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DRAFT ENVIRONMENTAL IMPACT STATEMENT

SECOND KC-135R
AIR REFUELING SQUADRON
MALMSTROM AIR FORCE BASE
MONTANA

UNITED STATES AIR FORCE
MAY 1989

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The United States Air Force proposes to deploy a Second KC-135R Air Refueling Squadron consisting of 14 additional tanker aircraft, at Malmstrom AFB, Montana. The aircraft will arrive in late 1991 and will bring the total number of assigned KC-135R aircraft to 30. Except for normal localized traffic patterns, the aircraft will fly more than 3,000 feet above ground, using existing established and approved airways and routes. Because no other base in the region can support the needed refueling mission, the no action alternative was the only alternative action considered. The primary environmental concern associated with the proposed action is the effect of additional vehicular traffic. Mitigation measures can be taken to reduce the additional traffic during peak load periods.					
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DEPARTMENT OF THE AIR FORCE
WASHINGTON DC 20330

OFFICE OF THE ASSISTANT SECRETARY

May 3, 1989

TO: ALL INTERESTED GOVERNMENT AGENCIES, PUBLIC GROUPS, AND
INDIVIDUALS

Attached for your review and comment is the Draft
Environmental Impact Statement (EIS) for Deployment of the Second
KC-135R Air Refueling Squadron at Malmstrom AFB, MT. The document
is provided in compliance with the regulations of the President's
Council on Environmental Quality.

The Draft EIS addresses the proposed action of deploying a
Second Air Refueling Squadron consisting of 14 aircraft at
Malmstrom AFB.

A public hearing will be held 31 May 1989 to provide an
opportunity for you to offer comments and present questions
concerning the Draft EIS for preparation of the Final EIS. Notice
of the time and place of the meeting will be announced in the local
news media.

The review and comment period ends on 27 June 1989. Please
forward any comments to:

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Deputy Assistant Secretary of the Air Force
(Environment, Safety and Occupational Health)

1 Attachment
Draft EIS



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SUMMARY

S.0 INTRODUCTION

It is proposed to deploy a second squadron of KC-135R aircraft in support of the 301st Air Refueling Wing (AREFW). Malmstrom AFB is proposed as the recipient of this mission in order to free required space for the Air Force's B-2 aircraft at various locations around the country. Since no other installation in the region can support the needed refueling mission, Malmstrom AFB was designated as the recipient of this mission. Therefore, the Alternative Action is the No Action Alternative.

Since significant impacts could be found, an Environmental Impact Statement was prepared. The impacts upon ten resource categories (issue areas) are discussed. They are: socioeconomics, utilities, transportation, land use, cultural, biological, water, geology and soils, air quality, and noise. In addition, safety issues are addressed. Significant environmental issues identified during the scoping process have been incorporated into the analysis. Mitigation measures to reduce significant adverse impacts are also identified.

S.0.1 PROPOSED ACTION

The Proposed Action is to base 14 additional KC-135R aircraft at Malmstrom AFB, Montana, with appropriate support facilities and support personnel. The aircraft will arrive in late 1991, and will bring the total number of assigned KC-135R aircraft to 30. Except for normal localized traffic patterns, the aircraft will fly more than 3000 feet above ground level, using existing established and approved airways and routes.

S.0.2 ALTERNATIVE ACTION

This basing action is needed to meet Single Integrated Operations Plan (SIOP) mating and ranging requirements for National Defense Alert. No other base in the region is considered suitable for this mission. Other bases in the region are at capacity and cannot accept additional aircraft. Other regions do not meet criteria for SIOP mating and ranging or peacetime refueling support for day-to-day training. The number of aircraft are matched against future bomber aircraft basing plans for air refueling requirements. Movement of fewer aircraft would not meet mission requirements. Therefore, the only alternative is the No Action alternative. The No Action alternative is unsatisfactory since it would not base sufficient numbers of tanker aircraft assets in the region to support national defense requirements and future basing actions.

S.0.3 OTHER FUTURE AIR FORCE PROGRAMS AT MALMSTROM AFB

Currently, two other major programs are under consideration for deployment at Malmstrom AFB. They are the Peacekeeper missiles in the Rail Garrison basing mode and the Small ICBM deployment programs.

S.0.3.1 Peacekeeper Rail Garrison Program

In this basing mode, Peacekeeper missiles are deployed on trains garrisoned at specified Air Force installations. Missile trains would remain in

garrisons on a day-to-day basis, and would move off the installations onto the national rail network only during times of national need. F E Warren Air Force Base (AFB) near Cheyenne, Wyoming, was designated by the President as the Main Operating Base (MOB) and the first garrison installation. In February 1987, the Air Force identified ten additional installations as candidate garrison locations. These candidate installations are Barksdale AFB, Louisiana; Dyess AFB, Texas; Eaker (formerly Blytheville) AFB, Arkansas; Fairchild AFB, Washington; Grand Forks AFB, North Dakota; Little Rock AFB, Arkansas; Malmstrom AFB, Montana; Minot AFB, North Dakota; Whiteman AFB, Missouri; and Wurtsmith AFB, Michigan. If Malmstrom AFB is not chosen as a candidate garrison, or under the No Action Alternative, no Peacekeeper missiles would be deployed there.

S.0.3.2 Small ICBM

The Proposed Action provides for the deployment of 200 Hard Mobile Launchers (HMLs) in earth-covered igloos (arched shelters) at 100 launch facilities in Montana. The Proposed Action provides for the construction of military housing for about 90 percent of new Air Force families. New housing would be constructed on land to be acquired adjacent to Malmstrom AFB. Under the No Action alternative, no Small ICBMs would be deployed at Malmstrom AFB.

S.0.4 SUMMARY AND COMPARISON OF PROGRAM IMPACTS

Figure S.0.1 summarizes the impacts of the Proposed Action, the cumulative impacts of the Proposed Action plus the Peacekeeper Rail Garrison Program, and the Proposed Action and the Peacekeeper Rail Garrison plus the Small ICBM programs.

For the Proposed Action, Moderate and significant short- and long-duration impacts were found for transportation, as a result of program-related traffic further degrading existing substandard service levels on 10th Avenue South.

For the cumulative impacts of the Proposed Action plus the Peacekeeper Rail Garrison program, low long-duration impacts for socioeconomics would also become significant because the current substandard conditions in the Cascade County jail could be further stressed as a result of a larger population.

If the Small ICBM Program impacts were added to the Proposed Action and the Peacekeeper Rail Garrison Program, short-duration socioeconomic impacts would also become significant along with long-duration geology and soil impacts. Short-duration socioeconomic impacts would be high and significant because the large number of construction-related immigration has the potential of further burdening the already inadequate county jail facilities. Another contributor to the long-duration significant impact rating is the need to expand school facilities in the area of the base to serve the additional operations personnel. Long-duration moderate geology and soil impacts would become significant because of the damage caused by continued hard mobile launcher operations. The concurrent deployment of the Proposed Action with the Peacekeeper Rail Garrison Program and the Small ICBM Program would also result in high and significant air quality impacts because of the fugitive dust generated by the movement of the hard mobile launchers of (HML) during training maneuvers.

The analysis of social impacts, as presented in Section B, shows that while the cumulative impacts of the Proposed Action, the Peacekeeper Rail Garrison Program, and the Small ICBM Program are significant, they are not of any one

FIGURE S.O-1

SUMMARY OF IMPACTS
PROPOSED ACTION, NO ACTION ALTERNATIVE, CUMULATIVE IMPACTS
ENVIRONMENTAL RESOURCES

	SOCIOECONOMICS			UTILITIES			TRANSPORTATION			LAND USE			CULTURAL RESOURCES			BIOLOGICAL RESOURCES			WATER RESOURCES			GEOLOGY & SOILS			AIR QUALITY			NOISE		
	SHORT DUR	LONG DUR		SHORT DUR	LONG DUR		SHORT DUR	LONG DUR		SHORT DUR	LONG DUR		SHORT DUR	LONG DUR		SHORT DUR	LONG DUR		SHORT DUR	LONG DUR		SHORT DUR	LONG DUR		SHORT DUR	LONG DUR				
	LOI	LOW/3	LOW/B	N/A	LOW		MOD	MOD		NEG	NEG	N/A	NEG	NEG		NEG	NEG		LOW	LOW		MOD	NEG	NEG	NEG	NEG				
PROPOSED ACTION	SIG	NO/B	NO/B	N/A	NO		YES	YES		NO	NO	N/A	N/A	NO		NO	NO		NO	NO		NO	NO	NO	NO	NO				
NO ACTION ALTERNATIVE		F B M		F B M		F B M		F B M		F B M		F B M		F B M		F B M		F B M		F B M		F B M		F B M		F B M		F B M		
CUMULATIVE: PROPOSED ACTION PLUS PEACEKEEPER RAIL GARRISON	LOI	LOW/B	LOW/B	N/A	LOW		HIGH	HIGH		NEG	NEG	N/A	NEG	LOW	MOD		LOW	NEG		LOW	LOW		HIGH	NEG	MOD	NEG				
	SIG	YES/B	YES/B	N/A	NO		YES	YES		NO	NO	N/A	NO	NO	NO		NO	NO		NO	NO		NO	NO	NO	NO				
CUMULATIVE: PROPOSED ACTION PLUS PEACEKEEPER RAIL GARRISON AND SMALL ICEM	LOI	HIGH/B	HIGH/B	N/A	HIGH		HIGH	HIGH		MOD	MOD	N/A	LOW	MOD	MOD		LOW	MOD		LOW	MOD		HIGH	MOD	MOD	HIGH				
	SIG	YES/B	YES/B	N/A	NO		YES	YES		NO	NO	N/A	NO	NO	NO		NO	NO		NO	NO		YES	NO	NO	YES				

LOI - Level of Impact
 Resource with significant impact
 FBM - Future Baseline Maintained
 SIG - Significant
 Yes - Significant
 No - Not Significant
 N/A - Not Applicable
 MOD - Moderate
 NEG - Negligible
 Dur - Duration
 /B - With beneficial impacts

of the above mentioned programs, these programs would generally be safe. Mishaps only pose a negligible risk to human health and the environment.

S.1 SUMMARY BY ENVIRONMENTAL RESOURCE

The environmental consequences of the proposed deployment of Second KC-135R AREFS were evaluated in terms of the magnitude and significance of impacts. Magnitude is a measure of the numbers and kinds of environmental consequences of the program as compared with existing and future baseline conditions. Magnitude is defined by the Level of Impact (LOI), which can be negligible, low, moderate, or high. Significance requires consideration of both the context and the intensity of impacts. Context includes consideration of whether the setting of an impact is at the local, or regional level, and whether it is of short or long duration. Intensity refers to the severity of an impact, which includes consideration of its magnitude (See Appendix A for more details).

The LOI and significance of short and long-duration impacts were evaluated separately. Short duration impacts are transitory effects of the proposed program that are generally caused by construction activities or operations start-up. Long duration impacts would occur over an extended period of time, whether they begin in the construction or operations phases. Most impacts of the operations phase are expected to be of long duration because program operations essentially represent a steady-state condition (i.e., impacts result from actions that continue over a long period of time). However, long-duration impacts can also be caused by construction activities if a resource is destroyed or irreparably damaged, or if the recovery rate of the resource is very slow, or may begin during the construction period (e.g., traffic congestion), and continue at the same level throughout the operational period (See Appendix A for more details).

S.1.1 Socioeconomics

For the Proposed Action and the cumulative Peacekeeper Rail Garrison and Small ICBM Programs, beneficial socioeconomic effects, such as increases in employment and income and greater utilization of vacant housing, would occur. For the Proposed Action, both short and long-duration impacts were concluded to be low and not significant because of the following findings:

- o Although the 116 additional students are projected to accompany immigrating operations-period workers, the elementary school pupil-to-teacher ratio is projected to change only from 21.5-to-1 to 21.7-to-1. This ratio would remain below the weighted average for all grades per state standards.

- o Public services staffing levels, as expressed in personnel per 1000 population, would change very little in either Great Falls or Cascade County. Although the County Jail is currently overcrowded, the relatively small number of military immigrants would not make a noticeable difference in its operation. Moreover, a large number of infractions by military personnel will be processed by military authorities, thus not impacting local law enforcement agencies, or jointly by military and civilian law enforcement agencies. The small number of construction workers immigrating are not expected to cause a significant impact on the jail population.

- o Except for education, local tax collections are projected to increase adequately to cover the additional expenses associated with program immigrants. The projected 0.5 percent shortfall in the education budget

would not trigger a significant impact but will require the attention of local school officials.

Short- and long-duration impacts for the cumulative impact of the Proposed Action plus the Peacekeeper Rail Garrison Program would remain low but would become significant because of the possibility that the overcrowded county jail conditions could become worse.

If the cumulative impacts of the Peacekeeper Rail Garrison and the Small ICBM Programs were added to the Proposed Action, short- and long-duration Levels of Impact for socioeconomics would be elevated to high and the impact would be significant. The primary reasons for this change would be the overcrowding of some schools within the Great Falls School District, the potential County Jail capacity problem, and shortages of public revenues to maintain current public service standards.

S.1.2 Utilities

All impacts for utilities are projected to be of long duration, since they start during the construction phase and continue during the operations phase. For the Proposed Action, the Level of Impact would be low and the impact would not be significant. Supply capacities are more than adequate to meet the potential demand.

The cumulative impacts of the Proposed Action and the Peacekeeper Rail Garrison Program combined would not change the Level of Impact or the determination of no significance. If the Small ICBM were added, the long-duration level of impact would be raised from low to high, because for some utility components the demand would increase by more than 10 percent. Impacts would not be significant, however, because current capacities would be able to satisfy this demand.

S.1.3 Transportation

For the Proposed Action, the Level of Impact on transportation would be moderate for both short- and long-duration because the level of street traffic service would change from C to D in some locations, and there would be additional traffic on roads operating at levels D and E. This impact would occur during the construction and operations phases. The increase in traffic would be considered significant because of adding loads to the existing substandard service levels.

The cumulative impacts of both the Peacekeeper Rail Garrison Program and the Proposed Action would change from moderate to high and significant because of increased congestion and delays along 10th Avenue South.

If the impacts of the Proposed Action were aggregated with those of the Small ICBM and the Peacekeeper Rail Garrison Programs, the Levels of Impact would become high because of increased congestion along 10th Avenue South, US Highway 87/89, 2nd Avenue North, 57th Street, and US Highway 87 Bypass, and other arterial streets. The impact would be significant because of the substandard levels of service involved.

S.1.4 Land Use

For the Proposed Action, the short and long duration Levels of Impact on land use would be negligible and not significant.

Likewise, the cumulative impacts of both the Proposed Action and the Peacekeeper Rail Garrison Program would yield a negligible Level of Impact for both the short and of long duration. These impacts would be rated not significant.

The cumulative impacts of the Proposed Action plus the Peacekeeper Rail Garrison and Small ICBM Programs would raise the Level of Impact to moderate because of the visual intrusions caused by the Training Train Shelter. The impact would not, however, be rated as significant.

S.1.5 Cultural Resources

All cultural resource impacts are considered to be of long duration, because once these resources are lost, the possibility is that they are lost forever. For the Proposed Action, the Level of Impact is negligible and the impact is rated as not significant.

For the cumulative impact of both the Proposed Action and the Peacekeeper Rail Garrison Program, the Level of Impact would also be negligible and rated as not significant.

For the cumulative impact of the Proposed Action, the Peacekeeper Rail Garrison Program, plus the Small ICBM Program, the Level of Impact would increase to low because lithic scatters are common throughout the ROI. The impact was not rated as significant because the affected site is not likely to be eligible for the National Register of Historic Places (NRHP).

S.1.6 Biological Resources

For biological resources, the short- and long-duration Levels of Impact would be ranked negligible and rated not significant for the Proposed Action.

For the cumulative action comprised of both the Proposed Action and the Peacekeeper Rail Garrison Program, short-duration impacts would be low due to construction disturbance and long-duration impacts would be moderate because 2.8 acres of wetland would be permanently disturbed. However, impacts would not be significant.

If the impacts of the Small ICBM Program were added to the cumulative impacts of the Proposed Action plus the Peacekeeper Rail Garrison Program, these impacts would essentially remain the same. The Levels of Impact for the short and long duration would be moderate. The impact would be rated as not significant.

S.1.7 Water Resources

For Water resources, the short and long-duration Level of Impact were ranked as low, because only minor hydrologic changes and minor degradation of water quality would occur. The impacts are rated as not significant.

For the cumulative impact comprised of the Proposed Action plus the Peacekeeper Rail Garrison Program, the Level of Impact for the short and long duration would remain low.

The cumulative impact for the Proposed Action plus the Peacekeeper Rail Garrison and Small ICBM Programs would remain as previously described.

The short- and long-duration Level of Impact would be low and moderate, respectively, and they are rated not significant.

S.1.8 Geology and Soils

For the Proposed Action, the Level of Impact for the Geology and Soils resource for the short- and long-duration would be moderate and negligible, respectively, and the impact would be rated as not significant.

If both the Proposed Action and the Peacekeeper Rail Garrison Programs were brought on line, the long-duration Level of Impact would remain negligible, but the short-duration level would increase to high because the accelerated rates of erosion during program-related construction would exceed the maximum tolerable soil loss of soils affected. Both short- and long-duration impacts would retain the no significance rating.

For the Proposed Action plus the Peacekeeper Rail Garrison and Small ICBM Programs, the short-duration cumulative impacts would exhibit a high level of impact but would not be significant. The long-duration Levels of Impact would be moderate and significant because the Hard Mobile Launcher would result in continuous on base ground disturbance during training activities.

S.1.9 Air Quality

For the Proposed Action, the short- and long-duration Levels of Impact (LOI) for the Air Quality resource are ranked as negligible. Both are rated as not significant.

Adding the Peacekeeper Rail Garrison Program impacts to the Proposed Action would not change the ratings. However, short-duration air quality impacts at the nearest property line would be moderate because 24-hour PM₁₀ concentrations would reach about 112/ug/m³ at the nearest property line. The cumulative impacts for long-duration Levels of Impact would remain negligible, and the impacts for both the short- and long-duration would be rated as not significant.

Concurrent deployment of the Second KC-135R AREFS Peacekeeper Rail Garrison and Small ICBM programs at Malmstrom AFB would result in additional onbase construction activities, creating additional air pollutant emissions. The local, short-duration impacts at the base property lines would be moderate and not significant. The long-duration air quality impacts at the base property lines would be high and significant because of the fugitive dust generated by the operation of the Hard Mobile Launchers (HML) during training activities.

S.1.10 Noise

The short-duration Level of Impact for the Noise resource is ranked negligible because most of the noise associated with the construction phase will not measurably affect sensitive receptors or existing noise contours.

For the long-duration, the Level of Impact for the Proposed Action would be moderate because the DNL noise levels would increase between 5 dB and 10 dB at the location of sensitive receptors. The impact would be rated not significant because housing occupants would not be exposed to noise levels exceeding DNL 75 dB due to the proposed action.

The long-duration cumulative Levels of Impact for the Proposed Action and the Rail Garrison Program would be similar to those described for only the Proposed Action because the Rail Garrison Program will not result in additional aircraft operations. The short-duration Level of Impact would change to moderate because noise levels during the Rail Garrison construction period would increase between 5dB and 10dB at the location of sensitive receptors. The short-duration impact would, however, remain not significant.

If, in addition to impacts from the Proposed Action, the impacts from both the Peacekeeper Rail Garrison and the Small ICBM Programs were added, short and long-duration noise impacts would remain moderate and not significant.

S.2 Safety Considerations

As is the case with commercial aircraft, with flying operations there is a certain risk of mishaps while aircraft are in the air or on the ground. Given the type of aircraft, the location of the airfield, landing and takeoff patterns, as well as the modern refueling facilities, it was determined that there are no extraordinary safety risks associated with the proposed action.

S.3 Mitigations

Significant adverse effects on traffic can be mitigated, in part, through scheduling work hours. Significant noise impacts can be mitigated largely by removing base military family housing mobile homes from areas within high noise contours, and through housing revitalization programs that include noise attenuating improvements. Geology and soils impacts can be mitigated by building sediment traps and reduction of ground slopes. Air Quality impacts can be mitigated by watering the disturbed area.

S.4 Issues to be Resolved

The major issues to be resolved involve the selection of mitigations from those listed for resources with significant impact. Policy makers have to decide which mitigations or a combination of mitigations are not only most effective, but most cost effective.

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1.0 PURPOSE AND NEED FOR ACTION

The United States National Defense policy dictates that strategic forces must provide a credible deterrence through a stable force posture that is both actually and perceived to be strategically equivalent to that of the Soviet Union. Essential to this perception is the continued modernization of all elements of the Strategic Triad. The B-1 and B-2 aircraft are designed to modernize the strategic bomber leg of the triad, which also includes land-based and at-sea ballistic missile systems. The strategic placement of refueling aircraft is an essential element of the Strategic Bomber force. This action is needed to move 14 KC-135R aircraft from numerous SAC locations which would free required space for the Air Force's Multiple Advanced Technology Bomber (ATB), also known as B-2, basing moves. The aircraft and aircrew and maintenance personnel will come from bases to be determined later.

The KC-135R aircraft was designed, manufactured and re-engined by the Boeing Company and is a four engine (CFM International F-108-CF-100 high bypass turbofan), swept wing, long range, high altitude, high speed aircraft. This aircraft is primarily used as a refueling tanker to support inflight refueling of bomber and fighter series aircraft. The KC-135R aircraft is required to support the B-1 bomber force. The updated KC-135R aircraft has a longer range, improved performance characteristics and a lower level of noise generation than older models.

Because no other base in the region can support the needed refueling mission, no other base is considered for this mission. Movement of fewer aircraft would not meet mission requirements and, therefore, the only alternative is the No Action Alternative. The No Action Alternative is unsatisfactory since it would not free the required space for the Air Force's B-2 bomber, at other bases.

The environmental issues addressed in this EIS were identified through the public scoping process, through consultations with federal and state agencies, and by Air Force and contractor personnel who have experience with programs of similar scope. For discussion and analysis, the issues are grouped into ten resource categories: socioeconomics, utilities, transportation, land use, cultural resources, biological resources, water resources, geology and soils, air quality, and noise.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

The Air Force proposed to deploy an additional 14 aircraft to support the Second KC-135R AREFS with its operational maintenance and associated support organizations at Malmstrom Air Force Base (AFB), Montana, during the calendar year 1990-1991. This will augment the recent deployment of the 91st Air Refueling Squadron with 16 KC-135R aircraft at full strength. The 14 KC-135R aircraft of the Second Squadron will be located on existing aircraft parking (ramp) space and will utilize both new and existing aircraft operation and maintenance facilities at Malmstrom AFB. Several existing facilities, however, need to be altered or expanded to support the Second Squadron (See Table 2.4-1 for more details). Also, the base primary electrical distribution system and water storage capacity will have to be modified and expanded.

The basing of 14 additional KC-135R aircraft at Malmstrom AFB will result in an increase of approximately 3510 flying hours annually. Approximately 425 flying hours will be spent in the local traffic patterns annually. This amount will be added to the 16 aircraft assigned to the 91st AREFS with 4,010 annual flying hours of which about 490 are spent in local traffic patterns. The average number of transient aircraft operations are approximately 1,200 hours annually. The transient operations include logistical air support, medical air evacuations, US Customs clearance, and transcontinental Naval and Air Force flight refueling stops and Montana Air National Guard Training Flights. Malmstrom AFB has six UH-1N helicopters authorized for Minuteman weapon system and rescue and recovery support.

Table 2.1-1 shows an increase of 284 personnel due to the proposed Second KC-135R AREFS aircraft mission during steady state operations. This total does not take into account the increase or decrease of personnel positions resulting from any other actions affecting Malmstrom AFB manpower authorizations.

2.2 Alternatives

This basing action is needed to meet Single Integrated Operations Plan (SIOP) mating and ranging requirements for National Defense Alert. No other base in the region is considered suitable for this mission. Other bases in the region are at capacity and cannot accept additional aircraft. Other regions do not meet criteria for SIOP mating and ranging or peacetime refueling support for day-to-day training. The number of aircraft are matched against future bomber aircraft basing plans for air refueling requirements. Movement of fewer aircraft would not meet mission requirements. Therefore, the only alternative is the No Action alternative. The No Action alternative is unsatisfactory since it would not base sufficient number of tanker aircraft assets in the region to support national defense requirements and future basing actions.

2.3 OTHER FUTURE PROGRAMS AT MALMSTROM AIR FORCE BASE

Two other Air Force programs have announced Malmstrom AFB as a potential deployment location. These programs are the Peacekeeper Rail Garrison Program and the Small Intercontinental Ballistic Missile Program.

Table 2.1.1

PROPOSED ACTION
MANPOWER REQUIREMENT AT MALMSTROM AIR FORCE BASE

Type of Employment	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993*</u>
Construction	157	86	32	-0-	-0-
Military** Operations	-0-	-0-	115	274	274
Civilian Operations	-0-	-0-	4	10	10
TOTAL	157	86	151	284	284

* 1993 represents steady state program operations in subsequent years.

** Authorized positions may vary from manning strengths. Operations personnel include base support positions.

2.3.1 Peacekeeper Rail Garrison Program

Malmstrom AFB is one of ten Air Force bases being considered as a deployment location (in addition to the main operating base at F E Warren AFB, Wyoming) for the Peacekeeper Rail Garrison basing mode. If Malmstrom AFB is selected as a Rail Garrison location, four to six train alert shelters would be constructed within a secure fenced area. Personnel support facilities and other technical facilities would also be constructed. Initial Operational Capability (IOC) could be as early as December 1991 with Final Operational Capability (FOC) as early as December 1993. Impacts of this programs on the environment are discussed as part of the cumulative impacts in Chapter 4.0. For more details, see the Final Environmental Impact Statement, Peacekeeper Rail Garrison Program.

2.3.2 Small Intercontinental Ballistic Missile Program

President Reagan, in December 1986, selected Malmstrom AFB as the location for deployment of the first 200 missiles at Minuteman launch facilities within the 341st Strategic Missile Wing. The Proposed Action for this program provides for the deployment of 200 Small Intercontinental Ballistic Missiles on Hard Mobile Launchers (HMLs) in earth-covered igloos at 100 launch facilities in Montana. This would require construction of a number of new facilities as well as the modification of existing facilities. Some land acquisition in the immediate vicinity of the base would be required to accommodate some program-related facilities. Construction of facilities would take place over a 6-year period (1990-1995) with the Initial Operational Capability targeted for 1992.

Facilities would also be built at the Minuteman launch facility sites, and roads connecting Malmstrom AFB with the launch facilities would have to be improved. These activities, however, would not generate major impacts on base or in the host community of Great Falls and are not discussed in this document. Only the activities that compound the impacts created by the Second KC-135R AREFS are reported in the cumulative impacts section of Chapter 4.0.

2.3.3 Combining Other Future Programs at Malmstrom AFB

It is possible that construction activities for the Peacekeeper Rail Garrison program at Malmstrom AFB will commence prior to the completion of the beddown of the Second KC-135R AREFS. Therefore, the cumulative impacts of these two programs will be analyzed.

It is also probable that construction for the Small ICBM program will commence before the Rail Garrison program has reached steady state operations. In addition, the Second KC-135R AREFS may not be completely bedded down before the start of construction for the Peacekeeper Rail Garrison program. Given the potential overlaps of these three programs, (Second KC-135R AREFS with Rail Garrison and Rail Garrison with Small ICBM), the cumulative impacts for all three programs will be analyzed.

Since it is highly improbable that the Small ICBM program will overlap with the Second KC-135R AREFS beddown, there will be no cumulative impacts caused by these independent actions.

2.4 DEPLOYMENT ACTIVITIES, PROPOSED ACTION SECOND KC-135R AIR REFUELING SQUADRON

2.4.1 Program Schedule

The first aircraft for the Second KC-135R AREFS are expected to arrive toward the end of Fiscal Year (FY) 1991 and continue until all aircraft are deployed. Full scale operation (FOC) is expected in FY 1992. Military and civilian positions for operations and support dedicated to the Second KC-135R AREFS will be filled starting in late FY 1990. By FY 1992 all authorized positions would be filled.

2.4.2 Facility Construction

Table 2.4-1 presents an overview of major facility construction requirements, the scope of each project.

2.4.3 Program Resource Requirements (including fuel use, vehicles, employment, construction materials, etc.)

The major types of construction material requirements include metal sidings, aggregate, structural steel, reinforcing steel, heating and air-conditioning equipment, cement, lumber, light fixtures, electrical equipment, and rental equipment. See Table 2.4-2 for estimated quantities.

The major types of construction crafts expected to be used include: ironworkers, laborers, and roofers. See Table 2.4-3 for more details.

TABLE 2.4-1
FACILITY REQUIREMENTS

<u>Facility</u>	<u>Scope</u>
Alter Mission Operations	18,200 Square Feet
Alert Crew Support Facility	4,000 Square Feet
ADAL PMEL and FTD Facility	16,200 Square Feet
ADAL Aircraft Parks Store	10,000 Square Feet
Upgrade Base Utilities	
Relocate Base Engineer Shops	15,000 Square Feet
Relocate Transient Aircraft Maintenance Shop	13,000 Square Feet
Three Bay Aircraft Maintenance Hangar	90,000 Square Feet
Alert Aircraft Parking Apron Expansion	24,700 Square Yards
ADAL Alert Crew Facility	26,200 Square Feet
AGE Shop/Storage Addition	10,000 Square Feet
Jet Fuel Storage and Dispensing Facility	- - - - -
Aircraft Maintenance Ramp Lighting	- - - - -
Alert Area Security and Blast Fences	2,500 Square Feet
Flight Simulator Support Facility	4,500 Square Feet
Relocate Publication Distribution Office	6,840 Square Feet
Relocate Personnel Support Facility	12,840 Square Feet
Unaccompanied Enlisted Personnel for Dormitory	38,000 Square Feet

During operations, a major resource requirement consists of jet fuel (JP-4). The annual consumption of JP-4 is expected to increase by 9.6 million gallons due to the requirements associated with the Second KC-135R AREFS.

TABLE 2.4-2

Major Construction Material Requirements
Second KC-135R Air Refueling Squadron

Material	Standard Industrial Classification (SIC) Code	Requirements/Units
Cement	3241	4,758 tons
Course & Fine Aggregate	1423	29,572 tons
Asphalt	2951	185 tons
Roofing	2952	4,381 rolls
Plywood	2431	344,122 sq ft
Lumber	2421	557,858 sq ft
Concrete Block & Brick	3271	360,888 sq ft
Structural Steel	3312	1,578 tons
Reinforcing Steel	3449	887 tons
Metal Siding	3448	469,001 sq ft
Miscellaneous Metal	3444	516,107 pounds
Heating Equipment	3433	\$931,897 lump sum
Air-conditioning Equipment	3585	\$665,575 lump sum
System Pipe & Fire Sprinkler System	4595	170,452 linear ft
Plumbing Fixtures	3432	\$362,736 lump sum
Equipment Handling	3536	\$782,464 lump sum
Electrical Wiring	3643	718,858 linear ft
Light Fixtures	3646	\$890,561 lump sum
Electrical Equipment	3613	\$608,914 lump sum
Communications System	3644	\$270,921 lump sum
Other	3442	\$3,356,597 lump sum
Water - Construction	----	5 acre ft
Equipment Rental	7394	\$1,608,254 lump sum
Vehicle Rental	7512	\$105,815 lump sum

TABLE 2.4-3

Construction Craft Employment Requirements for
Second KC-135R Air Refueling Squadron

<u>Labor</u>	<u>Total Manhours</u>	<u>Percentage of Total Manhours</u>
Carpenter	73,758	13.1
Cement Mason (brick)	102,788	18.3
Drywall Installer	2,444	0.4
Electrician	22,370	4.0
Electric Lineman	3,650	0.6
Ironworker	56,375	10.0
Laborer	161,482	28.7
Operating Engineer	9,462	1.7
Painter	10,667	1.9
Pipefitter	3,361	0.6
Plumber	4,644	0.8
Roofer	28,156	5.0
Sheetmetal Worker	8,267	1.5
Others as Required	22,383	4.0
Direct Labor (only)	<u>511,338</u>	
Management	51,134	9.1
TOTAL	562,472	100

2.5 Scoping

Scoping was undertaken in response to the above-mentioned federal requirements as part of the assessment of environmental impacts of major federal actions. The scoping process involved a series of activities that included:

- o A prescoping effort to collect preliminary data and information from federal, state, and local government organizations in the affected area;
- o A series of scoping meeting with the public and with governmental organizations in the affected area; and
- o Analysis and documentation of scoping results.

On 23 March 1988, a public scoping meeting was conducted in Great Falls, Montana covering both the Second KC-135R AREFS and the Peacekeeper Rail Garrison programs.

A wide range of issues related to the physical and social environment which included safety concerns were identified through the scoping process. Although almost all comments were directed toward the Peacekeeper Rail Garrison (PRG) program any issue applicable to the Second KC-135R AREFS has been addressed in this EIS.

Major social issues raised at the scoping meetings included program effects on employment, housing, education, public services, transportation, cultural resources, and visual resources; major physical science issues included program effects on biological resources, threatened and endangered species, water, air quality, noise, and safety. Based on past experience with programs of similar scope and discussions with public officials, all important issue areas were grouped into resource categories and presented at the scoping meetings. The comments and questions raised throughout the scoping process suggest that the important issues can be addressed through investigations in these resources areas.

2.6 POTENTIAL MITIGATION MEASURES

Potential mitigation measures are undertaken to minimize the adverse environmental impacts of a given program. Environmental impacts of the Proposed Action may be mitigated by commonly practiced construction methods or actions directed by Air Force and US Army Corps of Engineers. To the extent practical in consideration of operational requirements and schedule, standard construction practices that help reduce or eliminate environmental impacts are taken into account as part of the program. These assumed construction practices and other assumed mitigation measures are discussed in Chapter 4.0 and Appendix A. The Air Force expects to implement these assumed mitigations. Additionally, a discussion of potential mitigation measures to further reduce impacts and the agencies involved in their implementation can also be found in Chapter 4.0. Implementation of these potential mitigation measures may be constrained by budget limitations and mission requirements.

3.0 AFFECTED ENVIRONMENT

This chapter describes the potentially affected environment at the proposed Second KC-135R AREFS deployment area in Cascade and Lewis and Clark County, including Malmstrom Air Force Base (AFB). Because the Proposed Action would likely be extended into the next decade, it is necessary to develop projections of future baseline conditions against which project impacts can be compared. Therefore, both existing and future baseline conditions without the project are discussed in this chapter. Future baseline conditions include deployment of the First KC-135R Air Refueling Squadron (91st AREFS). The baseline conditions for the affected environment are discussed in terms of the specific resource categories that were presented and compared in Chapter 2.0.

The detailed methodology used to ascertain existing and future baseline conditions are discussed in Appendix A. The major areas of concentration consist of:

- o Socioeconomics
- o Utilities
- o Transportation
- o Land Use
- o Cultural Resources
- o Biological Resources
- o Water Resources
- o Geology and Soils
- o Air Quality
- o Noise

3.1 SOCIOECONOMICS

3.1.1 Resource Description

Six major elements are analyzed in the socioeconomics resource: employment and income, population and demographics, housing, education, public services, and public finance. The results of these analyses are either translated into program impacts, used as inputs for other analyses, or used to describe the socioeconomic environment.

Employment and Income. The employment and income element describes the general level of economic activity for the region surrounding Malmstrom AFB. Civilian labor force, employment, unemployment, total income, and income per capita were the principal attributes used to describe economic conditions.

Population and Demographics. This element presents population trends and selected demographic characteristics of the region. Historical population levels, current population, projected population levels, and the military-civilian mix are the principal attributes discussed.

Housing. The housing element describes the total permanent year-round and temporary housing stock and available vacancies in the vicinity of Malmstrom AFB. Permanent or year-round housing includes single-family, multifamily, and mobile home structures. Temporary or transient housing is defined to include primarily hotel and motel accommodations.

Education. The education element describes the characteristics of affected public and private school systems. Special attention is given to public elementary and secondary school districts. Student enrollment, staff levels, and facility capacities were the principal attributes studied.

Public Services. The public services element describes the overall service delivery systems of affected county and municipal jurisdictions, emphasizing major service functions. The total number of personnel employed by each jurisdiction relative to its population size, and the adequacy of existing equipment and facilities to meet current and projected demands were the principal factors evaluated.

Public Finance. The public finance element describes the fiscal condition of the affected counties, cities, and school districts. Annual operation expenditures, revenues, and reserve funding levels were the principal factors analyzed.

3.1.2 Region of Influence

Employment and Income. The Region of Influence (ROI) for the employment and income element is a multicounty market area, generally within 50 miles of the installation, that serves as a supply region for program-related labor requirements and construction materials. Not all counties within a 50-mile radius of the candidate deployment installations, however, were included in the ROI. The counties which do comprise the ROI are those from which at least 90 percent of local labor and material procurement could be available, and generally includes the principal commercial center in the area. Those two counties are Cascade and Lewis & Clark.

Population and Demographics. The ROI for this element includes areas where most of the population changes attributable to the proposed program would be expected. For the Second KC-135R AREFS Program at Malmstrom AFB this local area includes both Great Falls and Cascade County.

Housing. The ROI for this element includes those communities where most of the housing demand would be expected. In most cases, this would occur in Great Falls and other small communities around Great Falls.

Education. The ROI for this element includes the Great Falls school districts where most of the additional enrollment would be expected.

Public Services. The ROI for this element includes Cascade County and City of Great Falls where most of the public service demands generated by program-related immigration would be expected.

Public Finance. The ROI for this element includes Cascade County, the City of Great Falls, the Great Falls School Districts where increased public service demands would result in appreciable fiscal impacts.

3.1.3 Existing Conditions and Future Baseline

Employment and Income. Major industries in the two-county ROI include agriculture, mining and natural resource production, and local, state, and federal government (including Malmstrom AFB). The commercial trade, finance,

transportation, and service sectors of the area (originating primarily in Great Falls) serve north-central Montana and southern Alberta, Canada.

Total employment in the ROI increased between 1980 and 1984 from approximately 66,800 to 67,100. Overall employment for the region is projected to increase to about 75,600 in 1990 and reach 80,800 by 1995. The unemployment rate for the ROI was 7.3 percent in 1986, lower than the state average of 8.1 percent. The ROI unemployment rate is forecast to decline to 6.9 percent in 1990 and 6.4 percent in 1995.

Cascade County's total employment was reported at 40,800 in 1984, a 2.0 percent decline from the 1980 level. Retail trade, services, and government represented about 75 percent of 1984 employment.

Total earnings in the ROI and Cascade County in 1984 were \$1.1 billion and \$0.6 billion, respectively. Earnings in 1984 represented a 1.1-percent decline in the ROI and a 4.9-percent decline in Cascade County over the 1980 to 1984 period. In 1984, per capita personal income was \$12,300 in the ROI, and \$12,000 in Cascade County.

Total earnings for the ROI are projected at \$1.3 billion over the 1990 to 1995 period. Per capita personal income for the ROI is projected at \$12,300 for the same period. For Cascade County, per capita personal income is projected at \$11,900 for the same period.

Population and Demographics. The population of Cascade County was estimated at 83,700 in 1985, an increase of about 3,000 from the 1980 Census of 80,700. Cascade County population is projected to grow to 86,500 by 1990 and 88,000 by 1995.

Population in the Great Falls urban area (including the city, unincorporated suburbs, and Malmstrom AFB) was about 65,000 in 1985, and is projected to grow to 72,600 by 1990 and 74,000 by 1995.

Military personnel and their dependents amounted to approximately 8,570 persons in the Great Falls urban area in 1986. This was approximately 13 percent of the area's estimated 1986 population of 66,800. The highest share of military population to total community population previously experienced was about 20 percent, recorded in 1972. Military population in the Great Falls area associated with current missions and the first squadron of KC-135R aircraft (301st AREFW and 91st AREFS) is expected to total 10,700 (14.7% of the Great Falls area population) by 1990, and remain at that level in the absence of other future programs.

Housing. There were 27,253 permanent year-round housing units in the Great Falls urban area in 1980. Of these units, 1,722 (6.3%) were vacant and available for rent or sale. By 1985, permanent housing increased to an estimated 29,252 units, with about 970 units (3.3%) vacant and available. In 1986, temporary housing in the Great Falls area included 32 hotels/motels (1,600 rooms) and 4 private campgrounds (260 sites), with an average vacancy rate of 50 and 75 percent, respectively. During the summer months, (the period of peak occupancy), it is estimated that approximately 450 temporary room/sites are available.

In 1987, Malmstrom AFB had 1,406 family housing units on base with an average occupancy rate of 99.7 percent. A mobile home area with spaces for 100

privately owned units is located on base for use by military personnel. About one-half of these spaces were in use in 1987. On base unaccompanied personnel housing facilities have the capacity to house 40 officers and 1,663 enlisted personnel and were fully utilized in 1987. The renovation of five unaccompanied enlisted personnel housing facilities by 1988 reduced the capacity of these units by about 200 beds (2 dormitories/144 spaces each). The housing referral office had 168 listings as of February 1988. The breakdown by bedrooms was: 56 one-bedroom, 73 two-bedroom, 25 three-bedroom, 9 four-bedroom, and 5 five-bedroom rental units. It is expected that many of these units will be occupied by personnel associated with the first squadron of KC-135R aircraft, and associated base support personnel.

The permanent housing stock is projected to grow to approximately 30,300 by 1990 and 30,700 by 1995, with an approximate 2.9-percent available vacancy rate. Fewer available vacancies were projected in 1990 and 1995 as housing requirements of baseline population growth and personnel associated with the first KC-135R squadron are met. No changes in the supply of temporary facilities are projected.

Education. The Great Falls Public School system (GFPS) includes Elementary School District No. 1 and High School District No. A. In school year 1987-88, the system operated 15 elementary schools, 2 junior highs, 2 high schools, and several specialized schools with total enrollment of about 12,000 students. District No. 1 (elementary) has an overall pupil-to-teacher ratio of 21.5-to-1; this is below the weighted average state standard of 27.8-to-1. Approximately 17 percent of the school system's enrollment are dependents of federal employees.

Classroom enrollment for the GFPS system is projected to reach 12,315 in 1990-91, 12,599 in 1995-96, and 12,652 in the year 2000-01. These projections include students associated with the first KC-135R squadron at Malmstrom AFB. Additional staffing will be needed to maintain existing classroom sizes. Existing facilities and space associated with current capital expansion plans, including use of currently vacant school buildings, may be adequate to accommodate the projected increase in baseline enrollment. (The school district is asking voters to support additions to elementary schools in growth area as well as other program changes).

Public Services. Major public services in the Great Falls area are provided by the city and county governments. In 1986, the City of Great Falls had approximately 405 employees providing comprehensive city services including public safety, public works, community development, recreation, and libraries. In the same year, Cascade County had 587 employees in 45 different departments including the Sheriff, County Nursing Home, Roads and Bridges, Treasury, and many other functions providing for the public health, safety, and welfare of county residents. The city and county jurisdictions provided a public service level equal to 5.8 and 7.0 workers, respectively, per 1,000 population in 1986.

Budgetary restraints in 1987 and 1988 reduced employment for both jurisdictions, especially for Cascade County, and it is uncertain whether with the projected growth of employment and population in the area, they will be able to maintain 1986 service levels through the 1990s. Unless city government employment can increase from 405 to 421 by 1990 and 429 by 1995, the number of personnel per 1,000 population in the area would decrease to 5.6 and 5.5 from 5.8 and 7.0 respectively. Similarly, unless county

government employment can increase from 587 to 605 by 1990 and to 616 by 1995, the number of personnel per 1,000 population in the area would decrease to 6.8 and 6.7 from 7.0 respectively.

Public Finance. Services provided by the City of Great Falls are principally funded through the general and special revenue funds. In fiscal year (FY) 1986, expenditures from these funds were \$14.3 million. Public safety (law enforcement and fire protection services) and public works expenditures accounted for the majority of these outlays. Revenues in FY 1986 were \$15.3 million. Property taxes and intergovernmental revenues are the principal revenue sources of the city. The city does not levy or receive sales taxes. Year-end balances of these funds were \$12.8 million, approximately 90 percent of expenditures in FY 1986. Outstanding general obligation bond indebtedness at the end of FY 1986 was \$2.4 million, about 15 percent of the bonding capacity of the city. Over the 1990 through 1995 period, revenues and expenditures are projected to reach the \$22 million level.

Budgeting general fund revenues and expenditures of the elementary school district were \$21.4 million in FY 1986. Year-end fund balances were \$4.4 million, approximately 20 percent of expenditures in that year. Over the 1990 through 1995 period, revenues and expenditures are projected to be \$23.1 million to \$24.2 million. Budgeting general fund revenues and expenditures of the high school district were \$12.9 million. Year-end fund balances were \$3.2 million, approximately 25 percent of expenditures in that year. Over the 1990 through 1995 period, revenues and expenditures are projected to be \$11.9 million to \$12.3 million.

Revenues and expenditures in Cascade County were \$12.8 and \$12.6 million, respectively, in FY 1986. Reserve funding levels were approximately \$2.7 million, representing about 21 percent of expenditures in that year. Over the 1990 through 1995 period, revenues and expenditures are estimated to slightly decline to the \$11.6 million level.

3.2 UTILITIES

3.2.1 Resource Description

The utilities resource consists of a broad range of physical systems potentially affected by the Second KC-135R AREFS. These systems include the services and facilities that supply potable water, wastewater treatment, solid and hazardous waste disposal, and energy.

Potable Water Treatment and Distribution. Potable water treatment and distribution involves those facilities that distribute water to meet municipal and industrial demands. Facilities include treatment, pumping and distribution systems, and storage tanks.

Wastewater. Wastewater treatment includes those facilities that collect, treat, and dispose of waterborne wastes generated by municipal and industrial users. Facilities included sewage collection systems and treatment plants or lagoons.

Solid and Hazardous Waste. Waste disposal involves those facilities and systems that provide collection and disposal of solid and hazardous waste

from municipal and industrial activities. Landfills or other waste disposal facilities and hazardous waste storage facilities were included in the analysis.

Energy Utilities. Energy utilities include the consumption of electricity, natural gas (and other heating fuels), and liquid fuels as well as the facilities that are associated with the generation and transmission or distribution.

3.2.2 Region of Influence

The Regions of Influence (ROIs) for the utilities resource are the geographic areas where community utility service may be directly or indirectly affected by the proposed Second KC-135R AREFS program. Communities and other locations anticipated to receive significant immigration are the focus of the utilities analysis.

Service area boundaries for the water, wastewater, and solid waste disposal utilities in Great Falls define the ROI. The ROI for energy utilities is defined by the service area of those companies providing power fuel and natural gas to Great Falls and to Malmstrom AFB.

3.2.3 Existing Conditions and Future Baseline

Potable Water Treatment and Distribution. The City of Great Falls provides potable water to its residents and to Malmstrom AFB through diversions from the Missouri River. In 1987, average daily demands were 11.4 million gallons per day (MGD) or approximately 24 percent of the 48-MGD treatment plant capacity. System storage capacity of 15.7 million gallons (MG) is adequate to meet peak summer demands, though water use restrictions have been enforced in the past when necessary. The city is replacing outdated equipment at their treatment plant and will be increasing its capacity to 60 MGD by 1989. Average daily demands will increase to 12.7 MGD by 1990 and 12.94 MGD by 1998, using 22 percent of the proposed treatment capacity.

Potable water use at Malmstrom AFB was 1.02 MGD in FY 1987. Capacity of the interconnection with the city is estimated to be 3.37 MGD and the present contract allows for the annual use of 460 MG of water. Onbase storage of 2.8 MG is adequate for meeting peak summer demands. On base potable water use will increase to 1.16 MGD by 1990 as a result of the First KC-135R AREFS.

Wastewater. Wastewater treatment for Great Falls and Malmstrom AFB occurs at an activated sludge facility owned by the City of Great Falls and operated under service contract with a private sewage treatment management firm. The facility is currently processing 9.4 MGD and operating at 61 percent of its 15.5-MGD treatment capacity. Discharges to the Missouri River consistently meet Montana Pollutant Discharge Elimination System permit requirements. Wastewater flows are estimated to increase to 9.87 MGD by 1990 and 10.05 MGD by 1998. In 1998, the facility will be operating at 65 percent of its treatment plant capacity. Malmstrom AFB discharged 0.54 MGD to this plant in FY 1987. Wastewater flows will increase to 0.75 MGD by 1990. Adequate capacity will be available in the existing force main to handle these wastewater flows and the present contract with the city allows for the treatment of 0.82 MGD (300 MG annually) of effluent.

Solid and Hazardous Waste. Solid waste collection and disposal is provided by the City of Great Falls and two private firms. Total daily disposal requirements will increase from the current volume of 345 tons per day (T/day) to 357 T/day in 1990 and to 364 T/day by 1998. Currently, the city's landfill is estimated to have a lifespan of 15 years, while the private site is projected to be available for 75 years. Solid waste generated onbase is disposed of by a private contractor. A total of 4,188 tons per year or 11 T/day were removed in FY 1987.

Onbase hazardous waste collection is managed by Malmstrom AFB. The Defense Reutilization and Marketing Office (DRMO) Great Falls is responsible for providing for the proper storage of the wastes and arranging for transport to US EPA approved treatment and disposal facilities. The installation stores the wastes in a state-permitted storage facility located in the DRMO storage yard. A new conforming storage facility is programmed for construction. The wastes include sodium chromate, batteries and battery acid, oils, paints, thinners, solvents, and other regulated materials. On base hazardous waste generation will increase from about 2,400 pounds to approximately 10,000 pounds in 1990 as a result of the 91st AREFS (Referenced to as the First KC-135R AREFS).

Energy Utilities. The Montana Power Company (MPC) provides electrical service to the City of Great Falls and Malmstrom AFB cantonment area. In 1986, MPC had a system capability of 1,674 megawatts (MW) with a peak demand of 1,233 MW. Total sales of electricity in 1986 were 9.6 billion kilowatt-hours. The MPC projects a 1.6-percent average annual increase in peak demand between 1986 and the year 2000. To meet the projected peak demands of 1,439 MW in 1990 and 1,598 MW in 1998, the company will rely on purchased power, a number of upgrades and changes, such as improvement to the hydroelectric and coal fired generating plant.

For FY 1987, Malmstrom AFB purchased 44,380 megawatt-hours of electricity from MPC. Service to the base is supplied by the MPC Great Falls northeast substation, which has a transformer capacity of 20 megavolt-amperes (MVA). Peak demand on the substation was 10.3 MVA in 1985. Backup feed to the base is supplied by the Great Falls eastside substation, which has a transformer capacity of 20 MVA. Peak demand on the substation in 1985 was 23 MVA. With the addition of the KC-135R air refueling mission, demand onbase is projected to increase by 3.35 MW to a total of 11 MW. Additional power requirements will be supplied by MPC or from the Western Area Power Administration facilities. A complete upgrade of the onbase distribution system is planned for FY 1992. In addition, a new 115-kilovolt transmission line and 30-MW substation will be installed onbase prior to 1990, and will replace the use of the Great Falls northeast substation. The MPC plans to increase the capacity of the eastside substation by 25 percent with the addition of fan cooling to the transformer banks.

The Great Falls Gas Company (GFGC) supplies natural gas to the City of Great Falls and Malmstrom AFB. The GFGC had sales in FY 1988 that reached 4,280 million cubic feet (MMcf), a 4.3-percent increase from 1987. In 1985, the company provided service to approximately 22,518 customers, and average annual residential consumption was 115 thousand cubic feet (Mcf). The company purchases its supply from MPC and currently has a 30-percent excess capacity margin due to reduced use as a result of energy conservation measures and the base coal fired heating plant.

The GFGC anticipates growth in the residential, commercial, and industrial sectors, except for Malmstrom AFB, which has installed a coal-fired central heat plant and high temperature hot water distribution system. Sales are projected to increase at a 2-percent annual rate between 1987 and 1997 to a total of approximately 5,200 MMcf in 1990 and 6,000 MMcf in 1997. The GFGC provides natural gas to the base via a 12-inch diameter line with a rated capacity of 470 Mcf per hour. In FY 1987, consumption equaled 436 MMcf. While the installation of the heat plant reduces natural gas use, the first KC-135R air refueling mission will bring natural gas consumption to 287 MMcf.

Liquid fuels are supplied to Malmstrom AFB through contracts with local and regional distributors that are filled through the Defense Fuels Supply Center (DFSC). The fuel is currently delivered to the base by tanker truck and stored 54 on base tanks with a total capacity of 52,239 barrels or 2.2 MG. In 1986, the base used 0.65 MG gallons of regular and unleaded gasoline and 0.41 MG gallons of diesel. In 1987 military jet fuel (JP-4) consumption in the ROI was 5.9 MG. Use at Malmstrom AFB was 0.9 MG, while the Montana National Air Guard used about 5.0 MG. The First KC-135R AREFS is estimated to consume an additional 12 MG of JP-4 annually. Currently, Montana Refining Company is adequately meeting JP-4 requirements. With the activation of the first squadron, additional suppliers of jet fuel will be required. These supplies can be provided from existing refineries in Billings, Montana, and shipped to Great Falls through the Yellowstone Pipeline. While this commercial pipeline extends to the base's POL storage yards, supplies are currently trucked to the base.

To support the First KC-135R AREFS above ground, storage tanks with a capacity of 60,000 barrels will be constructed and a new aircraft hydrant refueling system above ground will be installed. An additional 50,000 barrel storage tank will be installed to support the Second KC-135R AREFS.

3.3 TRANSPORTATION

3.3.1 Resource Description

The transportation systems most likely to be affected by the proposed program are roads. Commercial airports and the public transportation systems are not expected to be affected by the proposed program.

The road networks considered in the analysis included all interstates, federal-aid designated primary US or state-numbered highways, and principal city streets (usually the major urban arterials or federal-aid designated urban roads) where program-induced traffic is expected to be concentrated.

3.3.2 Region of Influence

The Regions of Influence (ROIs) for transportation include all interstates and federal-aid designated primary US or state-numbered highways within 50 miles of Malmstrom AFB that serves as a supply region for program-related labor requirements and construction materials. Because most of the labor force and materials requirements would come from communities nearest the candidate deployment installation, the analysis concentrated on the potential impacts on roads nearest the installation. Therefore, the ROIs for transportation only include interstates and federal-aid designated

primary US or state-numbered highways between the host community and the candidate deployment installation, and the principal city streets (also referred to as major urban arterials of federal-aid designated urban roads) within the communities serving each base.

3.3.3 Existing Conditions and Future Baseline

The principal city streets in Great Falls follow a grid-type network of north-south and east-west roads. The most heavily used road in the city is four-lane divided 10th Avenue South (also designated as part of U.S. 87/89), which had sections with a 1985 average annual daily traffic (AADT) ranging from 19,100 to 32,800. The other principal arterials include east-west running River Drive/57th Street (also designated as U.S. 87 Bypass), with a 1985 AADT of between 3,300 to 9,200, 1st Avenue North with an AADT of 5,000 to 11,000, and 2nd Avenue North with an AADT of 4,000 to 7,300; and north-south one-way street couplets 5th and 6th Streets, 14th and 15th Streets, and 25th and 26th Streets, with an AADT of 3,000 to 7,200, and two-way 38th Street with 3,800 to 5,300 AADT. Interstate 15, which passes through the western section of the city, had an AADT of 4,000 to 9,200.

Peak-hour traffic flow conditions at most of the principal streets are at level of service (LOS) A or B except along sections of 1st Avenue North and 2nd Avenue North within the central business district where service is at LOS C or D. Traffic flow is also reduced along 10th Avenue South between River Drive and 38th Street where service levels are at LOS D or E during the peak hours. Estimated LOS resulting from normal traffic changes without the program are not expected to change, or at most would drop one level through 1994.

The primary access to Malmstrom AFB is provided by U.S. 87/89 and the U.S. 87 Bypass, which run immediately south and west of the base, respectively. The main entrance to the base is located at 2nd Avenue North, with an average of 10,540 vehicles daily passing through in 1985. The base has two other gates, the commercial gate along 10th Avenue North and the south gate along U.S. 87/89. The latter is used by military vehicle traffic commuting to the Weapons Storage Area and the eastern part of the base. The section of 10th Avenue North leading to the commercial gate had an AADT of 3,585 vehicles in the same year. There are no significant congestion or problem areas onbase except during the peak hours (7:30-9:00 A.M. and 3:30-5:00 P.M.) when occasional, short delays occur at the gate. The delays are a result of vehicle registration and identification card checks by base security personnel.

3.4 LAND USE

3.4.1 Resource Description

The land use resource analysis includes a discussion of land uses, prime farmlands, compatibility with local land use plans and policies, and visual attributes. Land use analysis involves both direct and indirect impacts. Direct impacts would result from construction of program-related facilities on or in the vicinity of a base. These impacts can affect both developed and undeveloped land, and result in changes in land use. Indirect impacts would result from land use changes caused by program-induced population growth.

Visual attributes are defined as the physical characteristics or qualities of the environment that can be seen by observers of the landscape. A landscape is defined as a portion of land that the eye can comprehend in a single view, irrespective of its aesthetic value. The analysis involves the evaluation of changes in the aesthetic value of a landscape caused by program-related activities and the extent of acceptability of these changes to viewers.

3.4.2 Region of Influence

The land use Regions of Influence (ROIs) include the affected portions of the base, the land surrounding the base, the communities hosting the immigrant population. The visual attributes ROIs are the foreground, middleground, and background areas in the vicinity of the proposed facilities as viewed from key observation points. Key observation points are highways with an average annual daily traffic (AADT) of at least 1,000, residential communities (subdivisions), and recreation areas.

3.4.3 Existing Conditions and Future Baseline

The Great Falls comprehensive plan, which includes all the area around the base, designates agricultural uses in the area to the south and east of the base. Cascade County has a development plan and zoning, but no comprehensive plan. The county does have special use permit control over any development other than rural residential and agricultural.

Figure 4.4-1 presents a generalized overview of land use on the base and surrounding areas. The primary land uses are military (associated with Malmstrom AFB) and rural (on private land). Cultivation of small grain on non-irrigated cropland constitutes the primary rural land use. No prime or unique farmland is designated in the ROI. The livestock operation consists of a cluster of accessory farm-related structures, including three inhabited buildings which are located adjacent to a county road, a small earth-filled dam and reservoir of about 4 acres, and rangeland which serves as pasture. There is another cluster consisting of a barn and grain storage bins located adjacent to the BN Railroad. There are no urban land uses within the off base portion of the ROI.

Off base, the ROI also contains one 69-kilovolt electrical transmission line, three telephone cables, one railroad communication line, U.S. 87/89, three county roads, and an existing Air Force-owned railroad spur.

The visual attributes of the ROI are typical of the northwestern portion of the Great Plains Physiographic Province. The area has flat to gently rolling terrain which is vegetated with short grassland. Landscape forms are undulating to flat, and lines are horizontal, straight, and angular. Colors are mostly pale green, brown, and gold, but winter colors are dark brown and white. Textures are smooth to medium and ordered. Existing onbase structures appear very low on the horizon north of the U.S. 87/89 (AADT 4,200), with the most obvious visual intrusions being power and light poles and radar domes. There are a few agricultural buildings in the offbase ROI but no residences along Highway US 87/89 area east of the base.

3.5 Cultural Resources

3.5.1 Resource Description

Cultural resources include four elements: prehistoric, historic, Native American, and paleontological resources.

Prehistoric Resources. Prehistoric resources are physical properties resulting from human activities predating written records. They are generally identified as either isolated artifacts or sites; the latter is the basic analytical unit in archaeology. Sites contain concentrations of artifacts, features, and floral and faunal remains. Depending on their age, complexity, integrity, and relationship to one another, sites may be important and capable of yielding information about past populations and adaptive strategies. Although most sites have some research potential, it is generally the larger and more complex sites that have a variety of research applications and are of greatest concern during program planning.

Historic Resources. Historic resources consist of physical properties that postdate the existence of written records; in the United States, such properties usually relate to Euro-American occupations. Historic resources include architectural structures (e.g., buildings and bridges) and archaeological features such as foundations and trash pits. Such resources may have research potential in the same manner as prehistoric sites, but historic sites are more often considered important because of their association with important historical persons or events, or as examples of distinctive architectural styles. Ordinarily, sites less than 50 years old are not considered *historic* for analytical purposes, but exceptions can be made for younger properties if they are of exceptional importance (36 CFR 60.4).

Native American Resources. Native American resources are sites, areas, and materials important to Native Americans for religious or heritage reasons. Resources may include prehistoric sites and artifacts, contemporary sacred areas, traditional use areas (e.g., native plant habitat), and sources for materials used in the production of sacred objects and traditional implements. Of primary concern in the Environmental Impact Analysis Process are concepts of sacred space that create the potential for land use conflicts. Fundamental to Native American religions is the belief in the sacred character of physical places such as mountain peaks, springs, and burials. Additionally, traditional rituals often prescribe the use of particular native plants, animals, or minerals. Therefore, activities that may affect sacred areas, their accessibility, or the availability of materials used in traditional practices may be of concern.

Paleontological Resources. Paleontological resources are the physical remains, impressions, or traces of plants or animals from a former geological age. They include casts, molds, and trace fossils such as burrows and tracks. Fossil localities typically include surface outcrops, areas where subsurface deposits are exposed by ground disturbance, special environments favoring preservation, such as caves, peat bogs, and tar pits. Paleontological resources are important mainly for their potential to provide scientific information on paleoenvironments and the evolutionary history of plants and animals.

3.5.2 Region of Influence

One of the main considerations used to evaluate the importance of cultural resources is their cultural/historical context, as defined at the regional level. The Region of Influence (ROI) is designed as an approximation of the areas within which data useful for establishing cultural/historical context can be derived. For the Second KC-135R AREFS, it is primarily Malmstrom AFB.

3.5.3 Existing Conditions and Future Baseline

Prehistoric Resources. Within the ROI, a variety of prehistoric site types have been recorded, including short-term plant-processing camps and hunting stands; habitation sites, including stone circle sites and rockshelters; antelope or buffalo kill and butchering sites; rock art sites; quarries and lithic sources; and rock cairns and alignments. Archaeological surveys have been conducted on approximately 470 acres onbase and 1,350 acres adjacent to the northern and eastern base boundaries. Three prehistoric sites (fire-cracked rock and lithic scatters) and six isolated finds were recorded. These sites appear to be surficial and are not likely to be eligible for the NRHP.

Historic Resources. Several sites important to Montana's history occur in the ROI as a result of mining, agricultural, ranching, military, and transportation activities. However, few such resources have been reported in the immediate vicinity of Malmstrom AFB. Only two historic sites have been identified in the immediate vicinity of the base. Segments of the Great Falls Portage, a National Historic Landmark, abut the base on the eastern and western boundaries. Portions of the route through the base are not included in the landmark because of the level of disturbance caused by previous base construction. One recorded historic site (24CA264), a 3.2-mile-long segment of historic railroad, is immediately north of the base.

Native American Resources. Native American groups were consulted concerning sacred or traditional use areas. A Native American religious specialist has evaluated previously undisturbed impact areas and has not identified any areas of concern. No concern has been expressed for previously disturbed areas where archaeological deposits are not likely to be preserved.

Paleontological Resources. Although there are several internationally famous paleontological sites in Montana, none are in the ROI. Malmstrom AFB is underlain by 30 to 100 feet of glacial sediments; therefore, it is unlikely that any paleontological materials would be uncovered as a result of normal construction activities.

3.6 BIOLOGICAL RESOURCES

3.6.1 Resource Description. For this study, available information was used to make site-specific and regional (i.e., ecosystem level) conclusions about the status of biological resources. Sections pertaining to biological habitats include all aspects of the general ecosystem in the study areas. Aquatic and terrestrial systems are treated together in the biological habitats discussion because they are closely interrelated, impacts from physical disturbances may affect both of these major systems, and these impacts can be best examined together in cause and effect relationships.

Threatened and endangered species are treated separately because of legal requirements and the need for special consideration in the preservation of these species.

Biological Habitats. The discussion of biological habitats addresses all aspects of the general ecosystem within the Regions of Influence (ROIs). For terrestrial portions of the ecosystem, vegetation is described and treated as the foundation of the analysis for that portion of the system. Wildlife species are treated as an integral component of the vegetative habitats present in the ROIs. Aquatic systems are treated in a similar manner; however, the physical nature of the aquatic system (i.e., whether the aquatic habitat is a lake, stream, marsh, or some other habitat type) is described in greater detail because the biotic structure is often more strictly controlled by physical factors (e.g., substrate type, streamflow, and turbidity). All components of terrestrial, aquatic, and intergrade systems are treated at the ecosystem and population levels. Major emphasis is placed on some biological habitats that represent especially important components of the ecosystem, are protected by law, or are highly regarded by natural resource management agencies. Emphasis in discussions of these components is also given to other species and biological communities that would be affected by the program.

Threatened and Endangered Species. The threatened and endangered species section focuses on plant and animal species that are: 1) federally listed as threatened or endangered and species; 2) are proposed for listing; and 3) are candidates for federal listing (See Table A.6-1). State-recognized species are also addressed. Threatened and endangered species that occur in the area of direct program disturbance that may be adversely affected by the program are emphasized in the discussion. Important characteristics of threatened and endangered species (e.g., wintering areas, nesting sites, and localities with high densities of species) are also described.

3.6.2 Region of Influence

The ROIs for biological resources are defined as the areas or locations where these resources can reasonably be expected to be directly or indirectly affected by program-related construction or operations activities. For biological resources, it is important to distinguish between areas and resources that may be subject to direct surface disturbance and other direct impacts from construction and operations activities, and areas where only indirect program impacts could occur as a result of increased recreation and program-induced development. The portions of the ROIs that would be subject to direct disturbance include those areas onbase and nearby where new facilities would be built, as well as adjacent areas that may also be affected by factors such as noise and runoff. Indirect impacts may occur where program-induced development is expected, or where program-induced recreational use would affect biological resources. The portions of the ROIs where indirect impacts may occur are the areas within a 1-hour driving time or approximately 60 miles from the major population center for each base. This area was selected because the program would result in only a small increase in population per base (approximately 800 people during operations). The resulting increase in recreational users would be negligible compared to existing levels of use at recreational resources beyond this area. The shape and extent of this area depends on the layout and type of roads in the area and the location of recreational facilities and biological resources of special sensitivity or interest.

3.6.3 Existing Conditions and Future Baseline

Biological Habitats. Malmstrom AFB lies within a grassland biome. The undeveloped portion of the base has been seeded with rye and crested wheatgrass. Trees such as ash, American elm, plains cottonwood, honey locust, Russian olive, willow, Scotch pine, and Colorado blue spruce have been planted throughout the cantonment area, along streets, and other open areas. Much of the area surrounding the base is presently used for agriculture (primarily wheat). Grassland habitat occur within 1 mile of the base boundary. Habitats onbase and near the base support various wildlife species such as the white-tailed jackrabbit, badger, skunk, ground squirrel, and various species of mice, voles, and shrews. A cattail marsh and areas of ponded water occur in a drainage located near the existing Weapons Storage Area (WSA).

The remaining ROI includes agricultural land, native grassland in lowlands, and coniferous forests in mountainous areas. Major rivers and creeks in the ROI include the Missouri, Sun, and Smith Rivers, and Belt Creek. Several of these areas support unique and sensitive habitats managed for habitat and wildlife preservation and public recreation. These unique and sensitive habitats include stream riparian zones, Giant Springs State Park, Freezeout Lake, and Benton Lake National Wildlife Refuge. These diverse habitats support abundant wildlife (e.g., white-tailed deer, mule deer, elk, and pronghorn), waterfowl and other bird species, and productive fisheries. The primary recreational use of these resources occurs along rivers, wetlands, and in mountainous areas.

Threatened and Endangered Species. No federally listed threatened and endangered species are known to occur on base.

Three federal-candidate bird species (the ferruginous hawk, long-billed curlew, and the Swainson's hawk) and one state-recognized species (the upland sandpiper) may occasionally occur onbase. Several threatened and endangered, federal-candidate, and state-recognized species occur in the ROI, and one species, the bald eagle, occurs in common use recreation areas. (See Table 3.6-1)

Table 3.6-1

Federally Listed, Federal-Candidate, and State-Sensitive Species
Malmstrom AFB, Montana and Vicinity

Common Name	Scientific Name	Federal Status	State Status	Distribution
Bald eagle	<u>Haliaeetus</u> <u>leucocephalus</u>	E	R	Occurs in ROI
Black-footed ferret	<u>Mustela nigripes</u>	E	SH	May occur in ROI
Canadian toad	<u>Bufo hemiophrys</u>	-	S1	May occur in ROI
Ferruginous hawk	<u>Buteo regalis</u>	2	R	May occur onbase occasionally
Harlequin duck	<u>Histrionicus</u> <u>histrionicus</u>	-	S2	May occur in ROI
Long-billed curlew	<u>Numenius americanus</u>	2	U	May occur onbase occasionally
Milk snake	<u>Lampropeltis</u> <u>triangulum</u>	-	S1	May occur in ROI
Peregrine falcon	<u>Falco peregrinus</u>	E	R	Occurs in ROI
Preble's shrew	<u>Sorex preblei</u>	2	R	May occur in ROI
Sage sparrow	<u>Amphispiza belli</u>	-	S2	May occur in ROI
Spotted bat	<u>Euderma maculatum</u>	2	R	Occurs in ROI
Swainson's hawk	<u>Buteo swainsoni</u>	2	-	May occur onbase occasionally
Swift fox	<u>Vulpes velox velox</u>	2	U	Occurs in ROI
Upland sandpiper	<u>Bartramia longicauda</u>	-	SU	May occur onbase occasionally

Notes: E = Endangered
 R = Rare
 SH = Historically known in Montana; may be rediscovered
 S1 = Critically imperiled
 2 = Federal candidate, Category 2
 S2 = Endangered in state
 U = Undetermined
 SU = Possibly in peril in state; status uncertain

Sources: US Fish & Wildlife Service 1984; Montana Department of Fish, Wildlife, and Parks 1984.

3.7 WATER RESOURCES

3.7.1 Resource Description

Water would be required to construct facilities and operate the proposed program and cumulative programs. Cumulative land disturbance which would occur during program construction was evaluated for its potential to alter the hydrology or degrade the quality of nearby surface or groundwater. Therefore, the water resources analysis considered three components: major water users, surface water hydrology and quality, and groundwater hydrology and quality.

Major Water Users. This component addresses the effects that program water requirements would have on existing major water users. The categories of major water users examined included military, municipal, self-supplied industrial, rural-domestic, and agricultural. Also examined was the adequacy of the water supply sources to meet the baseline and program-related water demands highlighting potential water shortages.

Surface Water Hydrology and Quality. This component addresses the effects of the proposed program on streamflows and the water quality of surface water bodies. State-designated water uses of streams and water quality standards violations were also addressed. Other issues included local drainage characteristics and water control works.

Groundwater Hydrology and Quality. This component addresses the effects of the proposed program on groundwater reserves, well yields, water table fluctuations, and water quality conditions and trends of the principal groundwater aquifers.

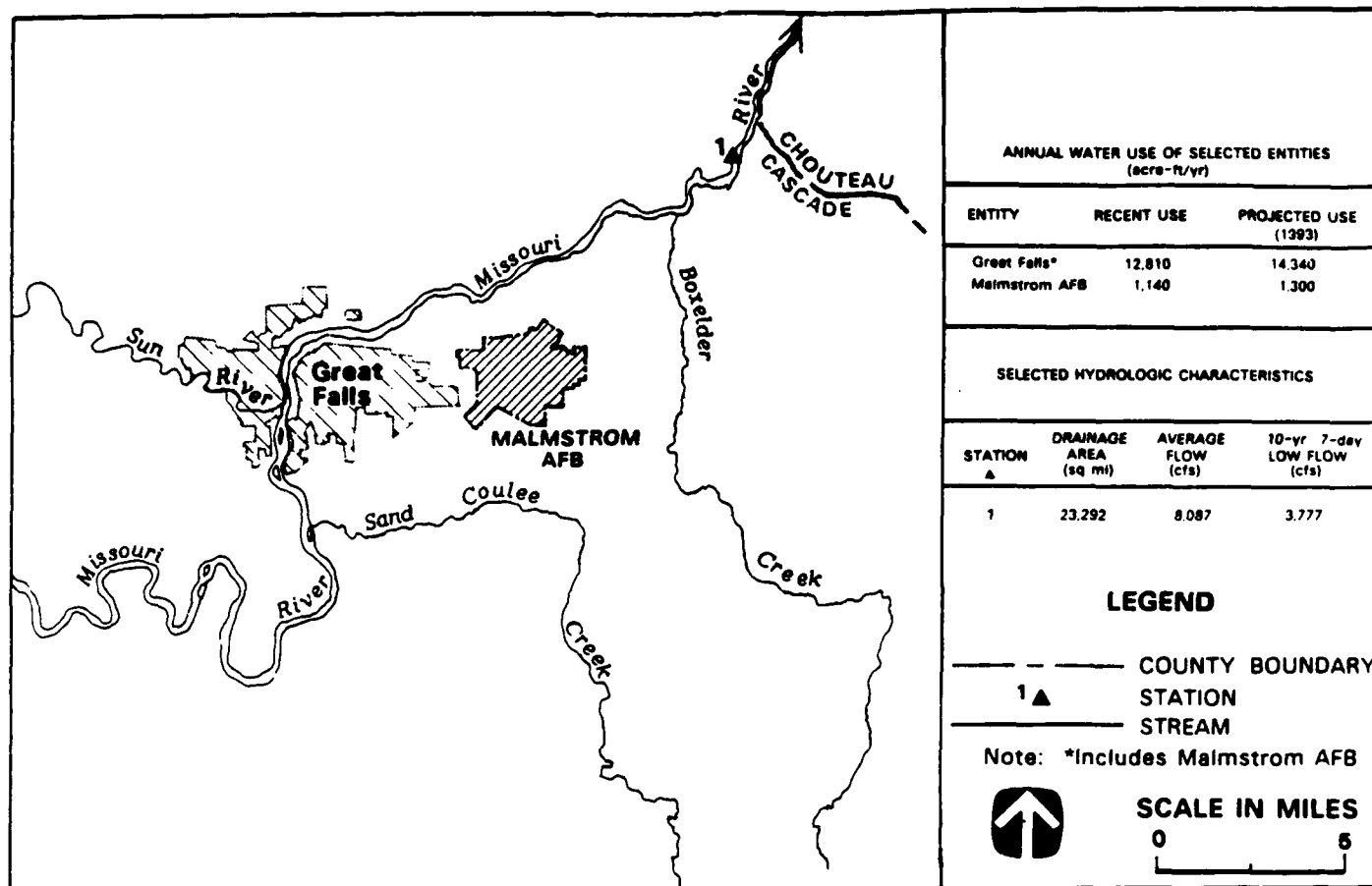
3.7.2 Region of Influence

The Regions of Influence (ROIs) for water resources are defined as the local surface water drainages within and immediately around Malmstrom AFB and its support communities where water quality may be affected by program-related construction. Where practical, the ROIs extend downstream to include the streams draining the general area. Beyond this point, program-related impacts would be minimal. The ROIs also include those groundwater aquifers that would supply program-related water requirements. Finally, the ROIs include the areas serving competing major water users who might be affected by water diversions to support the program.

3.7.3 Existing Conditions and Future Baseline

Major Water Users. Total water use in Cascade County, excluding hydroelectric power generation by five dams in the vicinity of Great Falls, was approximately 176,000 acre-feet (acre-ft) in 1985. Agricultural irrigation in the ROI accounted for about 90 percent of total water use. Nearly all of the municipal water used within the ROI is supplied by the City of Great Falls. The city also supplies water to Malmstrom AFB. Current and projected water use for Malmstrom AFB and Great Falls is presented in Figure 3.7-1. Great Falls obtains all of its water from the Missouri River. The water supply of the ROI is adequate to meet its anticipated needs and no major water resource developments are expected to occur.

FIGURE 3.7-1 Hydrologic Features of Malmstrom AFB, Montana,
Region of Influence



Surface Water Hydrology and Quality. The Missouri River is the principal hydrologic feature of the ROI. It provides nearly all of the water needs of the ROI and receives about 10,550 acre-feet per year (acre-ft/yr) (9.4 MGD) of treated wastewater effluent from Great Falls (including 850 acre-ft/yr [0.75 MGD] of sewage generated onbase). The quality of the river water is good in the vicinity of the ROI. Runoff generated within the ROI is relatively low, and the only perennial streams are those which form the borders of the ROI. Most of Malmstrom AFB is drained by a system of intermittent coulees that empty into the Missouri River 2 miles north of the base. This installation has no designated floodplain areas.

Groundwater hydrology and Quality. Several regional aquifers underlie the ROI at a depth generally greater than 100 feet. The Madison-Swift Aquifer, which has the greatest potential for development, feeds Giant Springs located 2 miles northwest of Malmstrom AFB, one of the largest springs in the world. However, given the presence of an ample supply of good-quality surface water, very little groundwater development has occurred in the ROI.

3.8 GEOLOGY AND SOILS

3.8.1 Resource Description

Geology and soils resources deal with the physical properties of the earth and its natural resources. The narrower scope considered in this EIS for adequately describing environmental effects of the proposed program includes energy and mineral resources, soil resources, and geologic hazards. The proposed program activities may require altering the existing terms of energy and mineral leases or extraction facilities in the project areas due to operational considerations. Program-related construction activities could affect the rates of soil erosion. This effect is important because of the potential loss of soil and possible secondary affects on water quality and biological habitat. The proposed program is not anticipated to influence the occurrence of geologic hazards. Consequently, this component is considered more relevant as a safety issue because of the potential for geologic hazards to affect elements of the proposed program.

Energy and Mineral Resources. Energy resources include geologic environments or regions where the generation or potential occurrence of energy resource materials such as oil, gas, coal, uranium, oil shale, and geothermal waters have been identified. Mineral resources include all forms of metallic and nonmetallic mineral deposits.

Soil Resources. Soil types in potential program construction areas were evaluated to determine if program-related construction activities would accelerate soil erosion rates resulting from increases in ground disturbance. Soil erosion includes wind, sheet, rill, and gully erosion.

Geologic Hazards. This component is divided into two categories that cover the potential effects from (1) seismic hazards, and (2) landslides and terrain failure. Seismic hazards include strong ground shaking motions and surface fault rupture, which may result in damage to installation facilities. Landslides and terrain failure include all forms of slope instability related to slides, slumps, soil creep, and rock falls.

3.8.2 Region of Influence

The ROIs for energy and mineral resources, soil resources, and geologic hazards include the installations and associated program-related areas in the immediate vicinity. The land within a 1-mile radius of Malmstrom AFB and a 1,000 foot-wide corridor along the connecting rail spurs was characterized for purposes of establishing the local baseline context. In addition, the regional ROI was established for geologic hazards for the purpose of developing a regional framework for seismicity.

3.8.3 Existing Conditions and Future Baseline

Malmstrom AFB lies in a region of high plains interrupted by isolated mountain ranges rising 2,000 to 4,000 feet above the surrounding plains. Locally, Quaternary glacial deposits overlie the Early Cretaceous Kootenai Formation which consists mainly of shales and sandstones. The installation lies in seismic zone 2 (Uniform Building Code 1985) in which a maximum credible earthquake with a magnitude of 6.1 is the largest predicted for the area. Maximum horizontal acceleration in rock is expected to be less than 0.10 g, with a 90-percent probability of not being exceeded in 50 years (Algermissen et al. 1982). Active faults have not been identified in the local ROI and the area is not susceptible to liquefaction. Areas susceptible to landslides or terrain failure were not discovered in the ROI.

Energy and Mineral Resources. No oil, gas, or coal leases/fields have been identified in the ROI. No uranium mines/leases, known geothermal resource Areas, or metallic/nonmetallic mineral resource mining operations or leasing activity exist in the ROI.

Soil Resources. The US Soil Conservation Service (SCS) has mapped 14 soil types in the ROI. Soils occur on level to strongly sloping surfaces, have loamy to clayey textures, and range from poorly drained to well drained. Wind erosion of unvegetated/disturbed ground in the ROI is a major concern of the SCS in Montana and has been identified as a potential problem for soils in the ROI. The prevailing southwesterly wind direction would make northeast-southwest elongated tracts of land susceptible to wind erosion.

Geologic Hazards. Geologic maps and publications were used to identify the tectonic province and seismic zone of the candidate installations. Regional and local maps and reports were also incorporated into the data base to characterize local fault zones. Data were also compiled to evaluate the potential effect of a major seismic event at each installation. The liquefaction potential was also investigated by collecting and analyzing data on sediment and soil types and depth to local groundwater. Landslides and terrain failure were characterized by incorporating aerial photograph interpretation with topographic elements (e.g., steepness of slopes) and geologic and soils characteristics. Materials susceptible to landslides or terrain failure, if any, were characterized and identified using the same techniques.

Future conditions for the geology and soils resource were assumed to be a continuation of existing geologic environments into the foreseeable future. This is because rates of natural geologic processes would not appreciably change over the short period of time associated with the proposed program when compared to the geologic time scale.

3.9 AIR QUALITY

3.9.1 Resource Description

For this program, air quality in a given location is described by the concentration of various pollutants in the atmosphere, which are expressed in units of concentration, generally parts per million or micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). Federal and/or state ambient air quality standards have been established for each of the criteria pollutants. These pollutants are ozone, carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), particulate matter equal to or smaller than 10 micrometers in diameter (PM₁₀), lead, sulfates, and hydrogen sulfide. These standards represent the allowable atmospheric concentrations at which the public health and welfare are protected, and include a reasonable margin of safety. The federal standards, which were established by the US Environmental Protection Agency (EPA) and termed National Ambient Air Quality Standards (NAAQS), are defined as the maximum acceptable concentrations that may be reached, but not exceeded more than once per year.

3.9.2 Region of Influence

The Region of Influence (ROI) include numerous areas where air quality may be affected directly by program-related construction activities or indirectly by program-induced transportation traffic. In general, the ROI includes Malmstrom AFB and Cascade County. In addition, the ROI includes any federal- and state-mandated Prevention of Significant Deterioration (PSD) Class I areas that are within a 50-mile radius from the base. In general, Class I is designed for "pristine" areas where almost any deterioration would be significant. Congress established several types of mandatory PSD Class I areas. These mandatory areas include international parks, wilderness areas larger than 5,000 acres, national memorial parks larger than 5,000 acres, and existing national parks larger than 6,000 acres. All other areas of the country classified as attainment are Class II. Class II limits allow for moderate, well-controlled growth and Class III limits allow pollutant levels to increase considerably.

3.9.3 Existing Conditions and Future Baseline

The area that may be affected by air emissions from the proposed program includes Malmstrom AFB and the City of Great Falls; both are included in the Great Falls Intrastate Air Quality Control Region (No. 141). Gates of the Mountains Wilderness, a Prevention of Significant Deterioration (PSD) Class I area, is within 50 miles of the base.

Ambient air quality at Malmstrom AFB has not been monitored onbase. However, ambient concentrations of total suspended particulate (TSP), carbon monoxide (CO), and particulate matter (PM₁₀) levels are monitored in Great Falls 2 miles from the base. No other criteria pollutants are monitored because of the lack of either point or area sources. The air quality measurements in Great Falls indicate that the maximum 24-hour TSP observation was 264 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) at Fire Station No. 1. The highest annual TSP geometric average at the fire station was 65.8 $\mu\text{g}/\text{m}^3$. Both the 24-hour and geometric average for TSP occurred in 1985. The PM₁₀ levels were monitored in downtown Great Falls. The maximum recorded 24-hour average was 73 $\mu\text{g}/\text{m}^3$ and the highest annual geometric mean was 30.1 $\mu\text{g}/\text{m}^3$, both within the standards.

There are very few year-round pollution sources in the vicinity of Malmstrom AFB. The predominance of southwesterly drainage winds across Malmstrom AFB usually vents pollution from the small industrial sites in the area. The major contributing source in the area will be the coal-powered heating plant when it becomes fully operational, with permit limits.

The closest nonattainment area to Malmstrom AFB is in Great Falls. A corridor along 10th Avenue South was declared a nonattainment area for the CO 8-hour standard. The Great Falls downtown area has not achieved the federal secondary standard for TSP, and is designated nonattainment for TSP; however, the EPA replaced the TSP standard with the PM10 standard. Monitored PM10 data for Great Falls are below the standards, thereby classifying the city into a Group III PM10 category, which is or is presumed to be in compliance with the standards. Malmstrom AFB itself, per modelling results, is in attainment status for all criteria pollutants.

The latest annual (1987) Cascade County air quality emissions inventory, extracted from the EPA National Emissions Data System (NEDS), is provided in Table 3.9-1. Emissions data were available for TSP, sulfur oxides (SO_x), nitrogen oxides (NO_x), CO, and volatile organic compounds (VOC) (a measure of reactive hydrocarbons). The PM10 fraction of TSP emissions are not identified in the NEDS.

The emissions data for Cascade County include the four most important source categories, namely fuel combustion, transportation, solid waste disposal, and industrial processes, as well as a fifth source category, miscellaneous. Miscellaneous emission types vary according to the region involved, but most commonly include fugitive dust, solvent evaporation, agricultural burning, forest fires, and structural fires. Existing major point sources of air pollutants include the Montana Refining Company, GTA Feed Company, and Agribasics all located in Great Falls.

Future baseline regional emissions will increase due to normal population and industrial growth, but these increases will be minimal because of the low growth potential in these areas.

Table 3.9-1

Cascade County, Montana Air Emissions Inventory, 1987
(tons per year)

Emission Source	TSP	SO _x	NO _x	VOC	CO
Fuel Combustion	427	579	758	861	2,500
Industrial Process	189	1,042	45	2,298	874
Solid Waste Disposal	84	1	3	237	711
Air/Water Transportation	44	10	85	112	497
Land Transportation	1,695	490	5,279	3,201	20,113
Miscellaneous	28,578	1	27	136	959
TOTAL	31,017	2,123	6,197	6,845	25,654

Source: US Environmental Protection Agency 1988d.

3.10 NOISE

3.10.1 Resource Description

Noise is defined as "unwanted sound." According to the US EPA, in the context of protecting the public health and welfare, noise implies adverse effects on people and the environment. Long-duration exposure to high noise levels may cause hearing loss. Noise interferes with human activities at home and work, and is in various ways injurious to people's health and well-being. Although hearing loss is the most clearly measurable health hazard, noise is also linked to other physiological and psychological problems. Noise annoys, awakens, angers and frustrates people. It disrupts communication and individual thoughts, and affects performance capability. Noise is one of the biological stressors associated with everyday life. Thus, the numerous effects of noise combine to detract from the quality of people's lives and the environment. Noise is described in terms of sound levels, which are measured in decibels (dB) or decibels adjusted to an A-weighted scale (dBA) to correspond with the range of human hearing.

Ambient noise is defined here as all noise generated in an area, including background and incidental sources which are usually expressed in terms of the equivalent sound level (Leq) or day-night noise level (Ldn). Ldn is also known as DNL. In an outdoor environment, Leq is used, which expresses the average overall noise for a specific period. The Ldn is a measure of noise for a 24-hour period, in which the measured noise levels between 10:00 P.M. and 7:00 A.M. are weighted by an additional 10 dB because of the increased receptor sensitivity during these designated sleeping hours. For single events, like overflights, L_{MAX} - the maximum sound level could be analyzed in order to assess noise exposures of civilians and military personnel. These noise level parameters are expressed in dBA scale and were used to characterize the baseline noise environment.

3.10.2 Region of Influence

The ROIs for noise are broadly defined as those areas in the proximity of Malmstrom AFB where noise-level exposure increases may occur as a result of program-related activities, excluding military traffic (or training) routes outside the proximity of the base. Initial assessments concluded the area of Great Falls (including Malmstrom AFB) and Cascade County, would adequately cover impacted areas. In addition to ascertaining noise, exposure, sensitive noise receptors like residential areas, schools, hospitals, parks, and churches, etc., that would be affected by increased noise levels, were discussed.

3.10.3 Existing Conditions and Future Baseline

The major noise sources in the vicinity of Malmstrom AFB are local highways and flying missions that include helicopter air traffic. The major locations of motor-vehicle-related noise at Malmstrom AFB are US Highway 87/89, 57th Street (US 87) Bypass, 2nd Avenue North, 10th Avenue South, 10th Avenue North, and primary and secondary streets within the base and the southeast section of Great Falls.

The equivalent sound level (24-hour) background concentrations in and around Malmstrom AFB, without any of the KC-135R missions, range from a low of 51

dB to a high of 59 dB. Road traffic generated noise level on US Highway 87/89 and on US 87 Bypass is about (Ldn) 61.0 dB.

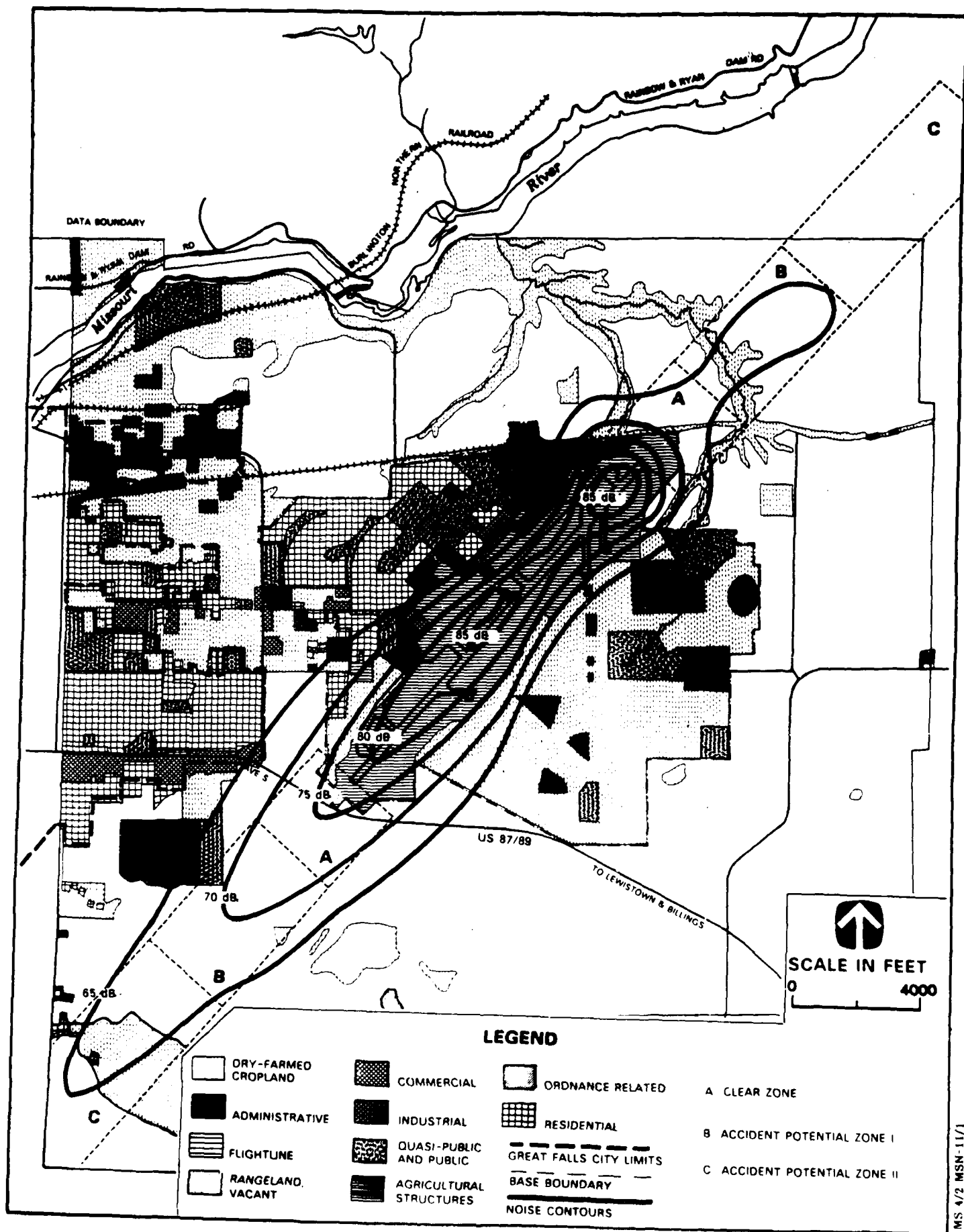
The current baseline, including noise impacts from the first KC-135R squadron is comprised of over 3,000 acres, 900 acres, and 60 acres bounded by the noise contours of DNL of 65-dB, 75-dB and larger than 85-dB, respectively (See Table 3.10-1). Approximately 35 on base mobile home units with a population of approximately 100 people would be located in the Ldn 65-70 dB noise contour. About 66 units of on base Malmstrom Drive Wherry housing with an estimated 233 people would be in the Ldn 65-70 dB noise contour. About 26 Malmstrom Drive Wherry housing units would be in the 70-75 dB noise contour, involving about one hundred people. In addition, at least two offbase residences would be located in the 65-75 dB noise contour. In total, about 129 housing units with approximately 433 people would be situated within the 65-75 dB noise contours. Most of these housing units are not equipped with central air conditioning or other specially-designed noise attenuating modifications. In addition, over 5,900 acres would be situated within DNL larger than 65 dB noise contours. Moreover, 19 administrative buildings, commercial, industrial, plus other buildings with full or part time occupants of approximately 760 people would be located in DNL larger than 70 dB noise contours (See Figure 3.10-1).

Table 3.10-1

Existing Conditions of Noise-Affected Area
Malmstrom AFB, Montana

DNL (dB)	Baseline Conditions First KC-135R AREFS (Acres)
65	3,067.07
70	1,475.23
75	904.76
80	403.48
85	67.84

Figure 3.10-1. Noise Contours (Ldn) of the First Squadron of KC-135R Aircraft at Malmstrom AFB, Montana



This chapter describes the environmental consequences of proposed deployment of the Second KC-135R AREFS at Malmstrom AFB, Montana. Impacts are considered for each of the resource categories described in Chapter 3.0, Affected Environment. Impacts are evaluated and rated in terms of their magnitude and significance.

The Council on Environmental Quality (CEQ) regulations state that environmental impact statements (EISs) "shall provide full and fair discussion of significant environmental impacts," and that impacts shall be discussed in proportion to their significance. In addition, the following definition of significance is provided: "'Significantly' as used in NEPA requires consideration of both context and intensity."

Under the definition of context, the regulations indicate that "significance varies with the setting of the proposed action." Typically, the setting of an impact can be characterized as site, local, or regional. For the proposed Second KC-135R AREFS at Malmstrom AFB, site impacts would occur as a result of construction disturbance at the base and aircraft operations. Local impacts would primarily occur in the City of Great Falls where most project immigrants would reside. Regional impacts would occur primarily in basins or airsheds, or Cascade County.

The CEQ definition of context also indicates that "both short- and long-term effects are relevant." For this EIS, both short- and long-duration impacts have been identified. Short-duration impacts are transitory effects of the proposed project that are of limited duration and are generally caused by construction activities or operation start-up. Long-duration impacts would occur over an extended period of time, whether they start during the construction or operations phase. Most impacts from the operations phase are expected to be of long-duration since project operations essentially represent a steady-state condition (i.e., impacts resulting from actions that occur repeatedly over a long period of time). However, long-duration impacts can also be caused by construction activities if a resource is destroyed or irreparably damaged, or if the recovery rate of the resource is low or very slow.

According to the CEQ regulations (Code of Federal Regulations 1981, 40 CFR 1508.27), intensity "refers to the severity of the impacts." Ten items are listed that "should be considered in evaluating intensity:"

1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.
2. The degree to which the proposed action affects public health or safety.
3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.

5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
8. The degree to which the action may adversely affect districts, site, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

It is not anticipated that the proposed project will have impacts with sufficient intensity to threaten the violation of laws as indicated by consideration 10. Nevertheless, this consideration is included in evaluating the significance of impacts to those resources that are protected by environmental laws.

Controversy, referred to in consideration 4, involves disagreement among recognized professionals over environmental impacts or assessment methodologies. Possible controversy over the purpose, need, or desirability of this project was considered in evaluating the significance of impacts.

A three-phase impact analysis process was used to evaluate environmental consequences of the proposed Second KC-135R AREFS. First, the environmental impacts within resource element categories were identified, then the level of the impact (LOI) was evaluated, and finally significance was assessed.

The LOI is a ranking (negligible, low, moderate, or high) of the magnitude of an impact. The magnitude has been evaluated in terms of "numbers and kinds" of effects as compared to baseline conditions. The evaluation of LOI is based on both the absolute quantity of an affected resource and the comparisons of this quantity with the resource base. Once the LOI is determined, an evaluation is made as to whether the impact is significant. Significance is determined by evaluating its context and intensity as previously identified. In many cases, high LOIs will be judged to be

significant, but not in all instances. For example, the excess capacity of a system may be large enough so that even a moderate or large impact will not be rated as significant. It should be noted that the ten CEQ items previously mentioned include geographically-dependent criteria. Therefore, specific significance criteria should not be assumed to be applicable in all situations. The LOI and significance of impacts are presented in Figure 4.0-1.

An overall collective summary of LOI and significance was prepared for each resource element. In preparing these assessments, the collective effects of all individual impacts have been considered.

A discussion of the methodology for evaluating potential impacts is provided for each resource category in Appendix A. The methodology includes procedures for evaluating proposed project impacts, determining LOIs, and determining significance and assumptions and assumed mitigations. Each resource discussion also includes consideration of impacts of the Proposed Action and the No Action Alternative. Finally, each resource discussion includes consideration of potential mitigation measures.

The following sections provide a description of activities associated with the deployment of the Second KC-135R AREFS aircraft at Malmstrom AFB for the Proposed Action and the Alternative Action. In addition, two other programs under consideration for deployment at Malmstrom AFB are discussed. These include the Peacekeeper Rail Garrison Program and the deployment of 200 Small Intercontinental Ballistic Missiles (ICBMs) in the vicinity of Malmstrom AFB.

Second KC-135R Air Refueling Squadron Program (Proposed Action)

Proposed Action

For the Proposed Action at Malmstrom AFB, the Air Force would construct facilities and provide personnel for deployment and operations of a second air refueling squadron consisting of 14 KC-135R aircraft. Except for normal localized traffic patterns, the aircraft will fly at or above 3000 feet above ground level using established and approved airways and routes. Standard KC-135R operation procedures will be employed to support the needed refueling mission. Approximately \$48.6 million in (1986 dollars) of construction would occur at the base for the Proposed Action (See Table 4.0-1). Most construction activities are scheduled to begin in 1989 and be completed in 1992. Direct employment would increase from 157 in 1989 to a relatively stable 284 starting in 1992 and continuing during steady state operations in future years. Table 4.0-2 summarizes these data and also indicates that indirect employment reaches a construction peak in 1989 and stabilizes at about 284 during the years of steady state operations.

Alternatives

This basing action is needed to meet Single Integrated Operations Plan (SIOP) mating and ranging requirements for National Defense Alert. No other base in the region is considered suitable for this mission. Other bases in the region are at capacity and cannot accept additional aircraft. Other regions do not meet criteria for SIOP mating and ranging or peacetime refueling support for day-to-day training. The number of aircraft are matched against future bomber aircraft basing plans for air refueling

requirements. Movement of fewer aircraft would not meet mission requirements. Therefore, the only alternative is the No Action alternative. The No Action alternative is unsatisfactory since it would not base sufficient numbers of tanker aircraft assets in the region to support national defense requirements and future basing actions.

Two additional programs are being considered for deployment at Malmstrom AFB: The Peacekeeper Rail Garrison Program and the Small ICBM Program.

TABLE 4.0-1
FACILITY REQUIREMENTS

<u>Facility</u>	<u>Scope</u>
Alter Mission Operations	18,200 Square Feet
Alert Crew Support Facility	4,000 Square Feet
ADAL PMEL and FTD Facility	16,200 Square Feet
ADAL Aircraft Parks Store	10,000 Square Feet
Upgrade Base Utilities	
Relocate Base Engineer Shops	15,000 Square Feet
Relocate Transient Aircraft Maintenance Shop	13,000 Square Feet
Three Bay Aircraft Maintenance Hangar	90,000 Square Feet
Alert Aircraft Parking Apron Expansion	24,700 Square Yards
ADAL Alert Crew Facility	26,200 Square Feet
AGE Shop/Storage Addition	10,000 Square Feet
Jet Fuel Storage and Dispensing Facility	- - - - -
Aircraft Maintenance Ramp Lighting	- - - - -
Alert Area Security and Blast Fences	2,500 Square Feet
Flight Simulator Support Facility	4,500 Square Feet
Relocate Publication Distribution Office	6,840 Square Feet
Relocate Personnel Support Facility	12,840 Square Feet
Unaccompanied Enlisted Personnel for Dormitory	38,000 Square Feet

Peacekeeper Rail Garrison Program (PRG)

For the Peacekeeper Rail Garrison Proposed Action at Malmstrom AFB, the Air Force would construct garrison facilities and provide personnel necessary for the deployment and operation of up to eight missiles in four Peacekeeper missile trains. Approximately \$92 million (in 1986 dollars) of construction would occur at the base for the Proposed Action. Construction activities for the purpose of analysis are assumed to begin in 1990 and be completed in 1992, with full operations beginning in 1993. Direct employment requirements would be 99 in 1990, peaking at 439 in 1992, and stabilizing at 338 during

TABLE 4.0-2

Selected Socioeconomic Indicators
Second Squadron of the 301st Air Refueling Wing Program
Malmstrom AFB, Montana, 1989-1993 (Proposed Action)

	1989	1990	1991	1992 ¹
REGION OF INFLUENCE				
Employment (Jobs)				
Total Program-Related Jobs	287	167	225	427
Direct Jobs	157	86	151	284
Civilian	157	86	36	10
Military	--	--	115	274
Secondary Jobs	130	81	74	143
Local Hires	239	140	98	146
Program-Related Spending (1000 86\$)	5,333	3,260	3,385	6,537
Personal Income (1000 86\$)				
Direct	4,367	2,392	3,357	5,886
Secondary	2,714	1,697	1,464	2,840
Total Personal Income	7,081	4,089	4,821	8,726
Program Population	115	63	328	725
GREAT FALLS AREA ²				
Population				
Baseline	72,550	72,648	72,904	73,161
Program-Related Change	115	63	328	725
Change as Percentage of Baseline	0.2	0.1	0.4	1.0
Housing Demand				
Temporary Units	16	9	8	10
Permanent Units	29	16	86	190
Total Units	45	25	94	200
School District Enrollment				
Elementary	10	5	36	81
Secondary	4	2	15	35
Total Enrollment	14	7	51	116

Notes: 1 Program-related effects would continue at these levels throughout the life of the program.

2 Includes Malmstrom AFB for population and school enrollment.

the full operations phase. Peak construction employment of 251 would occur in 1991. Annual direct employment requirements for the Proposed Action are presented in Table 4.0-3 for site activation, construction, assembly and checkout, and operations activities.

For the Proposed Peacekeeper Rail Garrison Action, two subalternatives would be considered. For the purpose of clarity, these are referred to as the south site option and the east site option. The garrison for the south site option would be located in the southeast portion of the base. Acquisition of restrictive easements on 226 acres adjacent to the southern boundary of the base would be required to accommodate the explosive safety zone for the garrison. Seven buildings (including the 4 alert shelters), roads, utilities, parking, and approximately 1.4 miles of track would be constructed within the garrison. Construction of the garrison would permanently disturb approximately 50 acres and temporarily disturb 92 acres.

For these options, approximately a 3.9-mile connector rail spur (0.7 miles on base and 3.2 miles off base) would be constructed from the garrison to the Burlington Northern (BN) main line southeast of the base. Approximately 40 acres would be acquired for the offbase portion of the rail spur and a wye connection where the spur would join the main line. Approximately 24 acres would be disturbed permanently and 19 acres temporarily outside the garrison for the connector spur and wye. For more details regarding these options, see the Final Environmental Impact Statement, Peacekeeper Rail Garrison Program.

For the Alternative Action, the Air Force would construct garrison facilities and provide personnel for the deployment and operation of up to six Peacekeeper missile trains. Approximately \$107.1 million (in 1986 dollars) of construction would occur at Malmstrom AFB for the Alternative Action. Construction and operations activities are assumed to occur in the same timeframe as the Proposed Action.

For the east site option, the garrison would be located in the eastern portion of the base and collocated with the existing weapons storage area (WSA). Seven buildings (including the 4 alert shelters), roads, utilities, parking, and approximately 1.4 miles of track would be constructed within the garrison. To accommodate the garrison, acquisition of 69 acres adjacent to the eastern boundary of the base would be required. Acquisition of restrictive easements on 344 acres adjacent to the base would be required to accommodate the explosive safety zone for the garrison. Restrictive easements on an additional 160 acres were previously acquired for the existing explosive safety zone for the WSA. Construction of the garrison would permanently disturb approximately 64 acres and temporarily disturb 133 acres.

For the east site option, a 3.1-mile connector rail spur (0.1 mile onbase and 3.0 mile offbase) would be constructed from the garrison to the BN main line southeast of the base.

Approximately 45 acres would be acquired for the offbase portion of the rail spur and a wye connection where the spur would join the main line. Approximately 17 acres would be disturbed permanently and 13 acres temporarily outside the garrison for the connecting spur and wye.

Annual Direct Employment (Military and Civilian) for the Peacekeeper Rail Garrison, KC-135R Refueling (Second Squadron), and Small ICBM Programs in the Malmstrom AFB Area by Calendar Year (Full-Time Equivalent Jobs)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 ¹
PEACEKEEPER RAIL GARRISON										
<u>Proposed Action (4 TASS)</u>										
Site Activation	1	15	24	11	0	0	0	0	0	0
Construction	0	83	251	89	0	0	0	0	0	0
Assembly & Checkout	0	1	18	1	0	0	0	0	0	0
Operations	0	0	99	338	338	338	338	338	338	338
TOTAL:	1	99	392	439	338	338	338	338	338	338
<u>Alternative Action (6 TASS)</u>										
Site Activation	1	15	24	11	0	0	0	0	0	0
Construction	0	101	265	89	0	0	0	0	0	0
Assembly & Checkout	0	2	27	2	0	0	0	0	0	0
Operations	0	0	108	372	372	372	372	372	372	372
TOTAL:	1	118	424	474	372	372	372	372	372	372
KC-135R (Second Squadron)										
Site Activation	0	0	0	0	0	0	0	0	0	0
Construction	157	86	32	0	0	0	0	0	0	0
Assembly & Checkout	0	0	0	0	0	0	0	0	0	0
Operations	0	0	119	284	284	284	284	284	284	284
TOTAL:	157	86	151	284	284	284	284	284	284	284
SMALL ICBM										
<u>Base</u>										
Site Activation	20	20	60	80	100	100	100	100	60	10
Construction	0	840	470	490	460	90	0	0	0	0
Assembly & Checkout	0	0	0	310	190	280	310	230	100	0
Operations	0	0	250	1,100	1,630	1,940	2,440	3,100	3,100	3,100
<u>Deployment Area</u>										
Construction	0	240	340	320	330	150	20	0	0	0
TOTAL:	20	1,100	1,120	2,300	2,710	2,560	2,870	3,430	3,260	3,110

Note: ¹ Employment would continue at these levels for the duration of the respective programs.

Technical and personnel support facility requirements for the east site option would be similar to the south site option. The east site option would require the construction of support facilities with a total floor space of approximately 93,600 square feet. To provide access to the Training Train Shelter, a 1.1 mile (0.7 mile onbase and 0.4 mile offbase) rail spur would be constructed from the connector spur. Approximately five acres would be acquired for the offbase portion of the spur. If additional military family housing is provided onbase, 166 family housing units would be constructed on land adjacent to the base; acquisition of 31 acres adjacent to the northwest boundary of the base would be required. In addition, approximately 1.5 miles of new base boundary fencing would be required. Construction of the support facilities, fencing, roads, utilities, and parking would permanently disturb approximately 61 acres and temporarily disturb 75 acres.

The east site option would also require the relocation of several existing base facilities, including some roads, to new locations. Relocation of these facilities would permanently disturb approximately 11 acres and temporarily disturb 2 acres. In addition, an existing park facility, located within the explosive safety zone for the garrison, would be eliminated.

The Small ICBM Program

The Small ICBM program (Proposed Action) would provide for the deployment of 200 Hard Mobile Launchers (HMLs) at up to 200 of the Minuteman missile launch facilities. The Main Operating Base would be Malmstrom AFB. New support facilities containing approximately 3.2 million square feet of floor space would be constructed over a 6-year period at the base to support Small ICBM operations; some existing facilities would require additions and/or modifications to provide an additional 67,000 square feet of floor space. Various roads, utilities, and other support construction would also be required.

The majority of the Small ICBM technical facilities would be constructed between 1990 and 1992 on the southeast side of the Malmstrom AFB runway, within or adjacent to the existing Weapons Storage Area (WSA). The WSA would be expanded to accommodate Small ICBM weapon assembly and storage facilities. A HML vehicle operations training area would be constructed requiring acquisition of 350 acres adjacent to the east base boundary.

Personnel support facilities would be sited on the northwest side of the runway and be integrated within the existing support complex, with the exception of military family housing and some technical and personnel support facilities which would require acquisition of an additional 430 acres of land north of the base.

Summary of Program Impacts

Second KC-135R Air Refueling Squadron Program

Figure 4.0-1 summarizes the impacts of the Proposed Action, the cumulative impacts of the Proposed Action plus the Peacekeeper Rail Garrison Program, the Proposed Action, and the Peacekeeper Rail Garrison plus the Small ICBM programs.

For the Proposed Action, significant short- and long-duration impacts were found for transportation, while only long-duration significant impacts were determined for noise. The LOI findings in both cases were moderate.

FIGURE 4.0-1

SUMMARY OF IMPACTS
PROPOSED ACTION, NO ACTION ALTERNATIVE, CUMULATIVE IMPACTS

ENVIRONMENTAL RESOURCES

	SOCIOECONOMICS		UTILITIES		TRANSPORTATION		LAND USE		CULTURAL RESOURCES		BIOLOGICAL RESOURCES		WATER RESOURCES		GEOLOGY & SOILS		AIR QUALITY		NOISE	
	SHORT DUR	LONG DUR	SHORT DUR	LONG DUR	SHORT DUR	LONG DUR	SHORT DUR	LONG DUR	SHORT DUR	LONG DUR	SHORT DUR	LONG DUR	SHORT DUR	LONG DUR	SHORT DUR	LONG DUR	SHORT DUR	LONG DUR	SHORT DUR	LONG DUR
	LOI	SIG	LOI	SIG	LOI	SIG	LOI	SIG	LOI	SIG	LOI	SIG	LOI	SIG	LOI	SIG	LOI	SIG	LOI	SIG
PROPOSED ACTION	LOW/B	NO/B	N/A	LOW	MOD	MOD	NEG	NEG	N/A	NEG	NEG	NEG	LOW	LOW	MOD	NEG	NEG	NEG	NEG	MOD
	NO/B	NO/B	N/A	NO	YES	YES	NO	NO	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
NO ACTION ALTERNATIVE	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M	F B M
CUMULATIVE: PROPOSED ACTION PLUS PEACEKEEPER RAIL GARRISON	LOW/B	LOW/B	N/A	LOW	HIGH	HIGH	NEG	NEG	N/A	NEG	LOW	MOD	LOW	LOW	HIGH	NEG	MOD	NEG	NEG	MOD
	YES/B	YES/B	N/A	NO	YES	YES	NO	NO	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CUMULATIVE: PROPOSED ACTION PLUS PEACEKEEPER RAIL GARRISON AND SMALL ICBM	HIGH/B	HIGH/B	N/A	HIGH	HIGH	HIGH	MOD	MOD	N/A	LOW	MOD	MOD	LOW	MOD	HIGH	MOD	HIGH	MOD	MOD	MOD
	YES/B	YES/B	N/A	NO	YES	YES	NO	NO	N/A	NO	NO	NO	NO	NO	NO	YES	YES	YES	NO	NO

LOI - Level of Impact
 Resource with significant impact
 FBM - Future Baseline Maintained
 SIG - Significant
 Yes - Significant
 No - Not Significant
 N/A - Not Applicable
 MOD - Moderate
 NEG - Negligible
 Dur - Duration
 /B - With beneficial impacts

Cumulative Impacts

For the cumulative impacts of the Proposed Action plus the Peacekeeper Rail Garrison Program, long-duration impacts for socioeconomics would also become significant. If the Small ICBM Program impacts were added to the Proposed Action and the Peacekeeper Rail Garrison Program, short-duration socioeconomic impacts would also become significant. In addition, long-duration geology and soils as well as long-duration air quality impacts would become significant. Impacts on specific resources are described in the remainder of Chapter 4.

4.1 SOCIOECONOMICS

4.1.1 Impacts of the Proposed Action

Employment and Income. Total employment created by the Second KC-135R AREFS Program would range from 287 during the initial construction year, to 427 during the operations phase (from 1992 on). During the peak construction year, of the 287 total jobs, 157 would be direct and 130 would be secondary. Local hires, during this year, would number 239. During operations, of the 427 total jobs, 284 would be direct (274 military and 10 civilian) and 143 would be secondary. Local hires would number 146.

This program is expected to generate personal income (in 1986 dollars) ranging from \$7.1 million in 1989 to \$8.7 million annually during the operations phase. Cascade County's share of that personal income during three years would be \$6.5 and \$8.3 million, respectively. Regional spending due to the program would amount of \$6.5 million annually during the operations phase.

Population and Demographics. Cascade County's population would increase by 36 in 1980, by 115 in 1989, and by 725 in 1992 and the remainder of the operations period. The majority of the program-related immigrants in 1992 and thereafter would be military personnel and their dependents. Population immigration would represent an increase of about 1.0 percent to the Great Falls area during the operations phase, 1992, and thereafter, and less than 1.0 percent during the construction phase.

Housing. For the Proposed Action, the Air Force has programmed for 38,000 square feet of unaccompanied enlisted personnel housing (new dormitory). This space should suffice to house at least 80 of the 90 unaccompanied personnel associated with the Second KC-135R AREFS, and would eliminate the deficit which was created by the unaccompanied personnel associated with the first squadron. The remaining 10 unaccompanied personnel would seek housing off base. No new military family housing units would be provided by the Air Force in support of the Second KC-135R AREFS. All program-related civilian and accompanied military households would be housed in privately owned permanent housing units and temporary facilities in the Great Falls area. In 1992 about 190 permanent units and about 10 temporary units would be required. In 1989, the number of permanent off base units required would amount to 9. This requirement would grow to 29 in 1989 and 86 in 1991. Prior to 1992 the program-related housing demand would reduce the vacancy rate by less than 10%. The change in demand for temporary housing would hardly be noticeable (16 units maximum).

The peak and steady state demand for permanent housing units would be in 1992 and subsequent years. In these years, 190 privately owned off base permanent units would be required. This demand would be met through the use of projected available vacancies (870 units), reducing the available vacancy rate from 2.9 to 2.3 percent in that year. The short-duration demand for the construction period would range between 9 and 29 privately owned off base units between 1988 and 1990. This would cause the vacancy rate to decline by no more than one-tenth of a percentage point. The demand for temporary facilities would also peak in 1992 at 10 units or 2.0 percent of the available vacant facilities. Short-duration demand would even be less.

Because the short-duration demand for temporary facilities in Great Falls would not cause a shortage even during periods of peak baseline occupancy, beneficial effects would occur as a result of the program. Similarly, the short- and long-duration demands for permanent units would remove excess vacancies. Because of the vacancy reductions, the program-related demand for permanent units would also be beneficial.

Education. During the operations phase, the two school districts in Great Falls are expected to receive an additional 116 students as a result of the program. For the district as a whole, the pupil-to-teacher ratio at the elementary level would increase from about 21.5-to-1 to 21.7-to-1. This overall level is also below the weighted average state standards. Since no onbase military family housing will be constructed, students would be dispersed throughout the system, minimizing concentrations of pupils at any one of the elementary and secondary schools. Additional staffing may be needed in some schools in order to maintain existing pupil-to-teacher ratio.

Public Services. Program-related increases in population would lead to increases in demands for public services provided by the City of Great Falls of about 1.0 percent over baseline levels in 1993. The increased service demands would be experienced by a majority of the departments now providing service to area residents. To maintain current service levels, as measured by the city's rate of 5.8 employees per 1,000 population, city staffing levels would have to increase from a baseline of 426 to 431 by 1993. Most of the additional staffing would be needed in the Police, Fire, and Public Works departments. Without additional personnel, the number of city personnel per 1,000 population would fall from about 5.8 to 5.7. This would not result in an appreciable deterioration from the community's current level of public service provision.

Program-related increases in population would lead to increases in demands for public services provided by Cascade County of less than 1 percent over baseline levels in 1993. To maintain existing service levels, county staffing would have to increase from a baseline level of 612 to 618 by 1993. The Sheriff's Department and Public Works Department would be expected to need a large share of these personnel. Without additional staffing, the number of county personnel per 1,000 population would fall from 7.0 to 6.9. The Cascade County jail, currently operating above capacity, has been identified as an inadequate public facility. Currently, no funds are available for the construction of a new jail. While the Cascade County jail facility is considered a problem under baseline conditions, program-induced population immigration could further exacerbate this problem, even though it is recognized that the base is expected to handle many of the problems that would otherwise tax the jail capacity if the problems were caused by civilians.

Public Finance. Program-related increases in the expenditures of the City of Great Falls and Cascade County would be limited to outlays for additional personnel (up to about \$130,000 for the city and \$100,000 for the county for the proposed action). These increases would represent less than a one percent increase in projected baseline expenditures in the county as well as the city.

Based on an average cost of \$3,500 per high school pupil, increased high school district expenditures for the proposed action would amount to \$122,000 by 1992 and continue at this approximate level over the life of the program. This would represent an increase of about 1.0 percent over projected baseline levels. Based on an average cost of \$2,500 per elementary school pupil, increased elementary district expenditures would amount to \$203,000 in 1992. This would represent an increase of less than 1 percent over projected baseline levels. For the school districts, temporary revenue shortfalls of up to \$40,000 in the high school district and \$60,000 in the elementary school district are projected. Potential shortfalls would represent less than one-half of one percent of operating expenditures of the districts and would require some adjustment in funding from either state foundation programs or other local sources. If this adjustment does not materialize or if the school districts' revenue base shrinks due to changes in the tax structure, the shortfalls as a percentage of operating expenses would increase and could threaten the quality of education.

During the short term (construction period) additional expenditure requirements for program-related high school and elementary school students would peak in 1989 at \$15,000 and \$25,000, respectively. These amounts are only a fraction of a percent of operating expenditures. Nevertheless, it is possible that individual schools or classrooms may have to make changes to accommodate the additional students and the accompanying higher student turnover rate.

Summary of Impacts. Both short- and long-duration socioeconomic impacts of program deployment at Malmstrom AFB would be low. Program-induced population immigration in the Great Falls urban area would represent increases of about 1.0 percent over baseline levels in 1992. Housing demand, public service demand, school enrollment increases, and local government expenditure requirements would be low. District-wide school enrollment increases could be accommodated.

A recent court decision held that the current funding mechanism for local school districts in the state is unconstitutional. Although the decision is being appealed by the affected state agencies, the resolution of the issue may result in major changes in the way local schools are funded. Depending on the resolution of this issue, program-related effects on local school district finances may become significant.

Short- and long-duration beneficial effects would be experienced by hotel/motel operators and landlords, respectively. (The already inadequate capacity of the Cascade County jail may be further strained by demand associated with program-related population increases.) Given that Malmstrom AFB would take care of many military personnel problems and that most workers during the construction phase are expected to be local hires, no unusual project-related impacts are anticipated and the current situation is not anticipated to change much due to the project. Therefore, the impact is not considered significant and the level of impact is low.

4.1.2 Impact of No Action Alternative

The proposed action is needed to move 14 KC-135R aircraft from numerous SAC locations which would free required space for the Air Force's B-2 Bomber. The aircraft and aircrew and maintenance personnel will come from a number of bases to be determined later.

This basing action is needed to meet Single Integrated Operations Plan (SIOP) mating and ranging requirements for National Defense Alert. No other base in the region is considered suitable for this mission. Other regions do not meet criteria for SIOP mating and ranging or peacetime refueling support for day-to-day training. The number of aircraft are matched against future bomber aircraft basing plans for air refueling requirements. Movement of fewer aircraft would not meet mission requirements. Therefore, the only alternative is the No Action alternative. The No Action alternative is unsatisfactory since it would not base sufficient number of tanker aircraft assets in the region to support national defense requirements and future basing actions.

Under the No Action alternative, baseline socioeconomic conditions would prevail.

4.1.3 Cumulative Impacts

To additional Air Force programs are under consideration for deployment at Malmstrom AFB--the Peacekeeper Rail Garrison Program and the Small ICBM Program. Concurrent deployment of the Second KC-135R AREFS and other Air Force programs at Malmstrom AFB would have cumulative effects greater than with the Proposed Action alone. The cumulative effects of these programs will be examined as well. The preliminary estimates of program employment generation for the concurrent deployment of the Second KC-135R AREFS and other Air Force programs at Malmstrom AFB are presented in Table 4.1-1.

4.1.3.1 Cumulative Impacts: Second KC-135R AREFS and Peacekeeper Rail Garrison Programs

Employment and Income. Total employment created by the Peacekeeper Rail Garrison Program and the Second Squadron of KC-135R aircraft would be 977 in 1991, and then stabilize at 957 during operations (1993). During the peak construction year (1990), of the 385 total jobs, 185 would be direct (179 civilian and 6 military) and 200 would be secondary. The number of local hires would be 319. During operations, out of 957 total jobs, 622 would be direct (68 civilian and 554 military) and 335 would be secondary. Local hires would number 355.

Combined, both programs would generate personal income (in 1986 dollars) of \$21.5 million in 1991 and then stabilize at \$19.0 million during operations. Cascade County's share of that personal income would range from \$19.6 million in 1991 and then stabilize at \$17.8 million during operations. Regional spending would be \$18.2 million in 1991 and \$15.0 million during operations.

Population and Demographics. Cumulative impacts of population immigration are discussed with respect to the Great Falls area because no other area is affected by the various program-related population immigration. The effect on population from the Peacekeeper Rail Garrison Program and the Second

Table 4.1-1

Total Employment* and Population Immigration
Peacekeeper Rail Garrison, Small ICBM, and Second KC-135R Squadron Programs
Malmstrom AFB, Montana
1989-1998

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total Employment	561	2,683	2,937	4,853	4,983	4,476	4,940	5,751	5,529	5,331
KC-135R	287	167	225	427	427	427	427	427	427	427
Peacekeeper Rail Garrison	1	218	752	729	530	530	530	530	530	530
Small ICBM	273	2,298	1,960	3,697	4,026	3,519	3,983	4,794	4,572	4,374
Population Immigration	247	928	2,138	5,395	6,462	6,993	8,172	9,679	9,415	9,163
KC-135R	115	63	328	725	725	725	725	725	725	725
Peacekeeper Rail Garrison	2	96	507	929	839	839	839	839	839	839
Small ICBM	130	769	1,303	3,741	4,898	5,429	6,608	8,115	7,851	7,599

* Includes direct and indirect employment

Squadron of KC-135R aircraft would be in 1989. Population would peak at 1,654 in 1992 and then stabilize at 1,564 during the operations phase. In the Great Falls area, the population immigration would represent a 2.3-percent increase over projected baseline levels in 1992 and a 2.1-percent increase in 1993. The number of weekly commuters would be less than 25 during the construction phase.

Housing. The cumulative demand for both permanent and temporary housing associated with the Second KC-135R AREFS aircraft and the Peacekeeper Rail Garrison program would also be confined to the Great Falls urban area. It is expected that new on base unaccompanied enlisted personnel housing facilities would be constructed at Malmstrom AFB to house about 80 of the 185 unaccompanied personnel associated with these two missions and to offset the deficit which resulted with the deployment of the first squadron. Another 85 would be housed in existing on base unaccompanied enlisted personnel housing facilities. The remaining 20 unaccompanied personnel would seek housing off base. The Air Force has programmed for up to 166 family housing units to be constructed either on Malmstrom AFB or in the proximity of the base in the event current housing availability changes in the future. However, current projections of housing vacancies and potential new construction in Great Falls suggest that no new units would have to be provided by the Air Force through one of its housing programs. Since these conditions may change, the Air Force would continue to assess the housing market in the Great Falls area and would increase or decrease the extent of its participation as necessary to prevent housing impacts in the community.

The peak demand for permanent housing units under this cumulative scenario would be in 1992. In this year, 287 privately-owned off base permanent units would be required. This short-duration demand would be met through the use of projected available vacancies (870 units), reducing the available vacancy rate from 2.9 to 1.9 in that year. The long-duration demand would be for 261 privately owned off base units (26 fewer than the peak) beginning the following year. This would cause the long-duration vacancy rate to decline

from 2.8 to 2.0 percent in 1993. The demand for temporary facilities would peak in 1991 at 34 units or 7.0 percent of the available vacant facilities during periods of minimum vacancy, and decline to the long-duration demand for 12 or 3.0 percent of the available vacant facilities during periods of minimum vacancy.

Education. The concurrent deployment of the Second KC-135R AFRES aircraft and the Peacekeeper Rail Garrison program would lead to increased enrollment in the GFPS system. In 1993, the operations year for the two programs, an additional 250 students would be added to schools in the area. Of these 250 students, 134 would be attributable to the Peacekeeper Rail Garrison program and 116 would be attributable to the second squadron of KC-135R aircraft.

The addition of these students would cause the district wide pupil-to-teacher ratio at the elementary level to increase from 21.5-to-1 to 22.0-to-1. This ratio would be below the weighted average state standard. Students associated with the Second Squadron of KC-135R aircraft would be dispersed throughout the district and would not add measurably to the influx at any one elementary school. Increased enrollments at Loy Elementary School, mainly associated with the Peacekeeper Rail Garrison program, may increase pupil-to-teacher ratios at that school above levels recently experienced. If the housing requirements associated with the Peacekeeper Rail Garrison

program are located off base, enrollment increases attributable to both programs would be dispersed throughout the district.

Public Services. In 1993, the concurrent deployment of the Second Squadron KC-135R AREFS aircraft and the Peacekeeper Rail Garrison program would lead to population increases of 2.1 percent and 1.8 percent for the City of Great Falls and Cascade County, respectively. These population increases would translate into increased demands for these jurisdiction's public services. The City of Great Falls would need nine additional personnel to maintain existing service level standards. The Police, Fire, and Public Works departments would need a majority of these personnel. Without additional staffing, the number of city personnel per 1,000 population would drop from 5.8 to 5.7. Cascade County would need 11 additional personnel by 1993 or the number of county personnel per 1,000 population would drop from 7.0 to 6.9. This level of population immigration would affect the county's ability to provide public services to their constituents, mainly as a result of the problems associated with the inadequacy of the Cascade County jail facility.

Public Finance. Concurrent deployment of the Second KC-135R AREFS aircraft and the Peacekeeper Rail Garrison program would result in increased net expenditures in the City of Great Falls of approximately \$320,000 by FY 1993. This would represent an increase of about 1 percent over projected baseline levels in this year. Program-induced revenues would be slightly lower at \$310,000. This assumes that housing for military families would be developed on base. If housing were constructed off base, collection of additional property taxes would result in slightly higher revenues.

In Cascade County, deployment of the two programs would result in increased expenditures of approximately \$210,000 by FY 1993. This would represent an increase of about two percent over projected baseline levels in this year. Program-induced revenues would be slightly lower at \$140,000 in the same year. This assumes that housing for military families is developed onbase. If housing were constructed offbase, the additional property taxes would result in slightly higher revenues.

For the Great Falls Elementary School District No. 1, deployment of the two programs would result in increased expenditures of approximately \$440,000 by FY 1993. This would represent an increase of about 2 percent over projected baseline levels in this year. Program-induced revenues would be slightly lower at \$410,000 in the same year. Payments from P.L. 81-874 programs would amount to approximately \$50,000 during the operations phase. If housing were developed off base, payments from P.L. 81-874 programs would be reduced while revenues from property taxes would increase.

For the Great Falls High School District No. A, deployment of the two programs would result in increased expenditures of approximately \$270,000 by FY 1993. This would represent an increase of about 2 percent over projected baseline levels in this year. Program-induced revenues would be slightly lower at approximately \$250,000 in the same year. Payments from P.L. 81-874 programs would amount to approximately \$30,000 during the operations phase. If housing were developed off base, payments from P.L. 81-874 programs would be reduced while revenues from property taxes would increase.

Summary of Impacts: Proposed Action and Peacekeeper Rail Garrison. Both short- and long-duration socioeconomic impacts associated with deployment of the Second KC-135R AREFS aircraft and the Peacekeeper Rail Garrison would be

low. Population immigration in the peak year (1992) would number 1,654 persons, representing 2.3 percent of baseline population levels in the Great Falls area. Long-duration population immigration would be 1,564 persons beginning in 1993, representing 2.1 percent of baseline population levels.

The program-induced demand for housing would be met by available vacancies, existing educational facilities would absorb program-related enrollment increases, and existing revenue sources of the jurisdictions would be able to meet program-related expenditures. The construction of on base family housing for the Peacekeeper Rail Garrison program may cause pupil-to-teacher ratios at Loy Elementary to rise above recently experienced levels, but these districtwide enrollment increases could be accommodated. Public service impacts are found to be significant even though Malmstrom AFB programs deal with a portion of military law offenders, because the Peacekeeper Rail Garrison and the Second KC-135R AREFS mission combined could severely stress the ability to service the civilian population with respect to County jail facilities. Beneficial effects would be experienced by hotel/motel operators (short duration) and by landlords (long duration).

As indicated earlier, a recent court decision, however, has held that the current funding mechanism for local school districts in the state is unconstitutional. Although the decision is being appealed by the affected state agencies, the resolution of the issue may result in major changes in the way local schools are funded. Depending on the resolution of this issue, program-related effects on local school district finances may become significant.

4.1.3.2 Cumulative Impacts: Second KC-135R AREFS, Peacekeeper Rail Garrison and the Small ICBM Program

Employment and Income. Total employment created by all three programs (Peacekeeper Rail Garrison, Small ICBM, and the Second Squadron of KC-135R aircraft) would be 2,683 in 1990 and then 5,751 in 1996. During the peak construction year (1990), of the 2,683 jobs created by the three programs, 1,183 would be direct (1,168 civilian and 15 military) and 1,500 would be secondary. The number of local hires would be 2,253. At their peak in 1996, of the total 5,751 new jobs, 4,051 would be direct (391 civilian and 3,660 military) and 1,700 would be secondary. Local hires would number 1,844. Total jobs related to all three programs would range from 0.1 to 7.1 percent of the total baseline jobs in the ROI during the 1989 to 1996 period.

Combined, all three programs would generate personal income (in 1986 dollars) ranging from \$68.9 million in 1990 to \$109.4 million in 1996 in the ROI. Cascade County's share of that personal income would vary from \$61.1 million and then \$104.5 million during those same years. Regional spending in the ROI for all three programs combined would increase from \$64.2 million in 1990 to \$104.6 million in 1996.

Population and Demographics. The effect on population from all three programs would range from 247 in 1989 to 928 in 1990, and then 9,679 in 1996. At its peak in 1996, the immigration into the Great Falls area would be 13.0 percent of the baseline population. During the operations phase of the programs, beginning in 1998, population immigration would be 9,163 persons, 12.3 percent of the baseline projected for the Great Falls area.

Housing. The cumulative demand for housing associated with the three programs would be confined to the Great Falls urban area. It is expected that new onbase unaccompanied enlisted personnel housing facilities would be constructed at Malmstrom AFB to house about 1,150 of the 1,365 unaccompanied personnel associated with the three missions. An additional 85 personnel would reside in existing onbase unaccompanied enlisted personnel housing facilities. The remaining 130 unaccompanied personnel would seek housing offbase. The Air Force has programmed for up to 1,912 family housing units to be constructed either on Malmstrom AFB or in the proximity of the base. If all Air Force personnel were required to seek suitable and affordable housing in the community in the absence of any Air Force housing program, some serious consequences would result. To avoid these significant impacts, the Air Force will provide adequate housing for its personnel to offset potential shortages.

The peak demand for permanent housing units under this cumulative scenario would be in 1992. In this year, 745 privately owned offbase permanent housing units would be required. This short-duration demand would be met through the use of projected available vacancies (870 units) and expected private construction (280 additional units). This would reduce the available vacancy rate from 2.9 percent to about 1.3 percent in that year. The long-duration demand would be for 530 privately owned offbase units (160 fewer units than the peak) beginning in 1999. The long-duration vacancy rate would fall from 2.8 to 2.0 percent in that year. The demand for hotel/motel units would peak in 1990 at 115 or 25.0 percent of the available facilities during periods of minimum vacancy. The long-duration demand would be for 30 temporary facilities or 7.0 percent of those available during periods of minimum vacancy.

Education. The concurrent deployment of the three programs would cause enrollment increases of 1,466 students above baseline levels by 1998. This would cause district wide pupil-to-teacher ratios at the elementary level to increase from 21.5-to-1 to 24.5-to-1 in that year. Loy Elementary School, located adjacent to the base, would have pupil-to-teacher ratios exceeding 50-to-1 with all three cumulative programs. These enrollment increases far exceed state standards and are beyond Loy's design capacity. Even with offbase housing, capacity problems may exist at selected schools.

Public Services. In 1998, the concurrent deployment of the three programs would lead to population increases of 12.3 percent and 10.3 percent for the City of Great Falls and Cascade County, respectively. To maintain existing service levels, Great Falls would need 53 additional personnel by 1998. Additional staffing would be needed for a majority of the city's departments. Without additional staffing, the number of city personnel per 1,000 population would drop from 5.8 to 5.2. Cascade County would need 64 additional staff above baseline levels. Staffing would be needed in most county departments. Without additional staffing, the number of county personnel per 1,000 population would drop from 7.0 to 6.3. With additional staffing, these jurisdictions would be able to accommodate program-related increases in service demand. The Cascade County Jail, however, would continue to be inadequate.

Public Finance. Deployment of all three programs (Second KC-135R Squadron, Peacekeeper Rail Garrison, and Small ICBM) would result in increased expenditures in the City of Great Falls of approximately \$2.0 million in the peak year (1996) and \$1.9 million per year during the operations phase.

These increases would be approximately 9 percent over projected baseline levels in these years. Program-induced revenues would be slightly lower at \$1.9 million in the peak year and \$1.8 million per year during the operations phase. This assumes that housing for the military families would be constructed onbase. If housing were constructed off base, the additional property tax collections would increase revenues to approximately \$2.0 million in the peak year and \$1.9 million per year during operations.

In Cascade County, deployment of all three programs would result in increased expenditures of \$1.2 million in FY 1996 and \$1.1 million during operations. These increases would be approximately 9 percent over projected baseline levels in these years. Program-induced revenues would be slightly lower at \$830,000 in the peak year and \$770,000 during operations. This assumes that housing for military families would be constructed on base. If housing were constructed off base, the additional property tax collections would increase revenues to approximately \$990,000 in FY 1996 and \$960,000 during operations. This increase in revenues, however, would still not be sufficient to meet program-induced expenditure demands.

For the Great Falls Elementary School District No. 1, deployment of all three programs would result in increased expenditures of \$2.7 million in the peak year FY 1996 and \$2.6 million during the operations phase. These increases would be approximately 11 percent over projected baseline levels in these years. Program-induced revenues would be approximately \$2.4 million in the peak year and \$2.6 million during operations. Payments from P.L. 81-874 programs would amount to approximately \$540,000 during operations. This assumes that the military family housing would be developed onbase. If housing is developed offbase, payments from P.L. 81-874 would be reduced substantially (to approximately \$25,000) while property taxes from the additional housing built in the community would increase. Because of lagging revenues for state foundation programs, temporary revenue shortfalls of up to \$310,000 in the peak year are projected. Revenues and expenditures would be in balance over the operations phase.

For the Great Falls High School District No. A, deployment of all three programs would result in increased expenditures of approximately \$1.6 million in both the peak year and during operations. This increase would be approximately 12 percent over projected baseline levels. Program-induced revenues would be approximately \$1.5 million in the peak year and \$1.6 million during operations. Payments from P.L. 81-874 programs would amount to approximately \$320,000 per year during operations. If housing is developed offbase, payments from P.L. 81-874 programs would be reduced substantially (to approximately \$15,000 per year) while property taxes from the additional housing built in the community would increase. Because of lagging revenues from state foundation programs, temporary revenue shortfalls of up to \$150,000 in the peak year are projected. Revenues and expenditures would be in balance over the operations phase.

Summary of Impacts: Proposed Action Plus the Peacekeeper Rail Garrison Program Plus the Small ICBM Program

Both short- and long-duration socioeconomic impacts associated with deployment of all three programs would be high. Population immigration in the peak year (1996) would number 9,679 persons, representing 13.0 percent of the Great Falls area baseline population levels. Long-duration population immigration would be 9,163 persons beginning in 1998, representing 12.3

percent of baseline population levels. These impacts would be significant because of the need for expanded school facilities in the area of the base without program-related revenues sufficient to meet the additional cost, overcrowding at the Cascade County jail (inadequate under baseline conditions), and revenue shortfalls in Cascade County.

Deployment of the Alternative Action, the Second Squadron of KC-135R aircraft, and the Small ICBM program at Malmstrom AFB would cause approximately 9,767 persons to immigrate into the Great Falls urban area during the peak year (1996). During operations, this total immigration would be approximately 9,250 persons. The population increases would not be sufficient to change the overall level of impact or significance ratings. Short- and long-duration impacts would remain high and significant as previously discussed in the Proposed Action/Second Squadron of KC-135R aircraft/Small ICBM cumulative section.

Both short- and long-duration beneficial socioeconomic effects would be generated by the Proposed and Alternative Actions, including increases in employment and income, and greater utilization of temporary and permanent housing.

Mitigation Measures. Mitigation measures that will be undertaken to eliminate potential significant impacts of the Proposed or Alternative Actions and the concurrent deployment of the Peacemaker Rail Garrison program, the Small ICBM program, and the Second Squadron of KC-135R aircraft at Malmstrom AFB are listed in the following. For each measure, the agencies that may be involved in implementation are identified.

- o Encourage participation in P.L. 81-874 entitlement programs by requesting parents who live or work on federal facilities to respond to school district requests for information. This federal program provides aid to local school districts which have had substantial increases in school enrollments as a result of new or expanded federal activities (US Air Force).

Other possible mitigation measures include:

- o As appropriate, award multiple small contracts to enable local firms with limited bonding capacities the opportunity to bid. Contract awards to local firms could reduce population immigration during the construction phase and subsequently lower demand for temporary housing units (US Army Corps of Engineers).

4.2 UTILITIES

4.2.1 Impacts of the Proposed Action

Potable Water Treatment and Distribution. Average daily requirements for the City of Great Falls system would increase from a baseline level of 12.78 MGD to a peak of 12.92 MGD in 1992. Program-related demands from the city and the base would equal 0.14 MGD or a 1.1-percent increase. The city's 60-MGD capacity treatment facilities would be operating at 22 percent and storage would be adequate to meet summer demands. Average daily demands at the base would increase from 1.16 MGD to 1.19 MGD for Malmstrom AFB and would be met

through the 3.37-MGD interconnection with the city. The existing contract with the city allows 460 MG annually or 1.26 MGD.

Wastewater. Average daily flows for the City of Great Falls would increase from a baseline level of 9.92 MGD to a peak of 10.02 MGD in 1992 because of a 0.10-MGD or 1.0-percent program-related increase. The existing treatment plant, with 15.5-MGD capacity, would be operating at 65 percent of capacity and would be able to adequately treat the increased flows. Wastewater flows from Malmstrom AFB would increase from 0.75 MGD to 0.77 MGD. The existing force main from the an estimated 2.74-MGD capacity and has adequate capacity to handle the expected increased flow. The existing contract with the city may require revisions if flows are any greater than those currently estimated.

A pre-treatment system may be required in the near future due to industrial wastewater generation increased in part associated with the Second KC-135R AREFS. It should be noted that under baseline conditions, a new pre-treatment system is necessary.

Solid and Hazardous Waste. With the military family housing located on base, solid waste generation resulting from the program-related population would increase by 1.8 T/day or less than 1 percent of the 358 T/day generation in the City of Great Falls in 1992. Solid waste generation on base would increase by 0.1 T/day or less than 1.0 percent in 1993 (steady state operations). With the city and private contract haulers already adequately disposing of 358 T/day, the minor program-related increase would require no additional equipment or personnel. Existing landfills have projected lifespans of 15 and 75 years and would be able to handle the increased flow without a discernible effect on their lifespan. Program-related hazardous waste at Malmstrom AFB would increase by approximately 10,000 pounds as a result of the additional maintenance activities for the Second KC-135R AREFS. The Defense Reutilization and Marketing Office (DRMO), Great Falls, is responsible for providing for the proper storage of the wastes and arranging for transport to US EPA approved treatment and disposal facilities.

Energy Utilities. Program-related electricity demands would peak in 1993 with an increase of 2.2 MW. This demand would increase the projected peak demand of 1,498 MW for the MPC system by 0.15 percent. The MPC system has adequate power supplies to meet this increase without affecting their reliability. Electrical requirements at Malmstrom AFB, would equal 1.79 MW or a 17-percent increase on the MPC northeast substation. Adequate capacity is available from this substation to meet the demands. Additional capacity will be available when if the new 30-MW substation is constructed on base. Natural gas consumption would increase by 32 MMcf or 0.6 percent. The Great Falls Gas Company (GFGC) has an adequate infrastructure and reserves to meet the new demand, and adequate capacity to supply Malmstrom AFB without affecting their operations. Jet fuel (JP-4) consumption at Malmstrom AFB would increase by 9.6 MG or 54 percent as a result of the Proposed Action. Supplies would continue to be filled by the Defense Fuels Supply Center (DFSC) through contracts with local and regional suppliers. Regional suppliers indicated that their pipeline network and refinery capacity could supply this volume without affecting private sector supplies.

Summary of Impacts. Energy utility requirements associated with the Second KC-135R AREFS mission would increase demands on the City of Great Falls systems by less than 2 percent in 1992 (steady state operations and peak consumption). Because the peak year requirements are steady state operations requirements, all utility impacts are considered to be of long duration. These impacts would be low because the increases are less than 5 percent of the existing demands. These impacts would not be significant because each utility system has adequate capacity to meet the new demands without increasing personnel or expanding existing facilities. There would be no short-duration impacts.

4.2.2 Impacts of the No Action Alternative

For the No Action Alternative baseline conditions would prevail, unless otherwise noted.

4.2.3 Cumulative Impacts

4.2.3.1 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison

Concurrent deployment of the Second KC-135R AREFS and the Peacekeeper Rail Garrison Program at Malmstrom AFB would have cumulative effects which would be greater than those associated with the Proposed Action. The deployment of the Proposed Action and the Peacekeeper Rail Garrison program would have the following effects on utility systems:

Potable Water Treatment and Distribution. Program-related requirements of 0.3 MGD would increase average daily demands in the City of Great Falls by 2.3 percent. Both requirements on base and in the city would increase the baseline demand of 12.77 MGD to 13.07 MGD in 1992. The city's 60-MGD capacity treatment facilities, would be operating at 22 percent of capacity and storage would be adequate to meet peak summer demands. Daily requirements at Malmstrom AFB would increase from a baseline level of 1.16 MGD to 1.3 MGD in 1992. Program-related increases of 11.8 percent would be met through the existing interconnection with the city.

Wastewater. Average daily flows for the City of Great Falls would increase from a baseline level of 9.92 MGD to a peak of 10.14 MGD in 1992. Program-related demands for both the base and the city would equal 0.22 MGD or a 2.2-percent increase. The existing treatment plant would be able to adequately treat the increased flows. Wastewater flows at the base would increase from a baseline level of 0.75 MGD to a peak of 0.85 MGD as a result of a 0.1-MGD or 13-percent increase. The existing force main from the base has adequate capacity to handle the increased flow. Also, a pre-treatment system may be required, as discussed under the Proposed Action.

Solid and Hazardous Waste. Solid waste generation would increase by 4 T/day or 1.1 percent in the City of Great Falls in 1992. Solid waste generation at Malmstrom AFB would increase by 1.3 T/day or 10 percent in 1992 (peak year). With the city and private contract haulers already adequately disposing of 358 T/day the program-related increase would require no additional equipment or personnel. Existing landfills have projected lifespans of 15 and 75 years and would be able to handle the increased flow without a discernible effect on their lifespan. Program-related hazardous waste generation on base would increase by approximately 10,000 pounds and be incorporated into the existing management system, stored on base in conforming storage, and then transported

to treatment and disposal facilities. The DRMO Great Falls is responsible for providing for the proper storage of the wastes and arranging for transport to US EPA approved treatment and disposal facilities.

Energy Utilities. Program-related electricity demands would peak in 1993 with an increase of 5.7 MW. This demand would increase the projected peak demand of 1,498 MW for the MPC system by less than 1 percent. The MPC system has adequate power supplies to meet this increase. Electrical requirements at Malmstrom AFB would equal 5.17 MW or a 48-percent increase on the existing substation. Adequate capacity is available from this substation to meet the demands. Additional capacity will be available when the new substation is constructed on base. Natural gas consumption would increase by 64 MMcf or 1.2 percent. The GFGC has an adequate infrastructure and reserves to meet the new demand. Natural gas use on base would increase from a projected demand of 288 MMcf to 317 MMcf or by 9.9 percent. The GFGC has adequate capacity to supply the base. Jet fuel (JP-4) consumption at Malmstrom AFB would increase by 9.6 MG or 54 percent as a result of the Proposed Action. Diesel fuel consumption at Malmstrom AFB would increase as a result of the Peacekeeper Rail Garrison Program. Supplies would continue to be filled by the DFSC through contracts with local and regional suppliers.

Summary of Impacts. Utility requirements associated with the Second KC-135R AREFS and the Peacekeeper Rail Garrison program would increase demands on the City of Great Falls system by less than 3 percent in 1992 (peak year). During the operations phase the increases would reduce slightly but remain above 1 percent. Both peak year and operations requirements on energy utilities would be less than 2 percent. Because the peak year requirements would not be substantially greater than the impacts associated with the operations requirements, all utility impacts would be of long duration. These impacts would be low because the increases are less than 5 percent. Impacts would not be significant because each utility system has adequate capacity to meet the new demands without increasing personnel or expanding existing facilities.

4.2.3.2 Cumulative Impacts: Proposed Action Plus the Peacekeeper Rail Garrison and Small ICBM Programs

The deployment of the Second KC-135R AREFS the Small ICBM, and the Peacekeeper Rail Garrison programs would have the following effects on utility systems.

Potable Water Treatment and Distribution. Potable water treatment requirements for the City of Great Falls would gradually rise to a peak in 1996 with an increase of 1.62 MGD or 12.6 percent. During the operations phase, the demands would equal 1.51 MGD, which is 1.38 MGD greater than the Proposed Action. Treatment facilities have a capacity of 60 MGD to meet the increased demand. On base requirements in 1996 would increase average daily demands by 0.46 to 1.62 MGD. The existing contract with the city allows 460 MG annually, or 1.26 MGD. Revisions to this contract would be required.

Wastewater. Wastewater flows to the City of Great Falls system from all three missions would reach a peak of 1.19 MGD or an 11.9-percent increase in 1996. This increase would be processed at a facility with a 15.5-MGD capacity. On base wastewater flows would increase by 0.93 MGD to 1.68 MGD. Current capacity of the force main is 2.74 MGD. The existing contract with the city allows for the treatment of 300 MG annually. Revisions to this

contract would be required. Also, a pre-treatment facility may be required in the near future due to industrial waste generation concerns. The DRMO, Great Falls, is responsible for providing for the proper storage of the wastes and arranging for transport to US EPA approved treatment and disposal facilities.

Solid and Hazardous Waste. Solid waste generation would increase by 5.4 percent in the City of Great Falls and at Malmstrom AFB. No additional equipment or personnel would be required to collect or dispose of this waste. Existing landfills have adequate capacity to handle the increased flow. Program-related solid waste would shorten the 15-year lifespan of the existing landfills by 6 months. Additional state permitted storage space would be required for hazardous waste and shipments to treatment and disposal facilities would increase. The DRMO, Great Falls, is responsible for providing for the proper storage of the wastes and arranging for transport to US EPA approved treatment and disposal facilities.

Energy Utilities. Requirements for electricity for all three programs would increase peak demands by 21.02 MW or the MPC system by 1.6 percent. Adequate capacity is available from the existing generating and transmission system to meet the new demand. Demands at Malmstrom AFB would increase by 182 percent. Programmed improvements to the base's electrical system would provide the capacity necessary to meet the projected increases. Natural gas consumption would increase by 6.4 percent. The GFGC would have adequate reserves to meet the increased demands. Gasoline, diesel fuel and jet fuel consumption would increase by 10, 14, and 54 percent, respectively because of the requirements of the three missions. These supplies will continue to be filled by the DFSC through contracts with local and regional suppliers.

Summary of Impacts: Proposed Action Plus the Peacekeeper Rail Garrison and Small ICBM Programs

Utility requirements associated with the cumulative impacts of the Proposed Action, the Peacekeeper Rail Garrison program, and the Small ICBM program, would increase demands on the City of Great Falls utility systems by 5 to 12.6 percent in 1996 (the peak year). During the operations phase, the increases are reduced slightly but remain between 5 and 12 percent. There are no short-duration impacts because of the gradual buildup of the direct and indirect program requirements. Long-duration impacts would be high because the increases are over 10 percent. These impacts would not be significant because each utility system has adequate capacity to meet the new demands without increasing personnel or expanding existing facilities.

Utility requirements associated with the cumulative impacts of the Proposed Action, the Peacekeeper Rail Garrison Alternative Action; and the Small ICBM programs would be slightly greater than the cumulative impacts containing the Peacekeeper Rail Garrison Proposed Action.

For the Peacekeeper Rail Garrison Alternative Action and the Second KC-135R AREFS program, (Proposed Action) the potable water treatment requirements would be 0.02 MGD greater in the peak year (1992). Wastewater treatment requirements would be 0.01 MGD greater in 1992. Solid waste generation would be less than one T/day greater. The city's utility systems have adequate capacity to meet the increased demands. Demands for electrical power would be 0.14 MW greater in 1992. Natural gas consumption would increase by 3.5 MMcf. Both the MPC and the GFGC have adequate capacity to meet the increased

demand. Impacts are about the same as those identified for the Proposed Action.

For the Proposed Action, Peacekeeper Rail Garrison Alternative Action, and the Small ICBM program combined, the cumulative impacts would be about the same as those identified for cumulative impacts with the Peacekeeper Rail Garrison Proposed Action. Impacts would be high but not significant.

4.3 TRANSPORTATION

4.3.1 Impacts of the Proposed Action

During the operations phase, an increase in incoming vehicular traffic would occur as a result of the movement of personnel, materials, and equipment. An estimated 284 military personnel and other direct program-related personnel would be required for the Second KC-135R AREFS during the peak employment year which occur after 1992 during steady state operations. Of these, 200 program-related employees are estimated to reside in Great Falls and commute daily to/from the base. They would generate an additional 182 passenger vehicle trips to the base in 1992. This increase in traffic would add to the delays and queues at the entrance gates to Malmstrom AFB. Additional heavy vehicle trips to the base would also increase traffic volumes at the gates. The south gate along US 87/89 could also be used by construction vehicles and equipment. Program-related short-term construction commuters and steady state operations commuters would cause the LOS rating along 2nd Avenue North to drop from B to C, and increase delays and queues at the main entrance to the base. Vehicular traffic along 10th Avenue South would also increase but its LOS rating would remain at D and E. Therefore, short- and long-duration impacts would be rated moderate because of the reduction in LOS from B to C along 2nd Avenue North, and the further degradation of traffic flow along 10th Avenue South at LOS E impacts would be significant because 10th Avenue South would further degrade the existing substandard service level.

Mitigation Measures. The following mitigation measures could be undertaken to reduce or eliminate program impacts on transportation. All, some or none of these measures may be implemented. It should be noted that the mere listing of mitigation possibilities does not imply an obligation to carry them out. It is primarily provided as a menu for policy-makers. Like using the AICUZ report, policy-makers have to make implementation decisions on costs versus benefits, not mere effectiveness. For each measure, the agencies that may be involved in implementation are identified in parenthesis.

- o Schedule work hours for program-related employees to avoid commuting during normal traffic peak hours, and encourage ride sharing. This mitigation would reduce peak-hour traffic flow increases and therefore reduce congestion and delay without additional cost to the Air Force and its contractors (US Air Force and its contractors).

- o Provide staged start and quitting times for installation employees. (US Air Force and its contractors)

- o Provide additional manpower for registration and card checks at the entrance gate during the peak hour. This mitigation would be effective in reducing the queuing and waiting times at the base entrance and prevents the queue to backup into a major thoroughfare (US Air Force).

o Encourage the use of the south gate along US 87/89 to divert some trips to the base from the main gate along 2nd Avenue North. This would be effective in reducing the congestion at the main gate and 2nd Avenue North. (US Air Force).

o Improve 10th Avenue South, use other existing routes, or construct a south arterial "bypass" to reduce traffic congestion and delays along 10th Avenue South. The construction of the south arterial may be a costly alternative but would provide for an alternate access route through the city and would avoid further delays to motorists traveling along US Highway 87/89 and 10th Avenue South (US Air Force, Military Traffic Management Command, Federal Highway Administration, Montana Department of Highways, and City of Great Falls).

If any or all of these measures are undertaken, impacts on roads would become low and not significant because program-related commuting would be dispersed and would not change the level of service ratings.

4.3.2 Impacts of the No Action Alternative

For the No Action Alternative baseline conditions would not change and no impacts would be anticipated.

4.3.3 Cumulative Impacts

4.3.3.1 Cumulative Impacts: Proposed Action Plus the Peacekeeper Rail Garrison Program

The cumulative transportation impacts of the Second KC-135R AREFS plus the Peacekeeper Rail Garrison Program would be greater than deployment of the Second KC-135R AREFS at Malmstrom AFB alone. The addition of the Peacekeeper Rail Garrison Program would require more construction workers and operations personnel than the Proposed Action alone, and, therefore, would generate additional amounts of vehicular traffic on the base.

The Peacekeeper Rail Garrison Program would employ 439 direct program-related personnel by 1992, 354 of which are expected to reside in Great Falls. This action would add 322 passenger vehicle trips to the base. With concurrent deployment of the Proposed Action and the Peacekeeper Rail Garrison, short- and long-duration impacts would be high because of increased congestion and delays along 10th Avenue South, where the LOS could drop from D to E and E to F, and along 2nd Avenue North, where the LOS could drop from B to C. Impacts would be significant because the LOS along these roads would be reduced to LOS D and lower.

4.3.3.2 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison and Small ICBM Program

The Small ICBM Program would require 2,710 program-related employees in 1993 and 3,430 by 1996. Of these employees, 1,934 and 2,367 are expected to reside in Great Falls in 1993 and 1996, respectively. These would be reduced to 1,016 and 621, respectively, if military housing facilities are provided on base. They would add an estimated 1,758 and 2,152 passenger vehicle trips to the base (924 and 565 if military housing is provided) during the peak hours in the respective years. With all three missions at Malmstrom AFB, short- and long-duration impacts would be high because of increased

congestion and delays along 10th Avenue South, 2nd Avenue North, and other arterial streets, and because of increased waiting time at the base entrance. Impacts would be significant because the LOS would be reduced within or below standard level D.

Mitigation Measures. The same mitigation measures identified for the Proposed Action could be undertaken to reduce or eliminate program impacts. If these measures are undertaken, impacts on roads with all three missions at Malmstrom AFB would be low because of the reduction in LOS along 2nd Avenue North from B to C. Impacts would not be significant because the LOS rating would not drop to D or lower.

4.4 LAND USE

4.4.1 Impacts of the Proposed Action

The Second KC-135R AREFS deployed at Malmstrom AFB would require the construction of a number of on base facilities which will be similar to existing structures on base. For these reasons, these structures would not be of such height, size, or color to cause them to be noticed by off base residents. The Proposed Action would result in a negligible impact. (For the AICUZ discussion, see the Noise section).

4.4.2 Impacts of the No Action Alternative

For the No Action Alternative baseline conditions would not change and no impacts would be anticipated.

4.4.3 Cumulative Impacts

4.4.3.1 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison and Small ICBM Programs

If the Second KC-135R AREFS is deployed concurrently with the Peacekeeper Rail Garrison program, it would be necessary to acquire in fee about 66 acres of non-irrigated cropland and about 5 acres of mixed open space. All of this area would be for the Peacekeeper Rail Garrison program and none for the Proposed Action. This acreage would be approximately 0.02 percent of the non-irrigated cropland and 0.001 percent of the mixed open space in Cascade County. Of this 71 acres, about 31 is proposed for Rail Garrison on base housing which would be compatible with industrial zoning in the area because the area zoned for industry is presently unused and such residential use could not be construed to be an annoyance or nuisance to future adjoining industrial uses. Military facilities and rail spur connector development proposed by the two programs would be compatible with current agricultural zoning. Neither program would require the relocation of inhabited buildings from the easements. Accordingly, the cumulative impacts of the Proposed Action and the Peacekeeper Rail Garrison programs would have a negligible LOI on land use. Impacts would not be significant because no inhabited buildings would require relocation and impacts on visual attributes would not be highly controversial.

4.4.3.2 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison and Small ICBM

If the Peacekeeper Rail Garrison, the Small ICBM, and the Second KC-135R AREFS programs were concurrently deployed, the impacts on land use would be

ranked and rated moderate and not significant, respectively, because of the probable objection of some viewers to the Rail Garrison Training Train Shelter located only 1,500 feet from US 87/89 without intervening terrain or vegetation to block the view. The Second KC-135R AREFS would not add to the land use impacts.

4.5 CULTURAL RESOURCES

4.5.1 Impacts of the Proposed Action

The Proposed Action impact areas consist of ground disturbance of less than 10 acres for support facilities and relocated facilities on base.

Prehistoric Resources. No NRHP-eligible sites are likely to be affected by the Proposed Action. Surveys have been conducted in the area and no prehistoric sites were found.

Historic Resources. None of the structures to be affected by the Proposed Action are considered historically important and no historic sites have been identified. The base is visible from some portions of the Great Falls Portage route (site 24CA238) thereby creating a visual intrusion on the landmark. However, because the Second KC-135R AREFS would be collocated with the existing facilities, the degree of visual intrusion would not be appreciably affected.

Native American Resources. Impacts on sacred or traditional use areas resulting from the Proposed Action are not expected.

Paleontological Resources. Impacts on paleontological resources are not likely to occur as a result of the Proposed Action.

Summary of Impacts. Long-duration impacts of the Proposed Action on cultural resources would be negligible. No important or sensitive resources would be affected. No short-duration impacts have been identified.

4.5.2 Impacts of the No Action Alternative

For the No Action Alternative baseline conditions would not change and no impacts would be anticipated.

4.5.3 Cumulative Impacts

4.5.3.1 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison

Known cultural resources consist of one lithic scatter and segments of the Great Falls Portage National Historic Landmark, which abut the base on the eastern and western boundaries. None of the cumulative programs would affect these sites. Therefore, cultural resources would not be affected by deployment of the Peacekeeper Rail Garrison program and the Second KC-135R AREFS at Malmstrom AFB.

4.5.3.2 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison and Small ICBM

If the Peacekeeper Rail Garrison program, the Second KC-135R AREFS, and the Small ICBM were all sited at Malmstrom AFB, long-duration impacts on

cultural resources would occur as a result of Small ICBM construction requirements. This would require the acquisition of approximately 780 acres of off base land to the southeast and northwest. Although the housing expansion and Hard Mobile Launcher (HML) vehicle operations training areas are presently under cultivation, cultural resources could remain. These areas have recently been surveyed, and one small lithic scatter (site 24CA279) in the HML vehicle operations training area would be affected. Lithic scatters (as opposed to tipi ring sites) may retain considerable research potential in spite of agricultural disturbance because subsurface material may occur below the depth of cultivation. Surface and shallow subsurface archaeological sites located in the HML vehicle operations training area may be disturbed or destroyed through crushing and/or the churning of the surface from the wheels.

Site 24CA279 has not been tested or fully evaluated for NRHP eligibility. However, it has been disturbed by agricultural activities, and preliminary indications are that it is not eligible. Additional cultural material may be located at depth, and test excavations would be necessary to determine its eligibility.

The LOI would be low because lithic scatters are common throughout the ROI. Impacts would not be significant because the affected site is not likely to be eligible for the NRHP.

A Programmatic Agreement has been executed by the Air Force, Montana State Historic Preservation Officer, and the Advisory Council on Historic Preservation. Effects of the Small ICBM program have been taken into account, and an Historic Preservation Plan will be prepared for management of any NRHP eligible resources. No other sites have been identified in any proposed program area. No impacts are expected to occur on historic, Native American, or paleontological resources. No short-duration impacts would occur.

4.6 BIOLOGICAL RESOURCES

4.6.1 Impacts of the Proposed Action

Biological Habitats. Construction of the Second KC-135R AFRES facilities at Malmstrom AFB would result in the disturbance of less than 10 acres of land. Some destruction or displacement of plants and plant cover, and small mammals will occur. However, most of the area likely to be affected by construction of project-related facilities has been previously disturbed during construction of other facilities on base.

Threatened and Endangered Species. No federally listed threatened or endangered species, federal-candidate species, or state-recognized species would be affected, directly or indirectly, by the proposed program.

Summary of Impacts. Implementation of the program would result in minor disturbance of biological resources on Malmstrom AFB and will not greatly reduce local wildlife populations or diminish regional biological diversity. Indirect impacts on recreation in the ROI would not noticeably degrade biological habitats in the area. Both short- and long-duration impacts would be negligible because no measurable amount of grassland habitat would be affected by the program. These short and long-duration impacts would not be significant because even if the habitats and population that would be

affected, they do not possess unique biological qualities, and these disturbances would not affect regional ecosystems.

4.6.2 Impacts of the No Action Alternative

For the No Action Alternative baseline conditions would not change and no impacts would be anticipated.

4.6.3 Cumulative Impacts

4.6.3.1 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison

Deployment of a Second KC-135R AREFS in conjunction with the Peacekeeper Rail Garrison program at Malmstrom AFB would result in cumulative impacts on biological resources. The extent of these cumulative impacts would be dependent on the amount of development required to meet the mission objectives of the potential programs. No threatened or endangered species are likely to be affected. The short- and long-duration cumulative impacts would be moderate because of the extent of disturbance which would occur onbase. These impacts would not be significant because the habitats and the populations that would be affected do not possess unique biological qualities, and these disturbances would not affect regional ecosystems.

Construction of Peacekeeper Rail Garrison facilities at Malmstrom AFB and along the rail spur off base option would result in the disturbance of approximately 316 acres of land, 132 acres permanently and 184 acres temporarily. Approximately 158 acres of grassland and 153 acres of developed land would be disturbed causing destruction or displacement of plants and plant cover, and small mammals. This grassland provides only limited habitat for wildlife because of lack of cover. The small wetland near the existing WSA may be influenced by runoff from the construction of garrison facilities. Most of the sedimentation from runoff would be controlled by standard US Army Corps of Engineers construction practices, and is not expected to be enough to affect local wetland populations.

Construction of facilities may disturb as much as 376 acres of land, 133 acres permanently, and 184 acres temporarily. Approximately 179 acres of grassland, 54 acres of agricultural land, and 140 acres of developed land will be affected. The grassland provides only limited habitat for wildlife because of lack of cover. The small wetland (2.8 acres) south of the existing WSA would be permanently disturbed by construction. Minor disturbances are not expected to affect biological resources in nearby habitats or substantially diminish biotic diversity. Future baseline conditions on base are expected to be similar to existing conditions based on current base management plans.

4.6.3.2 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison and Small ICBM

Deployment of the Proposed Action and the Peacekeeper Rail Garrison program in conjunction with the Small Intercontinental Ballistic Missile (ICBM) program would also cause cumulative impacts on biological resources. Approximately 1,476 acres would be disturbed on base for deployment of these three programs. No threatened and endangered species are likely to be affected. The short- and long-duration cumulative impacts would be moderate because of the extent of disturbance which would occur on base. These impacts

would not be significant because the habitats and the populations that would be affected do not possess unique biological qualities, and these disturbances would not affect regional ecosystems. Short- and long-duration cumulative impacts would be moderate because of the extent of disturbance which would occur on base. Impacts would not be significant.

4.7 WATER RESOURCES

4.7.1 Impacts of the Proposed Action

Major Water Users. Total program-related water use would peak at about 150 acre-ft/yr in 1992, and stabilize at the same during the operations phase. All of this water would be obtained from the Missouri River via the Great Falls water supply system. The program would increase baseline water use at Great Falls by approximately 1 percent. Baseline-plus-program water use in Great Falls (including Malmstrom AFB) would increase to about 14,490 acre-ft/yr (12.9 MGD) in 1993. This amount can be readily supplied since it represents less than 20 percent of the 73,120 acre-ft/yr city water rights to the river.

Baseline-plus-program water use at Malmstrom AFB would peak at about 1,330 acre-ft/yr (1.19 MGD) in 1992, or 2 percent over baseline. The base currently has a contract with the city for the annual delivery of up to 1,410 acre-ft/yr (1.25 MGD). This amount would be adequate to supply the program. The small increase in ROI water use resulting from the Proposed Action would not interfere with existing major water users and would not be significant.

Surface Water Hydrology and Quality. Program-related increases in withdrawals from the Missouri River would represent less than 0.01 percent of the average annual flow of the river, and would therefore have a negligible effect on its flow. Program-induced increases in treated wastewater discharge to the river would peak at 100 acre-ft (0.1 MGD) in 1992 and remain at that approximately level during steady state operations. Great Falls has adequate treatment capacity to accommodate this increase. The treated effluent would be greatly diluted by the river and would result in only minor water quality degradation over the duration of the proposed program.

Construction would result in minor land disturbance. Relatively little increase in sediment would be expected resulting in minimal downstream water quality impact. Moreover, the water quality effects resulting from construction would be of an infrequent nature, occurring only following periods of heavy rainfall or snowmelt. The impact on the Missouri River would be minor.

Summary of Impacts. In summary, the water supply of the ROI is adequate to meet program-related water requirements. Only minor hydrologic changes and minor degradation of water quality would occur. Therefore, the short and long-duration impacts on water resources would be low. None of these impacts would be significant.

4.7.2 Impacts of the No Action Alternative

For the No Action Alternative baseline conditions would not change and no impacts would be anticipated.

4.7.3 Cumulative Impacts

4.7.3.1 Cumulative Impacts: Proposed Action and Peacekeeper Rail Garrison

Concurrent deployment of the Proposed Action and the Peacekeeper Rail Garrison Program would require about twice as much water as the Proposed Action. Program-related water use would peak at approximately 340 acre-ft/yr in 1992 and would stabilize at 310 acre-ft/yr in 1993. Great Falls could supply all of these requirements. This would increase baseline water use in the city by 2 percent in 1993 to 14,650 acre-ft/yr (13.1 MGD). This small increase can be readily supplied by the city's allocation to the Missouri River (73,120 acre-ft/yr) and no interference with major water users would occur. The Peacekeeper Rail Garrison Program would result in an additional 316 acres of construction disturbance at Malmstrom AFB. The two largest land disturbances would be the garrison site, 142 acres located in the south-central portion of the base, and 34 acres of new military housing located in the northwest portion of the base. Both sites are flat and neither is located near a perennial stream. Erosion and sedimentation to local streams is expected to be relatively minor. Increases in turbidity and associated water quality degradation would be limited to infrequent occasions when rainfall or snowmelt is heavy enough to generate stormwater runoff from these sites. No groundwater impact anticipated. Given the highly intermittent nature of the potential water quality impacts, the short and long-duration impacts on water resources are rated low. These impacts would not be significant.

4.7.3.2 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison and Small ICBM

Concurrent deployment of the Peacekeeper Rail Garrison program, and the Small ICBM program would require substantial amounts of water, which would also be supplied by Great Falls. Cumulative water use would peak at about 1,810 acre-ft/yr in 1996 and would stabilize at 1,690 acre-ft/yr in 1999. Baseline water use in Great Falls would increase by 13 percent in 1999 to 16,230 acre-ft/yr (14.5 MGD). Despite this substantial increase, the effects on major water users would remain minor because the available supply to the city is adequate as previously discussed. Construction of the HML vehicle operations training area and family housing facilities would result in essentially the same hydrologic effects previously discussed. Therefore, the impacts on water resources would be essentially the same as for the concurrent deployment of the Peacekeeper Rail Garrison and Second KC-135R AREFS programs: the short-duration impacts would be low and the long-duration impacts would be moderate. These impacts would not be significant.

4.8 GEOLOGY AND SOILS

4.8.1 Impacts of the Proposed Action

Energy and Mineral Resources. No energy or mineral resources have been identified in the ROI. Therefore, impacts on energy and mineral resources are not expected.

Soil Resources. Construction associated with the Second KC-135R AREFS would result in short-duration, moderate impacts because ground would be disturbed during various construction stages, like clearing and excavation.

These impacts would be reduced to negligible after construction assuming revegetation of disturbed areas. These impacts are not expected to be significant because increased rates of erosion will not result in an appreciable net loss of topsoil during the short period of time under consideration.

4.8.2 Impacts of the No Action Alternative

For the No Action Alternative, baseline conditions would not change and no impacts would be anticipated.

4.8.3 Cumulative Impacts

4.8.3.1 Cumulative Impacts: The Proposed Action Plus Peacekeeper Rail Garrison

Cumulative impacts of the concurrent deployment of Second KC-135R AREFS and the Peacekeeper Rail Garrison program at Malmstrom AFB would be greater than those of the Proposed Action. Impacts on energy and mineral resources would remain negligible. The amount of soil eroded would increase due to the large amount of construction associated with the Peacekeeper Rail Garrison Program. The level of impact would be high during the construction phase (short-duration) and negligible afterwards (long-duration) assuming revegetation of disturbed areas. Soil erosion impact would remain not significant since program-related erosion would not result in an appreciable net loss of topsoil.

4.8.3.2 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison and Small ICBM

Short-duration cumulative impacts of the concurrent deployment of the Second KC-135R AREFS, the Peacekeeper Rail Garrison, and the Small ICBM Programs would be the same as the cumulative impacts of the Second KC-135R AREFS and the Peacekeeper Rail Garrison program. The LOI will be high and not significant. Post construction assumed mitigations will adjust any temporary problems. However, long-duration impacts will become significant due to the topsoil erosion caused by the continued Hard Mobile Launcher operations. The LOI would only be moderate, however, because of the limited area so affected.

Mitigation Measures. Mitigation measures which could reduce long-duration impacts resulting from increased rates of soil erosion during operations of the HML vehicle operations training area for the Small ICBM include the following, along with the agencies responsible for implementation:

- o Build sediment traps where appropriate on drainages flowing away from the training area to control the long-duration sediment load potentially leaving the site or entering nearby streams (US Air Force and US Army Corps of Engineers [COE]).
- o Reduce the ground slopes to control the rate of runoff, such as routing the runoff across adjacent, gently sloping grassed areas. Reductions in the amount of ground slope often require an increase in disturbed area. Consequently, the benefits of slope reduction are partially offset by the increased lengths of disturbed ground over which runoff would flow (US Air Force and COE).

4.9 AIR QUALITY

4.9.1 Impacts of the Proposed Action

Direct air emissions would result from operations and support facilities, as well as from operation of the proposed program at Malmstrom AFB. Emission sources associated with construction include light-duty vehicle traffic, diesel trucks, offsite heavy-duty vehicles, diesel construction equipment, and fugitive dust from ground disturbance. The primary emission sources for operations are aircraft and vehicle traffic.

The highest monthly fugitive dust emissions from proposed program construction activity would be less than 2 tons. Fugitive dust calculations assume a 50-percent reduction due to watering of the construction sites. All of the fugitive dust emissions at Malmstrom AFB were conservatively assumed to be within the 10-micrometer particle size and referenced against the PM₁₀ standard for impact analysis. It is expected that actual PM₁₀ emissions would be lower than the emissions calculated under the EPA guidelines for TSP. The operation of KC-135R aircraft at Malmstrom AFB would cause emission increases of 0.04 percent for CO, 0.01 percent for HC and 0.3 percent NO_x in Cascade County.

Construction-related impacts were calculated using the proportional model, for 24-hour and annual averaging periods. A program-related increase of 0.5 ug/m³, which includes particulates from combustion products, would occur, increasing the 24-hour average background concentrations in Cascade County to 73.5 ug/m³. The predicted fugitive dust 24-hour background concentration would not equal or exceed the 24-hour National Ambient Air Quality Standards (NAAQS) of 150 ug/m³ (PM₁₀). The annual background concentration would increase to 30.3 ug/m³, which would not equal or exceed the PM₁₀ standards of 50 ug/m³. These fugitive increases would not degrade the air quality at the nearest PSD Class I area (Gates of the Mountains Wilderness) which is located 48 miles from Malmstrom AFB.

Coal-fired Heating Plant

The addition of the Second KC-135R AREFS to Malmstrom AFB would result in an increase of approximately 10 percent in the base heating requirements. This increase in heating requirements would produce an increase in air pollutant emissions from the plant. However, this change in plant emission would only increase the air pollutant burden in Cascade County by less than 0.5 percent. It should be noted, however, that a modification of the operational air pollution emission permit for the heating plant, which was issued by the Montana Air Quality Bureau in October 1980, would be required.

Overnight start and termination air quality impacts of the Proposed Action and Grand Coulee Rail Garrison would be negligible.

4.9.2 Impacts of the No Action Alternative Action

For the No Action Alternative, all air emissions would not change and no fugitive dust would be generated.

4.9.3 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison

Results of the screening model analysis indicated that during construction activities, maximum 24-hour average PM₁₀ concentration would reach about 112 ug/m³ at the nearest property line and 98 ug/m³ at the downwind property line. Therefore, the local, short-duration air quality impacts at the nearest property lines would be moderate (an increase in concentration greater than 5 ug/m³ and ambient concentrations between 100 ug/m³ and 150 ug/m³) and not significant (ambient concentrations less than the 24-hour average PM₁₀ NAAQS of 150 ug/m³).

The short-duration air quality impacts in Cascade county would be negligible, but the local, short-duration impacts (base property lines) would be moderate and not significant. The long-duration air quality impacts for both site options would be negligible.

4.9.3.1 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison and Small ICBM

Concurrent deployment of the Second KC-135R AREFS Peacekeeper Rail Garrison and Small ICBM programs at Malmstrom AFB would result in additional onbase construction activities, creating additional air pollutant emissions. The maximum 24-hour PM₁₀ concentrations at the nearest and downwind baselines would be about 10 ug/m³ higher than those resulting from the Rail Garrison Program. On a countywide basis, the short-duration air quality impacts would be negligible for the combined programs. However, the local, short-duration impacts at the base property lines would be moderate and not significant. The long-duration air quality impacts at the base property lines would be high and significant because of the fugitive dust generated by the operation of the HML during training activities.

4.10 NOISE

4.10.1 Impacts of the Proposed Action

The Second KC-135R AREFS flights and ground-runups will increase noise levels and cause an additional 450 acres to be added to the area included inside the 65 dB contour (Ldn). Areas within the 75 and 85 dB contours (Ldn) will also increase by 128 and 73 acres respectively (see changes from Figure 4.10-1 and 4.10-2 and Table 4.10-1). Increased noise levels would also cause an additional 15 on base mobile home units to be included in the area between the Ldn 65-70 dB noise contours with an estimated population of 38. Because of the enlargement of the area within the 70 dB contour, about 18 units of on base Malmstrom Drive Wherry housing with an estimated occupancy of 63 people, would no longer be in the area between the 65-70 dB noise contours and would now be situated in the area between the 70-75 dB noise contours (See Table 4.10-2). Residential housing occupants would not be exposed to noise levels exceeding DNL 75 dB. Also, 10 additional administrative buildings, commercial, industrial and other buildings with full or part time occupants of 240 people would be located in DNL larger than 70 dB noise contours.

From the disaggregate input data used to derive the contour information, it can be estimated that approximately 50 additional number of sleep disturbances and sleep disruptions will occur as a direct result of the deployment of the Second KC-135R AREFS. In part, this is the result of some

Table 4.10-1
Comparison of Noise-Affected Acres
Malmstrom AFB, Montana

DNL (dB)	First Squadron	First and Second Squadrons	Variance (Proposed Action)
65	3,067.07	3,517.29	450.22
70	1,475.23	1,718.84	243.61
75	904.76	934.11	29.35
80	403.48	496.53	93.05
85	67.84	140.97	73.13

of the single event maximum noise levels during the night reaching 87 dB at housing areas. Although high peaks during the day would generally not be perceived as a problem, many military personnel work evening and night shifts and sleep during the day. Therefore, even daytime single event disturbances may result in sleep interference or disturbance. Some of the daytime noise single events peaks during the operations phase may reach as high as 100 dB at housing units. While other single event disturbances and the resulting effects will not be quantified any further, the reader should familiarize himself with those probable effects elaborated upon in Appendix A.

There appears to be no other sensitive receptors, like schools and hospitals within noise contours exceeding DNL 65 dB. While Loy and Chief Joseph Elementary Schools are not in any of the DNL larger than 65 dB noise contours. It was estimated that the number of baseline events causing speech interferences occurring during baseline conditions, including the operation of the first KC-135R squadron amount to approximately two per day. The Second KC-135R Squadron would add another two events per day which would cause speech disruptions. None of the maximum noise levels would be high enough to result in a temporary or permanent threshold shift in hearing.

Short-duration noise is primarily the result of construction activities and road traffic. Most of the construction activities would occur on base and during the daytime. Since the predominant noise on base is the result of flight operations, construction activities and road traffic noise would only add about one additional dB to the DNL value. This addition would not shift the noise contours so as to affect a measurable number of sensitive receptors. There exists the probability that single event disturbances may occur. Some of these may arise from impact and impulse noises. However, given normal construction practices and open channels of communications with of the Base Civil Engineer, repetitive occurrences of avoidable problems are assumed to be curtailed. It is, nevertheless, possible that inadvertent noise intrusions and some noise associated with emergency day and night operations may occur. It is not expected that the annual DNL level would

FIGURE 4.10-1 Noise Contours (Ldn) First KC-135R Air Refueling Squadron, Malmstrom AFB, Montana

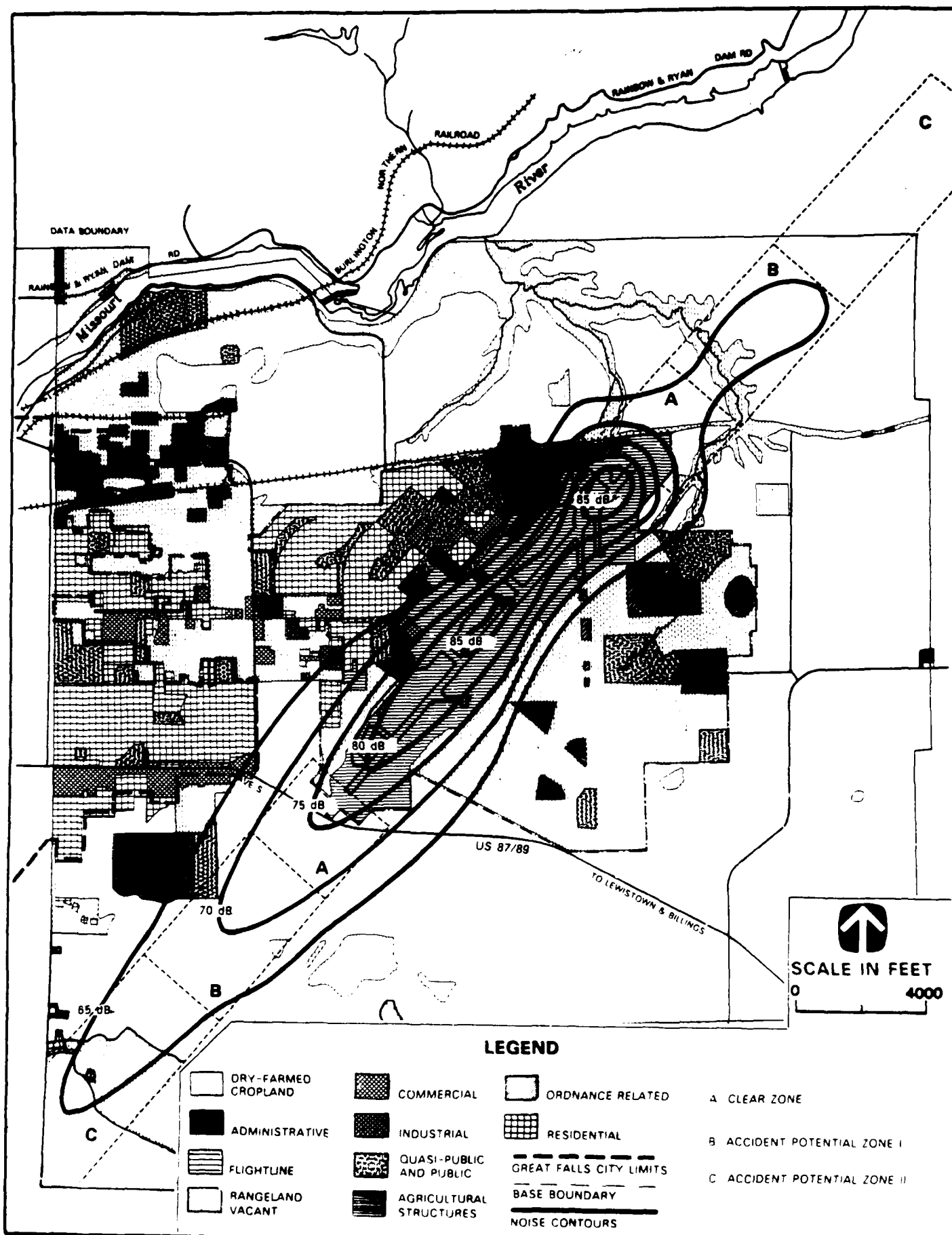


FIGURE 4.10-2 Noise Contours (Ldn) Second KC-135R Air Refueling Squadron, Malmstrom AFB, Montana

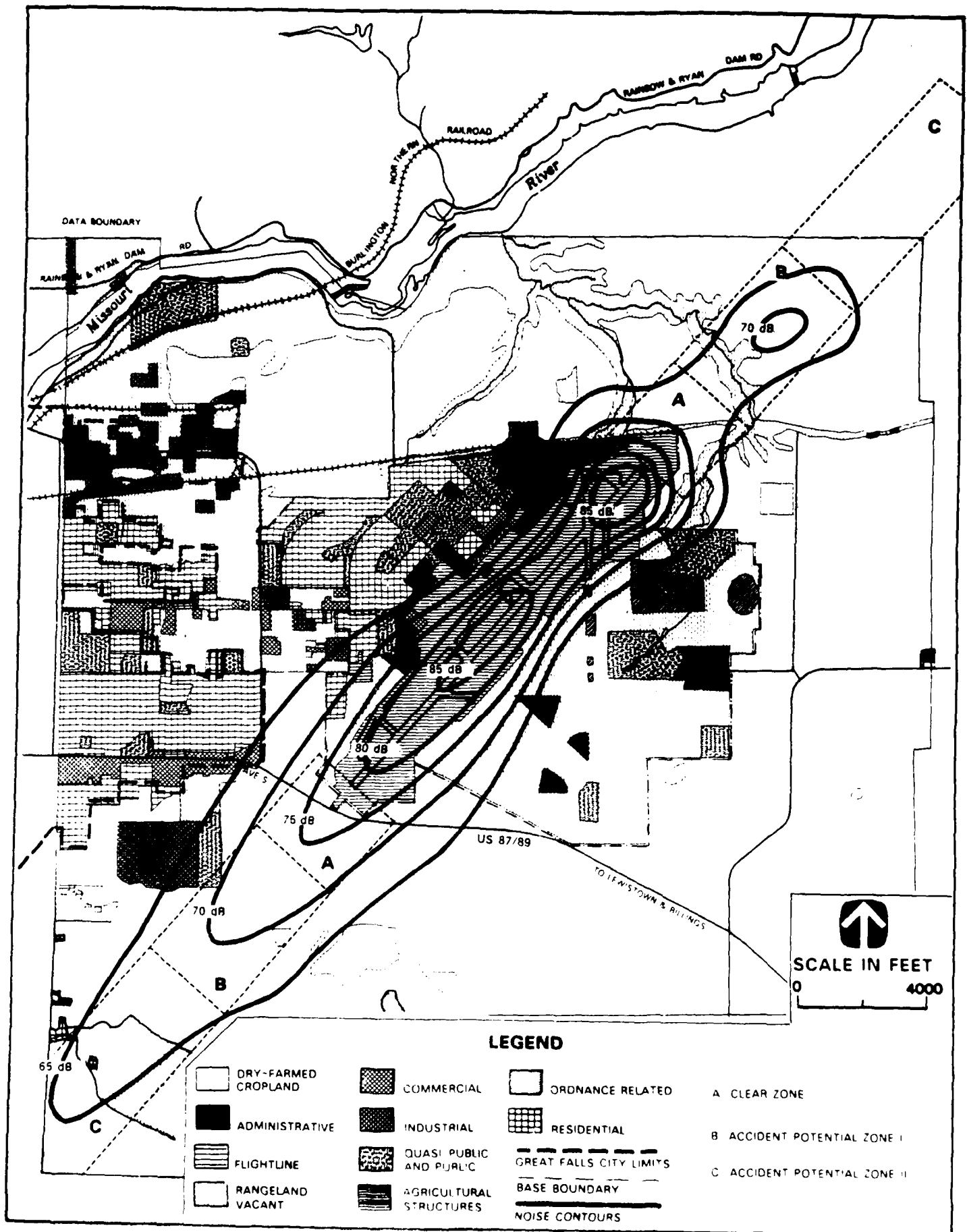


Table 4.10-2

Properties Experiencing Increased Noise Levels
Under Proposed Action

AICUZ CUD Zone	Geographic Location	1st Squadron 16 Aircraft	1st/2nd Squadrons 30 Aircraft	Change of Residential Units Due to the Proposed Action	Affected Population Due to Proposed Action
13 (65-70 dBA)	Onbase Trailer Park	35 Units	50 Units	15 Units	38
13 (65-70-dBA)	Onbase Housing (Wheary)	66 Units	48 Units	- 18 Units	- 63
12 (70-75 dBA)	Onbase Housing (Wheary)	26 Units	44 Units	18 Units	63

increase by more than 2 dB and that no other major noise intrusions, except unavoidable short duration events would occur.

The short-duration level of impact would thus be negligible. For the long-duration, impacts would be moderate because of the DNL noise levels would increase by more than 5 dB but less than 10dB. Impacts would not be significant, because while noise contours would shift, and as a result more housing occupants would be exposed to DNL larger than 65 dB, occupants of residential housing would not be living in the DNL larger than 75 dB noise contour.

Mitigation Measures

While no significant noise impacts were found, the following mitigation measures could be undertaken to reduce noise impacts and provide a more pleasant living environment. All, some, or none of these measures may be implemented. It should be noted that the mere listing of mitigation possibilities does not imply an obligation to carry them out. It is primarily provided as a menu for policy-makers. Like using the AICUZ report, policy-makers have to make implementation decisions on cost versus benefits, not mere effectiveness. For each measure, the agencies that may be involved in implementation are identified in parentheses.

- o When possible, unnecessary vehicular and construction noise shall be avoided or scheduled so as to minimize noise exposure of people at sensitive receptors. The guidelines should be not to do anything to sensitive receptors they would not do to the Wing Commander's residence. This does, of course, not apply to emergency repair operations and other vital activities. (US Air Force)
- o Environmental awareness briefings given to potential contractors and subcontractors should include noise awareness. It should stress that the generation of unnecessary noise will not be condoned, including the operation of vehicles with defective or ineffective noise attenuation devices. (Air Force and Corps of Engineers)
- o Construction and vendor contracts shall include provisions that will impose financial penalties or base access prohibition of contractors or their personnel if they operate vehicles or equipment that violate EPA product standards, local noise ordinances, or are found too noisy by either base security personnel or others to whom the authority is delegated by the base commander. Penalties may be imposed on contractors, vendors, and their personnel if they operate vehicles and equipment in such a manner as to cause excessive or unnecessary noise in the judgment of the above mentioned authorized personnel. To assure the inclusion of these provisions, construction project books and other relevant planning and programming documents should formally include this requirement. (Air Force and Army Corps of Engineers)

- o As part of the ongoing housing revitalization program, the following options will be considered:
 - oo Conversion of Malmstrom Drive Wherry housing to non-residential use. (US Air Force)
 - oo Removal of some of Malmstrom Drive Wherry housing to reduce the number of living units and provide a compatible greenbelt. (US Air Force)
 - oo Remodel Malmstrom Drive Wherry Housing buildings and incorporate building requirements for a minimum noise level reduction of 25dB. (See AICUZ Handbook, 1984, for specific requirements). (US Air Force)
 - oo Phase out privately owned mobile homes parked on Malmstrom AFB spaces located in the DNL larger than 65dB noise contours.
- o Acquire either restrictive easements in, or fee simple ownership of private land in the clear zone not currently owned by the Air Force. (US Air Force)
- o Adverse effects should be minimized by reducing aircraft noise levels and accident hazards, if possible. (US Air Force)
- o Local building codes should be reviewed to see if they are synchronized with the noise environs generated by the anticipated mix of aircraft. (Local governments and US Air Force)
- o During the first year of deployment of the Second KC-135R AREFS, additional well-trained personnel should be made available to the base Public Affairs office to address community noise complaints. (US Air Force)

4.10.2 Impacts of the No Action Alternative

The alternative action is the No Action Alternative. Impacts for this alternative would approximate conditions described as baseline conditions, including the operations of the first KC-135R squadron.

4.10.3 Cumulative Impacts

4.10.3.1 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison

The cumulative impacts from the deployment and operations of both the proposed action and the Peacekeeper Rail Garrison proposed action and its alternatives would result in additional construction activities and its associated noise impacts as well as additional road traffic noise. Given that the predominant noise footprint is generated by flying operations, for the long-duration, it is not expected that noise exposures would change sufficiently to change the level of impact or the non-significant rating determined for the proposed action. For the short-duration, the additional

noise generated by activities associated with the Rail Garrison Program would not result in a change in the negligible rating because noise at sensitive receptors would not increase sufficiently. Short-duration impacts would remain not significant. It should be noted that additional single event noise impacts are expected to occur. The primary sources are expected to be the operation of construction equipment (including safety backup signals) and road vehicles, especially those with defective or modified exhaust systems.

4.10.3.2 Cumulative Impacts: Proposed Action Plus Peacekeeper Rail Garrison and Small ICBM

The additional impacts arising from the additional deployment and operations of the Small ICBM system would result in a change of short-duration impacts from negligible to moderate because noise at sensitive receptors would increase by 5 dB to 10 dB. The impact would not be significant. Long-duration impacts would remain moderate and not significant as determined for the Proposed Action because additional aircraft operations would not be changed.

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Cascade County Board of Commissioners
Mayor (Great Falls)
City Manager (Great Falls)
Superintendent of Schools (Great Falls)

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James H. Bailey	Ed Dolezal
Henry and Helen Baker	Al Donohue
Steven E. Beaver	Ralph Driear
Claire Baiz	Lloyd M. Erickson
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Donald J. Burditt	Richard Greenwood
Tom Cave	Dick Grieb
Connie Cella	Carol Guhin
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Scotty Clark	Alan Hahn
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State Historic Preservation Offices

Montana State Historic Preservation Office (Helena, Montana)

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APPENDIX A

A.0 ENVIRONMENTAL ANALYSIS METHODS

This Appendix describes the methods used to document the existing baseline environmental conditions at each proposed deployment location, as well as the methods used to identify and analyze potential impacts. For each resource category, a description of the resource, the Region of Influence (ROI) for that resource, data sources, analysis methods, Level of Impact (LOI) criteria, and significance criteria are presented.

The environmental resource categories are convenient groups of issue areas which cover the entire spectrum of environmental issues likely to be experienced as a result of the program. Each environmental resource consists of one or more elements which generally represent individual issues within the resource categories, though some elements, for example, public services, represent groups of issues, such as police, fire, and health services. The ROIs refer to the geographic areas where most of the resource element-level impacts are likely to occur. Data sources used in describing the existing and future baseline conditions include published and unpublished documents, maps, and field studies conducted specifically for the program.

The environmental analyses for each resource included a five-step process: (1) description of existing baseline conditions; (2) projection of baseline conditions to years of interest, where applicable, including the influence of other proposed projects; (3) identification and evaluation of program impacts; (4) determination of LOIs; and (5) determination of significance. Impact evaluation was conducted using state-of-the-art models and proven procedures used in similar environmental analysis including those developed specifically for Air Force programs. The LOIs signify a rating of the magnitude of an impact. The determination of LOI is based on both the absolute quantity of an affected resource and comparison of this quantity with the resource base. Using these measures, the LOI for each resource is categorized as negligible, low, moderate, or high. Finally, the significance of an impact is determined by evaluating its context and intensity as required under the Council on Environmental Quality (CEQ) regulations.

The CEQ definition of context indicates that "both short- and long-term effects are relevant." For this EIS, both short- and long-duration impacts have been identified. Short-duration impacts are transitory effects of the proposed program that are of limited duration and are generally caused by construction activities or operation start-up. Long-duration impacts would occur or continue over an extended period of time, whether they start during the construction phase or operations phase. Most impacts from the operations phase are expected to be of long duration since program operations essentially represent a steady-state condition (i.e., impacts resulting from actions that occur repeatedly over a long period of time). However, long-duration impacts could also be caused by construction activities if a resource is destroyed or irreparably damaged, or if the recovery rate of the resource is very slow.

According to the CEQ regulations (Code of Federal Regulations 1981, 40 CFR 1508.27), intensity "refers to the severity of the impacts." Ten items are listed that "should be considered in evaluating intensity":

1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.
2. The degree to which the proposed action affects public health or safety.
3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.
5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
8. The degree to which the action may adversely affect districts, site, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

It should be noted that several of these items are geographically dependent, therefore specific significance criteria used in this appendix may not be applicable to other locations or other environmental assessment processes.

Controversy, referred to in consideration 4, involves disagreement among recognized professionals over environmental impacts or assessment methods. Possible controversy over the purpose, need, or desirability of this program was not considered in evaluating the significance of impacts.

In evaluating the significance of impacts on individual resources or elements, the applicability of these ten items was considered first. In addition, other considerations judged appropriate for specific resources/elements were also evaluated. These are identified under individual resource discussions (Sections 3.2 through 3.11).

Since the Second KC-135 Air Refueling Squadron (AREFS) Program is small compared to Gross National Product and other economic indicators, no national impacts were assessed. For national impacts of the Peacekeeper and other cumulative programs, see the Draft Environmental Impact Statement for Peacekeeper Rail Garrison for more details.

A.1 SOCIOECONOMICS

A.1.1 Resource Description

Six major elements are addressed in the socioeconomics resource: employment and income, population and demographics, housing, education, public services, and public finance. The results of these analyses are either translated into program impacts, used as inputs for other analyses, or used to describe the socioeconomic environment.

Employment and Income. The employment and income element describes the general level of economic activity for the region surrounding Malmstrom AFB. Civilian labor force, employment, unemployment, total income, and income per capita were the principal attributes used to describe economic conditions.

Population and Demographics. This element presents population trends and selected demographic characteristics of the region. Historical population levels, current population, projected population levels, and the military-civilian mix are the principal attributes discussed.

Housing. The housing element describes the total permanent year-round and temporary housing stock and available vacancies in the vicinity of Malmstrom AFB. Permanent or year-round housing includes single-family, multifamily, and mobile home structures. Temporary or transient housing is defined to include primarily hotel and motel accommodations.

Education. The education element describes the characteristics of affected public and private school systems. Special attention is given to public elementary and secondary school districts. Student enrollment, staff levels, and facility capacities were the principal attributes studied.

Public Services. The public services element describes the overall service delivery systems of affected county and municipal jurisdictions, emphasizing major service functions. The total number of personnel employed by each jurisdiction relative to its population size, and the adequacy of existing equipment and facilities to meet current and projected demands were the principal factors evaluated.

Public Finance. The public finance element describes the fiscal condition of the affected counties, cities, and school districts. Annual operation expenditures, revenues, and reserve funding levels were the principal factors analyzed.

A.1.2 Region of Influence

Employment and Income. The Region of Influence (ROI) for the employment and income element is a multicounty market area, generally within 50 miles of the installation, that serves as a supply region for program-related labor requirements and construction materials. Not all counties within a 50-mile radius of the candidate deployment installations, however, were included in the ROI. These counties were those counties at the limit of the 50-mile radius which are characterized by their rural nature, low population, and employment levels, and general lack of support services for the type of activities associated with program deployment. The counties which do comprise the ROI are those from which at least 90 percent of local labor and material procurement could be available, and generally includes the principal commercial center in the area. Those two counties are Cascade and Lewis & Clark.

Population and Demographics. The ROI for this element includes those counties and major communities where most of the demographic changes attributable to the proposed program would be expected. For the Second KC-135R Squadron Program at Malmstrom AFB this local area includes both Great Falls and Cascade County.

Housing. The ROI for this element includes those communities where most of the housing demand would be expected. In most cases, this would occur in Great Falls and other small communities around Great Falls.

Education. The ROI for this element includes the Great Falls districts where most of the additional enrollment would be expected.

Public Services. The ROI for this Element includes Cascade County and City of Great Falls where most of the public service demands generated by program-related immigration would be expected.

Public Finance. The ROI for this element includes Cascade County, the City of Great Falls, the Great Falls School Districts where increased public service demands would result in appreciable fiscal effects.

A.1.3 Data Sources

Data on employment and earnings by major industrial sectors and on personal and on personal income published by the US Bureau of Economic Analysis were obtained for Montana and its counties from the Montana Department of Commerce, Census and Economic Information Center. Information regarding civilian labor force and unemployment was provided by the Montana Department of Labor and Industry, Research and Analysis Bureau (1986). Information on key industries, activities, and economic trends in Montana was obtained from "Build Montana: Economic Conditions in Montana, 1986," published by the Montana Department of Commerce; the Montana Economic Outlook 1987 issue of Montana Business Quarterly (Vol. 25, No. 1, Spring 1987) published by the University of Montana, Bureau of Business and Economic Research; and "Population, Employment, Dwelling Unit, Vehicle, and Student Enrollment Forecasts for the Great Falls Transportation Study Area, 1980-2010," prepared for the Great Falls City-County Planning board by Mountain West Research-North, Inc., September 1985. Data on personnel levels at Malmstrom AFB were provided by the Wing Historian at Malmstrom AFB.

Demographics. Historical and projected population data for Montana and its counties were obtained from the Montana Department of Commerce, Census and Economic Information Center. Great Falls area population forecasts were obtained from the 1985 study by Mountain West Research-North, Inc. The on base population of Malmstrom AFB was obtained from the fiscal year (FY) 1985 Malmstrom Economic Resource Impact Statement (ERIS). Information on the demographic characteristics of Cascade County was taken from the US Bureau of the Census, 1980 Census of Population, General Population Characteristics publications series (1982b).

Housing. Historical housing data were obtained from two sources, the US Bureau of Census (1980) and the Federal Home Loan Bank of Seattle Great Falls Metropolitan Statistical Area, Montana Housing Vacancy Survey (1979, 1980, and 1985).

Education. Historical data on enrollments, and pupil-to-teacher ratios for all six school districts were received from the public schools of Great Falls, Lewistown, and Conrad. The baseline enrollment projections for the Great Falls Public Schools (GFPS) system were extracted from the 1986 Great Falls Public Schools: A Demographic Study of the School District by Attendance Areas and Enrollment Projections: Great Falls Public Schools Supplementary Report 1986-1990, prepared by J.M. Wardwell (1986a,b). Ancillary information on busing, facilities, and staffing was obtained from the offices of the school superintendent in each school system.

Public Services. In the public services area, some of the historical data on staffing, equipment, and facilities were extracted from the 1981 Great Falls City-Cascade County Planning Board Great Falls Area Comprehensive Plan 1981-2000 and the 1982 Cascade County Planning Board Cascade County Development Plan. The data were supplemented by information gathered in the areas of law enforcement, police and fire protection, health, emergency services, and social services from individual officials for the City of Great Falls, Cascade County, and the State of Montana. The Montana Uniform Crime Report was used to supplement some of the law enforcement data. Annual reports, when available, were used for the following agencies: Opportunities, Inc., the Salvation Army, the City-County Health Department, and the Cascade County Office of Human Services.

Public Finance. Historical revenue and expenditure data, taxable valuation of property, and property tax rates were compiled from each jurisdiction's financial statements. The data were supplemented by each jurisdiction's current budget.

A.1.4 Methods for Assessing Existing and Future Baseline Conditions

Employment and Income. Historical employment and income data for each ROI were compiled and compared with similar measures at the state and national levels. Unless otherwise specified, dollar values are expressed as constant 1986 dollar estimates. Employment and income data were presented for the census years 1980 and 1984 (the latest year available from the Department of Commerce Regional Economic Information System data tapes). Unemployment rates and civilian labor force information from the respective state employment development and job service agencies used the most recent available information (generally 1986). Forecasts of future baseline

conditions were based on econometric models developed for each ROI. Population forecasts supplied by state and local planning agencies provided the principal exogenous variable.

Population and Demographics. National population census data for 1980 and 1985 (the latest year for which information was generally available) formed the basis for the analysis of current demographic conditions and recent trends. As available, data for 1986 and 1987 were included in the baseline discussions. The current size and demographic composition of the population were prepared on an annual basis. Future baseline projections were based on existing forecasts obtained from state and local planning agencies.

Housing. The existing baseline conditions for permanent year-round housing were compiled for 1980 and updated from the most recent housing survey reports where available. Where recent data were unavailable, information from realtors, private associations, and local government officials was used to update the census estimates. Housing demand projections were prepared using estimates of projected baseline population and assumptions regarding estimated persons per household. Baseline supply data for temporary housing units were compiled from unpublished data.

Education. Existing baseline enrollments were compiled from published sources. Data were generally available through the current school year (1987-88). Enrollment projections were based on locally developed population forecasts and the ratio of school-age children to total population derived from the historical data.

Public Services. Descriptions of public services provided by the potentially affected jurisdictions were compiled from published sources and supplemented by information provided by local officials. Data were generally available through the current fiscal year (FY 1988). Public service employment levels were forecast based on estimated population growth and employment-to-population ratios derived from the historical data.

Public Finance. Historical revenues, expenditures, and changes in fund balances were compiled from published budgets and audited statements. Data from financial reports were generally available for the most recently completed fiscal year (FY 1987). Budget data were generally available through the current fiscal year (FY 1988). Projected revenues and expenditures were forecast based on the estimated growth in population and revenue/expenditure-to-population ratios derived from the historical data.

A.1.5 Methods for Assessing Socioeconomic Impacts

Employment and Income. Employment and income impacts were calculated for both direct program employment and procurement requirements as well as for indirect or secondary effects. All dollar values are presented as constant 1986 dollar estimates. Direct changes in construction employment were measured using the annual labor-hour requirements prepared by the U.S. Army Corps of Engineers and historically based assumptions regarding full-time equivalent work-hours per construction worker per year. Earnings were estimated by applying current craft-labor wage rates, derived from local building trade council publications, to annual construction work force estimates. Assembly and Checkout (A&CO) worker earnings (for cumulative

programs) were based on annual salaries derived from similar work for the Peacekeeper in Minuteman Silos program at F E Warren Air Force Base (AFB), Wyoming; and, annual A&CO work force requirements at Malmstrom AFB. Earnings of military personnel were estimated using a weighted average basic salary plus other payments (e.g., Basic Allowance for Quarters, Variable Housing Allowance, Basic Allowance for Subsistence and Flight Pay where applicable), and the estimated military operations work force requirements at Malmstrom AFB.

Secondary changes in jobs and income were estimated using an economic (input-output) model specified for this ROI. The model, developed from published data, uses an approach developed by the Bureau of Economic Analysis (BEA). The model is structured to provide employment requirements for those sectors most likely to be affected by the program. Average wage rates for appropriate sectors were applied to respective changes in employment to obtain secondary income estimates. Labor force impacts (i.e., measures of the number of immigrating workers, local hires, and weekly commuters) were estimated using factors derived for the Peacekeeper Monitoring Program at F E Warren AFB. The distribution of these labor force impacts on local areas was then estimated based on the location of worksites, potential residence locations, and commuting distances.

Population and Demographics. Annual population impacts were based on the number of program-related immigrating personnel and assumptions regarding accompaniment rates and average household sizes for specific military and civilian worker categories. The immigrating population was then allocated to the communities within the local area in the same pattern as the relocating labor force.

Housing. Annual program-related housing requirements were evaluated and compared to projected locally available vacancies. The impact analysis included four steps: (1) determination of immigrant housing requirements and preference by housing type, (2) estimation of annual permanent and temporary housing requirements, (3) estimation of new housing starts by both the private sector and the Air Force in response to program demand, and (4) comparison of the program-related housing requirements to baseline housing stock and available vacancies. By regulation, the Air Force is committed to using locally available housing to the greatest extent possible. If the private housing market is unable to supply housing, the additional housing required would be supplied through existing federal housing programs, or if other options are not feasible, through funding supplied by Military Construction Programs.

Education. Program-related enrollment increases were based on the number of immigrants and ratios of school-age children to total population as monitored at F E Warren AFB for the Peacekeeper in Minuteman Silos (PIMS). Monitoring data were also used as a guide in determining the school-age children to total population ratios for military and secondary workers and dependents. The ratio of school-age children of immigrant construction workers to immigrant construction population was estimated separately since many of the construction workers do not relocate their families. The pupil-to-teacher ratio for elementary grades was used as the primary factor for assessing public school impacts.

Public Services. Impacts on public service delivery systems were measured by the estimated increase in public sector employment required as a result of increases in service demands associated with program-related population immigration. Total local government employment by jurisdiction was used as a proxy measure of overall public service levels within each community since such services are predominantly labor-intensive activities. Estimates of increased need for additional facilities were based on the capacities of the existing infrastructure to absorb program-induced demand.

Public Finance. Operation and maintenance (O&M) expenditure impacts for city and county government units were based on additional personnel needs caused by program-related population immigration and estimates of the per employee costs for these personnel. School district O&M expenditures were based on current costs per student. Revenues from P.L. 81-874 programs were calculated based upon the number of program-related "A" pupils and "B" pupils. Expenditures for major capital and equipment outlays as identified by other resource analyses were estimated on a case-by-case basis. Revenue impacts were estimated for the principal revenue sources of each jurisdiction. Property taxes were calculated by estimating the additional taxable valuation that would be generated by program activities and applying current mill-rate levies against the estimated increase in the tax base. Other revenue sources (e.g., charges for services, fines, fees, redistributed state tax collections, and miscellaneous revenues) were estimated on a case-by-case basis.

A.1.6 Levels of Impact Criteria

Program impacts, including cumulative effects from other proposed projects, were evaluated as either beneficial or adverse. For impacts that were evaluated as adverse, levels of impact (LOIs) were assigned as negligible, low, moderate, and high.

The criteria for determining the level of socioeconomic impacts involve measuring the demand for the various components of the resource (e.g., housing, public services, and local government expenditures) relative to baseline levels. This measure provides an indication of the magnitude of the program-induced change relative to projected baseline conditions.

Because the additional housing needs, school enrollments, public service personnel needs, and local government expenditures are driven by and are directly related to population growth, criteria for LOIs for the socioeconomic resource used the estimated increase in population relative to baseline levels to measure the LOIs. The assumption that population growth, when measured against baseline population levels, is representative of the magnitude of the program-induced change in other socioeconomic elements (housing demand, enrollment increases in the local schools, public service demands, and local government expenditure needs) is based on the generally linear relationship (within a reasonable range) between population and these other elements: a population increase of 4,000 in a community of 40,000 would represent a 10-percent increase in population and also represents, for the most part, a 10-percent increase in school enrollments, housing demand, and local government services and expenditures.

Annual increases of a community's population over 10 percent were judged to cause a high impact based on a number of growth impact studies (President's Economic Adjustment Committee, 1981; Hammer, Siler, George Associates, 1982; US Department of Energy, 1978). This magnitude of change tends to strain local service delivery systems in the short term and may change a community's existing structure and organizations in the long term. Conversely, impacts would be negligible when population change is less than 1 percent. Population growth of this magnitude is normal in most communities and would not result in appreciable responses by either public or private enterprise or agencies. Low and moderate impact criteria are intervals between 1 and 10 percent.

The LOIs for the socioeconomics resource are:

Negligible Impact -- Increases in community population of less than 1 percent over projected baseline levels. This level of growth would not result in appreciable increases in housing demand, school enrollments, public service demands, or local government expenditures.

Low Impact -- Increases in community population of 1 percent to 5 percent over projected baseline levels. The proportionate increases in housing demand, school enrollments, public service demands, and local government expenditures would be generally within normal growth patterns and require little response by affected communities.

Moderate Impact -- Increases in community population of greater than 5 percent but less than 10 percent over projected baseline levels. Increases of this size are generally greater than normal baseline growth. The proportionate increases in housing demand, school enrollments, public service demands, and local government expenditures would require substantial responses by affected communities.

High Impact -- Increases in community population of 10 percent or greater over projected baseline levels. Growth of this magnitude would tend to strain local housing markets and local public service delivery systems in the short term and change a community's existing structure and organization in the long term.

A.1.7 Significance Criteria

The significance of socioeconomic impacts was evaluated in accordance with the context and intensity criteria provided in the Council on Environmental Quality (CEQ) regulations (Section 3.0).

In addition to the CEQ criteria, other considerations judged appropriate for socioeconomic impacts are the following:

The degree to which area residents would be adversely affected by decreased vacancy rates in local housing markets;

The degree to which the proposed program would reduce public services levels or aggravate already existing adverse conditions in the affected communities; and

The degree to which the proposed program would create excessive fiscal burdens on existing residents.

Therefore, socioeconomic impacts were judged to be significant when one or more of the following would occur:

Changes in housing demand that cannot be filled by available vacancies or by timely development of affordable and suitable housing. A shortage of low- and moderate-income housing would cause substantial burdens on both civilian and military families.

Increases in existing neighborhood elementary school enrollment would result in pupil-to-teacher ratios that are larger than the state standards, thereby threatening accreditation. Resolutions to these problems would require major additions of personnel or facilities for which sufficient funds are not expected to be available. For education, the funding criteria refers to the potential availability of funds for the mitigation of identified impacts. For accreditation, individual state standards for the number of students per classroom were used.

Increases in population would reduce service levels of key functions below locally prevailing levels and would require additional personnel or facilities to return service levels to preprogram levels for which sufficient funds are not expected to be available.

Revenue sources of local governments are unable to meet program-induced outlays or the financial resources of the jurisdictions are inadequate to meet potential shortfalls.

A.2 UTILITIES

A.2.1 Resource Description

The utilities resource consists of a broad range of physical systems potentially affected by the Second KC-135R Squadron Program. These systems include the services and facilities that supply potable water, wastewater treatment, solid and hazardous waste disposal, and energy.

Potable Water Treatment and Distribution. Potable water treatment and distribution involves those facilities that distribute water to meet municipal and industrial demands. Facilities include treatment, pumping and distribution systems, and storage tanks.

Wastewater. Wastewater treatment includes those facilities that collect, treat, and dispose of waterborne wastes generated by municipal and industrial users. Facilities included sewage collection systems and treatment plants or lagoons.

Solid and Hazardous Waste. Waste disposal involves those facilities and systems that provide collection and disposal of solid and hazardous waste from municipal and industrial activities. Landfills or other waste disposal facilities and hazardous waste storage facilities were included in the analysis.

Energy Utilities. Energy utilities include the consumption of electricity, natural gas (and other heating fuels), and liquid fuels as well as the facilities that are associated with the generation and transmission or distribution.

A.2.2 Region of Influence

The Regions of Influence (ROIs) for the utilities resource are the geographic areas where community utility service may be directly or indirectly affected by the proposed Second KC-13R Squadron Program. Communities and other locations anticipated to receive significant immigration are the focus of the utilities analysis.

Service area boundaries for the water, wastewater, and solid waste disposal utilities in Great Falls define the ROI. The ROI for energy utilities is defined by the service area of those companies providing power fuel and natural gas to Great Falls and to Malmstrom AFB.

A.2.3 Data Sources

Major data sources for each utility system included municipal, county, and industrial annual statistical reports, monthly performance reports, master plans, and other technical studies. Annual state reports on water quality provided information on the status of the water pollution control programs, including wastewater treatment plant upgrade studies. County and regional studies addressing the nature of solid waste generation and the status of existing facilities were used to develop the baseline analysis. Data sources for Air Force bases' utility systems included environmental impact statements and assessments and other technical reports.

A.2.4 Methods for Assessing Existing and Future Baseline Conditions

Potable Water Treatment. Potable water treatment systems were assessed for adequacy to provide for new demands. The number of facilities, existing capacities, and excess capacity, as well as proposed expansions, were evaluated. When available, data for a 3-year period were collected to identify trends in the amount of water treated. If projections of future treatment requirements were available, they were incorporated into the baseline analysis. Per capita rates were used in the absence of projections to determine future treatment requirements.

Wastewater. Wastewater treatment systems were assessed for adequacy to provide for new demands. The number of facilities, existing capacities, and excess capacity, as well as proposed expansions, were evaluated. When available, data for a 3-year period were collected to identify trends in the amount of wastewater treated. If projections of future treatment requirements were available, they were incorporated into the baseline analysis. Per capita rates were used in the absence of projections to determine future treatment requirements.

Solid and Hazardous Waste. Solid waste disposal, which involve landfills and collection systems, were analyzed for their ability to collect and dispose of the wastes of the baseline population. The availability of landfill space and future plans for expansions or for the use of new sites or technologies were investigated.

Existing on base hazardous waste generation and storage was identified. On base hazardous waste sites were identified through the use of the United States Air Force Installation Restoration Program documents. Other sites were identified based on discussions with state and local officials. These locations were provided to the water resources group so that the potential effect on surface and groundwater resources could be assessed.

Energy Utilities. Major utilities companies that provide electricity and natural gas, along with local suppliers of coal, liquid fuels and other alternative energy sources, were examined to assess existing service systems, including service areas, number of customers, and planned expansions. Energy resources were evaluated in terms of the change in peak demand for electrical systems and the change in annual sales for natural gas systems. Energy use was identified in terms of the annual per capita consumption of electricity (in kilowatt-hours), natural gas (in thousand cubic feet), and liquid fuels (in gallons).

A.2.5 Methods for Assessing Utility Impacts

Methods for assessing utility impacts were the same for each of the four resource components. The analysis included certain assumed mitigations and offered specific mitigation measures where significant impacts were identified.

Utility requirements were based on direct and indirect program-related demands. Direct construction utility requirements at Malmstrom AFB were identified. Direct requirements at the base during the operations phase were calculated using a per capita estimate for the additional personnel working on base. Indirect utility requirements were estimated from population projections based on the socioeconomic analysis. Per capita utilization rates were multiplied by the projected population to obtain an estimate of the utility capacity needed. These rates were based on historical use patterns and any significant industrial use or other factors.

Changes in average daily demands were estimated by comparing demands at each location with and without the program. Both direct and indirect demands were totaled and taken as a percentage increase over the projected baseline demand. Total demand was compared against existing or programmed capacity to determine if shortfalls would occur as a result of the program. If the total demand for a utility appeared to effect the price of the service, then an analysis of the programs effect on the price was conducted.

A.2.6 Levels of Impact Criteria

Impacts on the utilities resource are the result of requirements for potable water, wastewater treatment capacity, solid waste disposal capacity, and energy supplies associated with increased service populations and population-induced land development. In addition, the direct requirements that support specific program-related construction and operations activities were evaluated. For each of the four components of the utilities resource program-induced changes were evaluated as a proportion of projected baseline utilities use for both the short- and long-duration.

Impacts would be negligible when the growth in utility demands is less than one percent. Growth of this nature occurs in most communities as the existing population increases in per capita consumption or generation of a resource. Annual increases in utility consumption that exceed 10 percent generally would surpass growth projections for the system, and disrupt performance and delivery of service. This level of increase would require immediate attention and would be considered a high impact. Low and moderate impact criteria are intervals between these two extremes. A level of impact (LOI) was assigned to the utilities resource after the relative merits of each component LOI was evaluated. The LOIs were defined generally for the utilities resources as follows:

Negligible Impact -- A increase in service requirements attributable to the program-related utility demands of less than 1 percent over baseline demands.

Low Impact -- An increase in service requirements associated with program-related utility demands of 1 to 5 percent over baseline demands.

Moderate Impact -- An increase in service requirements associated with program-related utility demands that exceed 5 percent but are less than 10 percent over baseline.

High Impact -- An increase in service requirements associated with program-related utility demands that are 10 percent or greater over baseline.

A.2.7 Significance Criteria

The significance of utilities impacts was evaluated in accordance with the context and intensity criteria provided in the Council on Environmental Quality (CEQ) regulations (Section 3.0).

In addition to the CEQ criteria, the following considerations were judged appropriate for the utilities resource:

The degree to which a utility service would have to alter operating practices and personnel requirements;

The degree to which the increased demands from the proposed program would require the development of additional capacity or new facilities; and

The degree to which the increased demands from the proposed program would reduce the reliability of utility service, or aggravate already existing adverse conditions in affected communities.

The degree to which the proposed program would aggravate existing deficiencies in the provision of utility services.

A.3 TRANSPORTATION

A.3.1 Resource Description

The transportation systems most likely to be affected by the proposed program are roads. Commercial airports and the public transportation systems are not expected to be affected by the proposed program.

The road networks considered in the analysis included all interstates, federal-aid designated primary US or state-numbered highways, and principal city streets (usually the major urban arterials or federal-aid designated urban roads) where program-induced traffic is expected to be concentrated.

A.3.2 Region of Influence

The Regions of Influence (ROIs) for transportation include all interstates and federal-aid designated primary US or state-numbered highways within 50 miles of Malmstrom AFB that serves as a supply region for program-related labor requirements and construction materials. Because most of the labor force and materials requirements would come from communities nearest the candidate deployment installation, the analysis concentrated on the potential impacts on roads nearest the installation. Therefore, the ROIs for transportation only include interstates and federal-aid designated primary US or state-numbered highways between the host community and the candidate deployment installation, and the principal city streets (also referred to as major urban arterials of federal-aid designated urban roads) within the communities serving each base.

A.3.3 Data Sources

The major sources of data were the respective agencies in each region including the state departments of highways and/or transportation; county highway departments or engineers; city road, engineering, planning, and/or

public works departments of the host community; and the Federal Highway Administration. Most information was in the form of published or unpublished reports and maps showing the road network, geometric and physical characteristics, and volumes and characteristics of traffic. In addition, geometric characteristics and traffic information regarding on-base roads were obtained from each base or from published planning technical reports.

A.3.4 Methods for Assessing Existing and Future Baseline Conditions

Roads are described by their physical features, current traffic volume, and estimated level of service (LOS). The latest available average annual daily traffic counts were obtained to evaluate current use of road facilities. The LOS, which is specified by letter scores A (very good) to F (poor), provides a measure of the quality of service provided by a road segment or intersection and the likely level of acceptability of given traffic conditions to motorists. The LOS is a qualitative measure developed by the Transportation Research Board that incorporates the collective factors of speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating costs provided by a road facility under a particular volume condition. Typical descriptions of operating conditions for each of the LOS are given in Table A.4-1 and shown in Figure A.4-1.

Information on road, street, and intersection improvements was obtained from the appropriate agencies. Future traffic volumes were obtained from the Montana Department of Highways. Future traffic volumes on principal city streets in the host communities were estimated using projected population changes in the community. Population changes that include any effects of

Table A.4-1

General Operating Conditions For
Different Road Types by Level of Service

Level of Service	Freeways, Multilane Highways	Operating Conditions Two Lane Roads	Urban Streets
A	Traffic essentially free flowing. Speeds about 60 mph. Great freedom to maneuver. Minor disruptions easily absorbed.	Motorists can drive at desired speed, often about 60 mph. Passing demand well below capacity; delays no more than 30%. Few platoons of 3 or more cars.	Free flow operations at average travel speeds about 90% of the free flow speed for the arterial class. Ability to maneuver within the traffic stream is high and stopped delays at signalized intersection is minimal, i.e., less than 5 seconds per vehicle.
B	Reasonably free flowing, speeds about 57 mph. Maneuvering slightly restricted. High comfort. Incidents still easily absorbed.	Passing demand significant; delay about 45%. Speeds near 55 mph. Some platooning.	Reasonably unimpeded operations at average travel speeds about 70% of the free flow speed for the arterial class. Ability to maneuver within the traffic stream is only slightly restricted and stopped delays at signalized intersection are in the range of 5.1 to 15 seconds per vehicle.
C	Stable flow, speeds in low 50-mph range. Lane changes require care and vigilance. Noticeable driver tension. Incidents cause degraded service, queuing.	Noticeable increases in numbers and sizes of platoons; delay about 60%. Speeds in low 50 mph range. Stable flow, but subject to congestion.	Stable operations, but ability to maneuver and changing lanes are more restrictive resulting in longer queues and lower average travel speeds of about 50% of the free flow speed for the arterial class. Delays are in the range of the 15.1 to 25.0 seconds per vehicle.
D	Conditions border on unstable flow; small changes cause substantial deterioration in service. Speeds in low 40-mph range. Severe restrictions on maneuvering. Driver discomfort. Most disruptions cause LOS E.	Passing demand high, passing capacity near zero. Speeds may reach 50 mph. Platoons of 5-10 vehicles common. Delays may reach 75%. Approaches unstable flow.	Borders on a range in which small increases in flow may cause substantial increases in delays. Average travel speeds are about 40% of free-flow speed for the arterial class and stopped delays at intersections are in the range of 25.1 to 40 seconds per vehicle.
E	Conditions extremely unstable. No usable gaps; disruptions propagate upstream. Driver comfort, maneuverability extremely poor. Disruptions cause rapid transition to LOS F.	Passing virtually impossible; platooning intense; delays greater than 75%. Speeds below 50 mph; operation very unstable.	Characterized by significant delays at intersections ranging from 40.1 to 60 seconds per vehicle and average travel speeds of one-third or lower the free-flow speed for the arterial class. Many vehicles stop and the proportion of vehicles not stopping declines.
F	Forced or breakdown flow.	Heavily congested flow; volumes below capacity at low speed.	Arterial flow at extremely low speeds below one-third to one-quarter of the free-flow speed. Delays are in excess of 60 seconds per vehicle which is considered to be unacceptable to most drivers.

Note: ¹In the absence of strict enforcement. Assumes 55 miles per hour speed limit.

Source: Transportation Research Board 1985.

FIGURE A.3.4-1 Operational Conditions of Roads at Various Levels of Service



LEVEL OF SERVICE A



LEVEL OF SERVICE D



LEVEL OF SERVICE B



LEVEL OF SERVICE E



LEVEL OF SERVICE C



LEVEL OF SERVICE F

Source: Transportation Research Board, 1995.

addition or completion of missions were obtained from the socioeconomic analysis. Changes to the LOS at critical road segments was estimated for traffic counts projected through 1994.

A.3.5 Methods for Assessing Transportation Impacts

The effects of the proposed program on roads were estimated from the anticipated increase in commuting by direct and indirect workers during the construction and operations phases. Impacts were evaluated in terms of peak-hour commuting LOS changes generated by program-related construction workers and operations personnel to assess the maximum impact of the proposed program. The analysis involved an estimation of the number of workers and immigrants that would use specific lengths of roads/highways, conversion of these program-induced commuters to peak-hour traffic volumes, and estimation of the resultant with-program LOS.

Program manpower estimates and their classes of activity (e.g., construction, assembly and checkout, and operations) were obtained from the program description. Program-related travel patterns were evaluated on the basis of proposed program work locations, work schedules, and vehicle occupancies. The most direct routes from the host communities to the worksites were determined, and the corresponding program-induced traffic was then assigned to the road/highway system. Traffic assignments were made only on primary rural highways, such as interstates and federal-aid designated primary US or state-numbered highways between the host communities and the installation, and the principal city streets (usually federal-aid designated urban roads) within the host communities. For this analysis, all workers were assumed to commute by passenger car, with a ridership of 1.1 passengers per vehicle for up to 10 miles of commute, 1.35 passengers per vehicle for distances between 10 and 15 miles, and 1.55 passengers per vehicle for longer commuting distances. These factors were derived from information in the National Cooperative Highway Research Program Report 187, Quick Response Urban Travel Estimation Techniques and Transferable Parameters User's Guide (Transportation Research Board 1978).

The number of additional vehicle trips made by program-related employees that would occur during the peak hours was combined with baseline traffic projections to determine impacts on the road/highway system leading to the base. Commutes made by indirect employment workers and other immigrants were estimated and distributed to the principal streets in the community based on existing traffic flow levels. The effect of generating queues and delays due to increased traffic at the entrance gates to the installation was determined based on gate capacities provided in the Military Traffic Management Command publication Traffic Engineering for Better Gates. Gate capacities are based on security levels: a high-security gate, where employees must stop and show their identification, could process at most 200 to 400 vehicles per hour per lane; a medium security gate, where vehicles are not required to stop, could process at most 400 to 600 vehicles per hour per lane; and a low-security gate, found at installations that are open to the public, could handle about 600 to 800 vehicles per hour per lane. The resulting then-year traffic flow condition along roads leading to the base and at the gates was then compared to the without-program conditions to assess impacts of the program on transportation.

A.3.6 Levels of Impact Criteria

The effect of program-induced traffic on the quality of transportation service would have different levels of intensity. The measure of quality or level of impact (LOI) for roads would vary in relation to the ratio of the rate of flow to the capacity of the transportation facility.

For roads, the changes in the intensity of the quality of service is measured by changes in the traffic LOS. The LOI assignments are related to the changes in motorist safety and satisfaction associated with changes in the LOS rating or with appreciable increases in volume at degraded service levels. For example, a change from LOS A to B results in comparatively little inconvenience, delay, or hazard. By contrast, a change from LOS E to F results in breakdown conditions: the level of annoyance is high, delays are severe, and the potential for collisions is sharply increased. An impact may be produced even without a change in LOS rating if the roadway section is already at a degraded LOS rating (LOS D, E, or F) and additional traffic will result in annoyance, slowing, and increased hazard. An increase in the amount of heavy vehicles in the traffic stream could also change the LOS rating. The operational characteristics along a freeway and multilane highway, two-lane road, and an urban arterial street under each LOS letter score is described in Table A.4-1. The effects of increased queue lengths, delays, and service operations on urban streets are also expressed in LOS ratings.

The LOIs reflecting these considerations are characterized as follows:

Negligible Impact -- No change would occur in LOS for categories A, B, or C. Although traffic volumes may increase, the motorist would perceive no essential difference in traffic operations.

Low Impact -- The LOS would decline from A to B or B to C, or volume is added at LOS D. The motorist might perceive a slight change in traffic operations.

Moderate Impact -- The LOS would decline from A to C, C to D, or D to E, or volume is added at LOS E. The motorist would perceive a noticeable decrease in the quality of service of traffic operations.

High Impact -- The LOS would decline from A to D, A to E, A to F, B to D, B to E, B to F, C to E, C to F, D to F, or E to F, or volume is added at LOS F. The motorist would perceive a decided decrease in the quality of service of traffic operations, or existing LOS F conditions would be extended in duration and/or worsened.

A.3.7 Significance Criteria

The significance of transportation impacts was evaluated in accordance with the context and intensity of criteria provided in the Council on Environmental Quality (CEQ) regulations (Section 3.0).

In addition to the CEQ criteria, the following consideration is judged appropriate in evaluating significance for transportation.

An impact on roads was considered significant if the LOS is affected at or reduced to LOS D or lower for more than 1 hour per day because of

program-related traffic. The 1-hour criterion reflects a daily duration of impact beyond the usually accepted standard for road design and analysis. The LOS criterion also reflects motorists' exposure to conditions below minimum desirable design standards. Both factors imply associated impacts on road safety, and the potential demands for facility improvements with related capital expenditures.

A.4 LAND USE

A.4.1 Resource Description

The land use resource analysis includes a discussion of land uses, prime farmlands, compatibility with local land use plans and policies, and visual attributes. Land use analysis involves both direct and indirect impacts. Direct impacts would result from construction of program-related facilities on or in the vicinity of a base. These impacts can affect both developed and undeveloped land, and result in changes in land use caused by acquisition of land for proposed program use including (for cumulative impacts) the rail connector spur and the explosive safety zone restrictive easements around Malmstrom AFB. Indirect impacts would result from land use changes caused by program-induced population growth.

Visual attributes are defined as the physical characteristics or qualities of the environment that can be seen by observers of the landscape. A landscape is defined as a portion of land that the eye can comprehend in a single view, irrespective of its aesthetic value. The analysis involves the evaluation of changes in the aesthetic value of a landscape caused by program-related activities and the extent of acceptability of these changes to viewers.

A.4.2 Region of Influence

The land use Regions of Influence (ROIs) include the affected portions of the base, the land surrounding the base, the communities hosting the immigrant population, and land along the proposed connecting rail spur. The visual attributes ROIs are the foreground, middleground, and background areas in the vicinity of the proposed facilities as viewed from key observation points. Key observation points are highways with an average annual daily traffic (AADT) of at least 1,000, residential communities (subdivisions), and recreation areas.

A.4.3 Data Sources

Data on offbase land use, land use plans and policies, and soils were obtained from city and county planning offices, Air Force base planning personnel, state forester offices, the US Agricultural Stabilization and Conservation Service (ASCS), existing environmental studies, aerial and ground photographs, US Geological Survey (USGS) maps, and field surveys.

A.4.4 Methods for Assessing Existing and Future Baseline Conditions

The analysis of program impacts on land use required an inventory of present and future land use baseline conditions in the vicinity of bases affected by direct fee acquisition for the garrison, connector rail spur, or relocated facilities, and by explosive safety zone easements where inhabited buildings or public transportation routes would require relocation. Land uses have

been described based on interpretation of aerial photographs and existing maps such as those published by the USGS and the ASCS. Structures, utilities, roads, and easements are addressed as appropriate.

Because agriculture and silviculture are the predominant rural land uses in the ROIs, their generalized patterns were determined and analyzed by type of agricultural use (e.g., irrigated and non-irrigated pasture or rangeland, irrigated cropland, and non-irrigated cropland) or silvicultural use (harvesting of wood products).

Projected future land use conditions assume a continuation of existing conditions. Land uses, except in specific locations undergoing conversion, are expected to remain relatively similar to the current mix of uses, and as such, the projected conditions analysis is qualitative.

Landscapes for the proposed program siting locations were identified. They contain descriptions of the landscape features (land, vegetation, and structures) found in the ROI and identification of key observation points.

A.4.5 Methods for Assessing Land Use Impacts

Impacts were determined based on three factors: (1) the extent and kind of land which would be affected by the program facilities, (2) the number of inhabited buildings and other facilities (e.g., public roads and transmission lines) that would fall within restrictive easements of cumulative programs, and (3) the anticipated visual acceptability of newly constructed facilities. Land use issues associated with noise and aircraft operations are covered in the noise module.

The amount of land designated for various land uses that would be acquired (and thereby changed) by the program was related to the amount presently available in the host county. Proposed program activities and facilities were compared to existing local land use, land use plans, and zoning in the immediate vicinity to determine the compatibility of the proposed military uses with those local plans and requirements.

A.4.6 Levels of Impact Criteria

Program impacts on land use, including cumulative effects of other known projects, were analyzed and the following four LOIs were assigned: negligible, low, moderate, and high.

The criteria for determining the LOI on agricultural land use were based on the extent of program-induced changes in several types of land uses as compared to the amount presently available in the host county (a commonly used geographic area for identifying agricultural economic strength). Permanent loss of 10 percent of a given type of agricultural land use is considered a severe impact on the normal agricultural economy. Therefore, a loss of 10 percent or more in a given type of agricultural land use (e.g., irrigated cropland or grazing land) or of prime farmland in a given county was assumed to be a high impact.

The Second KC-135R AREFS Program has no programmed restrictive easements for explosive zones.

The criteria for determining the LOI on visual attributes were based on factors that would measure the degree of visual intrusion on the landscape as viewed from key observation points. The factors used were the distance between the key observation points and the facilities; the existence of topographic, vegetation, or structural features that would block views of program facilities from key observation points; and the degree of contrast within the landscape created by the facilities. The combination of these factors determine the viewer's acceptance or objection to the visual intrusions created by the program.

The LOI definitions for the land use resource (for all programs covered in this document) are the following:

Negligible Impact -- The loss of any land use type or prime farmland due to program acquisition would be than 1 percent of the inventory of that use in the host county; no inhabited buildings would be located within the restrictive easements; and visual intrusions would not be noticeable to the casual observer.

Low Impact -- The loss of any land use type or prime farmland due to program acquisition would be at least 1 percent but less than 5 percent of the inventory of that use in the host county; one to four inhabited buildings would be located within the restrictive easements; and/or visual intrusions would be noticeable but are not expected to be objectionable.

Moderate Impact -- The loss of any land use type or prime farmland due to program acquisition would be at least 5 percent but less than 10 percent of the inventory of that use in the host county; five to nine inhabited buildings would be located within the restrictive easements; and/or visual intrusions are expected to be objectionable to less than 50 percent of the viewers.

High Impact -- The loss of any land use type or prime farmland due to program acquisition would be 10 percent or more of the inventory of that use in the host county; ten or more inhabited buildings would be located within the restrictive easements; and/or visual intrusions are expected to be objectionable to more than 50 percent of the viewers.

A.4.7 Significance Criteria

The significance of impacts on land use was evaluated in accordance with the context and intensity criteria provided in the Council on Environmental Quality (CEQ) regulations (Section 3.0).

In addition to the CEQ criteria, the following considerations are also appropriate for the land use resource:

The extent to which the action would restrict or prevent the use of inhabited buildings or other major facilities within the explosive safety zone restrictive easements;

The degree of visual contrast between the program facilities and the existing landscape; and

Where land acquisition is necessary for program facilities, the extent to which these facilities would be incompatible with adopted local land use plans and zoning on adjoining private land.

A.5 Cultural Resources

A.5.1 Resource Description

Cultural resources include four elements: prehistoric, historic, Native American, and paleontological resources.

Prehistoric Resources. Prehistoric resources are physical properties resulting from human activities predating written records. They are generally identified as either isolated artifacts or sites; the latter is the basic analytical unit in archaeology. Sites contain concentrations of artifacts, features, and floral and faunal remains. Depending on their age, complexity, integrity, and relationship to one another, sites may be important and capable of yielding information about past populations and adaptive strategies. Although most sites have some research potential, it is generally the larger and more complex sites that have a variety of research applications and are of greatest concern during program planning.

Historic Resources. Historic resources consist of physical properties that postdate the existence of written records; in the United States, such properties usually relate to Euro-American occupations. Historic resources include architectural structures (e.g., buildings and bridges) and archaeological features such as foundations and trash pits. Such resources may have research potential in the same manner as prehistoric sites, but historic sites are more often considered important because of their association with important historical persons or events, or as examples of distinctive architectural styles. Ordinarily, sites less than 50 years old are not considered historic for analytical purposes, but exceptions can be made for younger properties if they are of exceptional importance (36 CFR 60.4).

Native American Resources. Native American resources are sites, areas, and materials important to Native Americans for religious or heritage reasons. Resources may include prehistoric sites and artifacts, contemporary sacred areas, traditional use areas (e.g., native plant habitat), and sources for materials used in the production of sacred objects and traditional implements. Of primary concern in the Environmental Impact Analysis Process are concepts of sacred space that create the potential for land use conflicts. Fundamental to Native American religions is the belief in the sacred character of physical places such as mountain peaks, springs, and burials. Additionally, traditional rituals often prescribe the use of particular native plants, animals, or minerals. Therefore, activities that may affect sacred areas, their accessibility, or the availability of materials used in traditional practices may be of concern.

Paleontological Resources. Paleontological resources are the physical remains, impressions, or traces of plants or animals from a former geological age. They include casts, molds, and trace fossils such as burrows and tracks. Fossil localities typically include surface outcrops, areas where subsurface deposits are exposed by ground disturbance, special

environments favoring preservation, such as caves, peat bogs, and tar pits. Paleontological resources are important mainly for their potential to provide scientific information on paleoenvironments and the evolutionary history of plants and animals.

A.5.2 Region of Influence

One of the main considerations used to evaluate the importance of cultural resources is their cultural/historical context, as defined at the regional level. The Region of Influence (ROI) is designed as an approximation of the areas within which data useful for establishing cultural/historical context can be derived. Although their sizes vary from one region to another, the ROIs generally include several counties, incorporating recognized culture areas and/or physiographic provinces. They are intended to reflect the regions within which impact area resources can be compared with known sites to establish their relative importance. The ROIs also include the regional resource bases that would be affected by the loss of a resource in the program impact areas. The program impact areas comprise only a small portion of the ROIs.

A.5.3 Data Sources

Data for all resource elements were obtained at two levels: the ROIs and program impact areas. A general literature review was undertaken for the ROIs; existing site records and detailed survey data were obtained for only a small area within the ROIs surrounding the on base and off base impact areas. Information used in the identification of cultural/historical contexts in the ROIs was obtained from a variety of published and unpublished reports. These documents were identified through consultation with the Montana State Historic Preservation Offices, the US Bureau of Reclamation, the US Bureau of Land Management, the US Forest Service, and a variety of professional researchers in the fields of anthropology, archaeology, geology, and history. Site-specific data on prehistoric, historic, and paleontological resources in the vicinity of program impact areas were obtained in two ways. A search of state site files was conducted to identify previously recorded sites near the base, and the National Register of Historic Places (NRHP) was consulted to identify any known eligible sites. Field surveys were subsequently carried out in those impact areas not previously studied. Native American resources were identified through direct consultation and field visits with religious specialists from the appropriate tribal groups.

A.5.4 Methods for Assessing Existing and Future Baseline Conditions

Baseline conditions for all resource elements were identified by combining resources previously identified in the vicinity of program impact areas with those identified during the site-specific field surveys. Regional geomorphic conditions were considered to assess the potential for encountering buried resources in the impact areas. The history of ground disturbance at the base and in offbase impact areas was detailed to the extent possible using existing records and field observations. Patterns of previous disturbance were used to further refine the definition of those impact areas where the preservation of intact subsurface deposits could be reasonably expected to occur.

A.5.5 Methods for Assessing Cultural Resource Impacts

The level of likely impacts was identified by comparing program impact areas with the distributions of all resources known or (in the case of potential buried sites) predicted to occur in the vicinity of the impact areas. The significance of impacts was determined by evaluating prehistoric, historic, and paleontological sites for their importance relative to other resources in the ROIs, as determined through consultation with area professionals and appropriate agency representatives. The assessment of impacts on Native American resources included the evaluation of the relative importance of different resource types, and the determination of specifically what actions or conditions would constitute disturbances to important resources. Both considerations were determined through consultation with religious specialists. With the possible exception of some types of Native American resources (e.g., native plant habitat), impacts on cultural and paleontological resources are considered to be of long duration. The potential reversibility of an effect contributed to the identification of the level of impact (LOI).

A.5.6 Levels of Impact Criteria

The LOIs were determined by identifying the numbers and kinds of resources likely to be affected relative to their occurrence and importance in the region. Therefore, the setting or context of the impacts is regional. However, the amount or proportion of a given resource (i.e., site or locality) to be affected was also considered. The severity of impact was evaluated for its effects on NRHP eligibility, future research potential, or future suitability for religious or heritage uses. For cultural resources, the following LOIs were identified:

Negligible Impact -- No important or sensitive resources are likely to be affected.

Low Impact -- Important resources are likely to be affected, but they make up a small percentage of a resource type common in the region. Affected traditional use areas are widely available or could be restored.

Moderate Impact -- Important resources are likely to be affected and they are of a type which is relatively uncommon in the region. Portions of affected resources may remain intact and some effects may be reversible.

High Impact -- A large proportion of a given resource type within the region is likely to be destroyed, damaged, or altered. The resource represents a rare or unusual occurrence within the region.

A particular LOI may be driven by effects on any or all resource elements. The criteria used in determining the LOI for each resource element are described in the following sections.

Prehistoric and Historic Resources. Impact assessments focused mainly on those properties likely to be eligible for the NRHP. In addition to identifying the number and kinds of resources to be affected, the following issues were considered:

- o Evaluation of the relative importance of a resource type in the regional context;
- o The depositional integrity of a given resource; and
- o The relative degree of protection afforded similar off base resources in the region.

Native American Resources. The individual resource type, the proximity of impact areas to the resource, and the likely duration of impacts were considered in the analysis of Native American resources. Specific concerns include the following:

- o The relative importance of the resource in the Native American physical universe and/or belief system;
- o The distance at which activities in the vicinity of a sacred area constitute a disturbance;
- o The extent to which affected resources may be restored; and
- o The extent to which alternative sources for raw materials are available and/or suitable.

Paleontological Resources. In addition to identifying the numbers and kinds of resources likely to be affected, the following issues were considered in estimating LOI:

- o The quality of fossil preservation in a given deposit; and
- o The proportion of the resource to be affected.

A.5.7 Significance Criteria

In addition to the CEQ criteria listed in Section 3.0, the following considerations were judged appropriate for cultural resources:

- o Whether the Proposed Action affects the research potential of a resource relative to regional research priorities; and
- o Relative rarity of specific site types.

On the basis of these considerations, criteria were developed to assess impacts as significant or not significant.

Prehistoric and Historic Resources. Potential impacts on prehistoric or historic resources were considered significant if either of the following conditions apply:

- o The proposed program could substantially add to existing disturbance of resources in the ROI; or
- o The proposed program may adversely affect NRHP-eligible resources or may cause loss or destruction of important scientific, cultural, or historic resources.

The NRHP-eligibility (i.e., importance) of prehistoric and historic sites is evaluated according to criteria contained in U.S. Department of Interior regulations (36 CFR 60.4). Important resources are those that:

Are associated with events that have made a significant contribution to the broad patterns of history; or

Are associated with the lives of persons significant in history; or

Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

Have yielded, or may be likely to yield, information important in prehistory or history.

The evaluation of resources with regard to these criteria is accomplished through consultation with the State Historic Preservation Offices and Advisory Council on Historic Preservation in accordance with the National Historic Preservation Act.

Native American Resources. Impacts on Native American resources were considered significant if professional judgment indicated that either of the following conditions could occur as a result of the proposed program:

A potential for affecting sites important for their position in the Native American physical universe or belief system; or

The possibility of reduced access to traditional use areas or sacred sites.

Additionally, where a documented history of Native American concern for sacred sites was identified, this history was considered noteworthy, and was a contributor to the significance determination because of the increased likelihood that Native Americans may identify previously unknown sacred sites in the area.

Paleontological Resources. Impacts were considered significant if they affected deposits with high research potential. Important fossils could be expected to include:

- o Those recovered in poorly studied regions or in unusual concentrations;
- o Poorly known fossil forms;
- o Assemblages containing a variety of fossil forms, particularly associations of vertebrates, invertebrates, and plants;
- o Well-preserved terrestrial vertebrates; and
- o Those in unusual depositional contexts.

A.6 BIOLOGICAL RESOURCES

A.6.1 Resource Description the proposed program. For this study, available information was used to make site-specific and regional (i.e., ecosystem level) conclusions about the status of biological resources. Sections pertaining to biological habitats include all aspects of the general ecosystem in the study areas. Aquatic and terrestrial systems are treated together in the biological habitats discussion because they are closely interrelated, impacts from physical disturbances may affect both of these major systems, and these impacts can be best examined together in cause and effect relationships. Threatened and endangered species are treated separately because of legal requirements and the need for special consideration in the preservation of these species.

Biological Habitats. The discussion of biological habitats addresses all aspects of the general ecosystem within the Regions of Influence (ROIs). For terrestrial portions of the ecosystem, vegetation is described and treated as the foundation of the analysis for that portion of the system. Wildlife species are treated as an integral component of the vegetative habitats present in the ROIs. Aquatic systems are treated in a similar manner; however, the physical nature of the aquatic system (i.e., whether the aquatic habitat is a lake, stream, marsh, or some other habitat type) is described in greater detail because the biotic structure is often more strictly controlled by physical factors (e.g., substrate type, streamflow, and turbidity). All components of terrestrial, aquatic, and intergrade systems are treated at the ecosystem and population levels. Major emphasis is placed on some biological habitats that represent especially important components of the ecosystem, are protected by law, or are highly regarded by natural resource management agencies. Emphasis in discussions of these components is also given to other species and biological communities that would be affected by the program.

Threatened and Endangered Species. The threatened and endangered species section focuses on plant and animal species that are: 1) federally listed as threatened or endangered and species; 2) are proposed for listing; and 3) are candidates for federal listing (See Table A.6-1). State-recognized species are also addressed. Threatened and endangered species that occur in the area of direct program disturbance that may be adversely affected by the program are emphasized in the discussion. Important characteristics of threatened and endangered species (e.g., wintering areas, nesting sites, and localities with high densities of species) are also described.

Table A.6-1

Federal Threatened and Endangered Species Categories

Category	Definition
Endangered	Taxa ¹ threatened with extinction throughout all or a significant portion of their range.
Threatened	Taxa likely to become endangered in the foreseeable future.
Proposed Endangered	Taxa proposed to be formally listed as endangered.
Proposed Threatened	Taxa proposed to be formally listed as threatened.
Category 1 ²	Taxa for which the USFWS currently has on file substantial information on biological vulnerability and threat(s) to support the appropriateness of proposing to list them as endangered or threatened species. Presently, data are being gathered concerning precise boundaries for critical habitat designations. Development and publication of proposed rules on these taxa are anticipated, but because of the large number of such taxa, it could take several years before they are published. Also included in Category 1 are plant taxa whose status in the recent past is known, but may already have become extinct. These plants may retain a high priority for addition to the list subject to the confirmation of extant populations.
Category 2 ²	Taxa for which information now in possession of the USFWS indicates that proposing to list them as endangered or threatened species is possibly appropriate, but for which substantial data on biological vulnerability and threat(s) are not currently known or on file to support the immediate preparation of rules. Also included in Category 2 are plant taxa that are possibly extinct and taxonomically questionable taxa that are believed extinct in the wild, but are extant in cultivation. It is likely that some of these will not warrant listing, while others will be found to be in greater danger of extinction than some taxa in Category 1.
Category 3A	Taxa for which the USFWS has persuasive evidence of extinction. If rediscovered, however, such taxa might acquire high priority for listing. At this time, the best available information indicates that the taxa included in this subcategory, or the habitats from which they were known, are in fact extinct or destroyed, respectively.

Table A.6-1
(Cont'd)

Category	Definition
Category 3B	Names that, on the basis of current taxonomic understanding, usually as represented in published revisions and monographs, do not represent taxa meeting the USFWS definition of "species." Such supposed taxa could be reevaluated in the future on the basis of subsequent research.
Category 3C	Taxa that have proven to be more abundant or widespread than was previously believed and/or those that are not subject to any identifiable threat. Should further research or changes in land use indicate significant decline in any of these taxa, they may be reevaluated for possible inclusion in Categories 1 or 2.

Notes: ¹Taxon pl. Taxa = a taxonomic entity (species, subspecies, or variety) or a group of such entities.

²The taxa in Categories 1 and 2 are candidates for possible addition to the List of Endangered and Threatened Species. The USFWS encourages their consideration in environmental planning, such as in environmental impact analysis under the National Environmental Policy Act; however, none of the substantive or procedural provisions of the Endangered Species Act apply to a species that is designated as a candidate for listing.

Source: Federal Register 1985.

A.6.2 Region of Influence

The ROIs for biological resources are defined as the areas or locations where these resources can reasonably be expected to be directly or indirectly affected by program-related construction or operations activities. For biological resources, it is important to distinguish between areas and resources that may be subject to direct surface disturbance and other direct impacts from construction and operations activities, and areas where only indirect program impacts could occur as a result of increased recreation and program-induced development. The portions of the ROIs that would be subject to direct disturbance include those areas onbase and nearby where new facilities would be built, as well as adjacent areas that may also be affected by factors such as noise and runoff. Indirect impacts may occur where program-induced development is expected, or where program-induced recreational use would affect biological resources. The portions of the ROIs where indirect impacts may occur are the areas within a 1-hour driving time or approximately 60 miles from the major population center for each base. This area was selected because the program would result in only a small increase in population per base (approximately 800 people during operations). The resulting increase in recreational users would be negligible compared to existing levels of use at recreational resources beyond this area. The shape and extent of this area depends on the layout and type of roads in the area and the location of recreational facilities and biological resources of special sensitivity or interest.

A.6.3 Data Sources

Data sources employed in vegetation/habitat mapping included 1:7,200 and 1:24,000 color aerial photographs, 1:58,000 color infrared aerial photographs, US Geological Survey (USGS) topographic maps, National Wetland Inventory maps, USGS land use/land cover maps, and other available maps and reports. Field surveys are scheduled for completion prior to publication of the Final Environmental Impact Statement (FEIS) to verify the photointerpreted maps and to support impact analyses. Federal and state natural resources management agencies (e.g., the U.S. Fish and Wildlife Service [USFWS], the US Environmental Protection Agency, the US Army Corps of Engineers [COE], and state fish and wildlife agencies), local experts, and base environmental personnel were consulted to obtain current information on the status of natural resources at each base. Literature surveys and searches of computerized natural resources data bases were also performed. These data sources were applied to the analysis of both biological habitats and threatened and endangered species.

A.6.4 Methods for Assessing Existing and Future Baseline Conditions

Biological Habitats. Major vegetation and aquatic habitats onbase and within 1 mile of the base were identified and mapped. Supporting data were incorporated in a data base management system. Wildlife, fisheries, and other biota were identified within the mapped habitats. Field surveys were used selectively to determine the status of key species in areas of direct surface disturbance and to fill particularly important data gaps. Primary attention was given to those plant and animal species whose local populations would be reduced by program-related activities and regional communities that would be disturbed by program impacts. Unique habitats were identified

through interviews with natural resource management agencies and informed local experts, and through direct analysis of habitats in the potentially affected areas. These habitats' unique qualities, degree of legal protection (if any), and likelihood for improvement or degradation in the future (as a result of nonprogram-related activities) were analyzed. Projections of future conditions for biological resources in the ROI relied heavily on information provided by natural resource management agencies and local planning groups.

Threatened and Endangered Species. Species evaluated include federally listed threatened and endangered species, proposed species, and federal-candidate species, which are defined in Table 3.7-1. Species given special protection or status by state agencies were also considered and are listed per base. Occurrences of threatened and endangered species were compiled from data supplied by the US Fish and Wildlife Service (USFWS), state agencies, computerized natural resources data bases, local experts, and base environmental personnel. Comprehensive tabulations of these species were compiled for areas that may be affected by direct surface disturbance and potential indirect impacts near these areas. Species present in the remaining ROIs were not analyzed unless a specific source of program-related disturbance was identified.

Special attention was given to threatened and endangered species that are thought to occur within the direct disturbance area. Favorable habitats near known locations of sensitive species were inventoried to determine the presence of rare species. Permanent habitats and important habitats used on a seasonal or transitory basis were also evaluated.

Information regarding regional and site-specific distributions, abundance, population status and prognosis, habitat requirements, recovery plans, and importance to national populations were reviewed for each threatened and endangered species that may be affected by the proposed program. This information and assessments from natural resources managers were used to assess future conditions for these species.

A.6.5 Methods for Assessing Biological Resource Impacts

Site-level impacts were evaluated for all biological components and an overall assessment was made for the resource. Site-level impacts on biological resources were evaluated for areas that may be directly or indirectly disturbed. Impacts on threatened and endangered species also have importance at the regional (i.e., ecosystem) level. The overall assessments place site-level impacts in perspective to the importance of accumulated impacts within the program study area.

Biological Habitats. Impacts on existing biological habitats were assessed relative to the habitat changes expected to result from the program. Overlays of facility disturbance zones were used to determine and locate the habitats potentially affected. The locations and amounts of potential offsite disturbance were also considered, including effects of erosion, siltation, dust, and excess water or water loss. All possible impacts on local watersheds were considered for aquatic habitats (e.g., the creation of barriers to upstream fish movement and downstream effects of sedimentation). Behavioral disturbance of wildlife (e.g., displacement) was considered, in

addition to the amount and type of wildlife habitat lost. These impacts were quantified to a level appropriate to determine whether local populations of flora or fauna would be diminished, especially if any existing populations would have difficulty continuing their existence as a result of program impacts. The extent of potential impacts was further described to the degree that local and regional biological communities would be disturbed, including consideration of recovery time. The ability of assumed mitigations to reduce or eliminate impacts was also considered in deciding on the final impact ratings. These assumed mitigations include general practices such as soil stabilization and revegetation. Specific mitigations are summarized at the end of the impact assessment sections for Malmstrom AFB, when appropriate.

The level of impact (LOI) represents the biological magnitude of the expected disturbances (i.e., the effect on the condition of populations, habitats, and ecological systems). The expected overall impacts on biological resources were categorized as negligible, low, moderate, or high. The same LOIs and criteria for defining them were applied to short- and long-duration impacts. The criteria used for defining the LOIs are as follows:

Negligible Impact -- No impact is expected, or the impact is expected to be so small as to be essentially unnoticeable by professional biologists.

Low Impact -- The impact is noticeable, but no consequences are expected that would alter the condition of populations, biological communities, or the integrity of ecological systems.

Moderate Impact -- The proposed program begins to adversely affect the condition of populations, biological communities, or the integrity of ecological systems. (For example, the proposed program begins to affect the reproduction success of a species.)

High Impact -- The proposed program has a substantial adverse effect on the condition of populations, biological communities, or the integrity of ecological systems. (For example, the proposed program seriously affects the reproductive success of a species.)

A.6.6 Significance Criteria

The significance of impacts on biological resources was evaluated in accordance with the context and intensity criteria provided in the Council on Environmental Quality (CEQ) regulations (Section 3.0).

In addition to the CEQ criteria for biological resources impacts, the concepts of intensity and context include the potential of an impact to affect a wider array of ecologically related biological resources than the directly affected resource, and the potential to affect the scientific, recreational, economic, or aesthetic value of the resource. These criteria are not necessarily dependent on the duration of an impact. Therefore, the same criteria apply to short- and long-duration impacts. The determination of significance of impacts on biological resources specifically included:

- o The unique characteristics of biological resources, such as areas designated as parklands, wetlands, wild and scenic rivers, or ecologically critical areas;
- o The general ecological, scientific, or economic value of a biological resource;
- o The resulting level of concern the impacts would be expected to elicit from natural resource management agencies, scientific authorities, or other individuals or groups with expertise concerning the affected resource;
- o The legal requirements for the affected resource (e.g., for threatened and endangered species and for wetland habitats);
- o The extent to which the proposed program would add to present or future disturbances of resources in the ROI; and
- o The potential of the affected resource to recover through natural population or habitat recovery or through artificial means such as revegetation and stream restoration.

A.7 WATER RESOURCES

A.7.1 Resource Description

Water would be required to construct facilities and operate the proposed program and cumulative programs. Cumulative land disturbance which would occur during program construction was evaluated for its potential to alter the hydrology or degrade the quality of nearby surface or groundwater. Therefore, the water resources analysis considered three components: major water users, surface water hydrology and quality, and groundwater hydrology and quality.

Major Water Users. This component addresses the effects that program water requirements would have on existing major water users. The categories of major water users examined included military, municipal, self-supplied industrial, rural-domestic, and agricultural. Also examined was the adequacy of the water supply sources to meet the baseline and program-related water demands highlighting potential water shortages.

Surface Water Hydrology and Quality. This component addresses the effects of the proposed program on streamflows and the water quality of surface water bodies. State-designated water uses of streams and water quality standards violations were also addressed. Other issues included local drainage characteristics and water control works.

Groundwater Hydrology and Quality. This component addresses the effects of the proposed program on groundwater reserves, well yields, water table fluctuations, and water quality conditions and trends of the principal groundwater aquifers.

A.7.2 Region of Influence

The Regions of Influence (ROIs) for water resources are defined as the local surface water drainages within and immediately around Malmstrom AFB and its

support communities where water quality may be affected by program-related construction. Where practical, the ROIs extend downstream to include the streams draining the general area. Beyond this point, program-related impacts would be minimal. The ROIs also include those groundwater aquifers that would supply program-related water requirements. Finally, the ROIs include the areas serving competing major water users who might be affected by water diversions to support the program.

A.7.3 Data Sources

Hydrologic unit maps, 7.5-minute topographic quadrangles, and large-scale color aerial photographs were used to identify potentially affected surface water bodies. Water resources studies conducted by federal agencies such as the USGS and the US Army Corps of Engineers, and by state water resource and water quality agencies, were reviewed. Several national water resource data bases were used to obtain site-specific data. This information was supplemented by interviews with agency personnel and with local water and wastewater officials.

A.7.4 Methods for Assessing Existing and Future Baseline Conditions

Major Water Users. Total baseline water use within the ROI was compiled using county-level statistical reports available from the USGS. Water use was characterized in greater detail for the 11 ROI. Local water demand and sewage generation were estimated in coordination with the utilities analysis. Existing water supply sources were identified in interviews with local agencies, and their capability to meet future water demands are discussed. Emphasis was placed on identifying cases where projected water use might exceed locally developed sources of water supply. The institutional aspects of water use and existing water rights for the major water users were reviewed, including contractual agreements for water supply to the bases from support communities.

Surface Water Hydrology and Quality. Data and statistical programs, available from national data bases, were used to characterize surface water flows, water quality, and flood information of the ROI streams. Surface water basins were delineated using USGS topographic quadrangles and maps of stormwater drainage systems. The 100-year floodplains were also plotted using flood insurance maps available from the Federal Emergency Management Agency. The state-designated uses for water bodies in the ROIs were reviewed along with their appropriate water quality standards. Major wastewater discharges to these water bodies were identified with help of information from the Montana Water Quality Bureau. Emphasis was placed in determining water quality problems and violations of water quality standards.

Groundwater Hydrology and Quality. The principal aquifers from which most of the groundwater in the ROI is withdrawn were identified from USGS records and interviews the Montana Water Quality Bureau. General data on groundwater pumpage, depth to groundwater, and historical declines in groundwater levels were reviewed.

A.7.5 Methods for Assessing Water Impacts

Estimation of program-related water use is fundamental in assessing impacts on the water resources base and existing major water users. Total program-related water use was evaluated for each year of the construction phase and for a typical year of full program operations (represented by 1993 unless otherwise noted). Direct water requirements such as construction- and operations-related water use were estimated based on historical data obtained from other military projects. Indirect domestic water use by immigrants in the ROIs was estimated by applying area-specific, per capita water use factors to program-induced immigrant projections developed by the socioeconomics analysis.

Major Water Users. Potential supply sources of program-related water requirements were identified. Program-related water requirements were compared to the future baseline use of the affected entities to determine the relative increase in water use. The annual water entitlement or supply capacity of the affected entities was compared to the peak annual, baseline-plus-program water use (typically 1992) and to water use in the first year of full program operation (typically 1993). The capability of the water supply sources to meet program-related demands was evaluated to assess the likelihood of interference with existing major users and to identify potential water shortages.

Surface Water Hydrology and Quality. For those bases and support communities with surface water supply sources, annual increases in river diversions to meet program requirements were compared to the river's average annual flow and a qualitative assessment of the resulting hydrologic effects was made. Increases in wastewater discharges to the river as a result of the program were obtained from the utilities analysis. Using available information on the adequacy of the wastewater treatment facilities and baseline water quality data of the affected river, a qualitative assessment was made concerning the potential for water quality degradation resulting from increased wastewater discharges.

Maps of program facility locations were overlain on maps showing floodplains and surface water basins. Alterations in local drainages were identified. Those facilities lying within the 100-year floodplain were identified and potential flood effects were qualitatively evaluated. The amount of disturbed area within each subbasin was estimated. Program-induced erosion within each stream basin was calculated in association with the geology and soils analysis using the Universal Soil Loss Equation. The resulting sedimentation to local streams was calculated using a standard sediment delivery ratio function available in the literature. The potential for water quality impacts was analyzed, taking into account the water quality classification of the stream and the potential effect of the sedimentation on existing stream uses.

Groundwater Hydrology and Quality. Groundwater does not provide a substantial portion of the existing water supply in the ROI; therefore, program-related groundwater requirements were not analyzed in detail.

A.7.6 Levels of Impact Criteria

The following criteria provided the basis for a determination of both short- and long-duration impacts for surface and groundwater resources and major water users. The level of impact definitions are expressed in qualitative terms.

Negligible Impact -- Program-related water use would be minimal and would not be noticeable to existing major water users. No detectable changes to the hydrology or quality of the existing water resources base would occur.

Low Impact -- Program-related water use would be small relative to baseline water use. This would not interfere with other major water users. Alternatively, small hydrologic changes or minor degradation of water quality would result.

Moderate Impact -- Program-related water use would be substantial relative to baseline water use and/or would occasionally interfere with other major water users. Alternatively, appreciable hydrologic changes or degradation of water quality would result.

High Impact -- Program-related water use would be large relative to baseline water use and/or would frequently interfere with other major water users. Alternatively, pronounced hydrologic changes would occur and/or serious or irreversible degradation of water quality would result.

A.7.7 Significance Criteria

In addition to the CEQ criteria, the following considerations were judged appropriate in evaluating significance for water resources:

- o Whether the proposed program would result in the development of more costly sources of water and a potential rise in the cost of obtaining water to other major water users.
- o The degree to which the proposed program would either result in or intensify water shortages.
- o The degree to which shifts in the categories of major water users would occur (including the elimination of one or more major water users), changing the economic or social patterns of an area.
- o The degree to which river water quality degradation resulting from the proposed program would impair state-designated uses, or further degrade the quality of the river.

Soil Resources. Soil types in potential program construction areas were evaluated to determine if program-related construction activities would accelerate soil erosion rates resulting from increases in ground disturbance. Soil erosion includes wind, sheet, rill, and gully erosion.

Geologic Hazards. This component is divided into two categories that cover the potential effects from (1) seismic hazards and (2) landslides and terrain failure. Seismic hazards include strong ground shaking motions and surface

fault rupture, which may result in damage to installation facilities. Landslides and terrain failure include all forms of slope instability related to slides, slumps, soil creep, and rock falls.

A.8 GEOLOGY AND SOILS

A.8.1 Resource Description

Geology and soils resources deal with the physical properties of the earth and its natural resources. The narrower scope considered in this EIS for adequately describing environmental effects of the proposed program includes energy and mineral resources, soil resources, and geologic hazards. The proposed program activities may require altering the existing terms of energy and mineral leases or extraction facilities in the project areas due to operational considerations. Program-related construction activities could affect the rates of soil erosion. This effect is important because of the potential loss of soil and possible secondary affects on water quality and biological habitat. The proposed program is not anticipated to influence the occurrence of geologic hazards. Consequently, this component is considered more relevant as a safety issue because of the potential for geologic hazards to affect elements of the proposed program.

Energy and Mineral Resources. Energy resources include geologic environments or regions where the generation or potential occurrence of energy resource materials such as oil, gas, coal, uranium, oil shale, and geothermal waters have been identified. Mineral resources include all forms of metallic and nonmetallic mineral deposits.

Soil Resources. Soil types in potential program construction areas were evaluated to determine if program-related construction activities would accelerate soil erosion rates resulting from increases in ground disturbance. Soil erosion includes wind, sheet, rill, and gully erosion.

Geologic Hazards. This component is divided into two categories that cover the potential effects from (1) seismic hazards, and (2) landslides and terrain failure. Seismic hazards include strong ground shaking motions and surface fault rupture, which may result in damage to installation facilities. Landslides and terrain failure include all forms of slope instability related to slides, slumps, soil creep, and rock falls.

A.8.2 Region of Influence

The ROIs for energy and mineral resources, soil resources, and geologic hazards include the installations and associated program-related areas in the immediate vicinity. The land within a 1-mile radius of Malmstrom AFB and a 1,000-foot-wide corridor along the connecting rail spurs was characterized for purposes of establishing the local baseline context. In addition, the regional ROI was established for geologic hazards for the purpose of developing a regional framework for seismicity at each candidate installation.

A.8.3 Data Sources

Data sources used to prepare this EIS included published and unpublished reports and maps, data bases available through federal and state agencies,

and consultations with local geologists and scientists. Major sources of data were previous geologic and soil investigations conducted at the installations in support of other programs, and preliminary siting activities for the Peacekeeper Rail Garrison and Small ICBM Programs. Previous DOD consultants' materials, such as Installation Restoration Program reports, were reviewed to determine if applicable data had already been collected.

A.8.4 Methods for Assessing Existing and Future Baseline Conditions

Energy and Mineral Resources. Baseline conditions for energy and mineral resources were obtained from public records concerning leasing activity and production data for each installation. Regional and local geologic interpretations from existing maps and publications on the energy potential of an area were also incorporated into this process. Areas identified as potential targets for resource exploration and/or production include known geologic structures, known geothermal resource areas, locations with existing extraction facilities, areas with known mineral accumulations, and lands currently held by oil and gas leases.

Soil Resources. Soil resource conditions were evaluated using criteria defined by the U.S. Soil Conservation Service (SCS). The susceptibility of a soil type to erosion was based on the erodibility index which is related to physical and chemical properties of a soil type. Wind erosion susceptibility was categorized based on the Wind Erodibility Group designation assigned to each soil by the SCS. Sheet erosion susceptibility was categorized based on the K-factor designation assigned to each soil by the SCS. Soil erosion susceptibility at the proposed affected areas was determined by constructing soil susceptibility maps which were overlaid with program facility maps. Future soil erosion conditions are not expected to differ from baseline conditions because the susceptibility of a soil to erode was based on the erodibility characteristics inherent to the soil particles regardless of outside factors (e.g., climate and construction).

Geologic Hazards. Geologic maps and publications were used to identify the tectonic province and seismic zone of the installation. Regional and local maps and reports were also incorporated into the data base to characterize local fault zones for Malmstrom AFB. Data on the maximum credible earthquake (MCE) and property of horizontal acceleration of rock were also compiled to evaluate the potential effect of a major seismic event. The liquefaction potential was also investigated by collecting and analyzing data on sediment and soil types and depth to local groundwater. Landslides and terrain failure were characterized by incorporating aerial photograph interpretation with topographic elements (e.g., steepness of slopes) and geologic and soils characteristics of the base. Materials susceptible to landslides or terrain failure were characterized and identified for site-specific areas of the program using the same techniques. Future conditions for the geology and soils resource were assumed to be a continuation of existing geologic environments into the foreseeable future. This is because rates of natural geologic processes would not appreciably change over the short period of time associated with the proposed program when compared to the geologic time scale.

A.8.5 Methods for Assessing Geology and Soil Impacts

Impacts were characterized for energy/mineral and soil resources. Energy and mineral exploration would be restricted if leases occur in the proposed garrison site. Leaseholders would receive just compensation for energy or mineral resource interests that must be modified or terminated in accordance with the requirements under mineral exploration and extraction on Air Force lands. Just compensation would be based on an independent geologic appraisal of the lease or production. Mineral resource production of aggregate materials (sand and gravel) is not considered an issue based on previous environmental studies for other programs conducted at Malmstrom AFB.

Negligible Impact - Soil erosion would not exceed the baseline rate. Access to energy/mineral resources would not be restricted.

Low Impact - Soil erosion rates would exceed the baseline rate but would be less than the maximum tolerable soil loss. On base energy/mineral leases encompassing proposed facility sites may have to be extinguished.

Moderate Impact - Soil erosion rates would approximately equal the maximum tolerable soil loss. Off base energy/mineral leases encompassing proposed facility sites may have to be extinguished. On base energy/mineral extraction in the vicinity of the proposed facility sites may be restricted for the life of the program.

High Impact - Soil erosion rates would exceed the maximum tolerable soil loss. Off base energy/mineral extraction in the vicinity of proposed facility sites may be restricted for the life of the program.

A.8.6 Significance Criteria

In addition to the CEQ criteria provided in Section 3.0, the following considerations are judged appropriate for the geology and soils resource:

- o Whether the proposed program would deny access to critical energy resources or strategic and critical mineral commodities;
- o Whether long-duration program-induced erosion would occur at rates greater than the soils natural regenerative capability due to an appreciable net loss of topsoil. Soil productivity would be reduced or possibly eliminated. The present ecosystem would be incapable of reestablishing itself under the altered soil environment; and
- o Whether program-related construction could result in detrimental effects that continue beyond the life of the program and would require extensive or continuous remedial action.

A.9 AIR QUALITY

A.9.1 Resource Description

For this program, air quality in a given location is described by the concentration of various pollutants in the atmosphere, which are expressed in units of concentration, generally parts per million or micrograms per

cubic meter (ug/m3). Federal and/or state ambient air quality standards have been established for each of the criteria pollutants. These pollutants are ozone, carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), particulate matter equal to or smaller than 10 micrometers in diameter (PM10), lead, sulfates, and hydrogen sulfide. These standards represent the allowable atmospheric concentrations at which the public health and welfare are protected, and include a reasonable margin of safety. The federal standards, which were established by the US Environmental Protection Agency (EPA) and termed National Ambient Air Quality Standards (NAAQS), are defined as the maximum acceptable concentrations that may be reached, but not exceeded more than once per year.

A.9.2 Region of Influence

The Region of Influence (ROI) include numerous areas where air quality may be affected directly by program-related construction activities or indirectly by program-induced transportation traffic. In general, the ROI includes Malmstrom AFB and Cascade County. In addition, the ROI includes any federal- and state-mandated Prevention of Significant Deterioration (PSD) Class I areas that are within a 50-mile radius from the base. In general, Class I is designed for "pristine" areas where almost any deterioration would be significant. Congress established several types of mandatory PSD Class I areas. These mandatory areas include international parks, wilderness areas larger than 5,000 acres, national memorial parks larger than 5,000 acres, and existing national parks larger than 6,000 acres. All other areas of the country classified as attainment are Class II. Class II limits allow for moderate, well-controlled growth and Class III limits allow pollutant levels to increase considerably.

A.9.3 Data Sources

Information and data relevant to the air quality descriptions presented in this document were obtained from federal agencies (e.g., EPA, National Technical Information Service, National Oceanic and Atmospheric Administration, National Climatic Data Center, and National Park Service), and the Montana Air Quality Bureau, the Cascade County Health Department, the Base Environmental Planning Office, and reports published by universities and research study groups.

A.9.4 Methods for Assessing Existing and Future Baseline Conditions

In most cases, baseline values for existing urban air quality were obtained through a detailed review of published data (measured onsite ambient air quality data). For nonurban areas, where onsite ambient air quality data were not available, monitoring data from a representative station were used to estimate the regional background air quality. When no ambient data were available, average background numbers as determined by the EPA were used.

Future air quality baseline conditions were determined from a review of planned regional industrial and commercial development and projected traffic increases. Emission inventory and air quality data were extracted from available environmental documents pertinent to planned projects. This information was used to qualitatively estimate the future air quality in the region.

A.9.5 Methods for Assessing Air Quality Impacts

The major emissions of the program would result principally from the generation of fugitive dust (PM10). Construction activities (e.g., land clearing, blasting, ground excavation, and cut-and-fill operations) and vehicle movements are the most significant sources of fugitive dust, defined as PM10, that becomes airborne because of natural causes and/or human activities. In spite of uncertainties, such as source activity and silt and moisture content of materials, estimates were made for fugitive emissions resulting from construction activity. Fugitive dust emissions resulting from construction activity are proportional to the area of land being worked and the level of construction activity. An emission factor of 1.2 tons per acre of construction per month of activity (EPA-AP42, 1985) was used to calculate uncontrolled fugitive dust emissions. These emissions were reduced 50 percent by assuming watering of construction areas. Emissions resulting from heavy diesel-powered equipment were estimated using EPA Document AP-42 and the numbers and types of construction equipment assumed to be onsite. The heavy truck emissions were estimated using the emission factors provided by the EPA (1985).

Air quality impacts resulting from pollutant emissions from program-related activities were determined through the use of a simple proportional model. This model assumes that the pollutant concentrations in an area of interest are linearly related to the emissions in the area. The model provides a vehicle for relating pollutant emissions to background pollutant concentrations.

The first step in the application of the model was to estimate the amount of fugitive dust and gaseous pollutants (CO, SO2, NO2, and hydrocarbons) emitted from program construction and operations activities. Construction activities included the operation of heavy diesel-powered construction equipment, trucks, and other motor vehicles. Operations activities included vehicular traffic increases, routine maintenance (e.g., standby power testing, and backup diesel generator testing), and aircraft operations. Emission factors obtained from the EPA document AP-42 were used for developing these estimates.

Using Cascade County Health Department emission inventories obtained from the EPA and the results obtained in the first step, the second-step calculation derives the percentage increases in county particulate and gaseous pollutant emissions resulting from program emissions.

Because the percentage increase for each of the individual gaseous pollutant emissions from construction and operations activities was minimal, it was not presented. However, the percentage increases in fugitive dust emissions resulting from construction activities were somewhat greater than the gaseous emissions and, consequently, were used to calculate increases in background particulate concentrations.

Using the existing background particulate concentrations obtained from a representative particulate monitoring station (PM10 where available, otherwise TSP) and the percentage increase in particulate emissions (obtained in the second step), the third step was to calculate the increase in background particulate concentrations.

The fourth step was to determine the total background particulate concentration by adding the result of step three to the existing background concentration.

The final step in determining air quality impacts for fugitive dust emissions was to compare the concentration increases and the resulting total background concentrations with the incremental particulate concentration increases and the ambient PM10 standards specified in the level of impact criteria.

A.9.6 Levels of Impact Criteria

The magnitude of program effects on air quality was classified as having negligible, low, moderate, or high LOIs depending on the general health effects of fugitive dust generated by program facilities and activities. These were determined by known or projected ground-level concentrations and their relationship to applicable ambient air quality standards. In addition, EPA minimum threshold increments from new or modified major sources in nonattainment areas were used to better define the LOIs. The analysis includes a breakdown of LOIs by both areal extent and duration, as appropriate.

The LOIs for air quality are the following:

Negligible Impact -- Predicted incremental concentrations of fugitive dust would not equal or exceed 1 ug/m³ averaged annually or 5 ug/m³ over a 24-hour period. These increments and background concentrations would be minimal when compared to the national or state air quality standards.

Low Impact -- Predicted incremental concentrations of fugitive dust would exceed 1 ug/m³ averaged annually or 5 ug/m³ over a 24-hour period, but the increment together with background concentrations of fugitive dust would not exceed 35 ug/m³ averaged annually or 100 ug/m³ over a 24-hour period.

Moderate Impact -- Predicted incremental concentrations of fugitive dust would exceed 1 ug/m³ averaged annually or 5 ug/m³ over a 24-hour period. The increment combined with background concentrations of fugitive dust would not exceed the ambient air quality standards of 50 ug/m³ of PM10 (only those particulate sizes with an aerometric diameter of 10 micrometers or less) averaged annually or 150 ug/m³ PM10 over a 24-hour period.

High Impact -- Predicted incremental concentrations of fugitive dust would exceed the PM10 primary NAAQS (50 ug/m³ averaged annually or 150 ug/m³ over a 24-hr period) when combined with background concentrations of PM10. General health effects would occur. Susceptible people would experience mild aggravation to the upper respiratory system.

A.9.7 Significance Criteria

In addition to the CEQ criteria listed in Section 3.0, the following additional consideration is judged appropriate for the air quality analysis:

Impacts are considered significant if estimated emissions from the construction activity would increase ambient pollutant levels from below to above federal, state, or local air pollution standards, would exceed

allowable increments under PSD regulations, would be inconsistent with measures contained in local air quality attainment plans, or would add to existing or projected violations of federal, state, or local standards.

A.10 NOISE

A.10.1 Resource Description

Noise is defined as "unwanted sound." According to the US EPA, in the context of protecting the public health and welfare, noise implies adverse effects on people and the environment. Noise causes hearing loss, interferes with human activities at home and work, and is in various ways injurious to people's health and well-being. Although hearing loss is the most clearly measurable health hazard, noise is also linked to other physiological and psychological problems. Noise annoys, awakens, angers and frustrates people. It disrupts communication and individual thoughts, and affects performance capability. Noise is one of the biological stressors associated with everyday life. Thus, the numerous effects of noise combine to detract from the quality of people's lives and the environment. Noise is described in terms of sound levels, which are measured in decibels (dB) or decibels adjusted to an A-weighted scale (dBA) to correspond with the range of human hearing.

Ambient noise is defined here as all noise generated in an area, including background and incidental sources which are usually expressed in terms of the equivalent sound level (L_{eq}) or day-night noise level (L_{dn}). L_{dn} is also known as DNL. In an outdoor environment, L_{eq} is used, which expresses the average overall noise for a specific period. The L_{dn} is a measure of noise for a 24-hour period, in which the measured noise levels between 10:00 P.M. and 7:00 A.M. are weighted by an additional 10 dB because of the increased receptor sensitivity during these designated sleeping hours. For single events, like overflights, L_{MAX} - the maximum sound level, and L_n - the night sound level, could be analyzed in order to assess noise exposures of civilians and military personnel. Moreover, L_{wp} - Level-Weighted Population (levels weighted more as they increase multiplied by exposed population), is helpful to evaluate changes in noise impacts, especially as they relate to the effectiveness of mitigation measures. (See Glossary of Terms and Acronyms for formula). All of these noise level parameters are expressed in dBA scale and were used to characterize the baseline noise environment.

Turbojet and turbofan engines in general produce considerably more acoustical energy than turboprop or piston engines. In addition to higher sound intensity, jet engines may produce more high frequency noise which generally is more annoying. Table A.10-1 shows the noise level of jet aircraft relative to other noise sources.

TABLE A.10-1

Typical Decibel [dB(A)] Valued Encountered in Daily Life and Industry*

	dB(A)
Rustling leaves	20
Room in a quiet dwelling at midnight	32
Soft whispers at 5 feet	34
Men's clothing department of large store	53
Window air conditioner	55
Conversational speech	60
Household department of large store	62
Busy restaurant	65
Typing pool (9 typewriters in use)	65
Vacuum cleaner in private resident (at 10 feet)	69
Ringling alarm clock (at 2 feet)	80
Loudly reproduced orchestral music in large room	82
Beginning of hearing damage if prolonged exposure over 85 dB(A)	
Printing press plant	86
Heavy city traffic	92
Heavy diesel-propelled vehicle (about 25 feet away)	92
Air grinder	95
Cut-off saw	97
Home lawn mower	98
Turbine condenser	98
150 cubic foot air compressor	100
Banging of steel plate	104
Air hammer	107
Jet airliner (500 feet overhead)	115
F-15 Aircraft (500 feet, afterburner power)	123

* When distances are not specified, sound levels are the value at the typical location of the machine operators.

Source: Newman and Beattie, 1985.

A.10.2 Region of Influence

The ROIs for noise are broadly defined as those areas in the proximity of Malmstrom AFB where noise-level exposure increases may occur as a result of program-related activities excluding military traffic routes (MTR) outside the proximity of the base. Initial assessments concluded the area of Great Falls (including Malmstrom AFB) and Cascade County, would adequately cover impacted areas. In addition to ascertaining noise, exposure, sensitive noise receptors identified as residential areas, schools, hospitals, parks, and churches that would be affected by increased noise levels, were discussed.

A.10.3 Data Sources

Noise observations, noise data, and general discussions appear in special studies involving highway traffic, airport traffic, or special military projects/studies. Noise data, when available, were acquired from contacts with base environmental offices or from environmental impact statements/reports published at the federal and state levels for certain transportation projects. Also, the Draft Environmental Impact Statement - F-15E beddown at Seymour Johnson AFB, North Carolina, provided a helpful summary from various technical documents of noise and sound metrics as well as effects on the human environment. In addition, EPA documents such as "Protective Noise levels" and "Noise Effects Handbook" were relied upon heavily.

A.10.4 Methods for Assessing Existing and Future Baseline Conditions

Although all noise sources contribute to L_{dn} , also referred to as DNL, the major noise sources in the vicinity of Malmstrom AFB were vehicular traffic on local roads and highways as well as aircraft operations. In addition, construction noise was considered. The Draft Peacekeeper Rail Garrison EIS provided detailed future baseline conditions. Land use patterns onbase and offbase, and the location of people and other sensitive receptors, were determined from a review of base and regional maps, and through site visits, aerial photos, and base housing records. Sensitive receptors (e.g., residential areas, schools, hospitals, and recreation areas) were identified and the number of people exposed to various noise levels were calculated and single event noise exposures were discussed. In addition, the most recent data used for a future Malmstrom AFB Air Installation Compatible Use Zone (AICUZ) report was used to derive the noise levels related to aircraft operations.

It should be noted that military aircraft are not regulated by the Noise Control Act. The Act only controls Federal Aviation Administration (FAA) certified aircraft. Local authorities cannot preempt Federal jurisdiction over aircraft and issue local aircraft noise regulations. Therefore, the principal concern of local governments regarding aircraft noise is for planning of land use. The US Department of Housing and Urban Development (HUD) and the Veterans Administration (VA) have issued noise regulations for the purpose of protecting individuals and communities. The US Department of Housing and Urban Development, for example, can refuse funding of projects in L_{dn} 65 dB contours.

The FAA regulates airspace and must approve flight routes. In the flight route approval process, the effect of noise on the environment is a consideration.

Although noise regulations may be lacking, noise impacts that adversely affect the human environment are being evaluated.

In evaluating airport and aircraft noise, two different types of noise measures are needed, one, to measure single noise events such as the noise of an individual aircraft flyover and another to describe the noise environment based on the cumulative effect of a number of complex noise events, such as the flight and ground operations of the base, combined with other transportation and construction noise. In this study, the single noise event measure used will be A-weighted sound level dB(A) and the sound exposure level (SEL). The cumulative energy average noise metric used will be the day-night average noise level (DNL) (USAF, 1985a). (Note Ldn and DNL are used when referring to day-night levels.)

The A-weighted sound level metric, dB(A) is the instantaneous measure of a single sound event. A-weighted sound pressure level is a sound metric which has been weighted to de-emphasize the high and low frequency portions of the noise signal. This weighting correlates well with the human perception of sound.

The SEL metric is a single number representation of a noise energy dose. This measure takes into account the effect of both the duration and magnitude of a noise event such as an aircraft flyover. SEL is measured in decibels (dB) on the A-weighted scale. Development of the SEL metric is discussed in more detail in USAF (1985a)

Level-weighted population (LWP) described with one number the impact on a number of people, weighted more heavily as the noise level increases. (EPA, 1979).

The cumulative energy average metric has been found to correlate well statistically with aggregate community annoyance response. The DNL has found wide acceptance by federal and local agencies as the primary measure for describing noise effect on communities (Newman and Beattie, 1985). It has been shown to be an effective tool for noise impact analysis for over fifteen years of use and is the noise assessment metric endorsed by the Federal Interagency Committee on Urban Noise (EPA, Department of Defense (DOD), HUD, Department of Transportation (DOT), and VA). Also, the DNL is a 24-hour average sound level measure. Night-time noise emissions are weighted with a 10 dB penalty to account for increased community annoyance during the hours between 10:00 PM and 7:00 AM. Time of week and seasonal variations are not considered. The DNL can be derived directly from actual sound level measurement or generated using a computer simulation of the noise environment (USAF, 1988).

It has been accepted that where a noise environment is dominated by major identifiable noise sources such as an airport, well defined predictive models can be used to describe the environment (CHABA, 1977). The DNL model incorporates a number of parameters describing the intensity, duration and frequency of the noise generated by flight operations. It provides an

effective way for assessing the cumulative and incremental effect of changes in flight operations. The model used in this report is NOISEMAP which is processed by the USAF Engineering and Services Center, Tyndall AFB, Florida.

In addition to aircraft flight data, NOISEMAP also incorporates noise from the base ground operations. This ground noise would include aircraft taxiing, take-off roll and engine run-up noise during maintenance operations.

From these data, the computer projects the estimated DNL noise level exposure at ground level. Contour lines are drawn indicating areas of equal sound level DNL. Typically contour lines are drawn for DNL levels of 65, 70, 75, and 80 dB. Table 3.10-1, described earlier, illustrates comparative DNL levels for various environments. Further description of the DNL is included in USAF (1985a).

In the Aviation Noise Effects publication developed for the FAA, Newman and Beattie (1985) state that "Noise contours or footprints are the accepted technique for displaying airport cumulative noise exposure." The noise contours are generated by a computer simulation model that processes an extensive collection of input data. These data include the flight track, flight profile, noise signature of the aircraft, engine power setting, etc., of every flight over a typical 24-hour day.

For analysis purposes, noise contours have been overlaid on base area maps. Figure A.11-1 provides AICUZ noise contours for preliminary baseline AICUZ contour.

A.10.5 Method for Assessing Noise Impacts

Aircraft noise is directly related to the power settings. The power setting is dictated by flight conditions, aircraft weight, wind speed, air temperature, etc. Afterburners may be used on take-offs during warm weather. The primary consideration in establishing aircraft power settings is ensuring the safety of the flight. Within that constraint, effort is made to reduce the flight's noise impact on affected communities.

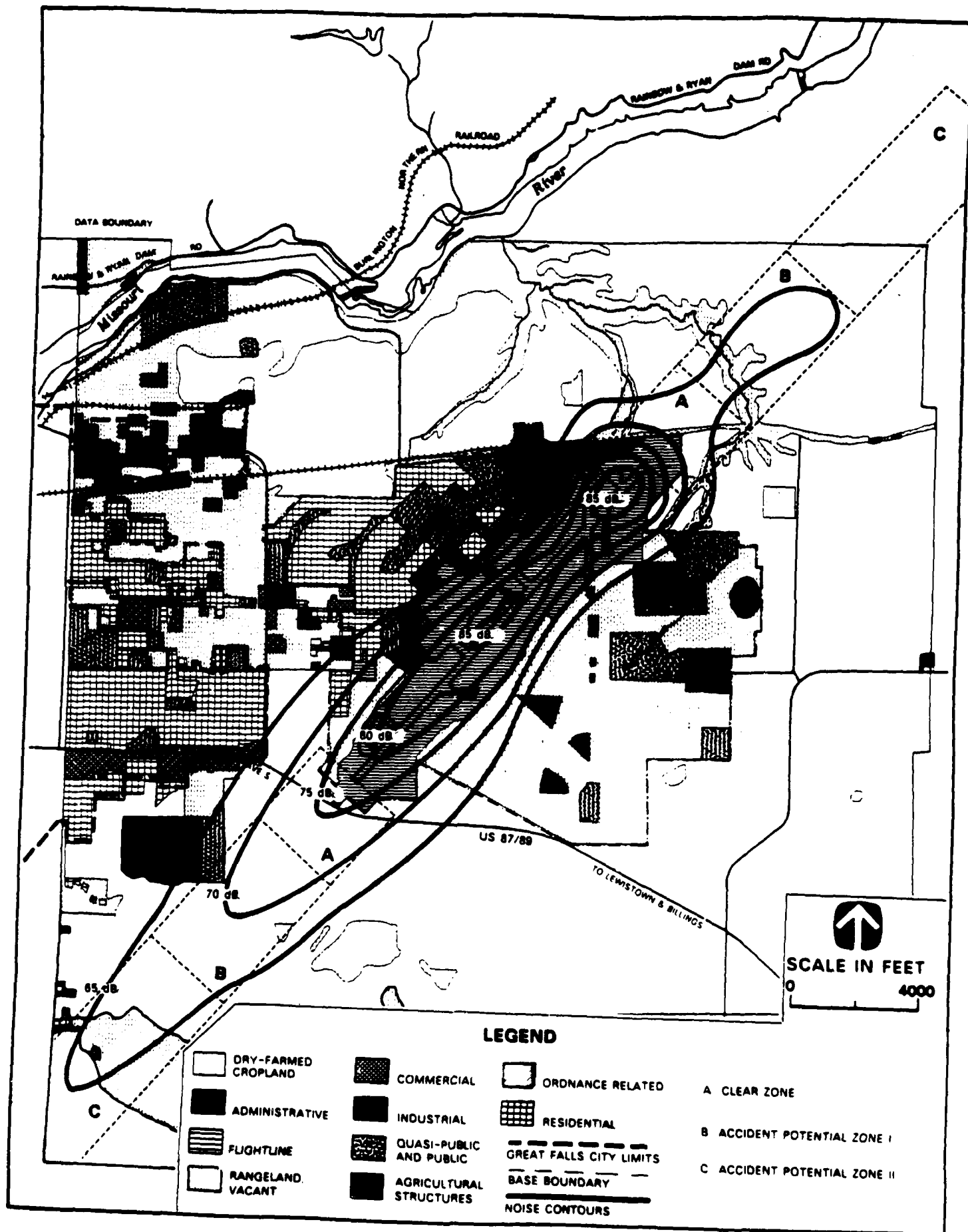
Malmstrom AFB is a Strategic Air Command (SAC) base, and the noise environment of the base will be dominated by the arrival, departures, and flight patterns of assigned and transient aircraft.

Noise from ground operations at the Base comes primarily from two basic sources: engine run-up from operational aircraft and ground run-up maintenance operations. Pilots typically go through an engine run-up and check-out procedures before take-off. Engine maintenance run-ups are normally scheduled only during daytime.

The noise exposure level at ground level depends on the intensity of aircraft noise which is a function of the power setting, altitude of the aircraft, and the duration time of exposure.

The base noise contours as established in AICUZ documents are intended to aid local community planning. The importance of this document is increased by the fact that HUD and VA funding assistance could be affected by DNL noise ratings (Newman and Beattie, 1985).

FIGURE A.11-1 Noise Contours (Ldn) First KC-135R Refueling Squadron, Malmstrom AFB, Montana



The population in and around Malmstrom AFB is exposed to the noise generated by the base ground and flight operations.

The effect of noise on human health can generally be divided into three categories: physiological, behavioral, and subjective. The primary physiological concern with noise is hearing loss. Other physiological concerns have been included as non-auditory effects. (USAF, 1988).

Hearing Loss. A considerable amount of data on hearing loss has been collected and analyzed. It has been established that continuous exposure to high noise levels will damage human hearing (EPA, 1978). The human ear is capable of hearing up to 120 dB over a frequency range of about nine octaves. Hearing loss is generally interpreted as the shifting to a higher sound level of the ear's sensitivity or acuity to perceive sound. This change can either be temporary, TTS (Temporary Threshold Shift), or permanent, PTS (Permanent Threshold Shift; Newman and Beattie, 1985)

Regular exposure to A-weighted sound levels of from 60 to 80 dB for periods of 8 hours will cause some TTS in a significant proportion of the population exposed (Science Applications, Inc., 1980). The Environmental Protection Agency has set 75 dB(A) for an 8-hour exposure and 70 dB(A) for a 24-hour exposure as the average noise level standard requisite to protect 96 percent of the population from greater than a 5 dB PTS (Science Applications, Inc., 1980). While these standards have relevancy for planning, they in themselves are not necessarily appropriate land use planning criteria for controlling noise sources because they do not consider cost, feasibility, or the development needs of the community.

Non-auditory effects. There have been a number of studies done to determine whether correlations exist between noise exposure and cardiovascular problems, achievement scores, birth weight, mortality rates, and psychiatric admissions (USAF, 1985a).

Cantrell (1976) concluded that the results of human and animal experiments show that average or intrusive noise can act as a stress provoking stimulus. Prolonged stress is known to be a contributor to a number of health disorders. Kryter (1980) states, "It is more likely that noise related general ill-health effects are due to the psychological annoyance from the noise interfering with normal everyday behavior, than it is from the noise eliciting, because of its intensity, reflexive response in the autonomic or other physiological stress reaction that could result in impaired health."

It is generally agreed that the level of reaction of residents near airports is directly proportional to the level of noise. Behavioral effects associated with excessive noise levels include speech and sleep interference and performance loss.

The National Institute for Occupational Safety and Health and EPA commissioned the Committee on Hearing, Bioacoustics, and Biomechanics (CHABA) to study the question of whether established noise standards were adequate to protect against health disorders other than hearing defects. CHABA's

conclusion (cited in USAF, 1985a) was: "Evidence from available research reports is suggestive, but it does not provide definitive answers to the question of health effects, other than to the auditory system, of long-term exposure to noise.

Speech interference. One of the most obvious effects of aircraft noise intrusion is speech interference. The disruption of leisure activities such as listening to the radio, television, music, and conversation is a primary source of annoyance, giving rise to frustration and irritation. In some situations a high degree of intelligibility is essential to safety.

The frequency spectrum of speech covers the range from 100 to 1000 Hz. The intensity level variation of successive sounds is equal to 30 dB. Speech is an acoustical signal characterized by rapid fluctuations in sound level and frequency pattern. It is essential for optimum speech intelligibility to recognize these continually shifting sound patterns. Not only does noise diminish the ability to perceive the auditory signal, but also reduces a listener's ability to follow the pattern of signal fluctuation (Science Applications, Inc., 1980).

A number of studies relate speech interference effects to noise. It has been found that A-weighted sound measures reasonably predict the understanding of speech.

The EPA (USEPA, 1978) has identified the DNL level of 55 dB as the maximum permissible daily level of intruding noise to allow satisfactory speech communication. It is recognized that single event maximum levels, such as aircraft flyovers can cause momentary speech communication interruption.

Sleep Interference. Sleep is not a continuous, uniform condition, but a complex series of states through which the brain progresses in a cyclical pattern. There are basically five stages of sleep. Arousal from sleep is a function of a number of factors which include: 1) age, 2) sex, 3) sleep stage, 4) noise level, 5) frequency of noise occurrences, 6) noise quality, and 7) pre-sleep activity. Since there are extreme differences in the physiology, the behavior, the habitation and adaptation to noise of individuals, few studies have attempted to establish noise criterion levels for sleep disturbance (Science Applications, Inc., 1980).

Some conclusions on the major determinants of human sleep response to noise drawn by Lukas (1972) include:

- o Children 5 to 8 years of age are generally unaffected by noise during sleep.
- o Older people are more sensitive to sleep disturbance than younger people.
- o Women are more sensitive to noise than men.
- o Within their own age group, there is a wide variation in the sensitivity of individuals to noise.
- o Sleep arousal is directly proportional to the sound intensity of aircraft flyover.

While there have been several investigations done to assess the effect of aircraft noise on sleep, none have produced quantitative dose-response relationships in terms of noise exposure level, DNL and sleep disturbance. Noise-sleep disturbance relationships have been developed based on single-event noise exposure. One such study is summarized in Figure 3.11-2.

The threshold level of noise that can cause sleep arousal ranges from 35 to 70 dB(A). Studies show that sleep interference can take place without a person being consciously awakened. The EPA has set 35 dB(A) as the disturbance level for steady noise and concludes that a single event level of 40 dB(A) can result in a 5% probability of awakening (Newman and Beattie, 1985).

The FAA (1985) has concluded from its research that, "The psychological annoyance from the effects of sleep interference due to aircraft noise is probably more significant than the direct physiological consequences" (Newman and Beattie, 1985). The effects of noise on sleep are not completely understood. There have been few studies done on the short-and long-term after effects such as psychological and physiological disorders or task performance degradation during periods following sleep disturbance. It is agreed that reasonable quality sleep is a requisite for good health.

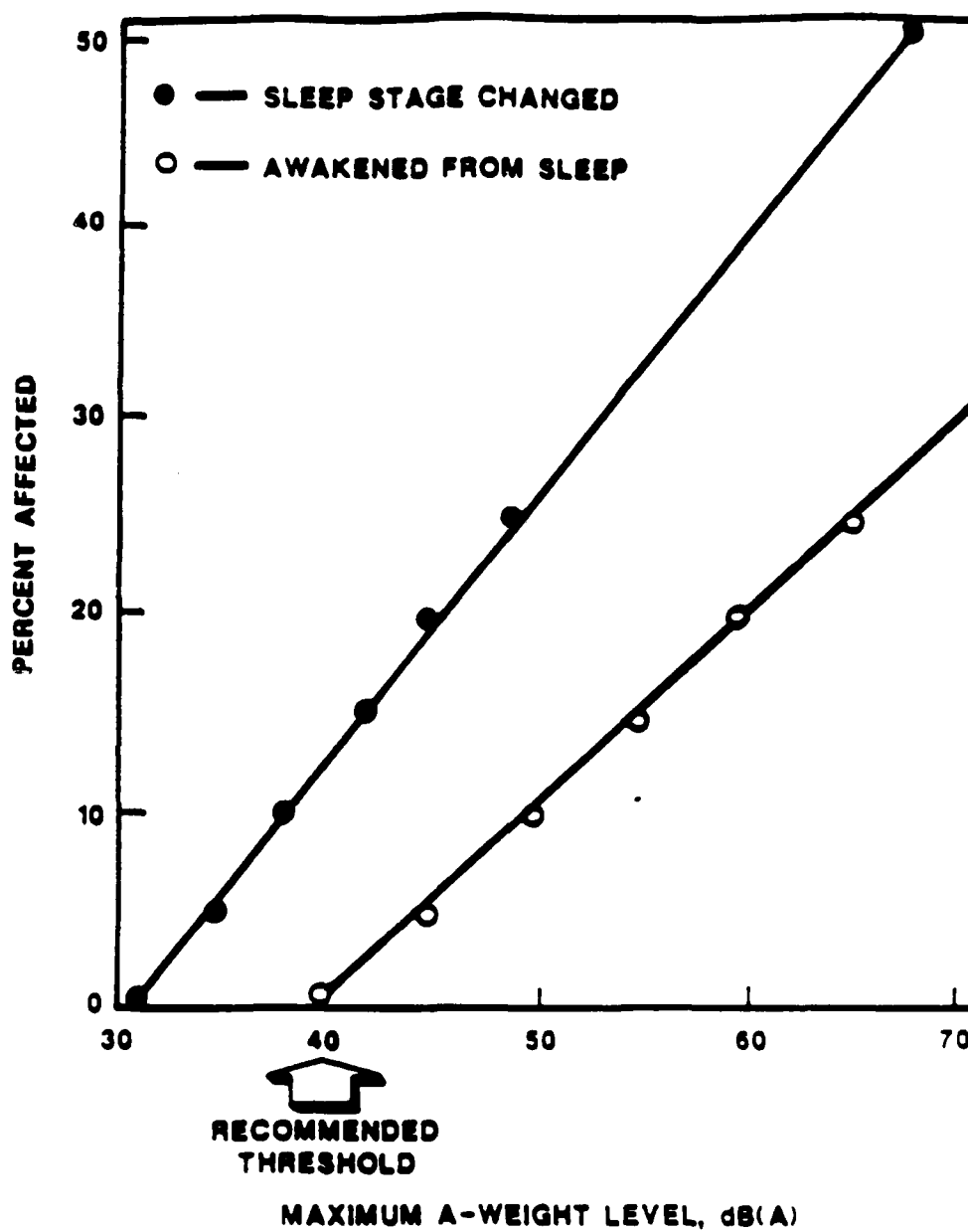
Performance Effects. The effect of noise on the performance of activities or tasks has been the subject of many studies. Some of these studies have established links between continuous high noise levels and performance loss. Noise induced performance losses are most frequently reported in those studies employing noise levels in excess of 85 dB(A). Little change has been found in low noise cases. It has been cited that moderate noise levels, 84 dB(A), appear to act as a stressor for more sensitive individuals performing a difficult psychomotor task (Science Applications, Inc., 1980).

The general effect of noise on performance is just beginning to be suggested from research studies (USAF, 1985a). The results have yet to yield definitive criteria with respect to the effect of periodic aircraft noise on performance. Several general trends that have developed are:

- o A periodic intermittent noise is more likely to disrupt performance than steady state continuous noise of the same level. Flyover noise, due to its intermittent nature, might be more likely to disrupt performance than a steady state noise of equal level.
- o Noise is more inclined to affect the quality than the quantity of work.
- o Noise is more likely to impair the performance of tasks that place extreme demands on the worker.

Annoyance is the primary consequence of aircraft noise. The subjective impression of noise and the disturbance of activities are believed to contribute significantly to the general annoyance response. The feeling of annoyance is a complex response and considered on an individual basis

FIGURE A.11-2 Composite of Laboratory Data for Sleep Interference Versus Maximum A-Weighted Noise Level.



Source: FAA 1985 Aviation Noise Effects Rpt No. FAA-EE-85

displays a wide availability for a given noise level. Research studies have found greater correlation by examining aggregate community annoyance to noise (Newman and Beattie, 1985).

A number of nonacoustical factors have been identified that may influence the annoyance response of an individual. Newman and Beattie (1985) divided these factors into emotional and physical variables.

Emotional Variables

- o Feelings about the necessity or preventability of the noise.
- o Judgment of the importance and value of the activity which is producing the noise.
- o Activity at the time an individual hears the noise.
- o Attitude about the environment.
- o General sensitivity to noise.
- o Belief about the effect of noise on health.
- o Feeling of fear associated with the noise.

Physical Variables.

- o Type of neighborhood.
- o Time of day.
- o Season.
- o Predictability of noise.
- o Control over the noise source.
- o Length of time an individual is exposed to a noise.

Most of the existing measures of community response to aircraft noise are based on the premise that the degree of annoyance experienced by a community as a whole can be adequately predicted by acoustical models. It has been found that in any community there will be a given percentage of the population highly annoyed, a given percentage mildly annoyed and some who will not be annoyed at all (Newman and Beattie, 1985).

A.10.6 Levels of Impact Criteria

Noise effects were classified as having a negligible, low, moderate, or high impact depending on the magnitude and/or duration of that effect on the existing ambient noise environment. The impact levels are based upon the fact that noise level changes of three dB or less are perceived as negligible by most people, while an increase of ten dB is perceived as a doubling in sound (Bolt, Beranek and Newman, Inc. 1973, and Air Force, Army, Navy 1978).

The LOIs for noise are the following:

- o Negligible Impact -- Predicted noise impacts would not exceed ambient noise levels by more than 2.9 dB. The increase is not normally noticeable.
- o Low Impact -- Predicted noise impacts would exceed ambient noise levels by 3 dB to 4.9 dB. The increase is barely noticeable.
- o Moderate Impact -- Predicted noise impacts would exceed ambient noise levels by 5 dBA to 9.9 dB. The increase is clearly noticeable.
- o High Impact -- Predicted noise impacts would exceed ambient noise levels by ten dBA or more.

A.10.7 Significance Criteria

In addition to the CEQ criteria listed in Appendix A, an increase in noise would be considered significant if either of the following conditions occur:

- o Exposing residential housing to noise levels greater than DNL 75 dB without sufficient noise attenuation.
- o Exposing schools and hospitals to noise levels greater than DNL 65 dB without sufficient noise attenuation.

APPENDIX B

SAFETY CONSIDERATIONS

B.1 Second KC-135R Air Refueling Squadron

Public safety has been and will continue to be of utmost concern throughout the development of the KC-135R refueling aircraft and the deployment of the Second KC-135R AREFS, including the design of the aircraft specification of support facilities, and to the training of support personnel and pilots.

The major findings are that among other things, (1) the superior engine power and design makes the aircraft relatively safe, (2) empirical operations data indicate that it has a good safety record, although the possibility of a major mishap does exist; (3) comprehensive safety, training, safer start-up procedures and state-of-the-art refueling techniques add to the low probability of major mishaps both on the ground and in the air, and (4) modern state-of-the-art ground refueling facilities will be provided.

B.1.1 KC-135R Design

Compared to the KC-135A model, the "R" model has more powerful engines. The former generates 13,750 lbs of thrust, while the latter can produce 22,000 lbs. With the additional power comes an increased margin of safety. In addition, the stabilizer area has been increased from 500 to 545 square feet, the main landing door has been modified, and an additional rotor has been added to the brakes. Moreover, an updated anti-skid system has been installed, an APU as opposed to a cartridge quick start system is used, and the fuel capacity has been increased from 189,702 lbs to 203,288 lbs.

B.1.2 Operations Safety Data

During FY 1987, all C-135 aircraft had two major mishaps. This amounted to 0.93 per 100,000 operations hours. None of these mishaps involved the newer "R" model. The safety record is expected to be relatively good for operations of the KC-135R aircraft at Malmstrom AFB. Only a small portion of the aircraft flying time is spent in Malmstrom AFB airspace and no explosive ordnance is normally carried on board. Nevertheless, mishaps are possible much like those occurring for civilian aircraft. The worst possible scenario would be that a fully fueled aircraft would crash in an inhabited on base or off base location. To be prepared to respond to such an emergency, the base Fire Department is well trained and equipped. Moreover, the base has mutual aid agreements with Cascade County and the City of Great Falls. Periodically, these departments hold joint training exercises to deal with aircraft mishaps and JP4 burns. In addition, the base Command Post will follow a prescribed checklist to respond to aircraft emergencies.

It is expected that local government will examine the next Malmstrom AFB AICUZ report and adopt zoning ordinances to avoid unnecessary risks to the population.

The Air Force believes that the Federal Aviation Administration (FAA) has adopted adequate procedures for controlling flight operations in the airspace that is used by Malmstrom AFB to avoid mishaps involving military and civilian aircraft.

5.1.3 Comprehensive Safety Training

The safety training is most comprehensive. Every major maintenance procedure is presented with the assistance of verbal, written, and video media. Sample safety courses are found in Table B.0-1.

Table B.0-1
Training Course Listing

Title

Pallet Build-up Training
Self-Aid & Buddy Care
Aircraft Smoke Mask Training
Aircraft De-icing
Alert Acft Inspection
Fire Extinguishing Training
Life Support Training
Liquid Oxygen Servicing
Physiological Training
Postflight Inspection
Preflight Inspection
Respirator Training
Driver Briefing (Age)
Quick Turn Procedures

B.1.4 Fuel Spills

There is a danger that fuel spills may occur during ground refueling operations despite state-of-the-art refueling facilities. A spill prevention and response plan is in place. Fuel spills will be contained and not be permitted to enter the public sewer system.

At times it may become necessary for an aircraft to jettison fuel into the atmosphere prior to landing. Generally, this is only done during life threatening emergencies to attempt to avoid an aircraft from crashing. Normally this action is taken over sparsely inhabited areas and at an altitude sufficient to assure evaporation of the fuel. Given these procedures and the infrequency of such action, no major environmental impacts are envisioned.

B.2 Peacekeeper Rail Garrison

The following safety conclusions were formed after a thorough analysis of the Peacekeeper Rail Garrison Program.

(1) While there is a very slight potential for mishaps with the deployment of the Peacekeeper Rail Garrison system, the system would be safe and would pose a negligible risk to human health and the environment.

(2) In the absence of a mishap, the materials in the Peacekeeper missile would impose an extremely small health risk to those who would be exposed to them on a daily basis or to the general public.

The Peacekeeper Program will build upon the excellent safety programs of the rail industry, the Federal Railroad Administration (FRA) and the American Association of Railroads (AAR). Peacekeeper trains are expected to have a substantially better safety record than commercial rail traffic because the Peacekeeper locomotives and cars would be the most modern available, contain special safety features, be better maintained, and would be subjected to less wear than commercial rolling stock. If there were a mishap involving a train carrying missiles, the missile would be protected by the launch canister and the missile launch car structure. Furthermore, the inherent stability of the solid propellants makes the missile an unlikely source of explosive or fire. Only operational Peacekeeper trains would have the potential of a mishap involving radioactive materials. In the exceedingly unlikely event of a fire or explosion causing airborne dispersal of radioactive materials, the chance of exposed persons eventually developing cancer would increase. Though the consequence is potentially very serious, radioactive material dispersal would be so unlikely that it is considered a negligible risk.

For more information, see the Draft Environmental Impact Statement, Peacekeeper Rail Garrison Program.

B.3 Small ICBM

For the Small ICBM Program, the safety conclusions are as follows:

The Small ICBM system safety program extends from concept development to a system design through deployment and operations. In the 25-year operating history of the Minuteman ICBM systems, the Air Force has never experienced a mishap leading to a fire or explosion. In addition, the technical advances to the components and operating procedures for the Small ICBM system ensure that the proposed system would operate safely.

Two extremely unlikely assumptions, that a mishap involving a HML occurs and that it results in the release of the total amount of available propellant and warhead materials, are the basis for the safety analysis. Given these unlikely assumptions, the predicted environmental impacts would be significant only within the immediate mishap vicinity for biology, human health and safety, water, and soils. Impacts on air quality would, however, be distributed farther, but such impacts would be of short-duration.

APPENDIX C

GLOSSARY OF TERMS AND ACRONYMS

Terms

A-Weighted Sound Level (dBA). A single number measure of a noise event. A-weighted sound pressure level is a sound pressure level which has been filtered or weighted to reduce the influence of the low and high frequency extremes in order to correlate better with human assessment of the loudness of sound.

Acquisition area. Offbase land to be acquired for the proposed program.

Acre-foot. The volume of the water that covers one acre to a depth of one foot; approximately 326,000 gallons.

Active fault. A fault on which movement has occurred during the past 10,000 years and which may be subject to recurring movement usually indicated by small, periodic displacement or seismic activity.

Advisory Council on Historic Preservation. A 19-member body appointed, in part, by the President of the United States to advise the President and Congress and to coordinate the actions of federal agencies on matters relating to historic preservation, to comment on the effects of such actions on historic and archaeological cultural resources, and to perform other duties as required by law (Public Law 89-655; 16 USC 470).

Air Installation Compatible Use Zone. A concept developed by the Air Force to promote land use development near its airfields in a manner that protects adjacent communities from noise and safety hazards associated with aircraft operations, and to preserve the operational integrity of the airfields.

Air Quality Control Region. An area designated by Section 107 of the Clean Air Act which is based on jurisdictional boundaries, urban-industrial concentrations, and other factors including atmospheric areas, that is necessary to provide adequate implementation of air quality standards.

Alluvium. A general term applied to sediments deposited by a stream or running water.

Ambient air. That portion of the atmosphere, external to buildings, to which the general public has access.

Ambient air quality standards. Standards established on a state or federal level that define the limits for airborne concentrations of designated "criteria" pollutants (e.g., nitrogen dioxide, sulfur dioxide, carbon monoxide, total suspended particulates, ozone, lead, and hydrocarbons) to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).

Aquifer. The water-bearing portion of subsurface earth material that yields or is capable of yielding useful quantities of water to wells.

Archaeology. A scientific approach to the study of human ecology, cultural history, and cultural process, emphasizing systematic interpretation of material remains.

Archaic. A stage of prehistoric cultural development, recognized throughout North America, characterized by broad spectrum hunting and gathering economies and seasonal mobility. The material remains are recognized by the development of barbed and stemmed spear points, the extensive use of groundstone tools, and the lack of ceramics. The Archaic is also commonly used to designate a prehistoric period (generally 6000 B.C. to A.D. 500), but the dates vary from one region to another.

Arterial. Signalized streets with signal spacings of two miles or less and turning movements at intersections that usually do not exceed 20 percent of total traffic. Urban arterials primarily serve through-traffic, and, as a secondary function, provide access to abutting properties (urban); roadways that provide large traffic volume capacity between major traffic generators, designed to facilitate traffic movement and discourage land access when feasible. Includes primary state roads (functional).

Artifact. Anything that owes its shape, form, or placement to human activity. In archaeological studies, the term is applied to portable objects (e.g., tools and the by-products of their manufacture).

Assembly and checkout. The process of final assembly and verification of a weapon system.

Attainment area. An area that has been designated by the U.S. Environmental Protection Agency and the appropriate state air quality agency as having ambient air quality levels below the ceiling levels defined under the National Ambient Air Quality Standards.

Available vacancy. A vacant housing unit that is either for sale or for rent.

Average annual daily traffic. For a 1-year period, the total volume passing a point or segment of a highway facility in both directions, divided by the number of days in the year.

Basalt. A dark colored fine-grained volcanic rock formed at the surface of the earth.

Baseline. The existing and future-growth characterization of an area without the proposed program.

Basin. A drainage or catchment area of a stream or lake.

Beachstrands. Linear areas of low topographic relief representing shorelines corresponding to progressively lower water levels around former glacial lakes.

Bedrock. Geologic formation or unit which underlies soil or other unconsolidated surficial deposits.

Biological diversity. Refers to the number of species and their relative abundance in an area or habitat.

Biome. Major regional ecological community of plants and animals extending over large natural areas.

Bonds. Financial instruments used by government agencies to fund major capital improvement projects; typically either a general obligation bond or revenue bond.

Bottomland. Land topographically low and typically found along a stream course.

Brachiopods. A phylum of invertebrates that has persisted from the Lower Cambrian to the present and consists of a marine animal with a calcareous bivalve shell with unequal valves.

Breaks. Terrain characterized by abrupt changes in surface slope (e.g., a line of cliffs and associated spurs and small ravines).

Bryozoans. A small phylum of aquatic animals that reproduce by budding, usually forming branching, mosslike colonies that are enclosed by a calcareous or ridged shell.

Budget. Document prepared by a government unit which estimates future revenues expected to be collected and the expenditure needs of the jurisdiction in a forthcoming fiscal year or years; includes estimates of potential revenues and expected expenditures by major fund groups (governmental funds, proprietary funds, and fiduciary fund types).

Cairn. A distinctly artificial pile of rocks that may mark or enclose burials, vision quests, caches, or geodetic locales.

Campsite. A short-term habitation site containing evidence of daily living activities, as opposed to specialized activities (e.g., quarry site). Campsites are generally open-air occupations of perhaps weeks to months in duration.

Cantonment Area. Residential area of an installation.

Capacity (Transportation). The traffic-carrying ability of a facility while maintaining prescribed operational qualities (e.g., a specific level of service); the maximum amount of traffic that can be accommodated by a given facility. (Note: Traffic facilities generally operate poorly at or near capacity, and facilities are rarely designed or planned to operate within this range.)

Capacity (Utilities). The maximum load a system is capable of carrying under existing service conditions.

Capital costs. Expenditures by local governments on physical infrastructure.

Capital projects fund. One of the governmental fund types used to account for capital improvement projects other than those financed by proprietary funds or special assessment funds.

Carbonaceous. Pertaining to a sedimentary rock containing carbon as the major constituent.

Cenozoic. An era in geologic history extending from 66 million years ago to the present time which is characterized by the rapid evolution of mammals, birds, grasses, shrubs, and higher flowering plants.

Chronology. The science of arranging time in periods and ascertaining the dates and historical order of past events.

Civilian labor force. The sum of the number of persons who are unemployed but able, willing, and actively seeking work and the number of nonmilitary persons who are working. The number of unemployed divided by the civilian labor force defines the unemployment rate. Military personnel are not considered in the unemployment rate calculations because, by definition, persons working in the military are fully employed and inclusion would tend to skew rates downward.

Climate. The prevalent or characteristic meteorological conditions (and their extremes) of any given location or region.

Collector streets. Surface streets that provide land access and traffic circulation service within residential, commercial, and industrial areas (urban); secondary roads that provide access to higher-type roads, connect small communities and nearby areas, and serve adjacent property (functional).

Component. One location or element within a settlement/subsistence system. Archaeological sites may contain several components that reflect the use of the locality by different groups in different time periods.

Comprehensive plan. A public document, usually consisting of maps, text, and supporting materials, adopted and approved by a local government legislative body, which describes future land uses, goals, and policies.

Confined aquifer. An aquifer that is overlain by an impermeable stratum and within which water pressure may build up so that penetration by a well will result in a static water level that is considerably higher than the top of the aquifer.

Corridor. A strip of land of various widths on both sides of a particular linear facility such as a highway or rail line.

Coulee. A deep gulch or ravine; usually dry in summer.

Crinoids. A large class of fossil echinoderms that has a cup-shaped body, feathery arms, and a long, jointed stalk fixed to the base of the body to anchor the animal to the sea bottom.

Cultural complex. A distinctive group of artifacts and sites that is distinct from other groups.

Culture. The system of behavior, beliefs, institutions, and objects human beings use to relate to each other and to the environment.

Cumulative impacts. The combined impacts resulting from all programs occurring concurrently at a given location, e.g., the deployment of the Peacekeeper Rail Garrison system and other military projects at any of the candidate military bases planned.

Day average sound level. Average sound level over the 15-hour time period from 7 a.m. up to 10 p.m. (0700 up to 2200 hours).

Day-night average sound level. The 24-hour average sound level, in decibels, from midnight to midnight, obtained after addition of 10 decibels to sound levels in the night from midnight up to 7 a.m. and from 10 p.m. to midnight (0000 up to 0700 and 2200 up to 2400 hours).

Debitage. Waste flakes resulting from stone tool manufacture.

Debt service. The scheduled repayment of a loan made to a local government, usually resulting from the sale of bonds.

Debt service funds. One of the governmental funds used to account for annual payments required to pay back money which is borrowed by a governmental unit; generally limited to account for long-term debt from issuance of bonds.

Decibel. The unit of measurement of sound level calculated by taking ten times the common logarithm of the ratio of the magnitude of the particular sound pressure to the standard reference sound pressure of 20 micropascals and its derivatives.

Decibel Scale. A logarithmic measure of audible sound pressure levels dimensioned in decibel units. The hearing threshold of 20 u PA is the starting point, or zero on the decibel scale. One million times the hearing threshold level or 120 dB equates to the approximate threshold of pain.

Decommissioning. The process of removing a weapon system from service.

Delay. Additional travel time experienced by a driver, passenger, or pedestrian beyond what would reasonably be desired for a given trip.

Deployment. Strategic emplacement of a weapon system.

Developed. Said of land, a lot, a parcel, or an area that has been built upon, or where public services have been installed prior to residential or commercial construction.

Direct effects. Effects that are immediate consequences of program activities. In economics, the initial increase in employment and income resulting from program employment and material purchases before the indirect effects of these changes are measured.

Direct employment. Military and civilian personnel who are employed by the Department of Defense and its contractors, and who are working onsite on the program.

Direct expenditure. Expenditures of local governments directly related to the provision of goods or services.

Direct impact. Effects resulting solely from program implementation.

District. National Register of Historic Places designation of a geographically defined area (urban or rural) possessing a significant concentration, linkage, or continuity of sites, structures, or objects united by past events (theme) or aesthetically by plan or physical development.

Disturbed area. Land that has had its surface altered by grading, digging, or other construction-related activities.

Dolomite. A general term applied to sedimentary rocks composed of calcium and magnesium carbonate.

Drawdown. The distance between the static water level and the temporarily depressed water level caused by well pumpage.

Earthquake. A sudden motion or trembling in the earth caused by the displacement of rocks below the earth's surface due to a release of strain.

Econometrics. The application of economic theory and statistical procedures to observed data in order to (1) estimate the degree of influence of one variable on another and (2) forecast endogenous variables from equations that quantify the interrelationships among the variables.

Economies of scale. The decreases in an entity's long-run average costs that occur when it moves toward a specialization of resources, efficient utilization of equipment and manpower, and a lowering of average production costs.

Ecotone. Transitional zone between two distinct ecological communities (e.g., grasslands to forest). Important because of the greater diversity provided by the presence of species from both communities.

Effect. A change in an attribute. Effects can be caused by a variety of events, including those that result from program attributes acting on the resource attribute (direct effect); those that do not result directly from the action or from the attributes of other resources acting on the attribute being studied (indirect effect); those that result from attributes of other programs or other attributes that change because of other programs (cumulative effects); and those that result from natural causes (e.g., seasonal change).

Effluent. Wastewater discharge from a wastewater treatment facility.

Employment. The total number of persons working (includes all wage and salary workers), both civilian and military, and proprietors.

Endangered species. A species that is threatened with extinction throughout all or a significant portion of its range.

Energy. The capacity for doing work; taking a number of forms which may be transformed from one into another, such as thermal, mechanical, electrical, and chemical; in customary units, measured in kilowatt-hours or British thermal units.

Enterprise activity. Services provided or goods produced by a local government agency, generally self-supporting in terms of generating revenues that cover operating costs.

Enterprise funds. In government finance, one of the proprietary fund types used to account for activities which are financed primarily through user charges.

Environmental impact analysis process. The process of conducting environmental studies as outlined in Air Force Regulation 19-2.

Eocene. An epoch of the Tertiary period extending from about 58 million to 36 million years ago.

Ephemeral. Lasting or existing briefly or temporarily.

Epicenter. The point on the earth's surface directly above the focus of an earthquake.

Escarpment. A long cliff or steep slope separating two comparatively level or more gently sloping surfaces; results from erosion or faulting.

Ethnography. The description of human groups and their behavior by direct observation and/or by transcription of statements by living persons.

Eutrophication. The enrichment of a body of water with nutrients which in the presence of sunlight can stimulate the growth of algae and other aquatic plants to the point that undesirable effects may result, such as highly turbid water or a depletion of dissolved oxygen.

Expenditure. A disbursement of funds by a government entity; includes operation and maintenance costs, as well as capital costs.

Explosive safety zone. An established distance from an area where military explosive materials are stored or located, within which military authorities assure that gatherings of 25 persons or more do not occur or human habitations are not maintained.

Farmstead. Horticultural community consisting of one house and associated structures or features.

Fault. A fracture or zone of fractures along which there has been movement of the sides relative to one another and parallel to the fracture.

Fault zone. An area or region that is expressed as a zone of numerous fractures or faults.

Fauna. Animals; organisms of the animal kingdom of a given area taken collectively.

Feature. Nonportable portion of an archaeological site. These include facilities such as fire pits, storage pits, or foundations.

Federal-candidate species. Taxa placed in Federal Categories 1 and 2 by the U.S. Fish and Wildlife Service, which are candidates for possible addition to the List of Endangered and Threatened Species.

Fee simple. Title to real property belonging to a person or government where full and unconditional ownership exists. Such ownership does not necessarily include mineral rights.

Fiduciary funds. One of the major fund groups, used to account for assets held by a jurisdiction in a trustee capacity, for example, pension funds.

Financial statement. Document prepared by a government unit which presents actual revenues received and expenditures made in the previous fiscal year; organized to present data along major fund groups (governmental, proprietary, and fiduciary fund types).

Fiscal year. In government finance, the 12-month period which corresponds to the jurisdiction's accounting period, typically beginning July 1st and ending June 30th.

Flake. A small stone fragment produced as a by-product of stone tool manufacturing; may also be used unmodified as a tool itself.

Floodplain. The relatively flat land lying adjacent to a river channel that is covered by water when the river overflows its banks.

Flora. Plants; organisms of the plant kingdom taken collectively.

Fluvial (Fluviatile). Pertaining to a river or stream.

Forage. Food for animals (e.g., deer), especially when taken by browsing or grazing.

Foraminifera. Marine protozoans enclosed in a typically calcareous shell consisting of several successively formed communicating chambers, each larger than the preceding.

Formation. A sequence of naturally created rock layers with distinctive upper and lower boundaries.

Freeway. A multilane, divided highway with a minimum of two lanes for exclusive use of traffic in each direction, allowing full control of access and egress.

French Colonial Revival. A twentieth-century architectural style characterized by tall, rectangular structures with symmetrical facades. Windows with decorative shutters occur on both sides of an arched porch with a Mansard roof.

Frictional unemployment. Unemployment attributable to time lost in changing jobs rather than to a lack of job opportunities.

Fugitive dust. Particulate matter composed of soil which is uncontaminated by pollutants resulting from industrial activity. Fugitive dust may include emissions from haul roads, wind erosion of exposed soil surfaces, and other activities in which soil is either removed or redistributed.

Fugitive emissions. Emissions released directly into the atmosphere that could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.

Full-scale development. The stage of development of a weapon system when all components are built and tested at full scale.

Full-time equivalent. Employment based on a 40-hour work week (i.e., one person working 40 hours would equal 1 Full-Time Equivalent; one person working 20 hours would equal 0.5 Full-Time Equivalent).

Fund balance. In government finance, the resultant cash balance of an account or group of accounts after actual expenditures made and revenues received have been debited or credited.

Gamma radiation. A product of the radioactive decay process which includes very high-frequency electromagnetic waves.

Gastropods. A type of mollusk with a univalve shell (e.g., snail).

General fund. One of the governmental fund types, used to account for all financial transactions and resources except those required to be accounted for in other funds. Typically supports governmental activities supported by local taxes; for example, public safety, public health, and general administration functions. In school districts, accounts for all direct instructional costs.

General obligation bond. Financial instrument used by government agencies to fund major capital improvements; backed by full faith and credit of the issuing agency. Total amount of general obligation bond indebtedness is subject to statutory limitations, measured as a percentage of the jurisdiction's tax base. Used primarily for general purpose projects (e.g., administrative facility construction, parkland acquisition, and law enforcement and fire protection facility construction) which do not lend themselves to revenue bond financing.

Geologic hazard. A naturally occurring or manmade geologic condition or phenomenon that presents a risk or is a potential danger to life and/or property.

Geologic time scale. Scale of time ranging from Precambrian (approximately 3.8 billion years ago) to the present.

Geologic unit. A geologic formation, group, or member.

Geothermal. Pertaining to heat in the earth's interior.

Glacial. Of or relating to the movement of continental or alpine ice sheets formed by the compaction and recrystallization of snow.

Glacial lake. Lake derived from meltwater off a glacier commonly formed when an ice sheet dams a natural drainageway.

Glacial till. Unsorted, generally unconsolidated and nonstratified coarse sediments deposited beneath a glacier which were not reworked by meltwater.

Glacio. Of or relating to glaciers or glaciation.

Gorget. A bone, shell, or stone artifact which is perforated so that it can be suspended. A gorget is also a piece of throat armor, a collar, or a neck ornament.

Governmental funds. One of the major fund groups, consisting of the general fund, special revenue funds, capital projects funds, debt service funds, and special assessment funds, as differentiated from proprietary funds (enterprise and internal service funds) and fiduciary funds (trust and pension fund accounts); accounts for almost all of the financial transactions of a jurisdiction.

Granite. A broadly used term for a quartz-bearing, coarse, crystalline igneous rock formed deep beneath the earth's surface.

Ground surface rupture. Surface expression of fractures that are usually a result of seismic activity.

Groundstone artifacts. Stone artifacts made by grinding rather than flaking (e.g., milling stones and mortar and pestle).

Group. A stratigraphic unit consisting of two or more contiguous or associated geologic formations.

Hazardous waste. A waste, or combination of wastes, which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may either cause, or significantly contribute to an increase in mortality or an increase in serious irreversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Hearing loss. Impairment of auditory sensitivity: an elevation of 2 hearing threshold level.

Hearing threshold level. The amount by which the threshold of hearing for an ear (or the average of a group) exceeds the standard audiometric reference zero.

Hearth/firepit. A feature used for the placement of fires; may be lined with clay or stones.

Herptiles. Referring to amphibians and reptiles.

Historic. A period of time after the advent of written history dating to the time of first Euro-American contact in an area. It also refers to items primarily of Euro-American manufacture.

Holocene. The time since the end of the Pleistocene epoch, characterized by the absence of large continental or Cordilleran ice sheets and the extinction of large mammalian life-forms. Generally considered to be the last 10,000 years.

Horizontal ground acceleration. An engineering measure of the severity of earthquake-induced ground motion. Units are expressed as a fractional measure of the gravitational acceleration (g) relating to the rate of change in horizontal ground displacement.

Horticulturalist. Group or individual who plants, cultivates, and harvests domesticated plants on a part-time basis.

Household size. The average number of individuals residing in a single dwelling unit.

Hydrology. The science dealing with the properties, distribution, and circulation of water on the surface of the land and in the soil and underlying rocks.

Impact. An assessment of the meaning of changes in all attributes being studied for a given resource; an aggregation of all the adverse effects, usually measured using a qualitative and nominally subjective technique.

Impulse noise. Noise of short duration (typically, less than one second) especially of high intensity, abrupt onset and rapid decay and often rapidly changing spectral composition.

Impulse sound level. In decibels, the exponential-time-average sound level obtained with a squared-pressure time constant of 35 milliseconds. The A-frequency weighting is understood.

Inactive fault. A fault with no historic activity; not recognized as a source of earthquakes.

Indirect employment. Employment resulting from the purchases of workers who are directly working on a specified program. Also includes any subsequent employment arising from the increase in purchases in the area.

Indirect impacts. Program-related impacts (usually population changes and resulting impacts) not directly attributable to the program itself. For example, direct program employees will spend some of their income locally. As a result, local industries will tend to hire more workers as they expand in response to the increased demand. This additional employment is termed an "indirect impact."

Inhabited building. Any building currently being used for the purposes of a dwelling or residence, workplace, place of business or industry, or an institutional function. Agricultural buildings such as barns do not generally meet the definition of an inhabited structure.

Immigrants. All persons relocating to a defined geographic area as a result of the proposed program, usually calculated on an annual basis.

Input-output model. Method of estimating the interrelationship and the flow of goods and services among industrial sectors of the economy. Used to estimate the secondary (indirect and induced) economic effects of an initial change in a specific economic sector.

Intercontinental Ballistic Missile. A large missile capable of accurate weapon delivery over intercontinental ranges (usually greater than 5,000 miles).

Intermittent stream. A stream that does not flow continuously during all periods of the year.

Internal service funds. One of the proprietary funds, used to account for the financing of goods or services provided by one department or agency to other departments or agencies of the jurisdiction on a cost reimbursement basis; for example, photocopying, typing, and publishing services.

Interstate. The designated National System of Interstate and Defense Highways located in both rural and urban areas; they connect the East and West coasts and extend from Canadian border points to various points on the Mexican border.

Isolated artifact. An artifact, or a small, disarticulated group of artifacts, that cannot be associated with, or is situated outside of, a cultural resource site.

K-factor. The soil erodibility factor (K) used in the Universal Soil Loss Equation. The index is a measure of the susceptibility of a soil to erode as related to physical and chemical properties of the soil.

Kettles. Steep-sided closed depressions in glacial deposits often containing a lake or marsh.

Kill site. An archaeological site indicated by the presence or association of faunal remains, butchering tools, and hunting equipment (e.g., projectile points).

Kilowatt. A unit of power equivalent to 1,000 watts.

Known Geological Structure. An area containing oil and gas leases in which an accumulation of hydrocarbons has been discovered by drilling and determined to be productive. The limits include all acreage that is hypothetically proven productive (43 CFR 3100.0-5[a]).

Known Geothermal Resource Area. An area in which the geology, nearby discoveries, competitive interests, and other indicators would, in the opinion of the Department of the Interior, engender a belief in the men who are experienced in the subject matter that the prospects for the extraction of geothermal resources are good enough to warrant expenditures of money for that purpose (43 CFR 3200.0-5).

Lacustrine. Pertaining to, produced by, or formed in a lake environment.

Land use plans and policies. Guidelines adopted by governments to direct future land use within their jurisdictions.

Landslide. The downslope movement of soil and/or rock material under gravitational influence.

Ldn noise level. The 24-hour average-energy sound level expressed in decibels, with a 10-decibel penalty added to sound levels between 10:00 P.M. and 7:00 A.M.

Leq noise level. A constant amount of acoustic energy equivalent to the energy contained in the time-varying noise measured from a given source for a given time.

Level of impact. The measure of the magnitude or degree of impact expressed as negligible, low, moderate, or high for each environmental resource.

Level of service. In transportation analyses, a qualitative measure describing operational conditions within a traffic stream and how they are perceived by motorists and/or passengers. In public services, a measure describing the amount of public services (e.g., fire protection and law enforcement services) available to community residents, generally expressed as the number of personnel providing the services per 1,000 population.

Limestone. A sedimentary rock composed of calcium carbonate.

Liquefaction. The transformation of unconsolidated sediment into a fluid form resulting from a loss of strength associated with seismic vibrations.

Lithic scatter. An archaeological site consisting only of stone artifacts.

Lithology. The physical character of a rock such as its color, hardness, mineral composition, and grain size.

Loamy. A general term applied to soils with a texture intermediated between fine-textured and coarse-textured soils.

Locality. A particular spot within a geologic unit from which a specimen is obtained or may be found; usually a location of dense or well-preserved fossils.

Loess. A typically buff-colored, windblown silt directly attributable to glacial outwash.

Long duration. Impacts that would occur over an extended period of time, whether they start during the construction or operations phase. Most impacts from the operations phase are expected to be of long duration since program operations essentially represent a steady-state condition (i.e., impacts resulting from actions that occur repeatedly over a long period of time). However, long-duration impacts could also be caused by construction activities if a resource is destroyed or irreparably damaged or if the recovery rate of the resource is very slow.

Magnitude (earthquake). A measure of strength of an earthquake or the energy it releases.

Mammoth/mastodon. Extinct elephants from the Pleistocene epoch.

Maximum credible earthquake. The largest earthquake capable of being produced from a source, structure, or region under the currently known tectonic framework.

Maximum sound level. The greatest sound level during a designated time interval or event. More specifically, it is the greatest FAST A-weighted sound level of the event.

Maximum tolerable soil loss. Represents the maximum amount of soil that can be removed by wind and/or sheet erosion without reducing the productivity of the land or altering the natural ecosystem of an area. The value conceptually represents a balance between the rate of soil formation and soil erosion of a given area.

Medicine wheel. Large stone circle with rock alignments radiating from the center to the circle edge; most likely ceremonial feature.

Megafauna. Various species of large mammals that became extinct in North America sometime before 6,000 years before present. These mammals include the mammoth, giant bison, camel, and giant sloth.

Megawatt. One thousand kilowatts or one million watts.

Mesoamerica. The region extending from the middle of northern Mexico to Panama, particularly southern and central Mexico, Guatemala, Nicaragua, Belize, Honduras, and El Salvador.

Mesotrophic. A body of water with moderate amounts of plant nutrients which result in a moderate level of primary productivity, and which usually has a moderate level of dissolved oxygen.

Mesozoic. A era in geological history, ranging from about 245 million to 65 million years ago, characterized by the development of reptiles.

Microbial. Relating to the study of microorganisms.

Midden. Soil horizon resulting from the accumulation of human living debris containing artifacts and cultural refuse (e.g., bone and shell fragments, fire-cracked rocks, charcoal, chipping detritus, stone tools, or organic residues).

Miocene. An epoch of the Tertiary period, 24 million to 5 million years ago, marked by the development of apes and the appearance of ancestral gibbons.

Mississippian. A period of the Paleozoic era extending from about 360 million to 320 million years ago.

Mitigation. A method or action to reduce or eliminate program impacts.

Mixed open space. A land use type that includes range and pasture land, noncommercial forests, riparian areas, water bodies, and vacant land.

Mobile home. A single-family dwelling unit that is transportable in one or more sections, built on a permanent chassis, and designed to be used with or without a permanent foundation. Does not include travel trailers or recreational vehicles.

Multifamily housing. Townhouse or apartment units that accommodate more than one family though each dwelling unit is only occupied by one household.

Multilane highway. A highway with at least two lanes for the exclusive use of traffic in each direction, with no or partial control of access, that may have periodic interruptions to flow at signalized intersections.

Multiplier. In economics, used to determine the indirect and induced effects (in terms of increased employment, income, or output) resulting from program activities.

National Landmark (Historic). A site, building, or object in private or public ownership that possesses national significance in American history, archaeology, or culture. In order to achieve landmark status, a property must be, or have the clear potential to be, recognized, understood, and appreciated publicly and professionally for the strength and clarity of its historical association, its architectural or design excellence, or its extraordinary information content on a national scale.

National Register of Historic Places. A register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture, maintained by the Secretary of the Interior under authority of Section 2(b) of the Historic Sites Act of 1935 and Section 101(a)(1) of the National Historic Preservation Act of 1966, as amended.

Native Americans. Used in a collective sense to refer to natives of North America.

Native vegetation. Plant life that occurs naturally in an area without agricultural or cultivational efforts.

Night average sound level. Average sound level, in decibels, over the split nine-hour period from midnight up to 7 a.m. and from 10 p.m. to midnight (0000 up to 0700 and 2200 up to 2400 hours).

Noise. Sound that is perceived by humans to be annoying and unwanted.

Noise Contour. A curved line connecting places on a map representing a line of equal noise exposure. Noise exposure is expressed using the average day-night sound level, LDN, expressed in decibels.

Noise-Induced Permanent Threshold Shift (NIPTS). The minimum level at which a person can perceive sound permanently shifts to a higher level, a permanent hearing loss of some degree.

Nonattainment area. An area that has been designated by the U.S. Environmental Protection Agency and the appropriate state air quality agency as exceeding one or more National Ambient Air Quality Standards.

Ostracods. A subclass of crustaceans comprising small active mostly freshwater forms having the body enclosed in a bivalve shell.

Overall vacancy. Total number of single-family, multifamily, or mobile homes that are not occupied at any given time.

Oxbow lake. A crescent-shaped lake formed when a stream abandons a semicircular curve in its channel and takes a new course.

P.L. 81-874 programs. Federal law which authorizes financial assistance to local school districts when federal actions place fiscal burdens on the districts.

Paleo-. Prefix meaning "old" or "ancient."

Paleontological resources. Fossilized organic remains from past geological periods.

Paleozoic. An era in geological history occurring between 570 million and 245 million years ago, marked by the culmination of almost all invertebrates except the insects; in its later periods, marked by the first appearance of land plants, amphibians, and reptiles.

Peak demand. The highest instantaneous amount of electrical power (in kilowatts) that an electrical system is required to supply over a given time frame, usually one year.

Peak hour. The hour of highest traffic volume on a given section of roadway between 7 a.m. and 9 a.m. or between 4 p.m. and 6 p.m.

Peak sound level. The greatest instantaneous A-weighted sound level, during a designated time interval or event.

Peak sound pressure level. In decibels, twenty times the common logarithm of the ratio of a greatest absolute instantaneous sound pressure to the reference sound pressure of twenty micropascals (0.0002 microbar).

Peak year. The year when a particular program-related effect is greatest.

Pelecypods. A class of bivalve mollusks with bilaterally symmetrical shells.

Pennsylvanian. A period of the Paleozoic era extending from about 320 million to 286 million years ago.

Perennial stream. A stream that flows continuously throughout the year.

Permanent housing. Units intended for year-round use.

Permanently disturbed land. Surfaces that will be covered by impervious materials or kept in a cleared condition to accommodate buildings, parking lots, roads, and security zones.

Permian. A period of the Paleozoic era extending from about 286 million to 245 million years ago.

Personal income. Current income received by persons from all sources; includes transfer payments from governments or businesses.

Petroglyph. Schematic or representational art incised or pecked into a rock surface.

Physiographic province. A region with similar geologic structure and climate which has a unified geomorphic history.

Pictograph. Schematic or representational art painted or drawn onto a rock surface.

Pleistocene. The last 1.6 million years of geological history, marked by repeated glaciation and the first indication of social life in human beings.

Pliocene. An epoch of the Tertiary period extending from about 5 million to 1.6 million years ago.

Post boost vehicle. The portion of the missile containing the reentry vehicle and the guidance and attitude control system.

Potentiometric level. The level to which groundwater would rise under unconfined conditions; it may assume values higher than the local topography.

Precambrian. All geologic time before the Paleozoic era, equivalent to about 90 percent of geologic time.

Prehistoric. The period of time before the written record, and before Europeans entered an area.

Prevention of Significant Deterioration Area. A requirement of the Clean Air Act (160 et seq) that limits the increases in ambient air pollutant concentrations in clean air areas to certain increments even though ambient air quality standards are met.

Primary contact recreation. Refers to the beneficial use of water involving recreation which results in full body contact with the water, such as swimming and diving.

Primary road. A consolidated system of connected main roads important to regional, interstate, and statewide travel; they consist of rural arterial routes and their extensions into and through urban areas of 5,000 or more population.

Principal aquifer. The particular aquifer that supplies the majority of the groundwater used in a given region.

Projectile point. Implement that probably served as the tip of a dart, lance, spear, or arrow.

Property tax. Tax imposed by local governments based on the value of property within their jurisdiction.

Proprietary funds. One of the major fund groups, consisting of enterprise fund accounts and internal service fund accounts.

Protohistory. The period when nonliterate American Indian cultures were affected by Euro-Americans without direct contact. For instance, inland Indian tribes received trade goods and reports of European cultures from coastal tribes before the arrival of European explorers in the interior.

Public finance. Finances of, or relating to, a government entity.

Quarry. A locality where lithic material was extracted and initially prepared for the manufacture of stone implements. In the narrow sense, the term refers to places where raw materials were actually excavated, but its use is commonly extended to localities where materials are collected at the surface (e.g., gravel deposits).

Quaternary. A geologic period representing the last 1.6 million years of earth history which includes the Pleistocene and Holocene (Recent) epochs.

Recent. A geologic epoch of the Quaternary period representing the last 10,000 years of geologic time.

Riparian. Of or relating to land lying immediately adjacent to a water body, and having specific characteristics of that transitional area (e.g., riparian vegetation).

Rockshelter. A naturally formed sheltered overhang that was commonly inhabited by prehistoric groups; it is generally found on a vertical rock face and is not as deep as a cave.

Runoff. The noninfiltrating water entering a stream or other conveyance channel shortly after a rainfall event.

Rural area. The area outside towns, cities, or communities that is characterized by very low-density housing concentrations, agricultural land uses, and a general lack of most public services.

Safe yield. The pumpage from a groundwater basin or aquifer that can be permanently maintained without substantially lowering the groundwater below a predetermined level.

Sampling. The selection of a portion of a study area or population, the analysis of which is intended to permit generalization about the entire population. In archaeology, samples are often used to reduce the amount of land area covered in a survey or the number of artifacts analyzed from a site. Statistical sampling is generally preferred since it is possible to specify the bias or probability of error in the results, but judgmental or intuitive samples are sometimes used.

Sandstone. A sedimentary rock composed of detrital materials generally composed of quartz and deposited by physical processes.

Scabland. An elevated tract of bare or shallow-soiled rocky land caused by denudation of the soil mantle.

Seasonality. Phenomena that show cyclic or repeated behavior according to the season.

Secondary contact recreation. Refers to the beneficial use of water involving recreation that results in limited body contact with the water, such as fishing and boating.

Secondary employment. In economics, the additional employment and income generated by the economic activity required to produce the inputs to meet the initial material requirements. The term often is used to include induced effects.

Secondary highways. Rural major collector routes that carry extensive local traffic.

Seismic. Pertains to the characteristics of an earthquake or earth vibrations including those that are artificially induced.

Seismic zone. An area of intense local seismicity.

Seismotectonic province. A region characterized by similar tectonic and seismic characteristics.

Sensitive Receptor. Areas defined as sensitive to noise, such as hospitals, residential areas, schools, outdoor theaters, etc.

Shale. A fine-grained sedimentary rock formed by the consolidation of clay, silt, and mud.

Sheet erosion. Erosion caused by a layer of water moving downward on a surface that has not yet developed channels, rills, or gullies. Uneven sheet erosion leads to the formation of rills and eventually gullies.

Short duration. Transitory effects of the proposed program that are of limited duration and are generally caused by construction activities or operations start-up.

Significance. The importance of a given impact on a specific resource as defined under the Council on Environmental Quality regulations.

Siltstone. A fine-grained sedimentary rock composed of silt-sized detritus.

Single-family housing. A conventionally built house consisting of a single dwelling unit occupied by one household.

Site. Any location where humans have altered the terrain or discarded artifacts.

Slough. A water-filled channel with little flow; often a former river channel.

Soil. A natural body consisting of layers or horizons of mineral and/or organic constituents of variable thickness and differing from the parent material in their morphological, physical, chemical, and mineralogical properties, and biological characteristics.

Soil association. A collection of soils found to geographically occur together.

Soil series. The lowest category used for differentiating groups of soils based on similar properties and characteristics. Soils are homogenous with respect to profile characteristics except for the A or surface horizon which may vary in texture.

Soil types. A category or detailed mapping unit used for soil surveys based on phases or changes within a series (e.g., slope, salinity).

Sole source aquifer. An aquifer which provides all or most of the potable water in an area and which has been specifically designated by the U.S. Environmental Protection Agency as provided for in the Safe Drinking Water Act. Projects which might affect a sole source aquifer are subject to special review procedures.

Sound exposure. Time integral of squared, A-frequency-weighted sound pressure over a stated time interval or event. The exponent of sound pressure and the frequency weighting may be otherwise if clearly so specified.

Sound exposure level. The level of sound accumulated over a given time period or event. It is particularly appropriate for a discrete event such as the passage of an airplane, a railroad train, or a truck. Sound exposure level is not an average, but a kind of sum. In contrast with average sound level which may tend to stay relatively constant even though the sound fluctuates, sound exposure level increases continuously with the passing of time. Technically, sound exposure level in decibels is the level of the time integral of A-weighted squared sound pressure over a stated time interval or event, with reference to the square of the standard reference pressure of 20 micropascals (0.0002 microbar) and reference duration of one second.

Sound pressure level. In decibels, 20 times the logarithm to base ten of the ratio of a sound pressure to the reference sound pressure. The reference for airborne sound is 20 microneutons per square meter.

Special assessment funds. One of the governmental fund types, used to account for financing of public improvements or services deemed to benefit the properties against which special assessments are levied (e.g., a charge for sidewalk construction, based on the linear footage of property frontage and a cost per linear foot for sidewalk construction).

Special district. Local government unit charged with provision of a specific service. Examples include water supply districts, lighting districts, and flood control districts. Generally, funding is from property taxes levied on the property benefiting from the service.

Special revenue funds. Used to account for the proceeds of special revenue sources (redistributed state-shared revenues such as gasoline taxes) that are legally restricted to expenditures for specific purposes (e.g., road construction); also supported in part by local property taxes.

Standard Industrial Classification. A federal scheme classifying industries by major lines of business grouped into categories of similar activity.

State Historic Preservation Officer. The official within each state, authorized by the state at the request of the Secretary of the Interior, to act as liaison for purposes of implementing the National Historic Preservation Act.

State-sensitive/State-recognized species. Plant and wildlife species in each state that are monitored and listed for purposes of protection.

Stratified site. An archaeological site exhibiting various strata or layers of occupation; usually implies a large site with a long occupation. The interpretation and analysis of strata are concerned with the original succession and age relations of layered materials and their individual properties (i.e., cultural materials are dated relative to each other by their position in stratigraphic layers).

Subsistence economy. The method of producing the food or goods necessary to provide a minimal standard of living, as opposed to a market economy in which a surplus is produced for redistribution.

Subsistence/settlement pattern. The distributional patterns of site types in relation to the environment that reflect a particular adaptation. Aspects of land use include the function, duration, and seasonality of individual sites.

Super "A" district. For purposes of qualifying for federal educational aid through P.L. 81-874 programs, a super "A" district is one where the school-age children of persons who live and work on federal property account for more than 20 percent of the district's enrollment.

Super "B" district. A school district where the school-age children of persons who work on federal property but live in the community account for more than 20 percent of the district's enrollment.

Surface collection. Systematic mapping and removal of artifacts from a site by means not involving excavation.

Survey. A systematic search for cultural resources; may include literature review and records search, but an on-ground field investigation is usually implied. Surveys may be conducted at different levels of intensity, ranging from a reconnaissance or spot check to an intensive inventory study.

Tax revenue. Revenue of local governments, generally based on the valuation of goods or services; includes property, sales, excise, and other miscellaneous taxes.

Taxon (pl.) Taxa. A taxonomic entity (species, subspecies, or variety) or a group of such entities.

Tectonic. Dealing with the regional assembling of structural or deformational features, and includes a study of their mutual relations, origin, and historical evolution.

Temporarily disturbed land. Surfaces disturbed during construction, but later regraded and/or revegetated; or those able to return to a natural state during the operational life of the program.

Temporary housing. Dwellings meant for occupancy on a temporary basis (generally for less than a month), such as rooms in hotels and motels.

Temporary Threshold Shift (TTS). A temporary shift in the minimum level of sound that humans can perceive with 100 percent recovery to the pre-noise exposure hearing acuity usually after a few hours. Also known as auditory fatigue.

Unique and sensitive habitats. Areas that are especially important to regional wildlife populations or protected species or which have other important biological characteristics (e.g., severe wintering habitats, nesting areas, and wetlands).

Universal Soil Loss Equation. An equation that estimates the amount of soil lost to rainfall erosion, commonly measured in tons per acre per year, based on factors such as rainfall intensity, K-factor, slope, and management practices.

Unsuccessful job seekers. Persons seeking employment in a given area in excess of employment demand.

Upland. Land that is topographically high.

Vision quest site. A sacred area used by American Plains Indians to seek supernatural guidance through fasting and prayer, usually located on a prominence (e.g., butte, mesa, or ridgetop).

Visual attributes. The arrangement of a particular landscape as formed by the variety and intensity of the landscape features and the four basic elements of form, line, color, and texture. These factors give an area the distinctive quality which distinguishes it from other areas.

Volume (Transportation). The total number of vehicles that pass over a given point or section of a roadway during a given time interval. Volumes may be expressed in terms of annual, daily, hourly, or subhourly periods.

Warhead. The nuclear device contained within a reentry vehicle. Does not include the detonating mechanism and associated equipment.

Water table. The upper surface of an unconfined body of groundwater.

Waterfowl. Bird species (e.g., ducks, geese, cranes) that live on or near water bodies.

Watershed. See Basin.

Watt. A unit of electrical power equal to 1/756th horsepower.

Weighted Average State Standard. Pupil to teacher ratio state standard by grade bracket, totaled and weighted by pupil distribution.

Well yield. The sustainable volume of water discharged from a well per unit of time, often expressed in gallons per minute.

Wetlands. Areas that are inundated or saturated with surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil, including swamps, marshes, bogs, and similar areas.

Wherry housing. A design of onbase family housing which was generally built before World War II.

Wind erodibility group. An assemblage of soils grouped by their similar properties which affect their resistance to soil blowing.

Wind erosion. Detachment, transportation, and deposition of loose topsoil by wind action.

Wind Erosion Equation. An equation that estimates the amount of soil lost as a result of wind erosion based on factors such as soil erodibility, climate, and vegetative cover.

Wye. Railroad intersection resembling the letter "y."

Year-round housing. Dwellings meant for occupancy throughout the year as distinguished from temporary housing (e.g., hotels and motels). Includes single-family structures, multifamily structures, and mobile homes.

Zoning. The division of a municipality (or county) into districts for the purpose of regulating land use, bulk of building, required yards, necessary off-street parking, and other prerequisites to development. Zones are generally shown on a map and the text of the zoning ordinance specifies requirements for each zoning category.

10-Year, 7-day low flow. Based on a statistical analysis of historical flow records, the lowest average flow over a period of seven successive days that would be expected to occur once during any 10-year period.

ACRONYMS

AADT	Average Annual Daily Traffic
ACHP	Advisory Council on Historic Preservation
A&CO	Assembly and Checkout
ADAL	Add/Alter
AFB	Air Force Base
AGE	Aircraft Ground Support
AICUZ	Air Installation Compatible Use Zone
APU	Auxiliary Power Unit
AQCR	Air Quality Control Region
AREFS	Air Refueling Squadron
AREFW	Air Refueling Wing
ATC	Air Training Command
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
COE	U.S. Army Corps of Engineers
DEIS	Draft Environmental Impact Statement
DFSC	Defense Fuels Supply Center
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DRMO	Defense Reutilization and Marketing Office
EIS	Environmental Impact Statement
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FHA	Federal Housing Administration
FTD	Field Training Attachment
FY	Fiscal Year
GFGC	Great Falls Gas Company
GFPS	Great Falls Public School
HML	Hard Mobile Launcher
HUD	US Department of Housing and Urban Development
ICBM	Intercontinental Ballistic Missile
LOI	Level of Impact
LOS	Level of Service
MAB	Missile Assembly Building
MOB	Main Operating Base
MPC	Montana Power Company
NAAQS	National Ambient Air Quality Standards
NCA	National Command Authority

NCO	Noncommissioned Officer
NCP	National Contingency Plan
NEDS	National Emission Data System
NRHP	National Register of Historic Places
ROI	Region of Influence
RV	Reentry Vehicle
SAC	Strategic Air Command
SATAF	Site Activation Task Force
SHPO	State Historic Preservation Officer
SIC	Standard Industrial Classification
TAS	Train Alert Shelter
TSP	Total Suspended Particulates
TTS	Training Train Shelter
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VA	Veterans Administration
WSA	Weapons Storage Area

Units of Measurement

acre-ft	acre-foot
acre-ft/yr	acre-foot per year
Bcf	billion cubic feet
C	degrees Celsius
dB	decibel
dBA	decibel on the A-weighted scale
DNL	Day-Night Sound Level
ft	foot
kg	kilogram
km	kilometer
kV	kilovolt
kWh	kilowatt-hour
LA	A-Weighted sound level
LApk	Peak A-Weighted sound level
Ld	Day sound level
Ldn	day/night equivalent noise level
Leq	Energy-equivalent continuous noise level
Lmax	Maximum A-Weighted Sound Level
Ln	Night sound level
LS	Lump Sum
MBtu	million British thermal units
Mcf	thousand cubic feet
MG	million gallons
MGD	million gallons per day
mi	mile
MMcf	million cubic feet
mph	miles per hour
MVA	megavolt-ampere
MW	megawatt

PM10	particulate matter
PN	personnel
ppm	parts per million
sq ft	square foot
sq km	square kilometer
sq mi	square mile
sy	squard yards
T/ac	ton per acre
T/ac/yr	ton per acre per year
T/day	ton per day
ug/m3	microgram per cubic meter

Chemical Abbreviations

CO	Carbon Monoxide
HCl	Hydrogen Chloride
NOx	Nitrogen Oxides
NO2	Nitrogen Dioxide
SOx	Sulfur Oxides
SO2	Sulfur Dioxide
VOC	Volatile Organic Compounds