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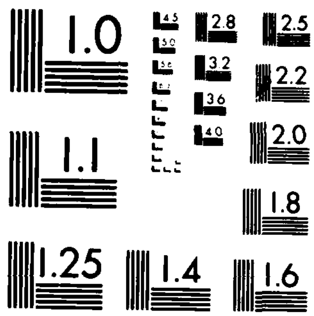

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USAF OEHL REPORT
83-111EA098BEE

FOR HEALTH & ENVIRONMENT

ENVIRONMENTAL ASSESSMENT OF A CENTRAL HEATING PLANT

K.I. SAWYER AFB MI 49843

FEBRUARY 1983

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USAF Occupational and Environmental Health Laboratory
Aerospace Medical Division (AFSC)
Brooks Air Force Base, Texas 78235

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William E Mabson

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Commander

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The purpose of this report is to identify the anticipated environmental effects which could be expected in a Central Heating Plant Conversion at K.I. Sawyer. These effects will determine whether an Environmental Impact Statement is required.

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USAF OCCUPATIONAL AND ENVIRONMENTAL

HEALTH LABORATORY

Brooks AFB, Texas 78235

ENVIRONMENTAL ASSESSMENT OF A

CENTRAL HEATING PLANT

K.I. SAWYER AFB MI 49843

FEBRUARY 1983

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Preface

In September 1982 the USAF Occupational and Environmental Health Laboratory (USAF OEHL) and HQ SAC, Department of Environmental Planning (DEV), contracted Engineering-Science to prepare an Environmental Assessment for a heating plant conversion at K.I. Sawyer AFB MI under contract No. F33615-80-D-4001, order No. 35. The primary project monitor for HQ SAC/DEV was Douglas S. Jansing. The contract project monitor for the USAF OEHL was Captain Robart W. Bauer.

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SUMMARY

CHAPTER 1

SUMMARY

A. BACKGROUND

Many Air Force boilers originally built to burn coal have been converted to burn oil or gas to meet environmental requirements. With the advent of the energy crisis in 1973, and shortages of natural gas and oil created by severe winters, the Air Force decided to return to the use of coal in its heating plants because coal is more plentiful and supply is more dependable. In March 1978, DOD issued Defense Energy Program Policy Memorandum (DEPPM) Number 78-2, Defense Energy Goals and Objectives. This DEPPM established the following goal: "To obtain at least 10 percent of DOD installation energy from coal, coal gasification, solid waste, refuse derived fuel, and biomass by 1985." Where existing boilers are less than 30 years old, a detailed study and life cycle cost analysis is performed to evaluate the option of conversion verses replacement of boilers and equipment. Boilers 30 years and older are replaced rather than undergo conversion. Where economical and feasible, the plant is designed for a second or alternate fuel to allow flexibility in operation.

Consistent with this policy, the Air Force is proposing to modify a high temperature water central heating plant at K. I. Sawyer AFB in Michigan. This modification includes decommissioning of three oil-fired boilers and construction of two new solid fuel-fired boilers. Under the National Environmental Policy Act, PL 91-190 (42 USC 4341), an environmental impact statement (EIS) must be developed for major Federal actions significantly affecting the quality of the human environment. The purpose of this document is to explore the environmental effects of the K. I. Sawyer AFB central heating plant project to determine whether an EIS is in fact necessary.

K. I. Sawyer AFB, located in the Upper Peninsula of Michigan about 10 miles south of Marquette, was activated in 1956. The site, like much of the Upper Peninsula, is heavily wooded, and (with the exception of Marquette and the Base itself) sparsely populated. Major industries in the area in addition to the Base are mining, higher education, tourism, forestry, and construction.

The central heating plant was originally constructed in 1955 (Boilers 1 and 3). Expansions followed in 1958 (Boilers 4 and 5) and 1959 (Boiler 6). All of the five boilers are high temperature water boilers. Boilers 1 and 3 were built as coal-fired units with spreader stokers and dumping grates, while Boilers 4, 5 and 6 were built as coal-fired units with spreader stokers, pulsating grates and intermittent front ash discharge. In 1973, Boilers 1, 3, and 4 were converted to #6 fuel oil.

The three oil-fired boilers (1, 3, and 4) are rated at 31.2 MMBtu/hr, 31.2 MMBtu/hr, and 30.0 MMBtu/hr. Boilers 5 and 6 are both rated at 30.0 MMBtu/hr. Therefore, the current total for the plant is 152.4 MMBTu/hr.

B. PROPOSED ACTION AND PRIMARY ALTERNATIVES INVESTIGATED

The Air Force plans to decommission all three oil-fired boilers, to convert the other two coal-fired boilers to a dual fuel (coal and wood chip) capability, and to construct two new dual fuel 60 MMBtu/hr boilers. The new boilers would be equipped with a traveling grate spreader stoker and a front ash discharge grate. Wood chips will be burned to the greatest extent possible, but a mix between wood and coal combustion is expected.

Fuel handling systems will be modified and expanded. A new 50 ton/hr coal handling system and a 40 ton/hr wood chip handling system will be installed. The coal storage pile will be expanded to 14,000 tons and will be surrounded by a perimeter run-off collection ditch. The existing coal bunker storage capacity will be expanded to 750 tons. The new wood chip handling system will be separate from the coal handling system, and a covered wood chip storage area will be where the fuel oil tanks currently are located. A new ash handling system, with a mechanical exhauster and a dustless unloader, will also be included.

Other alternatives have also been investigated. Current plans call for operation with both coal and wood chips. As primary alternatives, total coal and total wood operation (Alternatives 1 and 2 respectively) have been considered and analyzed. The possibility of taking no action has also been analyzed (Alternative 3). In the "no action" alternative, a 25% increase in heating demand to 694,000 MMbtu/yr is assumed.

C. DESCRIPTION OF WASTE STREAMS

There are three primary types of waste streams: air pollutant emissions, liquid waste discharges, and solid wastes. Emissions include stack emissions (comprised of many different types of pollutants) and fugitive particulate emissions. Fugitive emissions can result from normal operating activities around the plant site (e.g., coal handling), and can also result from construction actvities related to the proposed project. Potential liquid wastes resulting from plant operations include sanitary and floor drain wastes, boiler blowdown water, run-off from fuel piles, ash handling water, non-contact cooling water, and minor oil spills. Solid wastes include the and bottom ash generated.

D. ENVIRONMENTAL IMPACTS

The anticipated environmental impacts of the proposed action and alternatives are summarized as follows:

- Land Requirements and Physical Features

Construction activities associated with the proposed action would be confined to the immediate vicinity of the existing heating plant. The coal pile would not be expanded, and the wood storage area will occupy the site where the fuel oil storage tanks are now located. Except for the lack of construction in the "no action" alternative, there are no significant differences among the proposed action and the alternatives.

- Earth Resources and Solid Waste Disposal

The implementation of the proposed action will cause only a minor disturbance to the soils during construction. Only a minimal amount of earthwork will be necessary since the project areas are level with little or no change in contour. The minor soil erosion which may occur can be mitigated to a great extent by common abatement techniques such as placing hay bales or mulch in areas of potential erosion to trap run-off; covering stockpiles of soils or dry materials; and revegetating or covering exposed areas as soon as possible. The operation of the heating plant is not expected to cause any soil degradation.

Fly ash and bottom ash are the major solid wastes generated from the operation of the central heating plant. Coal ash currently generated at the facility has been disposed of in the base sanitary landfill. Ash generation can be expected to increase with the proposed action.

There are three alternatives for disposing of the ash: external sales, landfill off the Base, and landfill on the Base. Given the limited market for ash materials, landfill disposal is the most likely. If the new Marquette County regional landfill is located at a nearby site, the Air Force could economically haul ash to this facility. In this case, Marquette County could use the ash as part of the daily landfill cover as a substitute for native cover material. If the ash were to be disposed of on the Base, additional land would have to be devoted to landfill operations.

The proposed action and alternatives differ in terms of the total amount of ash generated. Alternative 1 (all coal) produces the largest quantity of ash, while Alternative 3 (no action) produces the least amount of ash. Minor amounts of fugitive particulates will be generated from the conveying and unloading of the ash. Potential leachates generated from landfill disposal of ash may contain trace metals, calcium, potassium, sodium sulfates, and anhydrous oxides.

- Water Quality

Implementation of the proposed action will not change the types of wastewaters generated from the heating plant operations. However, the methods for treating and discharging these wastewaters will in some cases be modified.

As mentioned above, the main effluents are:

- floor drain wastes from maintenance operations
- boiler blowdown water (periodic)
- sanitary wastes from plant showers, lavatories, and toilet facilities
- non-contact cooling water
- coal pile run-off from coal storage outside the plant
- minor oil spills from storage outside the plant
- ash handling water from washdown operations

Leachate from the ash (if disposed in a landfill) could also affect water quality.

The current plan is to discharge sanitary wastes, floor drain wastes, and boiler blowdown water to the wastewater treatment plant. Even when all of these waste streams are combined, the volume of the additional wasteload to the wastewater treatment plant is very low. As a result, the effluent characteristics should not change significantly.

The heating plant utilizes non-contact cooling water which is supplied from the Base water supply system. The water passes through the system one time and is discharged to the sanitary sewer system. No additional chemicals are added to the cooling water, and hence the water does not contain any contamination which would impact the wastewater treatment plant. It is estimated that 8,000-10,000 gallons per day of cooling water pass through the heating plant. The volume is not expected to change substantially under any of the proposed modifications.

Coal pile run-off, combined with small quantities of ash handling water, will be directed to an unlined perimeter ditch. Coal pile run-off may affect ground-water quality through an increase in total dissolved solids, acidity, conductivity, sulfate, and heavy metals. With respect to the National Interim Primary Drinking Water Standards (which are identical to the maximum concentration of constitutents for ground water protection), selenium and lead are the parameters of most concern. Run-off from the wood pile would not be expected to cause any significant contamination problems since these same materials are typically exposed to similar environmental elements under natural conditions.

Typical concentrations of a variety of parameters found in ash leachate have been determined through leachate extraction tests of coal ash and actual samples collected from landfill facilities. As a result of the nominal concentrations identified, the impact to ground-water quality is expected to be minimal.

o Air Quality

There are a variety of emissions and pollutants which result from this project. Stack emissions result from fuel combustion, ongoing fugitive particlate emissions result from material handling, and temporary fugitive particulate emissions result from construction and dismantling activities. Federal and State authorities have promulgated comprehensive regulations which mandate control over a broad range of these emissions. The proposed action is designed to meet all of the applicable regulations.

With the exception of the no action alternative, the proposed action and its alternatives provide a spectrum of coal/wood usage: 100% coal/0% wood; 68% coal/32% wood (the proposed action); and 0% coal/100% wood. Use of coal tends to increase sulfur dioxide emissions, while use of wood tends to increase nitrogen oxides emissions. However, no alternative produces either a violation of the National Ambient Air Quality Standards or an exceedance of Prevention of Significant Deterioration increments. As a result, it can be concluded that this project will result in no detrimental health effects and no significant air quality degradation.

o Biotic Environment

The proposed modifications to the heating plant involves construction which would occur in areas of the base which have previously been developed. Therefore, the project is not expected to have an impact on any existing wildlife habitats. Threatened and endangered plant and animal species which have been recorded as inhabiting Southeastern Marquette County are considered to be distant enough from the proposed project area to be out of danger. No detrimental impacts to the biota of the area are expected to occur as a result of any of the waste streams generated from the facility. The impacts from the proposed action and those of the alternatives will not differ significantly.

o Resource Characteristics

Use of coal represents an irretrievable commitment of resources. In contrast the use of wood chips is a renewable resource. There is an abundant supply of wood available within a convenient distance from the Base. The proposed action provides the additional advantage of virtually eliminating the use of oil which is a nonrenewable resource.

o Impact on Growth and Development and Human Resources of the Area

With respect to construction activities, the proposed action produces the greatest amount of additional regional revenue. Regional revenue as a result of operations is greatest when wood chips are used exclusively as the plant's fuel. Effects on regional transportation systems will be minimal under all of the alternatives.

E. MITIGATING MEASURES

There are a number of mitigating measures the Air Force is now considering to minimize the environmental impact of the plant. Stack particulate emissions will be almost eliminated as a result of the planned baghouse. SO_2 under the proposed action is already low due to the use of low sulfur coal, but it could be further reduced by flue gas desulfurization. This option, however, entails greater capital and operating costs and an increase in the amount of solid waste generated. With respect to fugitive particulate emissions, the coal storage pile represents the greatest source. Full or partial enclosure of the pile could minimize these emissions, and could also minimize coal pile run-off.

Mitigating measures pertaining to the impacts associated with wastewater generated from the operation of the heating plant relate primarily to the improvements of the wastewater treatment plant. K.I. Sawyer AFB has prepared a detailed evaluation of alternatives for such improvements.

A variety of measures are available to mitigate the effects of ash disposal. Proper covering of transport trucks to reduce fugitive emissions, and proper design and operation of the landfill to control leachate and decrease the potential for ground-water contamination are the most important to be considered.

F. AIR FORCE CONTACT

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CHAPTER 2

OVERVIEW OF PROPOSED ACTIONS AND ALTERNATIVES

CHAPTER 2

OVERVIEW OF PROPOSED ACTION AND ALTERNATIVES

A. INTRODUCTION

The Air Force is proposing to modify a high temperature water central heating plant at K. I. Sawyer AFB. This modification includes decommissioning of oil-fired boilers and constructing two new solid fuel-fired boilers. In this regard, the Air Force is dedicated to meeting National energy goals while conserving natural and human resources.

In 1970, the U.S. Congress passed the National Environmental Policy Act (NEPA) PL 91-190 (42 U.S.C. 4341). NEPA generally requires that the agencies of the Federal government make available information on the environmental impacts of its actions. Section 102(2) requires an environmental impact statement (EIS) for major Federal actions significantly affecting the quality of the human environment.

The Council on Environmental Quality (CEQ) has promulgated regulations governing this process (40 CFR 15001508). These regulations are based on NEPA and Executive Orders 11514 and 11991 which provide Presidential direction to Federal agencies to implement NEPA's requirements. In its regulations, CEQ directs that an environmental assessment (EA) be prepared when it is unclear whether an EIS is required. The Federal agency in question then is to utilize the EA to determine whether an EIS is in fact necessary (40 CFR 1501.4). Accordingly, the Air Force has decided that an EA on the K. I. Sawyer AFB central heating plant should be produced.

B. BACKGROUND AND EXISTING CONDITIONS

K. I. Sawyer AFB, located in the Upper Peninsula of Michigan about 10 miles south of Marquette, was activated in 1956. The site, like much of the Upper Peninsula, is heavily wooded, and (with the exception of Marquette and the Base itself) sparsely populated. Major industries in the area in addition to the Base are mining, higher education, tourism, forestry, and construction.

The central heating plant was originally constructed in 1955 (Boilers 1 and 3). Expansions followed in 1958 (Boilers 4 and 5) and 1959 (Boiler 6). All of the five units are high temperature water boilers. Boilers 1 and 3 were built as coal-fired units with spreader stokers and dumping grates, while Boilers 4, 5 and 6 were built as coal-fired units with spreader stokers, pulsating grates and intermittent front ash discharge. Each boiler is equipped with a 82.0-foot tall, 4.3-foot diameter stack. In 1973, Boilers 1, 3, and 4 were converted to burn No. 6 fuel oil. The coal pile (approximately 11,000 tons) is located just to the northwest of the plant. To the southeast of the coal pile are two fuel oil storage tanks (with a total capacity of 367,000 gallons) which are used to supply Boilers 1, 3, and 4.

The oil-fired boilers are rated at 31.2 MMBtu/hr, 31.2 MMBtu/hr, and 30.0 MMBtu/hr. Boilers 5 and 6 are both rated at 30.0 MMBtu/hr. The current total therefore for the plant is 152.4 MMBtu/hr. To date, the coal burned is Eastern bituminous with a maximum dry sulfur content of 1.5% and a minimum dry heat content of 14,000 Btu/lb. (In fact, coal with an average of 13,420 Btu/lb and 0.98% sulfur was used during 1980-81.) No. 6 fuel oil for these boilers has averaged 145,510 Btu/gal. Historical totals of coal and oil used are presented in Table 2.1.

During the three summer months there are no coal deliveries, but during the remainder of the year approximately 1400 tons per month is delivered. The coal is delivered at a rate of about thirty trucks per month. These deliveries are usually made in the late afternoon or evening, loaded into a track hopper or deposited into the coal storage area. Fuel oil is delivered by trucks with a 12,000-gallon capacity. During the warmer half of the year, the Base receives approximately four deliveries a month, and during the remainder of the year there are fifteen per month. Fuel oil deliveries may come at any time during the workday.

Coal is transported from the track hopper by a flight feed conveyer to a bunker elevator, which is connected to another conveyer which transfers the coal to the 370-ton capacity coal bunker. Current capacity of this operation is 30 tons/hr. The coal is then discharged from the bunker to the stoker hopper. The fuel oil storage tanks are connected to the boilers by underground pipes. Two pumps inside the plant keep a constant flow of fuel oil moving to the boilers.

Ash is transferred to a bin by automatic shakers attached to each boiler. A vacuum system then moves the ash to a storage silo. Ash is temporarily stored in the silo adjacent to the plant.

Ash is hauled to the Base landfill for disposal with one-and-a-half truckloads per day going to the landfill three times a week on the average during the summer. The rate is four truckloads per day, three times a week during the remainder of the year. Approximately 840 tons of ash per year is currently generated from the operation of the heating plant, with a peak generation of 33 tons per week.

All existing boilers utilize mechanical dust collectors. Boilers 5 and 6 also have electrostatic precipators. This hardware is designed to control combustion-related particulate emissions, while use of low sulfur coal minimizes sulfur dioxide emissions. At this time there is no control of fugitive emissions from the coal pile.

TABLE 2.1

SUMMARY OF PAST TEN YEARS OF
FUEL USAGE AT K. I. SAWYER AFB (Ref. 7)

Year	Oil Consumption (Gallons)	Coal Consumption (Tons)	Total Heat Input (Million Btu)	Degree Heating Days
1981	2,309,032	7,258	530,806	8,914
1980	1,692,899	10,979	540,993	9,436
1979	2,445,557	7,419	554,990	10,187
1978	2,029,235	9,708	552,649	10,030
1977	2,614,682	5,357	522,359	9,252
1976	1,533,528	11,707	520,280	10,290
1975	1,746,105	8,672	486,832[a]	9,509
1974	2,269,760	6,428	502,800[a]	10,005
1973	1,082,572	12,553	494,448[a]	9,312
1972	---	18,637	500,217[a]	10,914

[a] Calculated from fuel use data based on heating values of 13,420 Btu/lb of coal and 145,510 Btu/gal of No. 6 fuel oil.

Waste streams resulting from the present operation of the heating plants are identified in Tables 2.2 and 2.3. Blowdown waters and ash handling water are directly discharged to permeable soils adjacent to the plant. Sanitary wastes, floor drains, and non-contact cooling water are discharged to the wastewater treatment plant. Coal pile run-off is allowed to percolate into the adjacent soil.

C. PURPOSE AND NEED

Many Air Force boilers originally built to burn coal have been converted to burn oil or gas to meet environmental requirements. With the advent of the energy crisis in 1973, and shortages of natural gas and oil created by severe winters, the Air Force decided to return to the use of coal in its heating plants because coal is more plentiful and supply is more dependable. In March 1978, DOD issued Defense Energy Program Policy Memorandum (DEPPM) Number 78-2, Defense Energy Goals and Objectives. This DEPPM established the following goal: "To obtain at least 10 percent of DOD installation energy from coal, coal gassification, solid waste, refuse derived fuel, and biomass by 1985."

As boilers are reviewed for possible conversion or replacement, the burning of alternate fuels is studied during the design concept study. This study includes economics, feasibility, reliability, availability and life cycle cost of burning an alternate fuel (either by itself or in conjunction with coal). Where economical and feasible, the plant is designed for a second or alternate fuel to allow flexibility in operation.

Where existing boilers are less than 30 years old, a detailed study and life cycle cost analysis is performed to evaluate the option of conversion verses replacement of boilers and equipment. Boilers 30 years and older are replaced rather than undergo conversion.

Two of the existing three oil-fired boilers at K. I. Sawyer AFB are now approaching 30 years of age. The proposed action has been developed as a result of a thorough investigation of many alternatives.

D. PROPOSED ACTION AND ALTERNATIVES

1. Proposed Action

The Air Force is proposing to:

- Decommission the existing oil-fired boilers. Waste asbestos will be safely disposed of, and the oil storage tanks will be removed.

- Install two new 60 MMBtu/hr boilers designed to fire both coal and wood chips, plus related support equipment as an addition to the existing central heating plant. The boilers will be arranged for a traveling grate spreader stoker with a front ash discharge grate. The stoker will be equipped with a combination feeder to accommodate the burning of coal and wood chips.

TABLE 2.2

SUMMARY OF EXISTING EMISSIONS

Pollutant	Tons/Year
Total Suspended Particulates (Stack)	32
Total Suspended Particulates (Fugitive)	1.67
Sulfur Dioxide	352
Carbon Monoxide	12
Hydrocarbons	4
Nitrogen Oxides	124
Lead	0.0064
Arsenic	0.0132
Beryllium	0.0016
Cadmium	0.0072
Manganese	0.0128
Mercury	0.0004
Nickel	0.0952
Vanadium	0.2464

TABLE 2.3

ESTIMATED QUANTITIES OF EXISTING
LIQUID AND SOLID WASTES

Waste Streams	Quantities
Sanitary wastes	1000 gal/day
Floor drain wastes	100 gal/day
Blowdown water	700 gal/operation, less than 20 operations/year
Cooling water	8,000-10,000 gal/day
Run-off from coal pile	269,000 gal/day maximum (10-yr, 24-hr storm event)
Ash handling water	100 gal/day
Potential oil spills	367,000 gal maximum (capacity of storage tanks)
Total ash	2.3 tons/day

- Retain the existing coal-fired units and modify them so that they may also burn wood chips.

- Retain the existing coal pile, and expand the amount stored to 14,000 tons (a six-month supply). The same storage area will be used, and there will be an unlined perimeter ditch to collect coal pile run-off.

- Install a new coal handling system with a capacity of 50 tons per hour. The coal handling system will consist of a track hopper, inclined belt conveyers, a crusher, an overbunker belt conveyor complete with tripper, an underbunker conveyor, automatic coal scales, and nonsegregating conical distributors to serve all four boilers.

- Expand the existing coal bunker to a storage capacity of 750 tons.

- Install a new wood chip handling system with a capacity of 40 tons per hour. Wood chips will be stored in an area of approximately 40,000 square feet (based on a 7-day supply), and will be sheltered from the elements. The wood chip handling system will consist of two parts, the unloading system and the conveying system from the wood chip storage area to the heating plant. The wood chips will be delivered in semi-trailers with 30-ton capacity. The unloading system will consist of a hydraulic truck dumper complete with an electronic scale and control house. After storage, wood chips will be bulldozed to a feeder pit. The conveying system to the heating plant will consist of an inclined belt conveyor and scraper flight conveyor discharging into live bottom storage bins.

- Install a new ash handling system consisting of a new ash storage silo with mechanical exhauster and dustless unloader to be located at the northeast corner of the extended heating plant. The silo will have a net storage capacity of 3,300 cubic feet which relates to approximately 80 tons of ash from coal firing and 33 tons of ash from wood chip firing. The silo will be designed such that it would be charged with nitrogen or other inert gas to prevent explosions from possible glowing embers conveyed to the silo from wood chip ash. Explosion relief panels with safety cages will also be provided on the silo. Ash will then be disposed of in an adjacent area to the current landfill or in the proposed Marquette County regional landfill.

- Install a negative pressure reverse air baghouse to serve the two new boilers. Each baghouse unit will be designed to handle a gas flow of approximately 42,400 ACFM.

- Install a mechanical single pass dust collector ahead of each baghouse. These collectors will consist of a multiplicity of cyclones and will act as cinder traps to protect the bags in the baghouses.

- Install a new 80-foot tall, 4.3-foot diameter stack.

For the purpose of this analysis, it is assumed that the type of coal coal used in 1980-81 (13,420 Btu/lb) will be burned. Wood chips at 5100 Btu/lb (wet) are assumed for wood combustion. (Comparable dry wood chips would have a heat content of 8300 Btu/lb). Given the availability of wood chips, it is desirable to maximize the use of this fuel. As a conservative assumption, only about a third of the plant's Btu requirements is projected to be met by wood chips. A 68%/32% Btu ratio of coal to wood chips was assumed for all calculations concerning the proposed action. Tables 2.4 and 2.5 represent expected waste streams for the proposed action and the alternatives identified below.

2. Alternative 1 - 100% coal

For this alternative, coal would provide 100% of the fuel requirement. Since wood chips are not intended to supplement the fuel supply, no ancillary wood chip handling or storage equipment would be necessary. The coal storage pile and all other parts of the design would remain the same.

3. Alternative 2 - 100% wood

For this alternative, wood chips would be utilized to provide 100% of fuel requirements. No coal would be used and hence the existing coal storage pile would no longer be required. The size of the wood chip storage pile and all other parts of the design would remain the same. The implementation of this alternative is dependent on the availability and cost of wood chips.

4. Alternative 3 - No action

As discussed in this chapter, the current operation would continue. However, an increase in fuel requirements from current operations is assumed to occur to meet an increase in total annual heating demand to 694,000 MMBtu, which is 125% of baseline demand (1979).

E. ALTERNATIVES ELIMINATED FROM ANALYSIS

There are a number of additional alternatives which, while theoretically possible, are not appropriate for the central heating plant at K. I. Sawyer AFB. They are as follows.

1. Waste Fuel Combustion

The burning of waste lubricating oil (jet fuels and similar wastes) has been tried successfully by the Air Force at other bases. However, the burning of such fuels would not be practical because of the low quantities generated at K. I. Sawyer AFB. In addition, depending on the composition of such fuels, hazardous emissions could also be potential problems. Moreover, the Air Force advocates the recycling and recovery of such oils and fuels whenever possible. For all of these reasons, the combustion of waste fuel as a substitute for the proposed action has been rejected.

TABLE 2.4

SUMMARY OF EMISSIONS FROM THE
PROPOSED ACTIONS AND ALTERNATIVES

Pollutant	Emissions[a] in Tons Per Year			
	Proposed Action	Alternative 1	Alternative 2	Alternative[b] 3
Total Suspended Particulates[c] (Stack)	8	10	2	38
Total Suspended Particulates (Fugitive)	4	6	1	2
Total Suspended Particulates (Construction)	2	2	2	-
Sulfur Dioxide[d]	343	481	51	443
Carbon Monoxide	40	26	68	16
Hydrocarbons	31	13	68	6
Nitrogen Oxides	241	194	340	160
Lead	0.0014	0.0021	-	0.009
Arsenic	0.0264	0.0391	-	0.0155
Beryllium	0.0003	0.0005	-	0.0018
Cadmium	0.0090	0.0129	-	0.0104
Manganese	0.007	0.011	-	0.0162
Mercury	0.0001	0.0001	-	0.0005
Nickel	0.0003	0.0004	-	0.112
Vanadium	0.0005	0.008	-	0.3082

a Refers to controlled emissions, i.e., emissions including the effect of proposed air pollution control equipment.
b Assumes a 25% increase in the existing annual heat requirement to account for projected growth at the Base.
c Assumes an ash content of 6.1% for coal.
d Assumes a sulfur content of 0.98% for coal and 1.13% for fuel oil.

TABLE 2.5

ESTIMATED QUANTITIES OF POTENTIAL
LIQUID AND SOLID WASTES FROM
THE PROPOSED ACTIONS AND ALTERNATIVES

Waste Streams	Quantities
Sanitary wastes	1000 gal/day
Floor drain wastes	100 gal/day
Blowdown water	700 gal/operation, less than 20 operations/yr
Cooling water	8,000-10,000 gal/day
Run-off from coal pile	269,000 gal/day maximum (10-yr, 24-hr storm event)[a]
Ash handling water	100 gal/day
Potential oil spills	Less than 1000 gal maximum
Total ash	Proposed Action - 4.1 tons/day Alternative 1 - 4.1 tons/day Alternative 2 - 3.7 tons/day Alternative 3 - 2.9 tons/day

[a] Except for Alternative 2 which includes no coal pile.

2. Purchased Heat

Purchased heat is a possibility, but it is likely that such purchase could not satisfy the heating requirements of the base. Accordingly, this option has been rejected.

3. Electricity-Produced Heat

Producing heat by use of electricity is prohibitively expensive. The policy of the Office of the Secretary of Defense also clearly discourages the use of electric heat.

4. Nuclear Energy-Produced Heat

It has been concluded that nuclear energy would be impractical for use at K. I. Sawyer AFB. Numerous difficulties exist including extremely long lead times for approval of construction and operation, and the lack of a capability in the Air Force for the foreseeable future to run such plants.

5. Geothermal Heat

Geothermal energy has been rejected as an energy source because K. I. Sawyer AFB is not in a geothermal area and it does not have access to external geothermal energy.

6. Solar Heat

Although solar heat is theoretically possible, there are a number of problems at K. I. Sawyer AFB that make it impractical. Primary among these problems are K. I. Sawyer AFB's geographic location and severe climate which make gathering solar energy (especially in the winter) difficult if not impossible to depend upon. It is believed that total duplication in nonsolar energy production capability would be necessary to ensure adequate heat, thus making the advantages of a solar energy system negligible.

CHAPTER 3

AFFECTED ENVIRONMENT

CHAPTER 3

AFFECTED ENVIRONMENT

A. NATURAL ENVIRONMENT

1. Geography and Geology

K. I. Sawyer AFB is located in the central portion of the Upper Peninsula of Michigan, situated approximately 10 miles south of Lake Superior and the city of Marquette and 50 miles north of Lake Michigan. The Base is located in a rural sector of Marquette County (Figure 3.1).

The study area is characterized as the Superior Upland physiographic province. The major physiographic characteristics consists of a submaturely dissected, recently glaciated peneplain formed over crystalline bedrock (Ref. 8). Upland areas east of the base exhibit extensive dissection while low areas have a gently rolling to nearly flat appearance. Flat areas have a pitted appearance due to the presence of numerous kettles. Ponds and lakes are common surface water features. Area streams are well developed within narrow channels. Local relief is generally the result of erosional activity or stream channel development.

a) Topography

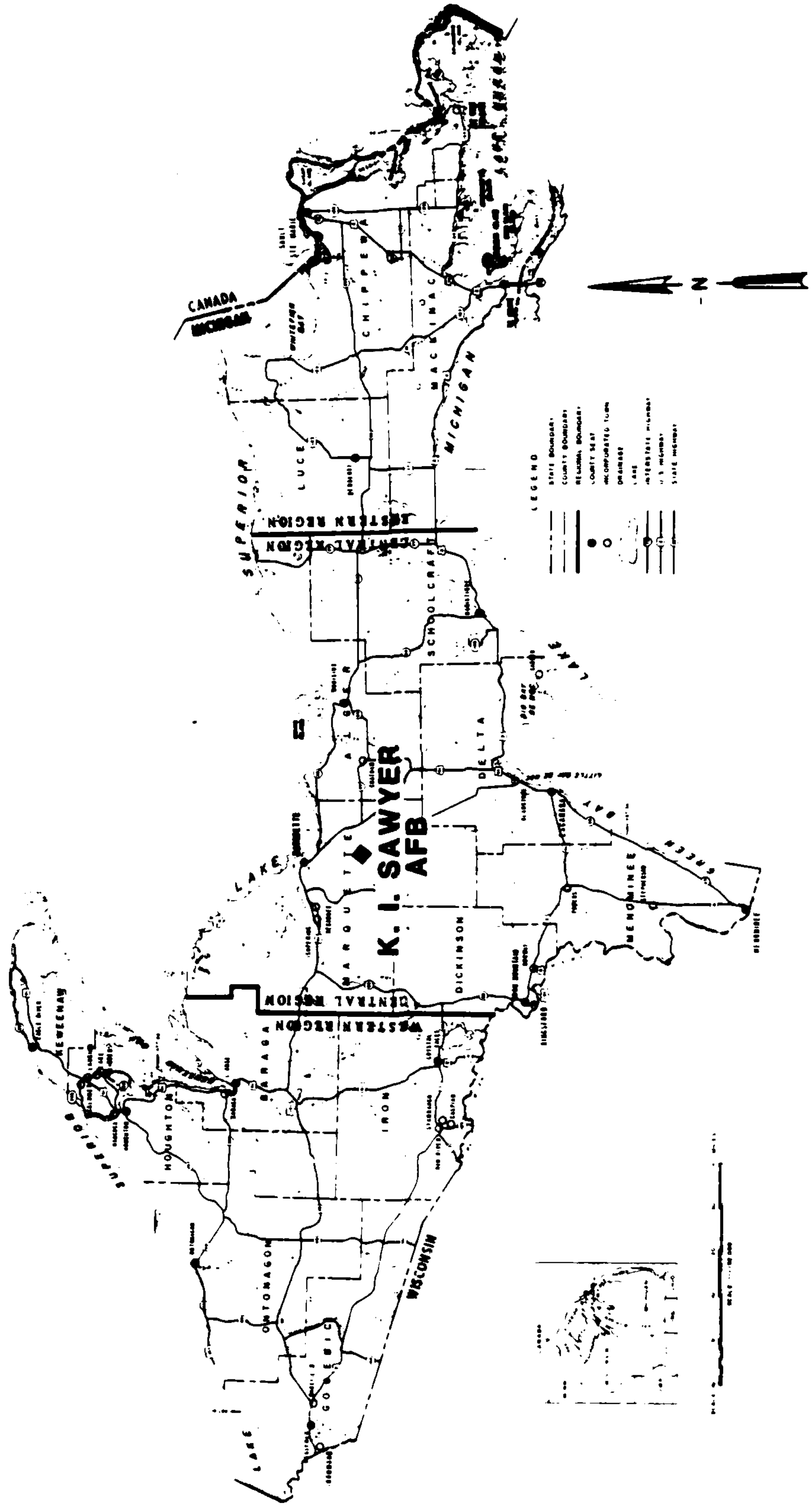
Upper Peninsula topography varies considerably. Elevations range from 602 feet National Geodetic Vertical Datum (NGVD) at Lake Superior to 1873 feet NGVD at Summit Mountain. At K. I. Sawyer AFB, surface elevations range from approximately 1,090 feet along the Silver Lead Creek stream channel at the Voodoo Avenue bridge to 1,273 feet immediately northwest of the main runway's north end (base information datum unknown). The most pronounced relief within the study area is present at the ski area, where surface elevations vary some 205 feet and along the relatively steep slopes that define the channel of Silver Lead Creek.

b) Drainage

K. I. Sawyer AFB is located within the Chocolay River Basin which drains north to Lake Superior. The base is situated very near to the divide between the Chocolay River Basin and the Escanaba River Basin

FIGURE 3.1

K. I. SAWYER AFB
LOCATION MAP



SOURCE: MICHIGAN'S UPPER PENINSULA RESOURCE CONSERVATION AND DEVELOPMENT PROJECT, U.S.D.A. SOIL CONSERVATION SERVICE, 1973 which drains south to Lake Michigan via the East Branch of the Escanaba River located about three miles west of the Base. Silver Lead Creek is the only stream which flows through the Base. The creek extends approximately 3.5 miles through the southeast portion of the Base and is a tributary to the West Branch of the Chocolay River which ultimately flows into Lake Superior. The Base area includes one five-acre lake (Little Trout Lake), located in the southeast section of the Base, two ponds totalling two acres, located in the Base housing area, and a seven-acre wetland area also located in the southeast section of the Base.

The storm drainage system at the Base consists of ground absorption or overland flow into drainage ditches and diversion structures. The developed areas of the Base are drained by a network of pipes to ground surface outfalls located throughout the area (Ref. 30).

c) Surface Soils

General soils information of the K. I. Sawyer AFB area has been reported by the U.S. Soil Conservation Service (Ref. 35). Detailed soils data for the K. I. Sawyer AFB area showed that the pH ranged from 4.9 to 6.3. It was also determined that the soils were low in magnesium, boron, phosphorus and potassium. A calculated ion exchange capacity of 2 was derived for each of four soil samples collected on the Base (Ref. 36). Generally level zones of the study area are dominated by Rubicon association soils. These soils are characterized by excessively drained granular materials formed in sandy sediments or till, outwash, lake plains, moraines, beach ridges and sand dunes (Ref. 35). This soil unit may reach a thickness of 60 inches and consists primarily of poorly graded or silty sands. Unit permeabilities are high, ranging from 6 to 20 inches per hour, while available water storage capacities are low. This unit is subject to erosion, especially along exposed slopes. The dominant slope range of this unit varies from 0 to 18 percent.

Hilly upland areas of the eastern portion of the Base are dominated by the Keweenaw-Munising-Kalkaska Association (Ref 35). These tend to be moderately well-drained, loamy soils and sandy soils. Permeabilities and available water capacities range from moderately low to high. This unit is known to be susceptible to erosion, which is the primary method by which local topographic relief has been formed, in some cases, as much as 200 feet. The dominant slope range of this unit varies from 2 to 18 percent.

d) Geology

The geology of the study area has been published by several investigators (Ref. 2,3,4,42). A brief review of their work has been summarized in the following discussion to support this investigation.

1. Consolidated Units

The consolidated rocks underlying the region have been reported to be igneous rocks of Precambrian age and sedimentary rocks of Cambrian age. The Precambrian rocks are metamorphic and igneous, consisting of quartzite, schist, gneiss, volcanics, granite, diorite and other igneous materials (Ref. 14,20). Cambrian rocks are primarily dolomitic and glauconitic sandstones (Ref. 3).

Most of the rocks found in the region have been subjected to a variety of deformational events throughout geologic time. The largest structural feature of the region, formed through deformation, is a syncline (a trough) extending from the City of Marquette westward for several miles. Locally, past deformational events may be manifested as large scale folds, faults, fracturing and fissuring of bedrock.

2. Unconsolidated Units

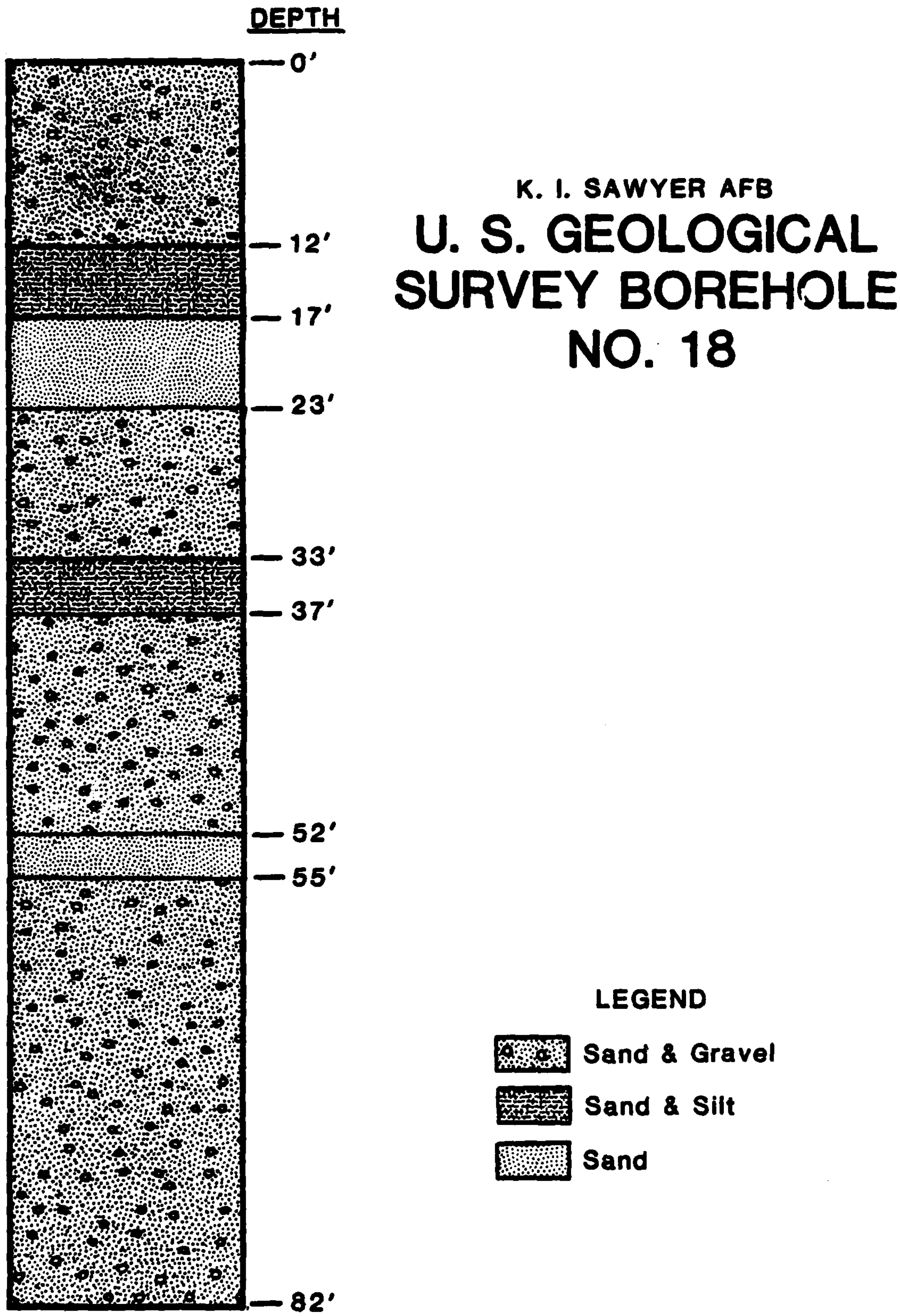
The single unconsolidated geologic unit of significance is Pleistocene age glacial outwash. The outwash, deposited by the flowing glacial meltwaters, characteristically consist of reasonably well sorted, coarse-grained particles, usually with few fines (particles passing a number 200 sieve). Particle gradation may vary remarkably according to locality, from boulder to sand size. The unit is known to be at least 150 feet thick at K. I. Sawyer AFB (Ref. 28,30). The lithology of the unconsolidated materials is graphically depicted as Figure 3.2., the log of U.S. Geological Survey Borehole No. 18. This boring was drilled as part of a continuing investigation of study area hydrogeology. Borehole No. 18 is located west of the Base boundary, near Michigan Route 553. A review of the material descriptions noted on the log indicate that sandy soils predominate. Alternating sand and silt and sand and gravel layers are noted; the stratigraphic trend indicates a depositional system that coarsens with depth.

2. Hydrology

a) Ground-Water Hydrology

Ground-water hydrology in the study area has been documented in several reports (Ref. 5,26,42). Additional information was obtained from a continuing U.S. Geological Survey investigation (Sands Plain Hydrogeology) presently being conducted in the general vicinity of the installation.

K. I. Sawyer AFB is located within the Sands Plain groundwater resource areas of Upper Peninsula Michigan (Ref. 14). Ground-water resources of the region are typically derived from unconsolidated glacial sediments or underlying rock aquifers. The major source of recharge to local acquifers consists of precipitation falling directly on the exposed unsaturated portion of the aquifer, or percolation through a communicating unit in contact with the acquifer.



NOTE: Borehole No. 18 is located West of the base boundary, near Michigan Route 553.

SOURCE: U.S. GEOLOGICAL SURVEY

Most of the installation area appears to lie within a ground-water recharge zone. This is supported by examination of the Base's geomorphic setting. The main Base is constructed on a generally level, sandy upland where typical ground elevations exceed the local surface water elevations by tens of feet. The regional water table is present at a moderate depth of 5 to 40 feet, however; site specific studies at K. I. Sawyer AFB have indicated that the water table depth may be greater (90 or 100 feet) at some locations on Base (Ref. 12).

Two distinct hydrogeologic units have been identified at the Base, which correspond directly to the previously discussed geologic units: consolidated rock and glacial outwash. A brief summary of the hydrologic characteristics of each unit follows:

1) Glacial outwash: This unit consists of stratified sands or sands and gravels with somewhat silty or clayey layers present at depth. The outwash is approximately 200 feet thick, varying locally and is the most reliable aquifer of the region.

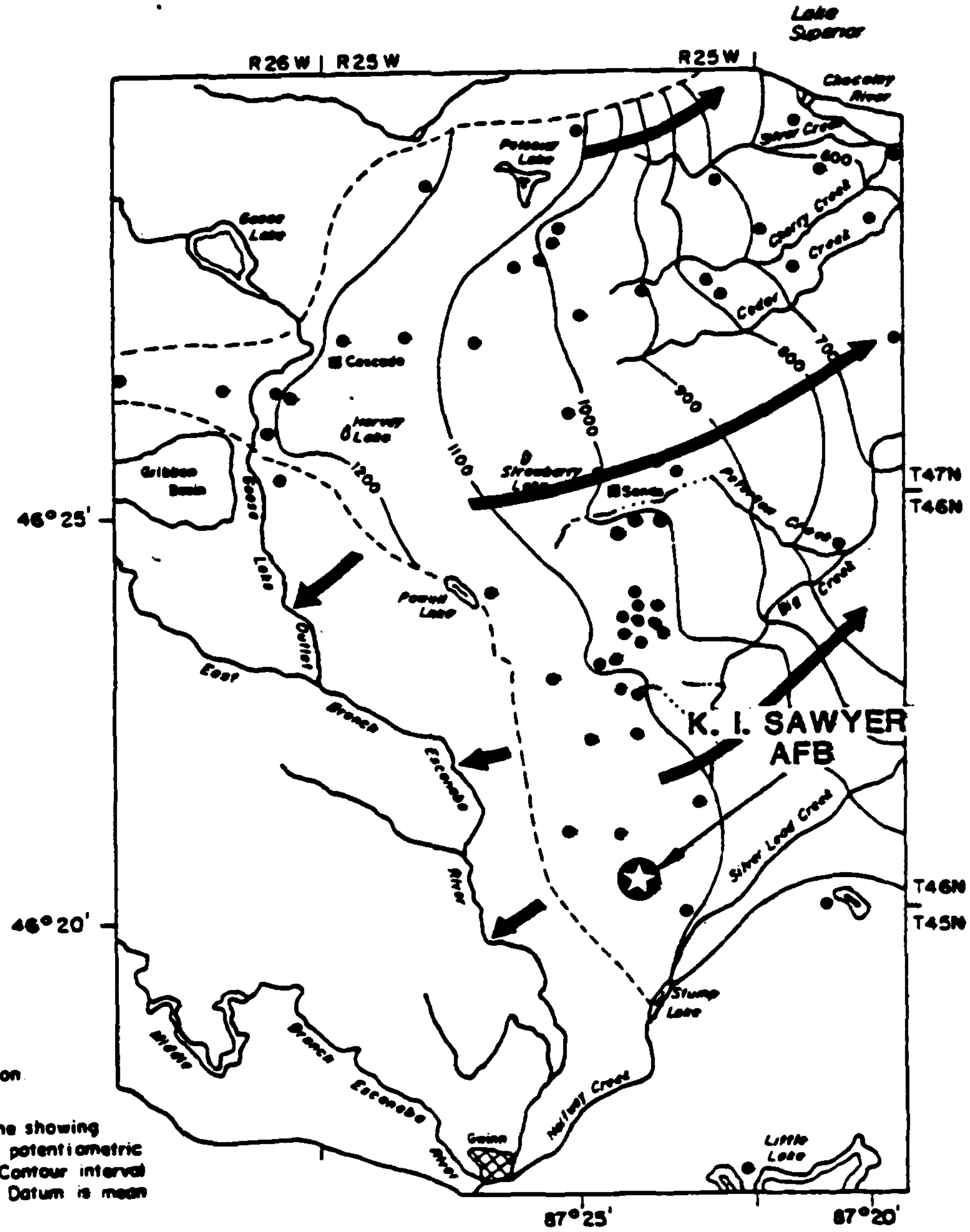
The occurrence and movement of ground water in the Sands Plain is closely related to that of surface water (Ref. 14). Area streams typically have high Base flows and low flood peaks, indicative of a close connection. Some area lakes have no obvious outlets. Precipitation quickly infiltrates through sandy surface soils, percolates to the ground water system and then flows downgradient toward Lake Superior. Ground water normally occurs under water table (unconfined) conditions, but may be present under artesian conditions locally. For example, it is known that the outwash aquifer is confined at K. I. Sawyer AFB, as aquifer tests indicate that the glacial deposits have a transmissivity of 70,000 gallons per day per square foot and a storage coefficient of 0.004 (Ref. 14).

According to USGS test drilling information, ground water occurs in the outwash aquifer at relatively shallow depths (5 to 40 feet below land surface) on the installation. Ground water contained in the outwash aquifer tends to flow northeastward toward Lake Superior with respect to the study area. Figure 3.3 depicts typical ground-water elevations and flow directions at the Base (Ref. 14). Ground-water flow approximately parallels that of Silver Lead Creek, northeast toward Lake Superior.

Wells screened into the outwash aquifer usually produce dependable supplies of water. Such wells are frequently less than 200 feet deep and tend to yield adequate supplies for domestic and municipal purposes (ten to several hundred gallons per minute).

2) Bedrock: Immediately underlying the glacial outwash is the consolidated rock aquifer, comprised of the previously described bedrock. Water is contained in the secondary openings (faults, fractures, fissures, etc.) of this unit under either water table or artesian conditions. Because this unit underlies an excellent aquifer, it is seldom tapped for

POTENTIOMETRIC SURFACE IN GLACIAL DEPOSITS OF THE SANDS PLAIN AREA



EXPLANATION

- • Well location
- —800— Contour line showing altitude of potentiometric surface. Contour interval is 100 ft. Datum is mean sea level.
- - - - - - Approximate ground-water divide

SCALE 0 1 2 3 MILES

➡ Direction of ground-water flow

SOURCE: U.S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 74-1338, WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MARQUETTE COUNTY, MI 1979 water supplies (Ref. 14), and little is known about it. The few wells drilled into bedrock are poor water producers and typically yield highly mineralized supplies (Ref. 14). Locally, modest water supplies may be obtained from sandstones, where they are present.

Study area municipal water supplies are typically drawn from the outwash aquifer. The largest (by volume) ground-water consumer of the study area is K. I. Sawyer AFB, where on the average, 1.3 million gallons per day are pumped (Ref. 26) using a supply system based on three wells, all screened in the glacial outwash. Table 3.1 summarized Base well data. Nearby communities (two miles or less from the Base) are unincorporated, and therefore, do not possess municipal water systems. Water is obtained independently for each household. Individual domestic requirements are usually met by small diameter (four inch) wells drilled to depths of less than one hundred feet and screened in the outwash aquifer. Typical yields average ten gallons per minute.

b) Ground-Water Quality

Marquette County ground-water quality is reported to be generally good (Ref. 26). Usually the best ground-water supplies are derived from the glacial deposits, while bedrock aquifers usually furnish highly mineralized water. A review of ground-water quality data (Ref. 14) based upon chemical analyses of samples obtained from representative study area glacial deposit wells indicates that dissolved solids concentrations range from 26 to 352 milligrams per liter, averaging 107 mg/l. Occasionally, glacial deposits do produce waters possessing objectionable concentrations of iron and manganese (Ref. 14). Dissolved solids concentrations observed in samples obtained from bedrock aquifer wells range from 69 to 4,040 mg/l.

A review of K. I. Sawyer AFB ground-water quality data indicates that Base wells furnish generally acceptable supplies. A notable parameter is aluminum with concentrations varying from 168 micrograms per liter (Well 7) to 391 ug/l at Building 850 (Ref. 34).

Dissolved solids concentrations have increased in wells near the Base over the past several years and there is speculation that pumping in the vicinity of the Base may have altered area ground-water flow, causing this situation to develop (Ref. 14). A summary of the Base ground-water quality is provided as Table 3.2.

c) Surface Water Hydrology

Surface water resources of the study area are within the Chocolay River Basin and the Escanaba River Basin. Silver Lead Creek, within the Chocolay River Basin, is the receptor of storm drainage from the Base and currently receives the effluent discharge from the Base wastewater treatment plant. A proposed project at K. I. Sawyer AFB involves the upgrading of the wastewater treatment system and possibly the relocation of the effluent outfall to the East Branch of the Escanaba River.

TABLE 3.1

K. I. SAWYER AIR FORCE BASE WELL INSTALLATION DATA SUMMARY (Ref. 30)

Well No.	Capacity (gpm)	Construction Date	Casing (in)	Construction Depth (feet)	Depth to Static Ground Water (feet)	Remarks
4	750	1959	10	106	19.30	--
5	1,000	1950	10	106	18.67	--
6	150	--	--	--	--	Emergency use only.
7	320	1973	12	186.5	83.0	--
8	250	1974	12	107	5.0	--
9	580	1974	12	185	80.16	Not in use.

TABLE 3.2

SUMMARY OF BASE GROUND-WATER QUALITY DATA (Ref. 34)

Well No./Parameter	Specific Conductance (umhos)	Ca ug/l	Na ug/l	Mg ug/l	Cl ug/l	SO_4 mg/l
4	160	15.8	2.7	4.0	4	8
5	260	26.5	7.2	6.6	16	12
7	205	20.4	4.7	6.2	4	10
Building 850	205	20.7	4.3	5.1	4	9

The U.S. Geological Survey (USGS) maintains a system of streamflow gauging stations in Michigan. Streamflow has been measured only intermittently in the Chocolay River Basin. However, a USGS gauge has been maintained on the East Branch of the Escanaba River near Gwinn since 1955. This gauge, located approximately three miles south of the Base, is the best source of hydrologic data for the study area. Mean monthly flows in the East Branch of the Escanaba near Gwinn are summarized in Table 3.3. Flows are highest during or shortly after spring snowmelt (April and May). However, heavy rain can cause elevated discharges at any time. Discharge declines during the summer months when evaporation is highest, and during the winter, when most precipitation is in the form of snow which does not reach the stream until spring snowmelt. The maximum discharge of record at the Gwinn gauge is 2,109 cubic feet per second (cfs) which was recorded in 1970. The minimum recorded discharge is 19 cfs, which was reported in 1963 (Ref. 1).

Streamflow in the Chocolay River Basin (with the exception of Cherry Creek) has been measured only periodically. Therefore, flow records are unavailable for Silver Lead Creek.

The Michigan Department of Natural Resources (MDNR) has determined the 7-day 10-year low flow (7Q10) for both the East Branch and the Silver Lead Creek as a basis for proposed effluent limitations for K. I. Sawyer AFB's wastewater plant. The 7Q10 is the minimum flow sustained for seven days during the most recent 10-year period. The 7Q10 flow is 23 cfs for the East Branch and 5 cfs for Silver Lead Creek (Ref. 1).

d) Surface Water Quality

Silver Lead Creek and the East Branch of the Escanaba River are considered cold water trout streams and typically have excellent quality water under natural (background) conditions. Selected parameters and typical natural concentrations are summarized in Table 3.4.

The USGS monitored water quality in the East Branch of the Escanaba River at the Gwinn gauge from 1955 to 1980 on a monthly basis. Results are about what would be expected, based on the information in Table 3.4. In samples taken from October 1979 to September 1980 at the Gwinn guage, pH ranged from 7.2 to 8.0, and averaged about 7.6. Hardness ranged from 50 to 70 mg/l, and averaged 59 mg/l. Total nitrogen as N (including nitrate and nitrite) ranged from 0.5 to 1.1 mg/l, and averaged 0.23 mg/l. Dissolved oxygen, phosphorus heavy metals and coliform bacteria were not measured (Ref. 1).

The USGS does not monitor the water quality of the Silver Lead Creek. However, the K. I. Sawyer Bioenvironmental Engineering Lab has measured water quality four times per year at six locations on the creek since 1978 (Ref. 32). Four stations are located upstream from the wastewater plant, one station about 100 feet downstream from the plant, and one station downstream where the creek exits the Base. Selected parameters reported at the three stations nearest the wastewater plant are summarized in Table 3.5. As would be expected, dissolved oxygen concentrations

TABLE 3.3

MEAN MONTHLY FLOWS
RECORDED FROM 1955 TO 1967 -
EAST BRANCH/ESCANABA RIVER NEAR GWINN (Ref. 41)

Month	Discharge (cfs)
January	46
February	39
March	58
April	350
May	202
June	103
July	69
August	47
September	54
October	73
November	85
December	64

TABLE 3.4

NATURAL WATER QUALITY OF STREAM
IN THE UPPER PENINSULA OF MICHIGAN[a] (Ref. 1)

Parameter	Natural Conditions in the Upper Peninsula (U.P.)
Turbidity - A measure of the amount of light intercepted by suspended sediments in the water (clarity of water).	Streams draining sandy soils are relatively clear.
Dissolved Oxygen	Most rivers in the U.P. are nearly saturated with oxygen at all times. At 70°F, water is saturated with 9 mg/l of oxygen.
Hardness - A measure of mineral content.	Water in Upper Peninsula streams is typically soft with hardness ranging from 20 to 60 mg/l at high flows and 60 to 120 mg/l at low flows. Soft waters do not support an abundant growth of aquatic plants.
pH - A measure of acidity/ alkalinity.	Water in U.P. streams typically has a pH between 7.0 and 7.5.
Nutrients - (Nitrate, phosphate, calcium) Influence productivity of plant and animal life.	Nutrient content is low (0.2 mg/l) in most streams of the Upper Peninsula. Concentrations of individual nutrients may exceed 1.0 mg/l in areas where municipal industrial or agricultural activities occur.
Coliform Bacteria - Enter stream where human or animal wastes are washed or discharged in the stream.	Typically less than 1000 per 100 ml in streams in undeveloped areas.

[a] Adapted from Hendrickson, Knutilla and Doonan, Hydrology and Recreation of the Cold-Water Rivers of Michigan's Upper Peninsula, 1973.

TABLE 3.5

WATER QUALITY DATA
SILVER LEAD CREEK ON K. I. SAWYER AFB (Ref. 32)
(Selected Parameters)

Parameter	Date of Sample	Sample Location: Station No. 4 Just above Wastewater Treatment Plant	Station No. 5 100 Feet Downstream From Wastewater Treatment Plant	Station No. 6 Where Stream Leaves Base
Dissolved Oxygen (mg/l)	3/81	---	---	---
	6/81	---	---	---
	9/81	9.0	7.0	10.0
	12/81	10.0	9.0	11.0
	3/82	6.0	4.0	9.0
	6/82	8.0	8.0	4.0
pH	3/81	---	---	---
	6/81	---	---	---
	9/81	6.9	6.8	6.8
	12/81	6.5	6.5	6.6
	3/82	7.0	7.2	7.8
	6/82	---	---	---
Nitrate as N (mg/l)	3/81	0.4	0.5	0.3
	6/81	1.2	0.3	<0.1
	9/81	4.0	0.3	1.3
	12/81	0.8	0.4	1.2
	3/82	0.5	7.4	2.4
	6/82	<0.1	<1.0	1.0
Phosphorus (Ortho PO_4 as P) (mg/l)	3/81	<0.2	1.5	<0.2
	6/81	<0.1	0.86	<0.1
	9/81	0.6	0.1	<0.1
	12/81	<0.1	0.1	<0.1
	3/82	<0.1	0.1	<0.2
	6/82	<0.1	---	1.0
Oil and Grease (mg/l)	3/81	<0.3	1.3	<0.3
	6/81	4.2	3.1	4.2
	9/81	0.4	<0.3	2.5
	12/81	<0.3	<0.3	<0.3
	3/82	<0.5	5.0	<0.5
	6/82	0.5	<0.3	<0.5

TABLE 3.5--Continued

WATER QUALITY DATA
SILVER LEAD CREEK ON K. I. SAWYER AFB
(Selected Parameters)

Parameter	Date of Sample	Sample Location: Station No. 4 Just Above Wastewater Treatment Plant	Station No. 5 100 Feet Downstream From Wastewater Treatment Plant	Station No. 6 Where Stream Leaves Base
Total Organic Carbon (as C) (mg/l)	3/81	2.0	15.0	5.0
	6/81	5.0	10.0	8.0
	9/81	5.0	2.0	2.0
	12/81	3.0	1.0	1.0
	3/82	2.0	5.0	3.0
	6/82	5.0	3.0	3.0
Total Dissolved Solids (mg/l)	3/81	152	207	140
	6/81	104	147	82
	9/81	---	---	---
	12/81	175	112	141
	3/82	1100	910	1100
	6/82	88	120	152
Total Suspended Solids (mg/l)	3/81	2	8	2
	6/81	8	4	8
	9/81	---	---	---
	12/81	3	1	<1
	3/82	2	14	93
	6/82	<1	6	8

decreased downstream from the wastewater plant, as the decay of organic material exerted an oxygen demand. Total organic carbon (TOC) increased immediately downstream from the plant. However, recovery occurred for both parameters before the creek exited the Base. The pH of the creek remained fairly steady throughout the year. Nitrate concentrations were greater than most coldwater trout streams, even at the sampling stations upstream from the wastewater plant. For the most part, phosphorus concentrations did not greatly exceed expected values. Total dissolved solids fluctuated considerably throughout the year without any direct relationship to the stations proximity to the wastewater outfall. The total suspended solids in the creek were very low throughout the year. Hardness, coliform bacteria and heavy metals were not measured.

3. Meteorology

The area around the Base is flat and has an altitude of 1160 feet above mean sea level. The highest point in the vicinity is about 1200 feet above mean sea level.

Climatic conditions vary considerably. The typical North American cold wave, which so frequently sweeps down from the northwest, attended by strong northwest winds, is considerably tempered in severity as it crosses the wide stretches of comparatively warm water of the Great Lakes.

The mean annual precipitation for K. I. Sawyer AFB is 34.2 inches (Ref. 31) much of this precipitation recorded in the form of snow (Ref. 30). Net precipitation for the study area is calculated to be 8.6 inches, based on a Class A pan evaporation of 32 inches with an 80 percent evaporation coefficient (Ref. 27). About seven inches of precipitation eventually becomes groundwater recharge (Ref. 26). Table 3.6 summarizes Base climatic data.

The most common winds are from the north. Winds from the south and southwest are also of frequent occurrence. The mean wind speed is 7 knots, though winds as high as 60 knots have been recorded. Frequency of occurrence of calm wind conditions range from 6 to 10 percent. Stability of the atmosphere which is related to the environmental lapse rate greatly influences the dispersion and dilution of air pollutants; generally when the atmosphere is more stable, pollutants have an opportunity to concentrate. The stability of the atmosphere is characterized by its tendency to resist or enhance vertical motion. A stable atmospheric layer in which temperature increases with height strongly resists vertical motion and tends to suppress turbulence. Such atmospheric conditions known as inversions allows very limited dispersion. Inversion layers may be either surface (ground-based) or elevated and act as lids on pollutants restricting them to the layers below. Surface inversions usually occur around sunrise and just after sunset and are usually short-lived. Elevated inversions last considerably longer than surface inversions and are often caused by stagnating high pressure systems. During 1981 there were two days of

TABLE 3.6

K. I. SAWYER AFB

CLIMATIC SUMMARY

CR DATED FEB 78 OBSOLETE

PREPARED BY USAFETAC AUGUST 1979 | STATION NAME: K I SAWYER AFB MI | LOCATION: N46 21 W087 41 | PERIOD: DEC 59-NOV 78 R | ELEV: 1221 | STN LTRS: SAW | WBAN NO: 94836 | WMO NO

AWS CLIMATIC BRIEF

MONTH	TEMPERATURE (°F) MEAN DAILY MAX	MEAN DAILY MIN	MEAN MONTHLY	EXTREME MAX	EXTREME MIN	PRECIPITATION (IN) MONTHLY MEAN	MONTHLY MAX	MONTHLY MIN	MAX 24 HRS	SNOWFALL (IN) MONTHLY MEAN	MONTHLY MAX	MAX 24 HRS
JAN	20	4	12	47	-27	2.0	4.0	.8	1.8	28	93	24
FEB	23	5	14	55	-29	1.9	3.9	.8	1.2	25	40	13
MAR	32	14	24	63	-22	2.3	4.2	.8	1.8	22	44	21
APR	46	27	37	83	-3	2.7	5.1	.7	1.5	6	17	7
MAY	61	38	50	94	18	3.2	6.9	1.7	2.3	1	5	3
JUN	70	48	59	102	25	3.7	9.3	.5	2.3	#	#	#
JUL	75	53	64	99	32	3.4	9.0	1.1	3.3	#	#	#
AUG	73	52	63	95	30	3.4	6.0	.3	2.7	0	0	0
SEP	64	45	54	94	21	3.8	6.7	1.2	2.3	#	3	3
OCT	53	36	45	81	17	2.7	6.1	.9	1.9	4	15	5
NOV	37	25	31	69	-5	2.5	4.1	1.0	1.5	17	41	12
DEC	25	12	19	57	-23	2.6	5.8	.7	1.7	32	71	15
ANN	48	30	39	102	-27	34.2	9.3	.3	3.3	135	93	24
YRS	19	19	19	19	19	19	19	19	19	19	14	19

MONTH	MEAN RELATIVE HUMIDITY (%) LST 04	LST 13	MEAN VAPOR PRESSURE (IN HG)	MEAN DEW PT (°F)	PRESSURE ALTITUDE (FT) 99.95%	SURFACE WINDS PVLG DRCTN (16 PT)	SPEED MEAN (KT)	SPEED MAX (KT)	MEAN CLOUD COVER (tenths)	PRECIP ≥ 0.01 IN	PRECIP ≥ 0.5 IN	SNOWFALL ≥ 0.1 IN	SNOWFALL ≥ 1.5 IN	THUNDERSTORMS	FOG VSBY < 7 MI	TEMP MAX ≥ 90	TEMP MAX ≥ 80	TEMP MIN ≤ 32	TEMP MIN ≤ 00
JAN	75	69	.05	4	2150	N	8	58	8	17	#	16	5	#	10	0	0	31	11
FEB	76	66	.06	7	2150	N	7	44	8	14	1	14	5	#	9	0	0	28	11
MAR	77	63	.09	13	2030	N	8	49	7	12	1	10	4	1	12	0	0	30	5
APR	78	58	.14	25	1950	N	8	59	7	11	2	5	1	2	11	0	#	23	#
MAY	79	54	.22	37	1850	N	7	60	6	12	2	1	#	3	12	#	3	10	0
JUN	84	57	.34	48	1850	S	7	54	7	12	2	0	0	6	13	1	6	1	0
JUL	86	58	.42	54	1700	SSW	6	47	6	10	2	0	0	5	13	1	9	#	0
AUG	88	60	.42	54	1650	SSW	6	43	6	11	2	0	0	6	14	1	7	#	0
SEP	89	63	.31	46	1750	S	7	43	7	13	3	#	#	6	17	#	2	3	0
OCT	85	66	.21	36	1900	S	8	54	7	13	1	3	1	2	15	0	#	12	0
NOV	81	71	.13	24	2050	SSW	8	57	8	14	2	10	4	1	13	0	0	25	#
DEC	79	74	.08	12	2050	SSW	8	53	8	17	1	16	7	#	12	0	0	30	5
ANN	81	63	.17	30	1950	N	7	60	7	156	19	75	27	31	151	3	27	193	33
YRS	10	10	10	10	11	10	10	17	6	19	19	19	19	19	19	19	19	19	19

SOURCE: DET. 24, 26th WEATHER SQUADRON, K.I. SAWYER AFB conditions favoring stagnation (an atmospheric condition characterized by prolonged periods of low wind), but stagnation did not persist more than 36 hours, thereby reducing the chances for a significant increase in pollutant concentrations. Mixing depth is another important parameter used in studying pollution potential as it determines the volume through which pollutants are mixed and diluted; a greater mixing depth increases mixing volume and the opportunity for pollutant dilution. Commonly mixing heights go through a large diurnal variation. Although not measured directly, they are calculated from routine meteorological measurements. Normally this is done two times of the day, morning and afternoon. Mean annual morning and afternoon mixing heights for this area are expected to be 500 and 1200 meters, respectively (Ref. 7).

4. Air Quality

a) Baseline Air Quality

In order to determine compliance with the National Ambient Air Quality Standards (NAAQS), the baseline air quality must be established. According to current EPA practices, measured air quality is used to establish the baseline air quality. The State of Michigan operates a network of air sampling monitors to measure air quality throughout the state. Several monitors are operated by county or city agency and industries. The Air Quality Division (AQD) of the Michigan Department of Natural Resources verifies, analyses, and collates all data collected from the air sampling network. All sampling sites are selected and/or approved by the AQD. Selection of sites and types of sensors used are consistent with EPA guidelines and accepted monitoring practices. In the past, major emphasis has been placed upon suspended particulates and sulfur dioxide. However, increased emphasis has been placed on other pollutants, which includes carbon monoxide, ozone, and lead.

The use of the available air quality data from a local monitoring site is preferred in establishing the Base air quality. Although several (nine for suspended particulates, four for sulfur dioxide and one for ozone) air quality samplers were operated in Marquette County, the air quality data in the immediate vicinity of the Base is sparse. The nearest monitoring site is about 10 miles away. A summary of the Marquette County monitoring sites is included here as Table 3.7.

Based on 1981 air quality (Ref. 21), baseline levels are shown in Table 3.8. With respect to carbon monoxide, nitrogen dioxide, and lead, the sites chosen (such as the carbon monoxide monitoring site in Grand Rapids) are a significant distance away and may give data higher than is appropriate for a remote location like K.I. Sawyer AFB. Similarly, TSP and SO_2 data taken from City of Marquette sites may be closer to industrial activity than K.I. Sawyer AFB, and therefore may be higher than comparable data from the immediate area of the Base. However, given the fact that the data for these five pollutants represent some of the closest sites available, and the fact that the magnitude of the data in each

TABLE 3.7

MARQUETTE COUNTY MONITORING SITES (Ref. 22)

Government Sites:

Site No.	SAROAD No.	Address	Sampler	Stop Date	Approximate Distance and Direction from K.I. Sawyer AFB
52-005	23-3260-005-F01	Federal Building 3rd and Washington Sts. Marquette	Hi-Vol[a] SO_2 (Bubbler) NO_2 (Bubbler)	10-05-79 12-31-77 12-31-77	10 mi. N
52-010	23-3280-001-F01	Acock Medical Facility Morgan Heights	Hi-Vol	06-16-81	11 mi. NNW
52-011	23-3280-002-F01	Palmer Fire Department Smith Avenue Palmer	Hi-Vol		12 mi. WNW
52-012	23-3260-010-F01	Northern Michigan Univ. Sugar Loaf and Wright Sts Marquette	Hi-Vol		11 mi. N
52-013	23-3280-003-F01	DNR Office County Road 550 Big Bay	O_3	11-01-81	36 mi. NW
52-014	23-3260-011-F01	IGA Store 200 South Third Marquette	Hi-Vol	06-16-81	10 mi. N

a High-volume sampler.

TABLE 3.7--continued

MARQUETTE COUNTY MONITORING SITES (Ref. 22)

Industrial Sites[b]:

Site No.	SAROAD No.	Address	Sampler	Stop Date	Company
52-901	23-9952-901	West Site No. 1 Presque Isle & Wright Marquette	SO_2		U. P. Generating
52-902	23-9952-902	East Site No. 2 Shiras Park Marquette	SO_2	08-20-80	U. P. Generating
52-904	23-9952-904	North Site No. 3 Shiras Pool Marquette	SO_2		
52-906	23-9952-906	Lakeview Arena Pine Street Marquette	SO_2		
52-910	23-9952-910	Pumping Station Crig and Albion Streets Marquette	SO_2	07-00-75	Marquette Board of Light and Power
52-911	23-9952-911	H. J. Bothwell School Mesnard & Tierney Marquette	SO_2		

b All industrial sites are 10-12 miles north of K. I. Sawyer AFB.

TABLE 3.7--continued

MARQUETTE COUNTY MONITORING SITES (Ref. 22)

Industrial Sites[b]:

Site No.	SAROAD No.	Address	Sampler	Stop Date	Company
52-920	23-9952-920	Shiras Pool Presque Isle Marquette	Hi-Vol		Cleveland Cliffs Iron Co.
52-921	23-9952-921	Lakeshore East North Side Marquette	Hi-Vol		
52-922	23-9952-922	Firestone Building Hawley & Presque Isle Marquette	Hi-Vol		
52-926	23-9952-926	Lakeshore Center Lakeshore Boulevard Marquette	Hi-Vol		
52-927	23-9952-927	Lakeshore West Lakeshore Boulevard Marquette	Hi-Vol		

b All industrial sites are located 10-12 miles north of K.I. Sawyer AFB

TABLE 3.8

BASELINE AIR QUALITY LEVELS[a] (Ref. 21)

Pollutant	Averaging Time	Measured Concentration	Primary NAAQS	Secondary NAAQS
TSP[b]	Annual	17	75	60
	24-hour	90	260	150
SO_2[c]	Annual	8	80	N/A
	24-hour	81	365	N/A
	3-hour	176	N/A	1,300
CO[d]	8-hour	7,200	10,000	10,000
	1-hour	11,500	40,000	10,000
Ozone[e]	1-hour	170	235	235
NO_2[f]	Annual	24	100	100
Lead[g]	Quarterly	0.22	1.5	1.5

a In ug/m^3.
b Based on monitoring site at Shiras Pool, Presque Isle, City of Marquette.
c Based on monitoring site at North Site No. 3, Shiras Pool, City of Marquette.
d Based on data measured in Grand Rapids (Kent County).
e Based on data measured at the DNR office in Big Bay (Marquette County).
f Based on data measured in Saint Clair County.
g Based on data measured in Muskegon County.

case should provide a conservative estimate of the actual air quality, the data in Table 3.8 can be considered representative. Because of the regional nature of ozone concentrations, the data taken at Michigan DNR's station at Big Bay can also be considered representative.

A comparison of measured air quality with the NAAQS in Table 3.8 shows that there are no violation of the air quality standards, despite the ozone nonattainment designation (see below). In addition, four industrial sulfur dioxide samplers operated in Marquette County have demonstrated over five years of compliance with the primary and secondary standards.

Out of the nine samplers to monitor levels of suspended particulates, four were operated by the Air Quality Division of Michigan DNR and five by Cleveland Cliffs Iron. During 1981, all but one industrial sampler showed compliance with the primary and secondary standard. During 1980 there were no violations of either primary or the secondary standards, an improvement over 1979 when three sites exceeded the secondary standard and 1978 when two sites violated the secondary standard and one violated the primary standard. Sites showing violation of the standard for suspended particulates are all located near large open coal storage piles.

b) Nonattainment Designation for Ozone

Marquette County was designated as a nonattainment area in 1978 when the ozone standard was 0.08 ppm (160 ug/m^3). The nonattainment designation resulted from a level of ozone concentration exceeding the ozone standard of 0.08 ppm. In early 1979 the air quality standard for ozone was revised to be 0.12 ppm. The most recent EPA information (Ref. 40) still lists Marquette County as a nonattainment area for ozone. However, the last five years of ozone monitoring in Marquette county indicate no violation of the 0.12 ppm ozone standard.

For all other pollutants, the area around the Base is designated as an attainment area.

c) Air Pollution Episodes

An air pollution episode means a condition that may lead to or result in the buildup of air pollutants which adversely affect human health. Depending upon the buildup of pollutant levels, one of the four episode conditions (forecast, alert, warning and emergency) may be declared. Conversations with Michigan Air Quality Division personnel indicate that no such episodes have occurred in Marquette County (Ref. 22).

5. Biotic Environment

a) Aquatic Ecosystem

Silver Lead Creek is a coldwater trout stream. Detailed fish surveys of Silver Lead Creek have not been completed in recent years. During 1969, brief sampling at three locations below the K. I. Sawyer AFB golf course dam (downstream from the wastewater plant), reported small numbers of the following species: brook and brown trout, perch, white suckers, and various species of chubs, dace, shiners and minnows. Evidence of sewage pollution and heavy growth of aquatic vegetation was also reported.

Conditions are likely to change considerably over a thirteen year period in any stream. This is particularly true in Silver Lead Creek, upgraded since 1969. However, small fish populations are not unusual in streams like Silver Lead Creek, which have relatively high temperatures and variable flows at the headwaters. The Michigan DNR has classified the Silver Lead Creek as a low priority fish management area.

The Escanaba River and its tributaries have historically received considerable attention from the Michigan DNR and fishermen alike. For the most part, little natural fish reproduction occurs in the Escanaba River, because flows are highly variable and are accompanied by temperature variations. However, the Michigan DNR has stocked brook and rainbow trout all along the river since the 1930's.

Fish surveys on the East Branch of the Escanaba River have been taken periodically since the mid 1960's. Good trout habitat has been reported but relatively few individuals spotted. Representative species are summarized in Table 3.9.

From 1936 through 1961, the East Branch of the Escanaba River was stocked annually with brook and rainbow trout. Planting of these legal sized fish was then stopped because of a Michigan DNR policy change against "put and take" management. Fingerling brook trout (2.5 to 4.5 inch) were stocked in the East Branch in 1979 and 1980, but survival of these small fish has been a problem. For this reason, stocking with yearling brook trout (6 plus inches) is planned in the future.

The Michigan DNR has identified the East Branch of the Escanaba River as a high priority fish management area, particularly for brook trout. Fifteen Mile Creek, a tributary upstream of the proposed discharge point, appears to offer suitable conditions to support natural reproduction of brook trout, if properly managed. Unlike the remainder of the Escanaba River, the flow of this creek and its temperature are fairly constant year round. The Michigan DNR is in the process of preparing a fish management plan for the Escanaba River Basin (Ref. 1).

b) Terrestrial Ecosystem

The 5,199 acres associated with K. I. Sawyer AFB include the following: 2,101 acres of forest of which approximately 300 acres consist of a natural area of mixed old growth; 560 acres of grassland; seven acres of wetland habitat; a five-acre lake (Little Trout Lake); two ponds totalling two acres; and one creek (Silver Lead Creek) which has a length of 3.5 miles within the Base boundaries. No field crops are grown on the Base.

The area surrounding K. I. Sawyer AFB is best characterized as a flat sandy plain, with rolling hills in some areas. Vegetation is dominated by northern hardwood (maple, beech and birch) and pine trees (white, red and jack pines). Of these species, white pine, red pine, and birch are considered to be species sensitive to sulfur dioxide concentrations (Ref. 15). Streambank vegetation includes willows, tag alders, and

TABLE 3.9

REPRESENTATIVE FISH SPECIES
EAST BRANCH OF THE ESCANABA RIVER (Ref. 23)

(Reported During Brief Surveys in
1967, 1969, 1972, 1974 and 1977)

GAME FISHES

Brook trout
Brown trout (less common than brook trout)

COARSE FISHES

Lawyer
White sucker
Black bullhead
Burbot
Longnose sucker

FORAGE FISHES

Longnose dace
Blacknose dace
Fantail darter
Johnny darter
Blackside darter
Mottled sculpin
Blacknose shiner
Creek chub
Bluntnose minnow
Fantail minnow
Brook stickleback

---

grass, with brushy vegetation predominant in mucky banks (Ref. 1). No endangered or threatened plants are known to inhabit K. I. Sawyer AFB; however several were recorded as inhabiting southeastern Marquette County (Ref. 22). These include the following species: Woodsia abbaea (endangered); Woodsia alpina, Calypso bulbosa, Gentiana linearis, Carex atratiformis, Juncus stygius, Orchis rotundifolia, Trisetum spicatum and Pinquigula vulgaris (all threatened).

Plant biomass production is important to wildlife species as food and cover. Food habitats vary between herbivores but production of seed, fruit, foliage, and woody browse rather than wood fiber can be critical for wildlife productivity. Nutrient content differs by plant species and vegetative part. Many interactions in the biotic community are dependent on plant productivity. The structure, density and composition of the vegetative cover influences the wildlife habitat value. Seasonal variations can occur in wildlife utilization of a specific community. Limiting factors such as amount of winter browse can determine large mammal populations. Timber harvesting may modify a community type, but it can create a diversity of habitat and therefore promote species diversity that increases utilization by wildlife.

Representative wildlife species include deer, bear, snowshoe hare, fox coyote, raccoon, skunk, woodchuck, porcupine, mink, and bobcat. A few muskrat, beaver, and otter may also reside in the area. A variety of songbirds, as well as woodcock, ruffled grouse and spruce grouse may also be found. No endangered or threatened animal species are known to reside in the vicinity of K. I. Sawyer AFB. On occasion endangered and threatened birds and mammals may pass through southeastern Marquette County. These include: Peregrine falcon, common tern and doublecrested cormorant (all endangered birds); coopers hawk, marsh hawk, bald eagle, osprey, piping plover, Caspian tern (all threatened birds); the gray wolf (endangered) and the marten (threatened).

Wetlands, which include marshes, bogs and similar areas, provide fish and wildlife habitat and serve important functions for ground-water recharge and filtering out sediments and pollutants. The only wetlands on K. I. Sawyer AFB are located in a small seven acre area near Little Trout Lake. The remainder of the Base is comprised of well drained sandy soils which are not conducive to forming wetlands. Extensive wetlands are located south and east of the Village of Gwinn (Ref. 1).

The only other significant habitat in the vicinity of K. I. Sawyer AFB is located north of the Base, along the East Branch of the Escanaba River. This area is managed for sharptail grouse (Ref. 1). The Seney National Wilderness Area is east of the Base, but is over 50 miles away.

6. Resource Characteristics

a) Fuel Resources

Forests constitute one of the greatest natural resources found in the Upper Peninsula of Michigan. The forest resources are renewable and theoretically could provide wood resources forever without being depleted, given proper management techniques and adequate capitalization. Nearly

90% of the Upper Peninsula, or about 10.5 million acres of land, support commercial forest, from which only a fraction of the annual gross growth presently is being harvested. Some estimates of potential production from these forests indicate that output of wood in one form or another could be increased as much as ten times if intensively managed.

Wood is widely utilized throughout the Upper Peninsula by the wood consuming industries (i.e., paper and lumber industries) as well as for home heating purposes. The wood consuming industries also typically derive 100 percent of their heating energy requirements from plant wastes and several also produce a sizeable portion of their electrical energy requirements.

Due to the constraints associated with transporting timber products, an area within a 50-mile radius of the Base was established as a limit to the area for study regarding forest resources. This area is bounded (approximately) on the west by the towns of L'Anse, Covington, and Crystal Falls; on the south by Iron Mountain and Escanaba; on the east by Manistique and Shingleton; and on the north by Lake Superior. It includes all of Marquette, Dickinson, and Delta counties; about two-thirds of Alger county; nearly half of Menominee County; about a third of Baraga and Iron counties; and somewhat less than a quarter of Schoolcraft County. The data used in this survey was originally derived from State and Federal Government agencies.

The study area encompasses approximately 5,000 square miles (3,200,000 acres) when one factors out the area (25 percent) which falls in Lake Superior and accepts 85% as land area classed as commercial forest. This 3,200,000 acres is a little more than a third of the 9-1/2 million acres of commercial forest land credited to the Upper Peninsula.

The actual and potential growth per unit of land is the ultimate measure against which long-term productivity is gauged. In the Upper Peninsula the current timber growth on over two million acres of land, public and private, as determined by Michigan Tech's Ford Forestry Center, ranged from 1/4 to 1/2 cords per acre per year. The average growth was 0.4 cords. Applying this average to the 3.2 million forested acres lying within the "study" area indicates an estimated annual growth of 1.28 million cords. Using 2 tons per cord as average weight, timber growth becomes 2.56 million tons (Ref. 12).

Other potential fuels utilized by the Base include coal and petroleum products (fuel oil and diesel fuel). Both of these fuels are obtained from areas outside the general region of K. I. Sawyer AFB. The United States has an abundant supply of coal resources which can meet all the needs of K. I. Sawyer AFB. Oil is a somewhat scarcer commodity within the United States and as greater quantities of oil are consumed, it is necessary for the United States to obtain more of its oil from foreign sources.

b) Nonfuel Resources

The following information regarding the nonfuel resources of Marquette County was obtained from the Marquette County Comprehensive Plan, adopted in 1982 (Ref. 18).

Iron-ore mining and beneficiation is the major industry in Marquette County. Substantial amounts of the high-grade, easily accessible, direct-shipping ore have been depleted by various methods of underground mining. Attractive reserves of these ores exist in areas such as Richmond Township, where occurrences can be found at depths of 1000 feet. The last operating underground mine (Mather "B") closed in 1979. Three open-pit mines are presently operating in the county (Empire, Tilden and Republic). The open pit/beneficiation process necessarily utilizes vast amounts of water and land resources. Iron-ore mining is of course sensitive to the demand for steel and the general state of the economy and therefore historical fluctuations in terms of production have occurred.

Iron deposits have been identified in two distinct mineral districts in Marquette County: Marquette Iron Range, stretching west from Negaunee to Michigamme and then south to Republic; and the Gwinn Iron District, located in central Forsyth Township in close proximity to K. I. Sawyer AFB. All current production is from the Marquette Range.

Occurrences of gold, silver, lead and zinc were found in the lower Precambrian greenstone which stretches from north of Ishpeming to Marquette and northwest to Silver Lake in a "V" shape. Gold was produced from several mines in this deposit, including the Ropes, Michigan, Gold Lake, Superior, Peninsula, and Fire Center. At the present time Callahan Mining Co., of New York, has reopened the Rose Gold Mine for exploration.

Proven reserves of copper mineralization occur in th Middle Precambrian Kona Dolomite deposits which begin in the Cliffs Ridge area and run west to Negaunee.

Concentrations of uranium which have higher readings than background can be found in the Middle Precambrian granites and Michigamme slate. These rocks have little potential for development at today's market prices.

7. Natural Hazards

The only natural hazards in the vicinity of K. I. Sawyer AFB are the cold winter weather and the heavy seasonal snowfall averaging 135 inches a season. Blowing snow results in poor visibility and snow accumulations can result in hazardous driving conditions.

A few tornados have occurred in the Upper Peninsula of Michigan, south of the Base area. These occurrences are very rare.

High winds often accompanied by thunderstorms do occur throughout the area, resulting in uprooting of trees and occasional structural damage to homes and buildings (Ref. 30).

8. Noise

The major source of noise on K. I. Sawyer AFB is attributed to aircraft. Noise is generated during both ground and air operations. Noise associated with coal combustion at the heating plant can be generated in areas using pumps, fans, compressors, pressure relief valves, fired heaters, and other mechanical equipment. Noise from individual equipment components may not represent the total noise level, which includes all equipment items, motor drives, piping, ductwork, reverberations from adjacent equipment and buildings, and sound interferences from different sound sources. On the basis of similar installations, noise levels from the equipment described are not expected to exceed 95 dBA measured at one foot separation (Ref. 15).

B. HUMAN ENVIRONMENT

1. Population

Population and population distribution data are summarized in Table 3.10; the population figures in parentheses under townships bordering K. I. Sawyer AFB are the sector attributed to the Base. A higher Base population than the Census data reported in Table 3.10 has been reported previously (Ref. 30): 9,691 (in 1977) versus the Census population (1980) of 7,347 (Ref. 17).

The Base population is approximately ten percent of the county total. Table 3.11 indicates the total Marquette County population increased by approximately 13 percent over the last decade. The increase, was in the non-city (all townships combined) which grew by 14 percent while the cities showed a combined growth of only two percent. Marquette City was the only metropolitan area to show a positive growth. The county is generally rural with an overall population density of 39 people per square mile.

2. Economic Conditions and Institutional Characteristics

Six basic employers provide the core of employment in Marquette County (Ref. 17). The six major employers in the order of their importance to the country are K. I. Sawyer AFB, iron ore mining, Northern Michigan University, tourism, forestry and forestry products, and construction. These provide the bulk of the "basic" employment and require the associated "non-basic" services.

A "basic" industry is one which exports goods or services and thus brings outside money into the local area. The "basic" employment generates "non-basic" or service industries (or goods producing/services that do not earn outside income) and employment. Each "basic" job supports a given number of "non-basic" jobs, i.e., the multiplier. The Marquette County Comprehensive Plan estimates the county multiplier for 1980 to be 1.9 "non-basic" jobs per "basic" job. Table 3.11 lists estimated 1980 employment by "basic" industry. The table includes both basic employment reported in the Comprehensive Plan and calculated non-basic employment. The actual basic employment at K. I. Sawyer is 4,285 people as of March 1982. Of this 3,806 are military and 479 civilian. U. S. Air Force estimates of the non-basic employment, 3,899 people, is less than that calculated in Table 3.11 (Ref. 1). The total employment due to K.I. Sawyer AFB probably lies between 8,184 to 12,470 people. The total employment which can be attributed to K. I. Sawyer AFB is approximately 35 percent of the Marquette County total.

TABLE 3.10

MARQUETTE COUNTY POPULATION DATA (Ref. 18)

	1970	1980	Percent % Change
Cities			
Marquette	21,967	23,336	5.9
Ishpeming	8,245	7,556	-9.1
Negaunce	5,243	5,187	-1.1
Townships bordering K. I. Sawyer AFB			
Forsyth	8,290	9,666	14.2
K. I. Sawyer(1)	(5,134)	(4,839)	
Sands	2,164	2,428	10.9
K. I. Sawyer(1)	(1,545)	(980)	
West Branch	1,870	2,167	13.7
K. I. Sawyer(1)	(____)	(1,528)	
Other Townships	16,902	23,775	28.9
Marquette Co. Total	64,685	74,115	12.8

(1) Population attributable to K. I. Sawyer AFB.

TABLE 3.11

ESTIMATED 1980 EMPLOYMENT IN MARQUETTE COUNTY (Ref. 18)

Industry(1)	Basic(1) Employment	Non-Basic(2) Employment	Total Employment
K. I. Sawyer AFB	4,300	8,170	12,470
Mining	4,200	7,980	12,180
Northern Michigan University	1,100	2,090	3,190
Tourism	800	1,520	2,320
Forestry/Forestry Products	300	570	870
Construction	100	190	290
Totals	10,800	20,520	31,320

(1) Six principal basic industries in Marquette County.
(2) Calculated with estimated county multiplier (non-basic emp./basic emp.) of 1.9 for 1980.

The salaries and personal expenditures of Base employees will contribute an estimated $136,768,850 to the Central Upper Peninsula in 1982. Operating expenditures (fuels, utilities, services, supplies and equipment) in 1981 were $13,865,278. Capital expenditures by K.I. Sawyer AFB in 1981 were $3,663,700. Capital expenditures in 1982 are estimated to exceed 10 million dollars.

The USAF estimates that 36 percent of all Base expenditures are made outside of the area. The total expenditures by the Base in the local area approximates 11.2 million dollars.

3. Land Use, and Sites of Historic or Archeological Significance

The area surrounding K. I. Sawyer AFB is predominantly rural. Table 3.12 lists the land use in Marquette County in 1974. Approximately 94 percent of the County is classified as forested land. The urban or developed area of the county only represented approximately 1.2 percent of the land use in 1974.

K. I. Sawyer AFB occupies 5,197 acres. Of this 2,835 acres are Federally owned and the remainder is controlled under easements or lease Agreements (Ref. 1).

The ownership of forest lands in Marquette County is summarized in Table 3.13. Of the total acreage approximately 30 percent, 325,900 acres, are owned by the forestry industry. The forests are potentially the county's greatest natural resource although presently they are not utilized to that extent.

There are no known historic or archaeological resources on the grounds of the K. I. Sawyer AFB. About one mile east of the Base, along Silver Lead Creek, is an early silver mining exploration site. Approximately eleven underground iron ore mines, dating to the late nineteenth century are located in the Princeton and Gwinn area, four to five miles southwest of the Base. These sites were abandoned around 1945, and there are no plans to restore any of the sites at this time (Ref. 1).

4. Transportation

The road network which serves K. I. Sawyer AFB consists of two U.S. Highways, two State highways and many county routes. North-South U.S. Highway No. 41 from Chicago to Hancock-Houghton and Calumet passes 7 miles east of the Base, into Marquette, and from Marquette west through Ishpeming and Negaunee before continuing north into the Keweenaw Peninsula. East-West U.S. Highway No. 2 from St. Ignace to Duluth passes 30 miles south of the Base, intersecting Highway No. 41 a few miles north of Gladstone and Escanaba (Refer to Figure 3.1).

The State of Michigan Highway No. 28 bears east-west from Sault Ste. Marie along the south shore of Lake Superior, intersecting U.S. Highway No. 41 just south of Marquette and follows U.S. Highway No. 41 through Marquette, Negaunee, and Ishpeming. State Highway 35 travels northwest from Escanaba to Negaunee, passing only 5 miles south of the Base.

TABLE 3.12

LAND USE IN MARQUETTE COUNTY (Ref. 17)

Land Use	Area (acres)	Percent of Total
Forested Land	1,097,100	91.8
Water[a]	41,000	3.4
Agricultural	24,761	2.1
Transportation	18,023	1.5
Urban/Built-up	14,793	1.2
Total	1,195,677	100.0

[a] Excluding Lake Superior

TABLE 3.13

FORESTED LAND OWNERSHIP IN
MARQUETTE COUNTY, 1979 (Ref. 18)

Ownership	Area (acres)	Percent of Total
Farmers and Small Private Land Owners	489,300	44.6
Forestry Industry	325,900	29.7
State Forests	258,800	23.6
Other Public Forests (County, Townships)	17,400	1.6
National Forests	5,700	0.5
Total	1,097,100	100.0

County Road No. 553, which lies directly west of the Base and presently constitutes the main access road to the Base, runs north-south from U.S. Highway No. 41 in Marquette to State Highway No. 35. Distances from the main gate of the Base to these intersections are 13 miles and 5 miles, respectively. County Road No. 460 was constructed by the Bureau of Public Roads to provide an all-weather highway connecting the Base to U.S. Highway No. 41. This route runs from Gate No. 2 on the east boundary of the Base approximately 7 miles in an easterly direction before connecting with U.S. 41 about one mile south of the village of Skandia. East-West County Road No. 480 provides a short route from the Base to Negaunee. County Road No. 480 travels west from U.S. 41, crosses County Road 553 approximately 8 miles north of the Base, and intersects with State Highway No. 35 east of the city of Negaunee. Throughout this region there are numerous roads and trails which provide access to hunting grounds, private property, lakes, or short routes from one highway to another (Ref. 30).

Marquette County has an adequate State Trunkline Highway System which provides better east-west than north-south accessibility. The county primary and secondary road system is more than adequate for existing traffic. Traffic loading/road capacity is not a problem except for certain urban locations, particularly U.S. 41 West from the bypass to County Road 492 (Ref. 18). Average Daily Traffic (ADT) figures exist only for County Road 553. The 1979 ADT on CR 553 was 4,436 vehicles north of the K. I. Sawyer AFB gate and 4,038 vehicles south of the K. I. Sawyer AFB gate (Ref. 17).

The trucking industry in Marquette County is to some extent adversely impacted by seasonal weight limitations on a few key county roads (Ref. 17). Coal is delivered to the Base by truck from Escanaba. The trucks are empty on their return trip.

County rail systems are primarily used for ore carrying. The rail system, like the highway, provides better east-west service. Prospects for the rail system are not good with the major east-west carrier, the Soo Line, threatening to discontinue service. Existing rail bulk ore carrying operations are expected to continue through the year 2000 (Ref. 18). A railroad spur exists on Base and is used occasionally for freight delivery.

The port facilities consist of ore, coal, oil, and freight shipping with ports at Marquette, Escanaba, Manistique, and Menominee. Shipping season is from April through January. Year-round shipping is being studied, using ice breakers. Vast amounts of the region's mineral production is exported by commercial shipping on the Great Lakes (Ref. 30).

CHAPTER 4

ENVIRONMENTAL STANDARDS AND PERMIT REQUIREMENTS

CHAPTER 4

ENVIRONMENTAL STANDARDS AND PERMIT REQUIREMENTS

The heating plant project at K.I. Sawyer AFB will need to comply with applicable Federal, state, and local statues, regulations, and rules. As a general policy, the Air Force makes every effort to comply with all legal requirements. Federal, state, and local environmental law can impose procedural as well as design requirements, and may require performance standards, limitations on waste streams, agency approvals, and interagency coordination. The purpose of this chapter is to review potentially applicable environmental laws and regulations, and to identify permits which probably will be required for the K.I. Sawyer AFB heating plant project.

A. SURFACE WATER QUALITY STANDARDS AND DESIGNATED USES

The Michigan Water Resources Commission, acting under the authority of the Federal Water Quality Act of 1965 and Michigan Act 245 P.A. 1929, as amended, has established water quality standards and designated water uses for the protection and upgrading of Michigan's waters.

Existing water quality, if superior to designated use requirements, cannot be lowered to meet water quality standards except as it is shown that no injury will result. Water which does not meet the water quality standards is to be improved to meet the standards (Ref. 26).

Standard parameters for receiving waters apply to stream flows which equal or exceed 7-day, 10-year minimum flow. Where a stream has more than one designated use, the most restrictive standards apply.

Silver Lead Creek and the East Branch of Escanaba River have the following designated uses: public water supply, industrial water supply, total body contact recreation, coldwater fish, agricultural, and commercial (navigation). Designated uses and associated water quality standards are summarized in Appendix A, Table A-1. As mentioned previously, the most restrictive standards are applicable to a given stream.

B. SURFACE WATER DISCHARGE LIMITATIONS AND NPDES PERMIT PROGRAM

1. Background

The Federal Water Pollution Control Act Amendments of 1972 and the Clean Water Act of 1977 were enacted to maintain, restore and enhance the "chemical, physical and biological integrity of the Nation's waters," with goals of attaining zero discharge of polutants into navigable waters by 1985 and fishable and swimmable waters by 1983. Section 402 of this complex legislation established the National Pollution Discharge Elimination System (NPDES) Program, which requires permits for all effluent discharges into surface waters. NPDES permits are required for all wastewater facilities which discharge treated effluent into waterways. Therefore, the waste streams eminating from the heating plant which are directed to the Base wastewater treatment plant will be regulated by the K.I. Sawyer AFB NPDES permit. An NPDES permit establishes effluent quality and quantity limits and associated monitoring requirements (Ref. 1).

On August 20, 1974, the United States Environmental Protection Agency (EPA) issued NPDES Permit No. MI 0021423 which regulates discharges from the K. I. Sawyer AFB wastewater treatment plant to Silver Lead Creek. Effluent limitations and monitoring requirements for this permit are depicted in Table 4.1. This permit expired on August 15, 1979.

On December 9, 1978, the State of Michigan received approval from EPA to administer the NPDES permit program for Federal facilities. At that time, EPA had a pending enforcement action against the K. I. Sawyer AFB wastewater treatment facility for failure to achieve effluent discharge standards. Plans for modifying the existing wastewater treatment plant to improve the plant's capabilities for the removal of residual chlorine, phosphorus and five-day biochemical oxygen demand (BOD5) are presently under study. One possible plan calls for upgrading the treatment system and changing the effluent discharge point from Silver Lead Creek to the East Branch of the Escanaba River. To accomplish this, a pipe approximately three miles long would be constructed from the treatment plant to the river. Another plan under review calls for the upgrading of the wastewater treatment plant with continued discharge to Silver Lead Creek.

2. Discharge Standards

On the basis of Michigan Department of Natural Resources (DNR) staff review and application of applicable standards and regulations, the Michigan Water Resources Commission (WRC) has proposed to issue a permit to allow discharge into Silver Lead Creek of one million gallons of treated wastewater subject to effluent limitations and special conditions. Interim effluent limitations are proposed for Silver Lead Creek and would last from the time the permit is issued until January 30, 1984. The plant is currently operating under these limitations. After that time, final effluent limits for Silver Lead Creek would be applicable. Both the interim and final limits are summarized in Table 4.2.

Two important points should be noted. First, the WRC's proposed effluent limitations for the Silver Lead Creek are more stringent than those specified in K. I. Sawyer AFB's previous NPDES permit, which was issued by the USEPA. This indicates that more extensive wastewater treatment would be required prior to discharge. Secondly, the interim limits for Silver Lead Creek are less stringent than the final limits. This situation would provide time for the wastewater plant improvements to be completed.

TABLE 4.1

USEPA PERMIT NO. MI0021423
EFFLUENT LIMITATIONS
FOR DISCHARGE TO SILVER LEAD CREEK
(Expired August 15, 1979) (Ref. 1)

Effluent Characteristics	Discharge Limitations
BOD5 (total)	18 mg/l as a daily maximum 12 mg/l as a daily average
Total Suspended Solids	15 mg/l as a daily maximum 10 mg/l as a daily average
pH	Not less than 6.5 nor more than 9
Fecal Coliform Bacteria	400/100 ml as a daily maximum 200/100 ml as a daily average
Total Residual Chlorine	0.5 mg/l as a daily maximum
Total Phosphorus(P)	6.0 mg/l as a daily maximum 4.0 mg/l as a daily average

TABLE 4.2

EFFLUENT LIMITS FOR
CONTINUED 1.0 MGD DISCHARGE
TO SILVER LEAD CREEK (Ref. 1)

Effluent Characteristics	Interim Limits	Final Limits	Comments
BOD5 (total) (October 1 - April 30)	30 mg/l 45 mg/l	30 mg/l 45 mg/l	30-day average 7-day average
BOD5 (carbonaceous) (June 1 - September 30)	20 mg/l 30 mg/l	20 mg/l 30 mg/l	30-day average Daily maximum
BOD5 (carbonaceous) (May 1 - May 31)	N/A	30 mg/l 45 mg/l	30-day average Daily maximum
Ammonia Nitrogen as N (May 1 - May 31)	N/A	9.0 mg/l	Daily maximum
Ammonia Nitrogen as N (June 1 - September 30)	N/A	6.0 mg/l	Daily maximum
Ammonia Nitrogen as N (October 1 - November 30)	N/A	11.0 mg/l	30-day average
Ammonia Nitrogen as N (December 1 - April 30)	N/A	N/A	--
Total Suspended Solids	30 mg/l 45 mg/l	30 mg/l 45 mg/l	30-day average 7-day average
Fecal Coliform Bacteria (May 15 - October 15)	200/100ml 400/100ml	200/100ml 400/100ml	30-day geometric mean 7-day geometric mean
Dissolved Oxygen (October 1 - May 31)	N/A	5.0 mg/l	Daily minimum
Dissolved Oxygen (June 1 - September 30)	N/A	7.0 mg/l	Daily minimum
Total Phosphorus as P	1.5	1.0 mg/l	30-day average
pH	N/A	6.0 - 9.0	--
Total Residual Chlorine	0.5 mg/l	0.05 mg/l	Daily maximum

C. GROUND-WATER QUALITY RULES AND STANDARDS

The General Rules of the Michigan Water Resources Commission include ground-water quality rules (Rule 323, Part 22 filed with Secretary of State, August 14, 1980) to protect the public health and welfare and to maintain the quality of ground waters in all usable aquifers for individual, public, industrial, and agricultural water supplies. The rules provide for the non-degradation of ground-water quality in usable aquifers, define the requirements for hydrogeological study before permitting discharges into ground waters, establish ground-water monitoring requirements for new and existing ground-water discharges and establish a procedure for obtaining variances from these rules (Ref. 25).

The proposed alternative for the coal storage pile drainage consist of an unlined perimeter ditch or trough to collect and control the coal storage pile run-off and allow for the percolation of the run-off into the underlying permeable soil. Presently, coal storage pile run-off is allowed to drain into the adjacent areas and percolate into the soil in an uncontrolled mannner.

The design and construction of the future coal storage pile and surrounding area must take into consideration the regulatory requirements of the State of Michigan and Chapter 11, Air Force Manual (AFM) 88-15, Wastewater, Solid Waste, Utility Services, and Siting. The Michigan regulations prohibit the discharge of wastewater into ground water or surface waters without a discharge permit. The issue concerning whether stormwater run-off from coal piles is considered to be a discharge of wastewater is still under review by the State and individual cases are subject to review by the Michigan DNR. Therefore, the base may be required to submit a permit application to the Michigan DNR for review to determine if appropriate design, construction and operating procedures will be allowed to prevent unlawful contamination of the ground waters or surface waters. Should the Michigan DNR determine that the proposed discharge requires a ground-water discharge permit, it is conceivable that the MDNR could impose, as a condition of the permit, some program to characterize the coal pile runoff and monitor the ground water. The purpose of a monitoring program is to determine the effects, if any, of the discharge into the ground water.

Ash handling water is currently discharged to an area adjacent to the heating plant and allowed to percolate into the permeable soils. An alternative under consideration entails diverting the washdown waters to a new coal storage pile run-off collection system and allow it to percolate into the soil in a controlled manner. Should this practice be implemented, any permit application submitted for the coal pile run-off collection system should include the ash handling water as an additional source of run-off.

Boiler blowdown from the heating plant is presently discharged to a sandy area adjacent to the heating plant building. The blowdown water percolates into the soil before it has an opportunity to enter the nearest creek. In order to continue this type of practice the State may require a ground-water discharge permit. The proposed modifications to the heating plant will reduce the amount of boiler blowdown to a negligible quantity. Future blowdown water will be discharged to the floor drain system and piped to the wastewater treatment plant. This will eliminate the potential for additional permits for this waste stream.

D. SOLID WASTE DISPOSAL REQUIREMENTS

The Resource Conservation and Recovery Act of 1976 established the basic structure of a program to regulate solid and hazardous waste handling and osal and to encourage and regulate recovery and reuse. The Act requires all Federal facilities to comply with Federal, state and local solid waste disposal regulations (42 U.S.C. 6951). These regulations require that ash be disposed of in a licensed landfill; however, at the present time, the Act states that ash will not be considered a hazardous waste.

The Michigan Department of Natural Resources, Resource Recovery Division recently enacted revised rules governing solid waste management (Act No. 641 R 299.4101 through R 299.4805) which meet the criteria established by the Federal government. These rules took effect January 6, 1982. In these rules the State of Michigan has developed three classifications for solid waste disposal facilities, i.e., Type I, Type II and Type III. Type I disposal facilities are considered hazardous waste disposal facilities and are regulated under the Michigan DNR's rules governing hazardous waste management. A Type II disposal facility is designed and operated to accommodate general types of solid waste, including but not limited to, garbage and rubbish, but excluding hazardous wastes. A Type III disposal facility is designed and operated to accommodate large volumes of certain solid wastes having minimal potential for ground-water contamination (e.g., building demolishings, foundry sands, fly ash).

Should the Base elect to dispose of its ash on the Base in a homogeneous manner, it would necessitate the licensing of the disposal site. The ash would be disposed of in an area adjacent to the existing sanitary landfill. The licensing procedure could involve grandfathering the existing Type II sanitary landfill or licensing the new cells which would accept only ash as a Type III landfilling.

To obtain a Type III sanitary landfill license the following criteria, summarized from the Michigan DNR Solid Waste Management R 299.4101 through R 299.4804, must be met:

- In the construction permit application, the rationale for the design shall be explained using calculations, if applicable, and professional analyses, to show how the proposed design is expected to comply with the ground-water quality performance standards (e.g., the ground water at the solid waste boundary will not exceed standards described in the criteria for classification of solid waste disposal facilities and practices, 40 CFR part 257.34 and Appendix A, Table A-2, National Interim Primary Drinking Water Standards).

- Type III landfill sites must have a permanent minimum clearance of 4 feet from the bottom of the waste to the ground-water level.

- In order to be disposed of in a Type III sanitary landfill the ash must be subjected to a leaching test protocol to assist in evaluation of ground-water contamination potential. Samples collected from the monitoring well adjacent to the existing landfill may suffice for this purpose.

- Sampling of monitoring wells must be performed during the sanitary landfill's operation and biannually following the closing of the site during a 5-year maintenance period. Michigan DNR may require this monitoring quarterly.

Should the Base elect to continue disposing of its ash in an on-base landfill along with the general refuse generated at the Base, it would require Type II licensing of the existing landfill and necessitate the expansion of the landfill into adjacent areas. To obtain a Type II sanitary landfill license for the existing landfill the following criteria summarized from the MDNR Solid Waste Management R 299.4101 through R 299.4804 must be met:

- Engineering plans, hydrogeologic evaluations, and surface and ground-water monitoring programs must be established and reviewed by the solid waste control agency to assure compliance with all rules in the above cited regulations. Landfills which are in compliance with Section 14(2) of the Michigan Solid Waste Management Act and are located in a county having a population density of less than 50 persons per square mile based on 1970 census data shall not be revised to modify their approved engineering plans to comply with the design standards of R 299.4307 and R 299.4308 so long as the ground-water performance standards of R 299.4306 (Appendix A Table 2-A) are met. However, if groundwater does exceed standards as a result of the operation, the applicant shall bear the responsibility for remedial action.

A preliminary study (Ref. 12) indicated the existing landfill could be licensable for ash disposal. Much of the information presented in this document supports that conclusion.

E. AIR QUALITY, EMISSION LIMITATIONS, AND PERMIT REQUIREMENTS

1. Background

Analysis for air quality is of major concern in assessing environmental impacts of proposed modifications to the heating plant at K. I. Sawyer AFB. The primary objective is to examine whether the proposed action or any of the alternatives is consistent with the Michigan State Implementation Plan (SIP) for attainment and maintenance of air quality standards) as well as any other applicable requirements.

Under the provisions of the Clean Air Act, as amended in 1970 and 1977, EPA established National Ambient Air Quality Standards (NAAQS) which define the maximum allowable ambient concentration for criteria pollutants. In early 1971, these standards were set for five criteria pollutants: suspended particulates, sulfur dioxide, carbon monoxide, photochemical oxidants, and nitrogen dioxide. A guideline was set for hydrocarbons as an aid towards meeting the photochemical oxidant standard. On October 5, 1978, the EPA promulgated an ambient air quality standard for lead and on February 8, 1979, a new air quality standard for ozone was promulgated to replace the photochemical oxidant standard. These six pollutants are the current criteria pollutants. In a recent action (48 Federal Register 628, January 5, 1983), EPA revoked the guideline for hydrocarbons.

Air quality standards were set at two levels for each pollutant. The primary standard is designed to protect the human health. The secondary standard is designed to protect the public welfare. Welfare in this context includes damages to buildings, plants, and animals,and impairment of visibility. Table 4.3 presents the baseline air quality for K. I. Sawyer AFB (discussed in Chapter 3) and the applicable NAAQS and PSD increments.

The prime responsibility of achieving these standards rests with the states. The Clean Air Act furthermore gave states the option of prescribing more stringent standards if desired. The State of Michigan has adopted the NAAQS as the state ambient standards. Source emission limitations may result from Prevention of Significant Deterioration (PSD) regulations, New Source Performance Standards (NSPS), and SIPs.

2. Prevention of Significant Deterioration Regulations

The Clean Air Act Amendments of 1977 firmly mandated PSD. The program establishes firm ceilings and increments which were not to be exceeded in those areas where air quality is better than NAAQS. Table 4.3 summarizes the maximum allowable increases for different areas of the country. Class I areas are the areas with the most restrictive limits and were so designated because they generally are environmentally sensitive areas (such as National Parks). All other areas of the country were designated as Class II areas. These areas are those where air quality was also better than the NAAQS and consist of largely populated and industrial centers of the United States. (There were no Class III areas, i.e. areas where industrial growth is maximized such that the ceilings are the NAAQS themselves.) When the difference between the ambient air quality standards and the baseline is less than the theoretically allowable PSD increments, then that difference becomes the applicable increment.

PSD regulations apply to major sources and major modifications. Sources listed in Table 4.4 are considered major if the emission of any criteria pollutant is greater than 100 tons per year. A source not included in one of these categories is also considered major if the emissions of any criteria pollutant exceed 250 tons per year. A modification is considered major if the net emission increase of any pollutant is greater than the de minimus values for that pollutant as given in Table 4.5. (The one exception to this rule is when the resulting source still does not qualify as being major.) Net emission changes take into account both any emission reductions from curtailment or elimination of existing operations and any emission control equipment that will be installed

TABLE 4.3

COMPARISON OF BASELINE AIR QUALITY DATA
FOR K. I. SAWYER AFB, NATIONAL AMBIENT AIR QUALITY
STANDARDS, AND PSD INCREMENTS (ug/m^3)

Pollutant	Averaging Time	Baseline Air Quality	Primary NAAQS	Secondary NAAQS	Class I PSD Increments (EPA)	Class I PSD Increments* (Michigan)	Class II PSD Increments (EPA)	Class II PSD Increments* (Michigan)
Particulate Matter	Annual	17	75	60	5	4	19	15
	24-hour	90	260	150	10	8	37	30
SO_2	Annual	8	80	N/A	2	2	20	16
	24-hour	81	365	N/A	5	4	91	73
	3-hour	176	N/A	1,300	25	20	512	410
CO	8-hour	7,200	10,000	10,000	N/A	N/A	N/A	N/A
	1-hour	11,500	40,000	40,000	N/A	N/A	N/A	N/A
Ozone	1-hour	170	235	235	N/A	N/A	N/A	N/A
NO_2	Annual	24	100	100	N/A	N/A	N/A	N/A
Lead	Quarterly	0.22	1.5	1.5	N/A	N/A	N/A	N/A

* Authority for PSD has been delegated to Michigan by EPA.

TABLE 4.4

PSD SOURCE CATEGORIES[a]

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1. Fossil fuel-fired steam electric plants of more than 250 MMBtu/hr heat input
2. Coal cleaning plants (with thermal dryers)
3. Kraft pulp mills
4. Portland cement plants
5. Primary zinc smelters
6. Iron and steel mill plants
7. Primary aluminum ore reduction plants
8. Primary copper smelters
9. Municipal incinerators capable of charging more than 250 tons of refuse per day
10. Hydrofluoric acid plants
11. Sulfuric acid plants
12. Nitric acid plants
13. Petroleum refineries
14. Lime plants
15. Phosphate rock processing plants
16. Coke oven batteries
17. Sulfur recovery plants
18. Carbon black plants (furnace process)
19. Primary lead smelters
20. Fuel converison plants
21. Sintering plants
22. Secondary metal production plants
23. Chemical process plants
24. Fossil fuel boilers (or combinations thereof) totaling more than 250 million Btu/hr heat input
25. Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels
26. Taconite ore processing plants
27. Glass fiber processing plants
28. Charcoal production plants

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[a] These source categories are listed in both the Clean Air Act and PSD regulations. A source in one of these categories is major if emissions of any criteria pollutant is greater than 100 tons per year. A source not included in one of these categories is major if emissions of any criteria pollutant exceeds 250 tons per year. Criteria pollutants are particulate matter, sulfur dioxide, carbon monoxide, oxides of nitrogen and lead.

TABLE 4.5

DE MINIMUS EMISSION RATES FOR PSD[a]

Pollutant	Emission Rate (Tons Per Year)
Carbon Monoxide	100
Nitrogen Oxides	40
Sulfur Dioxide	40
Total Suspended Particulates	25
Volatile Organic Compounds	40
Lead	0.6
Asbestos	0.007
Beryllium	0.0004
Mercury	0.1
Vinyl Chloride	1.0
Fluorides	3
Sulfuric Acid Mist	7
Total Reduced Sulfur (inc. H_2S)	10
Reduced Sulfur (inc. H_2S)	10
Hydrogen Sulfide	10

[a] Any new or modified major stationary source which is to be located within ten kilometers of a Class I area must also show that the impact of a given pollutant is less than 1 ug/m^3, 24-hour average, in order to be exempt from PSD review for that pollutant.

with source. Any major stationary source (new or modified) which is located within 10 km of a PSD Class I area must also show that the impact of any given pollutant is less than 1 ug/m^3 24-hour average in order to be exempt from PSD review for that pollutant.

The existing plant is not one of the 28 categories of sources listed in PSD regulations; however, the existing plant is considered major since the actual SO_2 emissions exceed 250 tons per year. Because of the substantial net emissions of SO_2 and NO_x from coal combustion from the proposed action, emissions of these two pollutants will likely be the controlling factor in determining whether the proposed modifications will be considered major. On the basis of the calculations summarized in Chapter 5, it is expected that the proposed action will be subject to PSD review.

When de minimus values are exceeded, a new or modified source governed by PSD regulations must meet the following requirements:

1. an analysis to show that the Best Available Control Technology will be used; and

2. an air quality analysis to demonstrate that available PSD increments would not be exceeded.

Sources locating in or impacting PSD areas must demonstrate that Best Available Control Technology will be used. Assessments of control technology requirements are made on a case-by-case basis taking into account cost, energy, and technical feasibility. NSPS control levels (see below) are generally used as the minimum acceptable emission control requirement for a BACT determination, so BACT control levels may be more stringent than those imposed by NSPS requirements.

With respect to the required air quality analysis, PSD increments have been set only for TSP and SO_2, and the Base falls in a PSD Class II area. The nearest Class I area is Seney National Wilderness Area (NWA) approximately 86 kilometers to the east of the Base. Another PSD Class I area in Michigan is Isle Royale National Park which is approximately 240 kilometers northwest of the Base.

EPA has encouraged the states to take over the PSD program. Accordingly, the Michigan Air Pollution Control Commission (APCC) has been delegated the authority by EPA for complete control of issuing permits to sources within its jurisdiction. The State PSD permit program is similar to the one promulgated by EPA, except that the State of Michigan allows only 80% of the maximum PSD increments allowed by EPA.

In meeting PSD requirements, sources face one additional requirement: EPA's stack height regulations. On February 8, 1982, EPA issued these final regulations, requiring emission limitation determination not be affected by height of the flue gas stack in excess of that suggested by Good Engineering Practice (GEP). (Tall stacks tend to maximize the dispersion of pollutants.) Because Air Force air space criteria (AFR 86-14) require a stack height less than GEP (in this case, less than 145 feet), meeting EPA's requirements should not pose a problem.

3. New Source Performance Standards (NSPS)

Congress also mandated new source performance standards (NSPS) which restrict the amount of emissions that can be discharged from various major source categories. These standards apply to new major sources. The new boilers proposed for the plant are not affected by NSPS since their heat input is below the 250 MMBtu/hr requirement specified in the boiler standard.

NSPS for boilers above 250 MMBtu/hr are 0.1 pounds/MMBtu for TSP, 1.2 pounds/MMBtu for SO_2,.and 0.7 pounds/MMBtu for NO_x. Although the proposed boilers (due to their capacity being less than 250 MMBtu/hr) are not subject to NSPS emission limits, these limits are used as a guide in determining Best Available Control Technology (BACT) which are required of sources subject to PSD regulation.

4. Applicable State Air Pollution Regulations

In addition to PSD and NSPS, state permits to construct and to operate must also be obtained. Normal processing time for a permit is 60 days after submission of a complete application. Within 30 days of the completion of proposed constructions, the Base will have apply for a permit to operate. In order to show compliance with emission limitations, the Base may be required to perform emission tests and to install a continuous opacity monitor as conditions of the permit. The permit to operate continues to be in effect as long as the equipment operates in accordance with any permit conditions.

There is no fee charged for a permit to construct or to operate; however, there is an annual surveillance fee which is based on the amount and type of pollutants being emitted and the difficulty of investigation of the source. The minimum fee is $25 per year. The annual surveillance fee will be determined by the Michigan Department of Natural Resources.

Specific Michigan APCC regulations applicable to the proposed boilers are described below (Ref. 20). These regulations only cover the air pollution aspect of the permit. Regulations adopted to assure attainment and maintenance of the ambient air quality standards are generally submitted to EPA by the State to be included as a part of the SIP.

Rule 220 specifies several requirements for sources of hydrocarbon in an ozone nonattainment area. One requirement under this rule is to provide for an emission offset (reduction) of the total hourly and annual emissions from existing sources equal to 110% of the allowed emissions from the proposed equipment. However, sources which will result in a net increase in emissions less than 50 tons per year, 1000 pounds per day and 100 pounds per hour are exempted from the requirement of this rule. Hydrocarbon emissions from burning coal are usually low, and it is believed that the proposed new boilers would be exempted from this rule because their emissions will be less than the applicable limits.

Rule 331 specifies limits on the emissions of particulate matter from the fuel burning equipment. For new coal-fired boilers the limit is 0.10 pounds per 1000 pounds of exhaust gases at 50% excess air. When burning wood or wood and coal (as long as heat input of wood fuel is 75% or more of the total heat input) the allowable limit is 0.50 pounds per 1000 pounds of exhaust gases. For any other combination of wood and coal firing, the allowable emission limit is determined by Michigan APCC on a case by case basis.

Rule 370 covers the disposal of collected air contaminants. Good engineering practice to minimize introduction of these contaminants into the air are generally required. For sources located in Michigan Priority I and II areas, there are specific requirements. (These Priority I and II areas are different from PSD Class I and II areas and should not be confused; they generally are the larger urban areas of the State). However, K. I. Sawyer AFB is not located in either a Priority I or a Priority II area, so these requirements do not apply.

Rule 402 governs the emissions of sulfur dioxide from fuel burning sources other than power plants. This rule sets a limit of 2.4 pounds SO_2 per million Btu input. Again sources subject to PSD regulations may be required to meet more stringent SO_2 limits. This regulation does not make a distinction between the type of fuel used and is thus applicable to coal and/or wood firing as well.

A special part of the Michigan regulations deals with air pollution episodes. An "air pollution episode" means a condition that may lead to or result in the build up of air pollutions which adversely affect the health of the people. Depending upon the buildup of the pollution levels, one of the four episode conditions (forecast, alert, warning and emergency) may be declared. In order to reduce the level of pollution during such episodes, Michigan air pollution regulations (Rule 336.2307) require that a source emitting 0.25 or more tons per day of any criteria pollutants shall prepare an episode emission abatement program for reducing the emission of air contaminants into the atmosphere. Since the emissions of several pollutants from the existing and proposed source exceed 0.25 tons per day, such a program must be submitted to the Michigan Air Pollution Control Commission when requested. Whenever an air pollution episode has been declared, the Commission may order a source to put into effect the applicable episode emission reduction program.

Michigan does have regulations which cover the control of fugitive emissions but these regulations also apply only to sources located in Priority I and II areas. As with air contaminant disposal, the K. I. Sawyer AFB heating plant is not affected.

F. OTHER POTENTIAL REQUIREMENTS

The Michigan DNR has issued guidelines for the containment, transportation, and disposal of asbestos waste. Generally these guidelines require dampening the material, enclosing the material in plastic bags, and disposing of the bags in a site approved for asbestos by Michigan DNR.

Other statutes and policies which would potentially affect the proposed action at K.I. Sawyer AFB are: the Endangered Species Act, which specifies Federal requirements intended to prevent the extinction of plant and animal species; the Statement on Prime Farmland, Range, and Forest Land, which states U.S. Department of Agriculture policy and the protection of such lands; Executive Order 11988, which gives direction on limiting development in floodplains; and Executive Order 11990, which sets Federal policy on minimizing detrimental impacts of development on wetlands. None of these appear to affect the project at K.I. Sawyer AFB.

G. SUMMARY OF PERMIT REQUIREMENTS

As described above, the following permits appear to be required for the K. I. Sawyer AFB heating plant project. All permits would be obtained from Michigan DNR.

- NPDES (effluent discharge) permit - K. I. Sawyer AFB will apply for a permit to discharge effluent into Silver Lead Creek. Interim effluent limitations are proposed for Silver Lead Creek and would last from the time the permit is issued until January 30, 1984.

- Ground-water discharge (coal pile runoff) permit - Michigan DNR may require a program to characterize the coal pile run-off and/or to monitor the ground-water characteristics in the vicinity of the coal pile. In many instances a permit for coal pile run-off is not required by Michigan DNR provided that the run-off is not discharged directly to a water body.

- Type II or Type III landfill license - If the Base elects to dispose of the ash in the existing Base landfill, the landfill must be licensed by Michigan DNR. The Base may apply for a Type II sanitary landfill license for the existing landfill and thus continue their current disposal practice with or without the disposal of general refuse in the landfill. Alternatively, the Base may develop new cells at the landfill site which will be used only for the disposal of ash, and thus the Base may request a Type III landfill license.

- Prevention of Significant Deterioration (air quality) permit - Depending on the alternative, the emissions of one or more pollutants will make the project liable to PSD requirements, including a demonstration that Best Available Control Technology will be applied for control of relevant pollutants.

- Permit to Construct and Operate an Air Pollution Source - To obtain this permit, K. I. Sawyer AFB must show compliance with Rule 220 (hydrocarbon emissions), Rule 331 (particulate matter), and Rule 402 (sulfur dioxide). In order to show compliance with TSP and SO_2 emissions, the Base may be required to perform emission tests for these pollutants and install a continuous opacity monitor as conditions of the permit.

CHAPTER 5

ENVIRONMENTAL CONSEQUENCES

CHAPTER 5

ENVIRONMENTAL CONSEQUENCES

In this chapter, the potential environmental impacts of the proposed Air Force action and the alternative actions are described and compared. Conflicts between the proposed action and alternatives and the objectives of Federal, regional, state and local land use plans, policies and regulations are also addressed. In addition, mitigation measures for specific adverse environmental impacts are identified and evaluated. The proposed action and alternatives are described in Chapter 2 of this document.

A. ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

1. Earth Resources

a. Land Requirements and Physical Features

Construction activities associated with the proposed action would be confined to the immediate vicinity of the existing heating plant which is situated on the southern portion of the industrial area of the Base. The construction will involve an eastern annex to Building 521; therefore, the new facility will require only a small parcel of land located in an area which has already undergone development.

The three-acre coal storage area will be sufficient to store a six month supply of coal for the heating plant. Though a greater amount of coal will be stored, no expansion of this facility has been proposed and hence the impact to this area will be minimal.

A new wood storage area will be required to store incoming wood chips. The wood chip storage area will occupy the site where the fuel oil storage tanks are presently located. No undeveloped land will be required for this purpose and therefore no significant impacts will result from the construction of this facility.

Land will also be required for the disposal of solid wastes generated during construction and operation of the heating plant. Construction debris will be disposed of in the "hardfill" area adjacent to the existing sanitary landfill on the Base. Several options exist for the disposal of fly ash and bottom ash, all of which require land disposal to some extent. The solid waste impacts are discussed in greater detail later in this chapter.

The impacts of the proposed action can then be compared to those of the alternatives. Land requirements associated with Alternative 1 would be the same as those for the proposed action with regard to the area required for the new boilers. By eliminating wood as a fuel source, the need for the wood storage area would also be eliminated. The coal storage area is sufficient to stockpile a six-month supply of coal for the peak heating period between mid-October through mid-April. Therefore, no additional land requirements would be necessary for year round coal usage.

Land requirements associated with Alternative 2 would also be the same. By eliminating coal as a fuel source, the area presently utilized as the coal storage area would be available for some other uses which could include additional Base facilities or an open storage area.

The "no action" alternative (Alternative 3) would have no modifications on the existing land uses associated with the heating plant.

b. Soils

The implementation of the proposed action will cause a minor disturbance to the soil during construction. Only a minimal amount of earthwork will be necessary since the project areas are level with little to no change in contour. While the soil may be somewhat compacted as a result of the use of heavy machinery during construction, this impact will be small because the soil has previously been disturbed. The minor soil erosion which may occur can be mitigated to a great extent by common abatement techniques such as the placement of hay bales or mulch in areas of potential erosion to trap run-off, covering stockpiles of soil or dry materials, and revegetating or covering exposed areas as soon as possible.

No significant impact is expected from the project with respect to acid deposition from air emissions. Local soil testing suggests the pH is in the range of 4.9 to 6.3, which indicates the natural soils in the area are slightly acidic. Because air pollutants are widely dispersed, it is unlikely that there would be a significant impact in the local area. Coal pile run-off is contained in a perimeter collection ditch, and hence any impact to the soils which could be attributed to run-off constituents will be restricted to the ditch area.

2. Solid Waste Disposal

At the time the new boiler units begin operation and the two existing coal-fired boilers have been converted to the new system, the three existing oil-fired boilers will be demolished. Salvageable materials will be disposed of by the Defense Property Disposal Office (DPDO) and all remaining materials such as concrete rubble and miscellaneous construction debris will be removed from the construction site by the contractor and disposed of in the "hardfill" area of the Base landfill. The area is located within two miles of the construction site and has sufficient capacity for the disposal of all construction debris from this project. Occasionally, concrete rubble disposed of at the site is reused as rip rap materials around the Base. The construction debris is not expected to cause any environmental contamination on the Base.

Waste materials containing asbestos, however, are of particular concern. It is known that a quantity of asbestos insulation exists around the pipes in the existing oil-fired boilers. As the boilers are dismantled, this waste will have to be identified and disposed of according to the Michigan Department of Natural Resources (DNR) and Occupational Health and Safety Administration (OSHA) standards. The disposal of asbestos will only have to be performed during the three-month dismantling period. The probable method for disposing of the asbestos will involve packing the material in double line plastic bags prior to burying the waste in the existing sanitary landfill on the Base. The method is considered an environmentally safe and acceptable manner of disposing of this material.

Fly ash and bottom ash are the major solid wastes generated from the operation of the heating plant. Coal ash currently generated at the facility has been disposed of in the Base sanitary landfill along with the general refuse and wastewater treatment plant sludge. The sanitary landfill is located on the northern portion of the Base, east of the main runway. K. I. Sawyer AFB is considering closing this landfill and disposing all future general refuse in a newly developed regional landfill. The Base is currently evaluating a program to dispose of the wastewater treatment plant sludge by land application on several areas throughout the Base. Three alternatives are under evaluation for disposing of future fly ash and bottom ash: 1) sell the ash, 2) landfill off the Base, and 3) landfill on the Base.

There is a limited market for ash materials. Wood ash, essentially potash, is used as a soil conditioner. Coal ash is used as a pozzolan in the manufacture of concrete products. Neither type of ash, however, is in high demand. A survey of major coal users in the K. I. Sawyer AFB area revealed only one, Escanaba Municipal Electric Utility, marketing its ash. Bark River Concrete Products uses ash from the utility's Escanaba Power Plant in manufacturing concrete blocks and other products. American Flyash Company of Chicago, Illinois, has tried unsuccessfully for several years to market ash generated in the area. The state of the economy is a partial explanation for the lack of success. The construction industry uses concrete products, but construction is currently a very depressed industry. The remoteness of the area from population centers and construction activity is also a problem. Future construction on the Base, however, might use some ash (Ref. 12).

The Marquette County Regional Planning Commission is currently conducting a study to select sites for the county-operated regional landfill. Several potential sites under review are within five miles of K. I. Sawyer AFB (Ref. 19). If the new regional landfill is located at a nearby site, the Air Force could economically haul ash to the regional landfill. County officials have indicated that they would derive several benefits from ash disposal at the regional landfill. The County generates only small volumes of solid wastes. By disposing of the ash generated at K. I. Sawyer AFB, the County would be able to reduce the overall operating costs for the regional landfill due to the economies of scale derived from the additional waste load. The County could also use the ash (particularly bottom ash) as part of the daily cover for the landfill. By using the ash as part of the required daily cover, the ash volume will be substituted for native cover material and therefore, minimize any impact on the total waste capacity of the landfill.

The third option for disposing of the fly ash and bottom ash entails disposing of the ash in a landfill within K. I. Sawyer AFB. The disposal area would likely be located on a ten-acre site adjacent to the existing sanitary landfill. Assuming the general refuse from the Base will eventually be hauled off the Base to a regional landfill, the ash would be disposed of in a homogeneous manner within the landfill. This disposal practice would require licensing by the Michigan DNR which at a minimum would necessitate routine ground-water monitoring (see Chapter 4, Solid Waste Disposal Regulations).

The Base currently disposes of approximately 840 tons of ash annually. Under the proposed action, the modified heating plant burning 68 percent coal and 32 percent wood chips would generate 1507 tons per year of total ash. (This calculation assumes coal ash content of 6.1 percent - 60 percent bottom ash and 40 percent fly ash - and a wood ash content of 2.0 percent - 30 percent bottom ash and 70 percent fly ash.) Annually the plant would generate 1547 cubic yards of bottom ash and 756 cubic yards of fly ash, which would require 1.44 acre feet per year of landfill volume. Assuming an average landfill depth of 18 feet, including a two-foot cap when the landfill is closed, a ten-acre site would serve the facility needs for approximately 112 years. The ash generation rates for the key alternatives evaluated in this study are summarized in Table 5.1.

The impact of ash disposal on the ground-water conditions will depend on the physical and chemical properties of the future ash composition (see Table 5.2). Specific leachate extraction tests on the ash generated from the new fuel sources will indicate the potential for contamination of the groundwater aquifer based on constituents detected in these tests. Generally, the soluble matter in coal ash may include several milligrams per liter of iron, nickel, and zinc sulfates, as well as trace quantities of chromium, copper, lead, arsenic, selenium and cadmium. The largest quantity of soluble matter however, consists of calcium, magnesium, potassium, sodium sulfates, and anhydrous oxides, which raise total dissolved solids levels but are not considered toxic pollutants. Fly ash typically contains higher concentrations of soluble material than does bottom ash, usually in the range of several percent (Ref. 10). Lower concentrations of trace metals are found in wood ash, and therefore the resulting leachate will have less of an impact on ground-water quality than leachate derived from coal ash.

Fly ash and bottom ash volumes generated by the implementation of Alternative 1 would be greater than the volume generated by the proposed action. Alternative 1 is expected to generate 1577 tons per year of ash. Annually the plant would generate 1893 cubic yards of bottom ash and 650 cubic yards of fly ash equivalent to 1.57 acre-feet per year of landfill volume. Assuming similar characteristics described above, the ten-acre site would serve the facility needs for approximately 102 years. Since the majority of the ash generated in the proposed action would be coal ash (approximately 66 percent) the characteristics of the ash leachates for Alternative 1 are expected to be similar to those of the proposed action (refer to Water Quality section).

TABLE 5.1

ASH GENERATION POTENTIAL

Ash Volumes	Proposed Action	Alternative 1	Alternative 2	Alternative[a] 3
Bottom Ash (cubic yards)	1547	1893	816	1260
Fly Ash (cubic yards)	756	650	982	433
Total Ash (cubic yards)	2303	2543	1798	1693
Total Ash (acre-feet/yr)	1.44	1.57	1.12	1.05

[a] Based on 25% increase in the existing annual heat requirement to account for growth at the Base.

TABLE 5.2

TRACE ELEMENT CONCENTRATIONS IN EASTERN/APPALACHIAN COAL, FLY ASH, AND FLY ASH LEACHATE (Ref. 29)

Element/ Ion	Coal (ppm)	Fly Ash (ppm, dry)	Fly Ash Leachate (mg/l)	National Interim Primary Drinking Water Standards (mg/l)
Al	--	60,000-350,000	1.1-(80*)	N/A
As	--	5-1000	<0.006-.03*	0.05
B	25	20-3000	--	N/A
Ba	--	400-3000	<.01-.03*	1.0
Ca	--	10,000-20,000	>73-(211*)	N/A
Cd	--	0.2-20	0.001-.037*	0.05
Cr	13	70-356	0.01-.11*	N/A
Cu	--	22-400	0.32*	N/A
F	--	1.7-21	--	N/A
Fe	--	90,000-235,000	927*	N/A
Pb	--	3.2-7	0.01-.08*	0.05
Mg	--	5000-25,000	3.4-(19.3*)	N/A
Mn	-	316-1000	0.63*	N/A
Mo	3.5	12-41	--	N/A
Ni	14	24-1000	0.05-.12*	N/A
Se	--	6.2-48	0.002-0.26*	0.01
SO_4	--	--	141-(2,777*)	N/A
Sn	0.4	20	--	N/A
V	21	100-780	--	N/A
Zn	7.6	12.9-3000	0.06-1.63*	N/A

* Ash pond discharge

Note: Values reported represent a number of widely varying environments which include utility ash pond overflows and laboratory leachate extractions which use different generation methodologies.

The use of 100 percent wood chips as the fuel source for the heating plant would produce less ash than either of the alternatives which use coal as a portion of the fuel supply. Alternative 2 is expected to generate approximately 1361 tons of ash per year. Annually, the heating plant would generate approximately 816 cubic yards of bottom ash and 982 cubic yards of fly ash, equivalent to 1.12 acre-feet per year of landfill volume. Assuming the same landfill characteristics previously described, the ten-acre site would serve the facility needs for approximately 143 years. Since approximately 70 percent of the total wood ash is made up of fly ash, the disposal methods must be modified because fly ash does not compact as well as bottom ash and has a greater tendency to be transported by wind and water. The disposal method may require additional measures to adequately cover and compact the fly ash. Wood ash and coal ash also differ in their chemical make-up. Wood ash normally does not contain as diverse an amount of trace heavy metals. Those trace metals that are detected in wood ash are typically found in lower concentrations than those detected in coal ash. Therefore, leachates from wood ash are expected to have less of a potential for environmental contamination than leachates derived from coal ash (refer to Water Quality section).

Under Alternative 3, coal ash would be generated at the heating plant at a rate of 1058 tons of ash per year. The ash quantity is less than either of the previously discussed alternatives and, therefore, the degree of the impacts associated with ash disposal are lessened relative to the quantity of ash generated. Coal ash is presently disposed of in the Base sanitary landfill. However, when Marquette County develops a regional landfill, K. I. Sawyer AFB may close the existing Base sanitary landfill. The Base would then have to implement one of the ash disposal options previously discussed under the proposed action. The impacts associated with these disposal options are similar to those discussed under the proposed action.

3. Water Quality

The construction impacts on the surface water resources of the area will be minor, since the site is flat and is over 1,000 feet from Silver Lead Creek; it also consists of permeable soils. Due to these characteristics, run-off from the disturbed construction site is unlikely to degrade the water quality of Silver Lead Creek or cause a siltation problem in the creek.

Implementation of the proposed action will not change the types of wastewaters generated from the heating plant operations; however, the methods for treating and discharging these wastewaters will be modified. Each of the wastewaters generated at the modified heating plant have been identified in the following discussion along with their present disposal method, proposed disposal method, and implications of the change in these methods.

Sanitary wastes are generated from the showers, lavatories and toilet facilities at the plant and are piped to the K. I. Sawyer AFB wastewater treatment plant. It is estimated that approximately 1000 gallons per day of domestic wastewater is generated from the heating plant. These wastes will continue to be discharged directly to the wastewater treatment plant. Since the proposed plans do not call for an increase in the work force within the heating plant, no additional sanitary wastes will be generated at the facility.

The floor drain wastes in the heating plant are also piped to the wastewater treatment plant. The floor drain wastes typically receive wash water containing cleaning detergents and minor spillage which may occur from miscellaneous sources within the heating plant. It is estimated that an average of 100 gallons per day of wash water may be generated from standard cleaning operations conducted at the heating plant. The wastes will continue to be discharged to the wastewater treatment plant. The characteristics and volume of this waste stream should not change significantly, since the three oil-fired boilers are to be dismantled when the two new boilers are in operation. Therefore, the total plant area affected will not change substantially.

Boiler blowdown water has been discharged into a blowdown tank, which in turn discharges directly to the permeable soil adjacent to the heating plant. Since the plant is a high temperature water system which does not generate steam, blowdown only occurs during infrequent occasions when the plant has excess water in its circulating system or during routine maintenance operations. When blowdown or bleed-off is necessary, it typically involves less than 700 gallons on any one occasion, with the exception of a large volume (approximately 13,000 gallons) which may occur during the annual maintenance operations. Typical constituents which may be found in boiler blowdown have been identified in Table 5.3. The table also identifies the range in concentrations for each parameter. It should be noted that it is highly unlikely that the maximum concentration for each of the parameters listed in the table would occur from the blowdown emanating from the K. I. Sawyer heating plant. Under the proposed modifications smaller quantities of boiler blowdown will be intermittently generated. The blowdown tank will be removed and the low volume of blowdown water will be discharged through the floor drain system to the wastewater treatment plant. Due to the low volume of this waste stream, the additional wasteload to the wastewater treatment plant will have an insignificant impact on the effluent characteristics of the treatment plant. By eliminating the direct discharge of the blowdown water to the permeable soil, the potential for ground-water contamination from this source is also eliminated along with the future requirement for a ground-water discharge permit for this waste stream.

The coal storage area situated adjacent to the heating plant is approximately 2-3 acres in size which includes a 30-foot wide perimeter area around the pile. The coal presently stored consists of oil-treated Eastern Bituminous coal. The base of the coal storage pile is primarily asphalt; however, portions of the base are made up of compacted crushed coal. The area around the coal pile is generally grass-covered sandy soil. No perimeter ditching or other surface collection system, nor underground collection system is presently available; consequently, stormwater run-off from the coal storage pile is allowed to run onto the perimeter grassy/sandy areas and percolate into the soil. The run-off

TABLE 5.3

TYPICAL CONSTITUENTS FOUND IN BOILER BLOWDOWN (Ref. 10)

Pollutant	Concentration (mg/l)
Conventional Measures of Pollution	
pH	8.300 - 12.000
Total Solids	125.000 - 1,407.000
Total Suspended Solids	2.700 - 31.000
Total Dissolved Solids	10.000 - 1,405.000
BOD_5	10.800 - 11.700
COD	2.000 - 157.000
Hydroxide Alkalinity	10.000 - 100.000
Oil & Grease	1.000 - 14.800
Major Chemical Constituents	
Phosphate (total)	1.500 - 50.000
Ammonia	0.000 - 2.000
Cyanide (total)	0.005 - 0.014
Trace Elements	
Chromium (total)	0.020 - ---
Chromium $^{+6}$	0.005 - 0.009
Copper	0.020 - 0.190
Iron	0.030 - 1.400
Nickel	0.030 - ---
Zinc	0.010 - 0.050

is directed primarily to the east and south sides of the existing coal pile, which is a grassy park-like area with several large trees. Some surface-soil discoloration is noticeable in the area. These discolored areas appear in small rivulets, and extend from the coal pile as far as 75 to 80 feet into the grassy area (Ref. 12). This discoloration is darkish-brown to brownish-black, and believed to be a result of stormwater run-off from the coal pile.

The soil characteristics underlying the coal storage pile and surrounding areas are of a sandy/silty nature, and are very permeable. There are no soil boring logs available, nor are any known to exist in the immediate vicinity of the coal pile. Previous studies have indicated that the ground-water table in the area of the coal storage pile is generally 70 to 90 feet deep (Ref. 12). The closest water well is approximately one-half mile from the coal storage pile area. No ground water data has been collected in the area of the coal pile; therefore, the impact of the existing coal pile run-off on the ground-water quality is not known.

The future coal storage pile, based on a six-month maximum storage, would consist of 14,000 tons of coal and occupy the same area as the existing coal pile. The proposed action for handling the run-off from the coal storage area consists of an unlined perimeter ditch approximately 20 feet in width with 4:1 sloping sides (Ref 12). The ditch would be designed to collect and control run-off from a 10-year, 24-hour storm event which, based on National Oceanic and Atmospheric Administration (NOAA) data, is 3.3 inches or a maximum potential run-off volume of approximately 269,000 gallons from the three-acre coal storage area. The run-off would be allowed to percolate in a controlled manner into the underlying permeable soil. Suspended solids would be filtered by the underlying sandy/silty soils.

Coal pile run-off discharged in this manner may require a ground-water discharge permit from the Michigan Department of National Resources. As discussed in Chapter 4, it is conceivable that the Michigan DNR could impose, as a condition of the permit, a program to characterize the coal storage pile run-off and monitor the ground water to determine if any changes in the ground-water quality occur over time.

Characteristics of the leachate generated from coal piles have a wide potential for variation depending on the specific type of coal stored. Table 5.4 identifies the composite range of conventional measurements of pollutants, major chemical constituents and eleven trace elements found in coal pile run-off. The parameters which tend to be of most concern due to their constituent concentrations in coal pile run-off are: total suspended solids, total dissolved solids, pH, conductivity, sulfate, and dissolved heavy metals such as iron, manganese, aluminium, zinc and selenium (Ref. 10). Any effect on the ground-water quality would likely involve an increase in one or more of these parameters, with the exception of total suspended solids.

TABLE 5.4

CONSTITUENTS OF COAL PILE RUNOFF (Ref. 10)

Conventional Measures of Pollution	Range (mg/l)
pH	2.100 - 6.600
Total Suspended Solids	22.000 - 610.000
Total Dissolved Solids	720.000 - 28,970.000
Turbidity	2.770 - 505.000
Total Hardness	130.000 - 1,851.000
Major Chemical Constituents	
Ammonia	0.000 - 1.770
Nitrate	0.300 - 1.900
Phosphorus	0.200 - 1.200
Sulfate	130.000 - 20,000.000
Chloride	3.600 - 481.000
Aluminum	66.000 - 1,200.000
Iron	0.060 - 4,700.00
Manganese	90.000 - 180.000
Sodium	160.000 - 1,260.000
Trace Element Constituents	
Arsenic	0.005 - 0.600
Beryllium	<0.010 - 0.070
Cadmium	<0.001 - 0.003
Chromium	0.000 - 16.000
Cobalt	0.025 - ---
Copper	0.010 - 3.900
Magnesium	0.000 - 174.000
Mercury	<0.0002- 0.007
Nickel	0.240 - 0.750
Selenium	<0.001 - 0.030
Zinc	0.006 - 12.500

The on-base wood storage area will require an area approximately 40,000 square feet, based on a seven-day (168 hour) supply (Ref. 12). The proposed action includes provisions for covering the on-site wood storage pile (Ref. 13). Sheltering the wood pile will reduce the exposure of the wood chips to stormwater. The proposed plans do not specify any special stormwater run-off control measures. However, even if the wood pile shelter were not constructed, run-off from the wood pile would not be expected to cause significant contamination problems since these materials are typically exposed to the same environmental elements under natural conditions.

The ash handling system washdown water is currently discharged to an area adjacent to the heating plant and is allowed to percolate into the permeable soil. These washdown waters are generated from the periodic cleaning of the ash handling equipment. It has been estimated that several hundred gallons of this wastewater are generated per day from cleaning operations. The wastewater contains particulate matter including ash and other suspended solids. Dissolved solids constituents in the present waste stream have not been characterized. The chemical characteristics of the washdown water will likely change at the time the new boiler systems are put into operation due to the variation in the physical and chemical properties of the coal and wood ash generated from the new fuel sources. Representative trace element concentrations in Eastern/Appalachian coal, fly ash, and fly ash leachate are shown in Table 5.2. The proposed plans are to divert the washdown waters to the coal storage pile run-off collection system, and allow it to percolate into the underlying permeable soils (Ref. 12). The regulatory requirements with the coal pile run-off collection system will therefore also apply for the washdown water.

No immediate impact to the ground water is expected to occur from this discharge. The sandy/silty soil will act as a filtration system for suspended solids. Leachate extraction tests must eventually be conducted on the ash generated from the new fuel sources to determine whether significant concentrations of heavy metals or other potentially toxic contaminants may be present in the leachate. Since only small quantities of ash handling water will be generated and allowed to percolate into the ground, a substantial time period would occur before any changes in the ground-water characteritics could be detected as a result of this discharge. Therefore, if contaminants are detected during ash leachate extraction tests, there will be ample time to modify the discharge procedures prior to adversely affecting the ground-water quality.

Ash handling water could also be directed to the wastewater treatment plant. The primary impact of directing this waste stream to the treatment system would be an increase in suspended solids to the treatment plant. The added suspended solids load would slightly increase the wastewater treatment plant sludge volume. Concentrations of other chemical constituents would have to be determined from the ash leachate extractraction tests. Dissolved heavy metals would likely pass through the treatment system; however, due to the relatively small volume of this waste stream and the low concentrations of trace metals (typically less than the National Interim Primary Drinking Water Standards listed in Table A-2 of Appendix A), the wastewater is unlikely to cause any detrimental water quality impacts to the receiving stream.

The heating plant utilizes non-contact cooling water which is supplied from the Base water supply system. The water passes through the heating plant cooling system one time and is discharged to the sanitary sewer system. No additional chemicals are added to the cooling water, and hence the water does not contain any contamination which would impact the wastewater treatment system or the receiving steam It is estimated that 8000 to 10,000 gallons per day of cooling water pass through the heating plant. The volume is not expected to change substantially under any of the proposed modifications.

The existing water treatment system, which includes one zeolite unit, a 4000 gallon heated water storage tank, feedwater heater, phosphate and sulfite feed units, and two make-up feedwater pumps, would remain to serve the addition to the existing heating plant. The modifications to the heating plant are expected to require less make-up water, particularly if the new modifications incorporate a nitrogen pressurized circulating water system (Ref. 12). The reduction in the quantity of make-up water would also reduce the amount of water treatment chemicals necessary as well as reduce the power requirements for operating the base water supply wells.

The only other potential effect on water quality pertains to the landfill disposal of the ash. If the ash is disposed of in a homogeneous manner within a landfill on the Base, the impact to the ground water will be dependent on several factors. Two of the major factors include the depth of ground-water table and the permability of the underlying soils. The area adjacent to the existing sanitary landfill has previously been identified as a likely location for ash disposal in the event the Base elects the on-base disposal alternative (Ref. 34). Regional hydrogeological data indicates the ground-water depth to be approximately 40 feet; other sources have indicated that the ground-water depth may be between 90 and 100 feet below the surface in this area (Ref. 34). The soil permeability in this vicinity is high due to the unconsolidated glacial sediments found in the underlying soils. Other factors which have an influence on the potential for ground-water contamination involve the design and operation of the landfill. If the ash is well compacted and the exposed areas of the landfill are graded to allow precipitation to run-off, the amount of percolation will be reduced and consequently the potential for ground-water contamination will also be reduced.

Run-off from the landfill may transport ash residue and other particulate matter away from the landfill site. This can be remedied by properly designing the drainage around the landfill to trap run-off and allow the solids to settle prior to discharging the run-off into the natural drainage system. Silver Lead Creek is over one half mile from the potential landfill site; therefore, no contamination of the creek is expected to result from any solids transport from the landfill.

If the ash is combined with general refuse at either the regional landfill, or the existing on-base landfill, it will be more difficult to relate any ground-water contamination problems directly to the heating plant ash. It would also be essentially impossible to later retrieve the ash from the landfill should a use for the ash be found at a later time.

Alternative 1's impact on water quality is expected to be virtually the same as that of the proposed action. The implementation of Alternative 2, however, eliminates the necessity for a coal storage area which consequently eliminates the impacts which may be associated with the treatment and disposal of coal pile run-off. As previously discussed, wood ash is expected to contain less trace metals and other potentially toxic constitutents which reduces the potential for ground-water contamination resulting from the landfilling of wood ash.

If Alternative 3 is selected, the types of waste streams generated from the operation of the existing heating plant will not change. Sanitary wastes and floor drain discharges will continue to be piped to the wastewater treatment plant. Effective treatment of these wastes would depend on the successful implementation of a proposed project to upgrade the existing wastewater treatment system. If the wastewater treatment plant is not upgraded, effluent characteristics will not improve, and the impact of waste streams originating from the heating plant will remain the same.

4. Air Quality

a. Determination of Emissions

To assess the air quality impacts of the proposed action and alternatives, emissions must first be determined. Two important parameters for calculating boiler emissions are the type and amount of fuel burned. This data is presented in Table 5.5. Using these fuel requirements and emission factors (Ref. 37,39) as given in Table 5.6, the air emissions expected to exit from the stack were computed and are shown in Table 5.7. Emissions of certain other pollutants such as asbestos, fluorides, sulfuric acid mist, etc. (for which EPA has established de minimus levels, listed in Table 4.6), are expected to be negligible since the relevant constituents in coal are negligible. The greatest stack emissions under the proposed action are 343 tons/year of sulfur dioxide and 481 tons/year of nitrogen oxides.

Fugitive emissions (Table 5.8) are those emissions which escape to the atmosphere through vents, windows, doors, etc., and not through a primary exhaust system such as a stack, flue or control system. Due to the nature of operation, fugitive emissions associated with the heating plant will be fugitive particulates which will result from material (coal, wood chips, and ash) handling, transfer and storage. Not counting construction emissions, fugitive particulate emissions total 4.38 tons/year for the proposed action.

Emissions during construction will be of a temporary nature and will involve mostly particulates due to earth moving activities, site clearing and increased traffic due to construction equipment. Since the proposed site for the new boiler is just an extension of the existing heating plant, it is anticipated that construction activities will not involve any major excavation. Construction of the boiler itself will involve mostly assembling parts together and installation of equipment. The emission factor provided by EPA is 1.2 tons of particulates/acre for every month of construction (Ref. 39). Since the addition will be 4400 square feet

TABLE 5.5

ANNUAL FUEL REQUIREMENTS[a]

Alternative	Fuel Required Coal [b] (tons/year)	Wood Chips[c] (tons/year)	Fuel Oil[d] (gal/year)
Proposed Action (32% wood, 68% coal)	17,583	21,773	-
Alternative 1 (100% coal)	25,857	-	-
Alternative 2 (100% wood)	-	68,054	-
Alternative 3 (No action)	9,270	-	3,060,000

a Annual fuel requirement is based on a design value of 694,000 MMBtu/year. This design load represents a 25% increase from the existing heat requirement to account for future growth at the Base.

b Based on a coal heating value of 13,420 BTu/lb.

c Based on a wood chip heating value of 5,100 BTu/lb.

d Based on an oil heating value of 145,510 BTu/gal.

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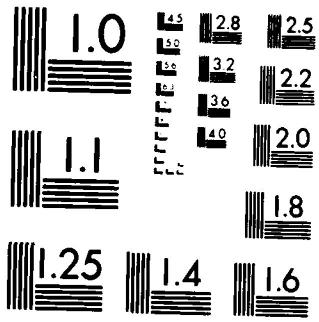

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

TABLE 5.6

EMISSION FACTORS[a] (Ref. 3,39)

Pollutant	Emission Factors		
	Coal (lb/ton)	Fuel Oil (lb/1000 gal)	Wood Chips[c] (lb/ton)
Total Suspended Particulates	79.3	14.3	5
Sulfur Dioxide	37.2	177.4	1.5
Carbon Monoxide	2	5	2
Hydrocarbons	1	1	2
Nitrogen Dioxide	15	60	10
Lead	0.0162	0.004	-
Arsenic	0.003[b]	0.001[b]	-
Beryllium	0.0037	0.0007	-
Cadmium	0.001[b]	0.0035	-
Manganese	0.08	0.001	-
Mercury	0.0008	0.00007	-
Nickel	0.003	0.08	-
Vanadium	0.0006[b]	0.3	-

a Refers to uncontrolled factor otherwise stated.

b Refers to controlled factor.

c For wood burning, AP-42 gives a range of emission factors for carbon monoxide, hydrocarbons and total suspended particulates. A recent report (Reference 9) cites emission factors for wood burning which are even lower than the lowest values given in AP-42. Based on this new information, lower values of emission factors (as shown above) were used.

TABLE 5.7

STACK EMISSIONS[a] OF PROPOSED ACTION AND ALTERNATIVES

Pollutant	Emissions in Tons Per Year			
	Proposed Action	Alternative 1	Alternative 2	Alternative[b] 3
Total Suspended Particulates[c]	8	10	2	38
Sulfur Dioxide[d]	343	481	51	443
Carbon Monoxide	40	26	68	16
Hydrocarbons	31	13	68	6
Nitrogen Oxides	241	194	340	160
Lead	0.0014	0.0021	-	0.009
Arsenic	0.0264	0.0391	-	0.0155
Beryllium	0.0003	0.0005	-	0.0018
Cadmium	0.0090	0.0129	-	0.0101
Manganese	0.007	0.011	-	0.0162
Mercury	0.0001	0.0001	-	0.0005
Nickel	0.0003	0.0004	-	0.122
Vanadium	0.005	0.008	-	0.3082

a Refers to controlled emissions, i.e. emissions including the effect of proposed air pollution control equipment.

b Based on a 25% increase in the existing annual heat requirement to account for projected growth at the Base.

c Based on an ash content of 6.1% for coal. The control efficiency of particulate control devices for the proposed action and Alternatives 1 and 2 is projected to be 99%. For Alternative 3, the control efficiency is 96%.

d Based on a sulfur content of 0.98% for coal and 1.13% for fuel oil.

TABLE 5.8

FUGITIVE PARTICULATE EMISSIONS [a]

Emission Source	EMISSION IN TONS PER YEAR Proposed Action	Alternative 1	Alternative 2	Alternative 3
Coal Handling				
Rail car unloading	0.43	0.63	-	0.23
Coal Storage	1.63	2.40	-	0.86
Coal conveying/crushing	0.35	0.52	-	0.19
Coal conveying/transfer bunker	0.43	0.63	-	0.23
	2.84	4.18	-	1.51
Wood Chip Handling				
Truck unloading	0.10	-	0.30	-
Storage	0.24	-	0.24	-
Conveying/transfer/bins	0.10	-	0.30	-
	0.44	-	0.84	-
Ash handling				
Conveying	0.4	0.6	0.40	0.22
Unloading	0.7	1.0	0.60	0.36
	1.1	1.6	1.00	0.58
Construction[b]	1.5	1.5	1.5	-

[a] Based on fuel requirements given in Table 5.5. Emission factors used in these calculations were taken from information published by EPA (Reference 38).
[b] Only during 15 months.

in area, and the construction period will be 15 months, there would be a total of 1.8 tons of particulate (1.5 tons/year) during the time of construction.

As asbestos insulation is removed from the pipes of the oil-fired boilers, there is potential for asbestos emissions. The Air Force is now considering possible approaches to minimize these emissions. Since asbestos is a carcinogen, persons involved in dismantling will be protected by use of suitable breathing apparatus or wetting agents to comply with Michigan DNR regulations.

Under the proposed action, the Air Force proposes to decommission the existing oil-fired boilers, and would thus be able to obtain credits for emission from these boilers. (Net increase in emissions refers to the difference in emissions for the proposed action or alternative under consideration and the emission from the existing oil-fired boilers to be decomissioned.) Emission credits are applicable only to actual emissions from the existing boilers to be decommissioned. Actual emissions from the existing oil-fired boilers are given in Table 5.9.

Table 5.10 shows the net increase in emissions. Table 5.10 is basically the difference between Tables 5.9 and 5.7 except that for Alternative 3 the difference was computed from the total (all existing boilers) heating plant emissions.

The combustion of 100% coal (Alternative 1) increases some emissions and decreases other. (Refer to Table 5.6, 5.7, and 5.8.) Most significant is an increase in sulfur dioxide of 138 tons/year, compared to the proposed action (Refer to Table 5.10.) Other pollutants, due to the combustion characteristics of coal, are emitted at a lower rate. These pollutants include carbon monoxide, hydrocarbons, and nitrogen oxides. Trace metals tend to show a slight increase compared to the proposed action. Fugitive emissions, because of the necessity for additional coal handling, are somewhat greater. Construction emissions would be the same as for the proposed action.

The combustion of all wood (Alternative 2) has substantially different impact than that of all coal. Carbon monoxide and nitrogen oxides emissions would increase, stack particulate emissions modestly decrease, fugitive particulate emissions would decrease, and trace metal emissions are negligible. Construction emissions would be the same as for the proposed action and Alternative 1.

Under Alternative 3, (compared to the proposed action), stack emissions would be greater due to projected increase in heat demand. Because coal would not be used to the extent envisioned in the proposed action, fugitive emissions would be less. Construction emissions would not occur.

TABLE 5.9

ACTUAL STACK EMISSIONS FROM EXISTING OIL-FIRED BOILERS

Pollutant	Emission in Tons Per Year
Total Suspended Particulates	18
Sulfur Dioxide	217
Carbon Monoxide	6
Hydrocarbons	1
Nitrogen Oxides	73
Lead	0.005
Arsenic	0.0012
Beryllium	0.0008
Cadmium	0.0042
Manganese	0.0012
Mercury	0.0002
Nickel	0.0978
Vanadium	0.2444

TABLE 5.10

NET INCREASES IN EMISSIONS

Pollutant	Emissions in Tons Per Year: Proposed Action	Alternative 1	Alternative 2	Alternative[a] 3
Total Suspended Particulates	-10	- 8	-16	8
Sulfur Dioxide	126	264	-166	88
Carbon Monoxide	34	20	62	3
Hydrocarbons	30	12	67	1
Nitrogen Oxide	168	121	267	31
Lead	- 0.0036	- 0.0029	- 0.0050	0.0016
Arsenic	0.0252	0.0379	- 0.0012	0.0033
Beryllium	- 0.0005	- 0.0003	- 0.0008	0.0004
Cadmium	0.0048	0.0087	- 0.0042	0.0018
Manganese	0.0058	0.0098	- 0.0012	0.0032
Mercury	- 0.0001	- 0.0001	- 0.0002	0.0001
Nickel	- 0.0975	- 0.0974	- 0.0978	0.0238
Vanadium	- 0.2394	- 0.2364	- 0.2444	0.0616

[a] For the no action alternative (Alternative 3) the increases were calculated from the total (Boilers 1, 3, 4, 5 and 6) heating plant emissions. No emission credits were allowed, since in this alternative the oil-fired boilers would not be decommissioned. A 25% increase in the existing annual heat requirement is assumed to account for projected growth at the Base.

b. Air Quality Impact

1. Methodology

EPA-approved atmospheric dispersion models were used to determine the potential impacts on air quality that might be caused by the emission from the proposed action and alternatives. Inputs to the models included pollutant emission rates, source geometry, stack characteristics and meterological data. In addition, the models require a grid of receptors at which the concentrations are to be computed. Meterological data used in the analysis consisted of one year of hourly surface observations taken at K. I. Sawyer AFB. Upper air data was taken at the Sault Ste. Marie airport. (No similar data was available for K. I. Sawyer AFB.) 1964 was the year of all of these observations, since this was the latest available year with hourly data.

A single point source model, CRSTER was used to determine the air quality impacts for short-term periods and long-term averages. The actual model used was a modified version of EPA's CRSTER model. (This modification was performed by Engineering-Science for Region IV of EPA to extend the capability of the model to evaluate impacts from multiple point sources.) Downwash analysis was performed using Huber-Snyder procedures as incorporated in the Industrial Source Complex (ISC) model. All these models are Gaussian plume models which have been extensively used and validated for air quality impacts. These models assume that the distribution of pollutant concentrations about the plume axis in the horizontal and vertical directions is Gaussian (or normal).

Short-term concentrations are of critical importance because they are not to be exceeded more than once per year. Hence, the impact of the new boilers were modeled at maximum daily emissions which were determined assuming full load operation of the boilers 24 hours a day. Furthermore, since SO_2 emissions from burning wood is much less than that from coal burning, it was assumed that only coal was being used during the entire 24-hour period.

Only SO_2 emissions were modeled. Since dispersion characteristics of other pollutants are similar, the concentrations of other pollutants were estimated using the ratio of SO_2 emissions and emissions of other pollutants. Only stack emissions were modelled. Since fugitive emissions (including construction emissions) are mostly emitted at or near ground level, and because they tend to have a larger particle diameter and settle out at a relatively rapid rate, the air quality impact of fugitive emissions will be mostly within the plant boundary line. Hence, fugitive emissions were not modelled.

2. Impact with Respect to NAAQS

Modeling of stack emissions was performed to determine if the plant would cause a violation of the NAAQS. As discussed previously, a permit cannot be granted to construct or modify a major source if emissions from the proposed source would cause a violation of the NAAQS or would preclude the attainment of NAAQS. In Chapter 3, the existing air quality in the area was established based on ambient air quality data available for the area. Based on expected increases in air quality concentrations (Table 5.11) and the baseline air quality (Table 3.7), the projected air quality concentrations are shown in Table 5.12. The air quality standards are also shown in this table. The results indicate there would be no violation of any NAAQS, and thus public health will be protected.

3. Impact with Respect to PSD Increments

The next major air quality impact to be determined is PSD increment consumption. Under the proposed action, and Alternatives 1 and 2 the Air Force would be able to obtain emission credits for decommissioning of Boilers 1, 3, and 4. In Table 5.11, increases in pollutant concentration are compared with the maximum allowable PSD increments. The results indicate that neither the proposed action nor any of the alternatives will exceed the allowable PSD increments.

In the analysis performed here, sulfur content of coal was assumed to be 0.98%, which is the sulfur content of coal presently being used. It can be demonstrated that a 1.83% sulfur coal could be accommodated without violating any PSD increment consumption or exceeding the NAAQS. PSD increment consumption when burning 1.83% sulfur coal is given in Table 5.13. Table 5.13 indicates that the available 24-hour SO_2 increments will be consumed first before consuming all of any other PSD increments available.

Table 5.14 shows how the impacts on the nearest Class I PSD area compare for the alternatives and the proposed action. The nearest Class I area is 54 miles east of the Base. Only SO_2 emissions were modeled because SO_2 emissions are more than that for other pollutants. The results indicate minimal impact on the Class I area and well below the allowable PSD class I increments for the proposed action and all of the alternatives.

Alternative 3, the "no action" alternative, would leave the oil-fired boilers operational. This alternative would not be subject to PSD regulations, because only increased operation of the existing facility would be involved and because the oil-fired boilers would not be decommissioned, no emission credits would be available.

4. Downwash

A third air quality impact to determine is potential downwash. The influence of mechanical turbulence around a building or stack can significantly influence the ground level concentrations in the vicinity of the plant. In order to prevent downwash due to nearby buildings, EPA has published a good engineering practice (GEP) stack height regulations. Good engineering practice for the Central Heating Plant was determined to be 155 feet. However, Air Force airspace criteria (APR 86-14) restricts the stack height to 145 feet, which is less than the GEP height. Potential downwash impacts were evaluated for a stack height of 80 feet which is substantially lower than the GEP stack height. The Huber-Snyder model as incorporated into EPA's Industrial Source Complex model was used in this analysis. The impact was evaluated at the nearest property line

TABLE 5.11

INCREASE IN POLLUTANT CONCENTRATION AND
COMPARISON WITH CLASS II PSD INCREMENTS (ug/m^3)*

Pollutant	Averaging Time	Increase in Pollutant Concentration: Proposed Action	Alternative 1	Alternative 2	Alternative 3[a]	Michigan Allowable PSD Increments
TSP	Annual	-0.08	-0.07	-0.09	0.06	15
	24-hour	0.1	0.1[a]	-0.74	0.4	30
SO_2	Annual	0.6	1.4	-1.3	1.7	16
	24-hour	34	34[b]	-6	7	73
	3-hour	85	85[b]	-28	25	410
CO	8-hour	3.7	11.7[c]	11.7	0.6	N/A
	1-hour	6.6	19.9[c]	19.9	0.7	N/A
NO_2	Annual	0.2	0.1	0.5	0.2	N/A
Ozone	1-hour	ND	ND	ND	ND	N/A
Lead	Quarterly	Neg	Neg	Neg	Neg	N/A

N/A = Not applicable.
ND = Not determined (no models available for predicting impact of individual sources)
Neg= Negligible (less than 0.01 microgram/cubic meter).
a Based on a 25% increase in the existing annual heat requirement to account for projected growth at the Base.
b Maximum short-term TSP & SO_2 concentration are expected when burning coal.
c Maximum short-term CO concentration are expected when burning wood.
*Note: All pollutant concentration increases (or decreases) are as a result of the emission increases (or decreases) displayed in Table 5-10.

TABLE 5.12

BASELINE AND PROJECTED AIR QUALITY (ug/m^3)

Pollutant	Averaging Time	Baseline Air Quality	Projected Air Quality: Proposed Action	Alternative 1	Alternative 2	Alternative[a] 3	NAAQS
TSP	Annual	17	17	17	17	17	75
	24-hour	90.1	90.1	90.1	89.3	90.4	150
SO_2	Annual	8	8.6	9.4	6.7	8.6	80
	24-hour	81	115	115	75	85	365
	3-hour	176	261	261	158	193	1300
CO	8-hour	7,200	7,204	7,212	7,212	7,201	10,000
	1-hour	11,500	11,507	11,520	11,520	11,501	40,000
NO_2	Annual	24	24.2	24.1	24.5	24.2	100
Ozone	1-hour	170	ND	ND	ND	ND	235
Lead	Quarterly	0.22	0.22	0.22	0.22	0.22	1.5

a Based on a 25% increase in the existing annual heat requirement to account for growth at the Base.

ND = Not determined because there are no models available to predict impact on ozone air quality from individual point sources.

TABLE 5.13

SO_2 PSD INCREMENT CONSUMPTION
WITH 1.83% SULFUR COAL (ug/m^3)

Averaging Time	Increase in Pollutant Concentration: Proposed Action	Alternative 1	Alternative 2	Alternative 3[a]	Michigan Allowable PSD Increments
Annual	2.4	3.9	-1.3	1.7	16
24-hour	73	73[b]	-6	7	73
3-hour	194	194[b]	-28	25	410

[a] Based on a 25% increase in the existing annual heat requirement to account for projected growth at the Base.

[b] Maximum short-term TSP & SO_2 concentration are expected when burning coal.

TABLE 5.14

IMPACT ON SENEY NWA[a] AND
COMPARISON WITH CLASS I PSD INCREMENTS (ug/m^3)

Averaging Time	SO_2 Concentration: Proposed Action	Alternative 1	Alternative 2	Alternative 3[b]	Michigan PSD Class I Increments
Annual	0.1	0.1	0.01	0.12	2
24-hour	0.8	0.8	0.08	0.98	4
3-hour	6.1	6.1	0.61	7.5	20

[a] Seney National Wilderness Area is the closest Class I area.
[b] Based on a 25% increase in the existing annual heat requirements to account for projected growth at the Base.

which is about 2000 ft (610 meters). The resulting concentrations are shown in Table 5.15. Downwash conditions only apply to short-term concentrations and hence only 3-hour and 24-hour SO_2 concentrations were evaluated. Maximum daily emission rates were used in the analysis. The results indicate that even under downwash conditions, there would be no violation of allowable PSD increments or NAAQS. The class II increment of 410 micrograms per cubic meter for a 3-hour average was slightly exceeded (by 1.5%) under Alternative 3. However, it should be noted that Alternative 3 is not subject to any PSD regulations.

5. Visibility

A fourth impact is the impact on visibility. A visibility analysis was performed using a model developed by Dr. Alan Wagner of the University of Washington. According to his model, the change in visibility is given by

$$dv = \frac{-1210}{m^2} dm$$

Where: dv = change in visibility (kilometers)
m = mean mass TSP concentration (particulates less than three microns in size) along this path of the plume (ug/m^3)
dm = change in mean mass TSP concentration.

Particulates which will be discharged to the atmosphere from the new heating plant are all under three microns in size. The TSP emissions were modeled with respect to their impact at the nearest Class I PSD area, and the resulting annual mean concentration was used in the analysis. The present concentration of TSP in this area is about 17 ug/m^3 (annual average) and the maximum increase is expected to be 0.06 ug/m^3. With this information, the maximum reduction in visibility at this site is estimated to be approximately one fourth of a kilometer. From an integrated form of Dr. Wagner's equation, the current visibility (a concentration of 17 ug/m^3) is estimated to be 1210/17 = 71 kilometers (44 miles). Given a reduction in visibility of one fourth of a kilometer, the change will be insignificant.

6. Secondary Emissions

Finally, there is the issue of secondary emissions. Secondary emissions are emissions not directly coming from the source but are indirectly associated with the construction and/or operation of a major source of major modification. Such emissions are an outcome of the growth projected in the area that would occur as a result of the proposed source. Examples of secondary emissions are the emissions associated with trains and trucks to and from the source and emissions from outside support services. Because the source under consideration is a modification of the existing heating plant and most of the employees will come out of the existing labor force, the proposed changes is not anticipated to cause any additional growth, and no resulting air quality impact is expected.

TABLE 5.15

DOWNWASH ANALYSIS
FOR 80-FOOT STACK HEIGHT (ug/m^3)

Averaging Time	SO_2 Concentration			
	Proposed Action	Alternative 1	Alternative 2	Alternative[a] 3
3-hour	341	341	34.1	416
24-hour	43	43	4.3	52

[a] Based on a 25% increase in the existing annual heat requirement to account for projected growth at the Base.

c. Compliance with State Regulations

From Table 5.7 it is determined that the proposed action would be subject to PSD regulations for two pollutants, SO_2 and NO_x. This determination is based on the criteria that net increase of these pollutants exceed the de minimis values given in Table 4.7. Alternative 2 is subject to PSD only because of NO_x, but could also be subject to hydrocarbon offset requirements.

Allowable emissions are presented in Table 5.16. These allowable emissions are only applicable to TSP and SO_2 and are based on SIP emission limits. There are no emission limits for other pollutants. Thus, all SIP limits are met, and as discussed in the Air Quality Impact section above, no PSD increments will be exceeded.

5. Biotic Environment

The proposed modifications to the heating plant involve construction which would occur in areas of the base which have previously been devel-The project would not have a significant impact on any existing wildlife habitats. Threatened and endangered plants and animal species which have been recorded as inhabiting southeastern Marquette County are considered to be distant enough from the proposed project area to be out of danger (Ref. 24). There are no significant differences in the biological impacts of the proposed action and those of the alternatives.

As discussed under water quality impacts, levels of pollutants in the effluent discharged from the wastewater treatment plant, including any waste streams associated with the modified heating plant, will meet the criteria permitted by the Michigan DNR. These criteria were based, among other factors, on the expected impacts on native fish species. No discharges are allowed if significant impacts on fisheries would result. For this reason, it is not expected that the proposed action will have any impact on aquatic biota.

The secondary National Ambient Air Quality Standards (NAAQS) are designated to protect the public welfare as opposed to the primary NAAQS which are designated to protect public health. Protection of the public welfare includes the prevention of vegetation damage. The secondary NAAQS will not be violated by any of the emissions from the proposed new boilers at K.I. Sawyer AFB. The pollutant with the greater potential for causing vegetation damage is sulfur dioxide. The highest 3-hour SO_2 concentration after the expansion will be well below secondary standard. At this concentration, no vegetation damage is expected.

6. Resource Characteristics

a. Forest Resources

The proposed action would utilize forest resources as a source of fuel. Based on the description of the forest resources found in Chapter 3, annual timber growth within a fifty-mile radius of the base is estimated at 2.56 million tons. This is over 100 times the tonnage

TABLE 5.16

ALLOWABLE EMISSIONS
(New Boilers)

Pollutant	SIP Emission Limits (lb/1000 lb of flue gas)	Allowable Emissions[a] (Tons/Year)		
		Proposed Action	Alternative 1	Alternative 2
TSP				
Coal-fired	0.1	24	35	N/A
Wood-fired[b]	0.5	56	N/A	175
SO_2	2.4	832	832	832

NA = Not applicable

a Based on a 25% increase in the existing annual heat requirement to account for projected growth at the Base.

b For boilers utilizing wood for at least 75% of required heat input.

which the Base would need under the proposed action . Timber being used for fuel would not be obtained in competition with other uses such as paper production or saw timber production. Whole tree harvesting and chipping in the forest will be the most practical method of obtaining a dependable supply while actually improving the forest for other uses by the removal of undesirable or defective trees.

The U.S. Forest Service owns 450,000 acres within the 50-mile radius of the Base and that it could produce an additional 9,000 cords from conventional thinning of second-growth dense hardwoods alone. Assuming 2 tons per cord and applying a factor of 1.79 (a Forest Service factor) to account for additional tonnage available by whole tree harvest, a total of 32,220 tons of fuel could come from this single source. Within the 50-mile radius area the Forest Service has an even greater potential volume of wood from conifers and aspen (Ref. 12).

The Michigan Department of Natural Resources (DNR) owns about 500,000 acres in the western part of the 50-mile radius area. Michigan DNR foresters estimated that as much as 3,000 acres of that land could be thinned per year, if markets were available and the work thus done at a profit. Much of past Michigan DNR thinning was done as an out-of-pocket cost under the "forest cultivation program." In Michigan's current financial straits, money for this sort of work is no longer available. Using an average of 25 tons of chips per acre (volume substantiated by research at Michigan Tech's Ford Forestry Center and at the U.S. Forest Service's Forest Engineering Laboratory) from strip thinning, at least 75,000 tons of chips could be produced annually from this source (Ref. 12).

Private landowners have also indicated that they could produce substantial volumes of wood. Connor Forest Industries, indicated that they could produce 10,000 cords annually (20,000 tons) from within a 50-mile radius of the Base. Other large landowners with substantial acreage include the Cleveland-Cliff Iron Company, American Can Company, Champion International, Mead Corporation, and Longyear Realty. Although computer analysis of inventory data is necessary to determine the volume obtainable from these companies, it should be as great as that which Connor can supply. In addition, it must be kept in mind that approximately 40 percent of the land ownership in the Upper Peninsula, and in the area within a 50-mile radius of the base is in small private ownership. The total for this type of ownership amounts to at least a million acres. The amount of wood available from this source would have to be determined by an on-the-ground survey, but it is probable that all of K. I. Sawyer AFB needs might be supplied from that type of ownership, if necessary (Ref. 12).

Based on the description of the forest resources found in Chapter 3, annual timber growth within a fifty-mile radius of the base is estimated at 2.56 million tons. This is over 100 times the tonnage which the Base would need under the proposed action. Timber being used for fuel would not be obtained in competition with other uses such as paper production or saw timber production. Whole tree harvesting and chipping in the forest will be the most practical and dependable method of obtaining a dependable supply while actually improving the forest for other uses by the removal of undesirable or defective trees.

Alternative 1 and the "no action" alternative would not utilize wood resources as a source of fuel. Therefore, resource management benefits which were discussed above would not be derived from the adoption of either of these alternatives. In contrast, Alternative 2 would require the harvesting of a greater quantity of timber (68,000 tons) to provide a year-round supply of fuel for the new boilers. As previously discussed, annual timber growth within a fifty-mile radius of the Base is estimated at 2.56 million tons which is 37 times the tonnage the Base would need if they implemented this alternative. Wood harvested for the Base fuel requirements would not be obtained in competition with other uses such as paper production or saw timber production.

b. Non-Renewable Fuel Resources

Under the proposed action, the Base will require approximately 17,586 tons of coal per year. The proposed plans are to procure future coal supplies through the Defense Supply Fuel Center from high grade low sulfur sources in Eastern Kentucky. The use of coal is an irretrievable commitment of natural resources; however, based on the abundant supply of coal resources available, the K. I. Sawyer AFB heating plant will not pose a significant strain on the supply of this natural resource.

The dismantling of the oil-fired boilers would substantially reduce the quantity of oil used at the heating plant. Currently 1.5 to 2.3 million gallons of fuel oil are burned in the oil-fired boilers each year. The proposed action would only use small quantities of diesel fuel to operate the emergency back-up generators. The amount of diesel fuel consumed will be quite small and will have virtually no impact on the supply or demand of this resource. The reduction in oil usage is consistent with Federal efforts to reduce the U.S. dependency on oil resources.

Alternative 1 would utilize 100 percent coal, which would require approximately 26,000 tons of coal per year. This is a 47 percent annual increase in the quantity of coal consumed at K. I. Sawyer AFB. However, this amount is still small enough not to present any significant impacts on the supply and demand of this resource. As in the proposed action, the only petroleum products which would be used is a small quantity of diesel fuel. Alternative 2 would not utilize any coal as a fuel, and hence, the Base would no longer require the irretrievable commitment of this natural resource. Under Alternative 3, while coal supply would not be a problem, the Base would continue to consume 1.5 to 2.3 million gallons of fuel oil per year which will have no contributing influence effect on the Nation's policy to reduce its dependency on oil resources. It should be noted that under the proposed action, Alternative 1, and Alternative 2, diesel fuel will be utilized as a fuel source to power the emergency back-up generators. However, the amounts will be so small as they will essentially have no impact on the supply or demand of this resource.

7. Noise

The major sources of noise which would result from this project are associated with fuel handling. These sources include the fuel processing equipment and conveyor systems, as well as noise associated with the additional truck traffic used to transport the wood and coal. These operations will conform to the regulatory requirements of the Michigan Department of Labor and the Michigan Occupational Health and Safety Administration (OSHA) program which has been approved by the Federal Occupational Safety and Health Administration. Compliance with the Michigan OSHA program implies the facility will be in compliance with all Federal and State noise standards. Thus, these noise sources are not expected to cause any detrimental impacts.

8. Impacts on Growth and Development and Human Resources of the Area

a. Economic Conditions and Industrial Characteristics

Construction of the facility described in the proposed action will have an estimated cost of $23.5 million. The regional revenue derived from the construction related activities associated with the implementation of the proposed action, including "non-basic" service industries, is estimated to be $35,030,000. Construction is expected to be completed within 17 months from the start of the project.

Marquette County and the surrounding areas are currently experiencing a period of high unemployment. The proposed project is expected to utilize the local labor force, thus alleviating some of the unemployment in the area. The project is not considered to be large enough nor last long enough to attract new residents to the area and therefore should not have a significant effect on housing or public services in the surrounding communities.

Regional revenues from the operation of the proposed facility are estimated to be $1,480,000. The major portion of these revenues will be associated with the timber harvesting which would occur in the general area. K. I. Sawyer AFB would require a labor force of six persons to handle the wood chips. Since under the proposed action only one third of the total possible wood chips would be burned, the total labor force at the Base would be increased by no more than three to support this activity. The increase in civilian personnel would contribute approximately $25,000 per person to the regional economy. Fuel oil is not procured from local distributors and therefore, reduction in the use of this type of fuel will not have an impact on the local economy. A summary of regional revenues is shown in Table 5.17.

The regional revenue (basic and non-basic) derived from the construction of the new boilers designed to burn 100 percent coal (Alternative 1) would be approximately 29.2 million dollars, approximately 17 percent less than that of the facility designed to burn a combination of coal and wood. (See Table 5.17). The impact of the construction project on employment and community services in the area would be similar to the proposed action. With respect to no significant regional revenues, there is no significant effect are expected to be derived from the operation of a 100 percent coal-fired facility. This is because the main source of additional regional revenues would have been derived from wood harvesting operations and the additional employment required on base to handle the wood. Coal is purchased outside of the K. I. Sawyer AFB region and therefore, the increased usage of coal has no impact on the regional economy.

TABLE 5.17

ESTIMATED REGIONAL REVENUES DERIVED FROM PROJECT ALTERNATIVES[a]

Regional Revenues	Proposed Action	Alternative 1	Alternative 2	Alternative 3
Revenues Generated from Heating Plant Construction	35,030,000	29,200,000	30,400,000	-0-
Additional Revenue Generated from Heating Plant Operation	1,480,000	-0-	4,300,000	-0-

[a] Includes "non-basic" service industries.

The regional revenue (basic and non-basic) derived from the construction of the new boilers under Alternative 2 (100 percent wood) would be approximately 30.4 million dollars. This is slightly greater than that of Alternative 1, but approximately 13 percent less than that of the proposed action designed to burn a combination of coal and wood. The impact of the construction project on employment and community services in the area will be similar to the proposed action. Total regional revenues will however increase substantially if the Base elects to fuel the new boilers with 100 percent wood. The estimated regional revenue from the implementation of this alternative is 4.3 million dollars per year. This increase over the proposed action is due primarily to the additional revenues derived from the increase volume of wood harvested from the local areas and the requirement for six additional year-round employees at the Base to handle the wood.

The "no action" alternative will have no beneficial impact on the already depressed regional economy associated with the K.I. Sawyer AFB heating plant.

b. Transportation

Impacts associated with the transporting of fuel and ash to and from K. I. Sawyer AFB are expected to be minimal, limited to only slight increases in the Average Daily Traffic (ADT). Current truck traffic associated with the K. I. Sawyer AFB heating plant averages three trips per day. Based on expected fuel requirements, ash volumes, and assumed truck capacities of 10 cubic yards for ash, 20 cubic yards for coal and 40 cubic yards for wood chips, the Base could expect approximately 15 trucks entering and exiting the Base for a total of 27 additional truck trips per day. The assumed truck capacities are typical for hauling the designated materials and do not exceed the weight limitations of the major County roads servicing the base (CR 553 and 460, both Class A roads). Based on the ADT figures for CR 553 provided in Chapter 3 and assuming CR 553 were used for both fuel deliveries and ash removal (a worst case scenario), traffic volumes on this road would increase only 0.7 percent. If hauling is conducted on an irregular basis the traffic volumes may be somewhat higher as a result of more than 15 truck loads arriving and departing the Base during any one day. A summary is presented in Table 5.18.

The transportation impacts associated with Alternative 1 are expected to be even less than those associated with the proposed action. Based on the expected coal requirements and ash generation rates, approximately seven truck loads per day of coal would be necessary. Just under one truck load per day of ash would be generated. The Base could, therefore, expect an average of 13 additional one-way truck trips per day assuming the deliveries were conducted on a regular basis. This would result in a 0.4 percent increase in the 1979 traffic volumes on CR 553. As previously discussed, it is unlikely that the deliveries will be conducted on a regular daily basis and traffic volumes could likely increase by more than 13 truck trips in any one day.

The transportation impacts associated with Alternative 2 are somewhat greater than those associated with the proposed action. Based on the expected wood chip requirements and ash generation rates, an average

TABLE 5.18

ADDITIONAL DAILY TRUCK TRIPS[a]

	Proposed Action	Alternative 1	Alternative 2	Alternative 3
Additional Daily Truck Trips	37	13	53	1

[a] It is assumed that coal and wood fuels are delivered by truck and ash is disposed off-base by trucks, except in the case of Alternative 3.

of 27 truckloads per day would be necessary to haul wood chips and one truckload per day would be necessary to dispose of the ash generated at the heating plant. The Base could, therefore, expect an average of 53 additional one-way truck trips per day assuming the deliveries were conducted on a regular basis. This would result in a 1.4 percent increase in the 1979 traffic volumes on CR 553. As previously discussed, it is unlikely that the deliveries will be conducted on a regular daily basis and, therefore, traffic volumes could likely increase by an amount greater than 53 truck trips in any one day.

c. Land Use and Sites of Historic or Archeological Interest

There are no known historic or archaeological resources on K. I. Sawyer AFB. There are no wetland areas or critical habitats in close proximity to project areas. Potential construction and operational impacts from the modification of the heating plant (or from any of the proposed alternatives) are therefore expected to be insignificant. Compliance with the Michigan (OSHA) program implies the facility will be in compliance with all Federal and State noise standards. Thus, none of these noise sources, under either the proposed action or any of the alternatives, are expected to cause any detrimental impacts.

9. Additional Secondary Impacts

The advantages of modifying the current heating plant have already been discussed in Chapter 2. The "no action" alternative will necessitate continued use of the three oil-fired boilers which have been utilized for nearly thirty years. In order to operate these boilers effectively, maintenance procedures must be performed more frequently, increasing the operating costs for these boilers. The risk of unexpected shut-down of the system also increases the longer these boilers are in use.

B. MITIGATION OF ENVIRONMENTAL IMPACTS ASSOCIATED WITH THE PROPOSED ACTION

1. Solid Waste

The method of ash disposal selected will determine the type of impacts which may be associated with the disposal of this waste product and the measures which can be implemented to mitigate these impacts. The following measures have been identified to mitigate impacts associated with off-base ash disposal: 1) install a cover system on all trucks used to haul ash to the landfill to reduce fugitive dust emissions during ash transport; 2) use the bottom ash to supplement the daily cover for the municipal refuse; and 3) exposed fly ash should be covered with soil material or bottom ash to alleviate a potential problem associated with fugitive dust emissions and storm run-off.

Measures identified to mitigate impacts associated with on-base ash disposal include: 1) trucks used to haul ash to the landfill can be installed with covers to reduce fugitive dust emissions; 2) fly ash can be covered with bottom ash on a daily basis to reduce fugitive air emissions and run-off of the ash from the disposal site; 3) percolation into the landfill can be reduced by adequate compaction of the ash and proper grading of the landfill to avoid ponding and allow for the run-off of precipitation; 4) compaction can be improved by directing truck traffic over the fill areas; 5) leachate extraction tests can be conducted on the ash generated from the new fuel sources to provide additional information on the likelihood of ground-water contamination, thereby indicating a need for corrective actions should the tests detect significant concentrations of pollutants in the leachate; and 6) monitoring wells upgradient and downgradient of the landfill can be established to detect any future change in ground-water quality.

2. Wastewater

Mitigating measures pertaining to the impacts associated with waste water generated from the operation of the heating plant relate primarily to the upgrading of the wastewater treatment plant. The proposed plans include directing the sanitary wastes, floor drain wastes, and boiler blowdown water to the wastewater treatment plant. In addition, alternate plans include directing the ash handling water to the wastewater treatment plant. K. I. Sawyer AFB has prepared a detailed evaluation of the wastewater treatment plant which included recommended modifications to the treatment plant to meet more restrictive future discharge requirements.

An additional mitigating measure associated with the coal storage pile run-off involves covering the coal pile to reduce the volume of leachate. Potential control approaches include installing a permanent shelter over all or a portion of the pile, placing an impervious liner over the pile, or spraying the surface of the coal pile with an impervious (e.g., tar) coating.

3. Air Quality

For the purpose of reviewing mitigating measures for the control of air pollutant emissions, it is useful to classify emissions into three categories: 1) stack emissions; 2) ongoing fugitive emissions; and 3) temporary fugitive emissions. As presented in the description of the proposed action, there are already plans to install a negative pressure reverse air baghouse, along with a mechanical dust collector for each baghouse. (It is assumed that the electrostatic precipitator (ESP) will remain on the existing coal-fired boiler.) Given these current and planned particulate control devices, very little additional control of particulate stack emissions can be gained.

Should the Air Force decide to further reduce SO_2, emission control equipment will be required. One proven system for SO_2 control is flue gas desulfurization (FGD). A variety of systems are currently in use on industrial boilers. The technology can be divided into two groups: nonrecovery systems which produce a waste material for disposal and recovery systems which provide a saleable by-product, sulfur or sulfuric acid, from the recovered SO_2. Nonrecovery systems are used most extensively, and can be either wet or dry. Wet processes involve contacting the flue gas with aqueous slurries or solutions of absorbents and produce liquid wastes for direct discharge or further processing. Dry processes produce moisture free waste solids through the use of dry injection of absorbents or spray dryers.

Given the relatively low sulfur coal available, a spray absorption system merits consideration. The dry system requires no sludge handling equipment such as thickners, centrifuges, vacuum filters, or blenders to obtain a dry product. Dry scrubber wastes can be handled with conventional dry handling systems used for flyash. In a dry handling system, scaling and plugging problems do not occur since the wet/dry interface point occurs in suspension and there are no packed beds or demisters. Dry scrubbers do not require expensive alloy materials, and problems with fan corrosion or imbalance are not present. Fewer operations personnel are necessary for the dry system than the complicated wet scrubbers. The dry scrubbers also has flexibility of operation in that feed rates can be adjusted to boiler load with little concern for pH control. Wet systems have high maintenance costs due to high pressures and volumes associated with slurry handling equipment while the dry system operates with low volumes and pressures. The dry system requires 25 to 50 percent of the energy used by a wet scrubber. Although the loading to the particulate control device is higher with dry systems, the gas volume is lower, reduccing the size and cost of the particulate control equipment. Also, the particulate control equipment is at the back end of the system to assure low particulate emissions. No reheating of the flue gas is needed for most dry scrubber applications; the heat from the boiler exhaust is sufficient. Water requirements for a dry system are also much less. Low quality water such as cooling tower blowdown or ash water can be used in the spray dryer. The dry system requires a smaller area for installation than the wet system. These advantages offer the potential for relatively low capital and maintenance costs with high reliability.

However, it should be pointed out that inclusion of FGD system would require a substantial increase in resources. Along with the obvious capital expense, a spray dryer absorption system using lime would require regular shipments of the sorbent. Lime preparation and storage equipment would also be required, and provisions would need to be made to dispose of the additional waste produced and collected.

With respect to ongoing fugitive emissions, a number of control meassures are possible. However, the one which deserves the most serious attention is the treatment or enclosure of the coal pile. Not only are coal pile fugitive emissions the largest component of total fugitive particulate emissions, but control methods also can reduce the volume of leachate as discussed above. Implementation of this measure though will have to be initiated only after a careful weighing of the costs against the rather small contribution to overall emissions and ambient quality such fugitive particulates make.

APPENDICES

COMMISSION OBJECTIVE:

WATERS IN WHICH THE EXISTING QUALITY IS BETTER THAN THE ESTABLISHED STANDARDS ON THE DATE WHEN SUCH STANDARDS BECOME EFFECTIVE WILL NOT BE LOWERED IN QUALITY BY ACTION OF THE WATER RESOURCES COMMISSION UNLESS AND UNTIL IT HAS BEEN AFFIRMATIVELY DEMONSTRATED TO THE MICHIGAN WATER RESOURCES COMMISSION AND THE DEPARTMENT OF THE INTERIOR THAT THE CHANGE IN QUALITY WILL NOT BECOME INJURIOUS TO THE PUBLIC HEALTH, SAFETY, OR WELFARE, OR BECOME INJURIOUS TO DOMESTIC, COMMERCIAL, INDUSTRIAL, AGRICULTURAL, RECREATIONAL OR OTHER USES WHICH ARE BEING MADE OF SUCH WATERS, OR BECOME INJURIOUS TO THE VALUE OR UTILITY OF RIPARIAN LANDS; OR BECOME INJURIOUS TO LIVESTOCK, WILD ANIMALS, BIRDS, FISH, AQUATIC LIFE OR PLANTS, OR THE GROWTH OR PROPAGATION THEREOF BE PREVENTED OR INJURIOUSLY AFFECTED; OR WHEREBY THE VALUE OF FISH AND GAME MAY BE DESTROYED OR IMPAIRED, AND THAT SUCH LOWERING IN QUALITY WILL NOT BE UNREASONABLE AND AGAINST PUBLIC INTEREST IN VIEW OF THE EXISTING CONDITIONS IN ANY INTERSTATE WATERS OF MICHIGAN.

WATER WHICH DOES NOT MEET THE STANDARDS WILL BE IMPROVED TO MEET THE STANDARDS.

WATER

Table A-1

PARAMETERS / WATER USES	1 COLIFORM GROUP (Organisms/100 ml. or MPN)	2 DISSOLVED OXYGEN (mg/l)	3 SUSPENDED, COLLOIDAL & SETTLEABLE MATERIALS	4 RESIDUES (Debris and material of unnatural origin and oils)	5 TOXIC & DELETERIOUS SUBSTANCES
A WATER SUPPLY (1) DOMESTIC — Such as drinking, culinary and food processing.	The monthly geometric average shall not exceed 5000 nor shall 20% of the samples examined exceed 5000, nor exceed 20,000 in more than 5% of the samples.	Present at all times in sufficient quantities to prevent nuisance.	No objectionable unnatural turbidity, color or deposits in quantities sufficient to interfere with the designated use.	Floating solids: None of unnatural origin. Residues: No evidence of such material except of natural origin. No visible film of oil, gasoline or related materials. No globules of grease.	Conform to current USPHS Drinking Water Standards except: Cyanide: Normally not detectable with a maximum upper limit of 0.2 mg/l. Chromium[6]: Normally not detectable with a maximum upper limit of 0.05 mg/l. Phenol: Limitations as defined under 4-8.
(2) INDUSTRIAL — Such as cooling and manufacturing process.	The geometric average of any series of 10 consecutive samples shall not exceed 5000 nor shall 20% of the samples examined exceed 10,000. The fecal coliform geometric average for the same 10 consecutive samples shall not exceed 1000.	Present at all times in sufficient quantities to prevent nuisance.	No objectionable unnatural turbidity, color, or deposits in quantities sufficient to interfere with the designated use.	Floating solids: None of unnatural origin. Residues: No evidence of such material except of natural origin. No visible film of oil, gasoline or related materials. No globules of grease.	Limited to concentrations less than those which are or may become injurious to the designated use.
B RECREATION (1) TOTAL BODY CONTACT — Such as swimming, water-skiing and skin-diving.	The geometric average of any series of 10 consecutive samples shall not exceed 1000 nor shall 20% of the samples examined exceed 5000. The fecal coliform geometric average for the same 10 consecutive samples shall not exceed 100.	Present at all times in sufficient quantities to prevent nuisance.	No objectionable unnatural turbidity, color, or deposits in quantities sufficient to interfere with the designated use.	Floating solids: None of unnatural origin. Residues: No evidence of such material except of natural origin. No visible film of oil, gasoline or related materials. No globules of grease.	Limited to concentrations less than those which are or may become injurious to the designated use.
(2) PARTIAL BODY CONTACT — Such as fishing, hunting, trapping, and boating.	The geometric average of any series of 10 consecutive samples shall not exceed 5000 nor shall 20% of the samples examined exceed 10,000. The fecal coliform geometric average for the same 10 consecutive samples shall not exceed 1000.	Present at all times in sufficient quantities to prevent nuisance.	No objectionable unnatural turbidity, color, or deposits in quantities sufficient to interfere with the designated use.	Floating solids: None of unnatural origin. Residues: No evidence of such material except of natural origin. No visible film of oil, gasoline or related materials. No globules of grease.	Limited to concentrations less than those which are or may become injurious to the designated use.
C FISH, WILDLIFE AND OTHER AQUATIC LIFE — Such as growth and propagation.	The geometric average of any series of 10 consecutive samples shall not exceed 5000 nor shall 20% of the samples examined exceed 10,000. The fecal coliform geometric average for the same 10 consecutive samples shall not exceed 1000.	At the average low flow of 7-day duration expected to occur once in 10 years the following DO values shall be maintained in rivers capable of supporting: Intolerant fish, cold-water species (trout, salmon) - Not less than 6 at any time; Intolerant fish, warm-water species (bass, pike, panfish) - Average daily DO not less than 5, nor shall any single value be less than 4; Tolerant fish (carp, bullheads) - Average daily DO not less than 4, nor shall any single value be less than 3; Principal anadromous fish migrations in warm-water rivers - Not less than 5 during migrations. At greater flows the DO shall be in excess of these values.	No objectionable unnatural turbidity, color, or deposits in quantities sufficient to interfere with the designated use.	Floating solids: None of unnatural origin. Residues: No evidence of such material except of natural origin. No visible film of oil, gasoline or related materials. No globules of grease.	Not to exceed 1/10 [illegible] 96-hour median tolerance limit obtained from continuous flow bio-assays where the dilution water and toxicant are continuously renewed except that other application factors may be used in specific cases when justified on the basis of available evidence and approved by the appropriate agency.
D AGRICULTURAL — Such as livestock watering, irrigation and spraying.	The geometric average of any series of 10 consecutive samples shall not exceed 5000 nor shall 20% of the samples examined exceed 10,000. The fecal coliform geometric average for the same 10 consecutive samples shall not exceed 1000.	Not less than 3 at any time.	No objectionable unnatural turbidity, color, or deposits in quantities sufficient to interfere with the designated use.	Floating solids: None of unnatural origin. Residues: No evidence of such material except of natural origin. No visible film of oil, gasoline or related materials. No globules of grease.	Conform to current [illegible] Drinking Water Standards as related to toxicants. Toxic and deleterious substances shall be less than those which are or may become injurious to the designated use.
E COMMERCIAL AND OTHER — Such as navigation, hydroelectric and steam generated electric power and uses not included elsewhere in standards	The geometric average of any series of 10 consecutive samples shall not exceed 5000 nor shall 20% of the samples examined exceed 10,000. The fecal coliform geometric average for the same 10 consecutive samples shall not exceed 1000.	Average daily not less than 2.5, nor any single value less than 2.	No objectionable unnatural turbidity, color, or deposits in quantities sufficient to interfere with the designated use.	Floating solids: None of unnatural origin. Residues: No evidence of such material except of natural origin. No visible film of oil, gasoline or related materials. No globules of grease.	Limited to concentrations less than those which are or may become injurious to the designated use.

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QUALITY STANDARDS

Table A-1 (cont'd)

6 TOTAL DISSOLVED SOLIDS (mg/l)	7 NUTRIENTS Phosphorus, ammonia, nitrates, and sugars	8 TASTE & ODOR PRODUCING SUBSTANCES	9 TEMPERATURE (°F)	10 HYDROGEN ION (pH)	11 RADIOACTIVE MATERIALS
Total Dissolved Solids: Shall not exceed 500 as a monthly average, nor exceed 750 at any time. Chlorides: The monthly average shall not exceed 75, nor shall any single value exceed 125.	Nutrients originating from industrial, municipal, or domestic animal sources shall be limited to the extent necessary to prevent adverse effects on water treatment processes or the stimulation of growths of algae, weeds and slimes which are or may become injurious to the designated use.	Concentrations of substances of unnatural origin shall be less than those which are or may become injurious to the designated use. Monthly average phenol concentration less than 0.001 mg/l. Maximum concentration limited to 0.005 mg/l for a single sample.	The maximum natural water temperature shall not be increased by more than 10°F.	pH shall not have an induced variation of more than 0.5 unit as a result of unnatural sources.	An upper limit of 1000 picocuries/liter of gross beta activity (in absence of a alpha-emitters and Strontium-90). If this limit is exceeded the specific radionuclides present must be identified by complete analysis in order to establish the fact that the concentration of nuclides will not produce exposures above the recommended limits established by the Federal Radiation Council.
Total Dissolved Solids: Shall not exceed 500 as a monthly average nor exceed 750 at any time. Chlorides: The monthly average shall not exceed 125.	Nutrients originating from industrial, municipal, or domestic animal sources shall be limited to the extent necessary to prevent the stimulation of growths of algae, weeds and slimes which are or may become injurious to the designated use.	Concentrations of substances of unnatural origin shall be less than those which are or may become injurious to the designated use.	The maximum natural water temperature shall not be increased by more than 10°F.	Maintained within the range 6.5-8.8 with a maximum induced variation of 0.5 unit within this range.	Standards to be established when information becomes available on deleterious effects.
Limited to concentrations less than those which are or may become injurious to the designated use.	Nutrients originating from industrial, municipal, or domestic animal sources shall be limited to the extent necessary to prevent the stimulation of growths of algae, weeds and slimes which are or may become injurious to the designated use.	Concentrations of substances of unnatural origin shall be less than those which are or may become injurious to the designated use.	90°F maximum	Maintained within the range 6.5-8.8 with a maximum induced variation of 0.5 unit within this range.	Standards to be established when information becomes available on deleterious effects.
Limited to concentrations less than those which are or may become injurious to the designated use.	Nutrients originating from industrial, municipal, or domestic animal sources shall be limited to the extent necessary to prevent the stimulation of growths of algae, weeds and slimes which are or may become injurious to the designated use.	Concentrations of substances of unnatural origin shall be less than those which are or may become injurious to the designated use.	90°F maximum	Maintained within the range 6.5-8.8 with a maximum induced variation of 0.5 unit within this range.	Standards to be established when information becomes available on deleterious effects.
Standards to be established when information becomes available on deleterious effects.	Nutrients originating from industrial, municipal, or domestic animal sources shall be limited to the extent necessary to prevent the stimulation of growths of algae, weeds and slimes which are or may become injurious to the designated use.	Concentrations of substances of unnatural origin shall be less than those which are causing or may cause taint in the flesh of fish or game.	In rivers capable of supporting: — Ambient / Allowable increase / Maximum limit Intolerant fish, cold-water species (trout): 32° to nat. max. / 10° / 70° Intolerant fish, warm-water species (bass): 32° to 35° / 15°; 36° to nat. max. / 10° / 85° Tolerant fish, warm-water species (carp): 32° to 59° / 15°; 60° to nat. max. / 10° / [illegible]	Maintained between 6.5 and 8.8 with a maximum artificially induced variation of 1.0 unit within this range. Changes in the pH of natural waters outside these values must be toward neutrality (7.0).	Standards to be established when information becomes available on deleterious effects.
Less than 700 dissolved minerals. Maximum percentage of sodium 60% as determined by the formula (Na x 100) / (Na+Ca+Mg+K) when the bases are expressed as milliequivalents per liter.	Nutrients originating from industrial, municipal, or domestic animal sources shall be limited to the extent necessary to prevent the stimulation of growths of algae, weeds and slimes which are or may become injurious to the designated use. NO_3 concentrations shall conform to USPHS Drinking Water Standards.	Concentrations of substances of unnatural origin shall be less than those which are or may become injurious to the designated use.	Not applicable	pH shall not have an induced variation of more than 0.5 unit as a result of unnatural sources.	An upper limit of 1000 picocuries/liter of gross beta activity (in absence of a alpha-emitters and Strontium-90). If this limit is exceeded the specific radionuclides present must be identified by complete analysis in order to establish the fact that the concentration of nuclides will not produce exposures above the recommended limits established by the Federal Radiation Council.
Limited to concentrations less than those which are or may become injurious to the designated use.	Nutrients originating from industrial, municipal, or domestic animal sources shall be limited to the extent necessary to prevent the stimulation of growths of algae, weeds and slimes which are or may become injurious to the designated use.	Concentrations of substances of unnatural origin shall be less than those which are or may become injurious to the designated use.	The maximum natural water temperature shall not be increased by more than 10°F.	Maintained within the range 6.5-8.8 with a maximum induced variation of 0.5 unit within this range.	Standards to be established when information becomes available on deleterious effects.

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TABLE A-2

NATIONAL INTERIM PRIMARY DRINKING WATER STANDARDS

Arsenic	50.0 ug/l
Barium	1,000.0 ug/l
Cadmium	10.0 ug/l
Chlorophenoxys	
2, 4-D	100.0 ug/l
2,4, 5-TP	10.0 ug/l
Chromium (Total)	50.0 ug/l
Endrin	0.2 ug/l
Fluroide	2,400.0 ug/l
Lead	50.0 ug/l
Lindane	4.0 ug/l
Methoxychlor	100.0 ug/l
Mercury	2.0 ug/l
Nitrate (as N)	10,000.0 ug/l
Selenium	10.0 ug/l
Silver	50.0 ug/l
Toxaphene	5.0 ug/l
Total Trihalomethanes	100.0 ug/l

40 CFR 141.11 and 141.12, promulgated pursuant to Section 1412 of the Public Health Service Act, as amended by the Safe Drinking Water Act, P.C. 93-523. It is important to note that the standards for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver also comprise the maximum concentration of constitutents for ground water protection (40 CFR 264.92).

APPENDIX B

LIST OF PREPARERS

LIST OF PREPARERS

John Absalon Hydrogeologist	-	Associate Scientist
Bruce S. Carhart Chemical Engineer	-	Senior Engineer and Project Manager
Gregory Gibbons Sanitary Engineer	-	Associate Engineer
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Thomas N. Sargent, P.E. Environmental Engineer	-	Technical Director
Mark Spiegel Environmental Scientist	-	Associate Scientist and Project Manager
Douglas A. Toothman Air Pollution Control Engineer	-	Senior Engineer
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APPENDIX C

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*Division of Solid Waste Disposal
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Sylvia Taylor, Endangered Species Unit
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Michigan Nature Conservancy

*Michigan Natural Features Inventory Section
Sue Krispen

Central Upper Peninsula Planning Commission

Henry V. Greenwood, Planning Engineer

Marquette County Planning Commission

Alan Chase, Planning Director
Ron Koshorek, Planner
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APPENDIX D

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