RECORD OF DECISION

EPA
REGION 6

UNITED NUCLEAR CORPORATION
McKINLEY COUNTY, NEW MEXICO

REMEDIAL ALTERNATIVE SELECTION

STATEMENT OF PURPOSE

This decision document presents the remedial action for the Groundwater Operable Unit of the United Nuclear Corporation (UNC) site selected by the United States Environmental Protection Agency (EPA) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Contingency Plan (NCP).

STATEMENT OF BASIS

The decision is based upon the administrative record for the United Nuclear Corporation Superfund Site. The attached index (Appendix E) identifies the items which comprise the administrative record upon which the selection of this remedial action is based.

Remedial action for the Groundwater Operable Unit is part of a comprehensive response action for the United Nuclear Corporation Superfund Site. Remedial activities addressing source control and onsite surface reclamation will be implemented by United Nuclear Corporation under the direction of the U.S. Nuclear Regulatory Commission (NRC), pursuant to the facility's NRC license, and integrated with the Environmental Protection Agency's selected remedy for the groundwater operable unit. Agency responsibilities for remedial action at the United Nuclear Corporation site are delineated in a Memorandum of Understanding (MOU) signed by the EPA and NRC in August 1988. (Appendix I)

The Nuclear Regulatory Commission and the State of New Mexico have reviewed the proposed plan for remedial action, as identified in the remedial investigation/feasibility study (RI/FS), and proposed Plan of Action Fact Sheet, and support the remedy described in this Record of Decision. (Appendices F, G)

DESCRIPTION OF SELECTED REMEDY

The Operable Unit for the United Nuclear Corporation site addresses high levels of radiological and nonradiological constituents that have seeped from tailings into groundwater outside the tailings disposal site. The hazardous substances of primary concern are arsenic, cadmium, cobalt, nickel, radium-226/228, selenium, and gross alpha. The tailings seepage has contaminated portions of the shallow alluvial groundwater system and underlying Upper Gallup Sandstones.

The selected remedy for this operable unit is designed to contain, remove, and evaporate contaminated groundwater resulting from tailings seepage outside the tailings disposal area thus preventing further migration of seepage into the environment. The remedy is comprised of the following six elements.

1. Implementation of a monitoring program to detect any increases in the areal extent, or concentration of groundwater contamination at, and outside of, the boundary of the tailings disposal area.

Evaluation of geochemical and hydrological information indicates that a tailings seepage mound exists in the tailings disposal area resulting in migration of contaminated groundwater into the alluvium, as well as underlying Zone 1 and Zone 3 Upper Gallup sandstones. Tailings seepage has migrated outside the tailings disposal area in each of these three aquifers, and there is the potential for further downgradient migration. For these reasons, a monitoring program will be established prior to the installation of extraction wells in each aquifer.

The monitoring program will consist of a groundwater monitoring network comprised of a series of wells to measure water levels and water quality. The monitoring points shall be located upgradient, downgradient, and cross-gradient of seepage plumes in order to further define the extent of contamination in Zones 1 and 3 of the Upper Gallup Sandstone, and the southwest alluvium. The extent of contamination in each aquifer, and concentration of contaminants in each well, shall be used to identify the most effective pumping well locations.

2. Operation of existing seepage extraction systems in the Upper Gallup aquifers.

Because seepage from tailings has migrated into underlying Zone 1 and Zone 3 sandstones, the selected remedy includes operation of the East pump-back wells in Zone 1 and the Northeast pump-back wells in Zone 3 until adequate dissipation of the tailings seepage mound has been achieved. Operation of these two pump-back systems will be integrated with active seepage remediation that may be required by the NRC inside the tailings disposal area, and with active seepage collection as required by EPA outside the disposal area.

3. Containment and removal of contaminated groundwater in Zone 3 of the Upper Gallup Sandstone utilizing existing and additional wells.

Active remediation of Zone 3 outside the tailings disposal site will be performed in areas contaminated by tailings seepage. The full extent of the tailings seepage plume will be determined during remedial design, prior to extraction well installation, and will be delineated on the basis of groundwater flow directions in the aquifer in conjunction with identification of the margin or amount by which standards are exceeded for hazardous constituents in groundwater.

Seepage collection in Zone 3 will be designed to create a hydraulic barrier to further migration of contamination. Final well locations will be guided by observed saturated thicknesses in Zone 3, and the extent of the tailings seepage plume as defined above. Data obtained during performance monitoring of the extraction system should be used to determine the optimum rate of pumping, and extent and duration of pumping actually required.

4. Containment and removal of contaminated groundwater in the southwest alluvium utilizing existing and additional wells.

Active remediation in the southwest alluvium will be performed in areas contaminated by tailings seepage. The extent of the tailings seepage plume outside the tailings disposal area will be determined prior to extraction well installation. Delineation of alluvial contamination will be based on groundwater flow directions in the aquifer in conjunction with identification of the margin or amount by which standards are exceeded for hazardous constituents in groundwater.

Seepage collection in the southwest alluvium will be designed to create a hydraulic barrier to further migration of contamination while the source is being remediated. The number of extraction wells required, and their final locations, will be determined from the observed saturated thicknesses in the alluvium, and the extent of the tailings seepage plume as defined above, during the remedial design phase. Data obtained during performance monitoring of the extraction system should be used to determine the optimum rate of pumping, and extent and duration of pumping actually required.

5. Evaporation of groundwater removed from aquifers outside the disposal area using evaporation ponds supplemented with mist or spray systems to enhance the rate of evaporation.

Tailings seepage extracted in pumping wells will be directed to an evaporation disposal system consisting of lined evaporation ponds and mist or spray evaporation systems. Inflow to the evaporation disposal system will be from current and required extraction wells outside and/or within the tailings disposal area. The evaporation pond system, coupled with mist and spray evaporation systems, will be sized and operated in order to provide sufficient evaporative capacity for maintenance of a reasonable operational water balance. Optimization of the evaporation disposal system should occur during the first several months of operation.

6. Implementation of a performance monitoring and evaluation program to determine water level and contaminant reductions in each aquifer, and the extent and duration of pumping actually required outside the tailings disposal area.

In order to evaluate predicted reductions in contaminant concentrations with time in a particular aquifer, and declines in pumping rates, a performance monitoring program shall be implemented. Performance monitoring during active seepage remediation will allow a determination to be made regarding the adequacy of groundwater remedial actions outside the tailings disposal area at the United Nuclear Corporation site.

These elements comprise remedial action in the groundwater operable unit at the United Nuclear Churchrock site. The Nuclear Regulatory Commission has directed United Nuclear Corporation to submit a reclamation plan addressing source control and surface reclamation measures at the site under the Company's Source Material License. Upon approval of a final reclamation plan, both groundwater and source control/surface reclamation remedial actions will be integrated and coordinated to achieve comprehensive reclamation and remediation of the site.

DECLARATIONS

Pursuant to CERCLA, as amended by SARA, and the NCP, I have determined that the selected remedy for the Groundwater Operable Unit at the United Nuclear Corporation site, is consistent with achieving a permanent remedy, and will provide adequate protection of public health and the environment. This remedy attains all location-specific and action-specific requirements that are applicable or relevant and appropriate (ARARs), and is cost effective. EPA believes that the selected remedy will attain chemical-specific requirements within a reasonable time period. Because of the physical characteristics of the aquifers at the site, performance monitoring will be required, as indicated above herein. If performance monitoring indicates that these ARARs are not being timely attained, then an alternate concentration limit may be considered at the boundary of the tailings disposal area in order to meet chemical-specific requirements.

The remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. Because this action will occur in concert with reclamation of source areas, required by the U.S. Nuclear Regulatory Commission, this remedy does satisfy the statutory preference for treatment as a principle element.

Because this remedy will result in hazardous substances remaining outside the tailings disposal area on a short-term basis above health-based levels, reviews of the remedial action will be conducted no less often than each five years after the initiation of the remedial action to assure that human health and the environment are being protected by the remedial action being implemented.

September 30, 1988
Date

Robert E. Layton
Robert E. Layton Jr., P.E.
Regional Administrator

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION
UNITED NUCLEAR CORPORATION
GROUNDWATER OPERABLE UNIT
McKINLEY COUNTY, NEW MEXICO

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1. SITE LOCATION AND DESCRIPTION

The United Nuclear Corporation (UNC) Churchrock site is located approximately 17 miles northeast of Gallup, New Mexico, in McKinley County (Figure 1). United Nuclear Corporation, also referred to herein as the potentially responsible party (PRP), operated the site as a uranium mill facility within UNC-owned Section 2, Township 16 North, Range 16 West (Figure 2). The site includes an ore processing mill and a tailings pond area which cover about 25 and 100 acres, respectively. The tailings pond area is subdivided by cross-dikes into three cells identified as the South cell, Central cell, and North cell. In addition, two soil borrow pits (Pits No. 1 and No. 2) are present in the Central Cell area. Borrow Pit No. 2 is currently used for storage of recovered and neutralized water extracted by three well systems operated by UNC. These pumpback wells are currently used to remove contaminated groundwater from Zones 1 and 3 of the Upper Gallup Sandstone.

The area around the site is sparsely populated and includes Indian tribal and allotted trust land as well as UNC-owned property. Section 36, Township 17 North, Range 16 West, located northeast of the site, is owned by UNC and bounded on the north by the Navajo Indian Reservation. The nearest residence is located approximately 1.5 miles northwest of the site. The nearest groundwater well is located 1.7 miles northeast of the perimeter of the site. Four known operating wells are located within a four mile radius of the site.

2. SITE STATUS

2.1 Site History

The UNC uranium mill was granted a radioactive materials license by the State of New Mexico in May 1977 and operated from June 1977 to May 1982. The mill, designed to process 4,000 tons of ore per day, used a conventional crushing, grinding, and acid leach solvent extraction method to extract uranium. The ore processed at the site primarily came from two of UNC's nearby mines: Northeast Churchrock and Old Churchrock. Ore was also obtained from the nearby Kerr-McGee (Quivira) mine. The average ore grade processed at the mill was approximately 0.12 percent U_3O_8 (EPA, 1988). The crushing, grinding, and milling processes produced an acidic waste of ground ore and fluid, commonly referred to as tailings. The tailings were pumped to the tailings disposal area. An estimated 3.5 million tons of tailings were disposed in the ponds (EPA, 1988).

Prior to licensing of the UNC mill, uranium mining began in the area north of the present site. In 1968, the northeast Churchrock mine began operating and removed and discharged mine water. Water discharged from this mine, and later the Quivira mine, percolated into the ground and added water to the alluvial and Upper Gallup aquifers underlying much of the site. Limited monitoring of groundwater during the period of mining, and prior to operation of the mill, indicated water quality was variable.

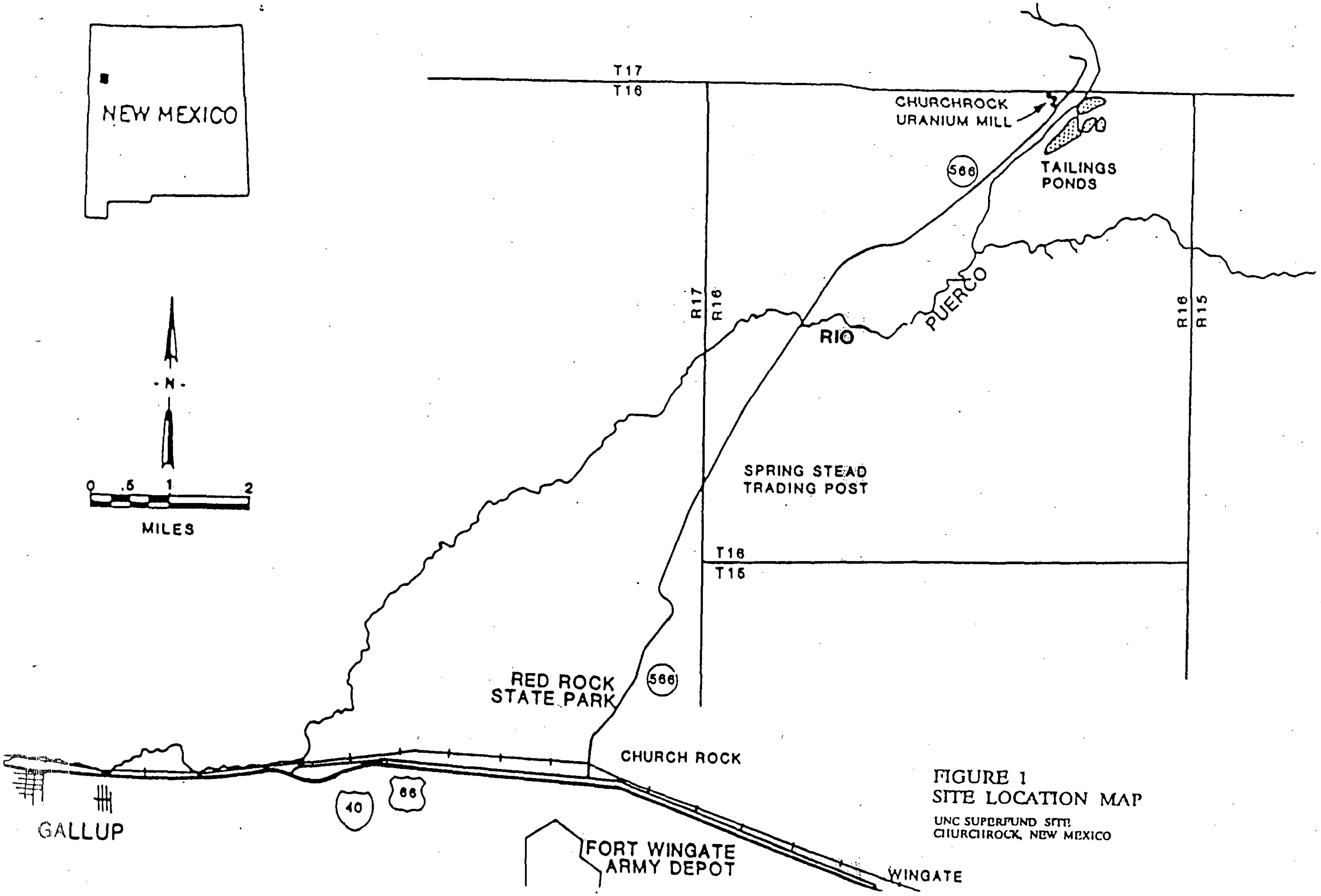


FIGURE 1
SITE LOCATION MAP
UNC SUPERFUND SITE
CHURCHROCK, NEW MEXICO

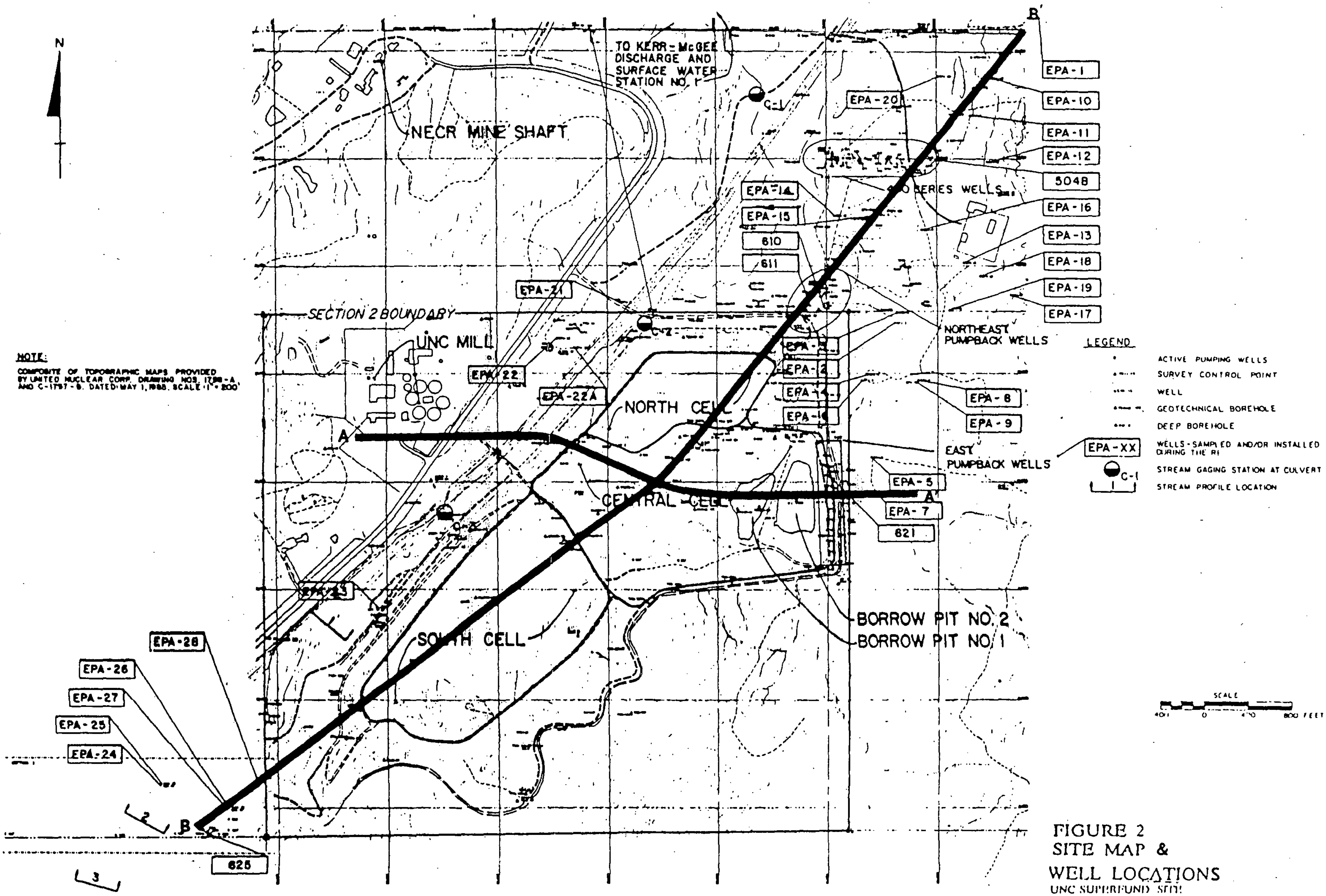


FIGURE 2
SITE MAP &
WELL LOCATIONS
UNC SUPERFUND SITE
CHURCHROCK, NEW MEXICO

In July 1979, the dam on the south cell breached, releasing approximately 93 million gallons of tailings and pond water to the Rio Puerco (EPA, 1988). The dam was repaired shortly after its failure. Cleanup of the resultant spill was conducted according to criteria imposed by state and federal agencies, including EPA, at that time.

In October 1979, the New Mexico Environmental Improvement Division (NMEID) ordered UNC to implement a discharge plan to control contaminated tailings seepage. The tailings seepage had been deemed responsible for groundwater contamination. In 1981, UNC implemented a groundwater pumping system that withdrew groundwater from the site aquifers and returned it to Borrow Pit No. 2 for evaporation (EPA, 1988).

UNC began tailings neutralization in late 1979, and continued the process until early 1982. Neutralization included the addition of ammonia or lime to the tailings; neutralization has also been conducted several times during the history of the mill operation (EPA, 1988).

In May 1982, UNC announced that they were going to temporarily close the Churchrock uranium mill because of depressed uranium market conditions. The market did not recover and UNC subsequently decided to close the facility permanently (EPA, 1988).

The offsite migration of radionuclides and chemical constituents into the groundwater, in addition to surface water and air emissions, prompted the placement of the UNC site onto the National Priorities List (NPL) of Superfund sites in 1983.

EPA's RI field activities at the UNC site were conducted from March 1984 to August 1987. The objectives of the RI field activities were to determine the nature and extent of groundwater contamination in the three aquifers at the site.

During early 1987, UNC submitted a closure plan to the NRC for reclamation of the mill site. This plan has been under review by the NRC since then and was formally approved in September 1988. On August 26, 1988, EPA and the NRC signed a Memorandum of Understanding (MOU), a copy of which is attached as Appendix I, which provides for the coordination of EPA's remedial action with the U.S. Nuclear Regulatory Commission (NRC) required site reclamation action. UNC's current activities at the site are limited to (1) compliance monitoring activities, (2) an improved seepage collection system operation, (3) dust control, (4) decontamination and sale of selected equipment, and (5) enhanced spray evaporation of water contained in Borrow Pit No. 2.

2.2 Response History

In 1981 EPA conducted a preliminary evaluation of the UNC site consisting of an assessment of existing data and a site inspection. The site, then regulated by the State of New Mexico under "agreement state" status with the NRC, was subsequently included on the Superfund Interim Priority List. In late 1982 EPA conducted an additional sampling inspection. In 1983 the site was formally placed on the National Priorities List of Superfund sites.

EPA began the RI in August of 1984 and fieldwork began in early 1985 after site access problems were resolved. The RI, which addresses groundwater outside the byproduct materials disposal site, was released in August 1988.

EPA also released a FS report in August 1988 along with a proposed plan of action fact sheet for the UNC site groundwater operable unit. EPA held a 29-day public comment period and a public meeting.

2.3 Enforcement History

During 1982 and 1983, EPA and UNC engaged in extensive negotiations with the aim of entering an agreed upon Administrative Order on Consent for conduct of investigative and remedial activities at the site in response to groundwater contamination. In August of 1983, after UNC declined to commit to an Order on Consent to promptly address groundwater concerns, EPA sent notice letters to UNC indicating its plans to conduct its own Remedial Investigation (RI) and Feasibility Study (FS).

In September of 1983 UNC objected to EPA's decision to conduct its own RI/FS, stating that EPA had no authority under CERCLA with respect to the site, and that EPA's work would interfere and be duplicative of UNC's own efforts. EPA continued with development of its plans for a CERCLA RI/FS, but progress was slowed as UNC denied EPA access to the site to conduct RI/FS activities from April through September 1984.

In August 1984 UNC filed suit against EPA for declaratory and injunctive relief in U.S. District Court for the District of New Mexico (No. 84-1163-JB) seeking to prevent EPA conduct of the RI/FS. In September of 1984, EPA obtained and executed an Administrative Warrant to conduct preliminary RI activities. EPA also filed an action in the same District court seeking injunctive relief and an Order in Aid of Access (No. 84-1409-BB). During the months of October through December 1984, UNC and the United States filed numerous motions, in relation to both cases no. 1163 and no. 1409. In December of 1984 U.S. District Court dismissed case no. 1163 "without prejudice". UNC also informed the Department of Justice of its intention not to interfere with EPA access to the site to conduct the RI/FS, and work on the study was able to proceed. In April of 1985, the U.S. District Court entered an order granting EPA access to the UNC site for the purpose of conducting the RI/FS. (UNITED STATES OF AMERICA v. UNITED NUCLEAR CORP., 610 F. SUPP. 527 (D.N.M.,1985))

In June of 1986 the State of New Mexico returned its authority to regulate uranium mills back to the NRC. This Regulatory change prompted the development of the previously mentioned MOU between Region VI of EPA and Region IV of NRC for remedial action at the UNC site. The MOU, signed in August 1988, establishes the roles and responsibilities of each agency in reclamation of the UNC site (Appendix I). The MOU recognizes that EPA will conduct an RI/FS and sign a ROD which addresses groundwater outside the byproduct materials disposal site while NRC is responsible as the lead-agency in matters of surface reclamation and source control.

The United States will seek to have the responsible party implement the UNC groundwater operable unit remedy under terms of a consent decree lodged with the Department of Justice. The remedy is discussed, along with other remedies, in the "Alternatives Evaluation" section of this ROD.

3. SITE CHARACTERISTICS

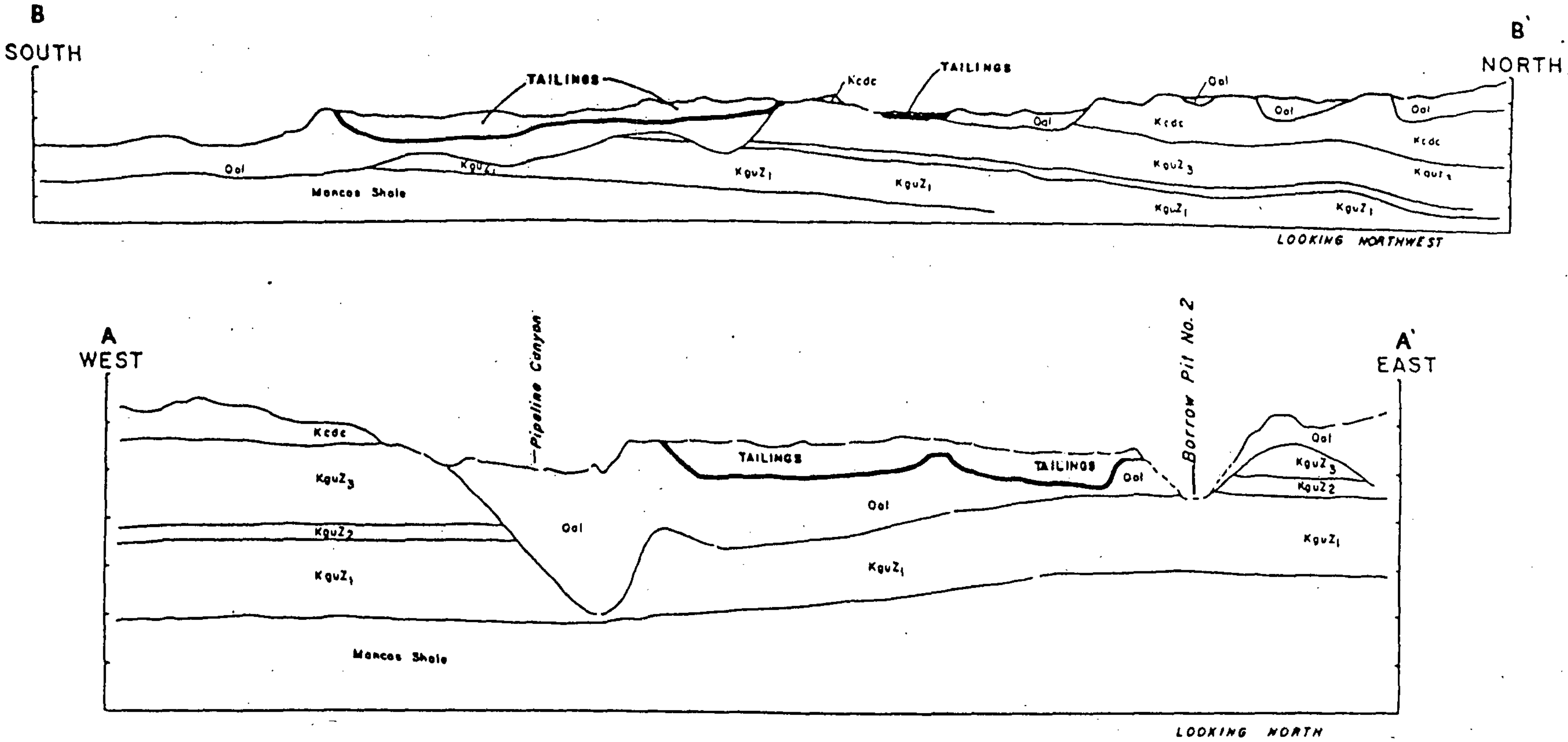
3.1 Geology and Hydrogeology

The stratigraphy at the UNC site is divided into two main components: the surficial unconsolidated deposits (Quaternary alluvium) and the underlying consolidated bedrock units. The Quaternary alluvium is the major surficial unconsolidated deposit at the site. This laterally discontinuous deposit consists of a mixture of sand, silt, clay, and to a lesser amount, gravel. Alluvial thicknesses are greater than 120 feet with an average of 50 feet.

The main bedrock units at the site are the Upper Gallup Sandstone (vertically, beneath the alluvium: Zones 3, 2, and 1) and the Upper D-Cross Tongue member of the Mancos shale. All bedrock units are of Cretaceous age. Zone 3 of the Upper Gallup Sandstone, which is up to 90 feet thick, contains a medium- to coarse-grained sandstone. Zone 2 (10 to 20 feet thick) contains a carbonaceous shale and coal with thin sandstone lenses. Zone 1 (up to 90 feet thick) is sandstone similar to Zone 3, but with a finer grain size. The Mancos shale is a carbonaceous, fissile shale at the site.

There are three principal structural zones at the site: Pipeline Canyon lineament, Fort Wingate lineament, and Pinedale monocline. These structural features impact the site hydrogeology in some locations by affecting groundwater flow directions. In some locations, the Zone 2 unit provides an effective barrier to communication between the two bedrock aquifers. In places, all three aquifers of concern are in hydraulic connection, indicating they are not isolated units. The Mancos shale is considered a barrier to further vertical migration into lower aquifers. Figure 3 presents generalized east-west and north-south cross-sections of the aquifer systems at the UNC site.

The Remedial Investigation (RI) report for the UNC site concluded that mine discharges and tailings seepage have impacted the alluvial aquifer, and



LEGEND

QUATERNARY	Qal	ALLUVIUM
UPPER CRETACEOUS	Kcdc	CREVASSE CANYON FORMATION DILCO COAL MEMBER
	KguZ3	UPPER GALLUP SANDSTONE-ZONE 3
	KguZ2	UPPER GALLUP SANDSTONE-ZONE 2
	KguZ1	UPPER GALLUP SANDSTONE-ZONE 1

FIGURE 3
GENERALIZED EAST-WEST & NORTH-SOUTH CROSS-SECTIONS
UNC SUPERFUND SITE
CHURCHROCK, NEW MEXICO

Zones 1 and 3 of the Upper Gallup Sandstone. Mine water discharges significantly recharged these three aquifers and mixed with seepage from the tailings ponds after milling operations began in 1977. A summary of the hydrogeologic characteristics of these aquifers is presented in Table 1.

The alluvial aquifer has been affected by both surface water discharges associated with the mine operations and by seepage of contaminants from the tailings pond. The Zone 3 aquifer has been impacted by contaminants that have leached from the northeast portion of the north tailings cell. The Zone 1 aquifer has also been contaminated from seepage from the central tailings cell and borrow pit No. 2. The remedial investigation report concluded that each of these aquifers are contaminated to varying degrees with heavy metals, other inorganics, and radionuclides through seepage from the tailings ponds (EPA, 1988).

3.2 Nature and Source of Contamination

Background Levels of Contaminants

Prior to evaluating the contamination that has resulted from site activities, a determination of background levels of contaminants must be made. These background levels are used as cleanup criteria if at a higher concentration than federal or state standards for a particular contaminant. For the UNC site, two background conditions are distinguished: 1) premining, pretailings background levels (i.e., prior to 1968), and 2) postmining, pretailings background levels (i.e., between 1968 and mid-1977). The first condition refers to the quality of the groundwater in the alluvium and Upper Gallup Sandstone in the vicinity of the site prior to mine dewatering. The second condition refers to the quality of groundwater in the same units after mine water discharge, but prior to tailings disposal.

As stated in the Feasibility Study, and reiterated here, background levels are based on postmining, pretailings conditions. They have been set by EPA based on an assessment of available information from 1) pre-tailings groundwater monitoring at the site, and 2) regional hydrogeochemical sampling in the Gallup Sandstone and alluvium. These background levels are presented in Table 2 along with additional contaminant-specific groundwater ARARs for the UNC site. A discussion of the rational used in the selection of background levels for iron, manganese, sulfate, nitrate and total dissolved solids (TDS) is found in Appendices C and H.

Should additional information become available that would significantly alter the estimation of background levels, such information would be evaluated in terms of its impact on remedial actions in each aquifer.

Source Characterization

Uranium milling byproduct materials, which were discharged to unlined ponds on UNC property, are the primary source of contaminants to the alluvial and

Table 1
SUMMARY OF HYDROGEOLOGIC CHARACTERISTICS AT THE UNC SITE

Characteristic	Alluvium	Zone 3	Zone 1
Outcrop	Discontinuous across site	Discontinuous across site	Discontinuous across site
Thickness	0-120 feet, average of 50 feet	Up to 90 feet	Up to 90 feet
Geology	Sand, silt, clay, and to a lesser amount, gravel	Medium to coarse grain sandstone	Fine- to medium-grain sandstone
Recharge	From direct precipitation, seepage from tailings ponds, and intermittent surface drainage in Pipeline Canyon	Same recharge sources as alluvium; alluvium can also discharge groundwater into Zone 3	Same recharge source as alluvium; alluvium and Zone 3 can also discharge groundwater into Zone 1
Groundwater Flow Direction	Southwest along Pipeline Canyon	North and easterly	North and easterly
Transmissivity	6,575 gal/day/ft	1,032 gal/day/ft	150 gal/day/ft
Storage Coefficients	0.09	0.05	0.05

Table 2
CONTAMINANT-SPECIFIC GROUNDWATER ARARs

Contaminant	Concentration mg/L[a]	Source
Aluminum	5.0	NMWQA
Antimony	0.014	Health-based
Arsenic	0.05	MCL
Barium	1.0	MCL, NMWQA
Beryllium	0.017	Health-based
Cadmium	0.01	MCL, NMWQA
Chromium	0.05	MCL, NMWQA
Cobalt	0.05	NMWQA
Copper	1.0	NMWQA
Iron	5.5	Background Level
Lead	0.05	MCL, NMWQA
Manganese	2.6	Background Level
Mercury	0.002	MCL, NMWQA
Molybdenum	1.0	NMWQA
Nickel	0.2	NMWQA
Selenium	0.01	MCL
Silver	0.05	MCL, NMWQA
Thallium	0.014	Health-based
Vanadium	0.7	Health-based
Zinc	10.0	NMWQA
Chloride	250.0	NMWQA
Sulfate	2,160.0	Background Level
Nitrate	30.0[c]	Background Level
TDS	3,170.0	Background Level
Radium-226 and -228	5 pCi/L	MCL
Uranium-238	5.0 (1,645 pCi/L)	NMWQA
Thorium-230[b]	15 pCi/L	MCL
Gross Alpha	15 pCi/L	MCL

[a] mg/L except as noted.
[b] Based on 15 pCi/L gross alpha.
[c] Preoperational data of 30 mg/L appears reasonable for background. Additional investigation and determination of the natural NO_3-N sources is necessary since NO_3-N is a health-related standard.

bedrock aquifers near the UNC site. Tailings leachate has migrated into the south alluvium, the north alluvium adjacent to the tailings ponds, and the Zone 1 and Zone 3 aquifers.

Although EPA did not sample tailings solids or liquids during the Remedial Investigation, UNC and NRC provided EPA with several tailings analysis used to characterize byproduct solids and liquids. These data are presented in Table 3. From these analysis, the tailings fluids are characterized as an acidic, high dissolved solids water with sulfate, ammonia and sodium as principle ions. Metal analyses, particularly aluminum, manganese, and iron, are very high (over 1,000 mg/L). Radioactivity as represented by Th-230 is very high.

3.3 Pathways of Contaminant Migration

This section discusses the major contaminant pathways and the interrelationships of these pathways as identified in the RI report. Figure 4 presents a simplified schematic of the relationships between the contaminant sources and migration pathways at the UNC site. There are two major sources of recharge to the site aquifers: the stream in Pipeline Canyon and seepage from the tailings pond. To a lesser extent, direct precipitation also supplies recharge water to the aquifers.

During the period when mine water discharges to Pipeline Canyon occurred, recharge from the stream to site aquifers was significant (up to 250 gallons per minute) (EPA, 1988). Mine discharges occurred at the UNC mine and the Kerr-McGee mine north of the UNC site. This recharge mechanism created an artificially high water table under the site, and helped transport contaminants southwest along the canyon and within the alluvium and bedrock aquifers. These waters, having the potential to leach constituents from the unsaturated alluvium, infiltrated into the bedrock aquifers and transported contaminants that had seeped from the tailings ponds. Groundwater recharge from surface water in Pipeline Canyon has ceased (except during precipitation events) following the termination of mine discharges by UNC in 1983 and Kerr-McGee in 1986. Since that time, water levels in the alluvium have decreased and are slowly returning to premining levels.

The tailings ponds are a source of contaminants to all aquifers at the site. Seepage of tailing liquids has entered the alluvial system from the three tailings cells to varying degrees. The mechanism responsible for this transport is gravity flow of water through the tailings into the alluvium. Where the alluvium is absent, tailings seepage has also entered the bedrock aquifers in the northeastern portion of the north cell where the Zone 3 aquifer contacts the tailings; and in the eastern portion of the central cell where Borrow Pit No. 2 contacts the Zone 1 aquifer.

Water levels in several UNC wells in Zone 3 have shown a small decline in response to termination of mine discharges to Pipeline Canyon outside the

Table 3
PROBABLE TAILINGS LIQUID CHEMISTRY

Parameter	Units	UNC[1] Summary	Well No. 633[2] 2/26/86	NRC Sample April 1987
pH	S.U.	1 - 3	1.71	3.34
TDS	mg/L	38,462 - 61,932	46,793	58,860
Aluminum	mg/L	1,167 - 2,906	2,880	2,100
Manganese	mg/L	100	100	210
Ammonia	mg/L	1,450 - 5,500	438	5,860
Nitrate	mg/L	75.5 - 282	1.84	<50
Th-230	pCi/L	1,064 - 277,733	-	13
Conductivity	umhos/cm	-	17,718	-
Calcium	mg/L	-	240	460
Magnesium	mg/L	-	287	1,100
Sodium	mg/L	-	526	890
Potassium	mg/L	-	4	-
Bicarbonate	mg/L	-	0	<1
Chloride	mg/L	-	253	580
Sulfate	mg/L	24,813 - 43,581	28,209	41,000
Arsenic	mg/L	0.024 - 0.208	0.65	<0.60
Selenium	mg/L	0.001 - 0.161	0.29	<1.2
Iron	mg/L	-	4,350	2,700
Lead	mg/L	-	0.6	3.34
Cadmium	mg/L	-	0.013	0.24
Zinc	mg/L	-	10	20
Molybdenum	mg/L	<0.05 - 0.15	-	<0.24
Ra-226	pCi/L	13	-	24 [3]
Ra-228	pCi/L	2.6	-	

(1) Range for 3 samples collected and analyzed by UNC.
(2) One-time sampling event. Analytical data is also presented in Appendix G.
(3) Total Radon (226 + 228)

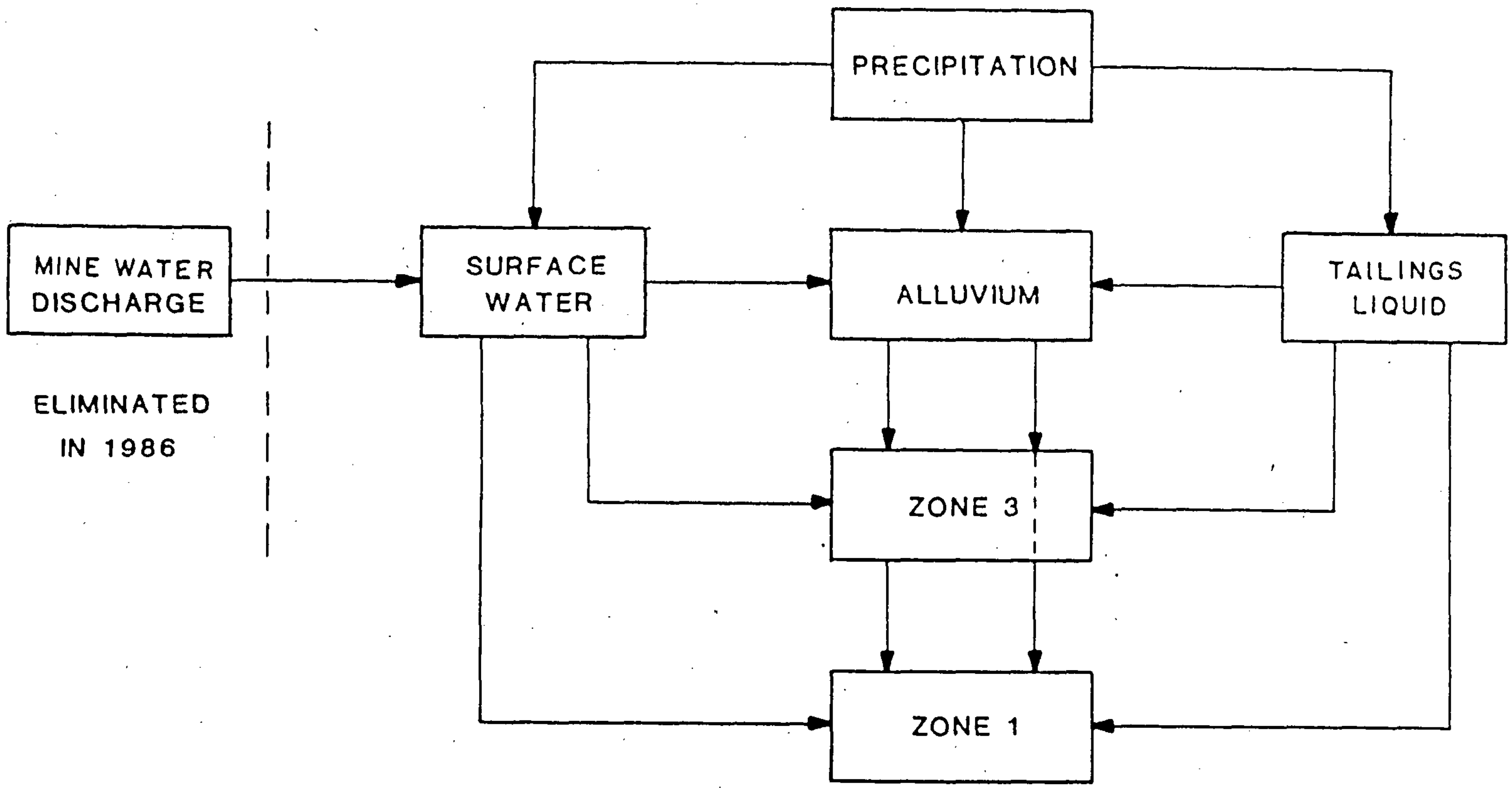


FIGURE 4
CONCEPTUAL FLOW PATHWAY RELATIONSHIPS
UNC SUPERFUND SITE
CHURCHROCK, NEW MEXICO

influence of the UNC pumping system. In addition, water levels in certain wells in the bedrock aquifers are affected by the pumpback systems at the site. However, groundwater, contaminated with tailings leachate, will continue to migrate downgradient as long as the source (the tailings pond) continues to leach; some decrease in concentration due to natural attenuation and dispersion would be expected.

3.4 The Extent of Contamination from Tailings Seepage

Monitoring Well Data

Twenty-nine monitoring wells were installed at the UNC site during the RI field activities (Well Nos. EPA-1 through EPA-28 and EPA-22A). Locations of the monitoring wells that were sampled during the RI field work are shown in Figure 2. Groundwater samples were collected from these wells in March, May, and August 1985 for radiological and nonradiological constituents. The March and May sampling rounds included five UNC wells (Nos. 504B, 610, 611, 621, and 625) and the 29 newly installed EPA wells (Nos. EPA-1 through EPA-28 and EPA-22A).

Tables 4 and 5 summarize the maximum and mean chemical and radionuclide concentrations, respectively, within each aquifer at the site. These concentrations were calculated using the May 1985 data for nonradiological contaminants and both March and May 1985 data for radiological contaminants. Mean concentrations were calculated by averaging contaminant values from each well in a given aquifer. Maximum concentrations represent the highest contaminant value measured in a given aquifer.

Data obtained during the 1985 RI field sampling were then compared to contaminant-specific Applicable or Relevant and Appropriate Requirements (ARARs) for the site. Contaminant-specific ARARs (Table 2) are the Safe Drinking Water Act (SDWA) Maximum Concentration Limits (MCLs), New Mexico Water Quality Act (NMWQA) standards, and background levels where background is higher than federal and state standards. A more detailed discussion of contaminant-specific ARARs is found in Appendix C.

Table 6 presents by aquifer these contaminants for which maximum detected concentrations exceed contaminant-specific ARARs (Table 2). Zone 3, Zone 1, and the southwest alluvial aquifer contain most of the compounds exceeding standards.

Figures 5 through 7 indicate the number and location of wells where ARARs have been exceeded for each aquifer at the site. Specific contaminants exceeding ARARs and their associated concentrations are also listed. As these figures indicate, contaminants exceed standards in fourteen wells immediately downgradient of the tailings ponds in Zone 3; in seven wells adjacent to and immediately downgradient of tailings ponds in Zone 1; and in nine wells downgradient of tailings ponds in the alluvium. Seven of the

Table 4
CONTAMINANT CONCENTRATION DATA
FOR NONRADIOLOGICAL PARAMETERS BASED ON MAY 1985 RI SAMPLING AND ANALYSIS

Contaminant	Contaminant Concentration (mg/l)							
	North Alluvium		South Alluvium		Zone 1		Zone 3	
	Mean[a]	Maximum	Mean[a]	Maximum	Mean[a]	Maximum	Mean[a]	Maximum
Aluminum	0.29	0.29	NA		9.8	29	52	614
Arsenic	0.01	0.01	0.01	0.01	0.029	0.1	0.59	2.4
Barium	0.05	0.05	0.05	0.05	0.07	0.09	0.05	0.06
Beryllium	0.005	0.005	0.0054	0.0078	0.0074	0.022	0.04	0.25
Cadmium	0.021	0.038	0.044	0.12	0.024	0.11	0.03	0.28
Chromium	0.01	0.01	0.013	0.029	0.01	0.01	0.04	0.27
Cobalt	0.02	0.02	0.067	0.35	0.068	0.21	0.35	1.6
Copper	0.022	0.024	0.02	0.02	0.02	0.02	0.06	0.47
Iron	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	0.17	0.30	2.7	16.3	4.1	9.1	7.8	43
Mercury	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	0.02	0.02	0.16	0.91	0.081	0.29	0.38	1.0
Selenium	0.005	0.005	0.029	0.05	0.025	0.039	0.01	0.01
Silver	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	0.023	0.027	0.030	0.041	0.04	0.16	0.25	3.0
Zinc	0.053	0.053	0.29	0.76	0.41	1.1	2.2	6.9
Sulfate	1,265	1,880	752	1,140	754	1,140	711	1,620
Nitrate ($N-NO_3$)	26	46	130	251	36	127	9.8	35
TDS	4,564	7,853	4,760	9,698	5,174	7,646	5,321	11,453
Molybdenum	5	5	5	5	5	5	5.8	17

NA--Data not available due to QA/QC concerns.

[a]Mean values calculated using detections limit values for those contaminants measured below detection limits (BDL).

Table 5
RADIONUCLIDE CONCENTRATION DATA FROM
MARCH AND MAY 1985 RI SAMPLING AND ANALYSIS[a]

Radionuclide	Concentration (pCi/l)							
	North Alluvium		South Alluvium		Zone 1		Zone 3	
	Mean[b]	Maximum	Mean	Maximum	Mean	Maximum	Mean	Maximum
Ra-226	0.32	0.66	0.35	1.0	0.82	2.7	6.8	47
Ra-228	0.45	0.65	1.5	3.5	2.4	8.6	8.4	36
Th-230	0.033	0.048	0.15	0.52	5.3	29	3,760	41,300
U-238	12	17	19	70	31	134	630	7,610
Gross Alpha[c]	30	50	27	47	67	267	356	3,798
Gross Beta	24	46	25	64	37	113	77	584

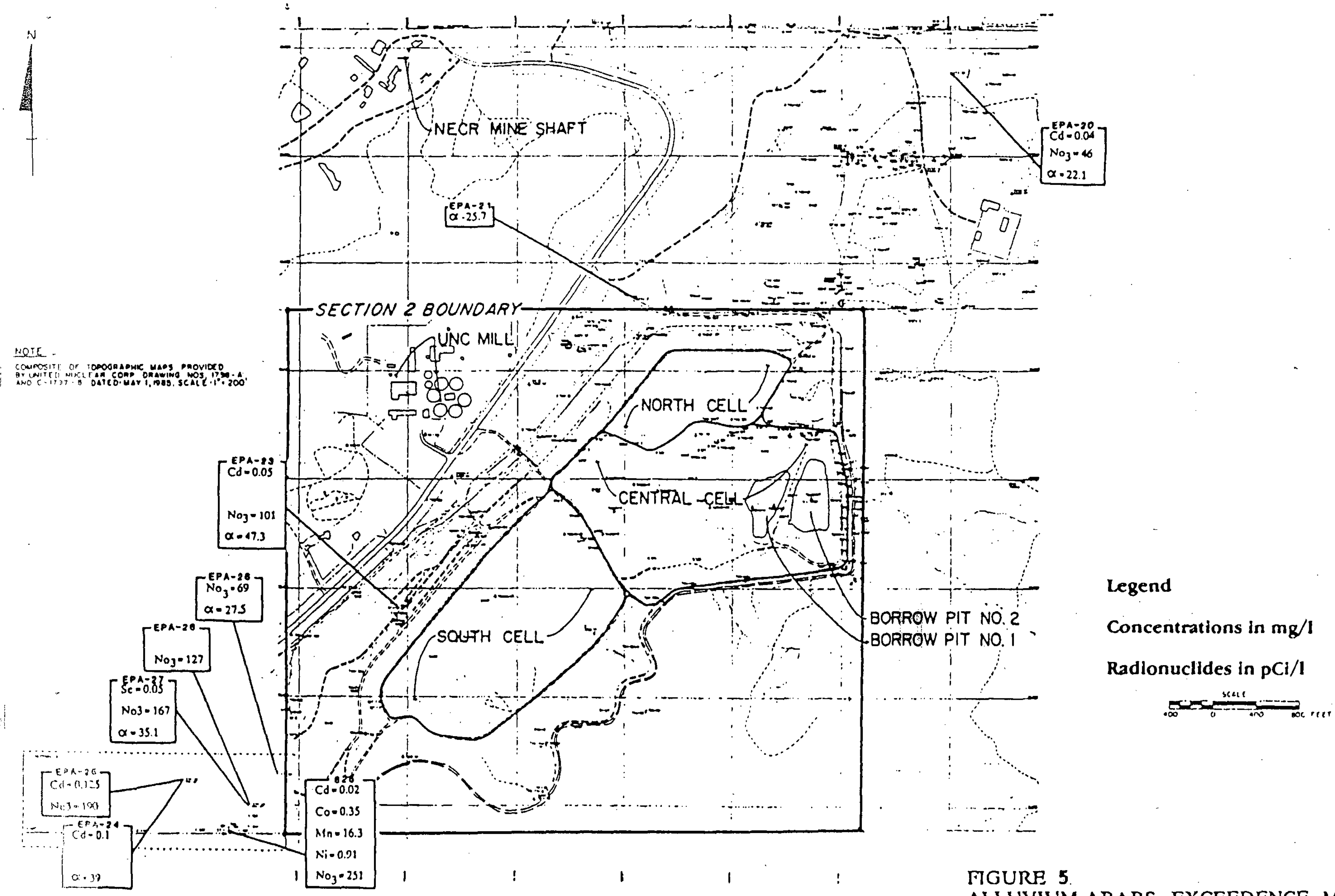
[a]Counting uncertainties contained in Appendix D of RI.

[b]Mean values estimated by averaging wells within each aquifer over both sampling periods.

[c]Gross alpha valuves reflect subtraction of uranium activity. No radon analyses were performed and, therefore, radon was not subtracted.

Table 6
COMPOUNDS EXCEEDING STANDARDS

Contaminant	Zone 3	Zone 1	North Alluvium	South Alluvium	Sec. 36 Alluvium
Aluminum	X	X			
Arsenic	X	X			
Cadmium	X	X		X	X
Cobalt	X	X		X	
Manganese	X	X		X	
Molybdenum	X	X	X	X	
Nickel	X	X		X	
Selenium	X	X		X	
Nitrate	X	X		X	X
TDS	X	X	X	X	X
Ra-226-228	X				
Gross Alpha	X	X	X	X	X



NOTE: Nitrate as NO_3-N; TDS exceedences not shown.

FIGURE 5
ALLUVIUM-ARARS EXCEEDENCE MAP

UNC SUPERFUND SITE
CHURCHROCK, NEW MEXICO

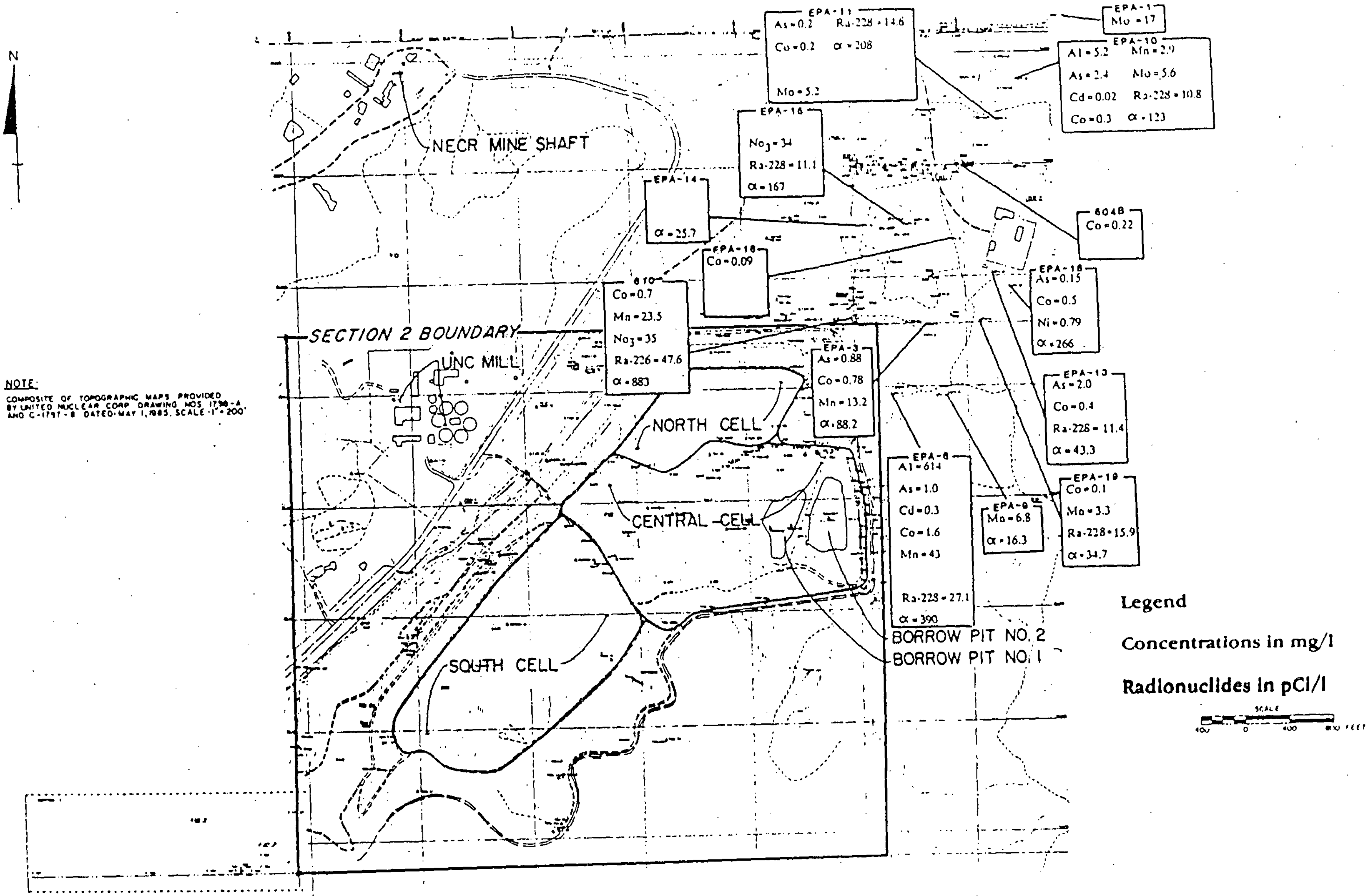
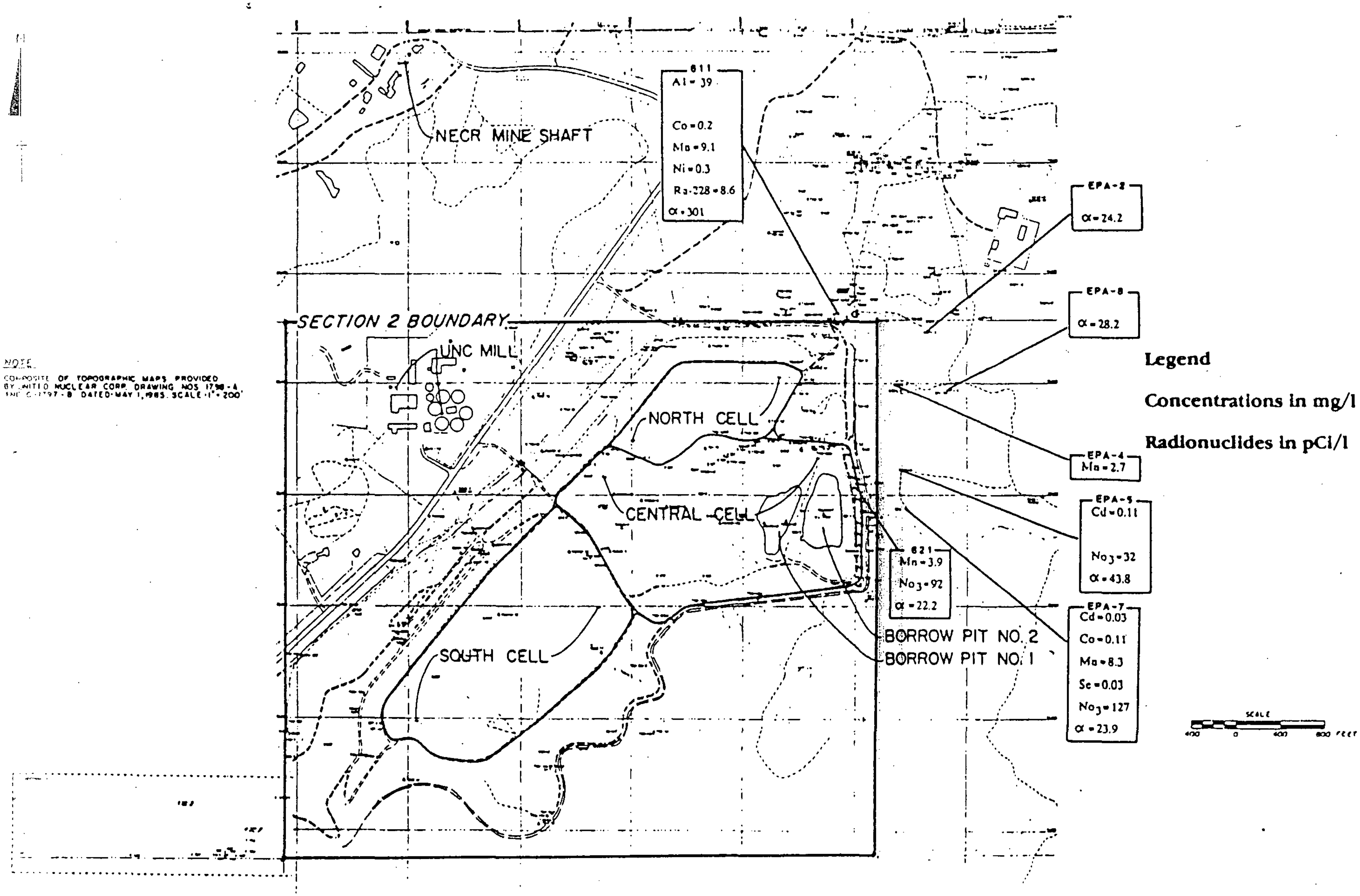


FIGURE 6
ZONE 3 - ARARS EXCEEDENCE MAP

UNC SUPERFUND SITE
CHURCHROCK, NEW MEXICO

NOTE: Nitrate as NO_3-N; TDS exceedences not shown.



NOTE: Nitrate as NO_3-N; TDS exceedences not shown.

FIGURE 7
ZONE 1 - ARARS EXCEEDENCE MAP

UNC SUPERFUND SITE
CHURCHROCK, NEW MEXICO

nine wells in the alluvium showing contaminant concentrations at levels exceeding ARARs are southwest and immediately downgradient of the tailings disposal area.

Cleanup Target Areas

Five initial cleanup target areas were delineated in the Feasibility Study using the locations of wells in Figures 5 through 7 and information on groundwater flow characteristics presented in the Remedial Investigation. The five initial target areas are shown in Figure 8 and are defined as follows:

- Zone 3 groundwater contamination northeast of Section 2. Contaminants in this target area appear to migrate in an easterly and northeasterly direction away from Section 2.
- Zone 1 groundwater contamination east and northeast of Section 2. Contaminants in this target area appear to migrate in an easterly and northeasterly direction away from Section 2.
- Alluvial groundwater contamination along the western boundary of the southern cell. Contaminants in this plume appear to be migrating in a southwesterly direction.
- Alluvial contamination on the northeastern corner of Section 2. Contaminants in this target area appear to be migrating in a northerly direction away from Section 2.
- Alluvial contamination that originates in Section 36. Based on the RI report, this area of alluvial contamination appears to be distinct from the alluvial contamination north of Section 2 and is not believed to be related to the tailings ponds.

To ensure that contamination does not exist beyond the cleanup target areas, EPA may require installation of monitoring wells downgradient of the initial target areas during remedial design. The initial cleanup target areas will be adjusted to include any contaminated downgradient areas, if groundwater samples from the monitoring wells indicate that contaminant-specific ARARs or background levels are exceeded.

3.5 Potential Impacts of Site on Human Health and the Environment

Groundwater has been contaminated directly by tailings seepage in portions of the Zone 3, Zone 1, and alluvial aquifers immediately downgradient of the UNC byproduct materials disposal area. However, based on the information gathered from groundwater investigations at the UNC, EPA has found no current exposure to local residents from ingestion of groundwater in currently operating domestic and livestock wells within four miles of the site. Other health issues are listed in the attached correspondence (Appendix D) from the Agency for Toxic Substances and Disease Registry (ATSDR).

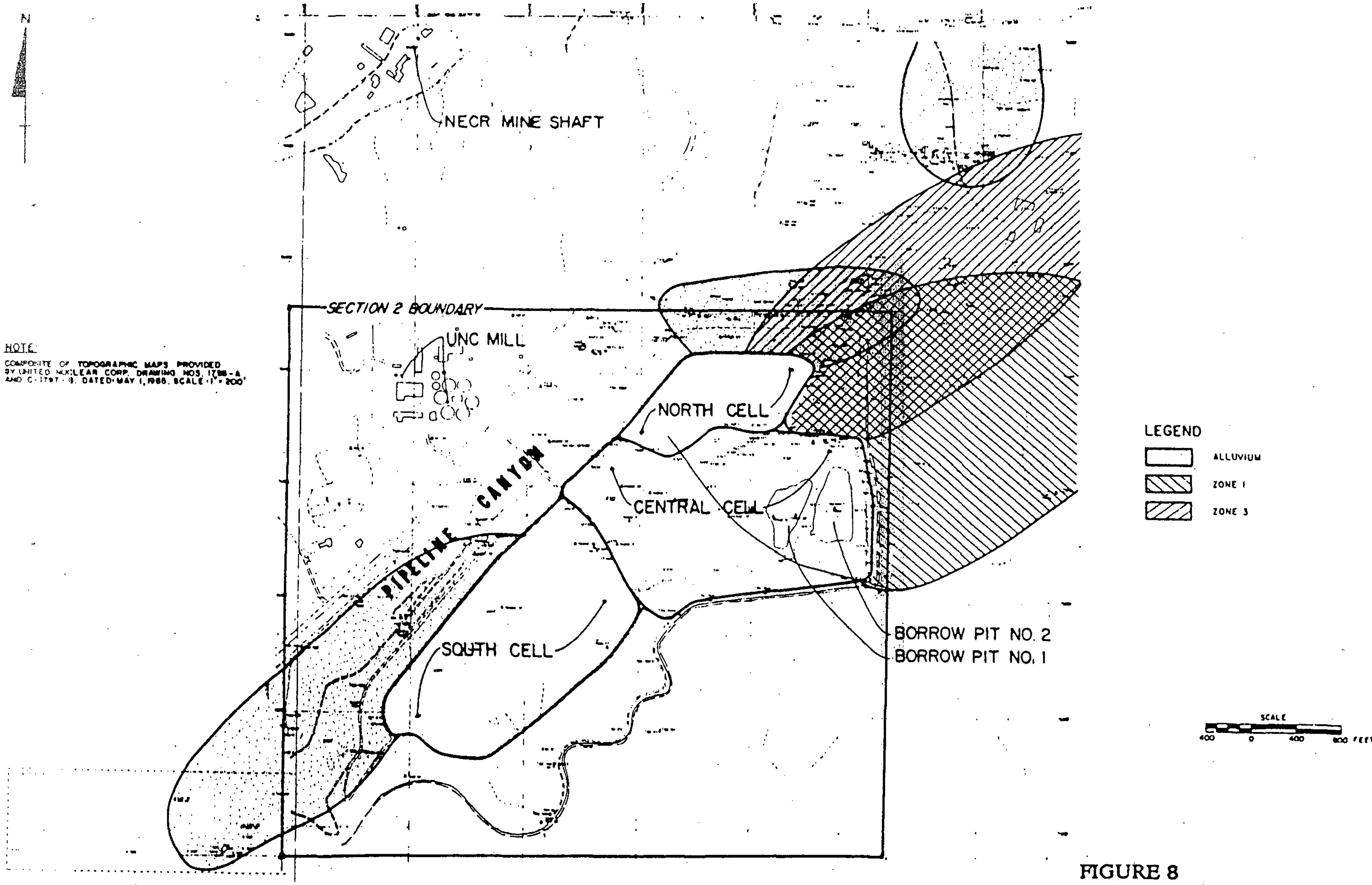


FIGURE 8
CLEANUP TARGET AREAS

UNC SUPERFUND SITE
CHURCHROCK, NEW MEXICO

The locations of operating wells sampled by EPA in 1987 are shown in Figure 9. Primary drinking water standards were not exceeded in any of the samples. Well 15K-303 and the Gray Well were the only samples containing radiological activity above 1 pico curie per liter (pCi/L), with 15K-303 containing 12.0 ± 2.7 pCi/L beta and 1.6 ± 0.1 pCi/L radium 226, and the Gray Well containing 2.5 ± 3.0 pCi/L alpha and 5.6 ± 3.6 pCi/L beta. These activities are below the drinking water standards, and related to natural background levels in area groundwater. The state standard for total dissolved solids (1000 mg/L) was exceeded in samples from all four wells, while the state standard for sulfate (600 mg/L) was exceeded in 15K-303. The state standard for iron (1.0 mg/L) was exceeded in wells 16F-606 and 15K-303, and that for manganese (0.2 mg/L) exceeded in well 15K-303.
The principal exposure pathways through which humans might potentially become exposed to contaminants in the future are:

- o ingestion of groundwater from wells outside the tailings disposal area in each of the contaminated target areas if water supply wells are ever installed before completion of remedial activity

- o inadvertent ingestion of surficial tailings solids

EPA concluded from its public health assessment in the Feasibility Study that adverse health or environmental hazards could result if no action was taken to prevent exposure to groundwater contaminants found at the site. The public health assessment assumed ingestion of groundwater at contaminant concentrations equal to those measured during the 1985 RI sampling events (Tables 4 and 5). This assumption was conservative since dilution and dispersion expected to occur if seepage were allowed to continue to migrate downgradient from the site would likely further reduce the concentration of contaminants from the concentrations assumed. The remedy selected for the UNC groundwater operable unit is designed to contain and remove groundwater contaminated by tailings seepage thereby preventing continued downgradient migration of seepage and reducing significantly the amount of radiogenic and nonradiogenic constituents released into the environment. Groundwater remediation coupled with source control remedial action required by NRC will allow further improvements in groundwater quality at the UNC site. NRC-required source control measures, which address surficial contamination from windblown tailings solids and control of groundwater evaporation residues, are expected to eliminate significant potential risks to human health and the environment via the direct contact, air emissions, or surface exposure routes.

4. COMMUNITY RELATIONS

On April 6, 1987, EPA held its first community meeting on the UNC site to discuss the status of on-going investigations at the site, and to clarify the respective roles of EPA and NRC in coordinating site reclamation. Navajo translation was provided and NRC was in attendance. Fact sheets

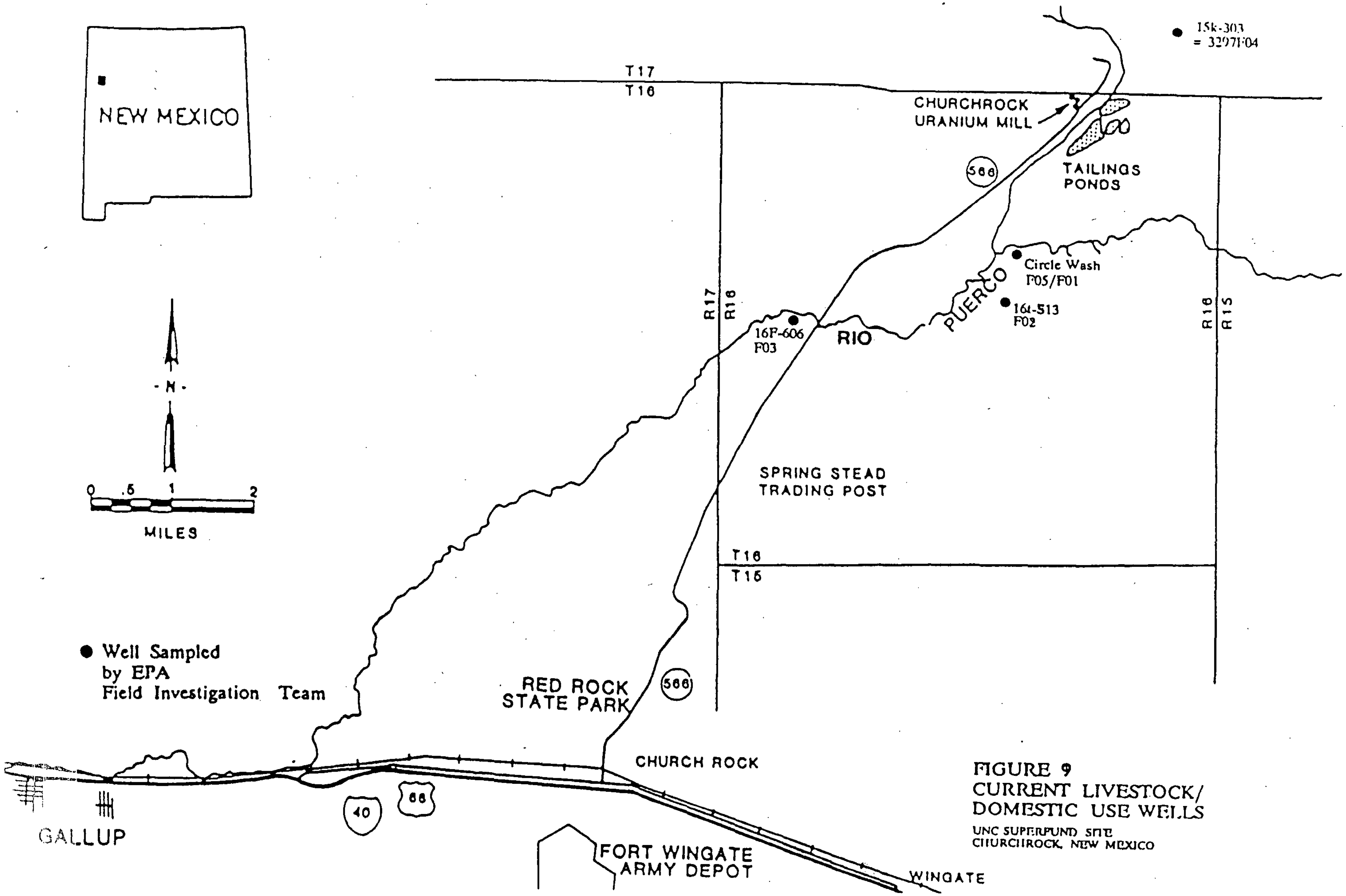


FIGURE 9
CURRENT LIVESTOCK/ DOMESTIC USE WELLS
UNC SUPERFUND SITE
CHURCHROCK, NEW MEXICO

were mailed to local residents and interested parties indicating that a Memorandum of Understanding (MOU) was being developed between EPA and NRC establishing each agencies role and responsibility in achieving site reclamation. Also, at the request of several citizens present at the meeting, EPA committed to sampling of domestic/livestock wells within a four-mile radius of the site. The well sampling was announced in September 1987 via a press release.

On August 11, 1988, EPA announced through a press release that the Remedial Investigation, Feasibility Study, and Administrative Record for the groundwater operable unit would be available in repositories for public review by August 19, 1988. In the same press release EPA announced that the public comment period on the groundwater operable unit RI/FS would be held between August 19 and September 16, 1988. The press release also announced that a public meeting to discuss the proposed remedy would be held at Red Rock State Park on August 31, 1988.

EPA prepared an English fact sheet and condensed Navajo fact sheet describing various alternatives evaluated in the FS and the proposed plan of action. This was mailed to the site mailing list of over 325 area residents on August 9, 1988. EPA also held an open house on August 4, 1988, with a representative of NRC, to informally discuss results of EPA's RI and EPA/NRC jurisdiction. This meeting was announced through a mailing on July 19, 1988, and a press release on July 29, 1988. Approximately 40 people attended including three press representatives.

The public meeting was held August 31, 1988, at Red Rock State Park in Gallup, New Mexico. Approximately 40 people attended. A representative of the NRC was included on the panel and responded to questions on surface reclamation as required by UNC's license. The Responsiveness Summary in appendix H lists the public response to the alternatives proposed by EPA at this meeting. The meeting began at 7:00 p.m., proceeded with Navajo translation, and adjourned at 12:15 a.m.

5. ALTERNATIVES EVALUATION

5.1 Evaluation Criteria

To ensure compliance with Section 121 (a)(b) and (d) of the Superfund Amendments and Reauthorization Act (SARA), the following nine factors are considered in selecting a remedy for a Superfund site. These are summarized below:

1. Consistency with Other Environmental Laws (ARARs)

In determining appropriate remedial actions at Superfund sites, EPA must consider the requirements of other Federal and State environmental laws, in addition to CERCLA as amended by SARA. Primary consideration is given to attaining applicable or relevant and appropriate Federal and State public health and environmental regulations and standards. Not all Federal and State environmental laws and regulations are applicable or relevant and appropriate to each Superfund response action.

2. Reduction of Toxicity, Mobility or Volume

The degree to which alternatives employ treatment that reduces toxicity, mobility, or volume must also be assessed. Relevant factors are:

- o The treatment processes the remedies employ and materials they will treat;
- o the amount of hazardous materials that will be destroyed or treated;
- o the degree of expected reduction in toxicity, mobility, or volume;
- o the degree to which the treatment is irreversible; and
- o the residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity for bioaccumulation of such hazardous substances and their constituents.

3. Short-term Effectiveness

The short-term effectiveness of alternatives must be assessed by considering the following:

- o Magnitude of reduction of existing risks; and
- o short-term risks that might be posed to the community, workers, or the environment during implementation of an alternative including potential threats to human health and the environment associated with excavation, transportation, and redisposal or containment;

4. Long-term Effectiveness and Permanence

Alternatives must be assessed for the long-term effectiveness and permanence they afford along with the degree of centainty that the remedy will prove successful. The facts considered are:

- o Magnitude of residual risks in terms of amounts and concentrations of waste remaining following implementation of a remedial action, considering the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents;

- o type and degree of long-term management required, including monitoring and operation and maintenance;

- o potential for exposure of human and environmental receptors to remaining waste considering the potential threat to human health and the environment associated with excavation, transportation, redisposal, or containment;

- o long-term reliability of the engineering and institutional controls, including uncertainties associated with land disposal of untreated wastes and residuals; and

- o potential need for replacement of the remedy.

5. Implementability

The ease or difficulty of implementing the alternatives must be assessed by considering the following types of factors:

- o Degree of difficulty associated with constructing the technology;

- o expected operation reliability of the technologies;

- o need to coordinate with and obtain necessary approvals and permits (e.g., NPDES, Land Use Permits for offsite actions) from other offices and agencies;

- o availability of necessary equipment and specialists; and

- o available capacity and location of needed treatment, storage, and disposal services.

6. Costs

The types of costs that should be assessed include the following:

- o Capital costs;

- o operation and maintenance costs;

- o net present value of capital and operation and maintenance costs; and

- o potential future remedial action costs.

7. Community Acceptance

This assessment should include:

- o Components of the alternatives that the community supports;
- o features of the alternatives about which the community has reservations; and
- o elements of the alternatives which the community strongly opposes.

8. State Acceptance

EPA must assess the concerns of the State government which, for this site, is represented by the New Mexico Environmental Improvement Division. This assessment includes:

- o Components of the alternatives the State supports;
- o features of the alternatives about which the State has reservations; and
- o elements of the alternatives under consideration that the State strongly opposes.

9. Overall Protection of Human Health and the Environment

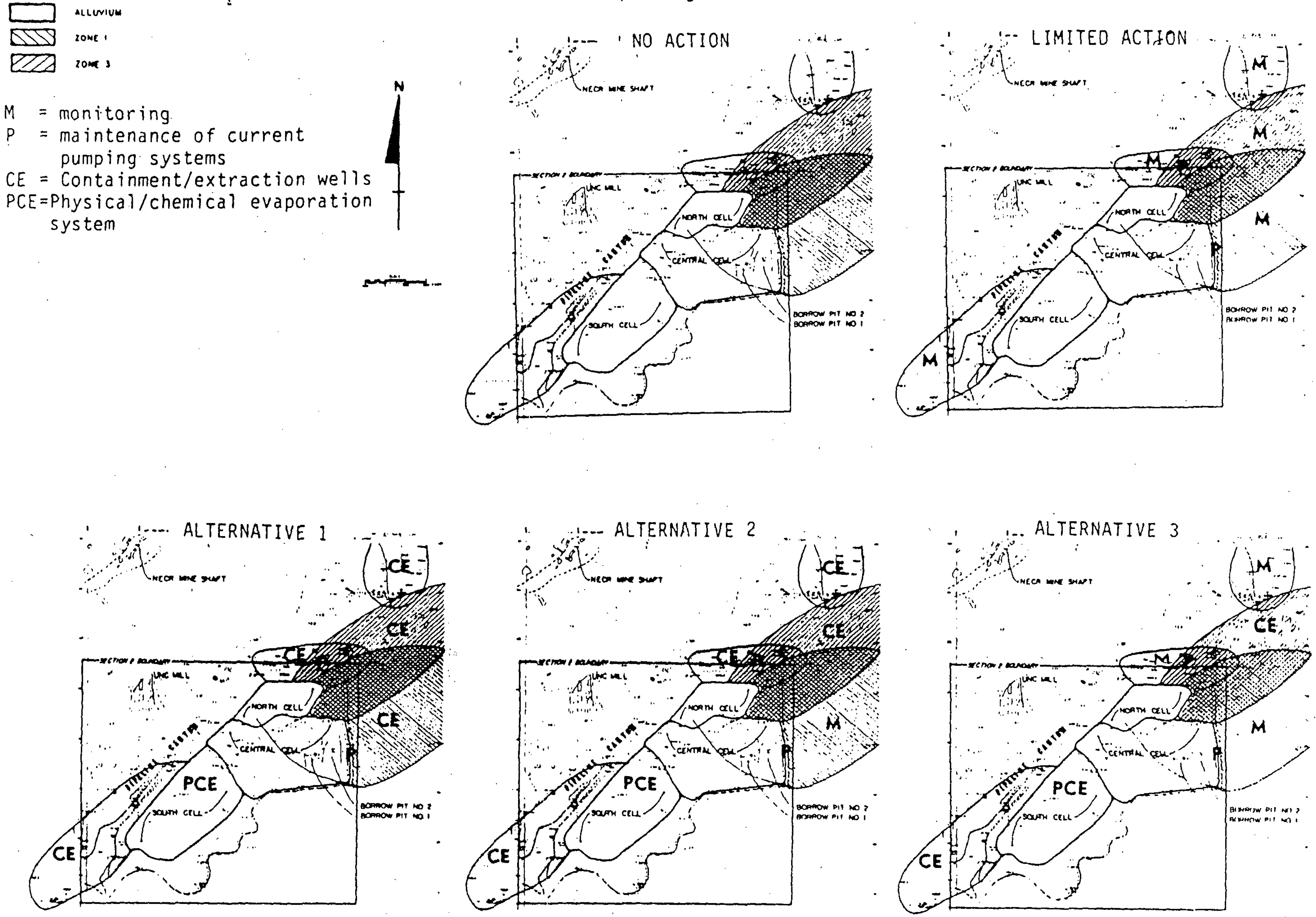
Following the analysis of the remedial options against individual evaluation criteria, the alternatives must be assessed from the standpoint of whether they provide adequate protection of human health and the environment. EPA is also directed by SARA to give preference to remedial actions that utilize treatment to remove contaminants from the environment. Offsite transport and disposal without treatment is the least preferred option where practicable treatment technologies are available.

5.2 Description of Alternatives

In conformance with the National Contingency Plan (NCP), EPA screened initial remedial possibilities to determine which might be appropriate for groundwater contamination outside the byproduct materials disposal site. The Feasibility Study describes the details of this evaluation. Source control measures required by NRC under United Nuclear Corporation's Source Materials License were given consideration during development of the ground-water remediation alternatives. Source control measures will be performed in sequence with any selected groundwater alternative. From the possible remedies, four were chosen for detailed evaluation under the remedy selection criteria outlined above. One other alternative, No Action, was also evaluated to comply with the requirements of the NCP. All five alternatives are summarized schematically in Figure 10.

Except for the No Action and Limited Action alternatives, all alternatives require collection and physical/chemical evaporation of contaminated ground-

Figure 10: Schematic summary of Alternatives showing target areas and corresponding remedial actions



water. The estimated duration and cost for each of the groundwater collection and treatment alternatives was based on remediation to federal and state standards, or background levels of constituents found in area wells prior to the beginning of tailings disposal activity in June of 1977.

Costs associated with collection and treatment alternatives are summarized for two physical/chemical treatment systems, column evaporation and enhanced mister/pond evaporation. The enhanced mister/pond evaporation system is the treatment process option proposed by United Nuclear Corporation under NRC license requirements. Column evaporation is a second process option evaluated by EPA to adequately treat contaminated groundwater. Estimated costs for each alternative were summarized in 10-year and 60-year time periods to allow for uncertainties in using models to predict responses to various pumping and restoration rates (see Appendix A for a discussion of hydrogeologic uncertainties; Appendix B for a discussion of cost estimates).

Each groundwater remedial action alternative would require pilot studies to determine reasonably achievable pumping rates in aquifers at the site and necessary storage and evaporative capacity. All alternatives assume implementation of NRC-required reclamation and closure activities within the tailings disposal area.

No Action Alternative

This alternative assumes that no monitoring would be performed outside the byproduct materials disposal site currently defined by Section 2. Under this alternative contaminants beyond the boundary of Section 2 would continue to migrate downgradient in the alluvium and Upper Gallup aquifers (Zone 1 and Zone 3). Although some reduction in the concentration of contaminants is expected to occur from natural flushing of the aquifers and downgradient movement of contaminated groundwater, future use of impacted groundwater in areas beyond Section 2 could occur with associated health risks. There is no cost for this alternative.

Limited Action Alternative

This alternative consists of institutional controls in the alluvial and Upper Gallup aquifers at the site, monitoring in all three aquifers, and maintenance of current pumping systems in the Upper Gallup aquifers. Operation of the East pump-back wells in Zone 1 and the Northeast pump-back wells in Zone 3 would continue until adequate dissipation of the tailings seepage mound has been achieved. Groundwater use and surface access restrictions would be implemented as part of this alternative in areas impacted by tailing seepage beyond Section 2 to protect public health and the environment. Flushing of all three aquifers would occur as natural upgradient groundwater flows through the target zones. A 50-percent contaminant reduction in the alluvial aquifer from natural flushing could take 30 years at current flow rates. A 50-percent contaminant reduction from natural flushing of Zone 3 could take 75 years, and possibly 200 years in Zone 1. The estimated cost of this alternative is $2 million over a 10 year period and $3 million over a 60 year period.

Alternative 1 - Groundwater Pumping and Treatment in Upper Gallup Zone 3 and Zone 1 Aquifers, in the Southwest Alluvium, and Two Areas in the North Alluvium:

The alternative consists of containment and selective extraction of contaminants in the Upper Gallup Zone 3 aquifer utilizing as many as 21 extraction wells appropriately placed to establish a hydraulic capture zone for the Zone 3 target area. This alternatives would require containment and selective extraction of contaminants in the Upper Gallup Zone 1 aquifer utilizing as many as 60 extraction wells necessary to establish a hydraulic capture zone for the Zone 1 target area. This alternative would also require containment and selective extraction of contaminants in the three alluvial target areas (see Figure 8) utilizing as many as 23 extraction wells to establish necessary hydraulic capture zones. All extracted water would be directed to either an enhanced mister/pond evaporation system or column evaporator at an optimum achievable flow rate. The evaporation system used would be sized in order to provide sufficient evaporative capacity for maintenance of achievable pumping rates. This alternative includes institutional controls, monitoring, and maintenance which also compose the Limited Action Alternative. The estimated cost of this alternative is $46 million with column evaporation and $36 million with enhanced mister/pond evaporation over a 10 year period; respective evaporation costs are $58 million and $43 million over a 60 year period.

Alternative 2 - Groundwater Pumping and Treatment in Upper Gallup Zone 3 Aquifer, the Southwest Alluvium, and Two Areas in the North Alluvium; Limited Action in the Upper Gallup Zone 1 Aquifer:

This alternative is identical to Alternative 1 for the Upper Gallup Zone 3 aquifer and three alluvial target areas. Containment and selective extraction of contaminants in Zone 3 and the alluvium would require as many as 21 and 23 wells, respectively, in order to establish necessary hydraulic capture zones for target areas in these aquifers.

This alternative differs from Alternative 1 in relation to mitigative action in the Upper Gallup Zone 1 aquifer. Alternative 1 would require the installation and operation of an extensive extraction well network in Zone 1 whereas this alternative calls for institutional controls, monitoring, and maintenance of current pumping systems in Zone 1 (e.g. limited action). Alternative 2 includes the components of the Limited Action Alternative for the Zone 3 and alluvial aquifers. All extracted water for this alternative would be directed to either an enhanced mister/pond evaporation system or column evaporater at an optimum achievable flow rate. The evaporation system used would be sized in order to provide sufficient evaporative capacity for maintenance of achievable pumping rates. The estimated cost of this alternative is $33 million with column evaporation and $20 million for enhanced mister/pond evaporation over a 10 year period; respective evaporation costs are $42 million and $26 million over a 60 year period.

Alternative 3 - Groundwater Pumping and Treatment in Upper Gallup Zone 3 Aquifer and the Southwest Alluvial Aquifer; Limited Action in the Upper Gallup Zone 1 Aquifer:

This alternative consists of containment and extraction of contaminants in the Upper Gallup Zone 3 aquifer utilizing at least 16 extraction wells appropriately placed to establish a hydraulic capture zone for the Zone 3 target area. This alternative would also require containment and extraction of contaminants in the southwest alluvial target area utilizing as many as 9 extraction wells appropriately placed to establish an effective hydraulic capture zone. As in Alternative 2, this alternative calls for institutional controls, monitoring, and maintenance of current pumping systems in the Upper Gallup Zone 1 aquifer (e.g. limited action). Components of the Limited Action Alternative also apply to the Zone 3 and the southwest alluvial target areas in this alternative. All extracted water for this alternative would be directed to either an enhanced mister/pond evaporation system or column evaporator at an optimum achievable flow rate. The evaporation system used would be sized in order to provide sufficient evaporative capacity for maintenance of achievable pumping rates. The estimated cost of this alternative is $29 million with column evaporation and $17 million for enhanced mister/pond evaporation over a 10 year period; respective evaporation costs are $38 million and $20 million over a 60 year period.

5.3 Evaluation of Alternatives

EPA has assessed the degree to which each remedial alternative meets the nine selection criteria; Table 7 summarizes this assessment. The following values were used to compare the remedy selection criteria:

++ Alternative would greatly exceed a selection criterion compared to other alternatives.

\+ Alternative would exceed a criterion compared to other alternatives.

0 Alternative can meet the selection criterion.

\- Special efforts will be necessary in the design of the remedy to meet the selection criterion.

-- Great difficulty would result in achieving a selection criterion as compared to other alternatives.

TABLE 7

COMPARISON OF REMEDIAL ALTERNATIVES

UNITED NUCLEAR CORPORATION
SUPERFUND SITE
(GROUNDWATER OPERABLE UNIT)

Alternative	Complies with ARARs	Reduces			Effectiveness		Implement-ability	Cost $ Million		Acceptance		Overall Protect of HH & E
		MOB	TOX	VOL	Short Term	Long Term		Initial	PW*	Community	State	
No Action	--	-	-	-	--	-	+	0	0	--	--	--
Limited Action	--	-	-	-	-	-	+	1	2	--	--	-
Alternative 1 with EM/PE**	0	0	+	0	-	0	-	24	36	0	-	0
Alternative 1 with CE***	0	0	+	0	-	0	-	26	46	0	--	0
Alternative 2 with EM/PE	0	0	0	0	-	0	0	15	22	0	-	0
Alternative 2 with CE	0	0	0	0	-	0	0	19	33	0	--	0
Alternative 3 with EM/PE	0	0	0	0	-	0	0	12	17	0	0	0
Alternative 3 with CE	0	0	0	0	-	0	0	16	29	0	--	0

* PW = Present worth based on 10-percent discount factor for 0-10 years.
** EM/PE = Enhanced mister/pond evaporation.
*** CE = Column evaporation.

The rationale for the ratings assigned in this table is as follows:

1. Complies with ARARs (i.e. meets or exceeds applicable, or relevant and appropriate Federal and State requirements). Appendix C discusses the compliance of each remedial alternative with all applicable or relevant and appropriate environmental laws. No Action and Limited Action are rated as "--" because groundwater restoration would occur at the natural rate of flushing such that chemical-specific ARARs may not be achieved for hundreds of years even after source control remedial action.

Alternatives 1, 2, and 3 are assigned "0" because removal of contaminated groundwater would occur resulting in attainment of chemical-specific ARARs for most contaminants. In the event that performance evaluations demonstrate that it is technically infeasible to achieve all chemical-specific ARARs in a reasonable time period, due to hydrogeologic conditions or other factors, then EPA may reconsider remedial levels for specific contaminants in question.

All groundwater extraction alternatives, including Limited Action, could be designed to meet location and action specific requirements. Both enhanced mister/pond evaporation and column evaporation systems can be designed to meet location and action specific requirements as well.

2. Reduces Toxicity, Mobility, and Volume

No Action and Limited Action are rated as "-" because they do not reduce toxicity, mobility, or volume to the extent expected from groundwater containment and extraction systems proposed for Alternatives 1, 2, and 3. Natural flushing action (No Action and Limited Action) of the alluvial and Upper Gallup aquifers would occur following source control remedial action thereby reducing groundwater contamination, however mobile contaminants would continue to migrate downgradient.

Alternatives 1, 2, and 3 are assigned "0" for mobility and volume because contaminated groundwater would be contained, extracted, and evaporated concentrating contaminants into a dewatered residue.

Alternative 1 is assigned "+" for toxicity since some margin of contaminant reduction would be achieved in Zone 1 of the Upper Gallup aquifer as compared with Alternatives 2 and 3.

3. Short Term Effectiveness

Alternatives 1, 2, and 3 are assigned a "-" because while actively reducing groundwater contamination levels within a given aquifer, remediation levels may not be reached within a short time frame due to physical characteristics of the aquifers.

No Action is rated as "--" since it does not offer the moderate reduction in contaminant concentrations, nor access and use restrictions, provided by the other alternatives.

Limited action is rated as "-" since it does provide access and groundwater use restrictions which would protect against public health risks from site contaminants.

4. Long Term Effectiveness

Alternatives 1, 2, and 3 would actively reduce groundwater contamination levels within each aquifer and are assigned a "0". Alternative 1 would reduce groundwater contamination in Zone 1 more than Alternatives 2 and 3, but only over an extremely long time period. Therefore Alternative 1 is not given a higher rating than Alternatives 2 or 3.

No action is assigned a "-" because the potential human health and environmental risks associated with continued downgradient migration of contaminants would not be adequately abated as discussed in Section 3.5.

Limited Action is assigned a "-" for the same reasons as for No Action.

5. Implementability

Alternatives 2 and 3 are equally feasible for the alluvial and Upper Gallup Zone 3 aquifers and are assigned a "0". Alternative 1 is assigned a "-" because the characteristics of the Upper Gallup Zone 1 aquifer limit the implementability and reliability of an extraction well network in significantly decreasing contaminant levels in this aquifer.

No Action and Limited Action are assigned a "+" because they can be easily implemented.

6. Cost

Table 8 lists the estimated costs for each remedial action alternative. This table includes capital, operation and maintenance, and 10 and 60 year present worth costs. These costs estimates were generated on the basis of a number of assumptions (see Appendix B) and are used to allow relative comparisons between remedial alternatives.

Limited Action is the least costly alternative apart from No Action. Costs for Alternatives 1, 2, and 3 are directly dependent upon the length of time required to effectively reduce groundwater contamination in a particular aquifer, and the type of evaporation treatment system used. Alternative 3 costs less than Alternative 2, both of which cost less than Alternative. 1. Enhanced mister/pond evaporation costs significantly less than column evaporation.

TABLE 8

SUMMARY OF COSTS ESTIMATES FOR ALTERNATIVES
UNITED NUCLEAR CORPORATION SITE
(Units in $ Million)

COSTS	No Action	Limited Action	Alt. 1 with EM/PE*	Alt. 1 with CE**	Alt. 2 with EM/PE	Alt. 2 with CE	Alt. 3 with EM/PE	Alt. 3 with CE
CAPITAL	0	1	24	26	15	19	12	16
Annual Operation Maintenance	0	0.3	2	3	1	2	1	2
Total Present Worth (0-10 years)	0	2	36	46	22	33	17	29
Total Present Worth (0-60 years)	0	3	43	58	26	42	20	38

* EM/PE = Enhanced mister/pond evaporation
** CE = Column evaporation

7. Community Acceptance

Most of those attending the public meeting demonstrated a preference for active groundwater restoration in conjunction with source control remedial action. Community representatives attending the meeting had no strong preferences between Alternatives 1, 2, and 3. One local resident favored Alternative 1 on the basis of elevated costs and therefore increasing potential employment opportunities in the area. In response to a question on the effectiveness of Alternative 3 in addressing tailings seepage contamination, EPA explained that this remedy would be performance based.

In the absence of strong preferences between Alternatives 1, 2, and 3, and in view of the duration of pumping that might be required, active groundwater restoration alternatives were assigned a "0". No Action and Limited Action were rated "--".

8. State Acceptance

The New Mexico Environmental Improvement Division (NMEID), the State regulatory agency for CERCLA sites, was briefed on remedial alternatives on July 27, 1988. The NMEID notified EPA by letter of its preference for Alternative 3 with enhanced mister/pond evaporation provided adequate protection of public health and the environment is achieved (See Appendix G). Alternative 3 with enhanced mister/pond evaporation (to be sequenced with source control remedial action) was therefore assigned a "0". Alternatives utilizing column evaporation were assigned a "--" due to cost considerations; a similar rating was assigned for No Action and Limited Action. Alternatives 1 and 2 using enhanced Mister/pond evaporation were assigned a "-" since Alternative 3 would provide comparable protection to public health and the environment at reduced costs.

9. Overall Protection of Human Health and the Environment

No Action is rated as "--" because it does not provide adequate protection from potential risks involved with continued downgradient migration of contaminants.

Limited Action is assigned a "-" since groundwater use restrictions would help prevent contact with contaminated groundwater in respective target areas.

Protection of public health and the environment can best be provided by containment and extraction of contaminated groundwater supplemented by groundwater-use restrictions. For this reason, Alternatives 1, 2, and 3 are assigned a "0". This rating holds for both enhanced mister/pond evaporation and column evaporation systems because both systems would be operated under controlled conditions within the byproduct materials disposal site and optimized during remedial design for adequate protection to public health and the environment.

6. SELECTED REMEDY

The selected remedy for the United Nuclear Corporation groundwater operable unit corresponds to Alternative 3 utilizing enhanced mister/pond evaporation. Figure 11 is a schematic diagram showing components of the selective remedy. EPA believes that this alternative best fulfills the statutory and selection criteria as compared to other solutions. Specific design details of the selected remedy will be developed during the remedial design process.

6.1 Description of Selected Remedy

The selected remedy for the United Nuclear groundwater operable unit consists of six components described below. The EPA remedy incorporates source control remedial action (surface reclamation, capping, and mill decommissioning) under Nuclear Regulatory Commission's licensing requirements as specified in the Memorandum of Understanding between EPA and NRC (Appendix I).

1. Implementation of a monitoring program to detect any increases in the areal extent, or concentration of groundwater contamination outside the tailings disposal area.

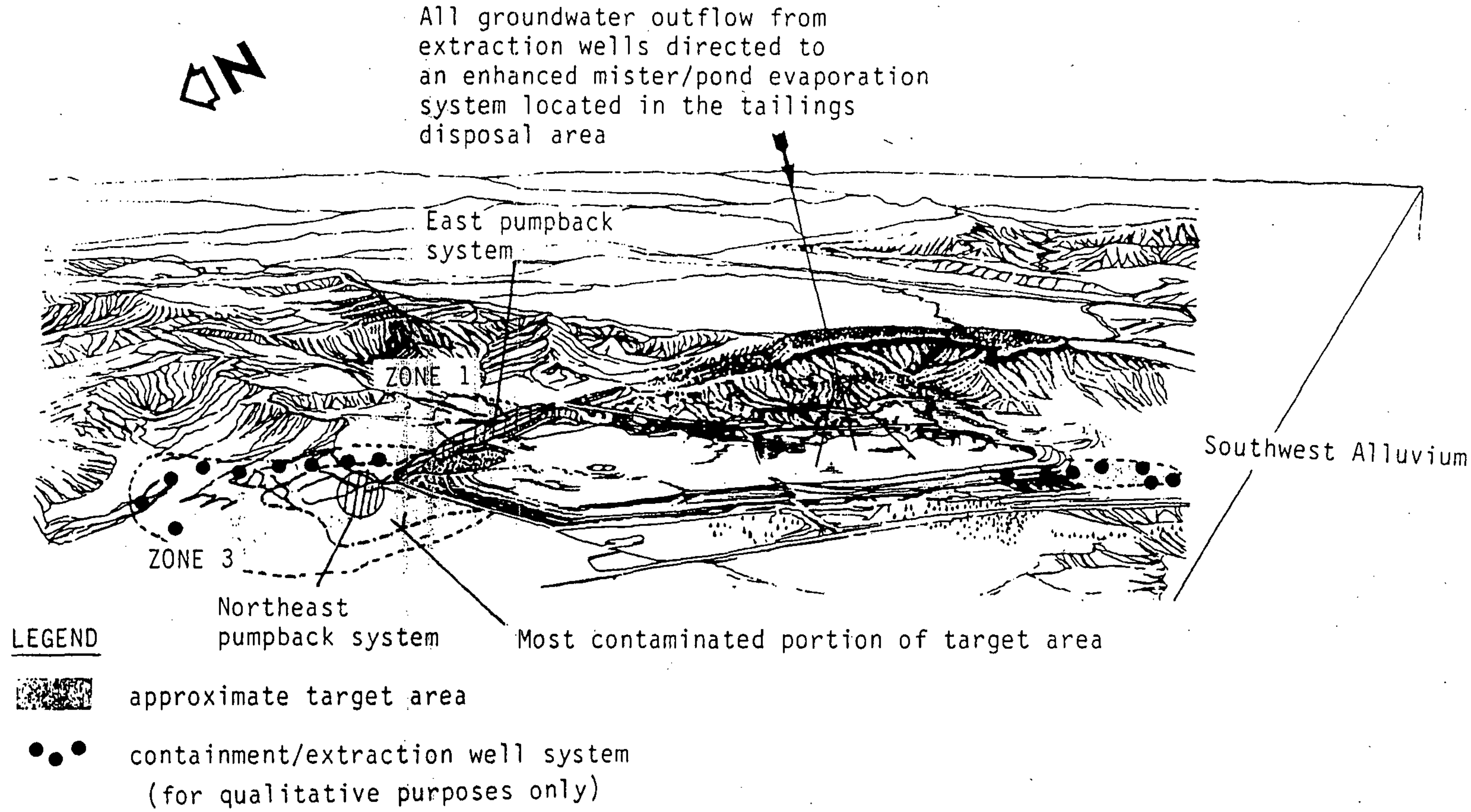
To ensure that contamination does not exist beyond cleanup target areas developed in the Feasibility Study, a groundwater monitoring program will be implemented during remedial design.

The monitoring program will consist of a groundwater monitoring network comprised of a series of wells to measure water levels and water quality. The monitoring points shall be located upgradient, downgradient, and cross-gradient of seepage plumes in order to further define the extent of contamination in Zones 1 and 3 of the Upper Gallup Sandstone, and the southwest alluvium. Results of monitoring will be evaluated against contaminant-specific ARARs or background to adjust target area to include any downgradient areas impacted by tailings seepage. The extent of contamination in each aquifer, concentration of contaminants in each well, and observed saturated thickness shall be used to identify the most effective pumping well locations.

2. Operation of existing seepage extraction systems in the Upper Gallup aquifers.

Because seepage from tailings has migrated into underlying Zone 1 and Zone 3 sandstones, the selected remedy includes operation of the East pump-back wells in Zone 1 and the Northeast pump-back wells in Zone 3 until adequate dissipation of the tailings seepage mound has been achieved. Operation of these two pump-back systems will be integrated with active seepage remediation that may be required by the NRC inside the tailings disposal area, and with active seepage collection as required by EPA outside the disposal area.

Figure 11: Schematic showing components of selected remedy for the UNC Groundwater Operable Unit (to be implemented in sequence with NRC-directed source control actions)



The fate of the two northern alluvial target area is addressed in Section 6.3 under reasons other alternatives were not selected.

3. Containment and removal of contaminated groundwater in Zone 3 of the Upper Gallup Sandstone utilizing existing and additional wells.

Active remediation of Zone 3 outside the tailings disposal site will be performed in areas contaminated by tailings seepage. The extent of the tailings seepage plume will be determined during remedial design, prior to extraction well installation, and will be delineated on the basis of groundwater flow directions in the aquifer in conjunction with identification of the margin or amount by which standards are exceeded (including background) for hazardous constituents in groundwater.

Seepage collection in Zone 3 will be designed to create a hydraulic barrier to further migration of contamination. Final well locations will be guided by observed saturated thicknesses in Zone 3, and the extent of the tailings seepage plume as defined above. Data obtained during performance monitoring of the extraction system should be used to determine the optimum rate of pumping, and extent and duration of pumping actually required.

4. Containment and removal of contaminated groundwater in the southwest alluvium utilizing existing and additional wells.

Active remediation in the southwest alluvium will be performed in areas contaminated by tailings seepage. The extent of the tailings seepage plume outside the tailings disposal area will be determined prior to extraction well installation. Delineation of alluvial contamination will be based on groundwater flow directions in the aquifer in conjunction with identification of the margin or amount by which standards are exceeded (including background) for hazardous constituents in groundwater.

Seepage collection in the southwest alluvium will be designed to create a hydraulic barrier to further migration of contamination while the source is being remediated. The number of extraction wells required, and their final locations, will be determined from the observed saturated thicknesses in the alluvium, and the extent of the tailings seepage plume as defined above. If existing monitoring wells are likely to intercept tailings seepage, then contingency plans should be developed to pump from these wells. Data obtained during performance monitoring of the extraction system should be used to determine the optimum rate of pumping, and extent and duration of pumping actually required.

5. Evaporation of groundwater removed from aquifers using evaporation ponds supplemented with mist or spray systems to enhance the rate of evaporation.

Tailings seepage extracted in pumping wells will be directed to an evaporation disposal system consisting of lined evaporation ponds and mist or spray evaporation systems. Inflow to the evaporation disposal system will be from current and required extraction wells outside and/or within the tailings disposal area. The evaporation pond system, coupled with mist and spray evaporation systems, will be sized and operated in order to provide sufficient evaporative capacity for maintenance of a reasonable operational water balance. Optimization of the evaporation disposal system should occur during the first several months of operation, and shall include pilot testing to determine the optimum pH for water evaporation.

6. Implementation of a performance monitoring and evaluation program to determine water level and contaminant reductions in each aquifer, and the extent and duration of pumping actually required outside the tailings disposal area.

In order to evaluate predicted reductions in contaminant concentrations with time in a particular aquifer, and declines in pumping rates, a performance monitoring program shall be implemented. Monitoring well locations shall be chosen at critical points to allow effectiveness evaluations of hydraulic capture zones in collecting tailings seepage.

Performance monitoring during active seepage remediation will allow a determination to be made regarding the adequacy of groundwater remedial actions outside the tailings disposal area at the United Nuclear Corporation site. Monitoring data will also be used to aid in making any modifications in remedial action outside the tailings disposal area, in order to meet CERCLA requirements.

These elements comprise the selected remedy for the groundwater operable unit at the United Nuclear Churchrock site. As previously mentioned the Nuclear Regulatory Commission has directed United Nuclear Corporation to submit a reclamation plan addressing source control and surface reclamation measures at the site under the company's Source Material License. Upon approval of a final reclamation plan, both groundwater and source control/surface reclamation remedial actions will be integrated and coordinated to achieve comprehensive reclamation and remediation of the site.

6.2 Cost of Selected Remedy

The estimated capital cost of the selected remedy is $12 million and the present-worth estimate using a 10 percent discount rate is $17 million over a 10-year period. This is approximate and made without detailed engineering data. The actual final cost of the selected remedy will depend on a number of factors which include:

- material and labor costs, extraction well development, competitive market, conditions, and others direct and indirect costs related to the startup of remedial activity;

- o achievable flow rates from extraction wells, and therefore, the size of the enhanced mister/pond evaporation system necessary to accommodate these flows;

- o changes in operation and maintenance costs related to well system performance;

- o changes in contaminant concentrations and pumping rates over time resulting from groundwater extraction and source control activities which may constrain the required duration of pumping; and

- o changes in parameters such as cleanup criterion, should significant additional information on background levels of constituents result in any significant adjustments of such parameters.

6.3 Statutory Determinations

Section 121 of SARA requires the selected remedy to be protective of human health and the environment, be cost effective, use permanent solutions and alternative treatment or resource recovery technologies to the maximum extent possible, be consistent with other environmental laws, and have a preference for treatment which significantly reduces the toxicity, volume, or mobility of the hazardous substances as a principle element. EPA believes that the selected remedy best fulfills the statutory and selection criteria as compared to the other solutions evaluated herein.

1. Protective of Human Health and Environment

The selected remedy, by containing and removing tailings seepage, will substantially reduce groundwater contamination in aquifers outside the byproduct materials disposal site. Contaminant concentration in impacted aquifers will be reduced to ARARs to the maximum extent practicable. The selected remedy, in conjunction with NRC-directed source control remedial action should effectively mitigate and minimize potential threats to human health and the environment. Implementation of the selected remedy will not cause unacceptable short-term risks or crossmedia impacts.

2. Cost Effective

The selected remedy offers the lowest cost of all the treatment alternatives. Compared to other treatments alternatives, it is equally effective in removing contaminants in the alluvial and Upper Gallup Zone 3 aquifers, and is equally implementable. As previously mentioned, the characteristics of the Upper Gallup Zone 1 aquifer limit the implementability and reliability of an extraction well network (e.g. Alternative 1) in significantly decreasing contaminant levels in this aquifer.

3. Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy satisfies the statutory preference for treatment as a principle element in reducing the volume, toxicity, and mobility of contaminants for the groundwater operable unit. The selected remedy uses an enhanced mister/pond evaporation system to remove all contaminants from groundwater. The solid residue generated will be contained within the tailings disposal area and capped along with the tailings piles as part of the NRC-directed source control remedial action.

The selected remedy utilizes permanent solutions to the maximum extent practicable. The principle element of the remedy is containment and removal of groundwater contaminated by tailings seepage. This will be accomplished by creating hydraulic barriers or capture zones designed to ensure that the remedy is effective. Future mass loading from the tailings will be minimized under NRC requirements.

4. Consistent with Other Environmental Laws

The selected remedy should result in attainment of legally applicable and relevant or appropriate requirements or ARARs. Appendix C lists all the ARARs which were initially identified for this operable unit in the Feasibility Study. The specific ARARs for the selected remedy are described below:

National Primary Drinking Water Standards:

Groundwater will attain final Maximum Contaminant Levels (MCLs), where these levels are above background, to the maximum extent practicable. Table 2 listed the MCLs for contaminants found in seepage plumes outside the tailings disposal area.

New Mexico Water Quality Act (NMWQA) Standards:

Groundwater will attain NMWQA standards, where these levels are above background, to the maximum extent practicable. Table 2 listed the NMWQA standards for contaminants found in seepage plumes outside the tailings disposal area.

RCRA Standards Applicable to Background:

Groundwater will attain background levels if above MCLs or NMWQA standards to the maximum extent practicable. Table 2 listed background levels for several contaminants found in seepage plumes outside the tailings disposal area.

Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40 CFR Part 192) as adopted by 10 CFR 40, Appendix A

Groundwater concentration limits set herein are equivalent to MCLs and will be attained to the maximum extent practicable where above background.

Maximum Contaminant Level Goals (MCLGs):

This is not an ARAR, but is another factor to be considered. Groundwater will attain the MCLGs for these contaminants to the maximum extent practicable where the MCLs or NMWQA standards have yet to be promulgated (if above background levels).

Health-Based Criteria:

This is not an ARAR but is another factor to consider for inorganics detected at the site without federal MCLs or NMWQA Standards. Groundwater should attain health-based standards to the maximum extent practicable where above background levels.

Executive Order on Flood Plains:

Solid residue resulting from groundwater treatment will be appropriately capped with tailings to prevent washout.

National Archaeological and Historical Preservation Act:

Remedial actions at the site will not disturb archaeological sites on Indian lands.

Other alternatives were not selected for the following reasons:

No Action:

This alternative does not address potential threats to human health and the environment.

Limited Action:

The long-term effectiveness of this alternative is not reliable in reducing potential threats to human health and the environment. Contaminated groundwater would continue to migrate downgradient without significant reductions in the toxicity, mobility, or volume offered by Alternatives 1, 2, or 3.

Alternative 1:

This alternative is protective of human health and the environment, but is high in cost and does not offer a significant reduction of contamination in the Upper Gallup Zone 1 aquifer as compared to Alternatives 2 or 3 over a reasonable time period. Furthermore, the two northern alluvial target areas will be mitigated by other actions expected to take place under Alternative 3. More specifically, the northernmost alluvial target area (see Figure 8) was determined to be related to a separate source during the Remedial Investigation. During the Feasibility Study EPA learned that this area was utilized by Quivira Mining Company for temporary storage of proto-ore and drill cuttings, drying of pond sediments from mine water treatment operations, and equipment washing, and would be mitigated under a separate reclamation plan. This proposed plan titled "Abandonment and Reclamation Plan: Churchrock I, IE and II mines, Navajo Nation Lease 14-20-20603-9988" is date January 1987 and is currently under review by the Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), and Navajo Nation Division of Resources (NNDR). The second northern alluvial target area is located adjacent to the north cell (Figure 8). This target area overlaps portions of the Upper Gallup Zone 3 aquifer and is expected to be mitigated in part by the Zone 3 hydraulic capture zone, and in part by downgradient containment and extraction wells which would be located in the southwest alluvium in Alternative 3.

Alternative 2:

This alternative is protective of human health and the environment, is more feasible than Alternative 1, but costs more than the selected remedy. Furthermore, the two northern alluvial target areas (Figure 8) will be mitigated by other actions expected to occur under Alternative 3. These activities include reclamation by Quivira Mining Company of the northernmost alluvial target area, and partial hydraulic capture of the second alluvial target area by other seepage collections systems in Alternative 3 as discussed above.

Column Evaporation:

This physical/chemical treatment system provides adequate treatment of contaminated groundwater and would be protective of public health and the environment. However, enhanced mister/pond evaporation will provide adequate treatment of contaminated groundwater at a significantly reduced cost. On this basis, and because no discharge is required, enhanced mister/pond evaporation is preferred over column evaporation pending successful demonstration during remedial design.

6.4 Future Actions

EPA has developed the following schedule for implementation of the remedy:

Action	Date
Begin negotiations for responsible party design and implementation of remedy	October 1988
Review monitoring data and status of NRC-directed reclamation activity	October - December 1988
Complete negotiations for remedial design and remedial action; consent decree	February 1989

Conduct remedial design as appropriate in conjunction with NRC-directed reclamation activity	February 1989 - July 1989
Begin remedial actions as appropriate in conjunction with NRC-directed reclamation activity	July - October 1989
Begin annual review of effectiveness of remedial actions	October 1989

REFERENCES

U.S. Environmental Protection Agency, August 1988. Remedial Investigation United Nuclear Corporation Churchrock Site, Volumes I and II.

U.S. Environmental Protection Agency, August 1988. United Nuclear Corporation Churchrock Site Operable Unit Feasibility Study Gallup, New Mexico.

Appendix A

HYDROGEOLOGIC IMPACT OF SELECTED REMEDY

Appendix A

HYDROLOGIC IMPACT OF SELECTED REMEDY

This section briefly discusses hydrologic impacts of the selected remedy as predicted by groundwater modeling in the Feasibility Study. Also discussed are uncertainties associated with model predictions of aquifer restoration rates and contingencies to be considered depending on the effectiveness of remedial actions as determined from regular performance evaluations.

UNCERTAINTIES IN SIMULATED REMEDIAL ALTERNATIVES

The intent of modeling in the Feasibility Study was to compare the relative effectiveness of groundwater containment and extraction alternatives in reducing contaminant concentrations over time in target areas. Modeling was not intended to quantitatively predict restoration rates. Uncertainties in model input parameters, and simplifying assumptions associated with the selection of model grids and boundary conditions, for example, limit quantitative predictions of groundwater restoration rates.

A number of assumptions made in simulations are mentioned in the Feasibility Study and summarized here. Starting model concentrations used in simulated remedial alternatives were based on 1985 Remedial Investigation data. Simulations were run assuming that the contaminant source, the tailings pile, was totally removed. Remediation times were bracketed for retarded and nonretarted contaminants. In addition, the simulated remedial alternatives were only conducted within areas of known contamination. Because such assumptions result in a degree of modeling uncertainty, the actual time required to reach a particular cleanup level will be verified during a performance monitoring period.

CONTINGENCIES FOR SELECTED REMEDY

The goal of the selected remedy is to restore groundwater outside the tailings disposal area to concentrations dictated by Federal and State standards, or background, to the maximum extent practicable and to the extent necessary to adequently protect public health and the environment. A program of regular performance evaluations, required as part of the selected remedy, will provide a measure of how well this remedial alternative meets modelling and design expectations. The performance evaluation program may indicate that the response objectives have been met and the remedy is complete. However, operational results may demonstrate that it is technically impractical to achieve all cleanup levels in a reasonable time period, and a waiver to meeting certain contaminant-specific applicable or relevant and appropriate requirements (ARARs) may require re-evaluation as a result. Operational results may also demonstrate significant declines in pumping rates with time due to insufficient natural recharge of aquifers. The probability of significant reductions in the saturated thickness of aquifers at the site must be considered during performance evaluations since much of the water underlying the tailings disposal area is the result of mine water and tailings discharge, both of which no longer occur. In the event that saturated thicknesses cease to support pumping, remedial activity would be discontinued or adjusted to appropriate levels.

Appendix B

COST ESTIMATES

Appendix B

COST ESTIMATES

Cost estimates presented in the Feasibility Study and in Section 5.3 of the Record of Decision for remedial action alternatives encompass all currently identified direct and indirect capital and postconstruction operation and maintenance (O & M) costs. The estimates were made without detailed engineering data, and are normally expected to be accurate within plus 50 percent to minus 30 percent. The actual final cost of each remedy will depend on the material and labor costs, site conditions, productivity, competitive market conditions, final project scope, final project schedule, the firm selected for final project design, and other variables. Any significant changes in parameters such as the contaminant concentrations, extraction well location and flow rate, facility siting, cleanup criterion, or contingencies for an alternative may also affect the estimated costs beyond the above accuracy range.

The actual cost of the selected remedy will depend on the factors listed above and on at least two other related factors. The first factor concerns the size of the enhanced mister/pond evaporation system necessary to dispose of extracted groundwater. The evaporation system for the selected remedy was sized for 229 gpm in the Feasibility Study. The final size of the evaporation disposal system will ultimately depend on the volume of water removed from extraction well systems outside and/or within the tailings disposal area during remediation. These questions will be answered during remedial design. The second factor directly affecting costs is related to the actual duration of pumping and evaporation required to complete remedial activity. This time period will be determined from performance evaluations as discussed in Appendix A.

Appendix C

EVALUATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Appendix C

EVALUATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

INTRODUCTION

Section 121(d)(2) of CERCLA as amended in 1986 by SARA requires that the selected remedy attain certain requirements adopted under Federal and State environmental laws. These requirements are called "ARARs" or "applicable or relevant and appropriate requirements".

The Feasibility Study for the United Nuclear Corporation Groundwater Operable Unit included a review of these laws, and identified those which could be ARARs based on the types of wastes at the site, the types of remedial actions contemplated, and the site location. This appendix lists all the laws which the Feasibility Study identified as potential ARARs for this site, and indicates their relationship to the selected remedy.

CONTAMINANT-SPECIFIC ARARS

The contaminant-specific ARARs identified for the site relate to protection of potential and existing drinking water supplies. The major Federal and New Mexico regulations that have been identified as contaminant-specific ARARs are the Federal Safe Drinking Water Act (SDWA) and the New Mexico Water Quality Act (NMWQA) standards. Where natural background water quality exceeds these standards, then an acceptable background value becomes the cleanup criteria for a particular contaminant.

Federal SDWA Maximum Contaminant Levels

SDWA maximum contaminant levels (MCLs) have been established as enforceable standards for public drinking water systems. An MCL is required to be set as close as is feasible to its respective maximum contaminant level goal (MCLG), taking into consideration the best available technology and the economic feasibility of removing the contaminant from the water supply. EPA's interim guidance on compliance with ARARs states that MCLs are applicable at the tap where the water will be provided directly to 25 or more people or will be supplied to 15 or more service connections. Furthermore, the guidance states that in other cases where groundwater may be used as a drinking water source, MCLs are generally relevant and appropriate. For those contaminants identified at the UNC site, MCLs have been set for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, nitrate, combined Ra-226 and Ra-228, and gross alpha. SDWA MCLs are presented in Table 1 along with other standards.

Table 1
CONTAMINANT-SPECIFIC GROUNDWATER ARARs

Contaminant	Concentration mg/L[a]	Source
Aluminum	5.0	NMWQA
Antimony	0.014	Health-based
Arsenic	0.05	MCL
Barium	1.0	MCL, NMWQA
Beryllium	0.017	Health-based
Cadmium	0.01	MCL, NMWQA
Chromium	0.05	MCL, NMWQA
Cobalt	0.05	NMWQA
Copper	1.0	NMWQA
Iron	5.5	Background Level
Lead	0.05	MCL, NMWQA
Manganese	2.6	Background Level
Mercury	0.002	MCL, NMWQA
Molybdenum	1.0	NMWQA
Nickel	0.2	NMWQA
Selenium	0.01	MCL
Silver	0.05	MCL, NMWQA
Thallium	0.014	Health-based
Vanadium	0.7	Health-based
Zinc	10.0	NMWQA
Chloride	250.0	NMWQA
Sulfate	2,160.0	Background Level
Nitrate	30.0[c]	Background Level
TDS	3,170.0	Background Level
Radium-226 and -228	5 pCi/L	MCL
Uranium-238	5.0 (1,645 pCi/L)	NMWQA
Thorium-230[b]	15 pCi/L	MCL
Gross Alpha	15 pCi/L	MCL

[a] mg/L except as noted.
[b] Based on 15 pCI/L gross alpha.
[c] Preoperational data of 30 mg/L appears reasonable for background. Additional investigation and determination of the natural NO_3-N sources is necessary since NO_3-N is a health-related standard.

NMWQA Standards

The NMWQA has 47 numerical groundwater standards that apply statewide to groundwater having a total dissolved solids (TDS) concentration of 10,000 mg/l or less. These standards are set forth in Section 3-101 of the NMWQA regulations entitled. "Regulations for Discharges Onto or Below the Surface of the Ground." These standards are grouped into three categories: human health, other standards for domestic water supply, and irrigational use. The purpose of these standards is to protect present and potential use of groundwater. These standards were originally adopted to permit the discharges of effluent or leachate onto or below the surface of the ground. These standards are also the criteria that have been applied statewide as the reclamation criteria in groundwater cleanups. Therefore, these standards apply to both the cleanup of the three aquifers and to any discharges of the treated groundwater. NMWQA standards which apply to the site are presented in Table 1.

Section 1-101.UU of the NMWQA states that if more than one water contaminant affecting human health is present, the acceptable levels for listed toxic contaminants will not exceed an additive excess lifetime cancer risk of 1 in 100,000. Because none of these listed toxic contaminants have been detected at the site, this portion of the NMWQA does not apply to the cleanup criteria.

Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40 CFR Part 192) as adopted by 10 CFR 40, Appendix A

40 CFR Part 192 Subpart D, "Standards for Management of Uranium Byproduct Material Pursuant to Section 84 of the Atomic Energy Act of 1954, as Amended," sets groundwater limits for combined Ra-226 and Ra-228 and for gross alpha (excluding radon and uranium). These concentration limits are equivalent to SDWA MCLs and are presented in Table 1. These standards have been adopted in the Uranium Mill Tailings Regulations promulgated by the NRC at 10 CFR 40, Appendix A, 52 Fed. Reg. 43553.

Background

40 CFR Part 264 sets forth standards for owners and operators of hazardous waste treatment, storage, and disposal facilities. Many of these standards relating to groundwater contamination were adopted by reference in the Uranium Mill Tailings Regulations in 40 CFR 192. Part 264.94 addresses concentration limits to be used for groundwater protection at these facilities. Concentration limits can be based on: background levels, SDWA MCLs, or Alternate Concentration Limits (ACLs). As previously discussed, background levels for a variety of contaminants have been established for the UNC site based on available information. These levels are presented in Table 1 for iron, manganese, sulfate, nitrate, and total dissolved solids, and were set by EPA and the State of New Mexico. Levels were originally determined from regional sampling data in for the alluvial and Gallup aquifers.

Background values from limited pre-milling monitoring data originally submitted by UNC to the State of New Mexico were evaluated in the context of regional background water quality for the alluvial and Upper Gallup Sandstone aquifers during the Feasibility Study. Experimental studies undertaken by UNC to simulate possible changes in water quality resulting from mine water flow through the alluvium were seriously considered in setting cleanup criteria. To date, however, limited data are available which can be quantaitatively applied to the determination of background concentrations in groundwater apart from regional sampling upgradient and downgradient of the site, thus precluding significant changes in the estimation of background levels of contaminants. Table 2 summarizes differences in proposed cleanup criteria based on comparisons of UNC and EPA background judgements at this time. As the Table indicates, EPA has proposed more stringent cleanup criteria for arsenic, cadmium, mercury, selenium, sulfate, nitrate-N, total dissolved solids, Ra-226/228, and Th-230. Given the geochemical complexities associated with determining the potential contribution of mine water recharge to background conditions at the site, EPA will continue to evaluate the background level question. Should additional information become available that would significantly alter the estimation of background levels, including data that may be submitted to the NRC under their licensing requirements, such information would be evaluated in terms of its impact on remedial actions in each aquifer.

Health-Based Criteria

Some inorganics detected at the site do not have federal MCLs or State of New Mexico standards. For these compounds, reference doses (RFDs), if developed, have been used to estimate groundwater concentrations that would result in no observable adverse health effects. These concentrations are estimated from the RfD assuming a 70-kg individual who consumes 2 liters of water per day. The resulting concentrations for antimony, beryllium, thallium, and vanadium are presented in Table 1.

Federal Ambient Water Quality Criteria

Ambient Water Quality Criteria (AWQC) developed under the CWA define the concentrations of pollutants in water that will ensure water quality adequate to support a specified use. AWQC are nonenforceable criteria and are based solely on the relationship between concentrations of pollutants and their effects on the environment and human health. These criteria do not reflect considerations of economic or technological feasibility. AWQA are used as the basis for state water quality standards. The water quality criteria were published by EPA in 1986 and updates have been announced in the Federal Register. These concentration limits are covered by other applicable standards in Table 1.

Federal Health Advisories

Federal health advisories are the EPA Office of Drinking Water's current assessment of concentrations of contaminants in drinking water at which

Table 2

COMPARISON OF EPA AND UNC-PROPOSED STANDARDS

Constituent	EPA[1] Contaminant-specific ARAR	UNC[1,2] Proposed Background	UNC Maximum[1,3] Pre-operational Data
Al	5.0	5.0	86
Sb	0.014	-	-
As*	0.05	0.1	0.02
Ba	1.0	1.0	0.99
Be	0.017	-	-
Cd*	0.01	0.12	0.12
Cr	0.05	0.05	0.02
Co	0.05	0.05	0.01
Cu	1.0	1.0	0.44
Fe	5.5	5.5	5.6
Pb	0.05	0.05	0.03
Mn	2.6	2.5	2.6
Hg*	0.002	0.004	0.004
Mo	1.0	1.0	-
Ni	0.2	0.2	0.04
Se*	0.01	0.08	0.08
Ag	0.05	0.05	-
Tl	0.014	-	-
V	0.7	-	-
Zn	10.0	10.0	0.49
Cl	250.0	85	86
SO_4*	2160.0	2800.0	1731
NO_3-N*	30.0	290.0	174
TDS*	3170.0	5000.0	4337
Ra-226 and -228*	5pCi/l	33pCi/l	20pCi/l
U-238	5.0	-	-
Th-230*	15pCi/l	240pCi/l	36pCi/l
Gross alpha	15pCi/l	-	-

1 Values in mg/l unless noted otherwise

2 Proposed background levels from "Geochemical Background Investigation" prepared by Billings & Associates, Inc. for United Nuclear Corporation in August 1986

3 Concentration levels reported as maximum value observed during 4 sampling rounds of seven GW-wells. Dates: 2/77, 3/77, 4/77, and 7/77. From "Geochemical Background Investigation" prepared by Billings & Associates, Inc. for United Nuclear Corporation August 1986.

* Indicates a difference between values in columns 1 and 2

- Background not proposed

adverse health effects would not be anticipated to occur. While not an ARAR, health advisories are a factor to be considered for those contaminants where the MCLs have yet to be promulgated.

Maximum Contaminant Level Goals (MCLGs)

MCLGs are nonenforceable drinking water quality goals set at levels of no known or anticipated adverse health effects, with an adequate margin of safety. While not an ARAR, MCGLs are a factor to be considered for those contaminants where the MCLs have yet to be promulgated.

LOCATION-SPECIFIC ARARS

Physical characteristics of the site may influence the type and location of remedial responses considered for this site. The site is within the 100-year flood plain of Pipeline Canyon. Superfund remedial actions must meet the substantive requirements of the federal Floodplain Management Executive Order 11988. These requirements specify assessment of flood hazards for any remedial measure that occurs in the flood plain. Further, the development of remedial actions will consider the presence of archaeological sites on adjacent Indian land, in accordance with the National Archaeological and Historic Preservation Act.

ACTION-SPECIFIC ARARS

Action-specific ARARs are associated with the implementation of remedial measures. These ARARs are identified below.

Federal Action-Specific ARARs

Actions that involve treatment or storage of contaminated groundwater are to take place within the tailings disposal area currently defined by the boundaries of Section 2. These actions are governed by NRC requirements.

State Action-Specific ARARs

The primary action-specific ARARs affecting remedial actions at the UNC site are the New Mexico Water Quality Regulations 3-103.A, B, and C. These regulations set quantitative discharge standards for 47 contaminants. These standards are ARARs for both discharge to Pipeline Canyon and reinjection to the groundwater. However, the groundwater extraction and enhanced mister/pond evaporation actions that accompany the selected remedy do not involve discharge or reinjection. The enhanced mister/pond evaporation system will be designed and operated within the tailing disposal as currently defined by the boundaries of Section 2. For these reasons, there are no State action-specific ARARs anticipated for the selected remedy.

Appendix D

AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY (ATSDR)/CENTER FOR DISEASE CONTROL (CDC) EVALUATION

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances
and Disease Registry
Atlanta GA 30333

MEMORANDUM

Date : September 28, 1988

To : William D. Rowe, Jr., Ph.D.
Environmental Scientist, EPA VI

From : Regional Representative
ATSDR/EPA VI

Through: Senior Regional Representative
ATSDR/EPA VI

Subject: United Nuclear Corporation Churchrock NLP Site

A copy of a rough draft of the Health Assessment being prepared by ATSDR on the subject site has been provided for your review. The draft recommendations in the document relate to:

1. completion of the site surveys and remediation of the site,

2. protection of the remedial workers during removal activities,

3. documentation of the nature and extent of contamination in various environmental media and further characterization of the extent of ground water contamination,

4. continued monitoring of on- and off-site wells,

5. further defining of the potential for food chain contamination, and

6. continued restriction of access to the site.

While there may be some changes in the final version, these reflect the current areas of concern.

It is anticipated that the planned EPA and NRC reclamation activities should serve to minimize potential exposure to contaminants from the surface media and ground water associated with the site.

George L. Pettigrew

George L. Pettigrew

Appendix F

U.S. NUCLEAR REGULATORY COMMISSION CORRESPONDENCE

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
URANIUM RECOVERY FIELD OFFICE
BOX 25325
DENVER, COLORADO 80225

SEP 27 1988

URFO:GRK
Docket No. 40-8907

USEPA, Region VI
ATTN: Allyn M. Davis, Director
Hazardous Waste Management
Division, (6H)
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202

Dear Mr. Davis:

Our office is in receipt of your draft Record of Decision (ROD) for the United Nuclear Corporation Groundwater Operable Unit, submitted by cover letter dated September 16, 1988. My staff has reviewed this document and it is our conclusion that your proposed recommendation of active tailings seepage collection in both the Upper Gallup aquifer (Zone 3 and limited action in Zone 1) and the Southwest alluvial aquifer is compatible with a ground-water restoration program we expect to achieve by implementation of the requirements of 10 CFR Part 40, Appendix A. Similarly, we agree with your conclusion that directing the recovered seepage waters to an evaporation system consisting of water storage and a mister system utilizes a proven and economical technology.

As I am sure you are aware, my staff required that United Nuclear Corporation collect appropriate data to establish ground-water protection standards. Considering this situation, I have had my staff review your recommended ground-water cleanup criteria for application outside of the byproduct disposal area as shown in Table 2 of the ROD document. We believe that your recommended cleanup criteria are generally within a range that is defensible, based upon historical data. However, we propose that you raise the value for nitrate concentrations in the southwest alluvium to a level of 30 mg/l to be applied outside the disposal area. We feel that historical records from several ground-water monitoring wells as well as independent studies by United Nuclear Corporation support the 30 mg/l nitrate value. We understand that this value is in excess of the 10 mg/l concentration you have proposed; however, for the reasons cited above, we feel that United Nuclear Corporation can reasonably argue for this value as representing a pre-milling background.

We are pleased to have the opportunity to comment on the draft ROD.

Sincerely,

R. Dale Smith, Director
Uranium Recovery Field Office
Region IV

Appendix G

STATE OF NEW MEXICO CORRESPONDENCE

NEW MEXICO
HEALTH AND ENVIRONMENT
DEPARTMENT

Post Office Box 968
Santa Fe, New Mexico 87504-0968

GARREY CARRUTHERS
Governor

CARLA L. MUTH
Secretary

MICHAEL J. BURKHART
Deputy Secretary

September 29, 1988

Allyn M. Davis, Director
Hazardous Waste Management Division
USEPA
1445 Ross Avenue
Dallas, Texas 75202-2733

RE: Proposed Remedy for UNC

Dear Mr. Davis:

EID has reviewed the draft ROD for the United Nuclear Corporation Groundwater Operable Unit. EID concurs with remedial alternative #3 as proposed by EPA.

Our staffs have consulted closely over the last two weeks in order to reach agreement on outstanding issues such as ARARs. New Mexico Water Quality Control Commission Regulations are applicable cleanup criteria. These standards specify numerical limits which apply unless background concentrations exceed the numerical standards, in which case background concentrations become the standards. As a result of our discussions, ARARs for a limited number of constituents have been set based on reasonable and rational estimates of pre-operational, background conditions. These estimates were derived from thorough consideration of regional and local data, as well as site-specific data, where available.

EID finds Table 2 of the FS to be an acceptable representation of ARARs for the site. Our conversations have specifically addressed the cleanup criterion for nitrate nitrogen (NO_3-N). Because nitrate poses a human health threat, EID prefers more conclusive documentation of background conditions before accepting a higher value. Should EPA proceed to assign a value greater than 10mg/l NO_3-N before such documentation is available, EID concurrence is provided with the understanding that: 1) additional research will be conducted to determine true background conditions, and 2) the ARAR will subsequently be adjusted as appropriate, downward if necessary.

EID acknowledges reasonable doubt that 10 mg/l is appropriate. Therefore, regardless of the specific cleanup criterion selected for NO_3-N at this time, additional investigation into naturally occuring N at the site should be performed. We also note that the specific value assigned as the NO_3-N ARAR does not significantly affect the cleanup target area. Therefore, additional research into background conditions will not delay design and implementation of the remedy. Planning of the investigation should be a cooperative effort between all parties. This will maximize acceptance of the results by all parties.

Sincerely,

Richard Mitzelfelt
Director

RM:SC:to

Appendix H

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

INTRODUCTION

This Responsiveness Summary has been prepared to provide written responses to comments submitted regarding the proposed plan of action at the United Nuclear Corporation (UNC) Superfund site. The summary is divided into two sections:

Section I: Background of Community Involvement and Concerns. This section provides a brief history of community interest and concerns raised during the remedial planning activities at the UNC site.

Section II: Summary of Major Comments Received. The comments (both oral and written) are summarized and EPA's responses are provided.

SECTION I
BACKGROUND OF COMMUNITY INVOLVEMENT

Uranium mines and mills in New Mexico have received considerable attention from local and national media during the past years. Citizens are generally concerned for their health and safety in areas where radioactive elements are involved, even in low concentrations.

Since the UNC site is located in a very sparsely populated area of the state, there are no population centers or housing developments near the site. The nearest residents are a Navajo allottee and his wife.

As early as 1979, the Centers for Disease Control convened public meetings after the tailings spill to assess citizen concern and conduct health tests on humans and livestock. After the site was included on the National Priorities List, EPA representatives interviewed local officials and area residents to determine issues and concerns.. At that time, the major concern was possible contamination of nearby private wells.

In April 1987, EPA held a public meeting to discuss the status of the on-going investigations at the site and to clarify the roles and responsibilities of EPA and the Nuclear Regulatory Commission. A Navajo translater was provided and the meeting was well-attended. Several citizens were concerned about area wells and EPA sampled the domestic/livestock wells within a 4-mile radius of the site.

On July 18, 1988, EPA announced an open house at the Red Rock State Park. The purpose of the open house was to summarize the results of the remedial investigation and reiterate the responsibilities of EPA and NRC. The open house was held August 4, 1988 and about 40 residents attended.

SECTION II
SUMMARY OF MAJOR COMMENTS RECEIVED

In accordance with Section 117 of CERCLA, the press release and proposed plan fact sheet announcing the public comment period and public meeting were released on August 11, 1988. The comment period began on August 19, and ended September 16, 1988. A public meeting was held with area residents and local officials on August 31, 1988 at the Red Rock State Park. The purpose of this meeting was to explain the results of the remedial investigation and to outline the various alternatives presented in the feasibility study, and seek comments on the alternatives and EPA's proposed plan. About 40 people from the area attended the meeting and eight people made oral statements or asked questions. The entire meeting was translated in Navajo and a written summary of the fact sheet, as well as a cassette recording, were available in Navajo. No written comments or questions were received from citizens. Overall, the residents and local officials do not appear to oppose the proposed plan. During the public comment period, EPA also received written comments on the Public Comment Draft Operable Unit Feasibility Study (OUFS) from the New Mexico Environmental Improvement Division, the Navajo Environmental Protection Administration, and United Nuclear Corporation (UNC).

RESIDENT/CITIZEN COMMENTS
(From Public Meeting)

Comment 1: Will there be employment opportunities for residents during remedial action?

Response: EPA hopes that UNC will agree to perform the remedial action. If so, hiring will be up to the company itself. EPA is not familiar with any additional mining planned for the area.

Comment 2: Are residents in the area safe?

Response: EPA sampled wells within a 4-mile radius of the site in 1987. Results of analyses indicated that groundwater in these wells met all primary drinking water standards. Based on sampling of operating wells, groundwater is safe to drink although it contains elevated levels of salts and metals that affect its taste such as iron, manganese, sulfate, and total dissolved solids.

UNC completed a preliminary survey of windblown tailings which indicated that the extent of windblown tailings is not very great. NRC will require UNC to complete a comprehensive survey to determine the full extent of windblown tailings during site reclamation. Tailings beyond the site boundaries which are at concentrations that exceed NRC standards will be removed and returned to the mill site for disposal.

Comment 3: One commenter stated he drank underground water when he worked in the mines. Was this safe?

Response: Water found in the mine which could have been consumed was from the Westwater Formation and generally considered to be potable water. Without an actual analysis of the particular volume of water consumed, however, EPA cannot quantitatively respond to this question.

Comment 4: Mine water caused erosion in Section 10 south of the site. Can EPA address this?

Response: All mine dewatering has stopped in the area so that erosion will occur under natural conditions (i.e., runoff). NRC will require UNC to address surface water runoff concerns related to flooding in the area during surface reclamation activities. Erosion control will consist of channel improvements designed to control runoff and prevent erosion of the tailings pile.

Comment 5: Since UNC has fenced around its property, access to property formerly possible by crossing UNC property is no longer possible. Can EPA build a bridge across Pipeline Arroyo to aid in access to privately owned property, or have UNC allow passage across the fenced area?

Response: The land owner needs to approach UNC regarding permission to cross over fenced UNC property to gain access to neighboring land. Providing access across Pipeline Arroyo is not something EPA would contemplate under its Superfund activities, since EPA's efforts by law are directed at protecting human health and the environment.

Comment 6: Can the site be used by residents after capping?

Response: The tailings disposal area will be continually controlled by the Department of Energy after remedial action at the site is complete. Access to the tailings disposal area will be restricted. The exact area to be deeded to the Department of Energy has not been determined.

Comment 7: Can EPA wells in the southwest alluvium be used for domestic or livestock purposes?

Response: EPA installed these wells during its remedial investigation to monitor the possible movement of contaminants. Water quality in these wells is such that EPA will not permit consumption of water from these wells at this time.

Comment 8: EPA does not know the full extent of groundwater contamination.

Response: The extent of contamination is constrained by migration rates and flow directions outside the tailings disposal area. EPA will require implementation of a monitoring program to detect any increases in the areal extent or concentration of groundwater contamination outside the tailings disposal area.

Comment 9: Residents should be aware that tailings seepage in Zone 1 of the Gallup Sandstone will make that aquifer in the target areas unusable for generations.

Response: EPA studies indicate that the physical characteristics of Zone 1 are such that sufficient quantities of water could not be pumped from the sandstone to support volumes required for domestic or livestock purposes. Therefore, Zone 1 would not be a good candidate for locating a domestic or livestock well even if there were no impacts from tailings seepage.

Comment 10: Will evaporation of contaminated groundwater cause air pollution?

Response: Contaminated groundwater does not contain volatile organic compounds which are typically of primary concern in physical/chemical evaporation. EPA and NRC will require monitoring to assure that residual salts from evaporation are controlled and contained within the tailings disposal area. For instance, the evaporation disposal system would not be operated on extremely windy days.

Comment 11: Background levels in the feasibility study were too high.

Response: Background is a complex issue at the UNC site, and was evaluated in detail by EPA, NMEID, and NRC. EPA believes that background levels were set in a reasonable manner. Additional information will be evaluated during remedial design should it become available.

Comment 12: Residents living in communities close to the UNC site are in need of assistance due to poor economic conditions.

Response: EPA is aware of community needs such as employment, electricity, and running water. Since operating groundwater wells have not been impacted by tailings seepage, EPA does not contemplate using Superfund monies to supply alternate water. However, EPA has and will assure remedial action at the UNC site occurs in a timely and protective manner.

Comment 13: How long will the tailings pile be stable?

Response: Federal requirements are that the tailings will be stabilized for a period of at least 200 to 1,000 years.

Comment 14: When can improvements (drilling of wells by residents in Section 10) south of the site begin?

Response: If wells are being planned for ~~this~~ area, EPA recommends they be screened in deeper formations. Any well installed in the alluvium directly south of the site in Section 10 would require water quality testing before consumption of the water. Deeper well installation could start any time and would avoid the potential of groundwater contamination immediately downgradient of the site, providing proper well completion techniques are followed that prevent alluvial water from mixing with lower formations.

Comment 15: Alternative 3 does not go far enough.

Response: EPA is proposing action in the alluvium and Upper Gallup aquifers to address groundwater contamination. Contaminated areas will be remediated to federal and state standards or background to the maximum extent practicable. The selected remedy addresses health concerns by containing downgradient migration of contaminants in target areas. This includes seepage in the area where the tailings dam broke in 1979.

NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION COMMENTS

Comment 1: The Superfund FS addresses offsite contamination, principally groundwater remediation and windblown tailings.

Response: The FS addresses contaminated groundwater outside the byproduct materials disposal area, currently defined by the boundaries of Section 2. Removal of windblown tailings outside the tailings disposal area will occur under NRC requirements.

Comment 2: Attempts should be made to drill additional monitoring wells offsite in order to better define the areal extent of contamination.

Response: The selected remedy requires implementation of a supplemental groundwater monitoring program to detect any increases in the areal extent or concentration of groundwater contamination outside the tailings disposal area. An additional background well in Zone 3 could be installed during the remediation phase if warranted.

Comment 3: Extracted groundwater should be lime treated before spray misting on the tailings or disposal in evaporation ponds.

Response: The evaporation disposal system should be optimized during the first few months of operation. This includes addressing the optimum pH for evaporation. EPA will weigh the positive and negative aspects of water pH on evaporation disposal system performance.

Comment 4: The selected remedy should foresee the need for additional lined pond area if pumping rates have been underestimated or design values for spray misting are not realized.

Response: The selected remedy requires evaporation ponds to be sized and operated in order to provide sufficient evaporative capacity for maintenance of a reasonable operational water balance. The number of hours of spray misting per day, as well as the number of months during which active spray misting takes place, can be adjusted to optimize operation of the system.

Comment 5: Column evaporation is not a cost-effective alternative.

Response: EPA prefers enhanced water/pond evaporation over column evaporation as being more cost-effective and efficient.

Comment 6: If more detailed modeling were to be conducted, with injection wells closer to the extraction wells, reinjection could speed up the cleanup.

Response: EPA's selected remedy calls for groundwater extraction and mister/pond evaporation. While reinjection was screened out in the FS, performance evaluations during remediation may indicate specific situations where reinjection might be considered. Therefore, EPA's selected remedy does not preclude NRC from considering reinjection if warranted.

Comment 7: A justification of mister system efficiency (15%) and annual evaporation (34 inches/year) was not given in the FS.

Response: EPA reviewed performance data from a number of operating mister/pond evaporation systems at mill tailings sites, as well as design specifications of UNC's proposed system. These reviews indicated a 15% evaporation efficiency to be reasonable. In addition, annual evaporation data was reviewed for the Gallup area by UNC consultants and the EPA suggesting a net evaporation rate of approximately 34 inches/year.

NAVAJO ENVIRONMENTAL PROTECTION ADMINISTRATION

Comment 1: Does the mill complex itself represent a significant source of contamination?

Response: EPA focused its RI/FS on groundwater contamination outside the tailings disposal area and, therefore, did not address the mill itself. However, NRC will require decommissioning of the mill complex and removal of contaminated sediments or soils associated with the mill.

Comment 2: PH is not a reliable indicator of plume extent.

Response: PH is an indicator of acid tailings seepage. EPA recognizes that not all contaminants are pH dependent and does not base its definition of tailings seepage solely on pH.

Comment 3: Flow volumes in Pipeline Arroyo need to be calculated.

Response: Flow volumes have been calculated by UNC for Pipeline Arroyo. NRC is currently reviewing these calculations.

Comment 4: What are the plans for reclamation of Kerr-McGee's protoore pile, evaporation ponds, and equipment storage area in Section 36? How is this related to UNC reclamation activities?

Response: Kerr-McGee (Quivira) Mining Company has submitted a Reclamation Plan to the Bureau of Land Management, Bureau of Indian Affairs, and Navajo Nation. EPA expects reclamation in Section 36 to occur when field activities are approved by the above agencies.

Comment 5: How are molybdenum levels explained in downgradient wells?

Response: There is no current definitive answer to the distribution of molybdenum downgradient of the site. The RI postulated another source could be responsible for the observed contaminant distribution; however, current data cannot refute or prove a second source of molybdenum.

Comment 6: How are radium levels explained in well No. 625?

Response: Radium present in well No. 625 is attributed to the leachate from the tailings pond. This well is located downgradient of the pond and would intercept groundwater leaving the disposal cells. The radium concentration of 7 pCi/L is slightly above the ARAR criterion of 5 pCi/L.

Comment 7: A leachate analysis of tailings solids needs to be performed.

Response: To date, a leachate analyses of the tailings solids has not been performed. However, UNC contractors performed a leachate analysis of tailings impacted alluvium directly beneath the base of the south cell, and discussed it in their report entitled, "The Evolution of Groundwater Chemistry," dated July, 1988.

Comment 8: The extent of contamination is not fully known.

Response: The extent of contamination is constrained by migration rates and flow directions outside the tailings disposal area. EPA will require implementation of a monitoring program to detect any increases in the areal extent or concentration of groundwater contamination outside the tailings disposal area.

Comment 9: Does EPA understand structural controls on groundwater flow?

Response: EPA recognizes some fault control in groundwater flow in Zone 3 of the Upper Gallup Sandstone. The surficial cover of the alluvium makes delineation of faults and fractures more difficult. Remedial design will address target areas of groundwater contamination. These areas may or may not be influenced by structural controls.

Comment 10: EPA should use proposed water quality standards for aquifers beneath inactive tailings piles.

Response: UNC-Churchrock is classified as an active mill tailings facility. Applicable regulations will apply at UNC to assure source control measures are implemented within the tailings disposal area.

Comment 11: The public health assessment needs to evaluate impacts on biota and other environmental receptors.

Response: EPA's public health assessment and FS focused on groundwater contamination and did not attempt to address potential contamination of biota. However, a preliminary survey of windblown tailings at the UNC site has been performed under NRC licensing requirements. Results indicate that windblown tailings are primarily concentrated in Section 36 and do not exist north of the reservation boundary. A comprehensive survey of windblown tailings contamination will be completed during site reclamation under NRC licensing requirements, and will include areas in Section 1.

Comment 12: What is meant by long-term sampling of groundwater in target areas?

Response: A performance monitoring program will be implemented as part of the selected remedy. Monitoring will continue until remedial action is complete. Limited groundwater monitoring is expected to continue at the site under long-term care by the Department of Energy.

Comment 13: Did consideration of an alternate water supply influence cleanup levels or restoration rates?

Response: No. Alternate water supplies have no influence on cleanup levels or restoration rates.

PRP COMMENTS

The Potential Responsible Party (PRP), which is UNC, submitted two volumes of comments and several file boxes of data and information. The documents submitted by UNC for inclusion to the administrative record for the Churchrock site included 217 documents. Many of the letters, reports, graphs, maps, and data had already been in EPA's files and have been reviewed. A summary of the major subjects included in these documents are:

- Comments on the draft remedial investigation
- Correspondence regarding the MOU
- UNC's proposed reclamation plan
- Correspondence regarding the feasibility study
- Correspondence regarding radioactive material licenses
- Reports on tailings pond construction
- Correspondence on the 93-million-gallon tailings pond breach
- Correspondence between NMEID and EPA regarding discharge plans, seepage collection system, and groundwater monitoring

- o Graphs of water level change from 1980 through 1988 .

- o Permit applications for mine water discharge

The PRP comments consist of legal and technical comments. These are addressed separately in the following sections.

PRP Legal Comments

At the outset of this response, it should be noted that the United States Environmental Protection Agency (EPA) contends that many of the comments provided by United Nuclear Corporation (UNC) concern issues that are not properly raised in this forum. Some of these comments concern legal and regulatory issues not unique to this case and some concern issues arguably already decided by the courts, or barred from further contention by rules of law. Accordingly, EPA hereby reserves any and all legal, equitable, administrative, and enforcement rights that it may have, including without limitation, the right to assert any claim, cause of action, argument, or defense and the right to undertake environmental response action.

Response to General Comments

Initially in its comments, UNC asserts a reservation of the right to raise all objections to the remedial action decision after selection of the site remedy by EPA under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Insofar as the public comment process under the National Contingency Plan (NCP) and CERCLA, as amended, is concerned, it is the contention of EPA that such comments must be made during the public comment period or will be deemed as having been waived by the commenter. Acceptance of any late comments by EPA is purely discretionary. While UNC may seek to raise objections in a subsequent proceeding if it wishes, EPA is not obliged to consider them for purposes of selection of the proposed remedial action for the UNC Churchrock Site.

Further, EPA does not agree with UNC's contention that there is no limit to the nature and scope of the challenge that UNC may subsequently bring against EPA's CERCLA remedial decision. The law is clear that any judicial review of EPA action on a record of decision (ROD) shall be upon the administrative record established by the President (or his delegee) and that the standard of judicial review of the decision is whether such decision was arbitrary and capricious or otherwise not in accordance with law. 42 U.S.C. § 9613(j). EPA notes that UNC has in fact made substantial and extensive comments on the proposed action, including a voluminous annex of documents proposed for inclusion in the EPA Administrative Record for the UNC Churchrock, New Mexico, CERCLA Groundwater operable unit remedial action (UNC Ad. Rec.). Many of these documents were already contained in the UNC Ad. Rec.

EPA disagrees with UNC's contention that the CERCLA remedial investigation and feasibility study (RI/FS) and remedy selection process are not a "true administrative process." EPA believes that this is not a proper forum for such an argument to be raised, but nevertheless will state that the plain language of the statue, as well as relevant case law (See UNC Ad. Rec. Doc. Nos. 433-435), including the law of this case, demonstrate otherwise. In response to UNC's suggestion that EPA lacks the sole discretion to cleanup the site, EPA will state that it cannot agree, because its authority to select a CERCLA remedy for this site is clear, unambiguous, and unfettered. No less than four court decisions have been rendered in connection with this particular uranium mill tailings site, and such sites in general that clarify EPA's CERCLA authority in this area.[1] EPA does, however, recognize the regulatory authority of the Nuclear Regulatory Commission (NRC) over the UNC site pursuant to the Atomic Energy Act and the Uranium Mill Tailings Radiation Control Act (UMTRCA), and the need, therefore, to coordinate the conduct of remediation and reclamation with respect to the site, between the two federal agencies.

In response to UNC's argument that determination of consistency with the NCP is a judicial function, EPA reasserts that determination of CERCLA remedial action at the site is vested by law in the President (and his delegee), and this includes any necessary supporting determinations such as consistency with the NCP. EPA rejects UNC's arguments that the CERCLA statute is unconstitutional for failure to satisfy due process requirements and that EPA has invented the public comment period. Instead, EPA notes for the record that it has proceeded according to its regulations and law in providing for public comment in this case. Further, EPA disputes UNC's contention that "operable units", such as is involved here, are improper, noting that the NCP clearly provides for them. 40 C.F.R. 300.68(c).

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[1]Eagle-Picher Industries, et al. v. United States Environmental Protection Agency, et al., 822 F.2d 132 (D.C. Circ., 1987) ("Eagle-Picher III"); American Mining Congress, et al., v. Lee M. Thomas, et al., 722 F.2d 640 (10th Cir., 1985)("AMC") Eagle-Picher Industries, et al., v. United States Environmental Protection Agency, et al., 759 F.2d 934 (D.C. Circ., 1985)("Eagle-Picher II"); United States v. United Nuclear Corp., 610 F.Supp 527 (D.NM., 1985).

Instead of ignoring remedial activities to be performed by UNC under the NRC license, as UNC argues in its comments, EPA has signed a Memorandum of Understanding (MOU) with the NRC to coordinate the activity of the two agencies. EPA has been in regular and substantial contact with the NRC for more than 2 years on the issue of remediation of this site.

In contrast to the baseless argument made by UNC that it has had no meaningful opportunity to comment, it would be hard to imagine a site with more opportunity to provide for comment than this one. As the record establishes, EPA has had numerous meetings with UNC to discuss investigations and remediation of the site, including UNC's NRC license directed activity, as well as the EPA RI/FS.

UNC was furnished with advance copies of the RI/FS for review and comment. UNC has also been furnished with a copy of the EPA-NRC MOU. UNC is presumably familiar with the site reclamation plan, which is included with other UMTRCA related site remediation documents that were included in the administrative record, since it authored the document for NRC approval. The public comment period, promulgated in accordance with the NCP, began on August 19, 1988 and closed on September 16, 1988, with a 5-hour public meeting conducted in Gallup, New Mexico, on August 31, 1988. An extensive and voluminous administrative record was made available in Gallup, New Mexico, and an informative, detailed public information sheet in English received wide circulation in the community. A summary of this information sheet was distributed in Navajo, as well. EPA also conducted a public open house on August 4, 1988, and a public information meeting in April 1987, both in Gallup, New Mexico. UNC and NRC representatives attended all three meetings.

UNC's description of background information is generally self-serving, inaccurate, and incomplete. For example, perhaps because it flies in the face of its argument that releases into the environment from the facility are "federally permitted releases," UNC conveniently omitted its 93-million-gallon tailings spill in 1979. See Eagle-Picher III at 150. See also UNC Ad. Rec. Docs. Nos. 3 and 8. EPA categorically rejects the notion that releases of hazardous substances and pollutants and contaminants from UNC's disposal facilities into the soil, air, surface, and groundwater of the environment constitute "federally permitted releases." within the meaning of CERCLA.

Similarly, UNC's description of the New Mexico "agreement state" Atomic Energy Act, Uranium Mill tailings regulatory program under which it had operated since its inception is misleading. UNC's description of the program as "comprehensive environmental protection requirements" with "extensive groundwater protection requirements" is at odds with the discussion set forth by the director of the program, in her 1986 letters concerning the return of jurisdiction to NRC. See UNC Ad. Rec. Doc. Nos. 472 and 474. Similarly, in citing the facility groundwater protection standards of 40 C.F.R. Part 192 (now incorporated into 10 C.F.R. 40, App. A) for their effectiveness, along with its alleged cooperative working relationship with NRC, UNC fails to note its unsuccessful litigation attempt to have those same regulations overturned. See AMC. UNC also fails to point out in its background argument, that EPA has determined these same requirements as applicable or relevant and appropriate requirements (ARAR's) pursuant to section 121(d) of CERCLA, among other requirements, to be imposed in EPA's CERCLA groundwater cleanup action that UNC so vehemently opposes in its comments.

This willingness to adopt any side of an argument, regardless of its facts, is characteristic of the tactics employed by UNC throughout the general comments. Another example of this "fast and loose" approach to the facts used by UNC in its background statement is its description of the EPA RI/FS process. UNC conveniently leaves out months of delaying and stalling tactics that it employed, designed to prevent EPA access to the site. These access delays followed long, protracted and unsuccessful negotiations between EPA and UNC to have UNC carry out such investigations and remediate the site. These UNC tactics culminated in a lawsuit by UNC against EPA designed to prevent access, filed by UNC in August 1984 (see UNC Ad. Rec. Doc. 378), and the filing of a counter lawsuit and the execution of an administrative warrant by EPA in September 1984. See UNC Ad. Rec. Doc. Nos. 394 and 395. UNC finally agreed that it would not interfere with EPA access to the site in a December 1984 letter to the Department of Justice (UNC Ad. Rec. Doc. No. 411), and UNC lost the case in April 1985 when the District Court granted an order in Aid of Access, Doc. Nos. 433-435.

EPA does not agree with UNC characterizations of its investigatory work and believes that those studies, as well as the other documents in the administrative record, will speak for themselves. EPA's focus is, and has been, the remediation of offsite contamination emanating from UNC's tailings disposal facility, which threatens health and the environment. It is an area of concern, which UNC has never adequately investigated, and thus cannot be deemed duplicative. Further, UNC's complaint that it was not permitted to conduct the RI/FS misses the mark. For even though EPA offered UNC opportunities to do such studies, these were rejected during months of negotiations in 1982-83. UNC's belated offers to conduct such studies came too late in the day, long after EPA had commenced its effort to conduct them itself.

UNC's continued argument for sole NRC authority over cleanup and remediation is interesting, since it is not supported by the NRC. Indeed, the NRC through the MOU and otherwise, supports EPA CERCLA remediation efforts, as does the State of New Mexico.

Specific Comments

1. UNC alleges "EPA failed to provide an adequate comment period."

Response: The public comment period employed in this action more than adequately meets the muster of 40 C.F.R. 300.67(d) and 42.U.S.C.§9617. The comment period commenced on August 19, 1988 and closed on September 16, 1988, using the "postmark rule." As the previous discussion herein and the administrative record demonstrates, this case represents a model of agency efforts in community relations. In the specific case of UNC, agency efforts have been substantial at getting this potentially responsible party (PRP) involved, as noted earlier herein. UNC's complaint is groundless.

2. UNC argues "EPA failed to develop the Administrative Record by withholding information from public review."

Response: EPA submitted an administrative record consisting of more than 550 documents comprising thousands of pages to its public repository in Gallup, New Mexico. In compiling this record, EPA complied with its policy procedure for preparation of interim administrative records, as well as the statutory provisions set forth at 42 U.S.C. §9613(k)(2)(C). These procedures provide that the agency may incorporate by reference certain types of documents that it would not be practical to place in the local repository. Such documents would include items, such as raw data pages, large and cumbersome maps or charts, and publicly available guidance documents. EPA intends to supplement the record with copies of the Record of Decision, the Summary of Remedial Alternatives (including attachments such as the Community Relations Responsiveness Summary), and documents recommended by UNC. No attempt has been made by the agency to withhold documents from public review, as asserted by UNC, and EPA certainly has not engaged in the selective inclusion argued by UNC.

EPA believes that its treatment of UNC as a PRP has been more than fair, as discussed previously herein and documented in the administrative record. UNC's failure to timely avail itself of early opportunities to participate in site investigation and remediation efforts effectively foreclosed this discretionary opportunity. EPA believes that it has acted consistent with the overall public interest and in accordance with the requirements of CERCLA. Section 122 of CERCLA, contrary to UNC's untimely assertions, does not require the agency to abandon existing studies and plans, and renegotiate them to begin anew, nor does it require at this time or previously a formal determination that good faith negotiations with UNC are not possible.

3. UNC comments that "EPA failed to provide for public review and comment regarding the MOU entered into with the NRC in violation of United Nuclear's due process rights."

Response: The MOU entered into between EPA and NRC is an inter-agency agreement between regional offices of the two agencies, which provides a mechanism for coordination of the two different regulatory efforts. It is designed to accomplish exactly the kind of efficiency and coordination of effort that UNC complains is lacking in EPA's efforts, elsewhere in its comments. Such an agreement is not itself subject to public comment, although the NRC reportedly intends to publish it in the federal register and EPA made it available to the public at its meeting in Gallup and is including it as an attached to the Summary of Remedial Alternatives. It is thus being included in the administrative record.

The MOU, as is clear on its face, did not purport to make any authoritative determinations with respect to the site, including the legally applicable or relevant and appropriate CERCLA requirements (ARAR's) that UNC alleges. Instead, it is clear that each agency is responsible for implementing its own requirements. The fact that the document speaks to ARAR's is merely an acknowledgement that ARAR's have been identified for the site, as required by the NCP.

4. UNC contends that "EPA's RI, OUFS, and RI/FS process as applied at the Churchrock site fail to satisfy CERCLA's and the NCP's requirement that the remedial action is cost effective. UNC argues that EPA cannot undertake response action for naturally occurring substances at the site."

Response: EPA is well aware of the provisions of CERCLA cited by UNC for its proposition, but believes that UNC's argument is misplaced. This is because EPA does not agree that the hazardous substances and pollutants and contaminants which have been released into the environment from UNC's tailings pits and spills constitute naturally occurring substances in their unaltered form, or altered solely through natural processes. EPA believes that the investigative information it has gathered on the UNC site, along with the other information and data which comprise the administrative record more than substantiate its position.

5. UNC asserts that "EPA's RI/FS process is not cost effective because it duplicates the work that has been or will be performed pursuant to NRC requirements."

Response: EPA is very keenly aware of the work that has been performed pursuant to NRC requirements, along with future plans for NRC-required investigative and remedial efforts. EPA does not agree that its efforts are duplicative or that this is a proper measure of cost effectiveness. This is because EPA and NRC have taken great care to coordinate their respective efforts, despite UNC contentions otherwise. EPA investigative efforts have been primarily aimed at existing and threatened contaminant migration from the site. Based on these extensive studies, EPA cannot agree that the NRC-required reclamation efforts onsite will alone sufficiently remedy these threatened and actual releases. This is confirmed by EPA's analysis of the "no-action" alternative. UNC correctly notes, as EPA has, that the NRC 10 CFR Part 40, Appendix A requirements constitute ARAR's for the site. On the extent of the contaminated groundwater migration problem, it is the requirements of 40 CFR 192, as incorporated into the NRC regulations, that are ARAR's along with other requirements identified in the record. UNC's cost effectiveness contentions are, therefore, without merit, with or without UNC agreement on the characterization of onsite NRC directed reclamation efforts.

6. UNC opines that "EPA can satisfy the requirement that actions be cost effective only by recognizing that NRC regulations are the ARAR's for the Churchrock site and by selecting the no-action alternative."

Response: EPA has properly determined the role of the NRC regulations as ARAR's in its action, as properly noted previously and in the record. EPA's close examination of the entire record, including the UNC reclamation plan has led it to a different conclusion than the no-action recommendation advocated by UNC. EPA notes that the no-action alternative had virtually no support in the community, as evidenced by the comments received at the public meeting of August 31, 1988, and subsequently, other than by UNC. Significantly, both the NRC and State of New Mexico disagree with UNC on this issue, as does the Navajo Tribal Council. EPA simply cannot agree that the no-action or limited action alternatives provide for adequate protection of public health and the environment, as required by CERCLA and the NCP. Such protection is a fundamental threshold test of cost-effectiveness. EPA believes that the proposed alternative is technically sound and reliable, and that it provides substantially greater environmental and public health benefits than either the "no action" or "limited action" alternatives.

7. UNC argues that "the RI and OUFS fail to comply with CERCLA and applicable EPA guidance and are inconsistent with the NCP." UNC comments that "EPA failed to identify correctly the applicable or relevant and appropriate federal requirements."

Response: EPA has scrupulously followed CERCLA, the NCP, and the interim ARAR guidance in the identification of ARAR's for the site. These are set forth in the OUFS FS and in Appendix C to the ROD/Summary of Removal Alternatives, and they are discussed elsewhere herein. UNC has correctly observed that EPA set forth the regulations of 40 CFR 192, Subparts D and E, in the FS, and EPA is most certainly aware as evidenced by the MOU that those requirements have been adopted by the NRC, as mandated by the Congress, in its regulations at 10 CFR 40, Appendix A. EPA intends to apply them in its CERCLA groundwater remedial action at the site, along with other ARAR's. UNC's comments miss the mark.

8. UNC contends that "EPA failed to consider adequately the factors established for determining the appropriate remedial action."

Response: As demonstrated by the Administrative Record for this action, EPA has complied with the "scoping" provisions of Section 300.68(e)(2) during the RI, which requires assessment "as appropriate" of several factors, including the "population... at risk" provision cited by UNC. EPA's efforts include performance of an adequate public health assessment. Further, unlike UNC, EPA believes that it has performed a sufficient inquiry into the designated or potential use of the affected groundwater media. Indeed, protection of public health and the environment from the threat of contaminated groundwater emanating from the UNC site is the chief thrust of EPA's proposed action. EPA has certainly, in contrast to UNC's assertion, adequately examined the details of proposed NRC required actions on the site.

9. UNC comments that "EPA failed to consider adequately the no-action and limited action alternatives in the OUFS."

Response: EPA has, in fact, considered a proper range of alternatives for remedial action as aptly demonstrated by the Administrative Record, including a detailed analysis of those alternatives passing initial screening. EPA disputes and disagrees with UNC's opinions concerning the potential for contaminant migration in groundwater. EPA has also considered the issue of restricted access under the long-term federal or state care provisions, contrary to the contentions of UNC. As indicated previously herein, EPA does not consider "no action" and "limited action" to be adequately protective of public health and the environment.

10. UNC comments that "EPA has discouraged private party involvement in the RI/FS."

Response: The record demonstrates that this comment is simply untrue. UNC foreclosed the opportunity for involvement in the RI/FS by its own action, or inaction. EPA and UNC engaged in long and protracted negotiations during 1982 and 1983 over the issue of UNC performance of RI/FS and remedial design/remedial action, in accordance with the existing EPA policy. Draft orders were developed, but negotiations ultimately failed. EPA then proceeded with its remedial investigation, incurring contractual obligations and developing plans for its conduct. The law has never required EPA to engage in RI/FS settlements. Indeed, they are discretionary agreements. In the circumstances here, EPA was more than justified in rejecting UNC's offers as being too late in the game and too disruptive of ongoing response investigation activity.

11. UNC states that "EPA's failure to remove the Churchrock site from the National Priorities List when NRC resumed jurisdiction violates EPA policy."

Response: As UNC obliquely infers, the UNC facility was properly placed on the National Priorities List. See Eagle-Picher II and III. EPA policy provides that sites will not be removed from the NPL until EPA certifies completion of cleanup and petitions for removal from the list, or a final determination by EPA that no action is required.

For the foregoing reasons, EPA rejects UNC's conclusions and arguments as set forth in its legal ("general") comments.

PRP Technical Comments

The PRP submitted technical comments on each chapter of the OUFS, including the Executive Summary and Appendices.

For purposes of the Responsiveness Summary, EPA grouped the comments into the following response categories:

1. ARAR's and Background Levels of Chemical Constituents

2. Limitations of Data Base Used in the OUFS

3. Geohydrological Characteristics of the Site

4. Groundwater Modeling

5. Relationship Between Selected Remedy and NRC Requirements at the Site

6. Public Health Assessment

7. Duplication of PRP and EPA Efforts

8. Evaluation of Other Remedial Alternatives

9. Compliance with Appropriate EPA Guidance

10. Groundwater Treatment Technologies

11. Relationship Between EPA and UNC Actions

12. Costs

13. Non-Action

Individual comments were grouped into one or more response categories. Each comment was given a code matching the comment number used by the PRP; for example, the PRP's second comment on Chapter 1 of the OUFS was given the comment code "1-2". The following indicate the comments addressed within each response category:

Response Category 1
ARAR's and Background Levels of Chemical Constituents
ES-2, ES-5, 1-2, 2-1, 2-3, 2-5, 2-6, 2-13, 2-16, 3-1, 3-2, 3-4, 3-5, 3-6, 3-8, 3-9, 5-3, D-General, D-5.

Response Category 2
Limitations of Data Base Used in the OUFS
ES-3, ES-4, 2-3, 2-8, 2-9, 2-10, 2-11, 2-12, 2-14, 3-6, 3-7, 3-8, 8-12, D-General, D-6, D-8, D-11.

Response Category 3
Geohydrological Characteristics of the Site
ES-2, 1-1, 1-2, 1-3, 2-1, 2-2, 2-4, 2-5, 2-6, 2-13, 2-14, 2-15, 5-1, 8-7, D-General, D-8, D-11.

Response Category 4
Groundwater Modeling
ES-7, 2-2, 2-4, 2-5, 2-7, 5-5, 6-2, 6-3, 7-1, 7-2, 8-7, 8-8, 8-10, 8-11, D-General, D-1, D-2, D-3, D-4, D-5, D-6, D-7, D-8, D-9, D-10, D-11, D-Alluvium Critique, D-Zone 3 Critique, H-6.

Response Category 5
Relationship Between Selected Remedy and NRC Requirements at the Site
ES-1, 1-4, 1-6, 5-2, 5-9, 5-10, 6-1, 8-6, H-3, H-5.

Response Category 6
Public Health Assessment
4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 8-11.

Response Category 7
Alleged Duplication of PRP and EPA Efforts
ES-1, 1-4.

Response Category 8
Evaluation of Other Remedial Alternatives
ES-6, 5-4, 5-7, 6-5, C-1, H-1, H-2, H-7.

Response Category 9
Compliance with Appropriate EPA Guidance
3-3, 5-6, 5-8, 8-1, 8-2, 8-3, 8-4, 8-9.

Response Category 10
Groundwater Treatment Technologies
5-9, 6-1, 8-13.

Response Category 11
Relationship Between EPA and PRP Actions
1-7.

Response Category 12
Cost
7-1, 7-2.

Response Category 13
Non-Action
1-5, 6-4, 8-5, H-4.

RESPONSE CATEGORY 1
ARAR'S AND BACKGROUND LEVELS

This response category addresses ES-2, ES-5, 1-2, 2-1, 2-3, 2-5, 2-6, 2-13, 2-16, 3-1, 3-2, 3-4, 3-5, 3-6, 3-8, 3-9, 5-3, D-General, D-5. These comments all relate to determining ARAR's and background levels.

Comment

The PRP states that EPA's choice of background levels in the OUFS invalidates the OUFS, creates non-existent target areas for cleanup, and ignores site-specific conditions. This summary includes all comments included in this response category.

Response

EPA does not intend for the PRP to pump and evaporate groundwater located in background areas outside of the tailings disposal area. Only areas which are impacted by tailings seepage, which are to be further defined and adjusted during remedial design, will be pumped. Furthermore, EPA believes that background at the Churchrock site must be determined in view of pre-mining conditions and infiltration of mine discharge water into the alluvium and sandstone formations. Site-specific conditions have been extensively considered during EPA's review of possible ARAR's for the Churchrock site. Preoperational data have been evaluated in the context of regional data for the alluvium and Gallup Sandstone since EPA perceives that some water existed at the site prior to mining, and because EPA considers groundwater at the site as Class IIB.

EPA was faced with a difficult and complex task of determining a set of contaminant-specific ARAR's for the Churchrock site. The proposed list of ARAR's was specified in Table 3-1 of the Feasibility Study (FS).

The difficulty arises because of the limited quantity of site-specific pre-milling groundwater data for the alluvium, and Zones 1 and 3 of the Upper Gallup Sandstone. EPA's approach is to consider any effects mine dewatering discharges may have had on post-mining groundwater conditions.

The only pre-milling site-specific ground water that is available to EPA is the data collected from well Nos. GW-1 through GW-6, GWD-1, and GWD-2. These wells were sampled on 2-4-77, 3-8-77, and 4-15-77. Milling operations began in June 1977; therefore, any subsequent sampling events for the wells listed above cannot be conclusively considered as pre-milling groundwater data.

The PRP is well aware that the groundwater data collected from these eight "pre-milling" wells is controversial. EPA participated in seven meetings with UNC, NMEID, and NRC, at which this topic was discussed at length. Pre-milling groundwater data submitted by UNC gives the following chemical concentrations as examples:

- Nitrate as N values range from a low of §0.1 mg/L in well Nos. GW-1 and GW-2, to a high of 95.9 mg/L in well GWD-1.

- Sulfate values range from a low of 470 mg/L in well No. GW-1 to a high of 1,731 mg/L in well No. GWD-1.

- Total dissolved solids range from a low of 904 mg/L in well No. GW-1 to a high of 4,076 in well No. GW-4.

This groundwater data is controversial for the following reasons:

- The nitrate, sulfate, total dissolved solids, and other constituent concentrations have a larger variance than one would expect from a site-specific continuous alluvial formation. Well Nos. GW-1, GW-2, and GW-3 have the most consistent pre-milling data of the eight wells. Nitrate levels in well No. GW-4 are the most inconsistent and change from 44 to 68 to 17 mg/L as N in the first three sampling events.

- Wells currently exist in the alluvium and the two sandstone zones that do not display such large nitrate values. The groundwater in these wells must either be pre-mining groundwater or mine discharge water that has infiltrated into the system.

- Some of the nitrate values reported in the pre-milling wells are typical of groundwater that has been contaminated by man-made sources and not groundwater that represents natural pre-milling background conditions.

- The PRP has not tagged a specific source of nitrogen to explain the large nitrate value reported in the pre-milling wells. Such nitrate concentrations are not seen in background groundwater at other sites; therefore, there must be a site-specific source of pre-milling nitrogen.

The PRP has funded two studies in an attempt to quell the pre-milling site-specific background controversy. The first study was entitled "Geochemical Background Investigation UNC Mining and Milling Churchrock Mill" and was prepared by Billings & Associates, Inc. in August 1986. The second study was entitled "Evolution of Groundwater Chemistry" and was prepared by Canonie Environmental in July 1988. Both studies propose that pre-milling surface water, flowing in Pipeline Arroyo, dissolved alluvial salts and concentrated them along groundwater flow paths, creating pre-milling groundwater background conditions with chemical values that exceed those proposed by EPA.

EPA and its consultants have looked at the Billings and Canonie studies extensively in an effort to determine pre-milling site-specific background conditions. Billings presents groundwater data from the same pre-milling wells that EPA has considered. Groundwater data from regional wells are discussed by Billings; however, little data is presented.

Billings tried to substantiate his theory that nitrate, sulfate, and total dissolved solids concentrations increase along groundwater flow paths as evidenced by data collected from well Nos. 639, 640, 641, 642, 643, 644, and 645. In addition to the groundwater chemical data collected from these wells, Billings performed a laboratory leaching study on borehole samples and succeeded in leaching nitrogen. Unfortunately, the borehole sample and groundwater data in the 639-645 wells collected during the Billings study may not be representative of site-specific background data due to previous mine-related activity in the immediate area.

The Kerr-McGee Corporation has indicated that the Quivira Mining Company (QMC) conducted activities in this area prior to the Billings borehole sampling and flow analyses studies. It is EPA's position that these activities could have influenced the 639-645 wells. More specifically, QMC's activities have included:

1. Surface storage of various equipment and material, plus equipment washing.

2. Construction of three evaporation ponds subsequently used for disposal of sediments extracted from mine settling ponds at the Kerr-McGee CRI mine site. QMC added chemicals including Calgon cation flocculants and barium chloride for the treatment of the mine water prior to discharge.

3. Transport and storage of some 23,000 tons of protoore.

Maps provided by Kerr-McGee, especially in the same area used for equipment storage, exhibit high gamma ray activity. These data from Kerr-McGee cast doubt on background studies in this area by the PRP. Therefore, EPA cannot base its ARAR decisions on data and a study that is in question because of possible outside effects.

The Canonie (1988) study has also been reviewed by EPA, and EPA's consultants review comments are contained in the administrative record (Jacobs Engineering Group, 1988). In summary, Canonie collected a very limited amount of data indicating that soluble nitrogen may be present in the alluvium which is unaffected by tailings pile seepage. EPA has considered these study results, but is unable to quantitatively apply them toward setting site-specific pre-milling background standards for the site. Canonie also presented technically inadequate discussions of pre-mining groundwater levels and the possibility of ammonia conversion to nitrate at the site.

The failure of the two studies mentioned above to resolve the site-specific ARAR controversy has left EPA with the following two choices:

1. Rely on the existing pre-milling groundwater data to determine site-specific ARAR's even though the data appears to be controversial and inconsistent; or

2. a. Determine ARAR's relying initially on existing regional groundwater data and/or existing state and federal standards. If chemical parameters from regional groundwater data exceed the state and federal standard ARAR's, then these background parameters are the ARAR's. If regional background is below the state and federal standards, then the regulatory standards are the ARAR's;

   b. Evaluate existing pre-milling groundwater data in the context of ARAR's in 2a and adjust background, if reasonable.

EPA does not believe it is appropriate to determine site-specific ARAR's at UNC Churchrock site based on existing inconsistent and questionable site-specific data. Therefore, EPA has chosen the second approach after giving due consideration to all the information and data submitted by the PRP.

In light of the above discussion, EPA has compiled concentration in its contaminant-specific ARAR's table according to the following procedure.

1. EPA reviewed regional groundwater quality data for the Upper Gallup Sandstone and Alluvium beginning with the results of EPA's September 1987 Field Investigation Team (FIT) sampling of domestic/livestock wells within a 4-mile radius of the UNC site. Results indicate that operational wells within this radius met all federal primary (health-related) drinking water standards, but contained levels of iron, manganese, sulfate, and total dissolved solids (TDS) above federal secondary (aesthetics-related) or state standards. Nitrate as nitrogen ($N-NO_3$) was below 2 mg/L in all four wells.

2. EPA next chose to look at the range of background values for each chemical constituent using data gathered by the FIT team in September 1987. The maximum observed concentrations of iron, manganese, sulfate, and TDS were in Well No. 15K-303 located approximately 1.5 miles north of the site in the Upper Gallup Sandstone. The maximum values for this data are:

Iron	1.75 mg/L
Manganese	0.48 mg/L
Sulfate	1,770.00 mg/L
TDS	2,593.00 mg/L

3. EPA subsequently reviewed historical data compiled by Southwest Research and Information Center (Shuey and Robinson, 1984) for Well No. 15K-303 since this well was known to have high background from recent FIT sampling. The maximum observed concentrations for sulfate from nine sampling events between May 1955 and July 1982 was 2,160 mg/L with a mean and standard deviation of 1,597 +/- 472.3 mg/L. The maximum observed concentrations for TDS from eight sampling events between May 1955 and July 1982 was 3,170 mg/L with a mean and standard deviation of 2,469.8 +/- 636.3 mg/L. The maximum observed value for $N-NO_3$ from these sampling events was 0.6 mg/L.

4. EPA subsequently compared background values of 2,160 mg/L sulfate and 3,170 mg/L TDS to regional background data from 115 Gallup Sandstone wells at distances of over 20 miles from the Churchrock site and found these concentrations to be maximum values.

5. EPA compared the sulfate value of 2,160 mg/L to pre-operational data collected in February, March, and April 1977 from GW-wells at the Churchrock site. The value of 2,160 mg/L was above the maximum value of 1,731 mg/L sulfate observed in GW-wells before the onset of tailings disposal in June 1977.

6. EPA compared the TDS value of 3,170 mg/L to pre-operational data collected in February, March, and April 1977 from GW-wells at the Churchrock site. The value of 3,170 mg/L was above all values observed in GW-1, -2, -3, -5, -6, and -D2 wells, and lower than only two observations in the remaining wells, one in GW-4 (4,076 mg/L) and the other in GW-D1 (3,769 mg/L). In view of this distribution of GW-well data in the context of regional data, EPA concluded it was reasonable to retain the value of 3,170 mg/L.

7. EPA compared the original FIT team background value for iron of 1.57 mg/L to the broader set of iron data described in (3) above and noted generally low iron concentrations in the Gallup Sandstone. However, on the basis of elevated iron levels in the 15K-303 well, adoption of Billings pre-operational value of 5.5 mg/L is reasonable.

8. EPA compared the original FIT team background value for manganese of 0.48 mg/L to regional manganese data. To be consistent with the approach taken for iron in (7) above, EPA has subsequently adopted Billings pre-operational value of 2.6 mg/L observed in GW-1 in February on 1977. Adoption of this value is reasonable in light of two additional pre-milling observations of 1.75 mg/L and 2.3 mg/L in well GW-2, which is just north of GW-1. Both these wells exhibit fairly consistent patterns for sulfate and TDS making reliance on them for manganese reasonable.

9. EPA compared the regulatory standard for arsenic of 0.05 mg/L to pre-operational data discussed in the Billings report. The highest pre-operational concentrations of arsenic observed were below 0.02 mg/L, therefore EPA retained the regulatory standard of 0.05 mg/L.

10. EPA compared the regulatory standard for cadmium of 0.01 mg/L to pre-operational data which exhibit a range from less than 0.001 mg/L to a maximum of 0.1 mg/L. With a median pre-operational cadmium concentration of 0.003 mg/L, no regional cadmium data other than 1987 FIT data available as a context better evaluate pre-operational data, and the historical range in concentrations in these wells; EPA concluded that it was reasonable to retain the regulatory standard of 0.01 mg/L.

11. EPA compared the regulatory standard for selenium of 0.01 mg/L to preoperational data which exhibit a range from less than 0.001 mg/L to a maximum of 0.067 mg/L. The regulatory standard of 0.01 mg/L was above all values observed in GW-1, -2, -3, -5, -6, -D1, and -D2 wells, and lower than only two observations in GW-4,

0.067 mg/L and 0.04 mg/L. In view of this distribution of GW-well data, combined with 1987 FIT data which indicate selenium in the alluvium and Upper Gallup Sandstone to be below 0.01 mg/L, EPA concluded that it was reasonable to retain the regulatory standard of 0.01 mg/L.

12. In the absence of regional 1987 FIT data for Th-230, EPA compared the regulatory standard for Th-230 of 15 pCi/L to pre-operational data which exhibit a range from less than 0.6 pCi/L to a maximum of 36.3 pCi/L. The regulatory standard of 15 pCi/L was above all values observed in GW-1, -4, -5, -6. -D1, and -D2 wells, and lower than only two observations in remaining wells, one in GW-2 (36.3 pCi/L) and the other in GW-3 (19.4 pCi/L). In view of this distribution of GW-well data, EPA concluded that the regulatory standard for Th-230 of 15 pCi/L was representative of background if not above background.

13. Consistent with the approach used above in evaluating existing data for background, EPA reviewed regional and pre-operational data for NO_3-N. The regional data included 1987 FIT sampling data from wells within a four-mile radius of the site; regional data compiled by Southwest Research and Information Center (Shuey and Robinson, 1984); and U.S. Geological Survey water quality data for the alluvium and Gallup Sandstone in the New Mexico portion of the San Juan Basin (WATSTORE database). As mentioned, NO_3-N concentrations were below 2 mg/L based on 1987 FIT sampling. NO_3-N concentrations were all below 2 mg/L based on regional data compiled by Shuey and Robinson (1984) for the Gallup Sandstone. NO_3-N data was obtained from U.S. Geological Survey water quality data for the alluvium in the New Mexico portion of the San Juan Basin. NO_3-N concentrations ranged from below 0.02 mg/L to a maximum value of 47 mg/L from 224 observations. Six of the 224 NO_3-N values were above 10 mg/L and the remainder below. NO_3-N concentrations from U.S. Geological Survey water quality data for the Gallup Sandstone range from below 0.01 mg/L to a maximum value of 27 mg/L for 110 observations. All required NO_3-N concentrations were below 10 mg/L except for the one maximum observed value.

EPA also reviewed pre-operational data for NO_3-N which ranged from below 0.01 mg/L to a maximum of 95.9 mg/L. The median concentration for NO_3-N from preoperational data is 17 mg/L. Data for NO_3-N are difficult to interpret, however, as GW-1 and GW-2 reveal consistently low concentrations prior to milling. GW-1 evidences a distinct rise in NO_3-N concentrations in late 1979, possibly in response to the tailings spill of July 1979.

GW-2, however, does not respond in this manner, even though it is located directly north of GW-1. NO_3-N concentrations in GW-3 climb steadily to a maximum preoperational value of 33.4 mg/L, while data in GW-4 and GW-D1 is sporadic with one-time values of 67.8 mg/L and 95.9 mg/L NO_3-N, respectively. Premilling concentrations of NO_3-N in GW-D2 are consistently low until mid-1978, while concentrations in GW-5 and GW-6 vary between 14.3 mg/L and 34.5 mg/L.

Trends in the above preoperational data for NO_3-N do not lend themselves to simple interpretation. While several wells indicate preoperational NO_3-N concentrations to be consistently below 10 mg/L, other wells indicate abrupt changes in NO_3-N concentrations during the same time period. One well (GW-1) shows a distinct increase in concentration in NO_3-N after the tailings spill. On the basis of preoperational data, a reasonable argument could be made for a background concentration of 30 mg/L; an equally reasonable argument could be made for a background concentration below 10 mg/L, depending on which wells are used. Regional background for NO_3-N, however, is consistently well below 10 mg/L, except for anomalies indicated previously. Moreover, February 1988 well data collected by Malapai Resources, Inc. (Navajo Nation, 1988) in the vicinity of the Quivira Churchrock Mine indicate NO_3-N values to be less than 1 mg/L for the Gallup Sandstone (Navajo Nation, 8/6/88).

While the regulatory standard of 10 mg/L was used in the FS, EPA recognizes that background for NO_3-N may exceed 10 mg/L and appears to do so inconsistently. EPA also recognizes that ammonia and nitrate resided in the tailings fluids and contributed to nitrate contaminations in alluvial and bedrock groundwater. The selected remedy will address higher NO_3-N levels.

Based on evaluation of all data to date, EPA recognizes a background for NO_3-N of 30 mg/L. If found to be above this level during remediation of the site, then such level will become the cleanup criteria to the extent practicable. However, EPA sees no reason to increase this value, and will look closely at additional data that may call this level into question.

14. EPA compared the regulatory standard for Hg of 0.002 mg/L to preoperational data. The regulatory standard was above all values observed in GW wells, except for one observation of 0.004 mg/L Hg in GW-4.

Based on this distribution of preoperational data, EPA concluded that it was reasonable to retain the regulatory standard of 0.002 mg/L.

15. EPA compared the regulatory standard for Ra-226 and Ra-228 of 5 pCi/L to 1987 FIT data and preoperational data. Preoperational concentrations of Ra-226 were consistently below the regulatory standard in all GW wells except for one observation of 8.7 pCi/L in GW-01. Preoperational concentrations of Ra-228 were below the regulatory standard in GW-1, -2, -3, -5, and -6, with two exceptions: one observation of 6 pCi/L in GW-4, and a second of 11 pCi/L in GW-D2. In view of this distribution of GW well data, and because 1987 FIT data are all below 2 pCi/L for Ra-226 and Ra-228, EPA concluded that it was reasonable to retain the regulatory standard of 5 pCi/L for each radioisotope.

16. EPA compared the regulatory standard for Cl of 250 mg/L to preoperational data, the maximum observation being 85 mg/L. Consistent with EPA's approach of using a regulatory standard as an ARAR if higher than background, EPA retained the 250 mg/L standard.

17. Health-based standards for Sb, Be, Tl, and V are to be considered only if elevated levels are present, which does not appear to be the case.

18. Where background is below a federal or state standard, then the federal and state standards becomes the cleanup criteria. This appears to be the approach for setting background that Billings used for Al, Ba, Cr, Co, Cu, Pb, Mo, Ni, Ag, and Zn, and is consistent with the approach used by EPA to determine contaminant-specific ARAR's for these constituents. However, EPA recognizes 10 mg/L NO_3-N is a health-related standard and will require extensive monitoring of nitrate levels in water.

RESPONSE CATEGORY 2
LIMITATIONS OF DATA BASE USED IN THE OUFS

The following comments are addressed under this response category: ES-3, ES-4, 2-3, 2-8, 2-9, 2-10, 2-11, 2-12, 2-14, 3-6, 3-7, 3-8, 8-12, D-General, D-6, D-8, and D-11. Since all these comments were of a similar nature, a single response will be given.

Comment

The PRP stated that EPA disregarded available data which would provide a comprehensive picture of the evaluation of groundwater at the site, and was arbitrary and capricious in only using its 1985 sampling data in the OUFS.

Response

EPA is very aware of the large historical database generated by UNC, UNC consultants, and NMEID since mining and milling operations began. This data was reviewed by EPA and its consultants during the RI in order to characterize and interpret site conditions. Review of this data did assist EPA in understanding site-specific conditions, but also led to several scientifically valid differences in interpretation of the site and site development, many of which were discussed in the RI, during technical meetings held between EPA, UNC, NMEID, and NRC during the RI/FS period, and reiterated in other response categories to the PRP comments. EPA has reviewed pertinent documents describing site characteristics including the Reclamation Plan (Canonie, 1987A, B), Geohydrologic Report (Canonie, 1987), the Geotechnical Background Investigation (Billings and Associates, Inc., 1986), and the Evolution of Groundwater Chemistry Report (Canonie, 1988). Discussion of findings in these reports appears under other response categories, particularly Response Category 3.

NMEID and UNC data were relied on to help interpret site conditions in the RI. The RI concludes, as does UNC, that water levels have declined in the alluvium and Upper Gallup Sandstone, and are slowly returning to premining conditions. EPA requested the most recent water level measures from UNC in April 1988 for review, as well as quarterly monitoring reports for 1986-1988. These data were used qualitatively to indicate variations in groundwater chemistry subsequent to termination of mine water discharge in 1986. As an example of this, EPA compared water quality data taken by the PRP in October 1987 with May 1985 EPA RI data (Table 2.5 OUFS). The maximum detected values and mean concentrations were presented for samples taken in a specific aquifer. As stated on page 2-15 of the OUFS, the comparison suggested that inclusion of the PRP data obtained since the completion of the RI field activities would not significantly change the development and evaluation of alternatives. Several PRP 1987 mean and maximum values were higher than corresponding EPA 1985 means and maximum values. The reverse is also true. Further, the maximum values from both data sets are often found in the same well. The main point is that PRP water quality data obtained during and since the completion of the RI field activities would not significantly change the target areas. The critical issue, as the PRP maintains, is the background concentration for a number of chemical constituents (as mentioned in Appendix C).

The PRP presented arguments that EPA was arbitrary and capricious in the manner of rejecting data during a three-way split among EPA, NMEID, and PRP. This case in point involves questionable inorganic sulfate data from the EPA lab. Because EPA data was questionable and verified by NMEID and PRP, the NMEID/PRP data was acceptable and used. The PRP further argues that questionable Th-230 data was used by EPA. During the split, neither the PRP nor NMEID provided radiological analyses; therefore, EPA data was used. The use and effect of the Thorium-230 data on the risk assessment is further explained in Response Category 6.

The PRP has commented that EPA has not assessed all data when EPA states that the tailings pond is a primary source of contaminants. The PRP references the study of Canonie 1988a which concludes that alluvium in the tailings pond neutralizes tailings fluids. EPA does not arrive at the same conclusion which was derived from one or two boreholes in a 100-acre tailings pond. EPA's position is that this study has not definitively determined that the tailings pond is not a primary source. The letter from Jacobs Engineering Group (1988) to EPA details EPA's position on this area of concern. In fact, the PRP's consultants, Canonie (1987a) and Billings (1986) have also concluded that the tailings seepage has impacted all aquifers.

The PRP has objected to the use of Table ES-1 which depicts contamination levels, but cannot be attributed to the source. These tables are to be used in conjunction with Exceedance Maps provided in the OUFS. These maps, which depict areas downgradient of the tailings ponds, represent the areas which are addressed in the table. Target areas are a function of background levels since 1985 EPA RI data and 1987 PRP monitoring data are comparable. Response Category 3 also addresses this issue.

Future well sampling results during remedial design should be used to further define and adjust target areas as specified in the FS in conjunction with background determinations.

RESPONSE CATEGORY 3
GEOHYDROLOGICAL CHARACTERISTICS OF THE SITE

This response category addresses ES-2, 1-1, 1-2, 1-3, 2-1, 2-2, 2-4, 2-5, 2-6, 2-13, 2-14, 2-15, 5-1, 8-7, D-General, D-8, D-11. These comments all relate to PRP's concerns about the geohydrological characteristics and conditions at the site. The following issues were noted by the PRP and are addressed in this Response Category:

- pre-milling conditions
- recharge interrelationship of aquifers
- site migration pathways
- post milling conditions

PREMINING CONDITIONS

EPA's perception of premining conditions is that groundwater existed at the site in the alluvium and bedrock aquifers. These aquifers were unsaturated (water was not present throughout the entire thickness). To date, the PRP has provided little conclusive evidence for the alluvial and bedrock aquifers as being dry prior to mining. Their evidence has been established by connecting water levels in the mine shaft and the Indian well and projecting them through the site. These projections have been made through hydrogeologic units that do not contain water and act as aquitards. The PRP also reports that premilling geotechnical holes also were reportedly dry at the time of drilling.

EPA's interpretation of the presence of groundwater during pre-mining conditions is based on the following:

- <u>Presence of Artesian Water in Well No. 15K-303</u>. This well is completed in the Gallup Sandstone and is downgradient of the tailings disposal site. Water in the well cannot be attributed to mine dewatering or tailings seepage because it was noted years before mining activity in the area. The most likely source of water is recharge at the outcrop from precipitation and surface water infiltration. The outcrop of this formation is known to be present in Section 2 (UNC tailings disposal area) as noted by the PRP's in their geologic map of the site. Therefore it is difficult to conclude that recharge and water is not available in these site aquifers.

- <u>NECR Mine Shaft Contained Water</u>. Geologic logs of the NECR mine shaft, supplied by the PRP's, note that water was found above the Zone 3/Zone 2 Gallup contact. Water reportedly entered the mine shaft at a rate of 30 gpm. This contact is also present in the tailings area which is less than a mile away. If water is present at the mine shaft, it is very plausible it was present in the same geologic conditions less than a mile away. Further review of Figure 1-2 in the July 26, 1988 Canonie transmittal to EPA provides a cross-section through the alluvium in Pipeline Canyon. This cross-section clearly shows that the Zone 3/2 contact outcrops below the stream in Pipeline Canyon and may be the source of water to the mine shaft.

- <u>Premilling Drill Logs Indicate Water</u>. The PRP has indicated no water is present in premilling geotechnical holes in the tailings area. The PRP has provided drill logs of these boreholes to EPA. Close review of these logs indicates a different interpretation. For example, borehole 76SHB-2W is reportedly "dry" according to Canonie, 1987A. Review of the log indicates perched water at a depth of less than 30 feet. Also, PRP data state that borehole HL-5 did not yield water in a 24-hour period. Review of this drill log indicates damp conditions over the entire extent of the borehole. The method of drilling this borehole (air rotary) is not conducive for finding low yielding water supplies, especially within a 24-hour period. In fact, the PRP's consultant (Sargent, Hauskins, and Beckwith), in a report submitted to the PRP on May 17, 1976, indicates that there may be a delay of much longer than 24 hours in this area before water is found in a test well.

- <u>Review of Topographic Maps</u>. Another piece of data which supports the premise of premining aquifers comes from the review of premining topographic maps. The USGS 7.5 minute quadrangle maps of the area that are dated 1963 were reviewed. EPA has found the presence of numerous dams and stockponds in Pipeline Canyon. A 5-acre pond was present in 1963 directly underneath a portion of the current south cell disposal area. It is against sound scientific judgment to suggest that this and other ponds in Pipeline Canyon would not supply water for infiltration to the aquifers.

RECHARGE INTERRELATIONSHIPS OF AQUIFERS

The PRP refutes the existence of premining aquifers. The PRP also states that recharge to the alluvium and the Zone 1 and 3 sandstones from precipitation and the Pipeline Canyon stream did not exist before mining and has ended following the cessation of mine discharge. Furthermore, all water-bearing formations will dry up naturally. Pumping, according to the PRP, will speed up this process.

EPA's understanding and interpretation of the hydrogeologic conditions were summarized in Figure 2-3 and Table 2-1 of the OUFS. The PRP apparently misunderstands EPA's interpretation of the recharge conditions, therefore they are resummarized here.

EPA agrees with the PRP that significant volumes of water infiltrated the alluvium and bedrock aquifers during mine dewatering. EPA also agrees that this source has been removed. Figure 2-3 is in agreement as it indicates the mine water ceased in 1986. Also, it is not EPA's contention that precipitation and surface water are continually supplying recharge to the alluvium as implied by the PRP. EPA in fact states in the RI and OUFS that the Pipeline Canyon has been an ephemeral stream since 1986. This is a stream that flows only in direct response to precipitation. EPA's position is that recharge cannot occur when the stream is dry or not flowing.

EPA also has assumed a very low infiltration areal rate for the alluvium (0.6 inches/year). This rate was utilized in the groundwater model. This infiltration rate is appropriate for semi-arid areas.

Review of Canonie 1987a water balance calculations support the existence of other sources of recharge. For example, Canonie estimates recharge into the alluvium of only 250 gpm during mine dewatering. In contrast, outflow southwest through the alluvium is estimated at 360 gpm by Canonie. If this is true, water levels would never have risen in the canyon as high as they did. If there was a net outflow, then another source of recharge is needed to equalize the water balance.

SITE MIGRATION PATHWAYS

The existing site migration pathways are depicted by the potentiometric contour maps provided in the remedial investigation report and the Canonie 1987a report. In the alluvium, groundwater is shown to flow from the mound in the tailings pile radially outward. Most of this alluvial flow is currently towards Pipeline Canyon where it enters the main alluvial channel and flows southwest out of Section 2.

As stated previously, the alluvium can recharge the Zone 1 and 3 aquifers. Flow direction in these aquifers also follow the piezometric contours. In Zone 1, flow occurs to the northeast away from the north tailings disposal cell. Flow also occurs eastward in Zone 1 from Borrow Pit No. 2. This is well illustrated in the D-D' cross-section in the Canonie 1987a report.

Zone 3 flow is towards the northeast. Recharge from this aquifer comes from the alluvium and the tailings cell. The PRP has acknowledged that this aquifer is contaminated in Sections 2 and 36 (PRP response to OUFS, page 154).

POST-MILLING CONDITIONS

It is the PRP's contention that pumping one pore volume of site groundwater will completely dewater the current aquifer at the site. The basis for the PRP's analysis is that there will be no recharge to the hydrogeologic system in the area. EPA's position is that a combination of recharge to the aquifers by natural mechanisms and dewatering of the tailings ponds will continue to recharge the aquifer systems. EPA does agree that water levels will continue to decrease if no action occurs; however, the site will not dry up because of recharge from surface water, precipitation, and tailings dewatering. The alluvium will eventually return to premining conditions and receive intermittent recharge and still maintain an overall southwestern flow direction. The Upper Gallup sandstone also will eventually return to previous conditions which are partially saturated with intermittent or continual recharge from the alluvium.

The answers to how long the pile will dewater, how much water can be pumped from the site, and how long pumping will last cannot be precisely estimated by the PRP or EPA. To compare alternatives, EPA utilized groundwater models as predictive and comparative tools. As will be explained in Response Category 4, the models provide comparative numbers. Actual field values may be different and pumping rates and times will require adjustment; however, relative remedial alternative comparison would not be greatly affected.

RESPONSE CATEGORY 4
GROUNDWATER MODELING

The following comments were grouped into Response Category 4, and relate to groundwater modeling: ES-7, 2-2, 2-4, 2-5, 2-7, 5-5, 6-2, 6-3, 7-1, 7-2, 8-7, 8-8, 8-10, 8-11, D-General, D-1, D-2, D-3, D-4, D-5, D-6, D-7, D-8, D-9, D-10, D-11, D-Alluvial Critique, D-Zone 3 Critique, and H-6.

Comment

The primary concerns expressed in the PRP response to the OUFS groundwater model can be summarized into the following categories:

- o Incorrect input into the groundwater model
- o Inability to verify the model
- o Inability to calibrate the model
- o Incorrect selection of remedial alternatives based on model inaccuracies

Response

The response to the above concerns are summarized in the following sections. However, a brief overview of why groundwater modeling was chosen over the PRP's method of determining pumping schemes is necessary. The PRP calculated pumping volumes by determining "their" area of contamination (delineated by the pH 7.0 contour), multiplying that area by a thickness, and assigning a porosity. The resultant volume was the PRP's contamination volume. No inflow from any other source was included in their volume calculation. Tailings seepage and recharge from precipitation and alluvium was omitted. Additionally, water outside the "PRP-determined" contamination is also not considered. This procedure underestimates pumping and clean up volumes.

EPA recognizes the uncertainties in estimating contamination volumes and the complex hydrogeology of the area. For this reason, EPA chose to develop a model to analyze and compare remedial alternatives. This model can be changed and rerun if future information necessitates changes. Regardless of the exactness of the model; the time, pumping rates, and costs should be relative for each alternative. EPA would be pleased if the estimated cost and cleanup time developed from the model simulation were higher than actually experienced during site remediation.

INCORRECT INPUT INTO THE GROUNDWATER MODEL

The PRP has commented on the flow model description for the PLASM alluvial aquifer model. EPA acknowledges that the Richard's equation presented is for unconfined groundwater conditions. The model was run for unconfined conditions; however, the text referred to an artesian aquifer. The text entry is a mistake and the model was properly assigned as unconfined. Therefore, the model was not erroneously run.

The PRP has commented that boundary conditions in the alluvial model are overestimated. EPA acknowledges that water levels are declining in the alluvium. It is also EPA's position that water will continually recharge the site. However, the exact volume was unknown. A conservative, documentable approach to calculate flow from upgradient sources was utilized. This was done by measuring upgradient watershed areas and assigning an infiltration rate (0.6 inches/year) that is characteristic for the area. From this method, a flux was determined. This flux may be higher than what will occur in the future; however, it is considered conservative.

The PRP further comments that steady state conditions do not exist at the site. EPA agrees that water levels are changing and that steady state conditions do not exist; however, the baseline or premining site conditions are not well known. EPA decided that assigning a steady state condition was more useful than simulating an unknown baseline condition.

The use of nitrate to define plume size and to calibrate the model was also critiqued by the PRP. Their contention is that the model cannot be calibrated to nitrate because significant background nitrate is present and solublized easily. This additional "background source," according to the PRP, would cause errors in modeling. At present, EPA's contention is that significant levels of nitrate from background sources do not exist. EPA's position on background is detailed in Response Category 1.

In the solute transport modeling, model times were multiplied by a factor of 2 for non-retarded chemical species and 5 for retarded species. The PRP questioned these values. Non-retarded species times were taken from a comprehensive modeling study by the Carter Mining Company. Reference is made to the report entitled "Predicted Post-Mining Groundwater Quality at the Caballo Mine, Permit 433-TI, February 26, 1985." As for retarded contaminants, model times could vary significantly. A value of 5 was determined as most appropriate for the species modeled.

The last model critique regarding model input is the modeling of Zone 1 and Zone 3 aquifers. These aquifers were modeled as confined systems. The PRP points out that the aquifers are confined in some locations of the site and unconfined in others. EPA agrees with the PRP. Zones 1 and 3 sandstones are confined and totally saturated near the tailings pond. Downgradient away from the ponds, the sandstones become unconfined. Zone 3 exhibits confined conditions for a greater distance than Zone 1. EPA believes that modeling the aquifer as confined was more appropriate than unconfined because confined conditions are present near the source and in the areas with the highest contaminant concentrations. The one minor disadvantage of the constant confined conditions would be a conservative overestimate of the number of pumping wells and rates in the unconfined areas.

Review of the selected remedies for the site indicates no major impact as the result of assuming confined conditions. For example, Zone 3 pumping rates for the various alternatives are similar to the current pumping rates predicted by the PRP. Also, the selected remedy for the Zone 1 sandstone did not include groundwater pumping because it is deemed as not cost effective. The PRP has also agreed with EPA's model developed conclusion on this aquifer.

In summary, EPA acknowledges that some of the assumptions made in the development and use of the model might not be entirely correct; however, the model was used only as a tool for comparing alternatives. It is also important to note that the model results mimic current field pumping rates at the site and that the remedial selection for the Zone 1 developed by comparison of alternatives through modeling was acceptable to the PRP.

INABILITY TO VERIFY MODEL

The PRP has commented that all input data is not presented in the OUFS in order that the public or the PRP can verify and run the model. It is not common that the entire input data base is entered into an RI, FS, or OUFS report. However, EPA will enter the data dump into the administrative record.

INABILITY TO CALIBRATE THE MODEL

The alluvial transport model could not be calibrated precisely for three reasons.

1. The limits of the plume are not well defined. This means that the downgradient extent of the southwest alluvial plume is not known because of the lack of wells southwest of the PRP's property. EPA does not imply that no plume exists.

2. Limited data within the internal plume structure. The majority of the site wells in the southwest alluvium are located near the PRP's property boundary. However, distribution of wells between the property boundary and the tailings pond are irregular. Additional data points in this area would have improved model calibration.

3. The Roberts method was not able to be used to define retardation and dispersion. The main reason for this is anomalies in the southwestern alluvium. The source of the anomalies are in question. The PRP believes that they are a result of the Mancos Shale. Information provided to EPA indicates that definitive proof has not been provided.

EPA used a conservative approach to solute transport modeling because of the inability to precisely calibrate the model. EPA input observed chemical data into the model and assumed no additional input source. This assumption implies no additional leaching of nitrate from the tailings pile occurs during the future, a position held by the PRP.

INCORRECT SELECTION OF REMEDIAL ALTERNATIVES BASED ON MODEL INACCURACIES

The purpose of groundwater modeling was to compare remedial alternatives. A part of this comparison is cost. EPA's opinion is that assumptions had to be made in the model. Not all assumptions may be precise; however, the model provides a tool to make comparisons of alternatives.

On a relative basis, the model will still perform the comparison even if the data or assumptions are not precise. For instance, the relative cost comparison of pumping at each alternative would be the same if the system operated for 20 or 30 years. Therefore, EPA believes that the use of modeling is valid.

The results of much of the modeling effort confirms what the PRP already prefers. The PRP-proposed pumping rate in Zone 3 is expected to be about 60-80 gpm. This rate approaches the pumping rate of the majority of pumping alternatives for the Zone 3 aquifer. As for inaccurate alternative selection, the selected alternative by the EPA for Zone 1 and 3 through modeling is comparable to Amendment 1 pumping rates of the PRP. EPA acknowledges that pumping rates may not be as high as those used in modeling; however, actual performance will indicate this.

SUMMARY

Groundwater modeling has limitations on many sites. EPA's purpose for using groundwater modeling was to provide documentable comparison of alternatives. EPA believes that the modeling effort succeeded in that purpose. EPA also believes that the modeling effort was in large part conservative in the development of cleanup time and costs. The Record of Decision (ROD) for this site will require performance standards for cleanup. Groundwater at the site will be remediated to reach predetermined contaminant levels to the maximum extent practicable. Achieving these levels sooner than predicted by the model would be favored by EPA.

RESPONSE CATEGORY 5
RELATIONSHIP BETWEEN SELECTED REMEDY AND
NRC REQUIREMENTS AT THE SITE

AND

RESPONSE CATEGORY 7
ALLEGED DUPLICATION OF UNC AND EPA EFFORTS

The following comments were of a similar nature and are addressed under a single response category: ES-1, ES-6, 1-4, 1-6, 5-2, 5-9, 5-10, 6-1, 8-6, H-3, H-5.

Comment

EPA field work has been duplicative of UNC's investigations and resulting OUFS alternatives conflict with potential work required by the NRC.

Response

EPA believes that its field work has not been duplicative. EPA has been responsible for and is the only party that installed wells on Navajo Tribal Lands and Reservation. These wells were critical in determining offsite migration. The PRP has used these wells in their analysis of the site.

As stated in Chapter 1 of the FS, and consistent with the Memorandum of Understanding (MOU) between EPA and NRC, EPA's final design of the selected remedy will be implemented in conjunction or sequence with NRC requirements at the site. Any potential conflicts that may develop will be dealt with in accordance with dispute resolutions procedures in the MOU. As per the MOU, NRC will require the PRP to plan for and implement a site reclamation plan meeting the requirements of 10 CFR Part 40, Appendix A, as amended in 52 CFR 43533 through 43568, "Uranium Mill Tailings Regulations; Groundwater Protection and Other Issues," which conforms with EPA 40 CFR 192, Subpart D. In conjunction with the NRC effort, EPA will develop and implement a remedial action plan to address groundwater contamination outside the byproduct materials disposal site in accordance with CERCLA and the NCP.

Rather than being in conflict, EPA believes that NRC license requirements are consistent with EPA's selected remedy in the Upper Gallup aquifers. Rather than being duplicative, Amendment 1 of UNC's Reclamation Plan is consistent with requirements of both agencies. EPA understands that NRC approval of Amendment 1 is an effective start to work in all Upper Gallup aquifers, but in no way precludes modification to remedial action in the Upper Gallup aquifers if performance monitoring warrants such. EPA also understands that NRC has made a decision that the alluvial zones will require remediation. The extent of the remediation has not been decided at this time (Appendix F). Since active tailings seepage collection will be required by NRC in alluvial zones, this is consistent with the selected remedy. EPA and NRC have been working closely together during the development of the FS and have coordinated efforts to the best extent possible to achieve full site reclamation in a timely and consistent manner. This is evidenced in EPA's evaluation of the spray/mister evaporation system in Appendix H of the FS. EPA prefers this means of evaporating collected groundwater as being cost effective and consistent with NRC licensing activities.

The PRP also states that EPA work will interfere with NRC remedial activities by delaying capping of the tailings. EPA is aware that groundwater remediation may not be complete in 5 years. However, actual performance evaluations of pumping systems are necessary to make this determination. If, as the PRP claims, decreasing saturated thicknesses will limit pumping in aquifers at the site, then groundwater remedial action will be discontinued as predicted. With regard to capping of the tailings, EPA has no intention of delaying this action. Rather, if contaminated water is still pumped after capping of the tailings, lined ponds could be constructed in areas adjacent to the tailings impoundment and within the byproduct disposal area, for example, to continue offsite groundwater remediation. Salts produced from this evaporation treatment could be buried in the covered tailings impoundment and then recovered, or adjacent to the covered impoundment. The final remedial design will evaluate options should work be required following placement of the cover required by NRC.

In summary, implementation of the selected remedy will not adversely affect the NRC approved remedy. Rather, the final design of the selected remedy will incorporate and not duplicate the NRC requirements.

RESPONSE CATEGORY 6
COMMENTS ON PUBLIC HEALTH ASSESSMENT (PHA)

The following comments are addressed in this category: 4-1 through 4-12 and 8-11. These comments are directed primarily to Chapter 4 of the OUFS--Public Health Assessment (PHA).

Comment 4-1, 5, 6, 7, and 9

The PRP stated that there was no indication that the PHA was performed in accordance with the Superfund Public Health Evaluation Manual (SPHEM). Specifically, the PRP stated that two components of the PHA (Selection of Indicator Chemicals and the Exposure Assessment) departed from the above mentioned guidelines. The PRP also questioned the objectives on the current use and future use scenario.

Response

EPA believes the PHA was performed in accordance with SPHEM. As stated on Page 4-1 of the OUFS: "The public health assessment has been developed following guidelines established in the Superfund Public Health Evaluation Manual." The SPHEM states that the selection of indicator chemicals is not necessary when less than 10 to 15 chemicals are present at the site; in such a case all chemicals should be evaluated (SPHEM, Page 19). As shown in Table 2-3 of the OUFS, 21 nonradiological chemicals were identified and, therefore, EPA could have included all chemicals in the PHA. However, EPA chose to limit the number of chemicals based on the consideration of toxicity information, physical/chemical factors, and measured concentrations. For this selection process, it was not necessary to quantitatively score each chemical.

The purpose of the current use exposure scenario was to assess the public health risks to individual using water from domestic or livestock wells. The assessment did not presuppose a current human health risk as stated in the comment. In fact, the PHA concluded that current daily intakes for noncarcinogens from these wells were below acceptable daily intakes and that the risk due to radionuclides was 1.7×10^{-6} based on maximum concentrations.

The future use scenario was chosen to represent a realistic but worst-case condition of human exposure. At this point, EPA cannot assume that the areas outside Section 2 will never be inhabited, as stated in the comment. The institutional restrictions referred to in the comment have not been defined in final form. Therefore, EPA feels the future use exposure scenario is appropriate considering the uncertainties at the site and EPA's goal of protecting human health from potential future risks.

Comment 4-2

The PRP stated that the data used in the risk assessment was not presented and the procedures used to calculate the maximum and mean values were not discussed. In addition, the PRP stated that the highest contaminant values were used.

Response

EPA disagrees with the PRP. The data presented in Tables 2-3 and 2-4 of the OUFS were used in the PHA and the methods used to calculate these data were fully explained in Chapter 2 of the OUFS. These data were repeated in Chapter 4 as Tables 4-1 and 4-2. EPA based the risk assessment on both mean and maximum concentration values. The values are presented in the above referenced tables.

Comment 4-3

The PRP stated that the OUFS did not consider whether the indicator chemicals chosen were related to the site or how indicator chemical concentrations are related to background levels. The PRP also pointed out that frequency of occurrence information was not presented in the PHA.

Response

Tailings source characterization data as presented in Table 5-1 of the RI and Table 5-1 of the RI were used to develop the indicator chemical list. The SPHEM indicates that, if there are questions concerning background levels of site contaminants, these concerns should be reported but the chemical should not be excluded from the evaluation (SPHEM, Page 21). The concerns relating to determination of background are addressed in the OUFS and are further discussed in this responsiveness summary. The OUFS referred the reader to Appendix D of the RI for frequency of occurrence information for site contaminants.

Comment 4-4

The PRP asked where the high and mean values used in the risk assessment were obtained and how the mean values were determined. The PRP also asked what aquifer Well No. 625 is screened in. Finally, the commenter stated that only by "completely characterizing" the site contamination would EPA be able to conduct an accurate exposure assessment.

Response

The data used in the PHA were presented in Tables 2-3 and 2-4. The maximum and mean contaminant values were calculated directly from Appendix D of the RI. As stated on Page 2-12 of the OUFS, mean concentrations were calculated by averaging contaminant values from each well in a given aquifer. Maximum concentrations represent the highest value measured in a given aquifer. Well No. 625, as stated in Table 2-2 of the OUFS and shown in Figure 3-1, is in the South Alluvium. EPA does not believe that it is necessary nor possible to "completely characterize" site contamination. Therefore, EPA used the data that were available and conservative (protective) assumptions to estimate potential human exposures and risks.

Comment 4-8

The PRP stated that the maximum Th-230 concentration of 41,300 pCi/L is an erroneous value and that the value resulted from mistakenly assigning a value one order of magnitude too high.

Response

Although the 41,300 pCi/L value is one order of magnitude higher than the next highest Th-230 value, EPA has no reason to believe that this is an "erroneous" value. The sample passed through EPA's Quality Assurance and Quality Control (QA/QC) procedures and was presented in the RI. Further, it is not unusual for contaminant concentrations in environmental samples to vary by one or more orders of magnitude.

Comment 4-10

The PRP asked what the receptors were considered in the PHA.

Response

For the current use scenario, the receptors are the current users of the wells. For the future use scenario, the receptors are the potential users of the future wells.

Comment 4-11 and 8-11

The PRP asked how Table 8-4 and Tables F-1 through F-10 in Appendix F should be interpreted.

Response

Tables F-1 through F-10 show the reduction in the hazard index and carcinogenic risk associated with each alternative. The tables were developed by applying the percent reduction in contaminant concentrations (shown in Figures 8-4 through 8-6) to the hazard index and carcinogenic risk numbers for the No Action Alternative. These tables demonstrate the reduction in public health risk for each alternative. Table 8-4 is a summary of Tables F-1 through F-10.

Comment 4-12

The PRP questioned the adequacy of using EPA RI data that was collected in May 1985.

Response

The May 1985 data represent the most complete RI data set and were therefore used in the PHA and throughout the OUFS. EPA recognized the fact that other sampling data existed (particularly from NMEID and the PRP). Although the PRP data had not been subjected to EPA QA/QC procedures, EPA considered these data. A comparison between EPA May 1985 RI data and PRP data is presented in Table 2-5 of the OUFS. The conclusion reached from this comparison was that inclusion of the PRP data would not significantly change the development and evaluation of the alternatives in the OUFS.

RESPONSE CATEGORY 8
EVALUATION OF OTHER REMEDIAL ALTERNATIVES

Comments ES-6, 5-4, 5-7, 6-5, C-1, H-1, H-2, and H-7 relate to the alternatives selected for evaluation in the OUFS and the way the alternatives were selected. The comments and associated responses are given below.

Comment ES-6, 5-4

The PRP suggested that remedial options recommended by EPA in its guidance documents were never considered in the OUFS. These options include more detailed institutional controls, alternate water supplies for potential water users, inclusion of remedial activities proposed by the PRP to NRC, and other innovative technologies.

Response

EPA believes that the OUFS considered all relevant options noted in the guidance documents. EPA notes that each of the options mentioned by the PRP was considered in the OUFS. Access and use restriction and alternate water supply technologies were considered when developing the Institutional Control response action. Some alternate water supply options were not selected as representative because the options would not meet the remedial objectives or were not applicable to the site. The Institutional Control response action that was retained was used to form a Limited Action alternative and was also combined with other response actions to form the groundwater remedial alternatives.

Remedial activities proposed by the PRP are considered throughout the OUFS. These are noted in the Key Assumptions section of Chapter 1 and in other portions of the OUFS. Innovative technologies were also considered in the screening portion of the OUFS. They were all some form of physical/chemical treatment and offered no apparent benefit over the option selected as representative.

As noted in the OUFS, process options not considered representative of the technologies may be reinvestigated during remedial design for the selected remedial alternative. All process options for the selected remedial alternative, including those options not selected as representative, can be evaluated more closely during design.

Comment 5-7

The PRP suggested the OUFS should consider not only whether use restrictions or other institutional controls are effective in meeting remedial action goals, but whether the controls protect human health and the environment and are more cost-effective than other response actions.

more cost-effective than other response actions.

Response

The OUFS considered a number of factors during the screening and evaluation process. A number of issues in addition to ability to meet remedial action goals were considered when screening use restrictions or other institutional controls. For example, it was noted in Figure 5-4 that institutional controls may be protective of human health. EPA believes it is important to note that a limited action alternative, consisting of institutional controls and use restrictions was subsequently formed and developed for detailed analysis. During detailed analysis, many issues were considered for the limited action alternative, including those described by the commenter.

Comment 6-5

The PRP suggested that the description of the PRP alternative in Chapter 6 is incorrect and should be clarified.

Response

EPA believes that the description in the OUFS was correct at the time the OUFS was released, but agrees that the proposed system has been modified by the PRP since then.

Comment C-1

The PRP stated that drilling a new well or deepening an existing one would be a more cost effective solution than those proposed in the OUFS.

Response

The process option screening portion of the OUFS noted that alternative water supply process options would either not meet the remedial objectives or would not be applicable at the site. An alternative water supply by itself would not meet the remedial objectives of containing contaminant migration or restoring groundwater quality.

Comment H-1

The PRP stated that expansion of the existing spray evaporation system deserves more than a qualitative evaluation in an appendix of the OUFS.

Response

EPA notes that the evaluation provided was not purely qualitative. The OUFS evaluation of the expansion of the existing spray system contained in Appendix H includes qualitative and quantitative assessments of such an option.

A cost analysis of the option, including capital, operation, and present worth costs is provided in Appendix H.

Comment H-2

The PRP noted that the spray evaporation system described as proposed in the OUFS had been started up. In addition, the PRP described a PRP reclamation plan that included both source control and offsite groundwater remediation. The PRP suggested that this plan had not been acknowledged in the OUFS.

Response

A component of the proposed system described in the OUFS has been started up. EPA notes that performance data on the system was not available at the time of the preparation of the OUFS. The requirement for preparation of a reclamation plan was noted in the OUFS as well as assumptions about PRP plans for source control. PRP proposals for offsite remediation were not noted since it is EPA's responsibility, as part of the MOU, to address offsite groundwater contamination. EPA, however, was keenly aware of the proposed active seepage collection in the Upper Gallup aquifers in Amendment 1 to the PRP's license and coordinated closely with the NRC on its approval.

Comment H-7

The PRP suggested that all treatment options described in the OUFS require the same manner of disposal of dried inorganic material. The commenter believes the OUFS unfairly singles out leaching of contaminants from a spray/evaporation treatment option.

Response

EPA agrees that there would be some potential for leaching for both methods of treatment, but disagrees that the column evaporation and spray/evaporation system would have the same method of disposal. Smaller quantities of material would likely be transported to the tailings pile from a column evaporation system at any given time as compared to a spray evaporation pond, unless the spray/evaporation system is operated under optimum conditions to minimize and control migration of residual solids in the tailings disposal area. The potential for migration of inorganic material was discussed in the effectiveness evaluation for remedial alternatives.

RESPONSE CATEGORY 9
COMPLIANCE WITH APPROPRIATE EPA GUIDANCE

The following comments are addressed in this category: 3-3, 5-6, 5-8, 8-1 through 8-4, and 8-9. These comments are directed primarily to the compliance of the OUFS with appropriate EPA Guidance.

Comment 3-3

The PRP questioned the use of Federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs), State standards, and 10 CFR Part 40, Appendix A, as ARARs.

Response

As stated on Page 3-4 of the OUFS, MCLs are considered relevant and appropriate in cases where groundwater may be used in the future as a drinking water source. The state of New Mexico standards apply to all groundwaters having a total dissolved solids concentration of 10,000 mg/L or less. As stated in the MOU between NRC and EPA, 10 CFR Part 40 Appendix A will be the applicable requirements within the disposal site. However, the MOU also states that EPA will develop its own site action requirements for groundwater contamination outside the disposal site. These requirements include MCLs and state standards referenced above.

Comment 5-6

The PRP questioned the cost criteria used in the development and evaluation of alternatives and whether the evaluation conformed to EPA guidance.

Response

The development and evaluation of remedial alternatives in the OUFS was performed in accordance with EPA guidance. The guidance on feasibility studies referenced by the PRP is a pre-SARA, 1985 document. For the UNC OUFS, OSWER Directive 9335.3-01 "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (Draft March 1988) was used. This guidance reflects the requirements of SARA. The cost evaluation referred to by the PRP is not the intermediate stage of evaluation; the intermediate level of cost evaluation is performed in Chapter 7 of the OUFS.

Comment 5-8

The PRP questioned whether the column evaporation treatment method met the requirements of implementability, effectiveness, and cost. In addition, the PRP suggested that spray evaporation of the groundwater would be a more appropriate treatment technology.

Response

The column evaporation treatment method was evaluated against implementability, effectiveness, and cost criteria as defined in EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. As stated in the OUFS, this process is relatively well developed and implementable and produces a low volume of treatment residue. A primary advantage of this process is that it can be operated on a continuous basis. EPA evaluated the spray evaporation system as part of Appendix H of the OUFS. Like the column evaporation process, this system has several unique advantages and disadvantages. As indicated in the ROD, EPA has chosen the spray evaporation system to treat contaminated groundwater.

Comment 8-1

The PRP questioned whether a Reliability Analyses was included in the analysis of alternatives as required by EPA guidance.

Response

The guidance that the PRP references is pre-SARA, 1985 guidance. The UNC OUFS was developed in accordance with EPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Draft, March 1988). This document reflects the mandates of SARA and the various OSWER directives that have been issued since the publication of the 1985 guidance. Reliability criteria are an integral component of the implementability and effectiveness evaluation presented in Tables 8-2 and 8-3 of the OUFS.

Comment 8-2

The PRP questioned whether the classification of the groundwater at the site was considered in the OUFS. The PRP suggests that the groundwater should be considered Class 3.

Response

EPA did consider the classification of the groundwater in developing and evaluating remedial alternatives. EPA's OSWER Directive 92831-2 "Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites" (Draft, April 1988) incorporates the classifications in EPA's Groundwater Protection Strategy. Class IIB groundwater is groundwater that is potentially available for drinking water. Class III groundwater is groundwater with higher than 10,000 mg/L TDS or contaminated beyond levels that allow remediation using methods reasonably employed in public water treatment systems. EPA considers the groundwater at the UNC site to be Class IIB.

groundwater at the UNC site to be Class IIB

Comment 8-3

The PRP stated that a cash flow over the life of the remedial action was not included as per EPA's 1985 Guidance.

Response

EPA developed and evaluated the remedial action alternatives in accordance with EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Draft, March 1988). As specified in this guidance, costs for remedial alternatives were based on capital as well as annual operation and maintenance costs. The present worth analysis also presents short-term (0-10 years) and long-term (11-60 years) present worth costs.

Comment 8-4

The PRP stated that the cost sensitivity analysis was not performed in accordance with EPA's 1985 guidance.

Response

EPA conducted a sensitivity analysis for the detailed cost comparison in accordance with EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Draft, March 1988). The cost sensitivity was performed for the factors that could significantly change the overall costs with only a small change in their values.

Comment 8-9

The PRP stated that the effectiveness evaluation for each alternative does not address the potential replacement of component parts, as required by 1985 EPA guidance.

Response

Reliability of controls was included as an assessment factor in the effectiveness evaluation of each alternative, as specified in EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Draft, March 1988). Specifically, reliability of controls addressed the availability of replacement equipment during the life of the remedial action.

RESPONSE CATEGORY 10
GROUNDWATER TREATMENT TECHNOLOGIES

Comments 5-9, 6-1, and 8-13 relate to the technologies used for groundwater treatment.

Comment 5-9

The PRP expressed concern that the technical discussion of the operation of the pond evaporation system is not correct. Specifically, the PRP is concerned that area requirements for ponds may be overestimated because of modeling results, that the same mechanism for wind blowing of material could occur for other treatment/disposal alternatives, and that the construction requirements which may be necessary would not be needed since the ponds could be constructed in the tailings area.

Response

EPA believes that the discussion in the OUFS is correct. Issues regarding groundwater modeling are discussed elsewhere in the responsiveness summary as is a discussion of the potential for wind-blown migration of inorganic material. The statement regarding the pond construction is correct since more rigid requirements may be required if all the necessary ponds cannot be constructed in the tailings disposal area. Additional issues were also included in the evaluation of process options that also factored into the selection of the representative process option. These issues were not acknowledged by the PRP.

Two additional points should be noted. First, the purpose of the OUFS process option screening is to select a process option that is representative of the technology. Process options not considered representative would be reconsidered during design of the selected remedial alternative. Because spray evaporation was not the selected process option does not mean it would not be reconsidered during remedial design for physical/chemical treatment. Secondly, despite the results of screening, a detailed analysis of the spray/evaporation process option for physical/chemical treatment is included in the OUFS. This analysis is included since the PRP is presently operating such a system.

Comment 6-1

The PRP suggested that the OUFS does not include a logical assessment of all implementable and feasible alternatives in the OUFS. Specifically, the PRP believes that evaporation ponds are not considered seriously in the OUFS.

Response

EPA believes the OUFS includes a logical process for development of final remedial alternatives, as is required for the OUFS. Representative process options were selected during the selection process; not all process options for a technology can be considered in detail for the OUFS. Despite this, the OUFS does include a detailed analysis of the use of evaporation ponds for physical/chemical treatment in Appendix H. Moreover, EPA has chosen the spray evaporation system in the ROD to treat contaminated groundwater.

Comment 8-13

The PRP asked about the availability of the Technical Memorandum on the spray evaporation system.

Response

Appendix H of the OUFS is the Technical Memorandum.

RESPONSE CATEGORY 11
RELATIONSHIP BETWEEN UNC AND EPA ACTIONS

Only one comment, 1-7, fell into this category which concerns the use of Section 2 by EPA for remediation equipment and structures.

Comment

The PRP indicates that no agreement has been reached with EPA regarding the placement of equipment on Section 2.

Response

For the OUFS, EPA has assumed that an agreement can be reached whereby portions of Section 2 can be used to implement remedial actions outside the tailings disposal area, if necessary. This assumption is a reasonable one since ample legal enforcement authority is available in CERCLA to permit EPA to gain access to the site in the event no agreement is reached.

RESPONSE CATEGORY 12
COSTS

Comments 7-1 and 7-2 relate to the cost of the remedial alternatives. The comments are of a similar nature and are grouped together as a single response.

Comments 7-1 and 7-2

The PRP suggested that the remedial alternatives and cost analysis summarized in Chapter 7 is faulty because model results are faulty.

Response

The EPA has responded to issues regarding the groundwater model elsewhere in the responsiveness summary. The EPA accepts that there is some uncertainty in any groundwater model and believes the cost analysis in the OUFS provides a satisfactory basis for comparison of the remedial alternatives.

RESPONSE CATEGORY 13
NON-ACTION

Comments 1-5, 6-4, 8-5, and H-4 required no action or no response. These comments were PRP statements of agreement with EPA's position or conclusion; therefore, a response is not necessary.

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Appendix I

MEMORANDUM OF UNDERSTANDING
BETWEEN REGION VI OF THE
U.S. ENVIRONMENTAL PROTECTION AGENCY
AND
REGION IV OF THE
U.S. NUCLEAR REGULATORY COMMISSION
FOR REMEDIAL ACTION AT THE
UNC-CHURCHROCK URANIUM MILL
IN McKINLEY COUNTY, NEW MEXICO

Memorandum of Understanding

Between Region VI of

The U.S. Environmental Protection Agency and Region IV of

The U.S. Nuclear Regulatory Commission

for Remedial Action at the UNC-Churchrock Uranium Mill

In McKinley County, New Mexico

I. PURPOSE

This document establishes the roles, responsibilities, and relationship between Region VI of the U.S. Environmental Protection Agency ("EPA") and Region IV of the U.S. Nuclear Regulatory Commission ("NRC"), hereinafter collectively referred to as the "Parties," regarding remedial action at the UNC-Churchrock uranium mill in McKinley County, New Mexico. The Parties have overlapping authority in connection with this site, and this Memorandum of Understanding ("MOU") will help assure that remedial actions occur in a timely and effective manner.

II. BASIS FOR AGREEMENT

NRC will assume the role of lead regulatory agency for the byproduct material disposal area reclamation and closure activities and EPA will monitor all such activities and provide review and comments directly to NRC. The objective of EPA's review and comment will be to assure that activities to be conducted under NRC's regulatory authority allow attainment of applicable or relevant and appropriate requirements under the Comprehensive Environmental Response Compensation and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. §9601 et seq outside of the byproduct material disposal site. NRC will require the Licensee to implement an approved disposal site reclamation plan which meets the requirements of 10 CFR Part 40, Appendix A, as amended at 52 Fed. Reg 433553 through 43568, "Uranium Mill Tailings Regulations; Groundwater Protection and other Issues," which conforms with the EPA 40 CFR 192, Subpart D. EPA development and implementation of its own site action requirements for groundwater contamination outside of the disposal area will be conducted in accordance with CERCLA and the National Oil and Hazardous Substances Contingency Plan ("NCP") 40 CFR Section 300 including any revisions thereto. The EPA and NRC agree that the groundwater protection requirements of 10 CFR Part 40, Appendix A are the Federal environmental and public health requirements applicable or relevant and appropriate to the disposal site. The EPA and NRC believe that conformance with 10 CFR Part 40, Appendix A (with the possible exception of nitrate), will generally assure conformance with CERCLA requirements. However, each Party will be responsible for assuring compliance with it's specific regulatory requirements as discussed in this section. The parties believe that the U.S. Department of Energy or another responsible State or Federal authority will assume responsibility for long-term care of the byproduct material disposal site, following remediation of the site.

III. BACKGROUND

The State of New Mexico was responsible as an "Agreement State" for licensing and regulating uranium mills within the State until June 1, 1986, at which time the NRC resumed this authority at the request of the Governor of New Mexico. Prior to this change, EPA had placed the UNC-Churchrock site on the National Priority List ("NPL") of sites for response action under CERCLA. EPA's policy is to list only those uranium mills meeting criteria for placement on the NPL which are located in Agreement States, that is States which have entered into agreements with the NRC pursuant to Section 274 of the Atomic Energy Act of 1954, as amended, to regulate certain nuclear activities in a manner compatible with the NRC's program. Mills in states where NRC has direct licensing authority have not been placed on the list. Although New Mexico is no longer an Agreement State insofar as uranium recovery operations are concerned and the NRC has reassumed primary jurisdiction, the site was properly placed on the NPL and the physical conditions resulting in that placement are still present. Therefore, EPA has no intention of recommending delisting the site from the NPL until all authorized EPA and NRC controlled remedial activities, addressing releases or threats thereof, at this facility are completed.

IV. AGREEMENT

In order to achieve satisfactory cleanup of the UNC site, the NRC and the EPA agree to do the following:

1. The Parties shall cooperate with each other in the oversight of reclamation and remedial activity at the UNC site.
2. Upon submittal by UNC of a proposed site reclamation plan ("the plan"), NRC and EPA will begin concurrent reviews of the

proposed plan. EPA will review the plan and will provide comments to the NRC. NRC will review and, if necessary, require revisions to the plan to assure conformance to 10 CFR Part 40, Appendix A, as amended, prior to approving the plan via license amendments. If EPA cannot conclude that the plan approved by NRC meets CERCLA requirements, then EPA may initiate separate actions as may be necessary to ensure conformance with CERCLA requirements outside of the disposal area site. NRC will not approve any specific components of the groundwater protection and recovery aspects of UNC's proposed reclamation plan until EPA has determined, in a Record of Decision or by review of the UNC plan and statement to NRC, that it is consistent with CERCLA requirements and/or remedial actions required under CERCLA. NRC does not intend to approve any specific aspects of UNC's groundwater protection and recovery actions contained in UNC's proposed reclamation plan until such time as any inconsistencies have been resolved. If remedial action is determined in a Record of Decision to be necessary, EPA intends to either enter into a Consent Decree with UNC under which UNC will conduct, with EPA oversight, remedial actions equal to or exceeding those outlined in an EPA Record of Decision, to take appropriate enforcement action, or perform remedial action itself pursuant to Section 104 of CERCLA, reserving all rights to seek cost recovery under Section 107 of CERCLA. Such actions may be conducted as part of the NRC's approval of the UNC plan or separately; but in any event EPA intends to coordinate its actions first with the NRC.

3. If either Party determines that remedial actions are deficient or unsatisfactory, then that Party shall provide notice to the other Party of the deficiency. The NRC shall assume the lead role for notification to UNC, except for such notification as EPA might statutorily be required to provide in certain events. The notification shall specify a time period in which regulatory compliance is expected to be achieved. Should compliance not be achieved in this time period, EPA will assume the lead for taking or seeking any enforcement action necessary for off-site groundwater and NRC will assume the lead for any other enforcement actions necessary within its area of regulatory responsibility. Both Parties reserve all rights under this MOU to take whatever actions are determined to be necessary, including the conduct of remedial actions on and off-site in order to fulfill their regulatory requirements. In any event no action will be taken by either party without prior consultation with the other Party.

4. Both Parties shall appoint a facility coordinator who shall be responsible for oversight of the implementation of the MOU and the activities required herein. The facility coordinators shall be appointed by each Party within seven (7) days of the effective date of this MOU.

The Parties each have the right to appoint a new facility coordinator at any time. Such change shall be accomplished by notifying the Party, in writing, at least five (5) days prior to the appointment of the name, telephone number, and mailing address of said facility coordinator.

5. The Parties will meet periodically at the request of either Party and at least semiannually insofar as it is necessary to accomplish the objectives of the MOU. The facility coordinators should communicate with each other on a routine basis by telephone.

6. The Parties will provide technical advice and any necessary regulatory consultation to one another upon request.

7. The Parties will generally provide each other with copies of all official correspondence and documents related to remedial actions at the site. The Parties will also normally provide copies of other information upon request. In the event that one of the parties does not wish to furnish certain specific information, documents, or correspondence to the other, then said material shall be identified to the other party along with the reasons for withholding it.

8. Whenever notice or information is required to be forwarded by one party to another under the terms of this MOU, it shall be given by

and directed to the individuals at the addresses specified below:

EPA: Allyn M. Davis, Director
Hazardous Waste Management Division
Region VI, U.S. EPA
1445 Ross Ave.
Dallas, Texas 75202

NRC: Dale Smith, Director
Uranium Recovery Field Office
U.S. Nuclear Regulatory Commission
P.O. Box 25325
Denver, Colorado 80225

9. Routine communications may be exchanged verbally, in person, or by telephone between the Parties to facilitate the orderly conduct of work contemplated by this MOU.

10. Enforcement documentation provided under this MOU will be kept as exempt material by EPA and NRC, to the extent legally possible, according to the policies and procedures under 40 CFR Part 2 and 10 CFR Part 2.790, respectively.

V. AGENCY RESPONSIBILITIES

A. NRC responsibilities

1. The NRC will require the owners/operators of the UNC Churchrock mill (UNC) to implement an approved on-site reclamation plan that meets all relevant NRC requirements, including 10 CFR Part 40, Appendix A, as amended. If any such plan is not complied with by UNC, NRC will take whatever actions it deems appropriate to ensure compliance.

2. The NRC will direct UNC to provide both parties with copies of major work product submittals as they become available. Such work products will include, but not be limited to, an adequate overall reclamation plan, and any other plans and specifications for assessment, remediation, and monitoring, including all analytical data.

3. The NRC agrees to provide progress reports on UNC remediation on a quarterly basis.

4. The NRC will assist in the development of information to support EPA's deletion of the site from the NPL upon completion of the remedial action.

5. The NRC shall notify EPA of all pending visits to the Churchrock property which relate to the site closure plan and shall afford EPA and its consultants opportunity to accompany NRC personnel on such visits.

B. EPA RESPONSIBILITIES

1. EPA will provide formalized review, consultation and comment throughout the entire project.

2. EPA will review and provide comments on the site reclamation plan, and other associated deliverables, within timeframes as agreed to between NRC and EPA. In the event that EPA determines that the implementation of the site reclamation plan has not resulted in, or may not result in, cleanup conditions that meet applicable or

relevant and appropriate requirements under CERCLA, then EPA may take whatever action it deems appropriate.

3. EPA intends to pursue and complete a Remedial Investigation and Feasibility Study, public comment and agency response process, and Record of Decision (ROD) directed at off-site groundwater contamination, with the intention of completing this process by to October 1, 1988. EPA intends to implement, or require UNC or other potentially responsible parties to implement, any EPA selected remedial actions set forth in a ROD. Any remedial actions conducted by UNC or other potentially responsible parties to implement an EPA selected remedy will be done under EPA oversight and in accordance with the terms of any Consent Decree entered into with EPA. EPA intends that any such Consent Decree would cover actions outside the byproduct material disposal site needed to implement the ROD remedy.

VI. DISPUTE RESOLUTION

In the event of dispute between EPA and the NRC concerning site activities, the persons designated by each Agency as primary or, in their absence, alternate contact points will attempt to promptly resolve such disputes. If disputes cannot be resolved at this level, the problem will be referred to the supervisors of these persons for further consultation. The supervisory referral and resolution process will continue, if necessary to resolve the dispute, to the level of the Regional Administrators of the NRC and EPA.

Both Parties shall continue to maintain their respective rights or responsibilites under the MOU during the dispute resolution process.

VII. EXECUTION AND MODIFICATION

This agreement shall take effect upon execution by EPA and the NRC. It shall remain in effect for the duration of the program addressed herein unless terminated by mutual agreement by the two Agencies; or, the MOU may be terminated unilaterally if any of the conditions set forth below are present.

1. The planning or conduct of groundwater cleanup actions fail to meet standards set forth in the Basis for Agreement (Section II) of this MOU.
2. The site is deleted from the NPL.
3. The site is turned over to the Department of Energy or other responsible State or Federal authority for long term care.
4. Regulatory, Statutory, or other events occur which make this MOU unnecessary, illegal, or otherwise inappropriate.

VIII. MODIFICATION

The Parties may modify this MOU from time to time in order to simplify and/or define the procedures contained herein. Each Party shall keep the other informed of any relevant proposed modifications to its basic statutory or regulatory authority, forms, procedures, or priorities. This MOU shall be revised, as necessary, by the adoption of such modifications. The MOU should be reviewed on an annual basis by both the Director-URFO, Region IV, NRC, and the Director-Hazardous Waste Management Division, Region VI, EPA or their designated representatives.

IX. RESERVATION OF RIGHTS

The Parties reserve any and all rights or authority that they may have, including but not limited to legal, equitable, or administrative rights. This specifically includes EPA's and NRC's authority to conduct, direct, oversee, and/or require environmental response in connection with the site, as well as the authority to enter the site and require the production of information, within each of their own areas of responsibility.

Executed and agreed to:

Robert D. Martin — August 26, 1988
Robert D. Martin
Regional Administrator
U.S. Nuclear Regulatory Commission,
Region IV, Arlington, Texas
Date

Robert E. Layton Jr. — August 26, 1988
Robert E. Layton Jr., P.E.
Regional Administrator
U.S. Environmental Protection Agency
Region VI, Dallas, Texas
Date