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113633

REPORT BY THE

Comptroller General

OF THE UNITED STATES

EPA Needs To Improve The Navajo Indian Safe Drinking Water Program

The safety of public drinking water depends on compliance with national regulations which specify maximum contaminant levels.

The Environmental Protection Agency's efforts to insure this safety on the Navajo Indian Reservation have not been effective because of its lack of overall supervision and standard sampling and training procedures and inadequate monitoring.

GAO found some water systems on the reservation with contaminants in excess of permissible levels. The Administrator needs to insure compliance with drinking water standards.

113633

UNITED STATES GENERAL ACCOUNTING OFFICE

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-199856

The Honorable Morris K. Udall, Chairman
Committee on Interior and Insular
Affairs

The Honorable Henry Waxman, Chairman
Subcommittee on Health and the
Environment
Committee on Interstate and Foreign
Commerce
House of Representatives

As requested in your June 5, 1979, letter, and after subsequent talks with your offices, we reviewed the Environmental Protection Agency's implementation of the drinking water program in conjunction with the Indian Health Service on the Navajo Indian Reservation. We also reviewed the water sampling and laboratory analysis practices used on the reservation and tested selected water supplies (mostly wells). In addition, we reviewed the Department of the Interior's role in the program on the reservation.

This report discusses the need for better planning and coordination of the program and standardization of sampling and training procedures. It also recommends ways to improve the program.

At your request, we did not obtain agency comments, but the matters covered in the report were discussed with program officials. Their views are included in the report where appropriate.

Also as requested, unless you publicly announce its contents earlier, we will not distribute the report to the agencies involved and other interested parties until 30 days after the date of the report.

Elmer B. Staats

Comptroller General
of the United States

REPORT BY THE COMPTROLLER GENERAL OF THE UNITED STATES

EPA NEEDS TO IMPROVE THE NAVAJO INDIAN SAFE DRINKING WATER PROGRAM

D I G E S T

The Environmental Protection Agency (EPA) has not effectively implemented a drinking water program on the Navajo Reservation. EPA needs to develop an overall supervision plan and an accurate and complete inventory of public water systems on the reservation. In addition, it needs to improve its monitoring of required program activities such as recordkeeping, reporting, sampling, public notification and correction of public water system violations to insure compliance with the national interim primary drinking water regulations.

OVERALL PLAN NEEDED TO IMPLEMENT PROGRAM

EPA requires States to have public water system supervision plans. But EPA's region IX in San Francisco which has the primacy role for the Safe Drinking Water Program on the Navajo Reservation has not developed an overall program plan to implement the program. (See pp. 2 and 12.)

Because there is no overall plan or supervision, confusion exists and misunderstandings have resulted over the roles and responsibilities of water suppliers and organizations in carrying out the drinking water program. (See p. 12.) For example, as late as November 1979, 2 years after the June 1977 effective date of the national interim primary drinking water regulations, EPA officials met with the Indian Health Service (IHS), the water suppliers, and representatives of the Navajo Tribe to clarify the roles and responsibilities of the various organizations. Although this meeting and an EPA reorganization of its drinking water activities on the reservation were helpful, GAO continues to believe that greater efforts and a formal plan which clearly identifies the roles and responsibilities of each organization are needed. (See pp. 15 and 25.)

CED-80-124

Tear Sheet. Upon removal, the report cover date should be noted hereon.

IHS estimates that about 3,500 wells or other water sources are on the reservation. EPA had identified 201 public water systems in November 1979 but no individual organization actually knows how many sources exist or how many meet the Safe Drinking Water Act criteria. Poor records and inconsistent or nonexistent identification systems make it difficult to inventory and locate water sources. (See p. 17.) For example:

--Bureau of Indian Affairs (BIA) and the Navajo Tribal Utility Authority records do not agree with EPA's inventory. EPA's inventory identified 5 water systems as BIA's that BIA does not operate. The Utility Authority identified 21 water systems it operates but EPA's inventory only lists 12. (See p. 17.)

--GAO identified several wells which may be public water supplies, according to the criteria, but have not been identified as such. (See p. 17.)

LITTLE ASSURANCE THAT REQUIRED ACTIVITIES ARE BEING CONDUCTED

Although EPA requires public water suppliers to establish and maintain records and make reports under the drinking water program, few water suppliers actually maintain these records and make reports. Consequently, EPA has little assurance that required activities--periodic sampling and analysis, customer notification of violations, and corrective actions on violations--are performed and drinking water standards are met. (See p. 20.) For example:

--GAO's review of 34 public water systems' records on the reservation showed that few of the records required by EPA were being maintained by water suppliers. (See p. 21.)

--BIA was the only water supplier that had a tracking system for determining if samples were submitted in accordance with EPA's sampling requirements. But, even BIA was not performing the required sampling. (See p. 21.)

--EPA does not receive all sampling results as required and there is little consistency in the manner and formats in which sampling results are reported. (See p. 22.)

--Little documentation exists to show that consumers are notified of excessive contaminants in public water systems. Therefore, GAO could not determine if consumers were notified as required, in all instances where contaminants had been detected. (See p. 23.)

IMPACT OF INADEQUATE SAMPLING PROCEDURES AND LABORATORY ANALYSIS

Poor field sampling procedures can significantly affect water quality determinations. Reservation sampling procedures have not been standardized and actual procedures used are often inconsistent with those recommended by authoritative sources. Also, many sampling technicians had little, if any, training in sampling procedures. (See p. 27.)

The remote location of wells and water systems on the Navajo Reservation hampers water sample collection and analysis. Since bacteria and organic samples must reach the laboratories within 30 and 24 hours, respectively, extra effort and resources are required to meet these requirements. Some samples have been rejected by the laboratories because they were not received within the required period of time. (See p. 31.)

GAO found a wide range of variances in analyses of reservation drinking water samples certified laboratories made. (See p. 32.) The variances can be caused by the precision of laboratory equipment, the analytical method used, and technicians' capability. Despite laboratory quality controls and EPA's certification and performance evaluation programs, some large variances were found in analyses between and within laboratories that analyzed GAO samples. (See p. 32.)

CONTAMINATED DRINKING WATER SUPPLIES

GAO found levels of radionuclide contamination in 6 of 32 drinking water wells to be in excess of allowable EPA levels. These findings generally confirm the results of EPA's sampling efforts. For four of the six wells, although the radionuclide levels were in excess of the allowable levels, EPA did not consider the levels to be an immediate danger and recommended continued monitoring of the wells. (See p. 48.)

For two wells, the radionuclide levels were substantially in excess of the allowable levels. The use of these two wells for drinking water purposes was discontinued. (See p. 49.)

GAO sampling results for bacteria and chemical (organic and inorganic) contaminants disclosed seven instances of bacteria and four instances of inorganic--fluoride, barium and selenium--contamination in excess of the maximum contaminant levels. Water suppliers on the Reservation told GAO that they have taken or plan to take corrective action for contaminated drinking water supplies, such as installing treatment systems and drilling new wells. (See p. 49.)

RECOMMENDATIONS

The Administrator, Environmental Protection Agency, should direct region IX to:

--Develop a drinking water program plan for the Navajo Reservation, which (1) clearly identifies the roles and responsibilities of each organization involved in water supply activities, (2) includes provisions for developing an accurate water supply inventory, and (3) is developed in cooperation with Navajo Tribal officials. (See p. 25.)

--Develop a followup system for the Navajo Reservation to insure that the water suppliers comply with recordkeeping, sampling, reporting, consumer notification, and corrective action requirements. (See p. 25.)

--Develop and mandate the use of standardized field sampling procedures for the reservation, taking into consideration the unique reservation circumstances, such as long transportation times. (See p. 46.)

--Establish minimum training standards for reservation water sampling technicians and support such standards with training programs, materials, and technical assistance. (See p. 46.)

EPA headquarters drinking water officials endorsed the need for additional guidance on field water sampling procedures and additional training, but did not agree that an overall program plan for implementing the drinking water program on the reservation is needed. Also, these officials disagreed that the Navajo Tribal Council and Chairman should be involved in EPA's implementation of the Safe Drinking Water Act on the reservation. They did state, however, that they would discuss these matters further with EPA regional officials responsible for the Navajo Reservation drinking water program.

IHS headquarters environmental health officials agreed that an overall reservation drinking water program plan would be helpful. They also agreed that the program should be operated in cooperation with the Navajo Tribal Council and Chairman.

GAO believes that EPA program officials' disagreement with the need for a formal program plan says in effect that EPA does not need to follow the same good management practices it imposes on States assuming primacy. Also, IHS which has had extensive dealings with Indian reservations, agrees with GAO on the need for a formal plan and to have the Navajo Tribal Council and Chairman involved in the drinking water program.

Contents

ABBREVIATIONS

BIA	Bureau of Indian Affairs
EMSL-CI	Environmental Monitoring and Support Laboratory - Cincinnati, Ohio
EMSL-LV	Environmental Monitoring and Support Laboratory - Las Vegas, Nevada
EPA	Environmental Protection Agency
GAO	General Accounting Office
IHS	Indian Health Service
mcl	maximum contaminant level
mg/l	milligrams per liter
ml	milliliter
NIPDWR	National Interim Primary Drinking Water Regulations
NTUA	Navajo Tribal Utility Authority
pCi/l	pico curies per liter
ug/l	micrograms per liter
SDWA	Safe Drinking Water Act
USGS	U.S. Geological Survey

CHAPTER 1

INTRODUCTION

In a June 5, 1979, letter (see app. I), the Chairmen, Committee on Interior and Insular Affairs; Subcommittee on Oversight and Special Investigations, House Committee on Interior and Insular Affairs; and Subcommittee on Health and the Environment, House Committee on Interstate and Foreign Commerce, requested us to (1) review the procedures used by the Indian Health Service (IHS), Department of Health, Education, and Welfare, 1/ and the Environmental Protection Agency (EPA) and appropriate laboratories in testing drinking water on the Navajo and other Indian reservations in the West under the Safe Drinking Water Act (SWDA) and (2) test certain key wells for radionuclide, bacteriological and metallic contaminants. Subsequently, in a July 26, 1979, letter (see app. II), the Chairman, Subcommittee on Health and the Environment, House Committee on Interstate and Foreign Commerce, requested that we also determine:

--What resources EPA has allocated for implementing SDWA in States that have not assumed primacy?

--How the SDWA is being implemented on Indian lands? Specifically, which entity has primary enforcement responsibility for public water systems on Indian lands?

--What relationship EPA and the Department of the Interior have for providing safe drinking water on Indian lands?

--Is this relationship satisfactory? If not, why not?

--The details of problems pertaining to the quality of sources of drinking water on Indian lands.

1/Renamed the Department of Health and Human Services May 7, 1980, as a result of a reorganization which created a separate Department of Education.

Information on the resources EPA has allocated for implementing the act in States that have not assumed "primacy" (responsibility for the program) was provided to the Chairman, Subcommittee on Health and the Environment, House Committee on Interstate and Foreign Commerce, by letter dated August 8, 1979, (CED-79-19). Also, it was agreed with the requesters that our efforts concerning the implementation of the act on Indian lands would be confined to the Navajo Reservation.

THE SAFE DRINKING WATER PROGRAM

In December 1974 the Congress passed the Safe Drinking Water Act (42 U.S.C. 300f et seq.) to insure that public water supply systems throughout the Nation meet minimum national health standards. The act was the first national commitment to safeguard public drinking water supplies. Prior to this time, Federal authority to regulate drinking water quality had been restricted to water provided on interstate carriers and to foreign and domestically bottled water sold interstate.

The act authorized establishing a joint Federal-State 1/ program for insuring compliance with the national drinking water regulations. EPA, through its Administrator, is responsible for protecting public health by establishing minimum national standards which limit the amounts of various substances in drinking water (see app. VI) and by establishing regulations to insure the safety of the Nation's drinking water supplies. The Congress' intent was that the States adopt and enforce these regulations which apply to the estimated 250,000 public water systems throughout the Nation. The act thus provides for States to assume primary enforcement responsibility or primacy, for monitoring the public water systems within their boundaries. The implementing regulations define a public water system as one which has at least 15 service connections or regularly serves at least 25 people a minimum of 60 days out of the year.

The National Interim Primary Drinking Water Regulations (NIPDWR) established by EPA became effective June 24, 1977. The final regulations required by the act have not been issued. The NIPDWR classified public water systems as either community or noncommunity. The former serves

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1/The term "State" as defined for the SDWA includes the 50 States, the District of Columbia, Puerto Rico, the Virgin Islands, American Samoa, Guam, the Trust Territory of the Pacific Islands, and the Government of the Northern Mariana Islands.

year-round residents and the latter serves all others--that is, transient populations in places such as motels, restaurants, and campgrounds.

The monitoring requirements for community systems became effective on June 24, 1977, but the monitoring requirements for noncommunity systems did not become effective until June 24, 1979.

For those States which have not assumed primacy and for Indian lands not under the jurisdiction of a State, EPA has interpreted the act as requiring it to assume primacy. To provide a coordinated approach on Indian lands, EPA and IHS entered into an interagency agreement. Generally, this agreement provides that IHS will assist EPA in identifying public water supply systems, monitoring the activities of water suppliers on Indian lands, conducting certain water sampling activities, and helping water suppliers technically and financially. EPA, however, retains the primary enforcement responsibility for Indian lands.

EPA's Region IX in San Francisco has been designated by the Office of Management and Budget as the office responsible for the drinking water program on the Navajo Indian Reservation. The IHS Navajo Area Office in Window Rock, Arizona, is responsible for IHS activities on the reservation.

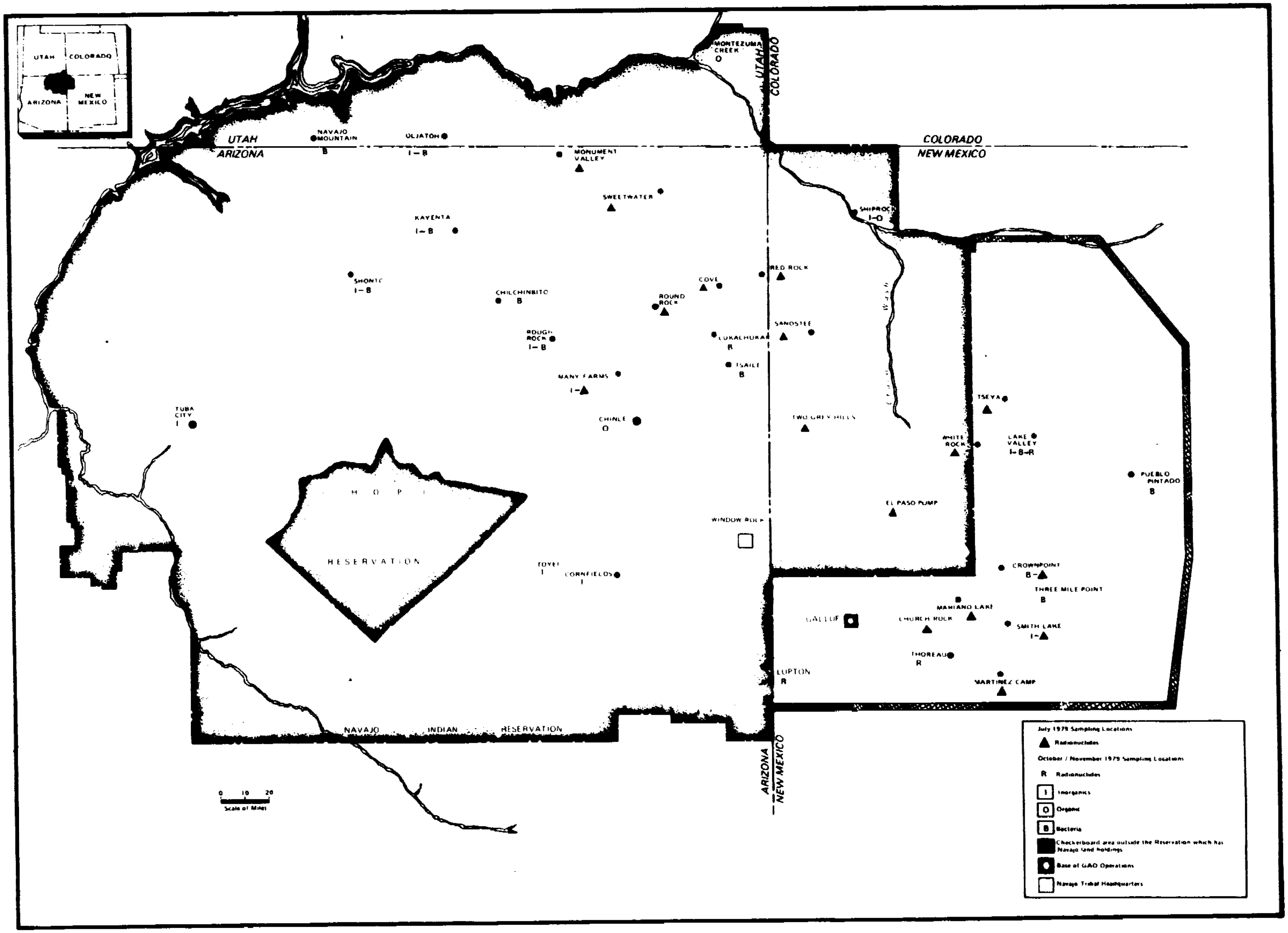
THE NAVAJO INDIAN RESERVATION

The Navajo Indian Reservation covers about 25,000 square miles and is located in Arizona, New Mexico, and Utah, joining Colorado in the four-corners area. The majority of the reservation is in Arizona and New Mexico (see map on next page). In 1979 the population of the reservation was estimated to be about 155,000, with more than half under 20 years of age.

Although the majority of the Navajo people live in the larger communities, many live on Navajo land in scattered, remote locations on or near the reservation. Many of these locations are difficult to reach because of unpaved roads, rugged terrain, and, at times, inclement weather conditions.

IHS estimates that there are about 29,100 Navajo homes, about 60 percent (17,500) of which are or will be served by running water. Of the 11,600 homes not served by running water, about 4,000 to 6,000 homeowners carry water from watering points intended for human consumption. Water for the remaining 5,600 to 7,600 homes is obtained from sources IHS considers to be inappropriate for human

LOCATION OF PUBLIC WATER SUPPLIES AND WELLS GAO SAMPLED ON THE NAVAJO INDIAN RESERVATION



consumption because they (1) are inadequately constructed, operated, or maintained, (2) have poor quality water, or (3) have not been adequately evaluated as to potability.

IHS estimates that 3,500 wells and springs on the reservation provide water for drinking, agriculture and livestock watering. IHS officials said that most of these sources were intended to be used solely for livestock watering purposes, but many, particularly those in remote locations, are reportedly used for human drinking purposes as well.

In the larger communities, wells are tied into water distribution systems. These wells are usually in pumphouses or other buildings and are, thus, protected from the elements. In the more remote areas, many wells are connected to watering points--locations where the people can fill cans and drums with water to take home. These facilities are often in the open, and the conditions around them are often primitive, with livestock grazing in the immediate area. (See photos on pp. 6 to 9.)

OBJECTIVES, SCOPE, AND METHODOLOGY

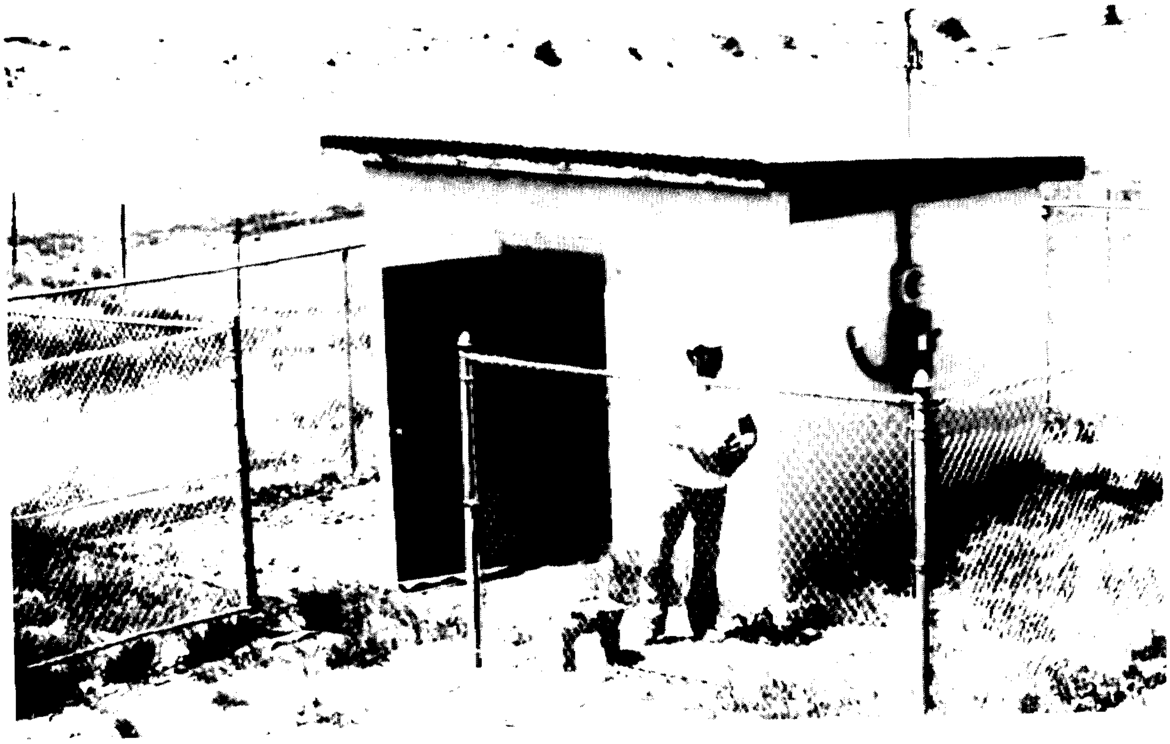
As agreed with the requesters, our review was done in two phases. The first phase involved testing selected water wells on the reservation for radionuclides. The second phase, which involved testing selected wells for radionuclide, bacteria and chemical contaminants, was directed primarily at evaluating how SDWA was implemented on the Navajo Reservation.

First phase

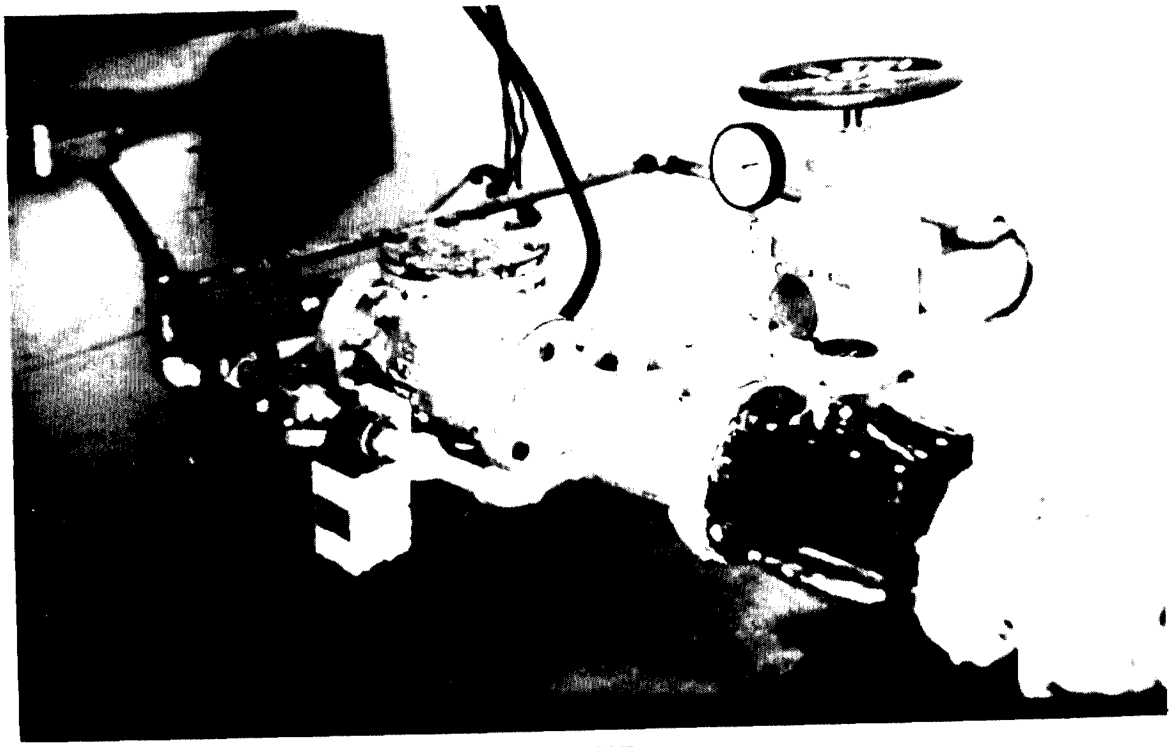
In the first phase we sampled 29 wells at 17 locations. We selected the wells on the basis of (1) information and recommendations from the requesters and Navajo Tribal officials and/or (2) proximity to active or inactive uranium mining or milling activities.

The number of wells we sampled in July 1979 was limited by the capabilities of the various laboratories to analyze the samples in time for us to report the results to the requesting committee and subcommittees by July 31, 1979. The actual sampling of the wells was done under our supervision by technicians from the U.S. Geological Survey, Department of the Interior, and the Los Alamos Scientific Laboratory, Department of Energy. The water samples were analyzed by three EPA certified radiological laboratories --the Department of Energy's Los Alamos Scientific Laboratory

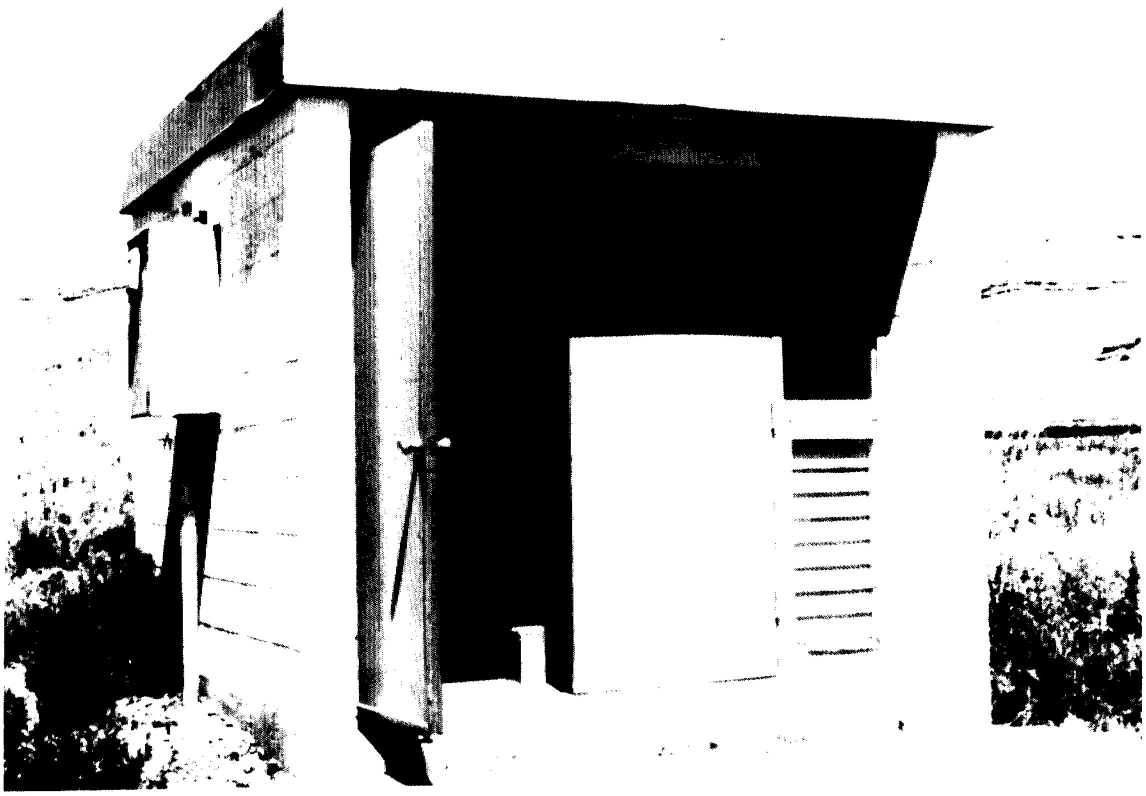
EXAMPLES OF MODERN WATER WELLS



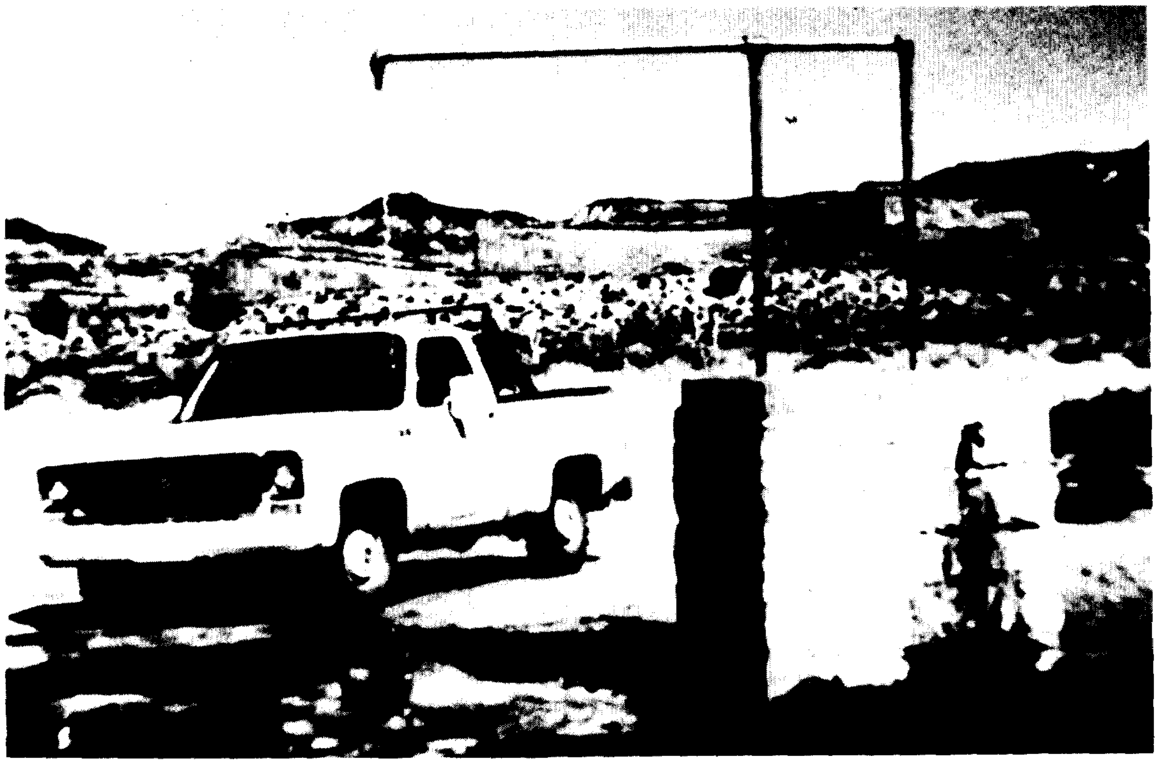
WATER AND SANITATION DEPARTMENT WELL
AT RED VALLEY, ARIZONA.



TYPICAL MODERN WELL PUMP EQUIPMENT.


BIA WELL NO. 3 AT MANY FARMS, ARIZONA.

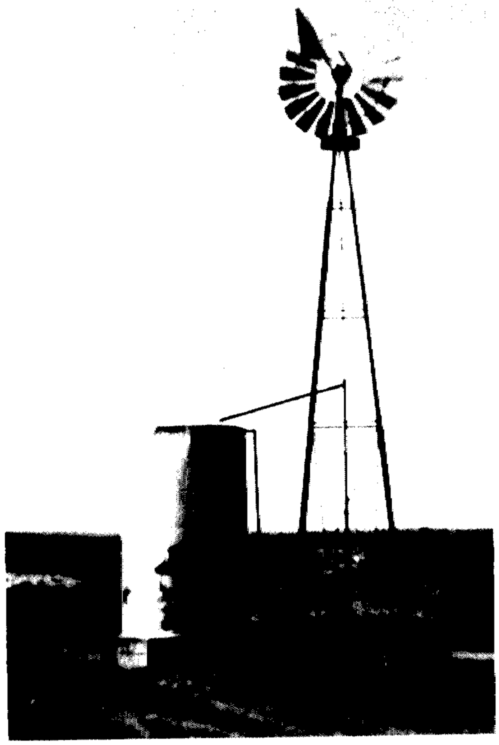
TYPICAL WATERING POINTS



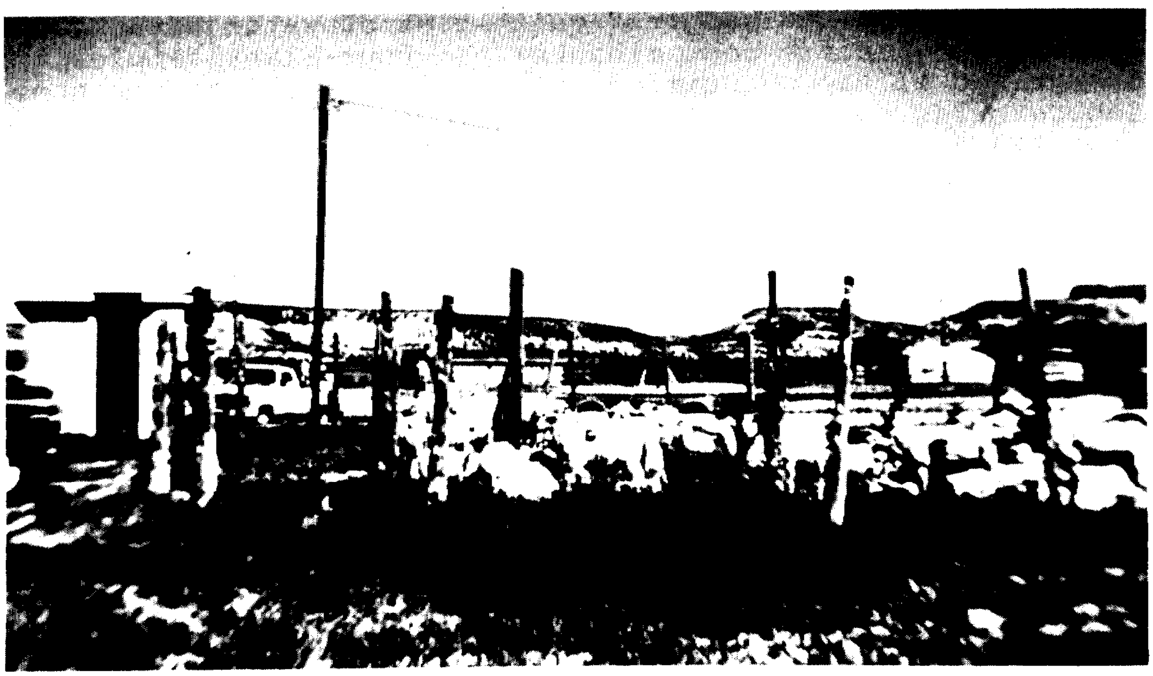
WATERING POINT AT CHAPTER HOUSE LUKACHUKAI, ARIZONA.

WATERING POINT AT
NAVAJO MOUNTAIN, UTAH.

EXAMPLES OF WELLS WITH LIVESTOCK IN AREA



WINDMILL WELL WITH WATERING TROUGH
FOR LIVESTOCK NEAR SANDERS, ARIZONA.



CHAPTER HOUSE WELL WITH NEARBY SHEEP PEN, SMITH LAKE, NEW MEXICO.

at Los Alamos, New Mexico (operated by the University of California); the California State Department of Health Services, Sanitation and Radiation Laboratory in Berkeley, California; and the LFE, Inc., Environmental Analysis Laboratories in Richmond, California (an EPA contract laboratory). The results of our sampling are discussed in chapter 4.

Second phase

During the second phase we sampled 24 water supply systems (wells, distribution systems, and a surface water supply) at 19 locations for radiological, organic (pesticide and chemical), inorganic (salt and metal), or bacterial contaminants. As in the first phase, we selected water supplies for sampling based on information and recommendations from various sources, including information on water supplies with histories of contamination problems. The actual sampling of the water supplies was done by our staff using field sampling procedures EPA and the U.S. Geological Survey recommended. Technicians from the Navajo Tribe's Water and Sanitation Department observed our sampling techniques to insure that we followed the recommended procedures.

Appendix III lists the laboratories used to analyze the samples for both phases, the type of analysis performed, and the number of samples analyzed. To assist in evaluating laboratory performance on the samples submitted, we also submitted seven spiked samples (quantities of water with known amounts of specific contaminants) and four blank samples (comprised of tap, distilled, or sterile water) to the same laboratories for analysis. The spiked samples were obtained from EPA's Environmental Monitoring and Support Laboratories in Las Vegas, Nevada (radiological spikes) and Cincinnati, Ohio (organic and inorganic spikes); and the California State Department of Health Services Laboratory, Berkeley, California (bacterial spikes). The blank samples were prepared in the Navajo Tribal Utility Authority (NTUA) laboratory, Fort Defiance, Arizona, and in EPA's Las Vegas laboratory.

We also visited the six laboratories which routinely analyze reservation drinking water samples; three laboratories which may be called upon to analyze reservation drinking water samples; and three laboratories used to analyze our samples (see app. IV). The purpose of our visits was to discuss laboratory and field sampling procedures and practices with laboratory officials.

To evaluate the adequacy of field sampling procedures used on the reservation, we observed the routine collection of water samples by EPA, IHS, NTUA, and Bureau of Indian Affairs (BIA) technicians. The number and extent of our observations are discussed in chapter 3.

We also reviewed drinking water records and interviewed officials of EPA, BIA, NTUA, IHS, and the Navajo Tribe, including the Water and Sanitation Department. In addition to the various locations on the Navajo Reservation and the laboratories discussed above, we performed work at EPA and BIA headquarters, Washington, D.C.; IHS headquarters, Rockville, Maryland; EPA Region IX, San Francisco, California; EPA's Environmental Monitoring and Support Laboratories in Las Vegas, Nevada and Cincinnati, Ohio.

CHAPTER 2

THE DRINKING WATER PROGRAM ON THE NAVAJO RESERVATION NEEDS IMPROVEMENT

Unsafe drinking water can result in disease or poisoning. For example, during the period 1961-77, 322 reported outbreaks of disease or poisoning attributed to drinking water resulted in acute illnesses to about 86,700 persons nationwide.

Providing water that poses no threat to consumers' health depends on continuous protection through intensive surveillance and treatment. Therefore, to protect public health to the extent feasible, EPA established NIPDWR which specify the maximum contaminant level (MCL)--maximum permissible level of a contaminant in drinking water delivered to users of public water systems, and requires water suppliers to monitor these systems to insure compliance with the MCLs. In addition, EPA requires States to establish public water system supervision programs as a condition to obtaining grants for implementing the program.

EPA has not adequately implemented the program on the reservation. Confusion exists among the water suppliers and other involved organizations over their roles and responsibilities, and public water systems have not been accurately inventoried. Also, because of inadequate recordkeeping and followup, EPA has no assurance that required water supply activities, such as periodic water sampling and analysis, reporting, and customer notification of violations, necessary to insure drinking water safety, are being carried out. We believe that EPA needs to develop a supervision program, an accurate inventory of public water systems, and a system to monitor and follow up on compliance with the drinking water program requirements on the Navajo Reservation.

OVERALL PLAN NEEDED TO IMPLEMENT PROGRAM

EPA has assumed the primacy role for enforcing and implementing the SDWA on the Navajo Indian Reservation. EPA has not yet, however, developed a supervision program for the Navajo Reservation.

Establishing a plan to carry out primacy on the reservation is essential because of (1) the number of organizations involved in the drinking water program on the reservation,

(2) the need for a clear understanding of the roles and responsibilities of the various organizations, and (3) the need for an accurate inventory of public water systems.

Organizational roles and responsibilities

In addition to EPA, four other organizations--IHS, BIA, the Navajo Tribe's Water and Sanitation Department, and NTUA--are directly involved in drinking water activities. Proper planning to insure the coordination of the activities of each of these organizations is important, but has not been done by EPA.

IHS

IHS provides health services to the Navajos. Since 1959, IHS has also been responsible for constructing and improving water and sanitation facilities on the reservation. IHS develops water systems and serves as the interim operator until the facilities are turned over to the Navajo Tribe. These facilities are generally single wells, which may or may not be tied to a distribution system. As of March 31, 1980, an IHS official estimated that it was operating about 30 wells which have not yet been turned over to the Tribe and, therefore, is responsible for these wells.

In 1977 EPA enlisted the assistance of IHS in performing many of its supervision functions on Indian lands, under SDWA. EPA and IHS entered into an agreement designed to provide a coordinated approach and eliminate unnecessary duplication in reservation drinking water programs. Under the terms of the agreement, IHS

--cooperates with EPA in identifying public water supply systems on the reservation and collecting inventory data,

--samples water supplies for EPA,

--serves as the technical advisor to the Navajos, and

--provides financial and other assistance to Navajo water suppliers and maintenance organizations.

IHS has no SDWA enforcement responsibilities. EPA has retained all SDWA enforcement responsibilities on Indian reservations where it has assumed primacy.

BIA

BIA operates water systems on the reservation. These systems, in most cases, support BIA facilities--primarily schools and adjacent support facilities. As of March 31, 1980, BIA was operating 61 water systems. It also operates a laboratory that does bacterial and inorganic chemical analyses of drinking water samples.

BIA has no responsibility for implementing SDWA other than as a water supplier. BIA officials, however, stated that because of BIA's trust responsibilities to the Indians, it tries to make sure that some organization implements SDWA. For the Navajo Reservation, BIA officials stated that EPA's Region IX is responsible for implementing SDWA.

Navajo Tribe Water and Sanitation Department

The department operates about 2,300 wells and springs, most of which are intended only for livestock watering, and 45 public water systems. The majority of the department's wells intended for drinking water are located at watering points and chapter houses (local meeting houses). The watering points which are located at chapter houses serve as sources of free drinking water for the people in the area who do not have drinking water in their homes.

NTUA

NTUA, an independent utility corporation, operates about 21 water systems in the more populous communities on the reservation. These systems are municipal-type water systems and usually have a number of electrically driven wells on each system. NTUA also operates one of the laboratories that has been analyzing water samples for bacteria and inorganic chemicals.

Tribal governing body

The Navajo Tribe, through the Tribal Council and Chairman, is the governing body on the reservation. Tribal officials told us that they are concerned about drinking water problems on the reservation, regardless of who supplies the water. They further stated that they believe they should be involved in a variety of drinking water activities, ranging from routinely receiving sampling results to actual participation in decisions involving drinking water.

Confusion over roles and responsibilities

When a State assumes primacy for the Safe Drinking Water Program, EPA requires that it establish a public water system supervision program which provides for planning, developing, and coordinating program activities for managing public water systems, including program direction and supervision.

EPA has not developed a plan for implementing the SDWA on the reservation, except for the agreement between EPA and IHS. EPA region IX officials said they believed meetings between IHS, the water suppliers, and region IX technicians were sufficient for implementing the program. Although such meetings were held, uncertainty continues among those on the reservation responsible for water supplies as to their roles and responsibilities under the drinking water program and as to whom they should deal with in the EPA region. The guidance provided during such meetings has not been communicated to all the parties needing such guidance and has not been put into written format for future use.

Because EPA has not provided overall program direction for implementing SDWA, confusion exists concerning the roles, responsibilities, and duties of water suppliers, and poor communications and misunderstandings have occurred further hindering effective program implementation. For example:

--IHS took samples for EPA to provide needed baseline data on reservation water supplies, but EPA used the baseline data for enforcement purposes and attempted to shutdown some water supplies. IHS officials, in turn, threatened to discontinue collecting baseline samples for EPA because of their understanding that the samples were not to be used for enforcement purposes. IHS also collects samples as part of its public health function and was concerned that water suppliers would confuse the samples taken for EPA with IHS's sampling and refuse to cooperate with IHS in the future.

--EPA repeatedly issued erroneous notices of violations to water suppliers, and later had to withdraw the notices. EPA issued the notices without contacting IHS, to assure that they had all necessary information. In some instances the notices were sent to the wrong water supplier because EPA did not have sufficient data to identify the water system in violation, and in other instances, EPA's analytical data was incorrect.

--Navajo tribal officials told us they requested certain sampling results from EPA, but never received them. As a result, they believed EPA was withholding the information and contacted congressional committees to express their concerns over the drinking water program on the reservation. Tribal officials stated that the Tribe should be informed of, and involved in, drinking water activities on the reservation.

EPA region IX drinking water program officials said they believed that by working with the water suppliers--NTUA and the Water and Sanitation Department--they were working with representatives of the Tribe, and expressed concern to us as to what constitutes the Tribe. These officials said they dealt with IHS because it has authority and responsibility for Indian health and provides water and sanitation facilities on the reservation. Also, the officials said IHS is knowledgeable about the water systems and can provide the necessary technical assistance for EPA. Some tribal officials, however, said the Tribe is interested in safe drinking water and does not consider EPA's dealings with NTUA and the Water and Sanitation Department working with the Tribe.

As late as November 5, 1979, over 2 years after the required implementation of NIPDWR, IHS wrote to the Navajo Tribal Chairman, attempting to explain SDWA and the role of the various organizations involved in drinking water activities on the Reservation. In that same letter, IHS requested that tribal representatives attend a meeting with IHS, EPA, NTUA, and Water and Sanitation Department officials to discuss these matters. On November 6, 1979, EPA, IHS, water suppliers, and tribal officials met to try to resolve problems and clarify the roles and responsibilities of the water suppliers in carrying out the requirements of SDWA.

Also, region IX drinking water officials said they realized there were problems in implementing the act on Indian lands. They said the various drinking water activities were reorganized under one branch in region IX, October 1979, and should result in program improvements. The officials said the reorganization, along with the November 6 meeting, should provide greater visibility and should allow them to follow-up more effectively on problems as they develop. However, regional drinking water officials told us that they believe developing a plan for implementing SDWA on the reservation may be a good idea.

We did not assess the effectiveness of the field reorganization, but believe improvement is still needed to implement the program on the reservation. For example, a

February 1980 EPA headquarters evaluation of region IX oversight of the drinking water program showed a need for improved supervision and increased routine monitoring and reporting on Indian lands. The report showed that improvements had been made in routine monitoring and reporting, but the noncompliance rate was still 50 percent.

NEED FOR ACCURATE PUBLIC WATER SYSTEM INVENTORY

EPA's national drinking water regulations require primacy States to develop and maintain an inventory of public water systems. IHS estimates that there are about 3,500 wells or other water sources on the reservation, but no individual organization knows the (1) total number of wells or other water sources or (2) number of water sources meeting SDWA criteria for a public water system--one which has at least 15 service connections or regularly serves at least 25 people a minimum of 60 days out of the year. Poor records and inconsistent or nonexistent water supply identification systems contribute to the problems of developing an accurate inventory.

Poor records

EPA has had difficulty in developing an inventory of public water systems. As of November 1979 EPA had identified 201 public water systems on the Reservation subject to SDWA. We could not, however, determine if EPA's list is correct because the records of the water suppliers are often nonexistent, incomplete, or inaccurate. However, during our work, we identified several wells which may be subject to SDWA but which have not been identified as public water supplies by EPA or the various water suppliers.

BIA's records were more complete and accurate than the other water suppliers, but did not agree with EPA's inventory. EPA's inventory identified five BIA-operated systems which are not identified by BIA as systems it operates. A similar situation exists for NTUA water systems. NTUA water supply officials told us they operate 21 water systems, but EPA's inventory identified only 12 NTUA-operated systems.

For Water and Sanitation Department-operated water systems, the situation is even more confused. For example, Water and Sanitation records show that the department operates 45 public water systems and about 2,300 wells that have not been classified as public water systems. But, they did not know how many people were using the wells for drinking water. In two instances, we identified department wells which may meet the criteria for a public water supply but are not listed as such by either the department or EPA.

--A well we sampled in Monument Valley, Arizona, was reportedly developed by a uranium mining company which no longer operates in the area. (See photo on next page.) Department officials stated the well is not used for drinking, but individuals residing in the area told us they do use it for drinking. Although we could not determine how many people use the well, 15 to 20 people from the immediate area observed our sampling efforts, and the nearest other drinking water sources are many miles from the area.

--A chapter house well at Two Grey Hills, New Mexico, is not identified by either the department or EPA as a public water system. The well is in regular use, but well records were not available to determine the number of people using it. A Navajo tribal official told us, however, that people drink the water from the well at chapter meetings and may carry water home from the well.

In additon to public water systems operated by BIA, IHS, NTUA, and the Water and Sanitation Department, a number of privately owned water sources on the reservation are owned and operated by trading posts, missions, mining companies, and others. Some of these sources may meet SDWA criteria for a public water system, but are not identified as such by EPA or included in its inventory. For example, the La Vida Mission well near Tseya, New Mexico, provides drinking water for the mission's day and boarding school. According to a Water and Sanitation official, the school serves 40 to 60 children. But, the well is not included in EPA's inventory. An IHS official stated that La Vida Mission probably should be included in the inventory.

IHS reservation environmental health officials said, because of inadequate records on reservation water supplies, there may be some supplies that are public water systems, but they have not been identified. One of these officials said wells and springs intended for animal watering are not being sampled because they were not constructed for drinking water and do not meet the requirements of an approved drinking water supply. Also, he said many of these supplies are not covered and contamination cannot be prevented. However, he said some of them may be used for drinking water.


WELL AT MONUMENT VALLEY, ARIZONA.

Inconsistent water supply identification systems

Each reservation water supplier uses a different system to identify its water supplies. EPA uses a coding system by State to identify water systems but does not identify individual wells serving a water system. IHS uses construction project numbers to identify individual wells, but for water systems it uses EPA's identification system. BIA uses a geographic identification (e.g., Many Farms) for its systems and consecutively numbers each well serving the system. NTUA assigns numbers to its public water systems by operating district and numbers the individual wells on the systems. Water and Sanitation generally uses a well identification system developed by the U.S. Geological Survey. However, springs and shallow wells generally are not assigned well numbers. For example, well numbers had not been assigned for the Water and Sanitation well at the chapter house in Red Valley, Arizona, or the one we sampled in Monument Valley, Arizona.

Officials of the Water and Sanitation Department said they assign a well number when they issue the permit to drill a well. They said IHS and NTUA normally obtain a permit, but BIA does not. In addition, they said many private wells are drilled without permits. Thus, they cannot account for all the wells drilled on the reservation.

Because of the inconsistent identification systems used on the reservation, we had some difficulty in crosschecking water suppliers' records with EPA's inventory. Consequently, we concluded that EPA has no assurance that its inventory agrees with water supplier records. For example, through talks with EPA officials, we found that they did not know which of two solar wells at Sweetwater, Arizona, their inventory number identified.

EPA HAS LITTLE ASSURANCE THAT REQUIRED ACTIVITIES ARE BEING CONDUCTED

Although required by NIPDWR, and subject to civil penalties up to $5,000 for each day in which a willful violation occurs, water suppliers are generally not maintaining the records necessary to assure compliance with NIPDWR. Therefore, EPA has little assurance that other water supply activities required by NIPDWR--periodic sampling and analysis, reporting of sampling results, and notification of and corrective actions on violations--are being properly carried out.

Inadequate records

NIPDWR requires water suppliers to maintain records at a convenient location on, or near their premises. The records are to include (1) the details and results of all water supply monitoring efforts, and actions taken to correct violations of the MCLs, (2) reports and materials related to any sanitary surveys--onsite inspection and review--of the system, and (3) information on variances or exemptions, if any, granted to the system. Variances and exemptions are granted to public water systems that cannot meet the MCLs because of the raw water source and inadequate treatment, respectively.

We reviewed the files for 34 reservation water systems or wells and found that few of the required records were being maintained by the water suppliers. Water system or well files often did not contain required information on monitoring (sampling) and results, consumer notification of violations of maximum contaminant levels, or actions taken to correct violations. As a result, we could not determine if water suppliers were meeting the MCLs of NIPDWR. As discussed below, however, we noted several problems with water suppliers activities which indicate that the suppliers may not be meeting SDWA requirements.

Monitoring water supplies

NIPDWR requires water suppliers to routinely monitor (sample) water systems at prescribed intervals. The sampling intervals vary, depending on the potential contaminant. For example, sampling for bacteria is required to be done anywhere from 1 to 500 times per month, depending on the population the system serves. Sampling for other contaminants is required less frequently than for bacteria. Appendix V lists required sampling frequencies. If any sample exceeds the MCL established by EPA, further immediate resampling is required.

Except for BIA, none of the water suppliers had established a system to track their sampling efforts and to insure that the water systems are sampled at the required frequencies. Water supplier personnel told us that they sample the systems as required, but because of the lack of sampling records we could not verify their statements.

BIA has established a sampling tracking system for its water systems, but we found that some sampling had not been done. For example, BIA's tracking system showed that sampling for bacteria contamination had not been done for 46 public water systems at the required frequency. For 17 systems, bacteria sampling had not been done at all for a 9-month period in 1979.

EPA's region IX has a system to track water suppliers monitoring, but until March 1980 there was no evidence that the system was used to determine if water suppliers were performing the required monitoring and reporting the results. EPA's region IX officials stated that their recent monitoring actions resulted from the reorganization of the water functions in the region. They said they are currently emphasizing the monitoring of bacteria sampling activities, since bacteria pose the greatest immediate health risk. They said compliance with other requirements will be emphasized when the bacteria monitoring is carried out satisfactorily.

Reporting sampling results

NIPDWR requires water suppliers to notify EPA within 48 hours when the laboratory analysis of a drinking water sample shows a violation of a MCL. For nonviolating samples, NIPDWR requires that the results be reported to EPA within 40 days.

Reporting of water sampling results on the reservation is confused and there is little consistency as to whom sampling results are reported. For example, the NTUA laboratory analyzes bacteria and inorganic samples for NTUA, Water and Sanitation, and IHS. The laboratory reports bacteria analyses for NTUA and the Water and Sanitation Department systems directly to the water suppliers and EPA. In contrast, for inorganic analyses, the NTUA laboratory reports the results only to the water suppliers and not to EPA. For IHS samples, however, the laboratory does not report the bacteria results to EPA.

EPA has also contributed to the sampling reporting problems on the reservation. EPA has sampled reservation water systems, but has not always provided the results to the water suppliers for their use. EPA or (IHS for EPA) has conducted most of the organic, inorganic, and radionuclide sampling of the reservation water systems, but has not routinely provided the laboratory analyses from these sampling efforts to IHS or the water suppliers. In most cases notices of violations have been the basic data communicated to the water suppliers. Nonviolation data has not routinely been provided by EPA.

Inconsistencies in the format and content of laboratory reports of sample results have also occurred. For example, two laboratories' reports for bacteria show coliform and background bacteria counts, whereas one laboratory's bacteria reports show only coliform counts. EPA personnel told us that both coliform and background bacteria counts are desirable to understand what is affecting a water supply and to anticipate when problems are beginning to develop.

Laboratories are also inconsistent in reporting radionuclide information. For example, one laboratory we used in our sampling reported uranium data in pico curies per liter, whereas the other two laboratories reported the information in micrograms per liter. This situation causes confusion and the need to convert results to consistent formats.

Consumer notification of violations

SDWA regulations require water suppliers to notify the water consumers when violations of the MCLs occur. Direct customer notification through water bills or other written notification and through other means such as newspapers, radio and television, or posting notices in post offices, is required. NIPDWR further requires that public notices be clear, not overly technical, and if appropriate, bilingual. If the water suppliers do not make the required notification, EPA, consistent with its assumption of primacy, may give such notice.

Many consumers of reservation water do not receive water bills and, therefore, other notification means are needed. We could not determine if consumers are being notified of violations because documents on public notifications were not contained in water system files. Water supplier personnel stated that they have used newspapers, radio notices, and direct oral communications, but again the water suppliers' records did not document such actions. In one instance, IHS notified EPA that it had posted signs on a contaminated well at Martinez Camp, New Mexico, but when we visited the well, no such signs were visible. A woman living in the area did tell us, however, that IHS personnel told her not to use water from the well for drinking or cooking.

An EPA region IX official told us that they do not routinely receive copies of water suppliers customer notifications. According to the official, they have confined their efforts to contacting the water suppliers and IHS requesting them to make consumer notifications and take corrective action on violations.

Taking corrective action

NIPDWR requires that water suppliers keep records of actions taken to correct violations. Because of the lack of documentation in water system records, we could not determine if the water suppliers are taking action to correct all violations. Water supplier personnel told us they are taking action on violations but have not documented such action.

Water and Sanitation personnel told us, for example, of a problem with a newly developed well at Kitsilly, Arizona, which was corrected but never documented in the system records. When the well started producing contaminated water, the problem was identified and corrective repairs in the form of a new casing were made with IHS assistance. The only documentation of the corrective action is IHS's record of assistance to the water supply.

EPA records also do not show if corrective action is being taken on violations. EPA region IX drinking water program officials told us they rely on the water suppliers to correct violations and do not require the water suppliers to report corrective actions taken. BIA, however, does provide EPA with information on corrective actions taken or planned for violations.

CONCLUSIONS

EPA has not developed an overall plan for implementing SDWA on the Navajo Reservation, and the program EPA is attempting to carry out is fragmented and uncoordinated. The roles of the various organizations involved in the program on the reservation are not clear, their activities are not coordinated, communication is poor, and misunderstandings have occurred. Also, EPA has not developed an accurate inventory of reservation water supplies and, therefore, does not know if all applicable drinking water supplies are being monitored.

EPA also has no assurance that public water systems are producing water that meet the MCLs specified in the NIPDWR because required sampling, reporting sampling results, notifying consumers of violations, and corrective action are not being properly documented and reported by water suppliers. Inadequate recordkeeping by water suppliers precluded us from determining if reservation water suppliers are complying with the MCLs.

RECOMMENDATIONS

We recommend that the Administrator, EPA, direct region IX water supply officials to develop an overall drinking water program plan for the Navajo Reservation which

--clearly identifies the roles and responsibilities of each organization involved in water supply activities,

--includes provisions for developing an adequate water supply inventory, and

--is developed in cooperation with Navajo tribal officials.

We also recommend that the Administrator direct region IX water supply officials to develop a followup system to insure that water suppliers on the Navajo Reservation comply with SDWA recordkeeping, sampling, reporting, consumer notification and corrective action requirements to insure compliance with the drinking water standards (MCLs).

VIEWS OF AGENCY OFFICIALS

EPA headquarters drinking water officials did not agree that a formal overall program plan for implementing the drinking water program on the reservation is needed or that the Navajo Tribal Council and Chairman should be involved in implementing SDWA. They stated that EPA cannot be expected to develop a formal plan for each and every program it operates. They also noted that SDWA requires EPA to work with water suppliers and because the Navajo Tribal Council and Chairman are not water suppliers and have no direct responsibility for water supply activities, they did not see any reason to include them.

IHS headquarters environmental health officials, which have had extensive dealings on various Indian reservations, generally agreed that a formal program plan is needed. They also agree that the Navajo Tribal Council and Chairman should be included in implementing the drinking water program on the reservation.

We do not agree with the program officials position. In effect, they are saying that EPA does not need to follow the same good management practices it imposes on States assuming responsibility for SDWA. Also, the Navajo Tribal Council and Chairman have a very strong interest in the drinking water program and do have significant authority over tribal water suppliers. Furthermore, the Navajo Tribal Council and Chairman can be of significant assistance to EPA in insuring that an effective drinking water program is implemented on the reservation.

CHAPTER 3

RESERVATION SAMPLING PROCEDURES

AND LABORATORY ANALYSES

CREATE ADDITIONAL UNCERTAINTIES

Accurate determinations of drinking water quality depend on how well the two interrelated activities of field sampling and laboratory analysis are performed. The reliability of the analysis depends on the validity of the sample. Errors in sampling can lead to inaccurate analytical results. Even a valid sample is useless, however, if the analysis is not done correctly.

We found that sampling procedures used on the reservation were not completely consistent with procedures recommended by EPA or other authoritative sources. We also found that laboratories, in analyzing essentially identical samples, often reported widely varying results. We believe these problems are caused by inconsistent sampling procedures, inadequate guidance and training of sampling technicians, and the inherent variability of analytical results for the types of analysis involved.

FIELD SAMPLING DIFFICULTIES

Field sampling involves sample container preparation and the collection, preservation, and shipment of the samples to laboratories for analysis. Good field sampling will provide the laboratory with samples that are truly representative of the water supply being evaluated. For the Navajo Reservation, the sampling procedures we observed were not consistent.

Lack of standardized sampling procedures

Although EPA has handbooks and methods manuals which contain sampling guidance, they provide limited information on sample collection procedures. Laboratory officials stated that the "Standard Methods for the Examination of Water and Wastewater" manual, published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation, is the most authoritative guidance in sampling. As with EPA handbooks and manuals, however, the Standard Methods manual does not provide details on sampling procedures and is primarily used by laboratory technicians.

Individual water suppliers and laboratories on the reservation provide guidance on field sampling, but like other sources, such guidance is often general and focuses on only one type of sampling, such as bacteria. Furthermore, certain sampling techniques considered proper by some water suppliers deviate from recommended EPA procedures. For example, NTUA allows bacteria water samples to be taken from water faucets with swing (movable) spouts, a practice contrary to EPA recommendations and which could result in contamination not representative of the water sampled.

The conglomeration of different procedural "bits and pieces" of guidance and lack of explicit sampling criteria does not contribute to sample collection uniformity and makes the comparability of laboratory results difficult. For example, one agency's guidance recommends running the water at the sample location for 5 minutes to clear the service lines, whereas another agency's guidance recommends running the water for 3 minutes. A third agency does not provide any guidance on running the water before collecting the sample. The confusion is especially acute on the reservation with three Federal agencies and two tribal organizations involved in monitoring drinking water quality.

Sampling inadequacies

Since a single complete source of water sampling procedures does not exist, we compiled a set of procedures for use in our observation of sampling procedures. These procedures were compiled from various written instructions, such as EPA handbooks and manuals, the Standard Methods manual, and guidance materials issued by various laboratories. We also consulted officials of EPA, the U.S. Geological Survey, and the Department of Energy's Scientific Laboratory at Los Alamos, New Mexico. In addition, we relied heavily upon an EPA film on sampling which was released for public use in November 1979. In effect, our evaluations were based on a composite of information from the above sources and officials on how samples should, and should not, be taken.

We observed EPA, BIA, IHS, and NTUA sampling technicians take 84 samples for radionuclide, inorganic, and bacterial evaluations. We noted 221 instances where the sampling techniques used did not agree with the sampling criteria we compiled. Our observations are in the table on page 29.

OBSERVED DEVIATIONS FROM

GAO LIST OF SAMPLING PROCEDURES

Samples taken by NTUA, IHS, BIA, and EPA

Improper technique	Potential problem	Number of occurrences
Samples taken from leaking and dirty taps.	Potential source of contamination that may not be representative of the system.	3
Samples taken without removing potentially contaminated attachments, such as screens and aerators.	Same as above.	7
Samples taken from taps with swing spouts.	Same as above.	32
Water not run at least 3 to 5 minutes to clear service line before taking sample.	Water sample may not be representative of the system.	42
Temperature reading not taken.	Stable temperature should be reached to insure water is representative of the system.	42
Sample transferred from one container to another.	Potential source of contamination that is not representative of the system.	1
Sample taken from unsanitary location.	Same as above.	2
Turned off water while taking sample.	Same as above.	1

OBSERVED DEVIATIONS FROM

GAO LIST OF SAMPLING PROCEDURES

Samples taken by NTUA, IHS, BIA, and EPA

Improper technique	Potential problem	Number of occurrences
Allowed water to overflow container.	Dilutes or washes preservative out of the container.	2
Expanded cubitainer by blowing into it. (note a).	Potential source of non-water system contamination.	26
Preservative not used for radionuclide samples.	Contaminants may attach to container walls and not be recovered by laboratories during analysis.	6
Bacteria samples not chilled effectively for shipment to laboratory (note b).	Contaminants might change in concentrations.	50
Bacteria samples mailed to laboratory without ice.	Same as above.	7
Total		221

a/A collapsible sample container.

b/Samples chilled to 4 degrees centigrade (39 degrees fahrenheit).

Some of the technicians we observed taking samples told us they had considerable experience and background in field sampling techniques, others said they had little experience. Most of the technicians told us they had received little, if any, training in field sampling procedures. Also, the technicians' supervisors told us they did not realize the procedures used were not in accordance with recommended practices.

Some EPA sampling technicians, and IHS and NTUA officials did not agree that some of the procedures we identified were poor practices. For example, some water system and EPA officials do not believe that any harm can result from expanding collapsed "cubitainers" by blowing into them. The EPA sampling film and USGS officials, however, recommend against this practice. A USGS official told us that a person's breath could introduce contaminants into the container, particularly if the person smokes.

Similarly, although most guidance recommends chilling bacteria samples to approximately 4 degrees centigrade during shipment to laboratories, some laboratories accept unchilled samples for analysis. The proponents of chilling to 4 degrees centigrade argue, however, the bacteria count in a sample may change by the time the sample reaches the laboratory, unless the sample is chilled to stabilize the bacteria count.

As can be seen, confusion exists and field sampling procedures used on the reservation are not consistent. We believe greater consistency in field sampling procedures can be achieved by using standardized sampling procedures and training field sampling technicians to use these procedures.

Transportation difficulties

Transporting reservation water samples to laboratories for analysis is not always easy. The requirements for transporting samples vary depending on the type of analysis to be performed. For example, EPA allows several days for inorganic and radionuclide samples to reach the laboratories. These samples also should be preserved with acid. EPA requirements for bacteria and organic samples, however, are more stringent--they must reach the laboratory within 30 and 24 hours, respectively, and must be chilled to 4 degrees centigrade. The organic samples also need to be protected against breakage because they are put in glass containers.

Taking and transporting samples collected on the Navajo Reservation to laboratories is difficult because of the geographic conditions of the reservation. Many water systems are located a day's drive or more from the nearest laboratory.

Unpaved roads and periodic inclement weather conditions make matters worse. (See photos on next page). In addition, no laboratories certified for organic analyses are located on or near the reservation. As result, it is not uncommon for samples to reach the laboratories late. The laboratories have rejected some samples because they were too old.

Our sampling of reservation water systems for potential radionuclide contamination in July 1979 and for other potential contaminants in October and November 1979, provided examples of the difficulties in sampling on the reservation and the resources needed to take the samples.

In our July 1979 sampling we used helicopters and a 10-person team to support our sampling efforts. Helicopters were the only means of transportation available which permitted us to sample 29 wells at 17 locations twice within a 1-week time frame. According to tribal officials, one sampling location alone would have taken a full day's travel time by ground.

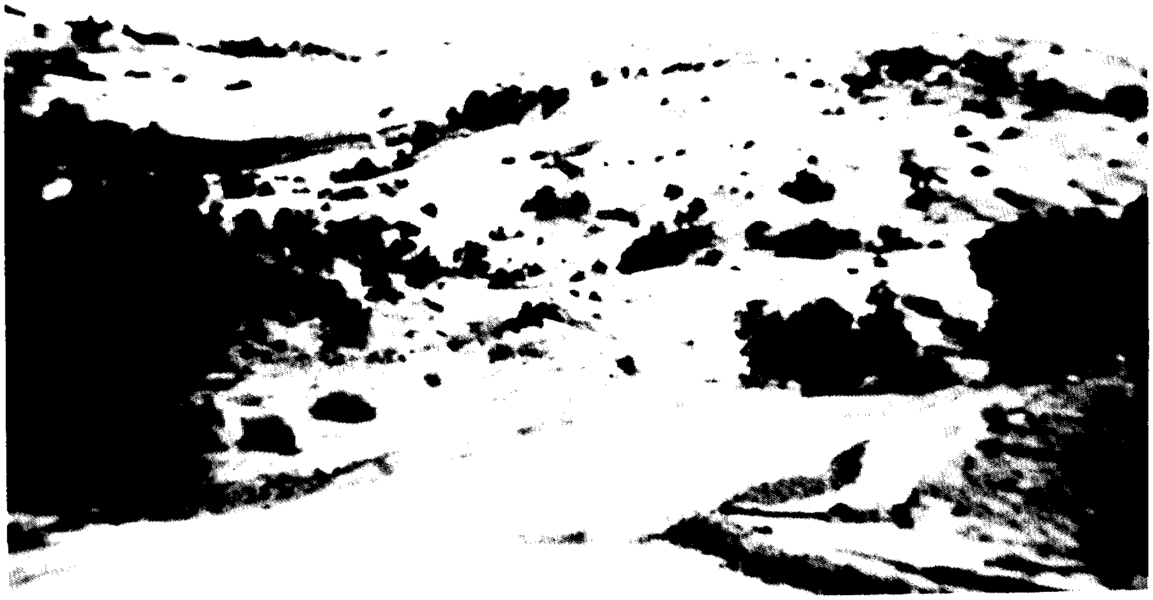
To sample four water sources for organics, in October and November 1979, we needed two teams of three people each to take the samples, not including water supplier personnel at each sampling site, and one person to handle shipping in order to get the samples to the laboratories within 24 hours. This effort also necessitated using insulated shipping containers, hundreds of miles of driving, an overnight trip to Albuquerque, New Mexico, and air shipment of samples to the laboratories.

VARIANCES IN LABORATORY PERFORMANCE

Laboratory analyses of water samples provide the information needed to determine water quality, but a variety of factors can affect individual analyses. Although individual laboratories and EPA carry out a variety of quality control activities to insure quality and consistent analyses, variances in laboratory analyses, both between laboratories and within an individual laboratory, do occur. We found a wide range of laboratory variances for analyses of water samples we took on the Navajo Reservation.

OBSTACLES TO WATER SAMPLING

MUDDY ROAD BETWEEN CHILCHINBITO AND ROUGH ROCK, ARIZONA



MUDDY ROUGH ROAD TO NAVAJO MOUNTAIN, UTAH.

INCLEMENT WEATHER CONDITIONS AT A TSAILE, ARIZONA, SPRING.

Major factors influencing laboratory performance

The major factors influencing laboratory performance include

--sample-taking procedures,

--handling in transit,

--analyst competency,

--analytical methodology,

--analytical equipment, and

--effectiveness of quality control programs.

Sample taking and transportation, discussed earlier in this chapter, are usually beyond the direct control of the laboratory, but the remaining four factors are under the direct control of the laboratory.

Proficiency of technicians

The proficiency of the technician performing the analysis is probably the biggest source of variability within the laboratory. Technicians analyzing identical samples, using the same equipment and prescribed methodology, frequently have different findings. Technician-related variables, such as professional training, proficiency with procedures and equipment, and care in performing the analysis can influence the accuracy of the results. For example, the concentration level of a given contaminant would probably be incorrect if the technician improperly diluted the sample.

Methodology

EPA has approved more than one method for many types of analyses. Even though these methods should yield similar results, they sometimes do not because of different laboratory procedures. One laboratory official said in radionuclide analysis, for example, the gross alpha counts can change over time (increase or decrease) depending upon the characteristic of the radionuclides in the water sample, yet, the time frames for performing the analytical processes are not specified.

Equipment

Differences in equipment can also affect analytical results. For example, automated equipment tends to provide more consistent results than manually operated equipment.

Quality control

EPA and laboratory officials told us that internal laboratory quality control can significantly affect the quality of data generated by a laboratory. The appropriate use of certified calibration standards, control samples, duplicates, spiked samples, etc., helps to insure the accuracy and precision of analytical results. Without quality control, a laboratory would not know if it were having a problem and would have no way of assessing the accuracy and reliability of the results of its analyses. Also, quality control records are essential if the analytical data is to be used as a basis for enforcement purposes, where the basis for actions need to be demonstrated.

All of the laboratories we visited had quality control programs in place and all of the laboratory personnel contacted fully recognized the importance of quality control programs.

Certification and performance evaluation programs

EPA has established a laboratory certification program to insure that laboratories analyzing drinking water samples consistently produce valid data needed to evaluate compliance with requirements of SDWA and NIPDWR. EPA also has a performance evaluation program to periodically evaluate the ability of laboratories to analyze samples.

Certification program

Analytical results are only considered valid for compliance with SDWA, if the laboratory has been certified by either EPA or a State having primacy. The EPA regions examine laboratory facilities, equipment, and methodology, and certify EPA, State, EPA contract and other laboratories involved with SDWA. The primacy States generally certify commercial laboratories in their States.

The laboratories serving the reservation were certified by either the States or EPA. At least one of the laboratories, LFE, Corporation, was certified by both EPA and the State of California.

The certifications cover specific types of analyses. We determined that each laboratory was appropriately certified to perform the analyses required on water samples from the reservation.

Performance evaluation program

Two major laboratories within EPA's Office of Monitoring and Technical Support manage the performance evaluation program. The Environmental Monitoring and Support Laboratory (EMSL-CI) in Cincinnati, Ohio, is responsible for the organic, inorganic, and bacteria performance evaluation programs. The Environmental Monitoring and Support Laboratory (EMSL-LV) in Las Vegas, Nevada, conducts the performance evaluation program for radiochemistry laboratories.

The performance evaluation programs are conducted by periodically sending samples with known amounts of contaminants to the participating laboratories for analysis. The results of the analyses are reported to EPA, summarized and compared to the known values, and a report is sent to the EPA regions and participating laboratories. The EPA regions are expected to work with the laboratories to correct performance weaknesses.

The laboratories we visited, that participated in the EMSL-CI program, achieved according to EPA reports an acceptable rate of 92 percent, compared to the overall EMSL-CI program average of 88 percent for all participating laboratories. The radiochemical laboratories had an acceptable rate of 88 percent, compared to the overall EMSL-LV program average of 82 percent. A summary of how well the laboratories performed against the EPA test samples, during the period mid-1978 to late 1979, is shown in table 1.

TABLE 1

ANALYSIS OF EPA PERFORMANCE

EVALUATION SAMPLES

	EMSL-CI program			EMSL-LV program
	Inorganic	Organic	Combined	Radiochemistry
Labs reviewed (note a)	7	6	7	5
Acceptable analyses				
Number	345	169	514	141
Percent	91	94	92	88
Unacceptable analyses				
Number	34	10	44	19
Percent	9	6	8	12
Total analyses				
Number	379	179	558	160
Percent	100	100	100	100

a/We reviewed 12 laboratories, some of which participated in more than one quality assurance program.

For two reasons, the percentage of acceptable analyses in table 1 does not accurately indicate a laboratory's "real world" analytical competency. First, performance evaluation samples are readily identifiable as such by the participating laboratory. This is particularly true with performance evaluation samples for organic and inorganic chemical analyses, which are packaged in glass ampules in concentrated form and need to be diluted by the laboratory to resemble a water sample before being analyzed. Therefore, the laboratories can give the performance evaluation samples special treatment. Officials of several laboratories said they have their best technicians assigned to analyze these samples and may analyze the samples more than once to double check the results. As a result, the program only measures a laboratory's optimum performance capability, not its normal routine capability.

Second, EPA and laboratory officials stated that performance evaluation samples are not as difficult to analyze as actual samples. A few synthetic parameters in distilled water is not typical of a normal drinking water sample, because the normal interferences from other elements are not present and the sample complexity is greatly reduced. Therefore, less expertise is required to properly analyze the synthetic samples and the real world analytical capability of the laboratories is not being effectively evaluated.

Laboratory performance on our samples

To assist us in evaluating laboratories capability to analyze drinking water samples, we submitted 333 drinking water samples we took on the Navajo Reservation to nine laboratories for analysis. Considering the performance of these laboratories on the EPA performance evaluation samples, the variability of results on our samples was much greater than we expected. Different laboratories analyzing the same basic sample frequently obtained significantly different results. Also, the magnitude of the variances between and within laboratories, where duplicate samples were analyzed, was occasionally large.

Table 2 on page 40 shows an inter-laboratory comparison of variances for radiological and inorganic contaminants from the analyses of our samples. Each sample taken was sent to three different laboratories for analysis. As the table shows for the contaminants, only 27 percent of the radiological and 18 percent of the inorganic analyses were within 10 percent of the average of all analyses. Deviations from the average value were greater than 50 percent for 24 and 41 percent of the samples, respectively.

TABLE 2

INTER-LABORATORY COMPARISON

OF VARIANCES FOR SELECTED RADIOLOGICAL

AND INORGANIC CONTAMINANTS

Samples analyzed		Number of analyses by range of deviation from mean			
Parameter	Number of analyses	<11 percent	11-25 percent	26-50 percent	>50 percent
Radiological					
Alpha	219	35	53	59	72
Total uranium	166	50	47	53	16
Radium 226	157	61	19	35	42
Total	542	146	119	147	130
Percent	100	27	22	27	24
Inorganic					
Arsenic	34	5	6	7	16
Barium	29	2	6	5	16
Fluoride	37	14	15	8	0
Nitrate	31	2	2	5	22
Total	131	23	29	25	54
Percent	100	18	22	19	41

The intra-laboratory performance was better on the same selected contaminants than the inter-laboratory performance, but variances still occurred. Duplicate samples were sent to the same laboratory for analysis to assess intra-laboratory performance. Table 3 shows the results of the intra-laboratory comparison for selected contaminants. It shows that 50 percent of the radiological and 61 percent of the inorganic analyses were within 10 percent of the average of all analyses. The deviations greater than 50 percent were 7 and 5 percent, respectively, which is significantly less than the inter-laboratory comparison.

TABLE 3

INTRA-LABORATORY COMPARISON

OF VARIANCES FOR SELECTED RADIOLOGICAL

AND INORGANIC CONTAMINANTS

Samples analyzed		Number of analyses by range of deviation from mean			
Parameter	Number of analyses	< 11 percent	11-25 percent	26-50 percent	> 50 percent
Radiological					
Alpha	156	49	65	24	18
Total uranium	108	84	22	2	0
Radium 226	106	54	20	24	8
Total	370	187	107	50	26
Percent	100	50	29	13	7
Inorganic					
Arsenic	10	4	4	2	0
Barium	10	6	0	2	2
Fluoride	10	6	2	2	0
Nitrate	6	6	0	0	0
Total	36	22	6	6	2
Percent	100	61	17	17	5

We also conducted our own proficiency assessment of the laboratories, using spiked and blank samples. The spikes, containing known concentrations of contaminants, were prepared by EPA and the California State Department of Health Services laboratory, which are experienced in preparing spiked samples. The spikes were sent to the laboratories for analysis in the same manner as the other samples. The blanks were prepared using sterile buffer solutions, distilled water, or plain tap water, depending upon the contaminant.

A summary of selected organic and inorganic contaminants from our performance evaluation is in table 4. The table shows that laboratory analyses frequently yield wide variances and inaccuracies even on spiked and blank samples. The variance for the selected contaminants exceeded the known value by 50 percent, 42 percent of the time for inorganic and 36 percent of the time for organic analyses.

TABLE 4

PROFICIENCY ASSESSMENT

VARIANCES FROM KNOWN VALUES FOR SELECTED CONTAMINANTS

Samples analyzed		Number of analyses by range of deviation from known value			
Parameter	Number of analyses	<11 percent	11-25 percent	26-50 percent	>50 percent
Inorganic (note a)					
Arsenic	6	2	4	0	0
Barium	6	5	0	0	1
Fluoride	6	3	0	0	3
Lead	6	2	0	1	3
Nitrate	6	0	0	0	6
Selenium	6	_	3	1	2
Total	36	12	7	2	15
Percent	100	33	19	6	42
Organic (note b)					
Endrin	6	0	1	1	4
Lindane	6	1	2	2	1
Toxaphene	6	0	2	3	1
Methoxychlor	6	0	0	2	4
2,4-D	6	0	1	2	3
Silvex	6	3	1	2	0
Total	36	4	7	12	13
Percent	100	11	19	33	36

a/Spikes and blanks.

b/Spikes only.

The analytical performance by the laboratories on contaminants not shown in the tables also had variances. Of particular note were the following:

--A laboratory failed to find any contamination in a bacterial spike that was highly contaminated with coliform bacteria.

--The same laboratory did not find any coliform bacteria in a water system sample, even though two others detected substantial contamination.

--The pesticide DDT was detected by one laboratory in one of two samples it analyzed, but two other laboratories that analyzed four other samples from the same well found no DDT.

The rate of acceptable performance evaluation analyses for EPA proficiency samples, ranged from 88 percent for radiological laboratories to 92 percent for other laboratories. The EPA test samples sent to laboratories for analysis are readily identifiable and result in nonroutine analyses. Variances in the laboratory analyses of samples we took on the reservation, including spiked and blank samples, were large. The inter-laboratory results varied by more than 50 percent for over 40 percent of the inorganic and 36 percent of the organic samples.

EPA is aware of the importance of accurate laboratory analyses of drinking water samples and monitors laboratory performance as part of its laboratory certification and performace evaluation program. In its operating year guidance for fiscal year 1981, EPA emphasized the need for improved monitoring data and plans to aggressively develop and implement the mandatory quality assurance program. Specifically, EPA plans to (1) require adequate quality assurance practices for all environmental quality monitoring, sampling, and analytical activities by EPA laboratories or contract laboratories and (2) work closely with its regional offices to make State and local laboratories quality assurance practices uniform. These laboratories provide most of the environmental data available to EPA.

CONCLUSIONS

Improper field sampling procedures can lead to sampling results which are not representative of the water supplies being sampled. Field sampling procedures used on the Navajo Reservation have not been standardized and water supplier technicians often use procedures which could invalidate sample results. Reservation sampling technicians also have received little training in sampling procedures. Transportation problems on the Navajo Reservation further contribute to sampling difficulties.

Differences in individual laboratory technician proficiency, equipment, methodology, and quality control procedures can also influence sampling results. Although EPA conducts laboratory certification and performance evaluation programs to insure consistency in analyzing drinking water samples, variances continue to occur and consistency between and within laboratories is difficult to achieve.

Although we recognize that it is difficult to eliminate all variances in sample results, we believe EPA's continuing emphasis on quality assurance will reduce the variability in laboratory results, and improve laboratory performance.

RECOMMENDATIONS

We recommend that the Administrator, EPA, direct region IX water supply officials to:

--Develop and mandate the use of standardized reservation sampling procedures to insure that sampling technicians are achieving at least minimal levels of proficiency and consistency in their collection of drinking water samples. The procedures should be flexible enough to accommodate unique circumstances, such as the long transportation times peculiar to conducting water sampling on the Navajo Reservation.

--Establish minimum training standards for reservation water sampling technicians and support the standards with training programs and materials, such as the recently developed EPA film on water sampling and technical assistance.

VIEWS OF AGENCY OFFICIALS

EPA headquarters drinking water officials endorsed the need for additional guidance on field water sampling procedures and for additional training of sampling technicians. They stated, however, EPA does not have sufficient funds to do much on these matters and any training programs would probably need to be carried out in cooperation with IHS.

IHS headquarters environmental health officials agreed that additional guidance and training is needed. They also noted, however, that IHS is constrained by funding limitations.

CHAPTER 4

PROBLEMS EXIST WITH

SOME DRINKING WATER SUPPLIES

ON THE NAVAJO INDIAN RESERVATION

EPA's sampling efforts on the Navajo Reservation showed radionuclide levels in excess of the MCLs for some water systems and wells. Our limited sampling of wells also showed radionuclide levels in excess of the MCL. Our sampling also showed bacteria levels in excess of the MCL, but only a few instances of inorganic and no instances of organic contamination.

EPA has recommended certain remedial actions for those water systems or wells with radionuclide readings in excess of the MCL, including the closure of two wells. Water suppliers are pursuing actions that are consistent with EPA's recommendations.

WATER SYSTEMS CONTAMINATED WITH RADIOACTIVITY

NIPDWR established maximum contaminant levels for certain radionuclide contaminants, for example, gross alpha particle activity 1/ and radium (see app. VI). EPA sampling, began about mid-1978, showed levels of gross alpha particle activity that exceeded the 15-pCi/l MCL for some water systems and resulted in great concern among the Navajo people and Navajo tribal officials. For example, the following table shows EPA obtained radionuclide levels for selected reservation water supplies, compared to the established maximum level.

1/The total radioactivity due to alpha particle emission, excluding activity due to radon and uranium.

Location/ water supply	Gross alpha particle activity (note a)	Combined radium-226 and radium-228
(MCL)	(15 pCi/l)	(5 pCi/l)
Church Rock Elementary School	370	262
Martinez Camp	291	94
Round Rock Community Well	26.5	15
Many Farms BIA System	18.7	10.5

a/Includes radium but excludes uranium and radon.

EPA resampled the water systems and still found radionuclide levels above the MCLs. EPA does not consider a system in violation of the MCL until four quarterly samples have been collected and the average of these samples exceeds the MCL.

Our results

We sampled 32 water systems or wells on the reservation for radionuclide contamination and submitted the samples to three laboratories for analysis. The wells and water systems we sampled include some of those sampled by EPA. Other wells we sampled were located in the vicinity of the contaminated wells or near uranium mining activities.

Our sampling also showed radionuclide activity exceeding the MCL in six reservation water systems, for either gross alpha particle activity or combined radium 226 plus radium 228. Appendix VII provides detailed results of our radionuclide sampling. Although some laboratory readings we obtained did vary from readings reported by EPA for the same wells or water systems, our results and EPA's were generally consistent.

Actions taken on radionuclide violations

EPA and IHS have initiated or plan corrective action for those water systems with radionuclide readings exceeding maximum contaminant levels. For example, for the two reservation locations consistently exceeding the MCL by a significant amount--Church Rock Elementary School and Martinez Camp, both of which are located in the Grants Mineral Belt in northwestern New Mexico--IHS took corrective action. Two uncontaminated wells in the Church Rock area remain open and supply the water needs of the local residents.

At Martinez Camp, the contaminated well was the sole water source. IHS notified residents that the well was contaminated and should not be used for drinking or cooking but could be used for bathing, washing clothes, and watering livestock. IHS subsequently provided funding to drill a new well at Martinez Camp, and the well was being tested to insure that it would meet the drinking water standards. Pending completion of the new well, drinking water was being transported to the area from alternative sources, and upon completion of the new well, the contaminated well is to be shut down.

According to EPA officials, other wells with less severe radionuclide problems, such as those at Many Farms and Round Rock, Arizona, are not immediate health risks but are receiving attention through increased monitoring. For example, BIA studied the feasibility of removing radionuclides from one of the wells at Many Farms, Arizona, but decided to drill a new well instead.

NO WIDESPREAD PROBLEM FOR OTHER POTENTIAL CONTAMINANTS

Our sampling results identified some inorganic and bacteria contamination on the reservation. We sampled 29 locations with histories of contamination and found 11 with contaminants in excess of the MCLs. We found seven instances of bacteria contamination and four instances of inorganic contamination, but no organic contamination. Appendix VIII provides detailed results of our sampling efforts for organic, inorganic, and bacteria contamination.

Although, as discussed in chapter 2, we could not determine if corrective action is being taken in all cases, we did note that corrective action has been taken at a few locations where levels of contaminants were found to be a problem. For example, a $71,000 treatment system was installed at Rough Rock, Arizona, to remove arsenic, and a system was installed at Lake Valley, New Mexico, to remove excessive fluoride. Also, IHS plans to complete two new wells at Smith Lake, New Mexico, to join with two existing wells to reduce the excessive levels of arsenic so that the water supply is within the standard.

CONCLUSIONS

Some water system wells on the Navajo Reservation do have radionuclide and bacteria levels that exceed the MCL. For the problem systems identified, EPA and the water suppliers have taken or plan action on the water systems and wells with hazardous levels of contamination.

We believe the most significant instances of contamination were identified, because, the wells we sampled had histories of chemical and bacteria contamination and were located in areas of uranium mining.

Congress of the United States
House of Representatives
Washington, D.C. 20515

June 5, 1979

Mr. Elmer B. Staats
Comptroller General of
the United States
Washington, D.C. 20548

Dear Mr. Staats:

This is to request assistance from the General Accounting Office on an oversight project being initiated by the Committee on Interior and Insular Affairs and the Subcommittee on Health and the Environment concerning contamination of drinking water on certain Indian reservations in the west.

Recently, the Indian Health Service (IHS) working in conjunction with the Environmental Protection Agency (EPA) detected levels of radio nucleids in excess of the limits permitted under the National Interim Primary and Proposed Secondary Drinking Water Standards in a number of drinking water wells on certain Indian reservations. Understandably, the initial test results have caused great concern among the Navajo people.

To assist our Committees in carrying out their respective oversight responsibilities over Indian health matters and safe drinking water requirements and because this matter could potentially affect a large segment of this nation's Indian people, we would like to request that the GAO conduct the following review activities and report back to our Committees by July 31, 1979:

1. A review of the procedures used by the IHS and the EPA and the appropriate laboratories in carrying out the testing of drinking water samples on the Navajo and other reservations in the west.

2. Testing of certain key wells on such reservations for radio nucleids, bacteriological, and metallic contamination.

The staff of each of our Committes will be available to work with representatives of your office in determining which drinking water sources should be included in your review.

Sincerely,

HENRY WAXMAN
Chairman
Health and Environment
Subcommittee of
Interstate and Foreign
Commerce Committee

MORRIS K. UDALL
Chairman
Interior and Insular Affairs
Committee

HAROLD RUNNELS
Chairman
Oversight and Investigations
Subcommittee of
Interior and Insular Affairs
Committee

jh

NINETY-SIXTH CONGRESS

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ROOM 2415
RAYBURN HOUSE OFFICE BUILDING
PHONE (202) 225-[illegible]

Congress of the United States
House of Representatives
Subcommittee on Health and the Environment
of the
Committee on Interstate and Foreign Commerce
Washington, D.C. 20515

July 26, 1979

Honorable Elmer B. Staats
Comptroller General
of the United States
Washington, D. C. 20548

Dear Mr. Staats:

The Subcommittee on Health and the Environment is in the process of examining several issues pertaining to implementation of the Safe Drinking Water Act (P.L. 93-523). We would appreciate your cooperation and assistance in responding to the following questions:

1. What resources, both monetary and personnel, has the Environmental Protection Agency (EPA) allocated or planned to allocate for implementation of the Safe Drinking Water Act in States which have not assumed primacy?

2. How is the Safe Drinking Water Act implemented on Indian lands? Specifically, which entity has primary enforcement responsibility for public water systems on Indian lands?

3. What is the relationship between EPA and the Department of Interior in regard to assuring the provision of safe sources of drinking water on Indian lands? Is this relationship satisfactory? If not, why not?

4. Please detail problems which have recently come to light pertaining to the quality of sources of drinking water on Indian lands.

I would appreciate receiving the above information at your earliest convenience.

Sincerely,

Henry A. Waxman

HENRY A. WAXMAN
Chairman

LABORATORIES GAO USED FOR NAVAJO RESERVATION DRINKING WATER SAMPLE ANALYSES

Type of analysis	Laboratory	Number of samples analyzed: July 1979	Number of samples analyzed: Oct./Nov. 1979
Radionuclide	LFE, Inc., Environmental Analysis Laboratories Richmond, California	73	6
	California State Department of Health Services Sanitation and Radiation Laboratory Berkeley, California	73	6
	Department of Energy Los Alamos Scientific Laboratory Los Alamos, New Mexico	73	6
Organic	U.S. Geological Survey Denver Central Laboratory Denver, Colorado	-	8
	Arizona Department of Health Services Laboratory Phoenix, Arizona	-	8
	LFE, Inc., Environmental Analysis Laboratories Richmond, California	-	8
Inorganic (note a)	Navajo Tribal Utility Authority Laboratory Fort Defiance, Arizona	-	19

Type of analysis	Laboratory	Number of samples analyzed July 1979	Oct./Nov. 1979
	Bureau of Indian Affairs Soil, Water and Materials Testing Laboratory Gallup, New Mexico	-	19
	EPA Environmental Monitoring and Support Laboratory Cincinnati, Ohio	-	19
Bacteria	NTUA Laboratory Fort Defiance, Arizona	-	19
	BIA Soil, Water and Materials Testing Laboratory Gallup, New Mexico	-	19
	New Mexico Scientific Laboratory Branch Farmington, New Mexico	-	19

a/The inorganic samples were divided into three parts for analysis: one part was preserved with nitric acid, a second part was preserved with sulfuric acid, and the third part contained no preservative. Therefore, each inorganic sample analyzed by a laboratory resulted in 3 analyses.

LABORATORIES GAO VISITED

Laboratories Which Routinely Analyze Reservation Drinking Water Samples

BIA Soils, Water and Materials Testing Laboratory Gallup, New Mexico

NTUA Laboratory, Fort Defiance, Arizona

New Mexico Scientific Laboratory Branch, Farmington, New Mexico

Arizona Department of Health Services Laboratory, Flagstaff, Arizona

LFE, Inc., Environmental Analysis Laboratories, Richmond, California

EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio

Laboratories Near the Reservation Which May Analyze Drinking Water Samples

New Mexico Scientific Laboratory Division, Albuquerque, New Mexico

Eberline Laboratory, Albuquerque, New Mexico

Arizona Health Department of Health Services Laboratory, Phoenix, Arizona

Laboratories Which Analyzed Our Water Samples

U.S. Geological Survey, Denver Central Laboratory, Denver, Colorado

California State Department of Health Services, Sanitation and Radiation Laboratory, Berkeley, California

Department of Energy Los Alamos Scientific Laboratory, Los Alamos, New Mexico

REQUIRED SDWA SAMPLING FREQUENCIES

Potential contaminants	Surface water	Ground water
Inorganics		
Community	Yearly	Every 3 years
Noncommunity	Set by EPA	Set by EPA
Organics		
Community	a/ Yearly	Set by EPA
Noncommunity	None	None
Bacteriological		
Community	b/ Monthly	b/ Monthly
Noncommunity	c/ Quarterly	c/ Quarterly
Turbidity		
Community	Daily	None
Noncommunity	Daily	None
Radionuclides		
Community		
Natural (note d)	Every 4 years	Every 4 years
Man-made (note e)	Every 4 years	Set by EPA
Chlorine Substitution (Optional)		
Community	Daily	Daily
Noncommunity	None	None

a/Pesticide samples to be collected during period of year specified by EPA.

b/Suppliers must collect minimum required samples during each month based on population. Minimum is one per month for supplies serving 1,000 or less.

c/May be revised at discretion of EPA based on sanitary survey.

d/Natural Radionuclides: Gross Alpha Activity, Radium-226,

Radium-228.

e/Man-made Radionuclides: Gross Beta Activity, Tritium, Strontium.

NOTE: This applies only to systems using surface water and serving more than 100,000 people.

Source: The Safe Drinking Water Act: A Brief Summary; U.S. Environmental Protection Agency, Region IX, San Francisco, Calif.

MAXIMUM CONTAMINANT LEVELS

Inorganics

Contaminant	Level (mg/l)
Arsenic	0.05
Barium	1.00
Cadmium	0.010
Chromium	0.05
a/ Fluoride	

Temperature (F)	Level (mg/l)
53.7 and below	2.4
53.8-58.3	2.2
58.4-63.8	2.0
63.9-70.6	1.8
70.7-79.2	1.6
79.3-90.5	1.4

Lead	0.05
Mercury	0.002
b/ Nitrate	0.10
Selenium	0.01
Silver	0.05

Organics

Contaminant	Level (mg/l) (note c)
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
2,4-D	0.1
2,4,5-TP Silvex	0.01

Turbidity--The MCL for turbidity in drinking water is 1 turbidity unit as determined by a 1 per day monthly average for surface supplies. Five or fewer turbidity units may be allowed if the higher turbidity does not do any of the following:

a. Interfere with disinfection.

b. Prevent maintenance of an effective disinfectant agent throughout the distribution.

MAXIMUM CONTAMINANT LEVELS

c. Interfere with microbiological determinations.

Microbiological

Coliform method	Per month	Less than 20 samples/ month	More than 20 samples/ month
MFT 100 ml (note d) Standard portions	Not to exceed 1/100 ml as the arithmetic mean	4/100 ml in one sample	4/100 ml in 5 percent of samples
FTM 10 ml (note d) Standard portions	Not to be present in 10 percent of portions	3 portions in one sample	3 portions in 5 percent of samples
		Less than 5 samples/ month	More than 5 samples/ month
FTM 100 ml Standard portions	Not to be present in 60 percent of samples	5 portions to one sample	5 portions in 20 percent of samples.

Radionuclides

Contaminant	Picocuries/l
Gross Alpha Activity	15
Radium-226 + Radium-228	5
Gross Beta Activity	50
Tritium	20,000
Strontium-90	8

MAXIMUM CONTAMINANT LEVELS

a/The MCL for fluoride is related to the annual average of the maximum daily air temperature.

b/All the above MCLs, except nitrate, apply only to community water systems. The nitrate level applies to both community and noncommunity water systems.

c/Apply only to community water systems.

d/MFT - membrance filter technique.

e/FTM - fermentation tube method.

NOTE: The number of samples to be collected per month is dependent upon the service population.

Source: The Safe Drinking Water Act: A Brief Summary; U.S. Environmental Protection Agency, Region IX, San Francisco, California.

INTRODUCTION

Appendix VII consists of two parts, schedule 1 and 2, and respectively they present the analytical results from the laboratory evaluations of samples we took during July and again in October and November 1979 to evaluate various water supplies for radionuclide contamination. The data presented in the schedules is most directly related to the maximum contaminant levels contained in the regulations.

The Alpha less uranium data as computed by substracting the uranium results from the Gross Alpha figures, and the Total radium Ra-226 + Ra-228 numbers are the combination of the RA-226 and Ra-228 figures, except where the laboratory only reported a total radium number.

The water supplies with possible problems are those with readings in either the Alpha less uranium or radium columns that exceed the MCL shown at the top of the column.

RESULTS OF GAO RADIONUCLIDE SAMPLING

Schedule 1

RADIONUCLIDE SAMPLE RESULTS--
GAO DRINKING WATER SAMPLING CONDUCTED
ON THE NAVAJO INDIAN RESERVATION FROM JULY 9-13, 1979

Water supply location	GAO sample number	Lab note c	Lab results (notes a and b) Gross Alpha pCi/l	Uranium pCi/l	Alpha less uranium pCi/l	226Ra pCi/l	228Ra pCi/l	Total radium 226Ra + 228Ra pCi/l
d/ MCL			None	None	15	e/ 5	e/ 5	5
Sweetwater, AZ-Water and Sanitation, chapter house well	78	LFE	16	10	6	[0.3	[2	[2.3
	489	LFE	19	5	14	[0.3	[1	[1.3
	893	LFE	10	9	1	[0.3	[1	[1.3
	116	CAH	16	12.9	3.1	-	-	f/ 0.2
	630	CAH	17	-	-	-	-	-
	742	CAH	16	-	-	-	-	-
	253	LASL	19	16.2	2.8	0.1	-	0.1
	326	LASL	18	15.6	2.4	[0.1	-	[0.1
	814	LASL	14	16.9	g/ [0	[0.1	-	[0.1
Average			16.1	12.2	4.2	0.2	1.3	0.8
Sweetwater, AZ-Public Health Service, solar well	682	LFE	40	13	27	6.3	[1	[7.3
	696	CAH	30	17.6	12.4	-	-	f/ 2.9
	687	LASL	22	25	g/ [0	0.8	-	0.8
Average			30.7	18.5	13.1	3.6	h/ -	3.7
Monument Valley, AZ-Water and Sanitation well	128	LFE	[4	[4	-	[0.3	[1	[1.3
	901	LFE	[3	[4	g/ [0	[0.2	[1	[1.2
	85	CAH	2.4	-	-	-	-	-
	560	CAH	2.8	-	-	-	-	-
	497	LASL	1.5	5.2	g/ [0	[0.1	-	[0.1
	651	LASL	0.6	4.8	g/ [0	0.1	-	0.1
Average			2.4	4.5	g/ [0	0.2	1	0.7

APPENDIX VII

APPENDIX VII

Many Farms, AZ-BIA well #1	235	LFE	[5	[5	-	1.0	[2	[3
	334	LFE	[5	[4	1	0.7	[1	[1.7
	766	LFE	4	[4	-	0.8	[2	[2.8
	7	CAH	1.4	-	-	-	-	-
	468	CAH	3.2	-	-	-	-	-
	522	CAH	3.8	-	-	-	-	-
	366	LASL	4.2	3.9	0.3	1.0	-	1.0
	399	LASL	6	3.7	2.3	1.0	-	1.0
	846	LASL	3.1	3.6	g/ [0	0.4	-	0.4
Average			4.0	4.0	0.6	0.8	1.7	1.7
Many Farms, AZ-BIA well #2	53	LFE	[3	[4	g/ [0	0.5	[1	[1.5
	175	LFE	[3	[4	g/ [0	0.5	[2	[2.5
	470	LFE	[4	6	g/ [0	[0.3	[2	[2.3
	602	CAH	6.9	0.3	6.6	-	-	f/ 1.3
	753	CAH	2.1	-	-	-	-	-
	788	CAH	0	-	-	-	-	-
	173	LASL	3.6	3.0	0.6	0.2	-	0.2
	718	LASL	2.5	3.2	g/ [0	0.4	-	0.4
	938	LASL	1.6	3.2	g/ [0	0.1	-	0.1
Average			3.0	3.4	1.0	0.3	1.7	1.2

APPENDIX VII

Water supply location	GAO sample number	Lab note c	Lab results (notes a and b) Gross Alpha pCi/l	Uranium pCi/l	Alpha less uranium pCi/l	226Ra pCi/l	228Ra pCi/l	Total radium 226Ra + 228Ra pCi/l
d/ MCL			None	None	15	e/ 5	e/ 5	5
Many Farms, AZ-BIA well #3	221	LFE	11	8	3	26	[2	[28
	402	LFE	16	[4	12	30	[3	[33
	924	LFE	25	[4	21	25	3	28
	82	CAH	29	-	-	-	-	-
	118	CAH	26	-	-	-	-	-
	424	CAH	31	0.3	30.7	21	0.8	21.8
	36	LASL	19	3.7	15.3	10	17	27
	357	LASL	29	4.6	24.4	4	[8	[12
	969	LASL	28	4.1	23.9	15	-	15
Average			23.8	4.1	18.6	18.7	5.6	23.5
Many Farms, AZ-BIA well #4	26	LFE	5	[4	1	0.7	[2	[2.7
	429	LFE	5	5	0	0.6	[2	[2.6
	632	LFE	6	[4	2	[0.3	[2	[2.3
	205	CAH	11	-	-	-	-	-
	811	CAH	9.4	-	-	6.1	0.8	6.9
	933	CAH	13	1.4	11.6	6.7	0.6	7.3
	44	LASL	10	3.7	6.3	1.0	-	1.0
	231	LASL	12	4.9	7.1	[0.1	-	[0.1
	394	LASL	12	3.7	8.3	5	[8	[13
Average			9.3	3.8	5.2	2.6	2.6	4.5

APPENDIX VII

Many Farms, AZ-Elem. school well	86	LFE	11	[4	7	12	[2	[14
	439	LFE	14	[4	10	9.2	[2	[11.2
	453	LFE	14	[4	10	12	[2	[14
	260	CAH	17	-	-	-	-	-
	301	CAH	21	0.3	20.7	14.7	0.8	15.5
	633	CAH	23	-	-	-	-	-
	491	LASL	17	3.2	13.8	11	[12	[23
	495	LASL	14	3.0	11	4	-	4
	979	LASL	17	3.5	13.5	13	[14	[27
Average			16.4	3.1	12.3	10.8	5.5	15.5
Many Farms, AZ-NTUA well #1	594	LFE	[4	[4	-	[0.3	[3	[3.3
	937	LFE	[5	5	-	0.4	[1	[1.4
	125	CAH	2.1	-	-	-	-	-
	490	CAH	2.4	-	-	-	-	-
	345	LASL	8	3.7	4.3	0.2	-	0.2
	684	LASL	7	4.6	2.4	[0.1	-	[0.1
Average			4.8	4.3	1.7	0.3	2	1.3
Round Rock, AZ-Water and Sanitation, chapter house well	254	LFE	21	7	14	19	3	22
	353	LFE	40	[4	36	22	[3	[25
	740	LFE	47	[4	43	18	[1	[19
	626	CAH	30	-	-	-	-	-
	694	CAH	43	2.0	41	15.2	-	15.2
	922	CAH	32	-	-	-	-	-
	17	LASL	29	4.1	24.9	10	[6	16
	294	LASL	41	4.7	36.3	12	[10	22
	859	LASL	44	4.6	39.4	4	-	4
Average			36.3	4.3	33.5	14.3	3.8	17.6

APPENDIX VII

Water supply location	GAO sample number	Lab note c	Lab results (notes a and b) Gross Alpha pCi/l	Uranium pCi/l	Alpha less uranium pCi/l	226Ra pCi/l	228Ra pCi/l	Total radium 226Ra + 228Ra pCi/l
d/ MCL			None	None	15	e/ 5	e/ 5	5
Cove, AZ-Water and Sanitation well (12T-341)	223	LFE	24	24	-	[0.3	2	[2.3
	324	LFE	20	26	g/ [0	[0.3	[2	[2.3
	808	LFE	170	21	149	[0.3	[1	[1.3
	203	CAH	37	-	-	-	-	-
	649	CAH	49	-	-	-	-	-
	807	CAH	50	51.4	g/ [0	-	-	f/ 0.2
	544	LASL	32	50.1	g/ [0	[0.1	-	[0.1
	671	LASL	31	50.1	g/ [0	[0.1	-	[0.1
	730	LASL	35	48.1	g/ [0	[0.1	-	[0.1
Average			49.8	38.7	21.3	0.2	1.7	0.9
Red (Rock) Valley, AZ-Water and Sanitation, Chapter house well	147	LFE	10	7	3	[0.3	[2	[2.3
	204	LFE	8	9	g/ [0	[0.3	[2	[2.3
	744	LFE	9	10	g/ [0	[0.2	[1	[1.2
	403	CAH	14	-	-	-	-	-
	639	CAH	23	12.2	10.8	-	-	f/ 0.1
	768	CAH	10	-	-	-	-	-
	374	LASL	17	16.9	0.1	[0.1	-	[0.1
	627	LASL	19	16.9	2.1	[0.1	-	[0.1
	711	LASL	32	17.6	14.4	[0.1	-	[0.1
Average			15.8	12.8	4.3	0.2	1.7	0.9
Sanostee, NM-Water and Sanitation well (12T-512)	202	LFE	6	6	-	[0.3	[2	[2.3
	997	LFE	4	8	g/ [0	[0.3	[1	[1.3
	425	CAH	12	-	-	-	-	-
	906	CAH	15	8.8	6.2	-	-	f/ 0.1
	34	LASL	12	13.5	g/ [0	[0.1	-	[0.1
	779	LASL	8	13.0	g/ [0	0.2	-	0.2
Average			9.5	9.9	1.2	0.2	1.5	0.8

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Two Gray Hills, NM-Water and Sanitation, chapter house well	9	LFE	3	[4	g/ [0	[0.3	[1	[1.3
	42	LFE	[5	[4	1	[0.3	[2	[2.3
	913	LFE	[3	[4	g/ [0	[0.3	[1	[1.3
	667	CAH	0.9	-	-	-	-	-
	849	CAH	1.2	-	-	-	-	-
	874	CAH	3.4	-	-	-	-	-
	295	LASL	4	3.7	0.3	0.4	-	0.4
	371	LASL	5	3.2	1.8	0.3	-	0.3
	790	LASL	3.7	3.5	0.2	0.2	-	0.2
Average			3.2	3.7	0.6	0.3	1.3	1.0
Tohatchi, NM-El Paso Natural Gas, pumping station well #3	816	LFE	[4	6	g/ [0	[0.3	[2	[2.3
	902	CAH	0.4	-	-	-	-	-
	617	LASL	3	2.6	0.4	[0.1	-	[0.1
Average			2.5	4.3	0.2	0.2	h/ -	1.2
Tohatchi, NM-El Paso Natural Gas, pumping station well #5	272	LFE	[4	[4	-	[0.3	[2	[2.3
	534	CAH	2.1	-	-	-	-	-
	565	LASL	1.0	3.2	g/ [0	[0.1	-	[0.1
Average			2.4	3.6	g/ [0	0.2	h/ -	1.2
White Rock, NM-Water and Sanitation, chapter house well	71	LFE	[5	[4	1	0.3	[2	[2.3
	140	LFE	[4	5.4	g/ [0	0.4	[1	[1.4
	787	LFE	[4	[4	-	[0.3	[2	[2.3
	100	CAH	2.1	-	-	-	-	-
	183	CAH	4.3	-	-	-	-	-
	283	CAH	4.2	-	-	-	-	-
	557	LASL	-2	3.3	g/ [0	0.4	-	0.4
	724	LASL	6	2.8	3.2	0.2	-	0.2
	948	LASL	16	3.2	12.8	0.2	[3	[3.2
Average			4.8	3.8	2.8	0.3	2	1.6

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Water supply location	GAO sample number	Lab note c	Lab results (notes a and b) Gross Alpha pCi/l	Uranium pCi/l	Alpha less uranium pCi/l	226Ra pCi/l	228Ra pCi/l	Total radium 226Ra + 228Ra pCi/l
d/ MCL			None	None	15	e/ 5	e/ 5	5
Tseya, NM-La Vida Mission well	378	LFE	[3	[4	g/ [0	[0.3	[3	[3.3
	59	CAH	0.7	-	-	-	-	-
	214	LASL	-	3.6	g/ [0	0.1	-	0.1
Average			1.2	3.8	g/ -	0.2	h/ -	1.7
Crownpoint, NM-NTUA well #1	256	LFE	[3	[4	g/ [0	0.5	[2	[2.5
	623	LFE	[3	[4	g/ [0	0.7	[2	[2.7
	888	LFE	[3	[4	g/ [0	[0.3	[2	[2.3
	157	CAH	0.8	-	-	-	-	-
	354	CAH	0.1	-	-	-	-	-
	480	CAH	0.6	-	-	-	-	-
	11	LASL	1.2	3.1	g/ [0	[0.1	-	[0.1
	228	LASL	1.0	3.5	g/ [0	0.1	-	0.1
	293	LASL	-0.4	2.6	g/ [0	0.2	-	0.2
Average			1.4	3.5	g/ [0	0.3	2	1.3
Crownpoint, NM-NTUA well #2	80	LFE	[3	[4	g/ [0	[0.3	[1	[1.3
	529	LFE	[4	[4	0	0.5	[2	[2.5
	727	LFE	[3	[4	g/ [0	[0.3	[1	[1.3
	457	CAH	0.6	-	-	-	-	-
	927	CAH	0.8	-	-	-	-	-
	945	CAH	-	-	-	-	-	-
	179	LASL	0.8	2.8	g/ [0	[0.1	-	[0.1
	691	LASL	1.5	2.9	g/ [0	[0.1	-	[0.1
	877	LASL	1.4	3.4	g/ [0	0.2	-	0.2
Average			1.7	3.5	g/ [0	0.3	1.3	0.9

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Crownpoint, NM-BIA well #6	271	LFE	[3	[4	g/ [0	[0.4	[1	[1.4
	284	LFE	[2	[4	g/ [0	[0.4	[2	[2.4
	751	LFE	[3	[4	g/ [0	0.4	[1	[1.4
	40	CAH	1.0	-	-	-	-	-
	778	CAH	0.1	-	-	-	-	-
	850	CAH	-	-	-	-	-	-
	35	LASL	1.4	3.4	g/ [0	0.1	-	0.1
	144	LASL	1.1	4.1	g/ [0	[0.1	-	[0.1
	537	LASL	2.5	3.1	g/ [0	2.0	[16	[18
Average			1.6	3.8	g/ [0	0.6	5	3.9
Smith Lake, NM-Water and Sanitation, chapter house well	267	LFE	13	6	7	0.4	[1	[1.4
	618	LFE	15	5	10	[0.3	[2	[2.3
	668	LFE	14	6	8	[0.4	[2	[2.4
	97	CAH	43	-	-	-	-	-
	189	CAH	55	12.2	42.8	-	-	f/ 0.6
	551	CAH	42	-	-	-	-	-
	245	LASL	19	13.1	5.9	0.3	-	0.3
	255	LASL	18	11.6	6.4	[0.1	-	[0.1
	982	LASL	27	14.2	12.8	[0.1	-	[0.1
Average			27.3	9.7	13.3	0.3	1.7	1.0
Smith Lake, NM-Water and Sanitation well (16T-593)	316	LFE	12	7	5	[0.3	[1	[1.3
	904	LFE	9	9	0	[0.3	[1	[1.3
	493	CAH	34	13.5	20.5	-	-	f/ 0.1
	864	CAH	29	-	-	-	-	-
	852	LASL	13	19	g/ [0	[0.1	-	[0.1
	865	LASL	32	18.3	13.7	[0.1	-	[0.1
Average			21.5	13.4	7.8	0.2	1	0.6

APPENDIX VII

Water supply location	GAO sample number	Lab note c	Lab results (notes a and b) Gross Alpha pCi/l	Uranium pCi/l	Alpha less uranium pCi/l	226Ra pCi/l	228Ra pCi/l	Total radium 226Ra + 228Ra pCi/l
d/ MCL			None	None	15	e/ 5	e/ 5	5
Martinez Camp, NM-private well	517	LFE	120	[4	116	86	[2	[88
	918	LFE	310	6	304	81	[1	[82
	995	LFE	115	9	106	87	2	89
	5	CAH	125	3.4	121.6	102	0.2	102.2
	469	CAH	175	4.7	170.3	97	1.4	98.4
	624	CAH	122	2.0	120	83	0.9	83.9
	471	LASL	530	8.9	521.1	83	[18	[101
	503	LASL	410	6.6	403.4	67	[14	[81
	912	LASL	300	9.1	290.9	65	[6	[71
Average			245.2	6.0	239.3	83.4	5.1	88.5
Mariano Lake, NM-BIA well #1	12	LFE	13	[4	9	[0.3	[1	[1.3
	596	LFE	7	[4	3	[0.2	[2	[2.2
	197	CAH	18	4.7	13.3	-	-	h/ 0.6
	315	CAH	14	-	-	-	-	-
	309	LASL	15	8.1	6.9	0.1	-	0.1
	554	LASL	10	7.3	2.7	[0.1	-	[0.1
Average			12.8	5.6	7.0	0.2	1.5	0.9
Mariano Lake, NM-Water and Sanitation, chapter house well	476	LFE	13	13	0	[0.2	[2	[2.2
	699	LFE	11	11	0	[0.3	[2	[2.3
	426	CAH	35	8.1	26.9	-	-	h/ 0.2
	719	CAH	19	-	-	-	-	-
	654	LASL	25	17.6	7.4	[0.1	-	[0.1
	831	LASL	20	19	1	[0.1	-	[0.1
Average			20.5	13.7	7.1	0.2	2	1.0

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Church Rock, NM-NTUA, Elementary School Well	14	LFE	300	[4	296	33	8	41
	435	LFE	190	[4	186	34	5	39
	676	LFE	122	[4	118	37	5	42
	74	CAH	189	0.3	188.7	88	6.2	94.2
	88	CAH	94	-	-	-	-	-
	844	CAH	104	0.3	103.7	92	6.2	98.2
	451	LASL	420	2.7	417.3	105	[16	[121
	748	LASL	430	3.2	426.8	71	9	80
	991	LASL	390	3.4	386.6	72	[10	82
Average			248.8	2.7	265.4	66.5	8.2	74.7
Church Rock, NM-NTUA, North Pump #1	29	LFE	[4	[4	-	[0.3	[1	[1.3
	165	LFE	[4	[4	-	0.4	[2	[2.4
	556	LFE	[4	[4	-	[0.3	[2	[2.3
	145	CAH	5.2	0.7	4.5	0.3	-	0.3
	311	CAH	3.4	-	-	-	-	-
	466	CAH	0.7	-	-	-	-	-
	459	LASL	-	3.7	f/ [0	1.0	-	1.0
	910	LASL	7	4.0	3	0.1	-	0.1
	996	LASL	-	3.4	f/ [0	0.1	-	0.1
Average			3.1	3.4	0.5	0.4	1.7	1.1
Church Rock, NM-NTUA, South Pump #2	574	LFE	[5	[4	1	4.9	[2	[6.9
	582	LFE	[4	[4	-	4.2	[2	[6.2
	728	LFE	[5	[4	1	4.0	[2	[6.0
	379	CAH	1.1	-	-	-	-	-
	806	CAH	4.6	-	-	-	-	-
	957	CAH	0.3	-	-	-	-	-
	27	LASL	2	2.6	f/ [0	[0.1	-	[0.1
	837	LASL	-	2.8	f/ [0.	[0.1	-	[0.1
	914	LASL	6	2.8	3.2	0.1	-	[0.1
Average			3.1	3.4	0.9	2.2	2	3.2

APPENDIX VII

a/The "less than" symbol (<) is shown in our schedule as [and indicates the number is the lowest detection limit for the condition of the sample analyzed.

b/A dash (-) indicates the lack of data. Either no information was reported or it could not be computed.

c/The laboratories analyzing the Radionuclide water samples were as follows:

LFE - LFE Corporation, Environmental Analysis Laboratories, Richmond, California.

CAH - California Department of Health Services, Sanitation and Radiation Laboratory, Berkeley, California.

LASL - Los Alamos Scientific Laboratory, Los Alamos, New Mexico.

d/MCL is maximum contaminant level.

e/No MCL's have been established for either 226Ra or 228Ra as separate contaminants. However, since the MCL for 226Ra and 228Ra combined is 5 pCi/l, the individual MCL's for 226Ra and 228Ra would necessarily be limited to 5 pCi/l.

f/Total radium results were used since laboratory did not do 226Ra and 228Ra analyses.

g/Due to the possibility of the natural separation of uranium isotopes, the alpha measurements could not be accurate.

h/An average was not computed since there was only one data point.

APPENDIX VII

Schedule 2

RADIONUCLIDE DRINKING WATER SAMPLE RESULTS--
GAO DRINKING WATER SAMPLING CONDUCTED ON
THE NAVAJO INDIAN RESERVATION DURING OCTOBER AND NOVEMBER 1979

Water supply location	GAO sample number	Lab note c	Lab results (notes a and b) Gross Alpha pCi/l	Uranium pCi/l	Alpha less uranium pCi/l	226Ra pCi/l	228Ra pCi/l	Total radium 226Ra + 228Ra pCi/l
d/ MCL			None	None	15	e/ 5	e/ 5	5
Lake Valley, NM-Water and	1601	LFE	5.0	[2.0	3.0	[0.3	[2.0	[2.3
Sanitation, chapter house	1693	CAH	13.9	[1.4	12.5	-	-	f/ 0.5
well	1709	LASL	13.0	0.4	12.6	0.11	-	0.11
Average .			10.6	1.3	9.4	0.2	g/ -	1.0
Lupton, AZ-Water and	86	LFE	17.0	8.0	9.0	[0.3	[2.0	[2.3
Sanitation, Begay well	175	CAH	24.1	8.1	16.0	-	-	f/ 0.3
(first sample) (note h)	453	LASL	20.0	12.2	7.8	0.04	-	0.04
Average			20.4	9.4	10.9	0.17	g/ -	0.88
Lupton, Az-Water and	53	LFE	6.0	10.0	i/ [0	[0.3	3.0	[3.3
Sanitation, Begay well	938	CAH	20.5	8.8	11.7	-	-	f/ 0.8
(second sample) (note h)	718	LASL	23.0	11.5	11.5	0.09	-	0.09
Average			16.5	10.1	7.7	0.195	g/ -	1.40

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Thoreau, NM-Water and Sanitation, chapter house well	1754	LFE	17.0	6.0	11.0	5.7	[2.0	[7.7
	1758	CAH	26.4	1.6	24.8	5.0	-	6.4
	1340	LASL	13.0	3.4	9.6	3.3	-	3.3
Average			18.8	3.7	15.1	4.7	g/ -	5.8
Blank-tap water (note j)	1253	LFE	15.0	[2.0	13.0	4.0	4.0	8.0
	1905	CAH	12.2	3.4	8.8	2.2	-	4.8
	1210	LASL	13.0	3.4	9.6	1.1	-	1.1
Average			13.4	2.9	10.5	2.4	g/ -	4.6
Spike (note k)	1189	LFE	161.0	7.0	154.0	5.0	[2.0	[7.0
	1834	CAH	270.0	9.5	260.5	15.7	-	76.3
	1102	LASL	120.0	12.9	107.1	5.8	-	5.8
Average			183.7	9.8	173.9	8.8	g/ -	29.7
Known values			144.0	14.0	130.0	11.1	12.0	23.1
Known value as adjusted by average blank values (note l)			157.4	16.9	140.5	13.5	12.0	25.5

APPENDIX VII

a/The "less than" symbol (<), shown in our schedule as [, is the lowest detection limit for the condition of the sample analyzed.

b/A dash (-) indicates the lack of data; either no information was reported or it could not be computed.

c/The laboratories analyzing the Radionuclide water samples were as follows:

LFE - LFE Corporation, Environmental Analysis Laboratories, Richmond, California.

CAH - California Department of Health Services, Sanitation and Radiation Laboratory, Berkeley, California.

LASL - Los Alamos Scientific Laboratory, Los Alamos, New Mexico.

d/MCL is maximum contaminant level.

e/No MCL's have been established for either 226Ra or 228Ra as separate contaminants. However, since the MCL for 226Ra and 228RA combined is 5 pCi/l, the individual MCL's for 226Ra and 228RA would necessarily be limited to 5 pCi/l.

f/Total radium results used since laboratory did not do 226Ra and 228Ra analyses.

g/An average was not computed since there was only one data point.

h/At Lupton, Arizona, a sample was collected, and then the well was pumped dry. A second sample was collected after the well recharged with water.

i/Due to the possibility of the natural separation of uranium isotopes, the alpha measurements could be accurate.

j/The blank sample was tap water from the EPA Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, and contained contaminants normally present in this water supply.

k/The spike sample was prepared by the EPA Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, with tap water and known amounts of contaminants.

l/The average contaminant levels in the blank tap water have been added to the known contaminant levels to give the estimated total.

APPENDIX VII

I N T R O D U C T I O N

Appendix VIII consists of three parts, schedules 1, 2, and 3. Respectively, they present the analytical results from the laboratory evaluations of samples we took during October and November 1979. The samples were taken to evaluate various water supplies with histories of contamination problems from inorganic chemicals, organic chemicals, or bacteria, respectively. The data that have been tabulated cover the substances with maximum contaminant levels specified in the drinking water regulations. In the schedules for organic and bacterial contamination, data have been included for a few substances that have no specified MCL's.

The water supplies with possible problems are those with readings in excess of the MCL shown at the top of the column in which the data is presented.

RESULTS OF GAO ORGANIC, INORGANIC, AND BACTERIA SAMPLING

Schedule 1

INORGANIC DRINKING WATER SAMPLE RESULTS--
GAO DRINKING WATER SAMPLING CONDUCTED ON
THE NAVAJO INDIAN RESERVATION DURING OCTOBER AND NOVEMBER 1979

Water supply location	GAO sample number note b	Lab note c	Lab results (note a) for substances with maximum contaminant levels									
			Arsenic (mg/l)	Barium (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/l)	Chromium (mg/l)	Fluoride (mg/l)	Mercury (mg/l)	Silver (mg/l)	Nitrate (mg/l)
MCL			0.05	1.00	0.01	0.05	0.01	0.05	d/1.4 to 2.4	0.002	0.05	10.00
Cornfields, AZ- Public Health Service well	1846 1144 1772	BIA) BIA) BIA)	0.003	1.652	Trace	0.07	Trace	Trace	0.72	[0.002	Trace	0.14
	1449 1342 1763	CIN) CIN) CIN)	[0.005	1.46	[0.002	0.069	0.005	[0.005	0.4	[0.0005	[0.03	0.3
	1206 1652 1602	NTUA) NTUA) NTUA)	0.016	1.05	[0.001	0.0086	[0.001	[0.001	0.48	[0.002	[0.001	1.4
Average			0.008	1.387	0.001	0.049	0.002	0.002	0.53	0.0015	0.010	0.61
Kayenta, AZ- NTUA System at the NTUA Shop	1239 1030 1999	BIA) BIA) BIA)	0.001	Trace	Trace	Trace	Trace	Trace	0.19	[0.002	Trace	0.48
	1152 1973 1360	CIN) CIN) CIN)	[0.005	[0.2	[0.002	[0.005	[0.005	[0.005	0.2	[0.0005	[0.03	[0.3
	1408 1266 1023	NTUA) NTUA) NTUA)	[0.01	0.013	[0.001	[0.001	[0.001	0.002	0.13	[0.002	[0.001	2.2
Average			0.005	0.071	0.001	0.002	0.002	0.002	0.17	0.0015	0.010	0.99

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Lake Valley, NM-Water and Sanitation, chapter house well	1427 1616 1878	BIA) BIA) BIA)	Trace	Trace	Trace	Trace	Trace	Trace	11.50	[0.002	Trace	Trace
	1780 1963 1123	CIN) CIN) CIN)	[0.005	[0.2	[0.002	0.013	[0.005	[0.005	6.5	[0.0005	[0.03	0.3
	1865 1725 1347	NTUA) NTUA) NTUA)	0.014	0.17	0.0029	[0.001	[0.001	[0.001	10.7	[0.002	[0.001	1.7
Average			0.006	0.123	0.002	0.005	0.002	0.002	9.57	0.0015	0.010	0.67
Many Farms, AZ-NTUA, well #1	1514 1258 1678	BIA) BIA) BIA)	Trace	Trace	Trace	Trace	Trace	Trace	1.05	[0.002	Trace	Trace
	1809 1986 1688	CIN) CIN) CIN)	[0.005	[0.2	[0.002	0.005	[0.005	0.012	.9	[0.0005	[0.03	[0.3
	1314 1717 1231	NTUA) NTUA) NTUA)	0.019	0.24	[0.001	[0.001	[0.001	[0.001	1.0	[0.002	[0.001	2.0
Average			0.008	0.147	0.001	0.002	0.002	0.004	0.98	0.0015	0.010	0.77

APPENDIX VIII

Water supply location	GAO sample number note b	Lab note c	Lab results (note a) for substances with maximum contaminant levels									
			Arsenic (mg/l)	Barium (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/l)	Chromium (mg/l)	Fluoride (mg/l)	Mercury (mg/l)	Silver (mg/l)	Nitrate (mg/l)
MCL			0.05	1.00	0.01	0.05	0.01	0.05	d/1.4 to 2.4	0.002	0.05	10.00
Oljatoh, UT-	1977	BIA)										
Water and	1443	BIA)	0.001	Trace	Trace	Trace	0.019	Trace	0.98	[0.002	Trace	0.74
Sanitation	1505	BIA)										
well												
	1290	CIN)										
	1899	CIN)	[0.005	[0.2	[0.002	0.006	0.012	[0.005	0.9	[0.0005	[0.03	[0.3
	1273	CIN)										
	1967	NTUA)										
	1470	NTUA)	0.006	0.089	[0.001	[0.001	[0.001	[0.001	1.0	[0.002	[0.001	3.6
	1162	NTUA)										
Average			0.004	0.096	0.001	0.002	0.011	0.002	0.96	0.0015	0.010	1.55
Rough Rock, AZ-	1735	BIA)										
BIA Day School	1515	BIA)	0.05	Trace	Trace	Trace	Trace	Trace	1.84	[0.002	Trace	0.26
well #2	1989	BIA)										
	1450	BIA)										
	1642	BIA)	No laboratory response									
	1461	BIA)										
	1660	CIN)										
	1175	CIN)	0.056	[0.2	[0.002	0.005	[0.005	0.010	1.50	[0.0005	[0.03	[0.3
	1956	CIN)										
	1059	CIN)										
	1458	CIN)	0.052	[0.2	[0.002	0.010	[0.005	0.010	1.6	[0.0005	[0.03	[0.3
	1551	CIN)										
	1070	NTUA)										
	1354	NTUA)	0.046	0.12	0.0018	[0.001	[0.001	0.0225	1.8	[0.002	[0.001	2.8
	1391	NTUA)										
	1431	NTUA)										
	1591	NTUA)	0.037	0.35	[0.001	[0.001	[0.001	0.021	2.1	[0.002	[0.001	3.2
	1968	NTUA)										
Average			0.048	0.174	0.001	0.003	0.002	0.013	1.77	0.0014	0.012	1.37

APPENDIX VIII

Shiprock, NM-NTUA treatment plant	1525 1628 1481	BIA) BIA) BIA)	Trace	Trace	Trace	Trace	Trace	Trace	0.48	[0.002	Trace	Trace
	1088 1835 1108	CIN) CIN) CIN)	[0.005	[0.2	[0.002	[0.005	[0.005	[0.005	0.3	[0.0005	[0.03	e/450.0
	1191 1770 1115	NTUA) NTUA) NTUA)	0.020	0.15	f/ --	[0.001	[0.001	[0.001	0.29	[0.002	[0.001	1.2
Average			0.008	0.117	0.001	0.002	0.002	0.002	0.36	0.0015	0.010	g/0.60
Shonto, AZ-Public Health Service well	1217 1925 1648	BIA) BIA) BIA)	Trace	Trace	Trace	Trace	Trace	Trace	Trace	[0.002	Trace	1.04
	1841 1742 1498	CIN) CIN) CIN)	[0.005	[0.2	[0.002	[0.005	[0.005	[0.005	[0.1	[0.0005	[0.03	[0.3
	1455 1009 1645	NTUA) NTUA) NTUA)	[0.01	[0.018	[0.001	[0.001	[0.001	[0.001	[0.1	[0.002	[0.001	4.2
Average			0.005	0.073	0.001	0.002	0.002	0.002	0.07	0.0015	0.010	1.85
Smith Lake, NM-Water and Sanitation, chapter house well	1595 1057 1560	BIA) BIA) BIA)	0.001	0.005	Trace	Trace	Trace	Trace	0.5	[0.002	Trace	0.07
	1862 1100 1988	CIN) CIN) CIN)	[0.005	[0.2	[0.002	[0.005	[0.005	[0.005	0.4	[0.0005	[0.03	[0.3
	1200 1363 1502	NTUA) NTUA) NTUA)	0.02	0.13	0.0038	[0.001	[0.001	[0.001	0.36	[0.002	[0.001	1.3
Average			0.009	0.112	0.002	0.002	0.002	0.002	0.42	0.0015	0.010	0.56

APPENDIX VIII

Water supply location	GAO sample number note b	Lab note c	Arsenic (mg/l)	Barium (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Selenium (mg/l)	Chromium (mg/l)	Fluoride (mg/l)	Mercury (mg/l)	Silver (mg/l)	Nitrate (mg/l)
			Lab results (note a) for substances with maximum contaminant levels									
MCL			0.05	1.00	0.01	0.05	0.01	0.05	d/1.4 to 2.4	0.002	0.05	10.00
Toyei, AZ-	1341	BIA)										
BIA System	1477	BIA)	0.004	0.898	Trace	Trace	Trace	Trace	0.92	[0.002	Trace	h/0.17
at dormitory	1715	BIA)										e/508.98
	1979	CIN)										
	1444	CIN)	0.005	0.84	[0.002	[0.005	[0.005	[0.005	0.8	[0.0005	[0.03	e/430.0
	1460	CIN)										
	1148	NTUA)										
	1453	NTUA)	0.016	0.049	[0.001	[0.001	[0.001	[0.001	1.0	[0.002	[0.001	e/720.0
	1062	NTUA)										
Average			0.008	0.596	0.001	0.002	0.002	0.002	0.91	0.0015	0.010	h/0.17
Tuba City, AZ-	1208	BIA)										
NTUA well #1	1489	BIA)	0.001	Trace	Trace	Trace	Trace	Trace	0.23	[0.002	Trace	1.54
	1667	BIA)										
	1635	BIA)										
	1572	BIA)	0.003	Trace	Trace	Trace	Trace	Trace	0.23	[0.002	Trace	h/1.15
	1467	BIA)										d/505.76
	1689	CIN)										
	1116	CIN)	[0.005	[0.2	[0.002	[0.005	[0.005	[0.005	0.2	[0.0005	[0.03	[0.3
	1737	CIN)										
	1013	CIN)										
	1690	CIN)	[0.005	[0.2	[0.002	[0.005	[0.005	[0.005	[0.1	[0.0005	[0.03	e/340.0
	1976	CIN)										
	1196	NTUA)										
	1764	NTUA)	0.014	0.13	[0.001	[0.001	[0.001	[0.001	0.15	[0.002	[0.001	e/720.0
	1159	NTUA)										
	1632	NTUA)										
	1058	NTUA)	0.010	0.014	[0.001	[0.001	[0.001	0.006	0.19	[0.002	[0.001	e/640.0
	1392	NTUA)										
Average			0.006	0.091	0.001	0.002	0.002	0.003	0.18	0.0015	0.010	g/1.00

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Spike #1	1588	BIA)										
	1705	BIA)	0.024	0.204	Trace	Trace	0.008	Trace	Trace	[0.002	Trace	Trace h/0.28
	1236	BIA)										
	1549	CIN)										
	1334	CIN)	0.019	0.21	[0.002	0.023	0.005	[0.005	[0.1	0.0005	[0.03	0.3
	1756	CIN)										
	1269	NTUA)										
	1864	NTUA)	0.025	0.20	0.006	0.0066	[0.001	0.017	[0.1	[0.002	[0.001	25.0
	1491	NTUA)										
Average			0.023	0.205	0.003	0.010	0.005	0.007	0.07	0.0015	0.010	8.53
Known values			0.022	0.20	0.0025	0.024	0.006	0.010	-	0.001	-	10.0
Spike #2	1118	BIA)										
	1425	BIA)	0.057	1.132	0.01	0.04	0.015	0.04	1.10	[0.002	Trace	1.66
	1209	BIA)										
	1924	CIN)										
	1402	CIN)	0.043	1.02	0.008	0.056	0.0095	0.04	0.4	0.0013	[0.03	0.3
	1694	CIN)										
	1749	NTUA)										
	1490	NTUA)	0.066	0.54	0.0085	0.016	[0.001	0.067	1.02	[0.002	[0.001	2.4
	1855	NTUA)										
Average			0.055	0.897	0.009	0.037	0.008	0.049	0.84	0.0018	0.010	1.45
Known values			0.056	1.10	0.012	0.060	0.012	0.060	1.0	0.0025	-	10.0

APPENDIX VIII

a/The "less than" symbol (<), shown in our schedule as [, indicates the lowest measurement possible for the conditions of the sample analysis.

b/Each sample set consists of three samples. The first sample listed was preserved with Nitric Acid (HNO_3), the second sample listed had no preservative, and the third sample was preserved with Sulfuric Acid (H_2SO_4). Each sample was assigned a sample number. One sample set was collected at all locations except Rough Rock, Arizona, and Tuba City, Arizona, where two sample sets were collected.

c/The laboratories used are as follows:

BIA - The Bureau of Indian Affairs Soil, Water and Materials Testing Laboratory, Gallup, New Mexico

CIN - The Environmental Protection Agency's Environmental Monitoring and Support Laboratory, Cincinnati, Ohio

NTUA - The Navajo Tribal Utility Authority Laboratory, Fort Defiance, Arizona

d/The maximum contaminant level for fluoride varies with temperature from 1.4 mg/l at 79.3 F and above to 2.4 mg/l at 53.7 F and below.

e/The high nitrate readings are apparently due to a mixup in the preservatives used during the sample collection process.

f/No data reported by laboratory.

g/The unrealistically high nitrate readings are not included in determining the average, because the evidence indicates they are the result of a preservation error.

h/BIA ran nitrate analysis on plain sample because unrealistic nitrate values were obtained from some H_2SO_4 samples.

APPENDIX VIII

APPENDIX VIII

Schedule 2

ORGANIC DRINKING WATER SAMPLE RESULTS--
GAO DRINKING WATER SAMPLING CONDUCTED ON
THE NAVAJO INDIAN RESERVATION DURING OCTOBER AND NOVEMBER 1979

Water supply location	GAO sample number	Lab note c	Lab results (note a) for selected substances and those with maximum contaminant levels: Pesticides (note b)					Herbicides (note b)			
			p,p DDT (ug/l)	Toxaphene (ug/l)	Methoxychlor (ug/l)	Endrin (ug/l)	Lindane (ug/l)	2,4-D (ug/l)	2,4,5-TP Silvex (ug/l)	2,4,5-T (ug/l)	2,4-DP (ug/l)
MCL			None	5.0	100.0	0.2	4.0	100.0	10.0	None	None
Chinle, AZ-Water . and Sanitation well (10T-501)	1048	AZH	-	-	-	-	-	-	-	-	-
	1464	AZH	-	-	-	-	-	-	-	-	-
	1345	LFE	[0.1	[0.1	[0.1	[0.01	0.03	[0.05	[0.01	-	-
	1462	LFE	0.16	[0.1	[0.1	[0.01	[0.01	[0.05	[0.01	-	-
	1024	USGS	-	-	-	-	-	-	-	-	-
	1164	USGS	-	-	-	-	-	0.26	0.03	-	-
Chinle, AZ-Water and Sanitation, Valley store well	1596	AZH	-	-	-	-	-	-	-	-	-
	1011	LFE	[0.1	[0.1	[0.1	[0.01	[0.01	[0.05	[0.01	-	-
	1054	USGS	-	-	-	-	-	-	-	-	-
Montezuma Creek, UT-Utah Power and Light Company well	1482	AZH	-	-	-	-	-	-	-	-	-
	1581	AZH	-	-	-	-	-	-	-	-	-
	1390	LFE	[0.1	[0.1	[0.1	[0.01	[0.01	[0.05	[0.01	-	-
	1825	LFE	[0.1	[0.1	[0.1	[0.01	[0.01	[0.05	[0.01	-	-
	1736	USGS	-	-	-	-	-	-	-	-	-
	1859	USGS	-	-	-	-	-	-	-	-	-

Shiprock, NM-NTUA water treatment plant	1554	AZH	-	-	-	-	-	-	-	-	-
	1138	LFE	[0.1	[0.1	[0.1	[0.01	[0.01	[0.05	[0.01	-	-
	1586	USGS	-	-	-	-	-	-	-	-	-
Spike #1	1745	AZH	-	2.03	72.5	0.18	3.52	198.83	13.44	-	-
	1331	LFE	[0.1	4.7	76.0	[0.01	6.4	48.0	11.0	-	-
	1316	USGS	-	4.0	27.0	0.11	3.7	62.0	7.6	.01	3.7
Known values			-	6.29	106.0	0.26	4.40	115.0	11.0	-	-
Spike #2	1783	AZH	-	3.52	3.01	0.05	0.04	3.09	0.73	-	-
	1599	LFE	[0.1	3.5	7.2	[0.01	0.08	1.1	0.44	-	-
	1861	USGS	-	4.0	0.77	0.11	0.03	1.8	0.78	-	-
Known values			-	5.24	0.276	0.061	0.043	2.336	0.799	-	-

a/The "less than" symbol (<), shown in our schedule as [, is used by LFE in lieu of zero.

b/The dash (-) indicates the lack of findings of these substances by the laboratories.

c/The laboratories analyzing the organic samples were as follows:

AZH - Arizona Department of Health Services Laboratory, Phoenix, Arizona

LFE - LFE Corporation, Environmental Analysis Laboratories, Richmond, California

USGS - U. S. Geological Survey, Denver Central Laboratory, Denver, Colorado

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APPENDIX VIII

Schedule 3

BACTERIOLOGICAL DRINKING WATER SAMPLE RESULTS--
GAO DRINKING WATER SAMPLING CONDUCTED ON
THE NAVAJO INDIAN RESERVATION DURING OCTOBER AND NOVEMBER 1979

Water supply location	GAO sample number	Lab note c	Lab results (notes a and b) Coliform (per 100 ml)	Background bacteria (per 100 ml)
MCL			Average of 1 d/ per month	None
Tsaile, AZ-Water and Sanitation, storage tank	1389	NTUA	82	TNTC
	1154	BIA	<1	181
	1923	FAR	9	e/ -
Tsaile, AZ-Watering point	1254	NTUA	18	OG
	1165	BIA	<1	TNTC
	1343	FAR	-	e/ -
Lukachukai, AZ-Chapter house watering point	1315	NTUA	69	OG
	1662	BIA	CG	CG
	1129	FAR	18	e/ -
Lake Valley, NM-Pre-school	1561	NTUA	3	45
	1486	BIA	TNTC	TNTC
	1220	FAR	-	e/ -
Three Mile Point, NM-NTUA Well	1657	NTUA	-	7
	1808	BIA	<1	<1
	1020	FAR	-	e/ -
Pueblo Pintado, NM-BIA System at a residence	1292	NTUA	TNTC	OG
	1415	BIA	<1	9
	1281	FAR	-	e/ -

Crownpoint, NM-BIA system at the boarding school	1335	NTUA	TNTC	OG
	1521	BIA	[1	[1
	1814	FAR	-	e/ -
Navajo Mountain, UT-BIA system at the day school	1518	NTUA	-	TNTC
	1237	NTUA	-	TNTC
	1383	BIA	[1	[1
	1480	BIA	[1	[1
	1414	FAR	-	e/ -
	1622	FAR	-	e/ -
Navajo Mountain, UT-Beaver Springs watering point	1137	NTUA	42	TNTC
	1150	BIA	57	TNTC
	1898	FAR	-	e/ -
Chilchinbito, AZ-Watering point	1130	NTUA	-	-
	1927	BIA	[1	[1
	1250	FAR	-	e/ -
Oljatoh, UT-Water and sanitation well	1839	NTUA	-	-
	1513	BIA	[1	[1
	1181	FAR	-	e/ -

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Water supply location	GAO sample number	Lab note c	Lab results (notes a and b) Coliform (per 100 ml)	Background bacteria (per 100 ml)
MCL			Average of 1 d/ per month	None
Rough Rock, AZ-BIA system at the facilities management office	687	NTUA	-	-
	1545	BIA	[1	[1
	1110	FAR	-	e/ -
Kayenta, AZ-NTUA System at the NTUA District Office Shop	1037	NTUA	-	1
	1939	BIA	[1	[1
	1849	FAR	-	e/ -
Shonto, AZ-Watering point	1170	NTUA	-	-
	1079	BIA	[1	TNTC
	1641	FAR	-	e/ -
Spike-Coliform	1411	NTUA	OG	e/ -
	1520	NTUA	OG	e/ -
	1311	BIA	CG	e/ -
	1692	BIA	12	TNTC
	1376	FAR	-	e/ -
	1636	FAR	-	e/ -
Blank-Sterile buffer solution	495	NTUA	-	e/0
	1365	NTUA	OG	e/ -
	682	BIA	[1	[1
	1948	BIA	2	[1
	979	FAR	-	e/ -
	1367	FAR	-	e/ -

(089132)

a/The "less than" symbol (<), shown in our schedule as [, was used by the laboratory in lieu of zero.

b/The labs used the following acronyms to describe highly contaminated bacteriological samples:

CG - confluent growth;

OG - overgrowth;

TNTC - too numerous to count.

c/The laboratories analyzing the bacteriological water samples were as follows:

NTUA - Navajo Tribal Utility Authority Laboratory, Fort Defiance, Arizona

BIA - The Bureau of Indian Affairs Soil, Water and Materials Testing Laboratory, Gallup, New Mexico

FAR - New Mexico Scientific Laboratory Division, Farmington Branch, Farmington, New Mexico

d/The screening limit on a single sample is 4 coliform bacteria, and if that is exceeded, at least two consecutive daily check samples must be taken that show less than one coliform bacterium per sample.

e/Background bacteria not reported by the lab.

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