United States
Environmental Protection
Agency

Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Solid Waste

EPA

A TECHNICAL ASSISTANCE PROGRAM REPORT

STRATEGY FOR SOLID WASTE MANAGEMENT ON INDIAN RESERVATIONS IN REGION VIII

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A TECHNICAL ASSISTANCE PANELS PROGRAM REPORT:

STRATEGY FOR SOLID WASTE MANAGEMENT ON INDIAN RESERVATIONS IN REGION VIII

Prepared For:

U.S. Environmental Protection Agency
Region VIII
1860 Lincoln Street
Denver, Colorado 80295

Prepared By:

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August, 1982

Public Law 94-580 - October 21, 1976

Technical assistance by personnel teams. 42 USC 6913

RESOURCE RECOVERY AND CONSERVATION PANELS

SEC. 2003. The administrator shall provide teams of personnel, including Federal, State, and local employees or contractors (hereinafter referred to as "Resource Conservation and Recovery Panels") to provide States and local governmentals upon request with technical assistance on solid waste managment, resource recovery, and resource conservation. Such teams shall include technical, marketing, financial, and institutional specialists, and the services of such teams shall be provided without charge to States or local governments.

Project Officer: William Rothenmeyer

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CHAPTER 1

INTRODUCTION

Overview

Fred C. Hart Associates, Inc. was contracted by EPA to assess solid waste management practices for five federally-recognized tribes within Region VIII (see Figure 1). Each of the reservations and the location of its tribal headquarters is identified below:

RESERVATIONS	TRIBAL HEADQUARTERS
Northern Cheyenne	Lame Deer, MT
Southern Ute	Ignacio, CO
Fort Berthold[1]	New Town, ND
Lower Brule	Lower Brule, SD
Wind River	Fort Washakie, WY

The project was conducted under the authority of the Resource Conservation and Recovery Act of 1976 (RCRA) which was enacted to protect public health and the environment through solid waste regulations and guidelines for the design of new waste management facilities and the upgrading of existing facilities. In addition, RCRA incorporates incentives for investigating and implementing resource recovery projects to encourage maximal use of resources.

This project focused on seven major components of a solid waste management system:

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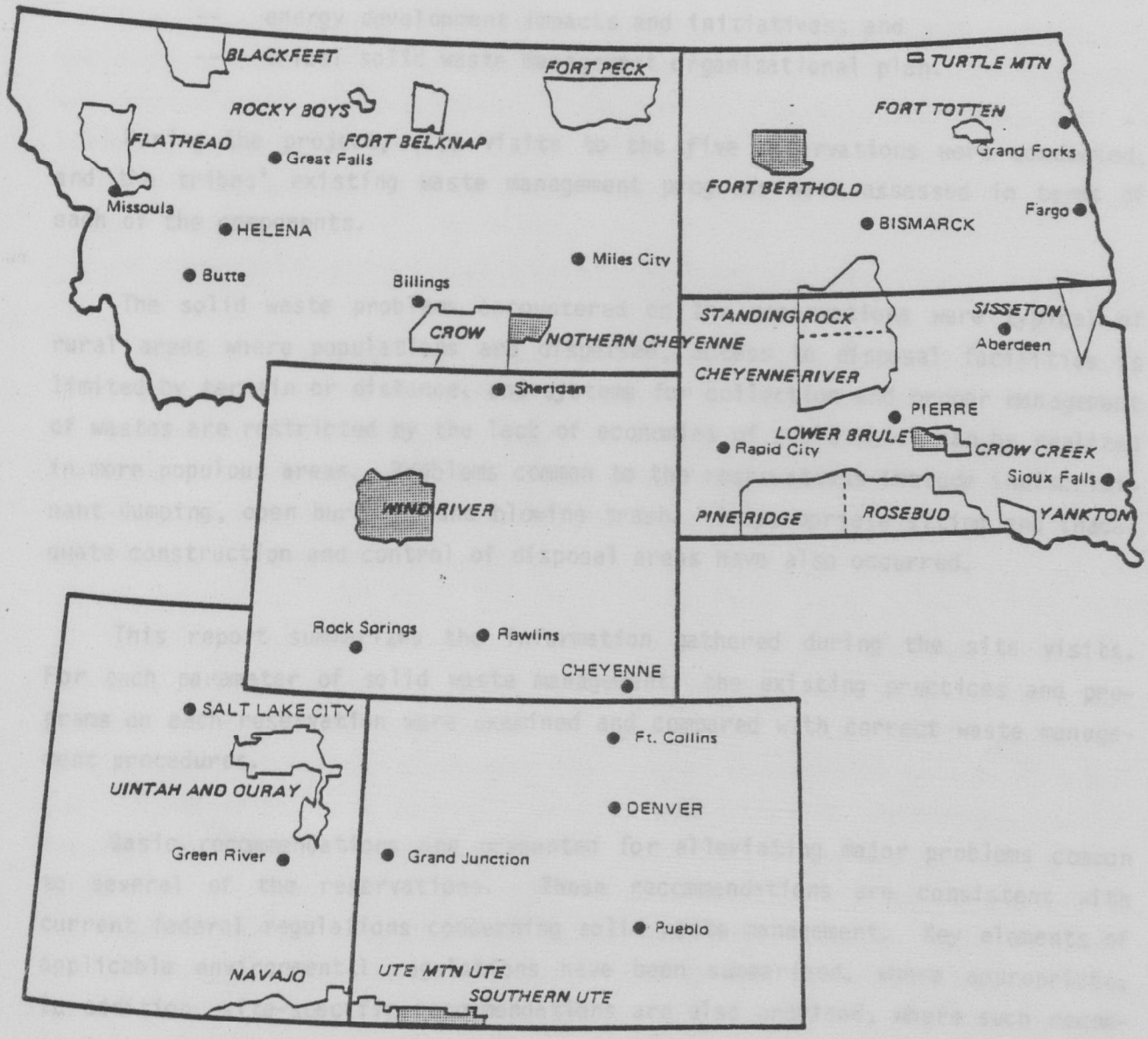
[1] Three affiliated tribes (Hidatsa, Mandan and Arikara) are located here with one tribal business council.

FIGURE 1

SOLID WASTE MANAGEMENT ON INDIAN RESERVATIONS
ENVIROMENTAL PROTECTION AGENCY REGION VIII
Technical Assistance Panels Program



-- collection and disposal systems;
-- sanitary landfill disposal;
-- septic disposal;
-- existing or potential threats to public health and the environment from improper solid waste management;
-- resource recovery potential;
-- energy development impacts and initiatives; and
-- tribal solid waste management organizational plan.

During the project, site visits to the five reservations were conducted, and the tribes' existing waste management programs were assessed in terms of each of the components.

The solid waste problems encountered on the reservations were typical of rural areas where populations are dispersed, access to disposal facilities is limited by terrain or distance, and systems for collection and proper management of wastes are restricted by the lack of economies of scale which can be realized in more populous areas. Problems common to the reservations include indiscriminant dumping, open burning, and blowing trash. Inappropriate siting and inadequate construction and control of disposal areas have also occurred.

This report summarizes the information gathered during the site visits. For each parameter of solid waste management, the existing practices and programs on each reservation were examined and compared with correct waste management procedures.

Basic recommendations are presented for alleviating major problems common to several of the reservations. These recommendations are consistent with current federal regulations concerning solid waste management. Key elements of applicable environmental regulations have been summarized, where appropriate. In addition, site-specific recommendations are also provided, where such recommendations would either differ from, or further expand upon, the basic recommendations.

The purpose of this report is to identify and explore major solid waste management problems, as they pertain to Indian reservations. Steps for implementing sound waste management practices have been identified. Due to the uniqueness of each tribe - type of government, culture, economy, physical terrain, etc. - these general solid waste management practices must be developed and implemented in a manner most suited to each individual tribe. An effective solid waste management program should consider overall tribal needs and concerns and combine modern technologies and practices within existing tribal frameworks and channels of communication. Additionally, an essential component in achieving an effective program is the coordination and cooperation of all appropriate federal agencies with the Tribal Councils.

Federal Agencies Involved in Solid Waste Management Planning Efforts

Several federal agencies have a basic responsibility to provide safe, sanitary, and decent living conditions for federally-recognized tribes. They are: The Indian Health Service (IHS), a branch of the Department of Health and Human Services; the Department of Housing and Urban Development (HUD); the Bureau of Indian Affairs (BIA), a division of the Department of the Interior; and the Environmental Protection Agency (EPA).

IHS is primarily concerned with the construction and/or development of community systems for water, sewage and solid waste. Once these services have been constructed by IHS, maintenance and operation of the systems is turned over to the tribe, as is consistent with the federal governmental policy of tribal self-determination. HUD provides financial and technical assistance to public housing agencies for the development and operation of low-income housing projects. BIA is involved in many types of programs providing basic services to the reservations in such areas as education, road building, and individual housing through their housing program. EPA, through its air, water and solid waste regulations, provides guidance to the above agencies in implementation of their projects for federally-recognized Indian tribes.

While each of these agencies provides specific services to federally recognized tribes, the services are clearly interdependent. For example, when HUD

builds a housing subdivision, the plans for sanitary services for that subdivision must be approved by IHS. IHS, in turn, complies with EPA's regulations concerning safe drinking water standards and obtaining permits for waste water discharges.

For HUD sponsored housing projects and BIA sponsored housing improvement programs ocurring on any reservation, HUD, BIA, and IHS cooperate on providing water supply and sewerage facilities to the housing projects. An agreement known as the "Tri-Agency Agreement" was formally developed in the Code of Federal Regulations, November 1979, Title 24, Part 805. Generally speaking, this agreement specifies that IHS is responsible for the funding, design, construction, and maintenance of water supply and sewerage systems for HUD and BIA projects. BIA is to provide assistance in management and operation of the systems to the maximum extent feasible. Details regarding these responsibilities are developed in 24 CFR, Part 805.

Interaction between the tribes and each of these agencies is equally important. To achieve any specific solid waste goal, the tribe may need to gain assistance from different agencies for different parts of the project. For example, IHS may provide assistance in the construction of a reservation's solid waste disposal facility. BIA, in turn, may work with the tribe in constructing the access roads to that facility.

RCRA and Solid Waste Management

The primary objectives of RCRA are the protection of public health and the environment and the conservation of valuable material and energy resources associated with solid and hazardous wastes. RCRA provides for the closure of open dumps, prohibition of future open dumping, and guidelines for proper solid waste management.

Major program areas include public information and participation, manpower development, land disposal, resource conservation and recovery, technical assistance, and state and local program development. While RCRA programs have not been enacted on Indian reservations, the reservations can benefit from RCRA program areas and take direction from guidelines developed under the authorities of the Act.

Subtitle D, covering non-hazardous solid waste, is of particular importance. Criteria and guidelines for land disposal of solid waste have been published and are drawn upon in this report as a basis for evaluating existing tribal waste management practices and needs. Landspreading, sludge disposal and resource recovery technologies are also addressed by RCRA. Environmentally acceptable and economically feasible approaches to these aspects of waste management are considered here to the degree that they may reasonably be employed by the tribes in either the short-term or long-term.

Legislation Applicable to Solid Waste Management on Reservations

Assistance in environmental programs is available to tribes through EPA and is integrally related to various pieces of environmental legislation. Either EPA or the states may administer such programs. For example, under the auspices of the Clean Water Act, tribes in both North and South Dakota have received 201 construction grant funds. "201" grants are made available through Section 201 of the Clean Water Act and provide matching funds for planning, design, and construction of municipal wastewater collection and treatment facilities. Similarly, tribes in Colorado and South Dakota have received 208 monies as part of Multi-County Area-Wide Planning Organizations. "208" grants are provided for through Section 208 of the Clean Water Act and are used for area-wide water quality management planning, the development of water quality goals, the establishment of priorities for maintaining or improving water quality and the investigation of non-point source and point source water quality problems.

Similary, under the Clean Air Act, Arizona is to serve as a "pass-thru" for air program funds to tribes within the state. Throughout Region VIII, EPA makes grants directly available to Indian reservations for planning the development of tribal air quality programs. The above programs, developed under the auspices of the Clean Air and Water Acts, have served as models for the program currently being developed under the authority of the Resource Conservation and Recovery Act.

Legislative history indicates that Congress did not intend to alter the legal relationship between states and tribes with the passage of the Clean Air Act Amendments (1977), Clean Water Act (1977), or Safe Drinking Water Act Amend-

ments (1977). Tribes are specifically exempted from certain procedural requirements under these regulations, yet may work cooperatively with states in achieving the prescribed goals. In enacting Public Law 84-280 (1953), Congress established a framework for states to obtain a limited degree of control over transactions occurring on Indian reservations. The 1968 Civil Rights Amendments, now codified as 29 U.S.C. Section 1302 et seq., precluded states from unilaterally assuming jurisdiction on reservations and imposed an additional requirement of tribal consent. Of the Region VIII states, only Montana passed legislation (1963) to assume jurisdiction over one reservation (Flathead) in certain matters. This legislation was passed with the concurrence of the tribal court. Because of the compromise nature of P.L. 84-280 and the federal court scrutiny to which states will be subject, it is likely that the jurisdiction states may obtain under this law will be limited.

Beyond the scope of P.L. 84-280, Federal courts have allowed the states jurisdiction on matters occuring within Indian reservations only where such jurisdiction does not "infringe" upon the right of tribal peoples to self-government, or create an "encumbrance" upon restricted or trust lands. County zoning ordinances have been held to be encumbrances, as have county permits. Such determinations, however, will probably have to be made independently by each reservation.

Internal Solid Waste Management Authorities

On many reservations, Tribal Utility Commissions (TUC) have been formed to manage water, wastewater, solid waste, and similar operations. Since the formation of TUC's is optional for the reservations, some tribes (e.g., Lower Brule) have opted not to institute such a commission. A TUC may be authorized by either the Tribal Council or the Tribal Council's Board of Health. The commissions are staffed by tribal members and are responsible for the day-to-day functions of the operations.

Southern Ute has an informal TUC that functions well in the task of solid waste collection. Northern Cheyenne has a formally delegated TUC that has some difficulties in meeting waste collection needs. Wind River has a TUC which deals only with water supply.

Summary

This chapter has provided a summary of the enabling legislation and the consequent responsibilities, powers, and interactions of organizations involved in solid waste management on the reservations. This material should serve as an overview for understanding both the need for improved cooperation between all parties in achieving solid waste management goals on the reservations and the necessity for continued funding in these areas, in in effort to resolve the existing waste management problems described in this report.

CHAPTER 2

OVERVIEW OF THE STUDY AREAS

In this chapter, background information for each of the five reservations is provided. Basic data are briefly summarized regarding such factors as locale, population, climate, terrain, significant transportation routes, and existing natural resources. Because each of these factors can impact waste management, consideration must be given both to their combined effect on current disposal practices and their consequent future impact on the development of an effective and appropriate waste management program for each of the reservations.

Northern Cheyenne Reservation

The Northern Cheyenne Reservation extends over more than 440,000 acres in southeastern Montana (see Figure 2). The region is characterized by rolling hills and narrow valleys and has a semi-arid climate. Two main roads which are open year-round service the reservation. The major highway, U.S. 212, requires significant maintenance especially after spring thaw. An improved road off U.S. 212, five miles west of Lame Deer, services the Muddy Creek community and other rural homes (see Figure 2).

The 1976 tribal census identified a total population of 3,227 (2,839 Indians, 388 non-Indians). Population is dispersed throughout the reservation with the greatest concentration (54 percent) in the Lame Deer area (see Figure 3). Adjacent off-reservation areas contain 356 persons increasing the total population to more than 3,500. Projections forecast population to increase 26 percent (4,136) by 1985 and 41 percent (4,638) by 1990.

Unemployment on the reservation is estimated to be greater than 50 percent. The tribal economy has very little internally-generated income or revenue. A few of the tribal people work at the Colstrip Power Plant. Energy development may increase in the vicinity of the reservation which would provide greater employment opportunities locally and could improve the economic base of the reservation.

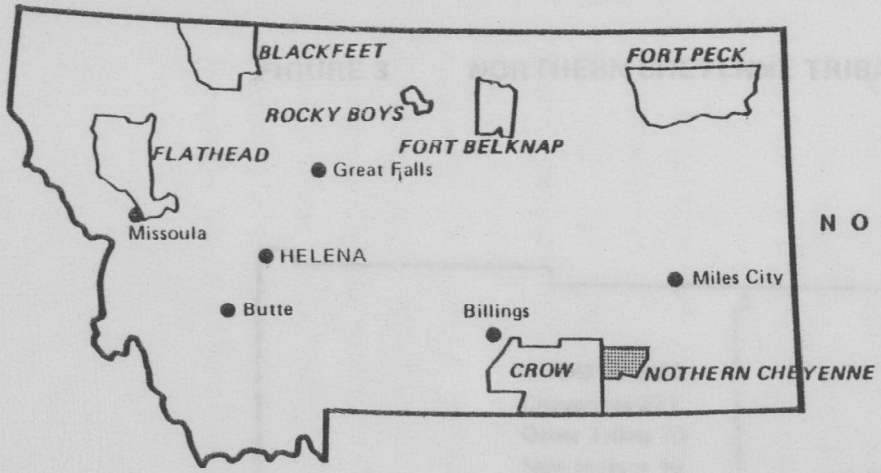


FIGURE 2

NORTHERN CHEYENNE RESERVATION

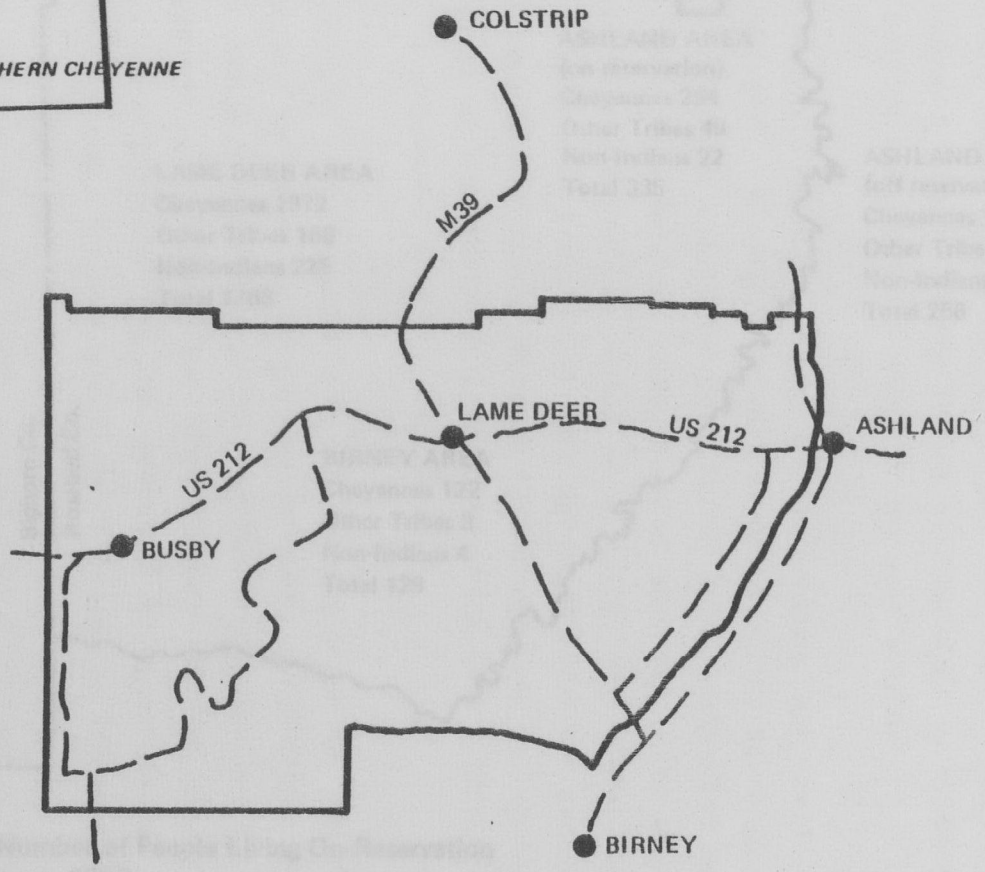
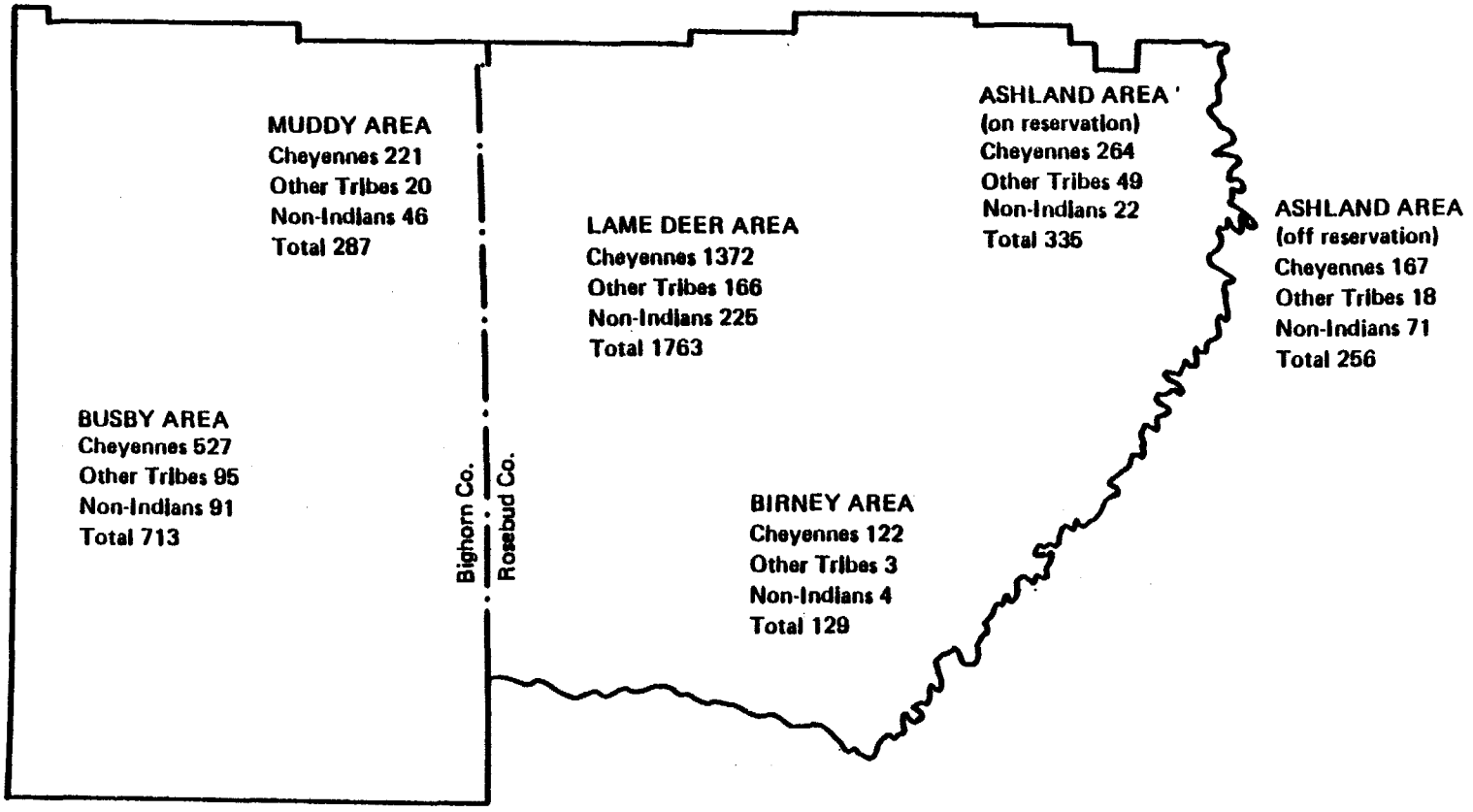


FIGURE 3 NORTHERN CHEYENNE TRIBAL CENSUS RESULTS (1976)



Total Number of People Living On-Reservation
Cheyennes 2506
Other Tribes 333
Non-Indians 388
Total 3227

The Northern Cheyenne reservation has the potential for future resource development. Although negotiations to obtain coal and timber leases are relatively slow, development appears likely in the near future. In addition, oil, natural gas, and uranium resources may exist on the reservation.

Of all the natural resources found on the reservation, coal has the greatest market potential. According to data supplied by the Northern Cheyenne Research Project (NCRP), the U.S. Geological Survey (USGS) estimated in a 1975 study that up to 5 billion tons of sub-bituminous coal may exist beneath the reservation at sufficiently shallow depths to be profitably strip mined. A maximum of 23 billion tons of recoverable coal may exist if deeper seams, accessible through underground mining and improved technology, are included. Eleven major coal beds exist on the reservation, three of which have a thickness of 65 feet or more.

While no synthetic fuel projects are currently planned for the Northern Cheyenne Reservation, the area is surrounded by seven gasification projects. Three are located within Montana (two to the west and one to the north); two are located to the east in North Dakota; and the remaining two are located to the south in Wyoming. These projects have the potential to impact energy development on the reservation and offer employment possibilities to tribal members.

Undiscovered ore, natural gas, and uranium resources may exist on the reservation. It has been estimated by USGS that up to 270 million barrels of oil may lie in undiscovered deposits beneath the reservation. The Bell Creek Field, Montana's largest oil producing area, is located 50 miles southeast of the reservation. Natural gas resources have not been located, to date, on the reservation; however, production of natural gas occurs to the northeast in the Pumpkin Creek area and may signal the possibility of potential natural gas resources in the Northern Cheyenne vicinity. According to a NCRP study, uranium deposits may exist under the Northern Cheyenne Reservation. Other areas of the Powder River Basin have been mined for uranium from the Fort Union Formation, a formation which occurs throughout the reservation.

Future energy development in the region may be impacted by the areas's designation, under the Clean Air Act, as a "Class I Area." If a new mine or other resource-related facility is established in this region, its operations would be limited by the standards of the Clean Air Act for Class I Areas, the strictest air quality requirements of the three categories.

Southern Ute Reservation

The Southern Ute Reservation is located on a strip of land extending 73 miles in length and 15 miles in width in southwestern Colorado bordering on New Mexico (see Figure 4). The reservation occupies over 800,000 acres, although only about 300,000 of the reservation's acres are owned by the Southern Ute people. This acreage is dispersed throughout the reservation in a checkerboard pattern. The remaining land is owned by non-Indians as a result of past homesteading activities.

The topography of the the reservation ranges from fertile river valleys with shallow alluvial aquifers to high timbered mesas. The region's climate is semi-arid with seasonally high runoff and ground-water levels following spring rains.

Of the 900 tribal members residing on the reservation, most live in the immediate vicinity of Ignacio, the trading center for the Pine River Valley. The reservation is intersected by several north/south paved all-weather roads including Colorado Highway 140, U.S. 550, Colorado Highway 172, and Colorado Highway 51. Remote sections of the reservation, however, are accessible only by gravel-surfaced or dirt roads.

The Southern Ute Reservation lies within the Grant's mineral belt, one of the most mineralized zones in the United States. Most minerals present have the potential for development. Oil, gas and timber are currently producing an income for the tribe. In the next five years, the projected development of the three to five hundred million tons of coal resources will bring a significant change in the economic development of the reservation and the surrounding area.

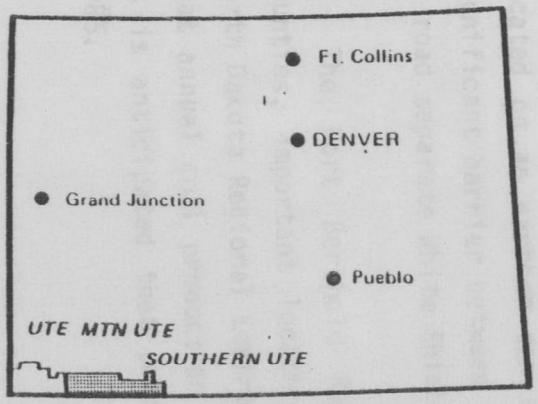
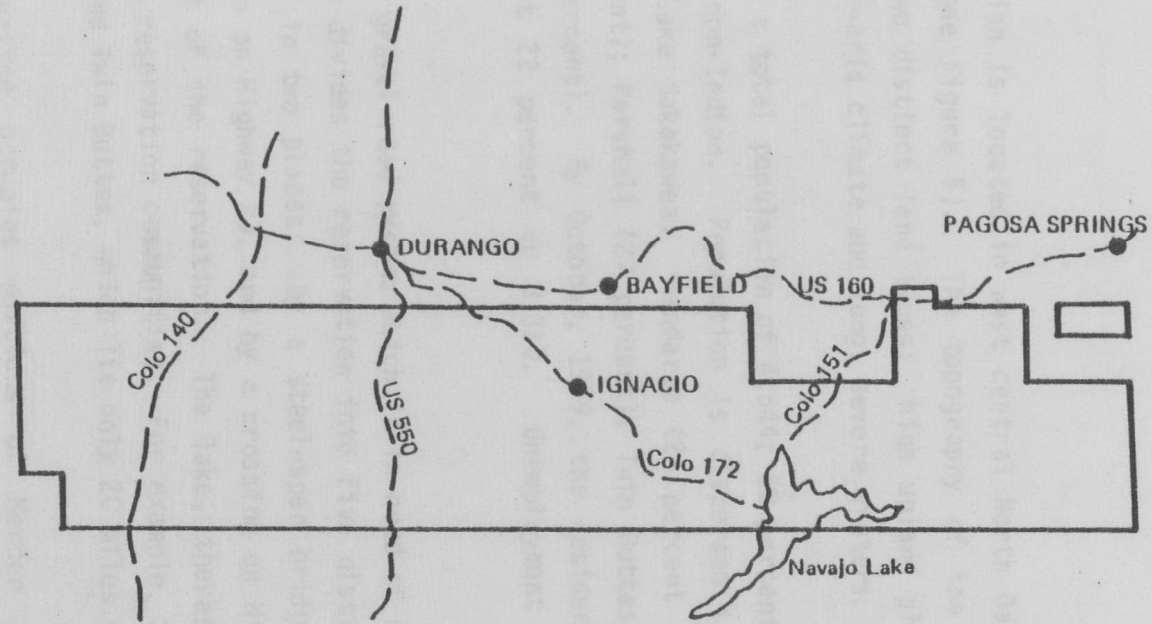


FIGURE 4

SOUTHERN UTE RESERVATION



In addition, a gasification plant and a coal liquefaction plant are planned to the south of the reservation in the Four Corners area of New Mexico.

Fort Berthold Reservation

The Fort Berthold Reservation is located in west central North Dakota and occupies over 980,000 acres (see Figure 5). The topography of the area is primarily rolling plains with two distinct land types: high upland plains and badlands. The region has a semi-arid climate and long, severe winters.

The 1975 census identified a total population of 4,644; 60 percent (2,780) Indian and 40 percent (1,864) non-Indian. Population is dispersed into five major communities surrounding Lake Sakakawea: Mandaree (24 percent of total population); New Town (31 percent); Parshall (27 percent); Twin Buttes (7 percent); and White Shield (11 percent). By October, 1979, the resident Indian population had increased almost 22 percent to 3,310. Unemployment in 1979 exceeded 43 percent.

BIA maintains the internal gravel road system which is in need of augmentation and improvement. The lake divides the reservation into five distinct segments and can only be crossed in two places: by a steel-span bridge in the northern part of the reservation on Highway 23, and by a crossing on Highway 83 located on an earthen dam east of the reservation. The lake, therefore is a significant barrier between the reservation communities. For example, 310 miles of road separate White Shield and Twin Buttes, which lie only 20 miles apart.

The Fort Berthold Reservation occupies portions of Mercer and Dunn Counties, important locations of strippable lignite. The draft West-Central North Dakota Regional Environmental Impact Study on Energy Development indicated that annual coal production is currently in excess of 6 million tons per year. It is anticipated that production may increase to 30 million tons per year by 1985.

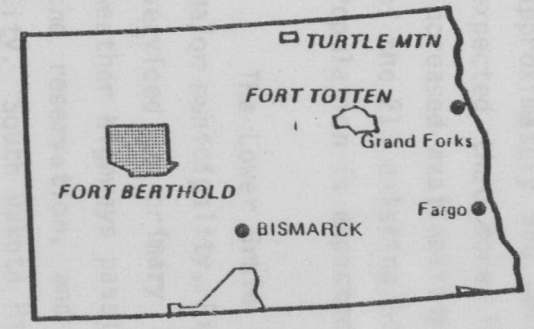
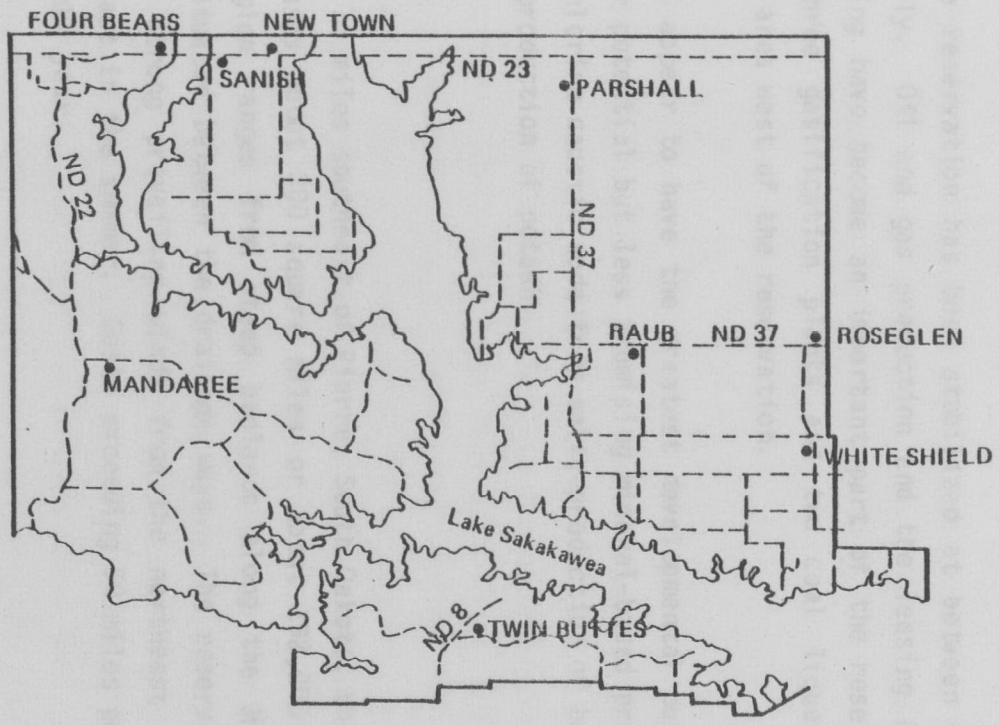


FIGURE 5

FORT BERTHOLD RESERVATION



Oil production on the reservation has been stabilized at between 450,000 and 700,000 barrels annually. Oil and gas production and the leasing of land for exploration and drilling have become an important part of the reservation economy. In addition, three gasification plants and two coal liquefaction plants are planned for the area west of the reservation.

Lignite, oil, and gas appear to have the greatest developmental potential for the reservation. Other potential but less promising mineral-based prospects include: production of chlorine caustic soda from salt; production of building materials from clays; and production of potash.

Lower Brule Reservation

Located approximately 75 miles southeast of Pierre, South Dakota, the Lower Brule Reservation encompasses about 300 square miles or about 192,000 acres. The topography of the region ranges from steep badlands along the Missouri River to rolling plains situated between the drainage ways. The reservation's climate is semi-arid with strong prevailing winds from the northeast in the winter and from the southeast in the summer. Gusts exceeding 50 miles per hour occur during any month of the year.

The reservation is sparsely populated with a current total population of approximately 950 persons, an increase of about 42 percent since 1950. It is expected that more Indians may soon return to the reservation, due to the increased availability of housing and education offered by Federal agencies (143 of the 213 existing homes on the reservation receive some form of HUD subsidy). Population is expected to increase six percent annually over the next decade.

The Lower Brule Indian Reservation is extremely isolated with the closest major municipality, Pierre, located over 75 miles away. The reservation area is serviced by primary and secondary roads with east/west and north/south all-weather highways passing through adjacent areas. U.S. Interstate 90 passes near the reservation, and provides access to Sioux Falls, Minneapolis, and Rapid City. South Dakota Highway 47 West connects the reservation with I-90.

Natural resources on the reservation are presently uneconomic to develop. Natural gas and oil occur in the Dakota Sandstones, and a manganese-bearing deposit has been discovered, but there are no plans at present for its development.

Wind River Reservation

The Wind River Reservation is located in western central Wyoming on almost two million acres of land (see Figure 6). The topography of the reservation ranges from fertile river valleys in the southeastern sector to high plains and badlands in the northern sector. Elevations range from 5,000 feet in the east to 13,000 at the southwestern boundary along the Continental Divide. The reservation's climate is semi-arid. High winds and snowfall throughout the winter cause blizzard conditions, transportation problems, and loss of livestock.

Most of the population is concentrated in the southern half of the reservation. The Arapahoe and Shoshone tribes share the Wind River Reservation. A total of almost 7,000 Indian people are concentrated in six communities on the reservation: the Arapahoe Area (28.0 percent); the Mill Creek Boulder Flat Area (3.2 percent); the Ethete Area (23.5 percent); the Fort Washakie Area (36 percent); the Crowheart-Burris Area (5.7 percent); and the Dry Creek Ranch Area (3.6 percent). Riverton, with a population of more than 10,000, contains the the largest concentration of non-Indians.

A good paved road system exists in the southern portion of the reservation, where the majority of the population resides. A network of state and county paved roads crisscross the reservation.

Economic growth on the reservation has not kept pace with population growth. High unemployment and severe underemployment are characteristic of the region.

Since the discovery of oil on the reservation in 1909, 16 oil and gas fields have been established. Over the years, petroleum and natural gas have

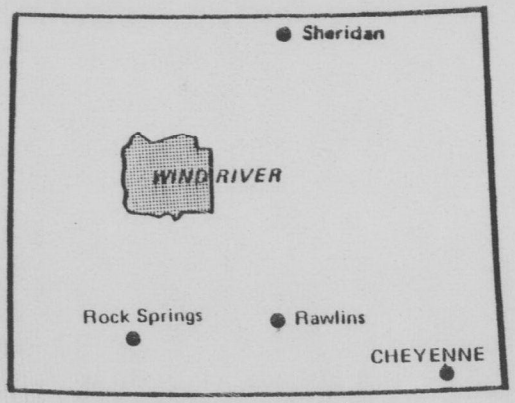
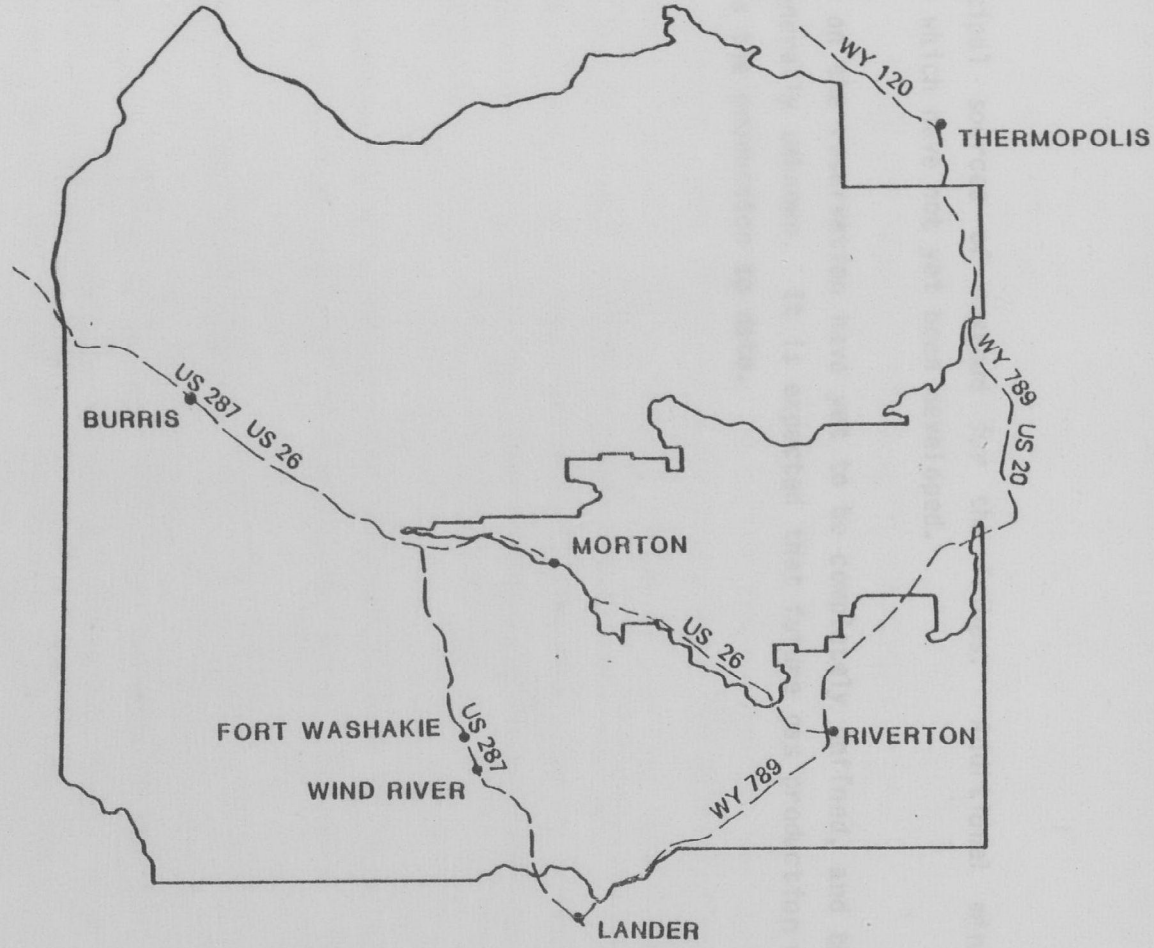


FIGURE 6

WIND RIVER RESERVATION



been the principal sources of revenue for the Tribes. Additional mineral resources exist which have not yet been developed.

Gas fields on the reservation have yet to be completely defined, and their reserves are generally unknown. It is expected that future gas production will total many times the production to date.

CHAPTER 3

MAJOR COMPONENTS OF SOLID WASTE MANAGEMENT

This section provides an assessment for each reservation of the current status of seven major elements of solid waste management. These include: an analysis of collection and disposal systems; a review of sanitary landfill disposal programs; septic disposal procedures; existing or potential public health threats posed by improper solid waste management; resource recovery potential and options; potential energy development impacts and initiatives; and overall solid waste management structure.

General approaches for alleviating major problems in each of these areas are provided, as well as site-specific recommendations, where applicable.

Analysis of Collection and Disposal Systems

The cornerstone of a sound solid waste management program is the development of a consolidated, systematic approach to collecting and disposing of all wastes generated in a given area in an environmentally acceptable manner. Key elements to such a system include:

1. development of a public collection service which provides:

    a) a sufficient number of adequately sized-collection containers throughout the overall area (determination should be based on population distribution, population density and waste generation estimates);

    b) measures for facilitating the separation of bulky and other inappropriate wastes (e.g., animal carcasses, septage) from the overall solid waste stream;

    c) an acceptable frequency of collection service (based on estimations of the amount of waste generated);

2. designation of an approved sanitary landfill area that is correctly sited, designed, constructed and operated; and

3. designation of an organization (such as a utility commission) with the authority to:

   a) implement and oversee the waste management program;

   b) coordinate public operations with private collection and disposal operations; and

   c) establish and maintain a public awareness program to promote sound waste management practices.

Other variables essential to the success of such a system are adequately maintained access roads, the appropriate equipment for collecting and disposing of wastes, and a sufficient number of adequately-trained personnel for maintaining and operating such a system.

Current Status on the Southern Ute Reservation. Of the five reservations, only the Southern Ute Reservation currently possesses a well-developed collection and disposal system. The system, which is operated by the Southern Ute Utilities Commission (SUUC), is one of the better reservation solid waste management programs in the rural West. Its program is discussed briefly below.

The SUUC has responsibility for the reservation's solid waste, sewer, and gas systems. The Commission consists of three full-time employees: the Tribal Executive Officer; the Tribal Accountant; and the Utilities Manager. The SUUC's program receives valuable assistance from IHS and operates in conjunction with programs provided by Ignacio Township and the privately-owned La Plata Sanitation Company.

Ignacio Township collects waste within the town limits and from a few customers outside its boundaries. Rates are $3.00 per month for once-a-week service for those outside of the town limits. The town has a 1972 International rear-load unit with a hydraulic dumping device.

La Plata Sanitation is a privately-owned company that provides rural collection in La Plata County. La Plata Sanitation provides services to rural households, the Town of Bayfield, and commercial and industrial accounts outside the Durango city limits. The rates are $6.00 per month for once-a-week roadside collection, and $7.00 per month for once-a-week yard collection. La Plata Sanitation has seven collection vehicles: six rearload units and one sideload unit. Both the Town of Ignacio and La Plata Sanitation transport solid wastes to the La Plata County Landfill, northwest of Bayfield.

SUUC services Tribal and government facilities at the Southern Ute headquarters complex, as well as housing in the immediate vicinity. Residential rates for rural service are $3.00 per month for once-a-week service.

Prior to 1979, the Southern Ute Tribe collected solid waste in a government surplus truck and deposited the waste in an open dump approximately four miles southeast of Ignacio. In 1979, as a result of an $88,000 grant from IHS, the Tribe acquired a side-loading refuse truck, a front-end loader and a maintenance building for a comprehensive solid waste management program. Unfortunately, the new collection truck, which has front-wheel drive and a rear compactor, was a poor choice for the operation. The truck has poor traction on the snow, ice, and mud prevalent during the winter and spring months and must be towed almost daily.

As an in-kind contribution, the Southern Ute Tribe has constructed a fenced sanitary landfill and a small maintenance facility six miles northeast of the tribal complex. The collection route was a joint effort by the Tribe and IHS. The Tribe funds the operating costs of the program, and IHS provides technical assistance.

Until the new landfill was completed, waste collected by SUUC was disposed in temporary trenches near the entrance to the old landfill site. SUUC did an excellent job of closing the old site in 1979.

The new landfill is located on 8.6 acres and began operations in 1980. This facility is sited close to the community in a sheltered area with good drainage. The equipment at the landfill consists of a tractor (equivalent to a

Caterpillar D-8 model), a tractor loader, and a pickup truck. The equipment is in relatively good condition for its age.

Now that the new landfill is opened, SUUC should evaluate its total equipment needs and consider the continued upgrading of its operation and equipment. For example, the present front-end drive collection truck should be replaced with a more appropriate vehicle such as a side-loading truck which could be operated by one person.

Problems Common to Other Reservations. As can be seen below, a number of inadequacies with the collection and disposal systems at the remaining four reservations are common to several of the reservations. Major problems, and the reservation on which they occur, are summarized below:

-- dispersed communities make collection difficult (Northern Cheyenne, Wind River, Fort Berthold)

-- the small total population is insufficient to support separate tribal-sponsored collection and disposal program (Lower Brule)

-- much individual dumping due to low number of subscribers to collection service (Northern Cheyenne, Wind River, Fort Berthold)

-- inadequate separation of inappropriate wastes such as bulky wastes or animal carassess (Wind River, Northern Cheyenne -- little bulky waste exists at Lower Brule and abandoned vehicles are periodically collected at Fort Berthold)

-- insufficient number of collection containers and insufficient frequency of collection resulting in increased windblown trash (Wind River)

-- no centralized collection points for winter use (Northern Cheyenne, Wind River, Fort Berthold)

-- prevalence of unauthorized sites (Northern Cheyenne, Wind River, Fort Berthold)

-- prevalence of indiscriminant dumping (Northern Cheyenne, Wind River, Fort Berthold -- some roadside dumping at Lower Brule)

-- no disposal site currently meeting minimum landfill disposal criteria (Northern Cheyenne, Wind River, Lower Brule, and Fort Berthold)

-- poor disposal site locations for users (Fort Berthold, Wind River)

-- sites not adequately fenced (Northern Cheyenne, Lower Brule, Wind River -- at Fort Berthold sites are fenced but haven't any locked gates)

-- open burning of wastes at dumps which increases the grassland fire danger and air pollution problems (Wind River, Lower Brule, Northern Cheyenne, and Fort Berthold)

-- cover applied infrequently resulting in increased vector problems and blowing debris (Wind River, Lower Brule, Northern Cheyenne, and Fort Berthold)

-- poor access roads (Northern Cheyenne, Wind River, Fort Berthold)

-- insufficient or inadequate collection and disposal equipment (Northern Cheyenne, Lower Brule, Wind River)

-- absence of technical and financial assistance necessary to implement sound collection and disposal program (Wind River, Lower Brule, Northern Cheyenne, and Fort Berthold).

Key details of each of these reservation's current collection and disposal programs are briefly discussed in the next sections.

Northern Cheyenne. The collection and disposal system operated by the Northern Cheyenne Utilities Commission (NCUC) is inadequate. It functions mainly due to the hard work and perseverance of the NCUC director. NCUC provides waste collection service to 23 commercial accounts and 252 residential units. This represents only 23 percent of the 1,095 residential units on the reservation. Waste collection is not mandatory, which discourages use of NCUC services.

The status of the Tribe's solid waste collection and disposal practices are summarized in Table 1. Waste collected by NCUC is disposed of at authorized dump sites. Waste not collected by the Commission is disposed of by residents at authorized and unauthorized disposal sites, or by burning and indiscriminant dumping. These methods of disposal cause control problems at authorized dump sites, health hazards throughout the reservation, and fire dangers to homes, forests, and grasslands.

A major operational difficulty arises from the lack of proper equipment. There is only one collection vehicle for the reservation, an old compacting and hauling truck, which must service the dispersed communities over poor roads. Moreover, lack of centralized collection points for winter use by tribal members encourages roadside dumping and disposal at unauthorized dump sites.

A number of administrative problems also prevail. Of the 28 percent of the Tribe that is serviced by the NCUC collection system, not all subscribers pay their monthly fees. Collection of refuse is optional, since the collection fee is not considered in (nor is it paid by) the HUD allotment for utilities. HUD, IHS, and BIA do not consider solid waste management a service to be addressed under the Tri-Agency Agreement dividing responsibilities for Tribal operations.

Efforts are presently underway at the Northern Cheyenne Reservation to improve the solid waste storage, collection, and transportation system through the use of 40-cubic yard "roll-off" containers. These containers will be located where the population density is greatest and where easy access is provided to ensure maximum use by residents. Waste will be hauled for final disposal at a regional landfill located at Colstrip, Montana, approximately 20 miles north of the reservation.

TABLE 1

NORTHERN CHEYENNE INDIAN RESERVATION

SOLID WASTE DISPOSAL AREAS AND METHODS

COMMUNITY	COLLECTION SERVICE	AUTHORIZED DUMPS	UNAUTHORIZED DUMPS	INDISCRIMINANT DUMPING	BURNING BARRELS	BULKY WASTE
Lame Deer	Yes	One	One	Yes	Yes	Yes
Busby	Yes	One	None	Yes	Yes	Yes
Ashland	Yes	None	One	Yes	Yes	Yes
Birney	No	None	Two	Yes	Yes	Yes
Muddy Creek	Yes	None	None	Yes	Yes	Yes

Lower Brule. Due to the small population on the reservation (less than 1,000 persons), the waste stream at Lower Brule is of low volume. The Tribal Council directs the daily operations of the waste collection system with assistance from BIA and IHS. Collection of household waste occurs once a week, although not on a regular schedule. Wastes are contained in barrels at each household and dumped into a small "Pup" compactor mounted on a pickup. The Tribe also has a Heil 20 yard rear loading compactor which requires $6,000 to $8,000 in repairs before it can be used again. Some open burning occurs in individual collection barrels, but it appears that the majority of wastes are being disposed of at the landfill.

Residential and commercial units are billed $2 per month and BIA is billed $25 per month for collection services, creating a total potential revenue of $425 per month. This current rate structure, however, does not cover the operating costs of the collection system. In addition, approximately 40 percent of the accounts billable are routinely delinquent and are expected to remain so.

Wind River. BIA personnel currently provide collection at dwellings within the BIA compound. HUD services the low income housing, and the City of Riverton collects solid waste within its city limits. At all other tribal dwellings and facilities, waste collection is the responsibility of the occupants. Litter is widespread throughout the reservation, indicating that the number of containers and frequency of collection are insufficient. Some open burning occurs in individual collection barrels, but it appears that the majority of wastes are disposed of at dumpsites in open burning trenches. The sixteen waste disposal sites serving the Wind River Reservation are listed in Table 2.

Cover is periodically applied at the disposal sites, but not often enough to control blowing debris. Animal carcasses were found in various stages of decay at each of the dump sites. Bad weather and road conditions limit access to the dump sites and waste is not always dumped in the trenches provided. Odors from decaying carcasses and burning waste also keep users at a distance from the trenches.

TABLE 2

WASTE DISPOSAL SITES

WIND RIVER RESERVATION

COMMUNITY	SITE LOCATION	COMMUNITY SERVED	TYPE OF SYSTEM
Arapahoe	South	Arapahoe	Trench, Open Burning
Arapahoe	17 Mile Road	Arapahoe	Trench, Open Burning
Ethete	No./Bridgeport	Ethete	Trench, Open Burning
Ethete	South	Ethete Rural	Open Dumping
Fort Washakie	BIA North	Fort Washakie	Trench, Open Burning
Shoyo Lane	No./South Fork	No. & So. Fork/ Little Wind	Trench, Open Burning Open Burning
Mill Creek & Boulder	North of Milford	Mill Creek & Boulder Flat	Trench, Open Burning Open Burning
Johnstown-Big Wind River	Southwest of Kinnear	Johnston-Big Wind River	Open Dumping Open Dumping
Crownheart-Burris	Northwest of Willow Creek	Crowheart-Burris	Trench, Open Burning
Riverton	Not on Reservation Land	Riverton & Fremont County	Compaction, Daily Cover Daily Cover
Mexican Flat	Dry Creek	Energy companies	Open Dumping
Armejo	Northeast of Milford	--------	Open Dumping
Sage Creek	--------	Sage Creek	Trench, Open Dumping
St. Michael Hill Area	Ethete	--------	Open Dumping
St. Stephens	St. Stephens	--------	Open Dumping
Thunder Lake	Ethete	--------	Open Dumping

At the present time, tribal officials on the Wind River Reservation are considering two options that would improve the reservation's solid waste management system. One option that was proposed by the IHS would reduce the number of disposal sites from the present 16 to nine and improve the collection system. The other option being considered is the use of numerous three to eight-cubic yard box containers strategically placed around the reservation to ensure maximum coverage and usage by residents, government agencies, and businesses. Routes and schedules for collection would be developed. Waste would be taken to one sanitary landfill on the reservation that would be sited, designed, and operated to meet environmental standards. All remaining disposal sites would be closed.

Fort Berthold. BIA, HUD, and Geving Waste Collection Service collect solid waste on the reservation. Geving, a private collection company, serves most of the non-Indian residents on the reservation, charging $4.00 to $6.00 for once-a-week service with a fleet of nine rear-load compaction vehicles ranging in capacity from 20 to 32 cubic yards. BIA and the HUD collect and transport waste to dumpsites with open body trucks.

Individual disposal sites are summarized in Table 3. Most disposal sites on the reservation are fenced, but none have locked gates. Cover is applied irregularly and infrequently, and none of the sites has provisions for leachate collection. Most sites have been located at a distance from the communities, which further exacerbates management problems arising from dispersed population centers and poor access routes. As can be seen in Table 3, the Mandaree, Twin Buttes, and White Shield sites all share the problems of poor access, open burning and no daily cover.

Improving Waste Collection and Disposal Systems. With the exception of the Southern Ute Reservation, all of the reservations require improvement and expansion of their waste collection systems. Effective steps in improving these systems are discussed below.

Extension and Standardization of Collection System. An important first step in improving collection efforts is the elimination or reduction of individual disposal of wastes and the associated problems of indiscriminant and

TABLE 3

WASTE DISPOSAL SITES

ON THE FORT BERTHOLD RESERVATION

COMMUNITY	TYPE OF SYSTEM	PROBLEMS
New Town (not located on the reservation)	State-approved landfill operated during winter months only	No major problems
Parshall (not located on the reservation)	State-approved landfill operated during summer months only	No major problems
Mandaree	Dump site fenced	Open burning; no daily cover; no insect or rodent control, grassland fires caused by burning waste; unimproved access road
White Shield	Dump site open	Open burning; no daily cover; grassland fire threat, no vector control, poor access road
Twin Buttes	Closed dump site (100 yds north of the school)	Site closed but residents of Twin Buttes continue unauthorized dumping, open burning
	Dump site northeast of the town	Open burning, no cover, vector problems, grass fire danger, access road needs improvement

unauthorized dumping. This can most easily be accomplished by extending the tribal collection system to all areas of the reservation. If possible, the collection service should be made mandatory for all tribal residents.

Use of A Transfer System. In addition, where applicable, upgrading of the existing collection system should include selection of a basic and inexpensive collection system, ideally some sort of green box or related transfer system. Introduction of such a system would alleviate many collection problems by increasing the number of containers and their locations throughout the communities. The use of closed containers would also help to control the following problems:

-- burning trash along roadways and in dumps;

-- burning trash in barrels;

-- storage of waste inside homes during inclement weather and the resultant health hazards;

-- windblown waste;

-- scattering of wastes by animals; and

-- discouragement of rats and other vectors.

Implementation of such a transfer system has several important advantages. A green box system is a relatively inexpensive and standardized system that provides easy access to all residences. It can be adjusted easily in areas which experience seasonal population fluctuations or sudden permanent increases in overall population and can be expanded to meet such development or growth with minimal cost. It ensures secure, outside storage of wastes on a twenty-four hour basis for several days at a time. Finally, it provides a durable system with a long life-expectancy and is both simple to implement and operate.

Containers for residential customers should be placed on regularly-traveled routes in central locations, based on population and capacity figures. Where

feasible, they should be clustered to improve collection equipment efficiency. Containers should always be placed on a level surface, away from walls, electric wires, telephone poles and other obstructions. They should never be placed at intersections where they could block motorists' vision or in areas where they could attact the attention of children.

The placement of containers for commercial and industrial customers differs slightly. Containers should be located at the rear exit of any facility, and not in front parking lots. Obstructions should be avoided and adequate clearance should be ensured. Generally high volume waste producers should receive more containers rather than more frequent collection services to minimize the labor and vehicle miles travelled incurred by the collection truck. Pick-up is usually scheduled once-weekly basis for all containers.

Wastes to be disposed of in these residential and commercial containers include all types of household refuse and food garbage, paper, cardboard and small manufactured items, as well most wastes from commercial and institutional facilities. The size of the containers selected will determine overall capacity and frequency of collection. For example, on the average, a three-cubic yard container can serve approximately 24 residents for one week, but has the flexibility to hold on the order of 10 days of waste during the winter season, when less solid waste is usually generated. However, collection schedules should be set to avoid this over-accumulation, due to the potential for increasing vector populations, odors, windblown litter, etc. Institutional customers should be assigned several containers for storage of waste.

Separation of Bulky and Other Inappropriate Wastes. The non-compactibility of the white goods, lumber and rubber which make up the bulky waste stream require that they be separated from residential and commercial waste. Bulky wastes cause damage to equipment designed to handle municipal solid wastes. Further, they do not require the same disposal procedures as other solid wastes, since they do not present the public health problems associated with the organic nature of residential garbage. Moreover, collection of mixed waste types is less efficient because bulky wastes take up more container space.

Bulky wastes generally include:

-- large household appliances (e.g., stoves, refrigerators, washers and dryers);

-- mattresses, bed frames, and other furniture;

-- auto bodies, parts and tires; and

-- stumps, tree trunks and yard wastes.

Bulky wastes are generally more efficiently collected and disposed of by a system different from the municipal system.

The bulky waste system requires segregation of large non-compactible items from the residential trash stream at separate collection sites. The items are then transported to the landfill site using a special transport system and disposed of at a location separate from the landfill sections used for municipal waste. Containers, such as twenty cubic yard roll-off containers, are good choices for storage of bulky wastes and can be placed at strategic reservation locations based on population and bulk waste generation rates. A roll-off-hitched flatbed trailer truck can haul the containers to the landfill when they are full. However, it is important to remember that the containers can be utilized properly only if residential garbage has not been dumped into them.

The bulky waste collection system will facilitate the removal of abandoned automobiles, large appliances, and other items from yards and fields on a special collection basis. It will also prevent use of these items as shelter for vectors or as play things by children. The need for individual hauling and dumping of these items should be eliminated by the use of containers. This system organizes the disposal of discarded bulky waste items and reduces the cost of clean-up, but to be truly successful it must be utilized by all tribal members.

In addition, the equipment used for collecting bulky wastes can be adapted for other uses on the reservation. The flatbed trailer can haul equipment, pre-

fabricated work platforms, or building materials to job sites. The containers and collection truck can haul coal to be used as fuel on the reservation.

Several other types of waste require special handling procedures and should not be disposed of in either the municipal waste system or the normal bulky waste system. These items include:

-- dead animals (lifestock);
-- burning materials and hot ashes; and
-- construction and demolition debris.

Dead cats, dogs, and livestock sometimes end up in the solid waste stream. In general, small animals can be safely disposed of if taken directly to their fill site and placed along with other waste and immediately covered. Whenever possible dead livestock should be disposed of through rendering plants or pet food companies. These types of businesses should be contacted to determine whether they will pick up the dead livestock. Dead livestock that cannot be disposed of through rendering plants or pet food companies should be disposed of by placing them in a special pit and covering them immediately with two feet of compacted soil. For reasons of safety and to minimize air pollution, open burning of wastes should be strongly discouraged. Burning or smoldering waste should not be accepted by collection personnel, or by landfill operating personnel. Wastes generated by private contractors should be transported to the landfill by the contractor on days specified by solid waste personnel. The disposal of construction and demolition wastes should occur at a predetermined location, separate from residential and commercial wastes, but usually with other bulky wastes.

Development of a Sanitary Landfill Disposal Program

Analysis of collection and disposal systems included a review of current disposal areas at each of the reservations. Information summarized in Table 4 identifies the location of all disposal areas on these reservations. In addition, the table classifies each disposal area as either a sanitary landfill or an open dump. This classification is based on the site's ability to meet EPA's

TABLE 4
DISPOSAL FACILITIES ON
THE FIVE RESERVATIONS

RESERVATION/LOCATION OF SOLID WASTE DISPOSAL FACILITY	TYPE OF FACILITY	
	SANITARY LANDFILL	OPEN DUMP
NORTHERN CHEYENNE RESERVATION		
Muddy Creek		1
Lame Deer		1
Busby		1
Ashland		1
Birney		2
SOUTHERN UTE RESERVATION		
Ignacio	1	
WIND RIVER RESERVATION		
Johnstown - Big Wind River		1
Crowheart - Burris		1
Shoyo Lane		1
Mexican Flat		1
Ethete		1
Arapho - Southwest		1
Arapaho - 17 Mile Road		1
Mill Creek - Boulder Flat		1
Armejo		1
BIA Trench - Fort Washakie		1
Sage Creek		1
St. Michael Hill Area		1
Riverton - Shoshone Rd.-east		1
Riverton - Shoshone Rd.		1
St. Stephens		1
Thunder Lane		1
LOWER BRULE RESERVATION		
Lower Brule		1
FORT BERTHOLD RESERVATION		
Mandaree		1
White Shield		1
Twin Buttes		1

landfill criteria. If a site fails to meet any of the basic landfill criteria, it is considered an "open dump." On the reservations studied, most disposal areas failed to meet the four criteria summarized below:

1. the facility must not allow uncontrolled public access which could expose the public to potential health and safety hazards;

2. the facility must not engage in open burning of solid wastes or any other method or burning that could result in air pollution;

3. the facility must not pose a hazard to the safety of persons or property from fire and must comply with the requirements concerning the proper application of cover material in such a manner as to reduce the risk of fire; and

4. the facility must ensure that the on-site population of disease vectors (rodents, flies, and mosquitoes capable of transmitting disease to humans) is minimized through the periodic application of cover material and through any other techniques appropriate for protecting public health.

All disposal sites on the Northern Cheyenne, Fort Berthold, Wind River, and Lower Brule Reservations failed to meet these criteria and consequently must be classified as open dumps. Only the Southern Ute Reservation currently utilizes a waste disposal system possessing an environmentally adequate landfill operation.

Reservations Requiring Upgraded Disposal Areas. At the Northern Cheyenne, Fort Berthold, and Wind River reservations, open dumps proliferate. Each of these reservations need to designate one or more current disposal sites to be upgraded to meet the requirements of a sanitary landfill. The remaining open dumps should then be closed, in accordance with proper closure procedures discussed later in this section.

For example, two disposal sites located in the Lame Deer and Busby sectors of the Northern Cheyenne Reservation are currently authorized for use by the NCUC. These sites came into existence as a result of people dumping their trash

in these areas as a matter of convenience. These sites were not designed and operated as sanitary landfills and are therefore currently inadequate. In addition, because the access road at the Lame Deer site lies above an aquifer recharge zone, dumping in this area enhances the potential for infiltration of contaminants into the drinking water supply.

The Lame Deer site is located within a quarter of a mile of the largest waste generation center, shielded from view, has potential for easy access from main roads, and the capacity for expansion. If a new access road were constructed entering the site from the west, access to this site both for collection vehicles and landfill users could be greatly improved. Such an action would also substantially alleviate present problems such as disposal over a recharge zone, blowing trash, and improper containment of solid wastes. The site could then be upgraded, in accordance with EPA criteria, and used as a landfill. The remaining open dump sites on the reservation should be properly closed to alleviate environmental problems and health hazards associated with them. For example, an unauthorized site near Birney is situated in a gulley which carries a perennial stream tributary to the Tongue River.

The fifth reservation, Lower Brule, currently uses only one open dump site to dispose of its solid wastes. Due to the unique situation at this reservation as a result of the relatively small tribal population, it may be more economical for the Tribe to contract its landfill disposal to an off-site location (such as the public landfill in Chamberlain, South Dakota) to alleviate the administrative and financial burden that would be borne by a tribally-run program to upgrade the existing dump site and maintain and operate it as a sanitary landfill. The existing dump site should then be properly closed and reclaimed by IHS, borrowing equipment as necessary from BIA. Once the site has been properly closed, the tribe may choose to use the site as a temporary collection center for abandoned vehicles as part of the basic resource recovery program outlined later in this report.

Criteria for Landfill Siting, Design and Operation. Current RCRA requirements and guidelines for solid waste management facilities have established criteria for the siting, design, and operation of sanitary landfills. These requirements and guidelines will be applied nationwide as new facilities are built and existing facilities are upgraded.

In the siting of new facilities, the following parameters must be considered:

-- adjacent land uses and their proximity to the proposed facility;

-- hydrogelogical characteristics of the proposed site and its ability to retard migration of contaminants into groundwater resources;

-- topographic and climatological characteristics of the proposed site and the potential for contamination of surface water resources; and

-- site access and visibility.

In designing a new site or upgrading an existing facility, the following factors are important:

-- controlled access and site security;

-- runoff/runon controls;

-- inhibition of potential leachate migration;

-- protection from methane gas buildup; and

-- control of odor, vector, fire hazard and blowing trash problems through application of daily cover.

Operation practices for a new or upgraded landfill should incorporate the above concerns and include monitoring programs that would adequately detect the following:

-- migration of contaminants into the groundwater system;

-- runoff of contaminated waters into local drainageways; and

-- emission or buildup of methane gas.

Because the siting, design and construction of new disposal facilities are costly, upgrading of existing facilities should be given consideration.

Based on the above criteria, key aspects in siting, constructing and operating a landfill are discussed below.

Operational Design Features. The disposal site should be provided with operational features and appurtenances necessary to maintain a clean and orderly operation: (1) control of access to the site by fencing or other suitable means; (2) an all-weather access road (if excessively bad weather makes the working face inaccessible, it may be necessary to provide a landfill area near the entrance to the site); and (3) suitable devices, such as portable fences, for litter control.

In addition to the required features, other features that are highly recommended include: (1) operational plans to direct and control the use of the site; (2) signs indicating traffic flow, hours of operation, and any charges for disposal; (3) dust control methods (these may require the use of chemicals, oils, or water sprays); (4) communication devices for emergency use and for operational control; (5) electrical service for operations and repairs; (6) fire protection and fire-fighting facilities adequate to ensure the safety of employees and provisions for dealing with accidental burning of solid waste in the landfill; and (7) first-aid equipment and training.

Personnel and Personnel Facilities. In order to manage and operate the site adequately the following are recommended: (1) a shelter for employees to use during inclement weather; (2) a portable water supply for landfill personnel and collection crews; (3) sanitary toilets on or near the site; and (4) training in the proper and safe operation of all equipment.

Equipment. To assure safe and efficient operation, the following are required: (1) sufficient equipment for spreading, compacting, and covering operations; and (2) arrangements whereby alternate equipment is provided within 24 hours following an equipment breakdown. As a further aid, the following are

recommended: (1) safety devices on equipment to shield and protect operators; and (2) maintenance and storage shelters.

Landfill Operation Procedures. Generally the following operations should be carried out:

1. Access to the site should be controlled to keep unauthorized persons out and to assist the landfilling operation. (Access should be allowed only when an attendant is on duty and only to authorized users).

2. Burning of waste material should be prohibited.

3. Blowing paper should be controlled by providing a portable fence near the working area, and the entire area should be policed at least daily.

4. Salvaging and scavenging should not be allowed at the working face.

5. Provisions should be made for on-site control of potential gas movement from the landfill.

6. Provisions should be made to ensure that no pollution of surface or ground water occurs.

7. Operational records should be maintained daily. They should include the type and volume of solid wastes received; type and volume of cover material used; the portion of the landfill used; and equipment maintenance and cost records. A monthly report should be prepared that describes the amounts of solid waste received, as well as the area of the fill used. Cost records should be maintained, and the reports should be submitted to the appropriate governmental agency.

8. Upland surface drainage should be diverted around the site to control infiltration at the fill site and erosion of the in-place cover material.

9. Conditions unfavorable for the habitation and production of insects and rodents should be maintained by carrying out sanitary landfill operations promptly and systematically. Supplemental vector control measures should be instituted when necessary. Domestic animals should be excluded from the site, and proper control measures should be used to control wildlife, if necessary.

10. A detailed description and plat of the completed fill site (as built) should be recorded with the BIA. These records can be used to provide notice to future users and owners of the site. The detailed description should include but not be limited to: type and location of pollution controls, and original and final terrain descriptions.

11. The working face should be as small an area as will allow safe and efficient operation of the equipment.

12. The solid waste should be spread and compacted in thin layers. In the construction of each cell, it should be spread into layers that do not exceed two feet prior to compaction. The number of layers incorporated into a cell depends on the design and configuration of the site.

13. All solid waste should be covered daily with at least six inches of compacted soil. Daily cover has several main functions: to provide insect and rodent control; to provide fire breaks between cells; to prevent exposure and blowing of litter; and to offer an aesthetically pleasing site at the end of the working day. The in-place cover must be maintained until further filling or the addition of final cover is made.

14. Final cover should be applied to any surface that represents the final grade of the sanitary landfill; two feet of compacted soil is required. The soil used for final cover influences the choice of vegetation. Suitable grasses should be planted to prevent erosion and surface deterioration. Final cover should be placed over any completed section of the fill within seven days following the placement of solid wastes within that portion.

Other useful procedures to be followed during landfilling include:

1. Supervision should be made available to coordinate all unloading activities.

2. Special provisions should be made for vehicles being unloaded by hand so that the flow of mechanically unloading vehicles is not impaired.

3. Final cover should be graded to drain surface run-off water. For this reason, it is best to slightly overdesign initial grades so that when settlement occurs, the surface will be sufficient for good drainage. The top surface should slope two to four percent, and the side slopes should not be so steep as to cause an erosion problem.

Supervision and Inspection Procedures. The following recommendations apply:

1. The supervisor of the operation should be an individual who has had experience in earthmoving, waste handling, and disposal.

2. Routine inspection and evaluation of landfill operations should be made by an IHS representative. A notice of any deficiencies, together with any recommendations for their correction, should be provided to the owner or agent responsible for the use of the land and the agency responsible for the landfill operation.

3. A representative of the appropriate regulatory agency should inspect the completed sanitary landfill before the earthmoving equipment is removed, and any corrective work should be performed before the landfill project is accepted as completed. Arrangements should be made for all cracked, eroded, and uneven areas in the final cover to be repaired as required during the years following completion of the fill.

Gas Production. The principal gaseous product of anaerobic decomposition of organic wastes is methane, although other gases such as carbon dioxide, nitrogen, and hydrogen sulfide, are also present. Wastes buried in landfills undergo predominantly anaerobic decomposition, and the gases normally take the shortest or easiest route to the surface. Occasionally, the presence of fissures in, or surrounding, the filled land, sometimes in conjunction with the presence of a surface barrier (such as a roadway or parking area), will cause the evolved gases to travel large distances horizontally. In some cases, these gases have found their way into basements of houses and buildings, resulting in a serious threat to residents.

Sanitary landfill regulations require that ducts be incorporated into landfills to ensure that gases are discharged at a safe location. Building codes for structures near new or old landfills normally require particularly stringent standards for the construction of impermeable basements and for sealed and ventilated underground services.

Gas is usually monitored to determine the rate of decomposition of wastes or to determine the direction of gas flow. Gas collection devices vary from a simple "dry well" to an inverted gas-capturing container. Gases normally diffuse upward; however if the cover material is sealed due to high clay content compaction, or wet or frozen conditions, the gas pressure will build up and travel laterally until it reaches an escape location. Gas barriers and gas channelling devices are advisable for problem landfill sites to vent the gases at selected locations.

Leachate Production. During decomposition, organic wastes normally produce a liquid which is termed a leachate. In landfills, some of this liquid is

extracted from garbage and results from the pressure applied by the fill above. Another principal component of leachate is rain water which, during its passage through the landfill, can dissolve a large range of materials. Leachate can filter through soils underlying the fill and migrate downward into a groundwater supply. The potential generation and movement of leachate are thus important considerations in the design and operation of a landfill.

Groundwater Monitoring. In monitoring for changes in ground or surface water quality, it is important to assess the background natural water qualilty. Otherwise, constituents present in the natural water may later be attributed erroneously to the landfill. Controlled groundwater sampling and analysis is presently the most common type of landfill monitoring. A ground-water monitoring system should include at least one well upgradient from the landfill, and three wells downgradient. Typical groundwater-monitoring includes dissolved solids, hardness, chloride and other parameters. The chloride ion has been shown to be an excellent tracer of leachate influence on groundwater. Other analyses commonly run are pH, alkalinity, nitrates, coliform, conductivity, phosphates, calcium, sodium, postassium, BOD_5, COD, and heavy metals.

Septic Disposal Problems

In many rural areas, the effective disposal of septic tank sludge can be a major problem. A review of current methods of septic sludge disposal was conducted for each of the reservations. Findings are summarized briefly in the Current Status section below.

The current septic disposal problems on the reservations can be alleviated by implementing suitable alternative disposal methods such as disposal by sanitary landfilling, or landspreading of septic sludge in mined land reclamation areas or on agricultural lands. The criteria for landfilling or landspreading septage in an environmentally sound manner and in conformance with the appropriate Federal guidelines as developed under RCRA, are detailed in a later subsection of this chapter.

Current Status. Four of the five reservations have no current septage problems. In Lower Brule, Fort Berthold, and Northern Cheyenne, most of the

homes in communities on these reservations are currently served by a sewage system with lagoon treatment. In dwellings outside the established communities, only minor septic problems exist. On the Southern Ute Reservation, the tribe owns the sanitary sewer collection system. This system discharges into the Ignacio Sanitation District's collection system, which in turn discharges into the district's lagoon system. The lagoon system provides a 2.3 acre aerated cell and a 7.7 acre polishing pond with a submerged gravel filter to remove suspended solids from the effluent. Effluent is discharged into Ignacio Creek, which discharges into the Pine River. Both the collection system and treatment facilities are adequate to serve the surrounding Indian homes and government facilities. For those homes not connected to the sewer system, the soil and geologic characteristics on the Southern Ute Reservation are compatible with a septic tank/leach field disposal system.

At the Wind River Reservation, septic sludge is currently being disposed in open dumps. Poor disposal techniques and the precarious environmental setting of these sites have created the potential for leachate contamination of ground and surface water.

If coal mining occurs in the future on the Wind River Reservation, landspreading may be a viable septage disposal alternative, since the high organic content of sludge makes it a valuable soil conditioner for mined land reclamation. This is currently being done on some reclamation sites in the Rocky Mountain region and provides the opportunity to dispose of sludge in an environmentally beneficial manner. If this plan is used, guidelines concerning landspreading of septic sludge should be met in accordance with EPA's Interim Final Regulations developed under the authority of RCRA, effective October 15, 1979. These guidelines are summarized in the Proper Landspreading Practices later in this chapter.

If landspreading of sludge through mined land reclamation proves infeasible, alleviation of the septic problem can be achieved through proper landfilling procedures, in compliance with EPA's Interim Final RCRA regulations. Proper landfilling procedures are detailed in the next subsection.

Proper Landfill Disposal of Septage. In accordance with the appropriate EPA criteria, proper landfill disposal of septage must take into account the following: analyses of soil characteristics; seasonal groundwater levels; neighboring land uses; ground and surface water protection and monitoring; climate; and site protection devices (e.g., signs and fences). If septage is landfilled, leachate production and migration should be periodically monitored. To properly dispose of septage in a sanitary landfill, a mixing ratio of ten gallons of septage for each cubic yard of solid waste should be adhered to, in order to achieve proper moisture absorption. Six inches of cover material should be applied daily at landfills where septage is disposed. Two feet of final cover should be emplaced no more than one week after placement of the final lifts.

Proper Septage Landspreading Practices. The procedures below summarize the most recent EPA guidelines for landspreading as summarized in the EPA Technology Transfer Seminar Publication, Alternatives For Small Wastewater Treatment Systems:

1. Prior to application or incorporation, sewage sludge applied to a land surface or incorporated into soil must be treated by a process to significantly reduce pathogens (i.e., aerobic digestion, air drying, anaerobic digestion, composting or lime stabilization);

2. Public access to the site must be controlled for at least 12 months after the final application of sewage sludge; and

3. Grazing by animals whose products are consumed by humans must be prevented for at least one month after the final application of sewage sludge.

For septic tank pumpings, application to land surfaces or soil incorporation requires treatment by a process to significantly reduce pathogens prior to application or incorporation, unless both the requirements outlined in (2) and (3) above are met.

In instances where crops for direct human consumption will be grown within 18 months after land application or site incorporation of sewage sludge or septic tank pumpings and the edible portion of the crop comes in direct contact with the waste, the sludge or pumpings must be treated by a process to further reduce pathogens prior to application or incorporation (i.e., composting heat drying, heat treatments, thermophilic aerobic digestion, beta ray irradiation, gamma ray irradiation, or pasteurization in conjunction with any of the above).

EPA recommends that landspreading take into account runoff conditions, and that land slopes should be limited to eight percent. Storage facilities are necessary for times when land application is inadvisable: before and during precipitation to prevent runoff of contaiminated water; and when surfaces are frozen to prevent runoff during thaws. Control procedures and loading criteria should also be considered.

Evaluation of the Threat to Public Health and the Environment

Based on the site investigations, determinations were made as to whether any existing disposal practices pose a current or potential threat to public health and the environment. Disposal procedures that were noted on reservations that may cause health and environmental threats include: improper siting, construction, and maintenance of landfill areas; inadequate or infrequent collection of wastes; insufficient sorting and separation of wastes; indiscriminate dumping; and unauthorized burning of wastes. Important indicators of such poor waste management practices include the presence of vectors and large amounts of windblown trash throughout the study areas.

Health and environmental problems which result from such practices include: degradation of ground and surface water quality near unauthorized disposal sites or improperly sited and constructed landfills; surface water contamination from unauthorized dumping in streams; disease and odor problems caused by decomposing animal carcasses and vector disturbance of waste; and air pollution due to burning of trash. Where such problems were identified, recommendations for initiating remedial measures have been provided.

Current Status. Degradation of ground and surface water quality is a problem at the Northern Cheyenne Reservation. A potential for groundwater contamination also exists at Wind River. Decomposition of animal carcasses is a problem at every reservation except Southern Ute. Open burning of trash, however, occurs on all reservations including Southern Ute. All reservations also have vector problems as a result of abandoned cars and/or the absence of daily cover at disposal sites. Similarly, scattering of wastes by animals occurs at most reservations.

Conditions that suggest water contamination problems at the Northern Cheyenne Reservation are worthy of attention. They include the following:

-- The unauthorized dumps near the Lame Deer disposal site threaten the community water supply, since it is located on a geologic rise above the aquifer tapped for Lame Deer's water. A number of groundwater monitoring, soil, and gas tests must be performed to assess current impacts. Tests and contaminants to be sampled for are summarized below.

-- The Birney disposal site is located on a contaminated stream which flows through the refuse and into the Tongue River. Several abandoned cars provided shelter for vectors and wildlife. The site needs to be properly closed and monitored.

Assessing Water Contamination. Methods for determining the extent of such water contamination problems are summarized below.

-- A number of groundwater, soil and gas tests must be performed to assess current impacts, track the upgrading of the disposal area, and aid in the approval of a site as a landfill. These tests include water well/drinking water standard tests, methane gas sampling and leachate monitoring tests.

-- Because groundwater contamination may have occurred, groundwater samples should be collected to determine ambient water quality

conditions. Samples should be analyzed for the following constituents: pH, specific conductance, total dissolved solids, chloride, and iron. Additionally, existing wells should be resampled for analysis of coliform bacteria originating from septage contamination that may have occurred subsequent to the approval of the well installations by the appropriate health authority. The findings of any elevated levels of these constituents would indicate the need for quarterly sampling and analysis.

-- Stream sampling and testing for indicator water quality parameters such as temperature, pH, electrical conductivity, coliform bacteria, turbidity, dissolved oxygen, biological oxygen demand, alkalinity, chloride and nitrate should be conducted.

Until the extent of water contamination is determined, it is impossible to make specific recommendations for mitigating the contamination. The reservation should seek technical assistance from the appropriate federal agencies, in order to initiate procedures for conducting such a contamination assessment and remedial program.

Preventive Measures. A sound and comprehensive solid waste management program is the best means of preventing future threats to public health and the environment. All of the waste management practices recommended in this report will eliminate problems which currently pose health threats and help to ensure against them reoccurring in the future. Development of a properly operated sanitary landfill site, in conjunction with a comprehensive collection system, will eliminate the open burning of trash which poses fire hazards and air pollution problems and will also serve to discourage proliferation of vector populations.

Implementing means for separating inappropriate wastes such as animal carcasses from other wastes will rid the reservations of the health threats posed by such decomposing matter. The collection and proper disposal of carcasses is an important component of solid waste management, due to the health problems that can result from the decomposition of uncovered remains. As

indicated earlier, most reservations have problems associated with decomposing animal carcasses. Trenches should be dug in the fall so that burial space is available when the carcasses are collected and ready for disposal in the spring. Also, carcasses should be flagged during the winter so that they can be easily identified during spring clean-up. Because the carcasses decompose rapidly, they should be buried and covered as quickly as possible in an area separate from the landfill.

Most reservations also have vector and safety problems resulting from abandoned cars. The situation can be significantly improved through implementation of an abandoned vehicle disposal program, as discussed in the Resource Recovery section later in this report.

Finally, proper closure of open dumps and upgrading of certain existing facilities into sanitary landfills, in accordance with the procedures discussed in the previous section, will contribute greatly to the elimination of environmental and public health threats currently posed by these areas.

These measures will be best accomplished through direct tribal government involvement, in conjunction with an educational program that conveys the importance of proper waste management.

Resource Recovery

Since the advent of the Resource Conservation and Recovery Act of 1976, resource recovery has increasingly been viewed as a valuable waste management option in the field of solid waste management. Resource recovery poses some significant advantages over traditional waste management practices, such as landfill disposal. It conserves valuable resources, and aids in reducing both the number and size of landfills, as well as the consequent environmental problems resulting from poor landfilling practices. In addition, implementation of a resource recovery program can sometimes provide needed jobs and income to economically depressed areas.

However, the feasibility of developing a resource recovery program on a local level is dependent on a number of factors including overall population, population distribution, the availability of nearby markets for recovered resources, hauling distances, and adequate transportation routes.

For each of the five reservations, the potential of utilizing some form of resource recovery was assessed, as well as the feasibility of implementing a successful recovery program and incorporating it into a sound overall solid waste management program. A brief summary is provided below of the current status of resource recovery on the reservations. In addition, a basic recovery program that could be implemented by each of the reservations is outlined. Where unique site-specific factors would augment or alter this basic approach, this information and its impact on the development of a future program for a specific reservation have been noted.

Current Status. At present, limited resource recovery is currently being practiced at only one of the reservations, Fort Berthold, with the occasional collection, crushing, and hauling away of abandoned automobiles. The potential for limited resource recovery does currently exist on all five of the reservations through the reclamation of abandoned vehicles and discarded aluminum. These materials, which were often observed scattered along roadsides and ravines and near junkyards and dumps, constitute an aesthetic and environmental nuisance for the tribal waste management organizations. They also provide habitats for vector populations.

Unfortunately, certain general factors common to all of the reservations pose significant obstacles to the implementation of any, but the most simplistic, recovery programs. Like other rural communities, the reservations (with the possible exception of Wind River) do not generate sufficiently large quantities of recyclable materials to support an economically viable recovery program. Moreover, on each of the reservations, wastes tend to be generated in several different communities dispersed across a large overall acreage, hindering easy collection operations. In addition, several of the reservation

(notably Wind River, Lower Brule, and Northern Cheyenne), are currently separated from markets for recycled materials by extremely long distances ranging up to hundreds of miles. These hauling distances, and in several instances, the absence of rail service, impose serious limitations on resource recovery.

Such constraints, however, should not discourage the tribes from establishing a limited resource recovery program. Such a program would be beneficial, since it would serve to reduce the overall vector population, remove the dangers posed to children's safety by removing abandoned vehicles, as well as contribute to the overall enhancement of waste management operations. A relatively simple initial recovery program, easily adaptable to any of the reservations, is outlined below.

Implementing A Limited Resource Recovery Program. Each of the tribes should develop a basic two-part recovery program that includes an aluminum recovery program and a vehicle recycling program. Wherever possible, these programs should utilize volunteer support to minimize operational expenses.

Aluminum Recovery Program. A program for the recycling of aluminim should be implemented on each of the reservations. The market for recycled aluminum is good, with current prices at about 20¢/pound. All tribal members, especially children, should be encouraged to collect aluminum cans to be sold to the tribe which, in turn, would sell them in volume to the aluminum processors located nearest to the reservation. For example, the Adolph Coors Company of Golden, Colorado, would serve as a suitable market for aluminum recycled on the Southern Ute Reservation.

Vehicle Recycling Program. An essential first step in the development of a viable vehicle recovery program is the designation of a separate disposal area for the interim collection of abandoned automobiles. Ideally, the disposal area should be situated within easy access of all major population centers, and adjacent to a reliable all-weather road. If possible, it may be useful to situate the vehicle disposal area in close proximity to the current major community disposal area. The disposal area should be properly shielded from public view

and cordoned off in some way to prevent children from entering it. Site size should be geared to the supply of materials, which in this instance is small. It is estimated that the number of automobiles abandoned each year on the reservations ranges from 50 to 200 vehicles. Thus, a site encompassing two acres would probably represent an adequate site size.

Once a site has been selected, an initial clean-up campaign should be launched to haul all abandoned vehicles currently dispersed throughout the reservations to the newly designated vehicle disposal area. Next, each reservation should conduct continuing education programs which advocate abandoned vehicle collection and storage. When the number of vehicles are economically sufficient, volunteer labor should be considered for removal, in order to help programs reach financial break-even status. Tribal management should then contract for the sale of such vehicles to outside contractors, if possible. For example, Albuquerque, Phoenix, and Salt Lake City all provide markets for automobile parts in sufficient proximity to the Southern Ute Reservation.

Education programs can also stress the advantages of individual, community and school aluminum can collection and redemption for fund raising efforts, as well as for the improvement of the environment by reducing the volume of wastes and the need for landfill space. Recycling and/or collection on any effective scale will require a continuing information program. Complete information programs should be offered at least once a year and phone numbers for information on these programs should be published and posted on a continuing basis.

Additional Recommendations. Two of the five reservations, Northern Cheyenne (Montana) and Fort Berthold (North Dakota), are located within states that have recently enacted legislation creating mechanisms for dealing with the abandoned vehicle problem. These State programs are discussed briefly below.

Montana's Junk Vehicle Disposal Law requires each county to establish a motor vehicle "graveyard" where any citizen may place a vehicle without charge. The county is also responsible for establishing a collection program for abandoned vehicles. The program is financed by a special junk vehicle disposal fee on each new application for a motor vehicle title or title transfer, other

special fees, and the sale of the vehicles to private car-crushing firms. The program stipulates that each collection point must have a minimum of two acres of land and be properly shielded from public view. After each county graveyard has accumulated 200 vehicles, a contract is obtained with a private firm to crush the vehicles and transfer them to a shredding plant.

North Dakota has also taken steps to assure that its abandoned cars are salvaged through the Abandoned Automobiles Act of 1973. Almost all of the counties in North Dakota have adopted this optional, State-funded program. The State Department of Health, charged with the administration of the program, recommends that cities and municipalities provide permanent, free collection areas for residents to deposit junk automobiles. Suggestions have been made to locate such collection areas adjacent to existing landfill areas. Repositories will allow residents to rid themselves of scrap without being charged a fee. Enhancing the implementation of the program are portable compactors which can be dispatched to rural areas to crush accumulated vehicles. Although marketing of crushed materials has been an inhibiting factor to the success of the program, private scrap metal buyers have given the program a reasonable degree of economic viability.

The existing programs in Montana and North Dakota are marginal and rely on State support and sensitive market factors. However, these programs could offer the means for the Northern Cheyenne and Fort Berthold Reservations to adopt abandoned vehicle recovery programs, if the number of vehicles abandoned annually on these reservations seems insufficient to justify the establishment of a solely tribal-administered program. In such cases, the tribes may wish to explore the possibility of interfacing with these state programs through their state and county governments.

Energy Development Impacts and Initatives

All of the reservations with the possible exception of the Lower Brule Reservation have commercial quantities of one or more developable energy resources. The Southern Ute, Fort Berthold, and Wind River Reservations are all currently involved in oil and gas production, with increased gas production likely at Wind River.

Future development of coal on the Northern Cheyenne, Southern Ute, and Fort Berthold Reservations could bring significant changes in the economic development of these tribes. Coal on each of the three reservations is recoverable by surface mining. The potential for future gasification or coal liquefaction projects exists for these reservations, although no such plan has been proposed to date.

In Chapter 2, potential energy and mineral resources on the reservations were previously discussed. This section focuses on the general implications of energy development and their relationship to the potential for both exacerbating and mitigating solid waste problems.

The actual mining of the coal and proper reclamation of the land following mining activities should not result in any significant waste management problems for the reservations. However, coal mining and other energy development projects can create a number of social and economic effects and environmental disturbances. Physical alteration of the terrain will preclude alternative uses of the land during mining and will restrict certain uses after mining. Any large energy development project will alter the social and economic structure of the tribes as they exist today. While the energy companies will be responsible for properly disposing of mine wastes, secondary solid waste impacts will likely occur as a result of construction-related wastes and a locally-increased work force.

Where revenues from projected energy development are sufficient to significantly alter economic development of the areas, funding mechanisms for solid waste management should be explored. Solid waste management funding from energy development is allowable under the Federal Land Policy and Management Act of 1977. Monies are transferred from the energy companies to federal authorities, and then to tribal authorities (e.g., from BLM to BIA). While solid waste management programs may be eligible for some funding as a result of public health implications, it is not reasonable to expect that more than a fraction of the revenues will be applied to such programs. Other programs may usurp any direct benefit from energy development to solid waste management. Competing for such revenues will be schools, job training, sewage treatment, road construction,

hospitals, police, recreation facilities and programs for the elderly. Nonetheless, this mechanism offers an avenue of support worth investigating. If even a relatively small amount of funds can be directed toward implementing a simple solid waste management program, it would still represent a significant improvement in the quality and status of waste management operations on the reservations.

Management of Solid Waste Programs

Previous sections of this chapter have addressed a number of physical and technical problems associated with existing waste management activities on the reservations. In response to such problems, recommendations in this report thus far have concentrated on alleviating these conditions by implementing a series of technical improvements to existing waste disposal practices.

While such an approach is necessary for resolving individual site-specific problems, improvement of the entire solid waste management program cannot be fully achieved without making administrative changes as well.

Current Status. Only two of the five reservations -- Northern Cheyenne and Southern Ute -- currently have a specially designated organization responsible for overseeing day-to-day solid waste management activities. The Northern Cheyenne Utility Commission (NCUC) oversees water, solid waste, and sewage operations on the reservation. It is responsible for operating water wells, stand pipes, water lines, sewer lines, sewage lagoons, and solid waste collection and disposal activities. The Commission, which has three full-time and three part-time employees, is set up to operate as a private enterprise with a Board of Directors and a Manager/Operator directly under the Board's supervision. Unfortunately, despite the formal arrangement of the Commission, income derived from individual and commercial subscribers is insufficient to cover management and operational costs, as was originally intended. This is in part due to delinquency in payment by some existing subscribers as well as the low overall ratio of participation (23 percent of total residential units) due to the fact that the waste collection program has not been made mandatory for tribal residents.

In contrast, Southern Ute's solid waste management activities are overseen by a more informally organized utility commission. The Tribe currently possesses an effective overall solid waste management program administered by the Southern Ute Utility Commission (SUUC). The SUUC is composed of the Tribal Executive Officer, an accountant and the Utility Manager and meets on an as-needed basis, to discuss and resolve waste management problems. The Utility Manager is responsible for day-to-day operations of solid waste, sewer, and gas systems and is assisted in these operations by two full-time employees. In developing and implementing its solid waste management program, the tribe has received technical and financial assistance from IHS.

Developing an Effective Waste Management Organization. With the exception of Southern Ute, each of the tribes need to designate some organization or organizations to implement and operate waste collection and disposal activities on the reservation. Solid waste management operations should be institutionalized in a manner similar to other principal functions of tribal government.

A crucial element in structuring waste management is the support and direct participation of the Tribal Council. Since a properly operated solid waste management system is essential to ensure protection of the public health and the environment, the Tribal Council's direct involvement is necessary. Outside sources such as EPA and State health agencies should provide only expert technical assistance on an as-needed basis. In addition, as the most respected and effective voice on the reservation, the Council's participation in enacting and overseeing solid waste regulation should help to ensure the programs's acceptance by the community as a whole.

An example is provided below of one approach to implementing a simple solid waste management authority. This example is meant only as a model for developing a basic institutional structure to oversee solid waste management. Many other appropriate methods for structuring such a program exist. The exact organizational structure developed should be designed to meet the specific needs of the community and should be structured in a manner most conducive to operating successfully in conjunction with existing tribal organizations.

Figure 7 illustrates a framework within which a solid waste system can function. Duties and responsibilities for each group or office are identified below. This system can be expanded or modified as necessary to suit the particular needs of a given tribe. For example, for a smaller tribe, the TUC General Manager could be eliminated and one Operations Manager could be responsible for all utility operations. On a more densely-populated reservation or one shared by several tribes, some responsibilities of the Tribal Council might be shifted to an Environmental Board that would oversee and coordinate all environmental programs on the reservation.

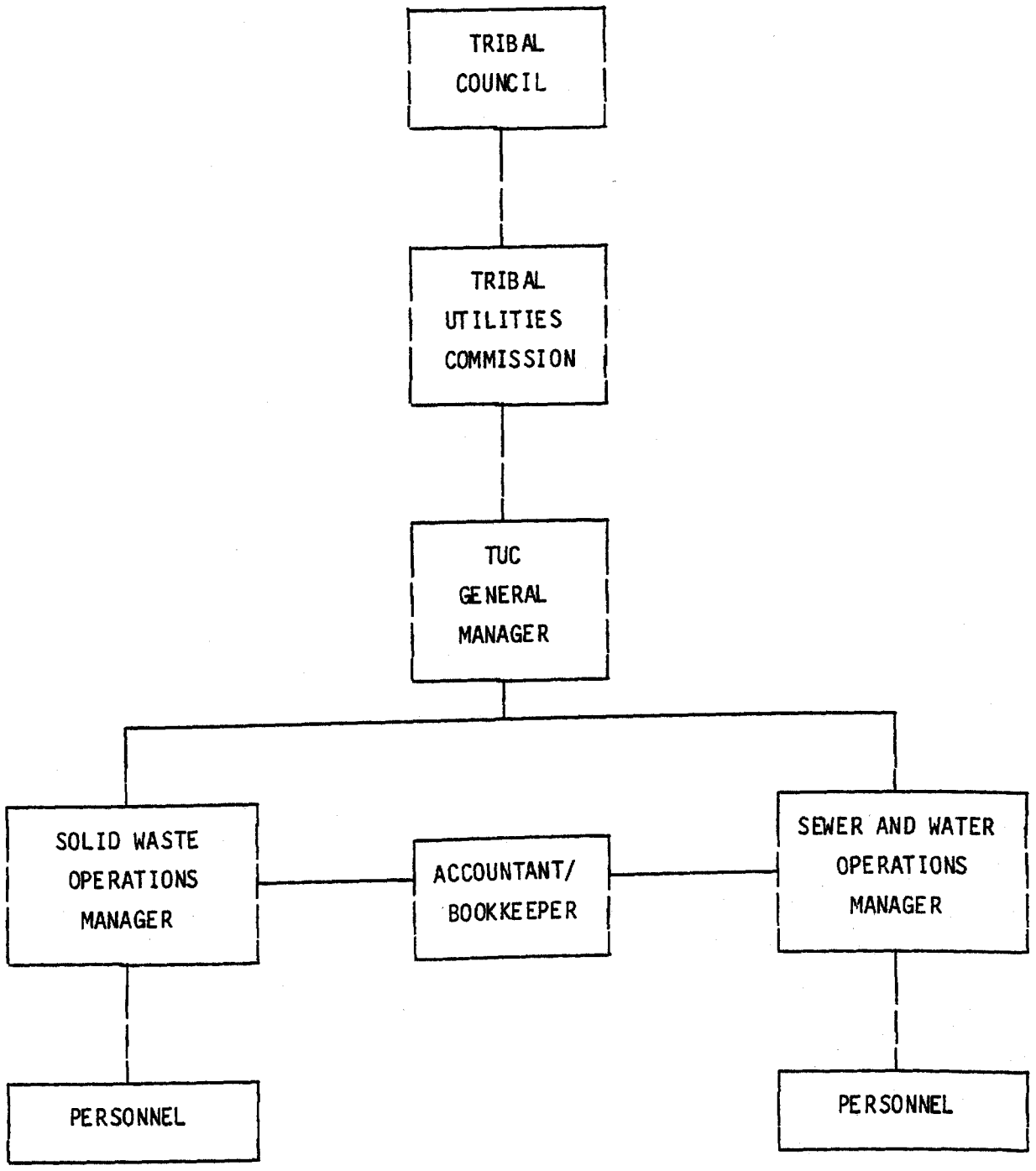
Tribal Council's Duties. The Tribal Council's first solid waste management responsibility is to determine the overall goals to be achieved on the reservation. These goals will help to determine the specific type of system to be implemented. Based on these goals, the Council should enact tribal ordinances which prohibit any solid waste disposal or management activities that are detrimental to public health or the environment. For example, ordinances could be developed that would prohibit dumping, open burning, littering; and would make it mandatory for all tribal residents to use the waste management system adopted by the tribe. Such ordinances have been successfully developed by the Blackfeet Tribe on their reservation located in northern Montana. Ordinances could also be adapted from current EPA regulations to specify the correct criteria for siting, design, and operation of a sanitary landfill.

The Council should also authorize the creation of a tribal utility commission, or if a TUC already exists, extend its authority to cover solid waste management operations in addition to overseeing water and sewer services. The Council may also want to consider setting up the TUC as a chartered tax-exempt entity of the tribe. This practice is commonly employed by states, counties, and cities to exempt them from federal, state, and local taxes.

In addition, it should be the Council's responsibility to explore mechanisms for securing adequate financing and to request technical assistance from federal agencies responsible for health and sanitation on the reservation. The Council should also develop operational standards and procedures to be followed

FIGURE 7

ORGANIZING SOLID WASTE MANAGEMENT



by the TUC, review these procedures and their efficacy periodically, and meet as needed with the solid waste manager to discuss problems with waste management operations and potential solutions for such situations.

TUC-General Manager. If necessary, a utilities operation can be divided into water, wastewater, solid wastes, and other operations. In such cases, a General Manager may be designated who has responsibility for overall utilities operations. He should coordinate all activities of the utility service. The General Manager should also evaluate each area of responsibility periodically and inform the Operations Manager of changes that should be made. He should also submit monthly income and cost records to the Tribal Council and meet with them as necessary to discuss any impending changes in overall tribal operations that could affect utility operations. Finally, he should develop and oversee a public awareness program for community members.

Solid Waste Operations Manager. This person should serve both as the landfill operator and the supervisor and trainer of all other personnel involved in solid waste operations. The Operations Manager should thus have a working knowledge of all equipment used, be skilled in landfill and solid waste management, routing and scheduling, operational safety and first-aid, and personnel training and supervision. He should be responsible for all recordkeeping pertaining to landfill management and waste collection. His duties should include preventive maintenance scheduling and a periodic system evaluation. Finally, the Operations Manager should also work in conjunction with the General Manager to develop and implement a public awareness program for the community.

Other Personnel Associated with Solid Waste Management. A bookkeeper/accountant should be responsible for the day-to-day office operations of the utilities organization including billing, procurement and payment. Route drivers will be required for waste collection activities and should be skilled or trained in truck driving, operational safety, and first-aid and preventative maintenance. A mechanic is also needed who is familiar with all equipment used. He should have a knowledge of diesel and gas engines, standard and automatic transmissions, hydraulic systems, welding, preventative maintenance and be trained in safety and first-aid.

CHAPTER 4

CONCLUSION

Solid waste management needs to be perceived by all involved as a major component of a comprehensive environmental program for the reservations. While it is understandable that this issue was dwarfed in the past by larger problems posing a more serious threat to the welfare of the tribes -- nutrition, employment, education, job training, cultural cohesiveness -- and while these concerns still must dominate the attention of both the tribal and federal governments, the time has come to recognize the need for implementing a sound solid waste management system for each reservation.

The focus of solid waste management must be on waste control, starting at the generation point and continuing through collection and transportation to final disposal in a sanitary landfill. Such a program requires both the full support of the tribal government and of the federal agencies currently providing assistance to the reservations. To achieve this, participation in the waste collection system must be mandatory for all tribal residents, and the Tribal Council must enact basic ordinances prohibiting poor waste disposal activities currently plaguing the reservations, as described throughout this report.

The federal agencies, in turn, must recognize solid waste management as a function of their overall responsibilities to help protect the health and welfare of the Indian tribes. If possible, a portion of monies currently allocated for other utilities operations (primarily directed at sewer and water services) should be redistributed to solid waste services, in order to provide some guaranteed funding in this area. Technical assistance and funding should be front-ended to the maximum extent possible, in order to alleviate problems created by past ignorance of proper waste management activities. Once these problems are resolved and a proper system is implemented, the primary responsibility for managing and operating the solid waste program should rest with the tribe's designated utility authority, and federal agencies need only provide minimal guidance as necessary.

Finally, a public awareness program should be implemented for tribal residents of all ages that encourages participation in the solid waste management program and that strives to increase the community's understanding of the benefits of adhering to proper waste management procedures.

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