e. trucking of fuel to a nearby commercial weigh station before transport to a final destination). Impacts along the route are expected to be short-term since the maximum scheduled site deactivation is only 45 days. Minor traffic jams may result from curious motorists stopping to view the transport of a major missile component. Obviously such impacts are very temporary and would occur infrequently. The total number of heavy truck trips required to deactivate any site will be very low.

Traffic impacts after a specific site has been placed in caretaker status will become nominal. Impacts related to existing operations would no longer occur. The only site-

related traffic would be generated by the Base Civil Engineer and infrequent security checks. This is estimated to amount to no more than a few trips per week.

1. Phase I--Noise Impacts

Minor noise impacts at missile sites will occur during deactivation. The noise which will be generated, however, is almost identical to that which presently occurs at missile sites during normal servicing operations. Truck movements and the operation of a mobile crane will produce the highest sound levels during deactivation. Heavy-duty trucks similar to those used to haul rocket fuel produce 82-95 dBA sound levels at 50 feet.[54] A moveable crane produces 77 - 88 dBA sound levels at 50 feet. These and other noise producing activities are all temporary and of short duration. The trucks will operate during portions of three days, barring weather or other delays, and the crane will be used briefly for a collective total of four to five workdays. Accidental detonation of ordnance would create a short-term, significant noise impact; however, the probability of such an event is considered to be very low.

Positive noise impacts at deactivated sites will result from the proposed action. Sites in caretaker status will be free of the majority of minor noise which is presently produced by missile crews and support personnel. Infrequent security vehicle visits should produce the only remaining mission noise at deactivated sites.

2. Potential Impacts of Transporting Components to Destination Points (Phase II)

The potential impact associated with transporting missile and other associated components from missile wings undergoing deactivation include those on the atmosphere, hydrology, biology, special interest areas, economics, cer-

tain public services, land use, transportation networks, cultural resources, and noise. These are discussed below, in that order, in somewhat of a generic fashion since the actual transportation routes will vary as transportation system conditions change during the program.

a. Phase II--Atmospheric Impacts

Transportation of propellants and other missile components will typically require over-the-road interstate transport. Exact trip duration will depend on origin and destination points and sometimes on weather conditions. Exhaust emissions from the transportation vehicles themselves are expected to be insignificant and, therefore, will have no appreciable impact on the surrounding air quality.

An accidental propellant spill, as described in Section III, will create near-source atmospheric impacts which could extend downwind. Depending on atmospheric conditions, a plume containing propellant vapor concentrations exceeding the 30-minute Short-term Public Emergency Limits (SPEL) would cover an area of less than one square mile in the case of an Aerozine-50 spill (see Tables III-3 and III-4) and an area of up to about 35 square miles in the case of a nitrogen tetroxide spill (see Tables III-5 and III-6). In the event of a spill in a confined area (ex., a tunnel), vapor buildup within the confining space could reach lethal concentration levels. Such factors will be considered in selecting propellant transportation routes and schedules.

Both mix and oxidizer may ignite on contact with many combustible items such as rags, wool, cloth, leather, wood, etc. Likely combustion products of incineration will include inorganic and organic nitrogen compounds, depending on which combustibles are ignited. A near-source adverse air quality impact would be expected. The plume generated by a fire will have a higher temperature than the surrounding

air. The ensuing plume rise will enhance plume dilution due to entrainment of ambient air. Hence, ground level concentrations from the fire-generated plume will most likely be less than those from a vapor leak.

b. Phase II -- Hydrologic Impacts

Propellant transport is the Phase II action most likely to produce impacts on the hydrologic environment. Traffic accidents pose a serious, though infrequent, problem.[221] With an increase in the number of propellant vehicle movements, accident potential can be expected to increase.

The spectrum of hydrologic impacts associated with propellant transport is large, ranging from minor to significant, depending upon variables such as type and amount of the spill, location, timing, and availability of appropriate emergency personnel and equipment. The effects of any spill into a body of water are likely to be locally severe, although the effects could be mitigated by vaporization and control of product spill area. An unmitigated spill could have significant impact upon the hydrologic environment. Dilution of the spill in a flowing water source is dependent upon flow characteristics and other physical and chemical parameters. Aside from the volume of the spill, the action most likely to have an effect on the eventual impacts of a spill is the time required before emergency remedial action takes place. If a spill were to occur in an ecologically sensitive area, this could result in a number of impacts, including serious damage to special status biota.

The extent of potential impacts would be dependent upon factors given above and would be determined using the same criteria applied to the assessment of Phase I impacts.

c. Phase II--Biologic Impacts

The transportation of propellants presents a potentially hazardous situation primarily related to the incidence of traffic accidents involving tanker trucks and the hazardous properties of the propellants. The occurrence of a major spill is more likely during the transportation phase than during the other two phases.

Because of the distances involved between the origin and destination sites, and because a spill could occur at any point along each route, it is virtually impossible to assess the potential impacts of a spill on all habitats and species which could be effected.

Impacts to the biological environment would be the same as those discussed for Phase I (see Section IV.A.1.c). Mitigation attempts used at a spill could accentuate adverse impacts due to the use of spill dispersal techniques such as earth moving equipment used to construct containment berms or to remove contaminated soil and vegetation, or the use of suppression methods for fires or hazardous vapor releases.

d. Phase II--Special Interest Area Impacts

The various cross-country transportation routes for missile components and fuel transport are located along and adjacent to numerous special interest areas throughout the country. The transit routes are well established highways which include the interstate highway system. Use of these routes will create no new potential for special interest area impacts. Existing right-of-ways and easement corridors also mitigate potential impacts related to potential transportation accidents. There is a very remote potential for adverse impacts to special interest areas as a result of a major accidental spill or fire. Such adverse impacts are

directly related to the probability of a transportation accident and related fire occurring in an area of special interest. Thus, the potential for impacts to special interest areas range from potentially adverse ones to no impacts at all.

e. Phase II--Economic and Institutional Impacts

The remote potential of a transportation related accident could involve state, regional and local socioeconomic impacts. In case of an accident both rail and truck transportation service contractors will rely heavily on the shipper for hazards information on specific commodities; on local fire and police departments along the various routes to respond to fires, carry out evacuations, and isolate and secure an accident site; on regional cleanup contractors to clean up and remove spilled chemicals; and on local wrecking contractors to remove wrecked and damaged transit vehicles and clearance of right-of-way. Socioeconomic impacts may include costs of hazardous response services such as local fire and police, damage costs to local facilities (e.g., bridges, streets, emergency vehicles), increased peak demand for public utility services such as local water supply, and potential temporary disruption of regional transit networks. The potential for economic and institutional impacts along the transit routes is directly related to the probability and intensity of a transportation related deactivation accident.

Some minor direct and indirect local economic benefits will occur as a result of component transportation to the various destination points. Interstate truck transportation activities would involve a potential minor increase in local spending for diesel fuel, oil, meals and lodging as well as state and regional spending for weight certification, license and permit fees, and escort/security-related ser-

vices. Rail transportation activities could also include a potential minor increase in local spending for component loading related services, and diesel fuel oil. Both truck and rail transportation will involve a potential temporary minor increase in state and local tax revenue from sales tax on fuels and supplies, transportation related permit fees and required licenses. Such benefits would be temporary and will not result in long term indirect population or employment impacts.

f. Phase II--Land Use Impacts

Temporary land use changes could occur in local areas following a chemical spill or fire. The degree of impact would depend upon factors such as; type of incident, location, degree, timing, intensity, and areal extent of the incident. The availability of personnel and equipment needed for corrective action are also important.

Serious chemical spills and fires would result in a temporary evacuation and suspension of residential, commercial and industrial land uses in an area close to the event. Following corrective action, reoccupation and resumption of use would follow. A full return to pre-event use would depend upon the nature and extent of change to the spill/fire site.

g. Phase II--Transportation Network Impacts

In Phase II, those items or fuels having continuing value will be shipped to storage for ultimate re-use. Other items will be declared surplus or destroyed as appropriate. With the exception of propellants which will be shipped directly to a weigh station near the site and then to a final destination, most items will be shipped directly to the operational base before subsequent shipment to receptor locations (See Section I.B.1.b).

The relatively low volume of materials requiring transport and the deactivation schedule will result in a situation where there are essentially no perceptable traffic-related impacts due to project operations. Each wing forecasts that it can easily handle the increased freight volume due to deactivation activity.[219]

Any material impacts along the routes from host bases to the various component or fuel receptor bases would be limited to those associated with accidents. Fuel and oxidizer transport have the greatest potential for producing impacts along any portion of the long cross-country routes. These materials will be trucked over routes proposed by the commercial carriers. The evaluation of routes will consider such criteria as shortest direct route, controlled access, detours around densely populated areas, and avoidance of tunnels. United States Department of Transportation (DOT) regulations such as those criteria established in DOT E-3121 will be followed for both oxidizer and fuel shipments. State and local regulations will also be followed. Nominated routes will be evaluated for public and environmental safety by qualified personnel prior to program implementation.

In the event of a fuel spill or fire, impacts to traffic due to road closures or traffic movement may be expected. These impacts would generally be short term and not serious. However, a worst-case scenario where a spill and a fire occurred on a major interstate highway in an urban setting could cause effects on traffic similar to those associated with a gasoline tanker fire. Damage to roads from an accident could require lengthy repairs.

h. Phase II--Cultural Resource Impacts

The various transportation routes for missile component and fuel transport are located along and adjacent to numerous potential historical and archaeological resource areas

throughout the county. The transit routes, however, are well established, minimizing the potential for resource impacts since any sites along the routes would have been previously disturbed during route construction.

Additionally, any significant sites discovered during construction would probably have been salvaged and appropriately stored which would further reduce the potential for significant resource impacts from the proposed action. Cleared right-of-way areas and easement corridors will mitigate potential impacts due to transportation related accidents.

There is a very remote potential for significant adverse impact as a result of an accidental spill and/or fire with respect to adjacent historic structures. Such adverse impacts are directly related to the probability of a significant transportation accident and related fire occurring in an area of high cultural/historical significance.

i. Phase II--Noise Impact

Noise impacts associated with the proposed transportation activities are similar to those which commonly occur along urban and rural roads and rail lines in all parts of the country. Civilian transportation accidents call for a vehicle and equipment mix similar to that required to respond to a potential propellant spill or fire. Project related fire truck, ambulance, police unit and rescue squad noise levels will not be unusual but rather will be similar to levels present with common emergencies.

3. Potential Impacts of Component Disposition
Activities at Destination Points (Phase III)

The potential impacts associated with the delivery and interim disposition of missile and other associated com-

ponents from missile wings undergoing deactivation include those on the atmosphere, hydrology, biology, economics, certain public services, local transportation networks, and noise. These are discussed below, in that order. Throughout this discussion, constant consideration should be given to the fact that individual deliveries of missile components to receptor destination points will each be a short-term, intermittently occurring activity over the life of the proposed deactivation period. Propellant deliveries, of course, should be viewed as intermittent sets of deliveries in the same light. Hence, most of the impacts and potential impacting situations associated with these activities will also be intermittent.

a. Phase III -- Atmospheric Impacts

There are eight possible sites for propellant off-loading activities associated with deactivation. At the present, scheduled off-loading activities occur at several of these sites, and the air quality impacts from present activities have been insignificant. Since the off-loading associated with deactivation will be similar to the present activities, it is reasonable to expect that the air quality impacts resulting from deactivation will be insignificant.

The air quality consequences resulting from accidental spills or combustion will vary similarly to those discussed under Phase II. Since the off-loading areas are well defined, any potential adverse impacts may be mitigated by established spill containment procedures.

As previously discussed three destination points (Cape Canaveral, Holston and Rocky Mountain) were identified as having high frequencies of thunderstorms posing potential hazards. To mitigate the effects of weather related problems at any of the destination sites, established procedures concerning propellant offloading activities during

adverse weather conditions will be followed.

The air quality impact of a major spill or fire will be greatest near the source and will rapidly decrease with downwind distance due to the plume dilution effects of dispersion and transport. Combustion products will most likely include ammonia, nitrogen oxides and carbon monoxide, depending on the species (fuel or mix) combusted. Of these pollutants only nitrogen oxides may have a significant effect on atmospheric ozone, which has been identified as a pollutant common to several of the destination sites. Nitric oxides, through photolysis, may deplete ozone locally at the expense of regional ozone production.

b. Phase III -- Hydrologic Impacts

Hydrologic impacts at propellant destination facilities may develop during Phase III as a result of spills and/or fire. Control and containment facilities at these installations are similar to those available at Titan bases and are described in the Phase I Hydrologic Impact section. Cape Canaveral Air Force Station has taken special precautions to prevent propellant spills from entering sensitive aquatic habitats in the area.

Propellant delivery activities of the proposed action will replace identical existing activities at all but one of the receiving installations. The associated impacts of the proposed action, in essence, are unchanged from those already present.

Phase III hydrologic impacts are not anticipated at training or other receiving and support bases/depots due to the proposed action.

c. Phase III--Biologic Impacts

Potential impacts to the biological environment during the Phase III transfer of propellants to the storage facilities are the same as those associated with Phase I fuel handling operations. Impacts may be slightly lessened by virtue of the experience of the destination site operators in handling hazardous materials.

No significant impacts are expected to occur through the maintenance of the deactivated sites in caretaker status, or through the storage or disposal of other components from the missile sites.

d. Phase III--Special Interest Area Impacts

There are various potential areas of special interest in the immediate surrounding areas of the propellant destination points. (e.g., Bays Mountain National Planetarium is located south of Holston Army Ammunition Plant). There would be potential impacts from accidental spills and related fires to any special interest areas immediately adjacent to propellant loading areas at the destination points. However, the potential for such impacts would exist at the destination points regardless of the proposed action since propellant handling already occurs at these locations.

e. Phase III--Economic and Institutional Impacts

The eventual disposition of the propellants from each missile site may include test firing, disposal by destruction, or sale. The goal, however, is to retain as much of the propellants as possible. The amount actually requiring storage at a given time will depend on usage rates and quality of the removed fuels. Accordingly, delivery and

storage of propellants at the destination points would preclude the need to purchase and transport new propellant supplies from manufacturers until the recycled supplies are exhausted. Since the fuel (Aerozine 50) is used in several Air Force/National Aeronautics and Space Administration (NASA) programs, there will be continuing usage of that commodity, although at times the usage rate may not keep up with the download rate. In such cases, storage quantities of Aerozine 50 will temporarily increase. Some minor economic benefits may be gained from storage and future reuse of fuel purchased previously due to the current increase in the cost of production.

In contrast, oxidizer is less expensive than the Aerozine 50. An economic analysis has been completed at the San Antonio Air Logistics Center in Texas regarding various propellant disposition options. Sales of oxidizer to the Army and/or chemical companies will result in some economic benefit gains by the Federal government.

There is a potential for institutional impacts from propellant storage at the destination sites. These impacts would be associated with the need for local community hazard response services, including fire and police assistance in the event of an accidental fire or spill. Because the proposed destination points already handle propellant fuels, no additional institutional impacts will result from the proposed action.

f. Phase III--Transportation Network Impacts

Once Phase III activities are underway, the general importance of transportation related impacts will decrease. Following the delivery of components and propellants to the various receptor bases, it is expected that there would be a temporary increase in base or facility truck traffic during

the pre-storage handling of materials. Storage activities would not produce noticeable transportation system impacts. However, spills and/or fires resulting from the accidental discharge of hazardous materials being transferred to storage could impact traffic at these destination points. Such impacts would most likely be due to localized traffic tie-ups and road closures. The candidate storage facilities for hazardous materials all have limited access; some are within secure areas of military bases. In the event of storage accidents, it is unlikely that there would be any significant or long-term impact to public transportation facilities.

g. Phase III--Noise Impacts

Very minor noise impacts will develop at component destination points as a result of project related delivery and off-loading activities. Truck noise between 85 and 95 dBA and compressor noises of 75 to 85 dBA are expected to be the highest encountered during normal Phase III activities. These same noises and noise sources exist at component destination facilities under present Titan operational conditions. The proposed action will not introduce new sources or levels.

Short periods of elevated noise levels can be expected at some component destinations in the event of a propellant spill or fire. Very brief periods of sound levels in excess of 120 dBA may occur. Longer periods of 85 to 95 dBA sound levels are most likely in association with heavy equipment operation.

4. Potential Impacts of Deactivating Other Support Functions

The potential impacts associated with the deactivation of Titan II training activities at Vandenberg AFB, California and Sheppard AFB, Texas, and the cessation of depot logistics support functions at Hill AFB, Utah are strictly socioeconomic and evolve from planned personnel reductions at these facilities. Slight impacts to the local demography, economic environment, housing, and certain public institutions can be expected and are discussed below.

a. Ancillary Demographic Impacts

The loss of a total 253 positions, including 194 temporary duty training positions at Vandenberg AFB following final deactivation activities, will have an insignificant impact on the projected 1985 regional population. The maximum number of persons to be affected by the proposed action including military and civilians are estimated at approximately 700. This figure represents less than 0.5 percent of the projected 1985 population for North Santa Barbara County. For computational convenience the total reduction impact resulting after 1987 was based on 1985 projections. As a result, the actual impacts are expected to be somewhat less than the worst-case levels reported. It should be noted that the Vandenberg AFB region is projecting a net annual growth rate of almost 2 percent through 1990, which would mitigate the relatively insignificant demographic impact resulting from a reduction in support and temporary duty personnel at Vandenberg AFB.

The loss of a total 661 positions at Sheppard AFB, Texas, including 562 temporary duty positions following final deactivation activities will have an insignificant impact on the projected 1985 regional population. The maximum number

of persons to be affected by the proposed action is estimated at approximately 1,500. This figure represents approximately one percent of the projected 1985 population in Wichita County, Texas. It should be noted that about 85 percent of the total personnel reduction involves temporary duty positions which generally have less demographic impact than their permanent counterparts. As a result, the actual impacts are expected to be somewhat less than the insignificant worst-case levels reported.

The loss of a total of 50 permanent duty positions at Hill AFB, Utah following final deactivation will have an insignificant impact on the projected 1985 population. The maximum number of persons to be affected by the proposed action is estimated at approximately 145. This figure represents less than 0.1 percent of the projected 1985 population. For computational convenience the total reduction impact resulting after 1987 was based on 1985 projections. As a result, the actual impacts are expected to be somewhat less than the worst-case levels reported. It should be noted that the Hill AFB region of Weber County is projecting a new annual growth rate of more than 1.3 percent through 1990, which mitigates the relatively insignificant demographic impact resulting from a reduction in permanent support personnel at Hill AFB.

b. Ancillary Economic Impacts

The reduction of personnel at Vandenberg AFB, plus those that are expected to be affected indirectly, will result in an increase in 1982 unemployment in the regional labor market of less than 0.5 percent. This figure implies a total of approximately 720 direct and indirect employment opportunities throughout the region which could be lost as a result of the proposed action. The direct employment loss would result in an estimated \$4.5 million reduction in

annual payroll spending or approximately 2.2 percent of the total 1982 regional economic impact of \$207 million. For computational convenience the total economic impact resulting after 1987 was based on 1982 data. As a result, the actual impacts are expected to be somewhat less than the worst-case levels reported. The estimated economic impacts are expected to be additionally mitigated by the projected growth rates for the region through 1990.

Total personnel reductions at Sheppard AFB will result in an increase in 1982 unemployment in the regional labor market of less than 1.8 percent. This figure implies a total of approximately 1,220 direct and indirect employment opportunities throughout the region which could be lost as a result of the proposed action. The direct employment loss would result in an estimated \$11.9 million reduction in annual payroll spending or approximately 8 percent of the total 1982 regional economic impact of \$147.5 million.

Loss of personnel at Hill AFB, plus those that are expected to be indirectly affected, will result in an increase in the 1982 unemployment in the regional labor market of less than 0.2 percent. This figure implies a total of approximately 143 direct and indirect employment opportunities which could be lost as a result of the proposed action. The direct employment loss would result in an estimated \$2.6 million reduction in annual payroll spending or approximately 0.6 percent of the total 1982 regional economic impact of \$421 million.

For computation convenience the estimated total economic impact resulting after 1987 was based on 1982 data. As a result, the actual impacts are expected to be somewhat less than the worst-case levels reported. The economic impacts reported for Sheppard and Hill AFBs are also expected to be mitigated by the projected growth rates for the region through 1990.

c. Ancillary Housing Impacts

An insignificant impact on regional housing is expected in the Vandenberg AFB region as a result of the proposed action. As a worst-case estimate, the region would experience less than a 0.5 percent increase in 1980 housing vacancy. The estimated increase in local housing vacancy induced by the proposed action is relatively insignificant given the regional and local annual average housing growth rate projections through 1990.

An insignificant impact on regional housing is expected in the Sheppard and Hill AFB areas as a result of the proposed action. As a worst-case estimates, the Sheppard and Hill AFB regions would experience less than 1.3 percent and 0.1 percent increase, respectively, in 1980 housing vacancy. For computational convenience the total housing impact resulting after 1987 was based on 1980 data. As a result, the actual impacts are expected to be somewhat less than the worst-case levels reported. The housing impacts reported for Sheppard and Hill AFBs are also expected to be mitigated by the housing growth rates projected for the regions through 1990.

d. Ancillary Institutional Impacts

As a result of the proposed action, total regional public elementary and secondary school enrollment in the Vandenberg and Sheppard AFB regions would decrease by less than one percent of the current total. Enrollment is expected to decline after 1987 by approximately 190 students in the Vandenberg AFB area, and by approximately 200 students in the Sheppard AFB area. In contrast, enrollment in the Hill AFB area is expected to decline by only 45 students. Accordingly, Federal financial aid to schools in these

regions would also be reduced in proportion to the student losses. The relatively insignificant school enrollment impacts induced by the proposed action would be mitigated by extended Federal funding. The estimated decrease in school enrollment in these three regions is very insignificant considering the potential for future population growth and associated school enrollments.

No other institution-related impacts are expected at Vandenberg, Sheppard, or Hill AFBs as a result of the proposed action.

e. Ancillary Traffic Network Impacts

Training and logistics support for current operations are carried out at Vandenberg, Sheppard, and Hill AFBs. As the missile sites are gradually deactivated, ancillary activities at each of these three locations will phase down accordingly. The impact of this to the transportation system will be positive since there will be a small net reduction in worker-related traffic on or near each base. The maximum impact will occur at Sheppard AFB where a total of approximately 560 personnel are scheduled for reassignment before the end of 1985. No regional or interregional ancillary impacts are expected to result from these actions.

B. Potential Impacts of Reasonable Alternatives

Three reasonable alternatives have been identified by the Air Force. The first is the no-action alternative which obviously implies that the Air Force will not deactivate the Titan II Missile System but will continue to operate it as it is at present. The second alternative is the concurrent deactivation option which requires that the three Titan II Wings, at Davis-Monthan, McConnell and Little Rock

AFBs be deactivated simultaneously over a three-year period rather than sequentially. The third alternative is the deactivation of the first wing over a 24-month period followed by the simultaneous deactivation of the remaining two wings over a subsequent 36-month period.

1. Potential Impacts of No-Action

Should the no-action alternative be adopted, the environmental impacts which are expected as a result of the proposed action will not occur.

The no-action alternative is inconsistent with the President's decision to encourage strategic force modernization.[219] Continued reliance upon this lower priority system ties up critical resources and prevents their use in developing more modern and efficient programs such as Missile X (MX). These modern programs are designed to end the decline of United States strategic capabilities and to create a deterrent that is more stable and secure than that which presently exists.[219]

Additional no-action impacts can be expected in the areas of finance, logistics, maintenance and training. Financial impacts will result when fuel, spare parts, equipment and other vital Titan equipment and support services must be funded from limited and already strained Air Force budgets. Long-range budgetary planning programs which could be better focused upon higher priority programs, like MX, will need to be modified to cover the costs of the less effective Titan II system.

Logistics and maintenance impacts for the no-action alternative are closely related. Older missile systems like Titan II require extraordinary efforts to keep them fully operational. Equipment, spare parts, support systems, com-

munications facilities, fuel and many other elements have become harder to obtain. Suppliers have converted or plan to convert to other activities due to anticipated termination or reduction of demand for their products. Propellant manufacturers and providers of support services are becoming fewer and associated costs have increased. In addition, hardware has aged, is less reliable, and requires more frequent maintenance. Moreover, there would be an increased likelihood of accidental propellant spills from aging equipment.

Training personnel, facilities, and equipment at Sheppard and Vandenberg AFBs would continue in full operation if the no-action alternative is selected. These missile training resources are needed for other important Air Force programs but will not be available due to substantial Titan II commitments.

2. Potential Impact of Accelerated Deactivation

It is possible that the three Titan II missile wings may be deactivated concurrently. This alternative can be expected to produce impacts upon the physical and biological environments which are similar to those identified for sequential deactivation. Socioeconomic impacts, however, will be somewhat different because of a cumulative effect that would develop with this option which would not occur with sequential deactivation. This is true because sequential deactivation will occur during a five year period; concurrent deactivation would occur within only three years. This shorter time period for the concurrent option tends to concentrate socioeconomic impacts into a shorter time frame which reduces growth mitigation effects and makes the impacts more apparent.

Some very minor and temporary employment, Federal defense spending, and regional transfer payment impacts will result if the accelerated deactivation plan is adopted. Combined personnel reduction figures for the three host base areas may have a slightly negative influence on national unemployment percentages. Defense spending decreases may also produce similar employment effects. Regional transfer payments, which include funds for federal impact aid to schools, will shift in a way that may focus mild interest upon the three host base regions.

Additional effects of the accelerated deactivation alternative include transportation and storage, logistic, and finance impacts. A limited number of propellant transport vehicles and storage facilities are or would be available. Serious doubts exist regarding the ability of this limited equipment and storage capacity to meet accelerated deactivation requirements. Also, valuable fuel stocks may be disposed of rather than converted or reused due to the lack of storage space. The need for spare parts and equipment, a related problem, will need to be evaluated. In addition, costs can be expected to be higher than those associated with sequential deactivation. This is due to the needs for duplicate equipment, hardware, propellant trucks and spare parts necessary in the deactivation process. These increased costs will have a minor beneficial impact. Increased Federal spending will support a small increase in employment and demand for goods and services. These positive elements will partially compensate for the loss of employment and income that will occur with missile wing deactivation.

3. Potential Impact of the Modified Deactivation Scenario

The modified deactivation scenario differs from the proposed

action in that the rate of silo deactivation at Little Rock and McConnell AFBs would be cut by half while the overall program rate and schedule would remain the same.

The environmental consequences of this alternate relative to the proposed action are not considered to be substantially different. The activities scheduled for Davis-Monthan would not change. Generally, impacts at both the remaining Wings would be extended in duration (because activities would be slower paced) but would tend to be of a milder nature.

Some increases in the overall Titan II program costs can be expected since concurrent deactivation is less cost efficient than the proposed action. Thus, the impact of this alternative relative to the proposed action would focus on primary and secondary effects of greater program spending.

C. Relationship of Proposed Action and Alternatives to Land Use Plans, Policies and Controls

The Titan II Missile land areas will remain unchanged and under Air Force control, regardless of which alternative is finally chosen. The individual missile sites will be placed in caretaker status as the last phase of any alternative and all agreements, easements, leases and licenses will remain as they are at present. The no-action alternative, likewise, would require that present land uses remain unchanged. As a result, no conflicts with Federal, regional, state or local land use plans, policies and controls are expected to develop in association with the proposed action or the reasonable alternatives.

D. Mitigation Measures

Operations associated with the Titan II missile system have been continuously upgraded over the years as a result of increased operational experience and, unfortunately, past major and minor accidents. As such, an operations and maintenance program has developed in concert with improvements in associated safety and security measures, thereby bringing about a present military operation that is replete with well-established impact mitigating practices. Such practices include all applicable safety directives, OSHA requirements, and Environmental Protection Agency and Department of Transportation regulations pertaining to handling and disposal of hazardous materials. The primary focus of these practices is to minimize or eliminate potential injury to humans and damage to the environment. Although these mitigation procedures are too numerous to discuss herein, relevant details concerning each can be found in appropriate Air Force technical orders on file at Titan II host bases. During the proposed deactivation of the Titan II missile system, these mitigation practices will be implemented and, if necessary, updated.

The Air Force will mitigate onsite safety impacts through the curtailment of specific deactivation procedures during inclement weather. Propellant transfer operations will not be initiated during periods of rain, snow, or other types of precipitation. Electrical storm activity in the vicinity of a missile site during ordnance removal will be cause for curtailment of this activity.

The Air Force will mitigate program cost impacts by prudent recycling of many Titan II components. Among these are: propellants, boosters, reentry vehicles, warheads and a variety of support hardware. The minor costs associated with the dismantling, transportation, refurbishment (when

required), storage, and component reissue are more than compensated for when compared with excessive replacement costs.

Propellant transportation routes will be proposed by the commercial carrier(s) contracted to transport Titan II propellants. In an effort to mitigate the potential hazards associated with the propellant transportation activity, the Air Force will evaluate contractor-proposed routes as part of the ongoing environmental and hazards analysis processes. This procedure will involve the evaluation of each proposed route for avoidance of population centers; road access, integrity, and continuity; prevalence of bridges, tunnels, and other various access constraints; and compliance with Federal, State and local transportation regulations. Efforts will be made to avoid routes involving prolonged travel through or proximate to ecologically sensitive areas, such as National parks and wildlife reserves. Should an alternate route be deemed more appropriate (i.e., safer, less hazardous, etc.), the carrier will be required to use it.

Mitigation of potential socioeconomic impacts evolving from the proposed action may occur in some areas (such as the largest cities of Tucson, Arizona and Wichita, Kansas) primarily from naturally occurring growth factors evident in the regions at these locations. These naturally occurring mitigation factors would include normal population growth of the region as well as net in-migration of population that is expected due to growth in regional employment opportunities. Such regional population and employment growth would tend to mitigate any potential socioeconomic impacts, since these growth trends exceed both the projected reduction in employment and estimated population changes resulting from the proposed action. Adverse employment-related impacts including reduced local payroll spending will be further mitigated by implementing Air Force personnel retraining and

relocation policies. Present missile operators, maintenance, and training personnel will be retrained and relocated to the maximum extent possible. In addition, community economic readjustment assistance in the form of specialized advisory services will be available to provide coordinated Federal assistance to help communities, regions, and states mitigate serious social and economic impacts which may result from defense program changes. Federal impact aid to schools in the form of grants will also be available to provide financial support to local education agencies when enrollments or availability of revenues are adversely affected by Federal activities. These funds may be used for both maintenance and operational expenditures.

Appropriate public affairs planning and coordination activities will be implemented to mitigate certain potential socioeconomic impacts. These practices will include providing necessary assistance to all public agencies in support of deactivation activities; providing advance notice of any movements of propellants; and advising key civic leaders, the news media, and the general public of Titan II deactivation developments. Such practices will greatly assist in minimizing the potential for public or internal apprehension growing into unreasonable, unfounded fears.

V. LIST OF PREPARERS

<u>Name</u>	<u>Position Title</u>	<u>Expertise</u>
Patrick F. Quinn, Captain	USAF Facilities Engineer Offutt AFB, Nebraska	Environmental Engineering
Raymond F. Rodrigue, Ph.D.	Director Environmental Sciences Tetra Tech, Inc.	Environmental Engineering
Lawrence J. Watson, Ph.D.	Senior Resource Planner Tetra Tech, Inc.	Environmental Sciences
Terry L. Campbell	Senior Socioeconomist Tetra Tech, Inc.	Socioeconomics
Leo D. Montroy, Ph.D.	Senior Scientist Tetra Tech, Inc.	Ecology
Lal Baboolal, Ph.D.	Senior Scientist Tetra Tech, Inc.	Air Quality
Thomas Soper	Senior Scientist Tetra Tech, Inc.	Environmental Planning
Jacqueline L. Bowland	Environmental Scientist Tetra Tech, Inc.	Environmental Sciences

VI. OFFICES AND AGENCIES CONSULTED

FEDERAL AGENCIES

Environmental Protection Agency, Region V,
Dallas, Texas

United States Air Force, Offutt AFB, Omaha, Nebraska

- Strategic Air Command Headquarters

United States Air Force, Davis-Monthan AFB, Tucson, Arizona

- 390th Missile Wing Headquarters
- Base Accounting and Finance Office
- Base Civil Engineer Office
- Base Community Planning Office
- Base Defense Property Disposal Office
- Base Disaster Preparedness Office
- Base Environmental Coordinator's Office
- Base Legal Claims Office
- Base Transition Planning Office
- Real Property Office
- Water Maintenance Office

United States Air Force, Little Rock AFB, Little Rock,
Arkansas

- 308th Missile Wing Headquarters
- Base Accounting and Finance Office
- Base Community Planning Office
- Base Legal Claims Office
- Base Real Property Office
- Engineering and Environmental Planning Branch
- Public Affairs Office
- Water Maintenance Office

United States Air Force, McConnell AFB, Wichita, Kansas

- 381st Missile Wing Headquarters
- Base Accounting and Finance Office
- Base Civil Engineer Office
- Base Disaster Preparedness Office
- Base Environmental Coordinator's Office
- Base Housing Coordinator's Office
- Base Legal Claims Office
- Public Affairs Office
- Real Property Office
- Water Maintenance Office

United States Army Corps of Engineers, District Archaeologist
Office, Little Rock, Arkansas

United States Attorney Generals Office, Federal Claims
Division, Wichita, Kansas

United States Department of Agriculture, Little Rock, Arkansas
United States Department of Commerce, Bureau of Land
Management, Phoenix and Tucson, Arizona
United States Federal Highway Administration, Office of Motor
Carrier Safety, Little Rock, Arkansas
United States Fish and Wildlife Service, Little Rock, Arkansas

STATE AGENCIES

1. Arizona Commission of Agricultural and Horticulture, Tucson, Arizona.
2. Arizona Department of Economic Security, Research and Analysis, Tucson, Arizona.
3. Arizona Fish and Game Department, Tucson, Arizona.
4. Arizona National Heritage Program, Tucson, Arizona
5. Arizona State Archaeology Office, Tucson, Arizona.
6. Arkansas Employment Security Division, Little Rock, Arkansas.
7. Arkansas State Conservation Department, Little Rock, Arkansas.
8. Arkansas State Department of Fish and Game, Little Rock, Arkansas.
9. Arkansas State Department of Highways, Little Rock, Arkansas.
10. Arkansas State Department of Pollution Control and Ecology, Little Rock, Arkansas.
11. Arkansas State Police, Little Rock, Arkansas.
12. Arkansas State Range Manager, Little Rock, Arkansas.
13. Arkansas State Resources Conservationist, Little Rock, Arkansas.
14. Arkansas State Soil Scientist, Little Rock, Arkansas.
15. California Employment Development Department, Research and Statistics Division, Santa Barbara, California.
16. Department of Health Services, Bureau of Water Control, Tucson, Arizona.
17. Kansas Department of Employment Security, Research and Statistics Division, Wichita, Kansas.
18. Kansas Department of Fish and Game, Topeka, Kansas.
19. Texas State Employment Security Department, Wichita Falls, Texas.
20. University of Arizona, Department of Geography and Regional Planning, Tucson, Arizona.

21. University of Arkansas, Department of Economics, Research and Extension Center, Little Rock, Arkansas
22. University of Arkansas, Department of Industrial Research and Extension Center, Little Rock, Arkansas.
23. University of Arkansas, State Archaeology Office, Fayetteville, Arkansas.
24. University of Arkansas, Department of Zoology, Fayetteville, Arkansas.
25. Utah Department of Job Service for Employment, Odgen, Utah.
26. Wichita City Library, Historian Office, Wichita, Kansas.
27. Wichita State University, Department of Anthropology, Wichita, Kansas.
28. Wichita State University, Department of Biology, Wichita, Kansas.
29. Wichita State University, Department of Economics, Wichita, Kansas.
30. Wichita State University, Department of Geology, Wichita, Kansas.
31. Wichita State University, Department of Urban Affairs, Wichita, Kansas.

REGIONAL AND LOCAL AGENCIES

1. Advance Plans Division, Wichita/Sedgwick County Metropolitan Area Planning Department, Wichita, Kansas.
2. City of Tucson, Chamber of Commerce, Tucson, Arizona.
3. Department of Environmental Resources, Sedgwick County, Kansas.
4. Metroplan Council of Local Governments, Little Rock, Arkansas.
5. Pima County Air Quality Control System, Tucson, Arizona.
6. Pulaski County Special School District, Pulaski County Arkansas.
7. Regional Planning Department, Pima County Association of Governments, Tucson, Arizona
8. Sedgwick County, County Clerk's Office, Wichita, Kansas.
9. Superintendents Office, Derby Public School District, Derby, Kansas.
10. Tucson Area Management Authority, Department of Water Resources, Tucson, Arizona.
11. Tucson Planning Department, City of Tucson, Tucson, Arizona.

PRIVATE

1. Advance Plans Office, Tucson Electric and Power Company
Tucson, Arizona

VII. LIST OF REFERENCES AND RELATED SOURCES

1. Aiocho, 1st Lt. Omar R. Accounting and Finance Officer, 381st Missile Wing, McConnell AFB. Personal contact, May 13, 1982.
2. Air Quality Advisory Council Report. 1981 Tucson Population Exposure to Criteria Pollutants. Report AQ-170. Prepared for Pima County Board of Supervisors. April 1, 1982.
3. Alexander, James. Deputy Base Civil Engineer, 836th CES, Davis-Monthan AFB. Personal contact, May 4, 1982.
4. American Demographics. The 1980 Guide to Metropolitan Areas. December 1981.
5. Anderson, Dan. Senior Economist, Arizona Dept. of Economic Security. Telephone contact, May 5, 1982.
6. Anonymous. Arkansas Population Summaries. No date.
7. Anonymous. Arkansas State Officials' Directory. No date.
8. Anonymous. Hourly NOX Averages, Little Rock, Arkansas. August 11, 1980.
9. Anonymous. Hourly Ozone Averages, Little Rock, Arkansas. May 7, 1980.
10. Anonymous. Jacksonville PO TSP Concentrations in g/m. No date.
11. Anonymous. Yearly Summary of Sulfur Dioxide for Little Rock, Arkansas. No date.
12. Applegate, Major, USAF. Missile Wing HQ, 390th Missile Squadron, Personal contact, May 4, 1982.
13. Arizona Commission of Agriculture and Horticulture. Arizona Native Plant Law, AH-N. 500. Revised 7-81.
14. Arizona Department of Economic Security Research and Analysis. Statewide Labor Force News Release December Statistics. January 20, 1982.
15. Arizona Game and Fish Commission. Threatened and Unique Wildlife of Arizona. October 21, 1978.
16. Arkansas Archaeological Survey. Pine Mountain--A Study of Prehistoric Human Ecology in the Arkansas Ozarks. February 1976.
17. Arkansas Archaeological Survey. The Conway Water Supply. Results of Archaeological Survey and Testing and a Historical Survey of a Proposed Reservoir Area in Conway County, Arkansas. Dec. 1980.
18. Arkansas Dept. of Local Services. Arkansas Areawide Planning Organizations Roster of Staff and Board Officers. May 1977.

19. Arkansas Employment Security Division. Annual Planning Information Fiscal Year 1982. June 1981.
20. Arkansas Employment Security Division. Arkansas' Industrial Progress 1970-1979. No date.
21. Arkansas Employment Security Division. Arkansas Statistical Review, First Quarter Fiscal Year 1982. No date.
22. Arkansas Employment Security Division. Arkansas Wage Survey 1981. No date.
23. Arkansas Employment Security Division. Average Covered Employment and Earnings by Industry and County 1980. August 1981.
24. Arkansas Employment Security Division. Covered Employment and Earnings. 3rd Quarter, 1981. April 1982.
25. Arkansas Employment Security Division. Current Employment Developments, Arkansas. March 29, 1982.
26. Arkansas Employment Security Division. Employment Trends for Little Rock-North Little Rock Metropolitan Area. April 5, 1982.
27. Arkansas Employment Security Division. Interface of Supply and Demand.
28. Arkansas Employment Security Division. Labor Market Information for Arkansas Counties. March 29, 1982.
29. Arkansas Employment Security Division. Occupational Trends: 1978-1984 Arkansas. April 1980.
30. Arkansas Employment Security Division. Occupational Trends: 1978-1984. Central Arkansas Consortium. July 1980.
31. Arkansas Employment Security Division. Occupational Trends: 1978-1984 East Central Arkansas. October 1980.
32. Arkansas Employment Security Division. Occupational Trends: 1978-1984. Little Rock-North Little Rock SMSA. June 1980.
33. Arkansas Employment Security Division. Occupational Trends: 1978-1984. North Central Arkansas. November 1980.
34. Arkansas Employment Security Division. Occupational Trends: 1978-1984 Pine Bluff SMSA. July 1980.
35. Arkansas Employment Security Division. Occupational Trends: 1978-1984 Southeast Arkansas. November 1980.
36. Arkansas Employment Security Division. Occupational Trends: 1978-1984. West Central Arkansas. September 1980.
37. Arkansas Employment Security Division. Staffing Patterns for Manufacturing Industries in Arkansas. 1977.
38. Arkansas Employment Security Division. Staffing Patterns in Manufacturing Industries in Arkansas. September 1980.

39. Arkansas Employment Security Division. Staffing Patterns in: Transportation; Public Utilities; Communications; Trade. December 1980.
40. Arkansas Employment Security Division. Trends in Selected Occupations 1978-1984 Arkansas. May 1980.
41. Arkansas Employment Security Division. Trends in Selected Occupations 1978-1984. Little Rock/North Little Rock SMSA. October 1980.
42. Arkansas Employment Security Division. Trends in Selected Occupations 1978-1984. Pine Bluff SMSA. October 1980.
43. Arnold, William E., Jr., P.E. Chief, Engineering and Environmental Planning Branch, USAF, Little Rock AFB, Arkansas, Letter to Dr. Leo D. Montroy, Tetra Tech, Inc. May 25, 1982.
44. Beimfohr, John. State Land Dept./Tucson Office, Telephone contact, May 5, 1982.
45. Bemyer, Mr. Water Maintenance, 836th Combat Support Group, Davis-Monthan AFB. Personal contact, May 6, 1982.
46. Berg, Dr. Robert. Professor of Geology, Wichita State University. Personal contact, May 13, 1982.
47. Bolton, Ken. Native Plant Investigator, Arizona Commission of Agriculture and Horticulture/Compliance Division, Tucson, Arizona. Telephone contact, May 5, 1982.
48. Bowman, Mr. Base Disaster Preparedness Officer, 390th Strategic Missile Wing, Davis-Monthan AFB. Personal contact May 6, 1982.
49. Brown, Jess. Regional Planner, Pima County Association of Governments. Personal contact, April 27; May 6, 1982.
50. Buercklin, John. 314th Combat Support Group, USAF, Little Rock AFB, Arkansas. Personal contact, April 27 and April 29, 1982.
51. California Air Resources Board, Forward to the State of California's 1979 State Implementation Plan Amendments in Response to the Clean Air Act Amendments of 1977. July 1979.
52. California Employment Development Department. Santa Barbara County Civilian Labor Force Bulletin. April 1982.
53. Campbell, Betty R. Administrative Assistant, Sedgwick County Court House. Personal contact, May 13, 1982.
54. Carter, L. McGraw Hill, New York. Environmental Assessment. 1977.
55. Chambers, Col. John E. Vice Commander, 390th Strategic Missile Wing, Davis-Monthan AFB. Personal contact, May 7, 1982.

56. Chemical Propulsion Information Agency, Laurel, MD. Environmental Impact Considerations for Disposal of Propellants and Ingredients. September 1975.
57. City of Tucson, et. al. Draft Comprehensive Plan. 1975.
58. City of Tucson Planning Department. Estimates of Preliminary Counts by Census Tracts: 1980 Census of Population and Housing. September 1980.
59. Coldwell, S.T., State of Arkansas, Dept. of Pollution Control and Ecology, Letter to Larry Watson, May 3, 1982.
60. Collins, Glenn. Director, Operations, Bureau of Land Management, Phoenix, Arizona. Telephone contact, May 5, 1982.
61. Crawford, Lt. David. 308th Missile Wing DED USAF, Little Rock AFB, Arkansas. Personal contact, April 29, 1982.
62. Curfman, Bruce. Senior Transportation Planner, Wichita/Sedgwick County Metropolitan Area Planning Dept. Personal contact, May 13, 1982.
63. Dalrymple, Garry R. Base Chief Missile Engineering Branch, DEL USAF, 836th Combat Support Group, Davis-Monthan AFB. Personal contact, May 3 & 5, 1982.
64. Darmer, Silver. Pima County Air Quality Control District, Telephone contact, May 5, 1982.
65. Davis, Hestor. State Archaeologist, University of Arkansas. Personal contact, April 29, 1982.
66. Devereaux, Steve. Public Health Engineer, Dept. of Health Services, Bureau of Water Quality Control, State of Arizona. Telephone contact, May 6, 1982.
67. Dillon, Major Tom. Sector Commander, 308th Missile Wing Little Rock AFB. Personal contact, April 28, 1982.
68. Dissler, Dr. Don. Professor of Biology, Wichita State University. Personal contact, May 15, 1982.
69. Donahue, et. al. Prentice-Hall, Englewood Cliffs. Soils, An Introduction to Soils and Plant Growth. 1971.
70. Dumbauld, R.K., et. al. GCA Corporation. Handbook for Estimating Toxic Fuel Hazards - NASA CR-61326. April 1970.
71. Earth Sciences Associates/PRC Toups, prepared for USAF/SAC, Offutt AFB, Nebraska. Supplemental Water Supply for Vandenberg AFB, California. Task III Executive Summary. 1982.
72. Earth Sciences Associates/PRC Toups, prepared for USAF/SAC, Offutt AFB, Nebraska. Supplemental Water Supply for Vandenberg AFB, California. Task IA Project Vandenberg AFB Water Demands. 1982.
73. Ellington, William. Historian, Wichita City Library. Personal contact, May 14, 1982.

74. EPA. Federal Register. Hazardous Waste and Consolidated Permit Regulations. May 19, 1980.
75. EPA. Project Summary. Modification of Spill Factors Affecting Air Pollution: Volume II. The Control of the Vapor Hazard from Spills of Liquid Rocket Fuels. October 1981.
76. Farmers Investment Company. Memorandum on Green Valley Population Forecast. March 24, 1982.
77. Farrell, Tom. Labor Market Analyst. California Employment Development Dept. Personal contact, June 9, 1982.
78. Feiro, Capt. Base Chief Legal Claims Officer, 390th Strategic Missile Wing, Davis-Monthan AFB. Personal contact May 6, 1982.
79. Ferm, Rod E., Lt. Col., Chief, Transition Planning, 390th Strategic Missile Wing, Davis-Monthan AFB. Personal contact, May 5, 1982.
80. Fire Chiefs Association of Santa Barbara County/USAF, Safety Department, Vandenberg AFB, CA. Hazardous Material Information, Guide Special Information. No date.
81. Fish, Paul. Chief of Field Operations/State Archaeologist, University of Arizona. Personal contact, May 6, 1982.
82. Fisher, Glenn W. Professor of Urban Affairs, Wichita State University. Personal contact, May 14, 1982.
83. Foster, Patsy. Assistant Claims Officer, 381st Missile Wing, McConnell AFB. Personal contact, May 13, 1982.
84. French, T. Sgt. Earl R. Real Property, 836th Combat Support Group, Davis-Monthan AFB. Personal contact, May 5, 1982.
85. Fryer, H.C., Allyn and Bacon, Inc., Boston. Concepts and Methods of Experimental Statistics. 1966.
86. Garrett, Capt. Kenneth L. Public Affairs Officer, 308th Strategic Missile Wing, Little Rock AFB. Personal contact, April 28, 1982.
87. Geraghty, J.G., et.al. Water Atlas of the United States. Published by Water Information Center Inc., New York. May 1973.
88. Gibson, Dr. Lay J. Professor and Head, Dept. of Geography and Regional Planning, University of Arizona. Personal contact, May 6, 1982.
89. Greenwood, David. Assistant Superintendent, Pulaski County Special School District. Personal contact, April 28, 1982.
90. Greer, J.S., et. al. Modification of Spill Factors Affecting Air Pollution: Volume II. The Control of the Vapor Hazard from Spills of Liquid Rocket Fuels. EPA-600/S2-81-215 October 1981, available from NTIS, Springfield, Virginia.

91. Gutshall, Don. Base Defense Property Disposal Operator, USAF, Davis-Monthan AFB. Telephone contact, May 6, 1982.
92. Hahn, Dr. Douglas R. Director, Sedgwick County Kansas Dept. of Environmental Resources. Personal contact, May 13, 1982.
93. Harris, Ann. Research Statistics Analysis, Pima Association of Government. Personal contact, May 6, 1982.
94. Harvey, M.J., et. al. Memphis State University. Endangered Bats of Arkansas: Dist., Status, Ecology, and Management. No date.
95. Havens, Cathy. Analyst, North Regional Planning Commission. Personal contact, June 10, 1982.
96. Hazzard, Grace. National Highway Transportation Safety Administration, Washington D.C., Telephone contact, July 13, 1982.
97. Hill, R.D., San Antonio Air Logistics Center, Kelly AFB, Texas. Telephone contact. July 13, 1982.
98. Holbrook, Alma. Research Assistant, Arkansas State Employment Security Dept. Personal contact, April 29, 1982.
99. Hubbard, Charles W., Derby Public Schools Deputy Superintendent. Personal contact, May 14, 1982.
100. Huinker, Capt. John. Pilot, Helicopter Detachment 1, 37 ARRS, USAF, Davis-Monthan AFB. Personal contact, May 5, 1982.
101. Hunt, C.B. Freeman, San Francisco. National Regions of the United States and Canada. 1974.
102. James, D.A., et. al. Dept. of Zoology, University of Arkansas for the Arkansas Game and Fish Commission. Study of the Red-Cockaded Woodpecker in Arkansas Project E-105 (Job II). Fall, 1981.
103. Janssen, Larry. Base Environmental Planner, 381st Combat Support Group, McConnell AFB, Personal contact, May 10, 1982.
104. Jones, Mr., Derby Public Schools District Superintendent, Personal contact, May 14, 1982.
105. Johns Hopkins University. Jannaf Working Group on Safety and Environ. Protection, Chemical Propulsion Info. Agency. Environmental Impact Considerations for Disposal of Propellants and Ingredients CPIA Pub. 269. Sept., 1975.
106. Johnson, Rex. 381st, Combat Support Group, McConnell AFB, Personal contact, May 10, 1982.
107. Johnson, Terry. Arizona National Heritage Program, Tucson, Arizona, Telephone contact, May 6, 1982.
108. Kahler, Capt. Jon P., et. al., Air Weather Service (MAC), Scott AFB, Illinois. Calculating Toxic Corridors. November, 1980.

109. Kane, Donald A., and Kenneth J. Williamson, Department of Civil Engineering, Oregon State University, Corvallis, Oregon, prepared for Tyndall AFB, Florida. Bacterial Toxicity and Metabolism of Three Hydrazine Fuels. September 1980.
110. Kansas Department of Human Resources Research and Analysis Section. Kansas Monthly Employment Review. March 1982.
111. Kansas Fish and Game. Various papers regarding Kansas Threatened and Endangered Plant and Wildlife Species.
112. Kansas State University, Manhattan, Kansas. Extension Engineering in Kansas. Contour Farming Pays. March 1970.
113. Kirby, John A., Director of Membership, Tucson Metropolitan Chamber of Commerce, Personal contact, May 3, 1982.
114. Knox, Otis, Roads and Grounds Maintenance, USAF, Little Rock AFB, Personal contact, April 28, 1982.
115. Lesko, Capt. A.L., 390th Strategic Missile Wing, Davis-Monthan AFB, Personal contact, May 5, 1982.
116. Levino, Dr. Carl. Principal Planner, Wichita/Sedgwick County Metropolitan Area Planning Dept. Personal contact, May 13, 1982.
117. Lewis, Linda. Special Assistant to Director, Tucson Area Management Authority, Dept. of Water Resources, Tucson, Arizona. Telephone contact, May 6, 1982.
118. Liechti, Carrol. Director of Administrative Research, Wichita Unified School District #259. Personal contact May 14, 1982.
119. Long, R.M. Wichita Century. A Pictorial History of Wichita, Kansas 1870-1970. October 1969.
120. Lueck, Curtis C. Chief, Environmental Planning, 836th Control Support Group, Davis-Monthan AFB. Personal contact, May 3, 1982.
121. Lutton, Darrell L. Rocky Mountain Arsenal, Colorado. Personal contact. June 10, 1982.
122. Madrone Associates Environmental Consultants. Environmental Assessment. Hypergolic Propellant Storage Facility, Vandenberg AFB, CA. May 1, 1980.
123. Marcoa Publishing Inc., San Diego, CA. Wichita Welcomes You to McConnell AFB! No date.
124. Martin, Col. Richard A., USAF, Director of Energy Management, San Antonio Air Logistics Command, Kelly AFB, Texas. Letter to Capt. P.F. Quinn, HQ SAC/DEVQ, June 30, 1982.
125. Martin Marietta Aerospace Corp., Denver, CO. Inter-Department Communication-Comments on "Test Reports on Fume Scrubber". January 1982.
126. Martin Marietta Aerospace Corp., Denver, CO. Propellant Safety Considerations for Titan IIIX/Agena at PALC II-WTR. October 28, 1964.

127. Martin Marietta Aerospace Corp., Denver, CO. System Hazard Analysis and Operating and Support Hazard Analysis. February 1982. Titan II Propellant Spill Pumping Set. No date.
128. McDougal, Dr. Gerald. Professor of Economics, Wichita State University. Personal contact, May 14, 1982.
129. Merriam, D.F., State Geological Survey of Kansas, Bulletin 162. The Geologic History of Kansas. 1963.
130. Metroplan. Jacksonville, Arkansas Data Book. Planning Studies Report. 1974.
131. Metroplan. Little Rock/North Little Rock SMSA Data Book. Population and Land Use (1970-2020). No date.
132. Mills, Michael. Chief Engineer, Holston Army Ammunition Plant, Kingsport, Tennessee. Telephone contact, June 6, 1982.
133. Money, Dick. Labor Market Specialist, Utah Job Service for Employment. Personal contact, June 10, 1982.
134. NASA/American Planning Association. Resolves of the Monterey Conference on Planning for Rotorcraft and Commuter Air Transportation. Monterey, CA, August 31 - September 4, 1981.
135. NASA, Washington, D.C. Environmental Impact Statement for the Kennedy Space Center. Final. October 1979.
136. NASA, Washington, D.C. Environmental Impact Statement. Space Shuttle Program. Final. April 1978.
137. New, Ms. Chief, Real Property Management, 308th Missile Wing, Little Rock AFB. Personal contact, April 27, 1982.
138. Norad, Mr. Disaster Preparedness, 381st Missile Wing, McConnell AFB. Personal contact, May 13, 1982.
139. Norman, Jerry. Boeing Service, Inc. Cape Canaveral AFS, Florida. Personal contact, July 16, 1982.
140. Northrop, Capt. Carrol. Public Affairs Officer, 381st Missile Wing, McConnell AFB. Personal contact, May 10, 1982.
141. Opitz, John. Industrial Development Coordinator, University of Arkansas. Industrial Research and Extension Center. Personal contact, April 29, 1982.
142. Parris, Dr. Wayne. Professor of Anthropology, Wichita State University. Personal contact, May 15, 1982.
143. Patriarcha, Geno. Base Community Planner, 836th Combat Support Group, Davis-Monthan AFB. Personal contact, May 3, 1982.
144. Pima County Air Quality Control District, Tucson, Arizona. Air Quality in Tucson, Arizona. March 18, 1982.

145. Pima County Association of Governments. Adopted Allocation of County Population Forecasts. March 24, 1982. A Draft Pima County Association of Governments. A Draft Comprehensive Plan for the City of Tucson, Pima County, the City of South Tucson, and Pima Association of Governments. A Draft for Community Review. 1976.
147. Pima County Association of Governments. Areawide Wastewater Management Plan. June 1978.
148. Pima County Association of Governments. Environmental Impact Assessment PAG 208 Alternatives and Final Plan. June, 1978.
149. Pitts, James N. Jr., et. al. Statewide Air Pollution Research Center, University of California, Riverside, CA., prepared for Tyn dall AFB, Florida. Atmospheric Chemistry of Hydrazines: Gas Phase Kinetics and Mechanistic Studies. August 1980.
150. Pleasant Valley Country Club, Little Rock, Arkansas. World Trade Outlook Agenda. May 19, 1982.
151. Pollard, Dr. Senior Research Associate and Professor, University of Arkansas, Research and Extension Center. Telephone contact, May 4, 1982.
152. Poole, H.K. Environmental Coordinator, 836th Combat Support Group, Davis-Monthan AFB. Personal contact, May 4, 1982.
153. Potts, R.G., et. al. Air Force Engr. and Services Center, Tyn dall AFB, Florida. Mathematical Development of the Spill Assessment Model (SAM) for Hydrazine and Similar Acting Materials in Water Bodies. ESL-TR-80-07. February 1979-1980.
154. Potts, R.G., et. al, Arthur D. Little, Inc., Cambridge, Massachusetts, prepared for Tyn dall AFB, Florida. Spill Assessment Model (SAM) Procedure for Manual Field Calculations. April 1980.
155. Professional Engineering Consultants, Wichita, Kansas. Four Mile Creek Facilities Plan for Sedgwick County, Kansas, Butler County, Kansas, and City of Wichita, Kansas. 1979.
156. Quinn, Capt. Patrick F. Project Officer, HQ SAC, Offutt AFB, Nebraska. Personal contact, April 26, 1982.
157. Quinn, Capt. Patrick F. Project Officer, USAF, HQ SAC, Offutt AFB, Nebraska. Telephone contact, May 17, 1982.
158. Quisenberry, Maj. B.R.. HQ SAC/IGF. Minutes - Titan II Safety Working Group. March 30-31, 1982.
159. Randal, Charley. Director of Planning, Metropolitan Council of Local Government. Personal contact, April 29, 1982.
160. Reinert, Ken. Chief, Planning and Environmental, Bureau of Land Management, Phoenix, Arizona. Telephone contact, May 6, 1982.

161. Roberts, Capt. HQ SAC. Telephone contact, June 14, 1982.
162. Robertson, Lt. Col. Assistant Deputy Commander, Missile Maintenance, USAF. Personal contact, April 28, 1982.
163. Roddy, Michael G. Forecast Analyst, Tucson Electric and Power Company. Telephone contact, May 7, 1982.
164. Rodriquez, Ruper. Analyst, Texas State Employment Security Dept. Personal contact, June 10, 1982.
165. Russell & Axon, Engineers-Planners-Architects, Inc. Environmental Assessment. Patrick AFB, Florida, Cape Canaveral AFS. August 1979.
166. Sands, Marie. Real Property Officer, 381st Missile Wing, McConnell AFB. Personal contact, May 10, 1982.
167. Santeford, L.G. and W.A. Martin, et. al., Arkansas Archaeological Survey, Fayetteville, Arkansas. The Conway Water Supply: Results of Archaeological Survey and Testing and a Historical Survey of a Proposed Reservoir Area in Conway County, Arkansas. 1980.
168. Scambilis, Col. A., 381st Combat Support Group, McConnell AFB. Personal contact, May 10, 1982.
169. Schwitters, Michael T., Lt. Col., USAF, Chief, Aerospace Sciences Div., Dir. of Weather, DCS, Operations, HQ, SAC, Offutt AFB, Nebraska. Personal contact. August 2, 1982.
170. Sedgwick County, Kansas, Dept. of Environmental Resources. Bibliography of DER's Library. March 3, 1981.
171. Short, J.L. Tital II System Safety, Martin Marietta Corp. System Hazard Analysis and Operating and Support Hazard Analysis, Contract No. F42600-80-D-0947. February 1982.
172. Sickert, Major. HQ SAC CEMAT, USAF. Personal contact, May 5, 1982.
173. Sims, W.R. Baseline Data Collection, Minuteman and Titan Bases. Letter to L. Baboolal. Synopsis of Air Quality at McConnell AFB. December 17, 1981.
174. Sinclair, John. Pima County, Tucson, Arizona. Telephone contact, May 6, 1982.
175. Singleton, Capt. Stan R. Assistant Staff Judge Advocate, 381st Missile Wing, McConnell AFB. Personal contact, May 13, 1982.
176. Smead, Phillip E., Col., USAF, Chief Bioenvironmental Engineering Division, HQ, SAC, Offutt AFB, Nebraska. Personal contact. August 3, 1982.
177. Smith, Phyllis. Assistant Research Specialist, University of Arkansas, Industrial Research and Extension Center. Personal contact, April 29, 1982.
178. Spain, Vivian. Planning Aide, Wichita/Sedgwick County Metropolitan Area Planning Dept. Personal contact, May 13, 1982.

179. Spatz, Belle. Base Community Planner, 314th Combat Support Group, Little Rock AFB. Personal contact, April 27, 1982.
180. Stanton, Joe, Base Fuels (LGSF), Vandenberg, AFB, Personal contact. May 26, 1982.
181. State of Arkansas. Revised Labor Force Estimates. January 1981.
182. Stauffer, T.B., Eyl, A.W., Environmental Chemical Division Environics Directorate. Studies on Evaporation of Hydrazine and Procedures for Cleanup of Small Spills CEEDO-TR-78-12, Tyndall AFB. June 1977-July 1978.
183. Stephens, Sgt. Richard L. Cost and Management Analysis, 308th Missile Wing, Little Rock AFB. Personal contact, April 28, 1982.
184. Stockwell, Willard L. Chief Planner, Advance Plans Division, Wichita/Sedgwick County Metropolitan Area Planning Dept. Personal contact, May 13, 1982.
185. Stump, Col. and Col. Anderson, USAF, Little Rock AFB. Personal contact, April 29, 1982.
186. Styles, Wilson. Director, Arkansas State Historic Preservation Office. Personal contact, April 30, 1982.
187. Sutay, Major. Bio-environmental Office, USAF, Davis Monthan AFB. Telephone contact, May 6, 1982.
188. Systems Technology Laboratory, Inc., Arlington, Virginia. Post-Accident Procedures for Chemicals and Propellants. Draft Interim Report. April 15, 1981.
189. Systems Technology Laboratory, Inc., Arlington, Virginia. Risk Assessment of Titan II Propellant Routes. Interim Draft Report, Davis-Monthan/ALRC. May 1982.
190. Systems Technology Laboratory, Inc., Arlington, Virginia. Titan II Transportation Accident Response Coordination Guide. Interim Draft Report, Davis-Monthan/ALRC. May 1982.
191. Taylor, Dave. Housing Planner, City of Tucson Planning Dept. Telephone contact, May 7, 1982.
192. Texas Employment Commission, Austin, Texas. Texas Labor Market Reviews. May 1982.
193. Troutman, Dr. Frank. Professor and Senior Research Specialist, University of Arkansas Industrial Research and Extension Center. Personal contact, April 29, 1982.
194. Tucson Citizen. The Emerging Tucson Economy. March 1, 1982.
195. Tucson Citizen. The Emerging Tucson Growth. March 1, 1982.
196. Tyce, Ms. Arizona Fish and Game Dept. Telephone contact, May 5, 1982.

197. USAF, Air Directorate National Guard Bureau, Washington, DC. Background Studies for Environmental Assessment Southern Arizona Auxiliary Airfield. November 1981.
198. USAF, Air Force Association. Air Force Magazine. May 1982.
199. USAF, Davis-Monthan AFB, Arizona. Baseline Data Collection, Minuteman & Titan Bases, Synopses, Davis-Monthan AFB. November 3-6, 1981.
200. USAF, Davis-Monthan AFB, Arizona. Davis-Monthan AFB Overall Economic Impact Analysis as of April 1982. April 1982
201. USAF, Davis-Monthan AFB, Arizona. M-X Environmental Baseline Data Collection Workshop. November 3-6, 1981.
202. USAF, Davis-Monthan AFB, Arizona. Statement of Resources and Economic Impact FY 1981. September 1981.
203. USAF, Davis-Monthan AFB, Arizona. USAF Real Property Inventory Detail List. March 25, 1982.
204. USAF, Davis-Monthan AFB, Arizona. Utility Consumption Record File Summary as of April 1982. May 1982.
205. USAF. Draft Supplement to the Final Environmental Impact Statement of the Space Shuttle Program at Vandenberg AFB, California. January 1982.
206. USAF. Environmental Assessment for Nitrogen Production Plant and Pipeline, Vandenberg AFB, CA. September, 1980.
207. USAF. Environmental Impact Analysis Process. Deployment Area Selection and Land Withdrawal/Acquisition DEIS. III Part I Affected Environment. No date.
208. USAF, HQ Air Force Reserve, Robins AFB, GA. Environmental Assessment for the Proposed Mission Change at Richards-Gebaur Air Force Base, Missouri. January 1982.
209. USAF, HQ Space Division, Los Angeles, California. Impact of Space Shuttle Activities on Air Quality at Vandenberg AFB. Final. August, 1981.
210. USAF, HQ SAC, Offutt AFB, Nebraska. Disaster Preparedness. Titan II - Hazard Corridor Planning and Evacuation Notification Procedures. September 30, 1980.
211. USAF, HQ SAC Offutt AFB, Nebraska. Draft Environmental Assessment Project "Pacer Down". The Recovery of Titan II Launch Complex 533-7 McConnell AFB, Kansas. May 15, 1979.
212. USAF, HQ SAC, Offutt AFB, Nebraska. Fact Sheet Titan II. August 1981.
213. USAF, HQ SAC, Offutt AFB, Nebraska. Program Plan 82-4 Titan II Deactivation - 390th SMW(u). April 1982.
214. USAF, HQ SAC, Offutt AFB, Nebraska. Supplemental Amendment to the Mission Change Assessment (Proposed 184th TFG Action, McConnell AFB, Kansas). Letter. May 27, 1980.

215. USAF, HQ SAC, Offutt AFB, Nebraska. 390 SMW Titan II Missile Complex Weather Analysis. April 1, 1982.
216. USAF, HQ, Washington D.C. Titan II Deactivation Management Plan. April 1, 1982.
217. USAF, HQ, Washington, D.C. Titan II Deactivation Management Plan. April 21, 1982
218. USAF, HQ, Washington, D.C. Titan II Deactivation Plan. February 20, 1982.
219. USAF, HQ, Washington D.C. Titan II Deactivation Plan. June 30, 1982.
220. USAF, HQ, Washington, D.C. Titan II Deactivation - Reclaimed Spares and Items List (NSN Sequence).
221. USAF, HQ, Washington, D.C. Titan II Weapon System Review Group Report (Davis Report). December 1980.
222. USAF. Impact of Delaying or Terminating the Titan II Deactivation. Point paper. March 29, 1982.
223. USAF, Little Rock, Arkansas. Base Level Resource Statement for FY 1981. September 30, 1981.
224. USAF, Little Rock AFB, Arkansas. Baseline Data Collection, Minuteman and Titan Bases, Synopses, Little Rock, Arkansas. December 8-11, 1981.
225. USAF, Little Rock AFB, Arkansas. Environmental Narrative Safe and Seal Procedures Titan II Missile Base 374-7 North-Central Arkansas. January 1982.
226. USAF Little Rock AFB, Arkansas. Overall Economic Impact Analysis of April 1982. April 1982.
227. USAF, Little Rock AFB, Arkansas. Pest Control Historical Record. No date.
228. USAF, Little Rock AFB, Arkansas. Utility Consumption Record File Summary as of April 1982. May 1982.
229. USAF, McConnell AFB, Kansas. Air Installation Compatible Use Zone. April 1981.
230. USAF, McConnell AFB, Kansas. Baseline Data Collection, Minuteman & Titan Bases, Synopses McConnell AFB, Kansas. November 17-29, 1981.
231. USAF, McConnell AFB, Kansas. Fact Book McConnell AFB, Kansas as of September 1981. October 1981.
232. USAF, McConnell AFB, Kansas. Future Paving at McConnell AFB. February 1982.
233. USAF, McConnell AFB, Kansas. McConnell AFB MPAT Study. September 1981.
234. USAF, McConnell AFB, Kansas. McConnell AFB Overall Economic Impacts Analysis as of April 1982. April 1982.

235. USAF, McConnell AFB, Kansas. Project and Disposal Programs Brochure as of March 1982.
236. USAF, McConnell AFB, Kansas. USAF Real Property Inventory Detail List. May 10, 1982.
237. USAF, McConnell AFB, Kansas. Utility Consumption Record File Summary as of April 1982. May 1982
238. USAF, Malmstrom AFB, Montana. M-X Environmental Baseline Data Collection Workshop. November 17-20, 1981.
239. USAF Military Specification MIL-H-6083D. Hydraulic Fluid, Petroleum Base, for Presentation and Operation. September 28, 1973.
240. USAF, Ogden Air Logistics Center, Utah. Pamphlet 144-XX Titan II. Propellant Hazard Management Guide - Volume I- IV. 1981.
241. USAF, Ogden Air Logistics Center, Utah. Titan II Deactivation Planning Conference. April 13-14, 1982.
242. USAF. Oil and Hazardous Substance Pollution Contingency Plan, McConnell AFB, Kansas. January 1982.
243. USAF. Rock, Kansas Fuel Spill Scenario. No date.
244. USAF/SAC. Minutes - Titan II Safety Working Group. 30-31 March 1982. April 12, 1982.
245. USAF. San Antonio Air Logistics Center, Kelly AFB, Texas. Titan II Deactivation Plan Annex G, Appendix I. April 13-14, 1982.
246. USAF. Silver Anniversary Review 1955-1980.
247. USAF. Space Shuttle Program EIS Reference Document Vol. I. 1977.
248. USAF. Studies on Evaporation of Hydrazine and Procedures for Cleanup of Small Spills. August 1978.
249. USAF. USAF Model LGM-25C Missile Weapon System Operation. 1 February 1976 with 10-13 July 1981 changes.
250. USAF. Various Requests for Environmental Impact Analysis forms.
251. USAF. Weapon System Description - Titan II Appendix A. No date.
252. USAF/308th SMW, Little Rock AFB, Arkansas. Operations Plan 404-81 ICBM and RV Receipt, Delivery and Movement Plan. 6 August 1981.
253. USAF/308th SMW, Little Rock AFB, Arkansas. Operations Plan 410-81 Propellant Receipt, Delivery and Movement. February 15, 1981.
254. USAF/308th SMW, Little Rock AFB, Arkansas. Semiannual Facts Book. September 1981.

255. USAF, 351st SMW, Whiteman AFB, Missouri. Report of Missile Accident Investigation. Major Missile Accident Titan II Complex 533-7 Assigned to 381st Strategic Missile Wing McConnell AFB, Kansas. October 1978.
256. USAF, 381st Civil Engineering Squadron, McConnell AFB, Kansas. Environmental Assessment for Aircraft Conversion 184 TFTG Kansas Air National Guard at McConnell AFB, Kansas. December 1978.
257. USAF, 381st Civil Engineering Squadron, McConnell AFB, Kansas. Environmental Assessment for Repair of Airfield Pavements at McConnell AFB, Kansas Strategic Air Command. July 7, 1979.
258. USAF 381st Combat Support Group (SAC), McConnell AFB, Kansas. Reports Relating to the Rock, Kansas Missile Incident, 24 August 1978. 14 May 1982.
259. USAF, 381st Strategic Missile Wing, McConnell AFB, Kansas. 381st Strategic Missile Wing Management Analysis Review 1-31 December 1981.
260. U.S. Army Corps of Engineers. FES Toad Suck Ferry Lock and Dam Arkansas River Water Supply Relocation - City of Conway. April 1979.
261. U.S. Army Corps of Engineers. Fourche Bayou Basin in Pulaski and Saline Counties, Arkansas. December 1972.
262. U.S. Department of Commerce, Bureau of Census. 1980 Census of Population and Housing Advance Report for Arkansas. March 1981.
263. U.S. Dept. of Commerce, Bureau of Census. 1980 Census of Population and Housing. Provisional Estimates of Social, Economic, and Housing Characteristics. No date.
264. U.S. Dept. of Commerce, Bureau of Census. 1980 Census of Population: Number of Inhabitants of Arkansas. 1982
265. USDA, Soil Conservation Service Agriculture Information Bulletin No. 260. Soil Erosion the Work of Uncontrolled Water. No date.
266. USDA, Soil Conservation Service Agriculture Information Bulletin No. 267. Know Your Soil. Issued February 1963, Revised August 1970.
267. USDA, Soil Conservation Service, and Kansas Agricultural Experiment Station. Soil Survey of Butler County, Kansas. January 1975.
268. USDA, Soil Conservation Service, and Kansas Agricultural Experiment Station. Soil Survey of Cowley County, Kansas. January 1980.
269. USDA, Soil Conservation Service, and Kansas Agricultural Experiment Station. Soil Survey of Kingman County, Kansas. May 1979.

270. USDA, Soil Conservation Service, and Kansas Agricultural Experiment Station. Soil Survey of Reno County, Kansas. March 1966.
271. USDA, Soil Conservation Service, and Kansas Agricultural Experiment Station. Soil Survey of Sedgwick County, Kansas. April 1979.
272. USDA, Soil Conservation Service, and Kansas Agricultural Experiment Station. Soil Survey of Sumner County, Kansas. April 1979.
273. USDA, Soil Conservation. Service/Arkansas Agricultural Experiment Station. Soil Survey of White County, Arkansas. No date.
274. USDA, Soil Conservation Service/Sedgwick County Conservation District Agriculture Information Bulletin No. 349. Soils and Septic Tanks. No date.
275. USDA, Soil Conservation Service/Sedgwick County Conservation District, Wichita, Kansas, Leaflet No. 517. Russian-Olive for Wildlife and Other Conservation Uses. No date.
276. USDA, Soil Conservation Service/Sedgwick County Conservation District, Wichita, Kansas. Papers on Habitat Management of Various Game and Non-game Species. Various dates.
277. USDA. Soil Conservation Service/U. of Arizona Agricultural Experiment Station. Tucson-Avra Valley Area, Arizona. April 1972.
278. USDA. Soil Conservation Service/U. of Arkansas Agricultural Experiment Station. Soil Survey of Conway, County Arkansas. No date.
279. USDA. Soil Conservation Service/U. of Arkansas Agricultural Experiment Station. Soil Survey of Faulkner County, Arkansas. No date.
280. USDA. Soil Conservation Service/U. of Arkansas Agricultural Experiment Station. Soil Survey of White County, Arkansas. No date.
281. USDA, Soil Conservation Service. Waste Disposal...Soil Surveys Can Help You. Issued September 1974.
282. USDA, Soil Conservation Service, Wichita, Kansas. A Conservation Plan...for a Developing Area. Issued January 1973.
283. U.S. Dept. of Labor. Employment Trends Hot Springs Labor Area. April 5, 1982.
284. US Dept. of Labor. Employment Trends Jonesboro Labor Area. April 8, 1982.
285. U.S. Dept. of Labor. Employment Trends Little Rock-North Little Rock Metropolitan Area. April 5, 1982.
286. U.S. Dept. of Labor. Employment Trends Pine Bluff Metropolitan Area. April 7, 1982.

287. U.S. Postal Service. Arkansas Zip Code Directory. 1979.
288. University of Arkansas Industrial Research and Extension Center. Arkansas 1980 Census Summary Type File Summary by County. April 1982.
289. University of Arkansas, Little Rock, Arkansas. An Economic Adjustment Plan for Fort Smith, Arkansas. April 1980.
290. University of Arkansas, Little Rock, Arkansas. An Economic Adjustment Plan for Phillips County, Arkansas. January 1980.
291. University of Arkansas, Little Rock, Arkansas. Arkansas Personal Income Handbook, May, 1981.
292. University of Arkansas, Little Rock, Arkansas. Arkansas: State and County Economic Data. December 1981.
293. Utah Job Service for Employment Security. May 1982 Civilian Labor Force Data, Personal contact with Mr. Dick Money. June 10, 1982.
294. Valley National Bank of Arizona. Arizona Statistical Review 36th Annual Edition. September 1980.
295. Virginia Polytechnic Institute and State University. After the Flood. A Guide for Restoration of Flooded Homes and Farms. No date.
296. Vogler, Robert. Utility Engineer, 381st Missile Wing, McConnell AFB. Personal contact, May 12, 1982.
297. Wachinski, Anthony M. and Jay A. Farmwald, Environics Division, Environmental Sciences Branch, Engineering & Services Laboratory, Air Force Engineering and Services Center, Tyndall AFB, Florida. The Toxicity and Biodegradability of Hydrazine Wastewaters Treated with UV-Chlorinolysis. April 1980.
298. Warner, Sharon. Attorney, U.S. Attorney Generals Office, Wichita, Kansas. Personal contact, May 13, 1982.
299. Weber County Planning Commission, Estimated Number of Housing Units, Personal contact, June 10, 1982.
300. Wichita Area Chamber of Commerce, Wichita, Kansas. Various publications on Wichita and Kansas.
301. Wichita (Kansas) Public Schools Unified School District 259. Statistical Report for School Year 1980-1981. October 1981.
302. Wichita Public School District 259, Division of Research, Planning, and Development Services. Housing Report. The Effects of Selected Housing Developments upon the East Area Schools USD 259. January 1982
303. Wichita Public School District 259, Division of Research, Planning, and Development Services. Housing Report. The Effects of Selected Housing Developments upon the North Area Schools USD #259. January 1982.

304. Wichita Public School District 259, Division of Research, Planning, and Development Services. Housing Report. The Effects of Selected Housing Developments upon the South Area Schools USD #259. January 1982.
305. Wichita Public School District 259, Division of Research, Planning, and Development Services. Housing Report. The Effects of Selected Housing Developments upon the West Area Schools USD #259. January 1982.
306. Wichita Public School District 259, Division of Research, Planning, and Development Services. Statistical Report for School Year 1980-1981 Wichita (Kansas) Public Schools USD 159. October 1981.
307. Wichita-Sedgwick County Metropolitan Area Planning Dept. Annual Intergovernmental Survey. 1978.
308. Wichita-Sedgwick County Metropolitan Area Planning Dept. Censustats 1980 Census Data for Wichita and Sedgwick County. April 1982.
309. Wichita-Sedgwick County Metropolitan Area Planning Dept. Population Wichita-Sedgwick SMSA 1970/1980. October 1980.
310. Wichita-Sedgwick County Metropolitan Area Planning Dept. Revised Population Projection for Butler County. September 1977.
311. Wichita-Sedgwick County Metropolitan Area Planning Dept. Revised Population Projections for Sedgwick County. May 1978.
312. Wichita-Sedgwick County Metropolitan Area Planning Dept. Small City Report Profile for Andale, Kansas. 1971-1977. Prepared April 1978.
313. Wichita-Sedgwick County Metropolitan Area Planning Dept. Small City Report Profile for Bel Aire, Kansas. No date.
314. Wichita-Sedgwick County Metropolitan Area Planning Dept. Small City Report Profile for Bentley, Kansas. No date.
315. Wichita-Sedgwick County Metropolitan Area Planning Dept. Small City Report Profile for Chevey, Kansas. No date.
316. Wichita-Sedgwick County Metropolitan Area Planning Dept. Small City Report Profile for Clearwater, Kansas. No date.
317. Wichita-Sedgwick County Metropolitan Area Planning Dept. Small City Report Profile for Derby, Kansas. No date.
318. Wichita-Sedgwick County Metropolitan Area Planning Dept. Small City Report Profile for Eastbrough, Kansas. No date.
319. Wichita-Sedgwick County Metropolitan Area Planning Dept. Small City Report Profile for Garden Plain, Kansas. No date.
320. Wichita-Sedgwick County Metropolitan Area Planning Dept. Small City Report Profile for Goddard, Kansas. No date.
321. Wichita-Sedgwick County Metropolitan Area Planning Dept. Small City Report Profile for Mulvane, Kansas. No date.

- 322. Wichita-Sedgwick County Metropolitan Area Planning Dept.
Small City Report Profile for Oaklawn-Sunview, Kansas. No date.
- 323. Wichita-Sedgwick County Metropolitan Area Planning Dept.
Small City Report Profile for Park City, Kansas. No date.
- 324. Wichita-Sedgwick County Metropolitan Area Planning Dept.
Small City Report Profile for Valley Center, Kansas. No date.
- 325. Wichita-Sedgwick County Metropolitan Area Planning Dept.
Small City Report Profile for Viola, Kansas. No date.
- 326. Wichita-Sedgwick County Metropolitan Area Planning Dept.
Water Systems and Supplies to Year 2000 Sedgwick County, Kansas. November 1977.
- 327. Williamson, Bill M. Industrial Development Specialist,
University of Arkansas Research and Extension Center.
Personal contact, April 29, 1982.
- 328. Witkin, Max. District Archaeologist, Little Rock District
Corps of Engineers. Personal contact, April, 1982.
- 329. Youngman, Dr. Art. Professor of Biology, Wichita State
University. Personally contact, May 15, 1982.
- 330. Zimmerman, Mr. Kansas Employment Service Research and
Statistics Division, Personal contact, July 15, 1982.

END

FILMED

384

DTIC