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U.S. Nuclear Regulatory Commission
Mr. Joseph J Holonich, Chief
Uranium Recovery Branch MS-T-7J9
Division Of Waste Management
Office of Nuclear Safety and Safeguards
11545 Rockville Pike
Rockville, MD 20853

December 4, 1996

40-8907

Re: Comments to The Background Evaluation Report

Dear Mr. Holonich:

United Nuclear Corporation would like to thank you for sending us a copy of the U.S. Nuclear Regulatory Commission staff report titled "Evaluation of the Statistical Basis for Establishing Background Standards at the United Nuclear Corporation Church Rock Uranium Mill Tailings Disposal Facility, Gallup, New Mexico" (ESB). We would like to take this opportunity to comment on a number of issues raised in the report, and to clarify several items. The comments are organized into six sections which address common subjects. These are:

Section 1.0 - Regulatory Process for the Church Rock Site
Section 2.0 - Quivira Evaporation Pads
Section 3.0 - Source For Nitrate in Soils and Background Water
Section 4.0 - Other Constituents Evaluated For Background Levels
Section 5.0 - Evaluation of Background For Zone 1 and Zone 3
Section 6.0 - Other Issues of Concern

Figures and tables associated with the comments are included in each separate section.

United Nuclear intends that these comments provide documentation in the public record of our viewpoint on the content of the ESB. Unfortunately, because of the closing of the Denver Uranium Recovery Field Office (URFO), the dialogue between the agencies and United Nuclear that existed prior to 1993 has been lost. As a result, the document contains some information that is either incorrect or confusing. United Nuclear feels that this could have been avoided if we had been given the opportunity to review the draft document and to be a party to the communications between NRC, EPA, Jacobs, NMED and the Navajo Superfund.

Of particular concern is the fact that it has been 4 years since we first requested revision of the background standards for nitrate, sulfate and TDS. The request was first made during the meeting on December 4, 1992 as part of the presentation of the results of the Background Water Quality Report (BWQR). This request was followed up more formally in the 1992 Annual Review based on the results of the BWQR (not the 1993 Annual Review as stated on page 3 of the ESB). The request at that time included termination of pumping in the Southwest Alluvium.

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NRC responded to the request in the letter dated February 25, 1993 which stated that United Nuclear must complete the statistical analysis of the background water quality data before requesting a corrective action modification. Accordingly, United Nuclear performed the analysis and presented the results in the Statistical Analysis of Alluvial Water Quality Report (Statistical Analysis Report) which was submitted in April 1993. Unfortunately, by the time the report was submitted, the Denver URFO was in the process of closing. Key personnel had left NRC by the middle of 1993 and, as a result, the momentum created from submittal of the BWQR in October 1992 and the presentation in December 1992 was lost.

In the meanwhile, United Nuclear has continued to submit the annual ground water monitoring reports as required by its license. Each of these reports contains recommendations and requests for modification of the corrective action program. United Nuclear also submitted, in 1994, the five year review of the ground water corrective actions as required by the EPA. Response to these requests have been held up pending review of our statistical analysis report.

United Nuclear was hopeful that in the ESB, the NRC had finally responded to the request made in 1992 to reevaluate and change the ARARs for nitrate, sulfate and TDS. However, review of the document shows that this is not the case. The majority of the document is spent reevaluating the 1977 data to revise pre-tailings background levels and providing critique of the background water quality evaluation performed by Jacobs as part of the EPA's Five-Year Review. A formal review of the BWQR and the Statistical Analysis Report was not included in the ESB.

United Nuclear is very concerned that with the passage of time that there has been a loss of continuity such that the interpretation of the goals for cleanup of the site are being interpreted in a very different manner than they were at the outset of implementation of the program. With this in mind, United Nuclear offers the following historical perspective in hopes that the decisions made today will reflect the intention of the regulators when this process began. We have assembled the following review after review of the available files and interviews with NRC personnel that were at URFO at the time the Corrective Action Plan was approved.

After the State of New Mexico relinquished its Agreement State status, the site was licensed by the NRC. It is our understanding that the State had deferred to the NRC all regulatory control for byproduct materials and site remediation, particularly in light of the fact that the State had never approved a ground water discharge plan for the Church Rock site. The NRC maintained communication with the State and the Navajo as a courtesy inasmuch as these entities had stated a desire to devote its resources to other regulatory matters.

NRC was also aware that the EPA was conducting a ground water investigation at the site under CERCLA. This investigation was similar to the efforts required under Appendix A of NRC's regulations. Consequently, the NRC and EPA, through mutual informal agreement, worked together to define a regulatory strategy for the site with the intent to avoid duplication of effort and to allow

the licensee to interface with a single point of contact to the extent possible. It was recognized that NRC had extensive experience with uranium mill tailings issues. United Nuclear was led to understand that NRC was to maintain the regulatory authority at the site to oversee the remediation activities, while maintaining communication with the State, Navajo, and EPA.

With regard to the ground water issues, it was recognized that while two regulatory pathways were being pursued simultaneously, i.e., the NRC regulations and Superfund, they had common origins and common destinations. The regulatory authority under which EPA managed the site had its technical basis in 40CFR, Part 264, which were also the guiding documents for NRC's 10CFR Part 40, Appendix A regulations. However, Appendix A was specific to protection of human health and the environment at uranium mill tailings sites and, thus, tailored to the remediation of those sites rather than being generically applicable to characterization and remediation at CERCLA sites. We are advised that EPA recognized that Appendix A contained all of the necessary elements for a CERCLA site response.

EPA' s and NRC's program managers, both ground water technical specialists, worked together towards three common goals; to develop a ground water corrective action program, to determine an adequate monitoring network, and to establish background values. NRC took the lead role in these efforts because of its experience at many mill tailings sites throughout the arid southwest.

In zones one and three it was agreed that the limited extent of seepage could be remediated by dewatering the formation at the location of seepage. In the alluvium, it was determined that source containment was the appropriate remedy. i.e., capping the tailings to cut off the source and controlling the flow of contamination downgradient while the source was being contained. NRC required that corrective actions be undertaken in the southwest alluvium at the request of EPA because certain "non-hazardous" constituents in the ground water at that location were believed to exceed background levels. NRC had concluded that there were no hazardous constituents in ground water in the southwest alluvium.

With regard to the establishment of background water quality, we understand the NRC was of the view that the wells at the northern boundary of the site, referred to as the 600 series wells, adequately represented background conditions in the alluvium. It had been stated on several occasions by NRC that there was sufficient ground water data to confirm that hazardous constituents, verified by NRC to be found in the tailings solution by NRC sampling, had not migrated to the 600 series wells. EPA, however, considered the nitrate, sulfate, and TDS concentrations in the 600 series indicative of some form of contamination, if not from tailings, from another postulated source, i.e., the Quivira ponds. The attached comments provide significant detail on this matter. United Nuclear believes that there is clear and ample evidence to demonstrate that the 600 series wells are indeed representative of background.

The various studies conducted by United Nuclear in support of background were for the purpose of confirming that the alluvial soils themselves were a potential and likely source of nitrate, sulfate, and

TDS. It was our understanding that by the time that the NRC URFO was closed that NRC and EPA were in agreement that such was the case. We were asked in late 1992 conduct a statistical analysis of the data generated from the 600 series wells and wells EPA-22 and GW-4, not because there was continuing question about the validity of the data, but rather, because it represented the resident, i.e., background water, in the alluvium as well as the water that may locally recharge the gallup formation. The purpose of the statistical analysis requested by NRC was to allow NRC to evaluate the multiple background locations at a 95% level of confidence, consistent with EPA's 40CFR, Part 264 and NRC's 10CFR, Part 40, Appendix A requirements. The stated intent was that such an analysis would be certain to satisfy the needs of both NRC and EPA and serve as the technical basis for an amendment to the ground water protection standards.

In summary, the EPA and NRC worked very closely together at the outset to implement a ground water corrective action program that encompassed the regulatory needs of the respective agencies, the State of New Mexico, and the Navajo. NRC emerged as the lead agency because of its experience at numerous uranium mill tailings sites and because of its specific regulatory authority and the operational license issued to United Nuclear.

The NRC and EPA reached similar conclusions associated with the initially unsaturated state of the zone one and zone three formations. Additionally, there was agreement that the mine discharge water was the primary recharge source for the alluvial materials. Although background water quality for nitrate, sulfate, and TDS was in question, United Nuclear implemented a corrective action program. The program was designed to remove water from zone one and zone three, returning the formation in the vicinity of the site to its pre-milling desaturated state and containing seepage in the alluvium until the source was remediated. The program was jointly approved by the NRC and EPA under the terms of the MOU and is currently operating awaiting the long requested modifications.

Ultimately, as indicated by the statements on page 17 of the ESB, the NRC has come to conclusions about revised ARARs for the three constituents that are in agreement with the recommendations made by United Nuclear four years ago. However, these conclusions are made in the context of recommendations to EPA for consideration as part of the EPA's Five-Year review. Based on the previous regulatory history of the site, United Nuclear understands that the NRC is the lead agency that has the responsibility to develop the final revised ARARs, with input from EPA. We have operated under that premise and look to NRC to make those determinations.

Unfortunately since the closure of URFO progress in this direction has been slowed by what appears to us to be a lack of understanding of the respsective roles agreed to by NRC and EPA. United Nuclear is anxious to get this project back on track. Ground water management and corrective action at the Site have dramatically reduced water levels and recovered tons of dissolved constituents. Conditions at the site have reached a point where it is now appropriate to modify or terminate the corrective action plan.

United Nuclear looks forward to the NRC again functioning as the guiding agency for the corrective

action at this site as it was originally conceived and represented to us when we agreed to commence remedial actions in 1988.

Sincerely,

Juan R. Velasquez

cc: Don Williams US EPA
Ken Hooks

COMMENTS TO NRC BACKGROUND EVALUATION REPORT

1.0 REGULATORY PROCESS FOR THE CHURCH ROCK SITE

The regulatory process for the Church Rock site which defined the responsibilities of the agencies and what constituents would be monitored is lengthy and may cause confusion. United Nuclear Corporation (United Nuclear) would like to take this opportunity to clarify several references in the "Evaluation of the Statistical Basis for Establishing Background Standards at the United Nuclear Corporation Church Rock Uranium Mill Tailings Disposal Facility, Gallup, New Mexico" (ESB) where information regarding the regulatory process was either incomplete or incorrect. The references and associated discussion are presented in the following sections. The discussion was prepared after extensive review of documents shipped to the Nuclear Regulatory Commission (NRC) headquarters Public Document Room by the Denver Uranium Recovery Field Office (URFO), which was responsible for the process of establishing agency responsibility and ground water monitoring requirements.

1.1 Nitrate, Sulfate and Total Dissolved Solids in the License

The statement is made in the ESB that "Although the constituents in question are not included in the NRC license, ..." (page 1, first paragraph, lines 11-13). This statement is inaccurate because these constituents are included in the NRC license, in Condition 30A. They were first included in the license in 1988 as Amendment 2, which required that these constituents be monitored.

These constituents were included in the license considering the standard regulatory process under Criterion 5 of Appendix A to Title 10 Code of Federal Regulations (CFR) Part 40. Criterion 5 requires that background ground water concentrations be identified. The regulatory citation requires that the NRC establish background levels based upon information that the licensee supplies. Establishment of background levels at the Church Rock site followed this process.

In accordance with the requirements of the Denver URFO, United Nuclear supplied the ground water monitoring data that had been collected at the site. Following a review of these data, the NRC sampled the tailings impoundment solution. Because the impoundment had no standing water, large diameter auger holes were utilized to reach the tailings solution. The samples were filtered in the on-site United Nuclear laboratory, preserved, and sent to Oak Ridge National Laboratory for analysis. All 375 Criterion 13 constituents were evaluated as were numerous metals not listed in Criterion 13. This intense sampling effort was undertaken to determine if there were any constituents present in the tailings solution that had not been detected in the ground water.

The NRC utilized these data to compile a list of monitored constituents that were representative for the site, as required by Criterion 5B(1). This list is incorporated into the United Nuclear License by Amendment No. 2. These efforts were implemented independent of similar work that the U.S. Environmental Protection Agency (EPA) was undertaking at the site at the same time. However, it was apparent that parallel efforts were being implemented. Consequently, the data developed under the Criterion 5 process were shared with the EPA. This was not the initial meeting of the two agencies, but it did begin a dialogue that relied heavily on the NRC's expertise at uranium mill tailings sites and the by-product materials that they contain.

Additional meetings between the NRC and EPA indicated a desire to have a single document that contained all the monitored constituents. The selected document was the existing Source Material License SUA-1475 (License). The subsequent ground water corrective action program that was implemented at the site in accordance with Criterion 5D was designed to recover the less mobile hazardous constituents. As a consequence of this action, the more mobile and easily dissolved constituents, including sulfate, nitrate and total dissolved solids (TDS), would be recovered. All constituents placed in the ground water monitoring and corrective action programs represented joint efforts, with the NRC being the lead agency.

1.2 Process for Including Nitrate, Sulfate and TDS in the License

United Nuclear would like to clarify the process by which these constituents were included in the valuation of background and in the NRC license. The purpose is to clarify the discussion in the ESB on page 4 in the first paragraph. The process is presented in chronological order as follows:

1. On April 10, 1987, the NRC upgraded United Nuclear's License to incorporate the first stages of tailings reclamation. Prior to this date, United Nuclear was working with the New Mexico Environment Department (NMED) [formerly the New Mexico Environmental Improvement Department (NMEID)] to address ground water issues in accordance with New Mexico state regulations. The State regulations were incorporated into the License by reference.

2. On December 24, 1987, the NRC requested United Nuclear to design and implement a detection monitoring program. This request was made in accordance with the finalized revisions to Appendix A, Criterion 5B and Criterion 7.

3. In March 1988, United Nuclear formally submitted a proposed detection monitoring program in accordance with the requirements of Criteria 7 and 5B. This included: 1) a list of analytes based on the results of the data collected by the NRC and discussed above in Section 1.1; 2) a list of monitoring wells; and 3) proposed Points of Compliance (POCs). The listed analytes included only those Criterion 13 hazardous constituents that were identified in the tailings liquid samples collected by NRC in 1987.

4. NRC reviewed United Nuclear's proposal. At the same time, EPA was in the process of developing applicable or relevant and appropriate requirements (ARARs) as part of the remedial investigation/feasibility study (RI/FS) process. The data for nitrate, TDS and sulfate were jointly reviewed by the NRC and EPA at this time. The decision was made to include these constituents in United Nuclear's license to meet the EPA's requirement that they be monitored and to ensure that the monitoring was performed under the jurisdiction of only one

program (i.e., NRC Licensing). The NRC and EPA jointly agreed to background levels for nitrate, TDS and sulfate which were presented in EPA's Record of Decision (ROD) dated September 1988.

5. On July 26, 1988, NRC revised United Nuclear's license with Amendment 2. This amendment placed ground water monitoring in the license as Condition 30, which includes the requirement for a comprehensive monitoring program including nitrate, sulfate and TDS.

1.3 Agency Responsibility for Corrective Action

On page 3 of the ESB, in lines 6 and 7 of the third paragraph, is the statement that "NRC is the lead agency in matters of surface reclamation and source control... EPA will address groundwater remediation outside the byproduct materials site ...". This sentence is misleading because it implies that the NRC is not responsible for ground water remediation. However, because of the NRC's experience at uranium mill tailings sites, it took the lead in all actions at the site. Also, NRC's responsibility for ground water is clearly defined by Criterion 5B(1) and Criterion 5D, which require monitoring and corrective action for ground water at licensed sites.

When NRC took over regulatory responsibility at the site from NMED, the by-product material disposal area included the ground water plumes as well as tailings. Including ground water in the by-product material disposal area is similar to and consistent with the approaches that were taken at other mill tailings sites in New Mexico and Wyoming. This thought process originated with the "working" definition that the POC should be located at the toe of the reclaimed tailings pile outslope. Stable slopes meeting the NRC longevity criterion of 200 to 1,000 years, without exception, extend beyond the operational limits of the tailings impoundments. Therefore, the reclamation plan and corrective action programs are intimately associated.

By-product material includes all constituents, both radiological and nonradiological, that originate from the milling of uranium ore. United Nuclear's license, the technical criteria in Appendix A to 10 CFR 40, and the fact that United Nuclear is required by NRC to

implement corrective action, independent of the Memorandum of Understanding (MOU), clearly show that NRC is responsible for the ground water as well. The MOU limited EPA's responsibility to the ground water only.

1.4 Process for Developing EPA ARARs

United Nuclear would like to clarify the information presented in first paragraph in the Methodology section on page 5 of the ESB. This paragraph discusses in general terms the process by which the EPA developed the ARARs for the Church Rock site. However, this discussion is misleading because it does not tell clearly the process involved in developing the EPA's remediation standards. The NRC and the EPA worked together throughout the RI/FS process. This cooperative work represented years of effort to align United Nuclear's NRC license as the guiding document for the site. The license was designed to incorporate all of the site regulatory parameters into a single document so that all of the regulatory controls necessary to reclaim the tailings and remediate the ground water resided within the NRC license.

1.5 Criterion 7 Requirements

The statement on page 1, paragraph 3, lines 4 and 5 of the ESB that the February through April [1977] data "... do not meet the temporal variation objective of Criterion 7" is correct but misleading. Appendix A to 10 CFR 40, which includes Criterion 7, was added to the regulation in October 1980 and became effective in November 1980. As a result, the NRC requirements for a full year of preoperational monitoring did not exist at the time milling operations began at the Church Rock site.

In 1977, the Church Rock facility was under the jurisdiction of the NMED as New Mexico was an Agreement State at that time. NMED requested that United Nuclear collect pre-milling monitoring data and the GW-series wells were installed and sampled. The request from the State for pre-milling monitoring was made in late 1976 so that the amount of data that could be collected was limited by the time available.

The absence of one full year of pre-operational monitoring was a common occurrence within the uranium industry. The majority of the uranium mills, both in New Mexico and Wyoming, began milling operations prior to the NRC regulatory requirements stated in 10 CFR 40, Appendix A. As a result, the NRC utilized two approaches to establish background water quality at all licensed sites:

1. Review of existing data
2. Collection of additional data at an unaffected monitoring location

Also, because the available data on background water quality at uranium mill sites were typically limited, data from other formations, down gradient wells, or cross-gradient wells were commonly utilized to assist in background determination. This process was utilized at the United Nuclear site to establish background levels of the constituents present in the ground water.

At the time that the ground water work was being completed by the NRC and EPA, it was recognized that little or no data existed for Zone 1 and Zone 3. Consequently, the data gathered for the alluvium were used to establish background water quality for the entire site.

2.0 QUIVIRA EVAPORATION PADS

Background values for nitrate, sulfate and TDS, based on data from the "600-Series Wells" (Wells 639, 640, 642, 643, 644 and 645), have been disputed because of the belief that these wells could have been contaminated by the activities at the Quivira property, located northeast of the United Nuclear tailings facility. This is a discouraging development, as NRC's Denver URFO had previously concluded that this was not the case and that the 600-Series Wells are representative of background. A number of references in the ESB indicate that the NRC headquarters staff, in the absence of historical continuity of information, has come to a different conclusion and has again raised the question of potential contamination associated with the Quivira operations. These references include:

- **Methodology, page 12, top of page, line 2:**

  "...and the suspected contamination from the Quivira ponds."

- **Methodology, page 12, 1st paragraph, last sentence:**

  "...or movement of contamination away from the disposal cells."

- **Methodology, page 14, last paragraph, lines 5 and 6:**

  "It may also be exhibiting contamination from the Quiv[i]ra ponds area."

- **Discussion and Recommendations, page 17, Issue 3:**

  "The staff believes that there may be a contaminant plume to the north, sourced from the Quiv[i]ra ponds. Potential contamination of ground-water from the mill site needs to be evaluated."

The references also indicate confusion with respect to the relative locations of United Nuclear's "mill site" and "tailings disposal area" and Quivira's operations.

United Nuclear would like to take this opportunity to put to rest the hypothesis that the "Quivira Ponds" are a source for the hypothetical contamination of the alluvium in the vicinity of the 600-Series Wells. The following sections describe the Quivira facilities and activities that took place in these locations and provide a chronology of the dispute over use of the 600-Series Wells to represent background water quality. An explanation as to why the elevated concentrations of nitrate, sulfate and TDS in the 600-Series Wells could not have been produced by activities at the Quivira site is also provided. The description of the Quivira facilities and activities is based on documentation provided to the EPA in a letter from Quivira dated July 29, 1988. This documentation was requested by the EPA as part of the RI/FS activities for the United Nuclear site and is included in the Administrative Record. Quotations in the following sections are taken from this letter.

2.1 Description of Quivira Operations

Figure 2-1 shows the location of the facilities associated with Quivira's (formerly Kerr-McGee's) uranium mine operations. As shown, the mine site was located on the Navajo Reservation on the north side of the northwest branch of the Pipeline Arroyo. This location was across the arroyo from United Nuclear's Northeast Church Rock (NECR) Mine, which was located off the reservation on Section 35. Quivira's mine operations were supported by several facilities within a Business Lease located off of the reservation on Section 36, approximately 1 mile southeast of its mine site. These facilities are shown on Figure 2-1 and included a main office complex enclosed by a security fence and a temporary storage area in the vicinity of Well EPA-20. The temporary storage area included three evaporation pads and a proto-ore stockpile.

Quivira's mining operation consisted of two underground mines, designated the CRI and CRI-E. As with the United Nuclear mine, Quivira's mines were completed in the Westwater Canyon Sandstone Member of the Morrison Formation, which is a major water-bearing zone in the region. The water that was pumped from the mine workings

at CRI was discharged to the northwest branch of Pipeline Arroyo. The Quivira discharge point, shown on Figure 2-1, was located approximately 1,300 feet downstream from United Nuclear's discharge point. Quivira's discharge water was similar in quality to the water discharged from the NECR Mine.

Before the mine water was discharged to the arroyo, it passed through a series of settling ponds to remove the suspended solids. A similar process was used at the NECR mine site where four mine settling ponds were used. In accordance with Quivira's National Pollutant Discharge Elimination System permit requirements, small amounts of "... Calgon (registered) cation flocculent and barium chloride were added to the mine water discharged to the settling ponds..." to "... facilitate settling of suspended solids and removal of soluble radium content" (Quivira, 1988, pg. 4). No other substances were added to the mine discharge water which was, as documented by samples collected from the arroyo, of good quality with low levels of nitrate, sulfate and TDS. It is important to note that these mine water settling ponds were located at CRI, not at the "evaporation pad" location on Section 36.

The solids that accumulated in the bottom of the mine site settling ponds were excavated and transported by truck to the temporary storage area, where they were spread on the three evaporation pads. The "pads" are the so-called Quivira Ponds referred to in the ESB (pages 12, 14 and 17). The remaining moisture in the sediments was allowed to evaporate. "The dried material was picked up and shipped by truck, along with the uranium ore extracted from the ... mines, to the Ambrosia Lake Mill for processing ..." (Quivira, 1988, pg. 2).

According to Quivira's information, the pads were constructed in 1978 and used for a two-year period in 1978 and 1979 (pgs. 2, 3 and 4). The pads were circular, approximately 90 feet in diameter, and only a few inches deep. They were constructed with a road grader which scraped the surface soils to provide a flat area and the scraped material was used to construct outside berms 1 foot to 1.5 feet high. The "... pads were cleaned up and reclaimed in the latter part of 1979" (Quivira, 1988, pg. 2).

The NRC provided a copy of the Quivira letter to United Nuclear after a meeting held in July 1995. Smith Technology Corporation (Smith Technology) (formerly Smith Environmental Technologies Corporation) reviewed the letter and, as suggested by the NRC during the July meeting, provided clarification of the potential impact of Quivira's operations on the water quality of the 600-Series Wells. Smith Technology provided the clarification to the NRC in a letter dated October 16, 1995. It is unclear whether this information was considered in the ESB. Therefore, the following discussion is provided again to explain the relationship between the 600-Series Wells and the Quivira evaporation pads.

2.2 Background

United Nuclear installed and tested the 600-Series Wells in 1986 to establish background water quality for the site [Billings and Associates (Billings), 1986]. However, EPA believed that concentrations of nitrate, as well as sulfate and TDS, in several of the wells were too high to occur naturally. During the RI, EPA identified an area of the alluvium at the northern property boundary that had elevated levels of sulfate, TDS and nitrate when compared to other areas of the alluvium. This area encompassed four of the 600-Series Wells (642, 643, 644 and 645) and Well EPA-20.

At the time of the RI, Quivira had a proto-ore pile located just east of the Well EPA-20 location, as shown on Figure 2-1. EPA requested information about Quivira's operations in this area as part of the RI process. This information was provided to EPA by Quivira in the letter dated July 29, 1988, and is included in the Administrative Record for the Church Rock site. NRC headquarters staff became aware of this letter in 1995, although the Denver URFO knew of it in July 1988.

NRC and EPA were aware of the uses of the Quivira evaporation pads, as described in Quivira's letter, in July 1988. However, because many of the agency personnel involved with the United Nuclear site lacked first-hand knowledge of the Quivira operations, the mine settling ponds, located at CRI, have become confused with the evaporation pads, located on Section 36. This is first evident in Appendix H of the ROD, (Responsiveness Summary, Response Category 1, ARARs and Background Levels, bottom of page 3,

bullet 2) where the EPA states that three evaporation "ponds" (rather than pads) were constructed. EPA then discusses the chemicals that were added to treat the mine water in the settling ponds at the mine site. EPA erroneously concluded that the evaporation pads described in Quivira's letter were ponds where water was stored, rather than pads where sediment was spread out and allowed to dry.

EPA reviewed this information and at the time decided that Quivira's operations and elevated gamma ray readings reported for surface soils in the area "... cast doubt on background studies in this area ..." (i.e., the 1986 Billings study of the 600-Series Wells). However, EPA made no effort to determine whether the Quivira operations actually did impact the ground water in the vicinity of the 600-Series Wells. Rather, the data from the wells were dismissed.

To resolve the uncertainties associated with the 600-Series Wells, United Nuclear conducted a background water quality investigation in 1990 and 1991. The investigation was conducted at two upgradient locations, NR-1 and NR-2, shown on Figure 2-1, which were approved by NRC and EPA as being outside the influence of mining and milling operations. The results of this investigation confirmed the findings of the two previous investigations conducted in 1986 (Billings) and 1988 [Canonie Environmental Services Corp. (Canonie)] that high levels of naturally occurring nitrate are present in the site soils. The results of the investigation were presented in the "Background Water Quality Report" (BWQ Report) (Canonie, 1992a) which was submitted to the NRC, EPA and NMED in October 1992. The results were also presented to the agencies during a meeting in December 1992.

During the December 1992 meeting, the agencies agreed that the 600-Series Wells were representative of background water quality. As a result, both the NRC and EPA agreed to the use of the water quality data from the 600-Series Wells and requested that United Nuclear perform a statistical analysis of background water quality using the data from the 600-Series Wells, Well EPA-22 and Well GW-4. The results of the analysis were presented in the "Statistical Analysis of Alluvial Water Quality Report" (Statistical Report) (Canonie, 1993a) submitted in April 1993.

Following the submittal of the Statistical Report, the NRC's URFO was closed. Personnel from URFO had been responsible for the United Nuclear site since it was licensed and were involved in the decision to use the data from the 600-Series Wells to establish background for the site. References in the ESB indicate that the current NRC headquarters staff responsible for the Church Rock site is not aware of NRC's previous commitment to recognize the 600-Series Wells as background wells. The ESB also references concerns that the Quivira evaporation pads could be a source of potential contamination in the northern alluvium and the 600-Series Wells. United Nuclear is of course of the view that this issue had long ago been resolved. The following sections discuss why, based on the documented use of the evaporation pads, the pads could not have been a source of the nitrate, sulfate or TDS present in the northern alluvium and the 600-Series Wells.

2.3 Reevaluation of Quivira Evaporation Pads

The documented use of the Quivira evaporation pads clearly shows that they could not have impacted ground water quality in the area of the 600-Series Wells (Quivira, 1988). This conclusion is based on the following factors:

1. The evaporation pads never contained water, only moist sediments trucked in from the mine and spread out to facilitate drying.

2. Most, if not all, of the moisture in the sediments would have evaporated before percolating into the underlying soils.

3. The moisture that was present in the sediments was similar in quality to the mine discharge water, which had low levels of nitrate [0.95 milligrams per liter (mg/l)], sulfate (150 mg/l) and TDS (442 mg/l).

4. No nitrate or nitrate-bearing materials were used in the Quivira operations.

5. The pads were used for only a two-year period.

The use of nitrate or nitrate-bearing materials in the evaporation pads has been postulated as a source of high nitrate in the northern alluvium and the 600-Series Wells. However, the Quivira documentation clearly indicates that no nitrate or ammonia was associated with the operations at the mine or associated facilities. Therefore, no man-made source for nitrate exists in this area of the alluvium.

A number of theories proposed by NRC, EPA and NMED have postulated a localized ground water mound originating from the evaporation pads to provide the driving force necessary to allow the migration of man-made contamination to the area of the 600-Series Wells. However, the Quivira letter clearly shows that there was never sufficient water in the evaporation pads to support such a hypothesis. The Quivira letter documents that the only water placed on the pads was that associated with the sediments from the settling ponds.

For a ground water mound to have developed, a constant, large volume of recharging surface water would be necessary. Considering that the depth to ground water was at least 40 feet at the time the pads were used and using an estimate of 30 percent porosity of the alluvium (Remedial Design Report, Canonie, 1989a), the volume of water required just to saturate the vadose zone underlying the pads would have been about 1.7 million gallons. This is the equivalent of having 3 ponds containing water to a depth of 12 feet. The documented purpose and use of the pads shows that this condition did not exist.

Additionally, construction and operation of such a facility would have required a ground water discharge plan approved by NMED. To United Nuclear's knowledge, no such documentation exists in the NMED files that would indicate that ponds were constructed in this area of Section 36. The documentation would be similar to the documentation that existed for the mine settling ponds operated by United Nuclear at the NECR mine and by Quivira at CRI. Construction of such a facility would not have gone unnoticed by the State of New Mexico as the Church Rock area was under significant scrutiny by NMED at the time.

2.4 Summary and Conclusion

All the available data concerning the Quivira operations and background conditions at the United Nuclear site show that no man-made source for the elavated nitrate, sulfate and TDS was present in the upgradient background alluvium. Rather, the data demonstrate that the nitrate is naturally occurring in the alluvial soils and associated ground water. Consequently, the 600-Series Wells are representative of background water quality values for nitrate, sulfate and TDS, and have not been impacted by a man-made source of contamination.

3.0 SOURCE FOR NITRATE IN SOILS AND BACKGROUND WATER

United Nuclear is concerned that the process of selecting revised background levels/cleanup standards continues to be clouded by an academic desire to know the exact source of the nitrate in the soils and background water at the site. This desire is evident from the following references in the ESB:

- **Methodology, Pages 10 and 11:**

  Discussion about the source of nitrate in the soil

- **Methodology, page 11, paragraph 2:**

  "Of note is the lack of a definitive analysis of the soil for nitrate salts."

- **Methodology, page 11, paragraph 3:**

  "However, the source of nitrate in the soils and alluvial sediments still needs resolution."

- **Discussion and Recommendations, page 17, Issue 2:**

  "The data from the leach tests and groundwater analyses are only corroborative, not definitive." and "Soils analysis for a more likely source of nitrogen would have been helpful in bringing this issue to resolution earlier."

However, knowing the exact source or form of the nitrate does not change the fact that nitrate is present in the site soils and at elevated concentrations in background water. United Nuclear has met the requirements of Appendix A, Criterion 5B (2) by determining that the levels of nitrate are <u>not</u> "...derived from the byproduct material in the disposal area..." The regulations do not require licensees to perform an academic study to define the source of nitrates once it has been determined that the nitrate levels found at the

monitoring wells cannot be attributed to the by-product source (i.e., mill tailings). For the purposes of remediation, it is not necessary to identify how the background water quality at a given site developed.

Contrary to statements in the ESB, United Nuclear has made no "effort to justify high nitrate concentrations" in the ground water, nor has United Nuclear "... attempted to demonstrate that the variation in nitrate concentration ... was due to the presence of evaporite salts." We have called attention to high concentrations of nitrate in soils at numerous locations that were clearly not impacted by mining or milling activities and have suggested that evaporites might be the source of the nitrate based on an observed correlation between soils which contain evaporites and had elevated nitrate concentrations. United Nuclear has made no further attempt to "prove" that evaporites are the source of the nitrate. We consider it sufficient that the NRC and EPA have accepted that nitrate does occur naturally in the local soils and is the primary source of the nitrate in the background water.

Figure 3-1 shows the locations where soil samples for analysis of nitrate have been collected. As shown, five geographically separate areas have been sampled, including:

1. Two independent sets of samples (United Nuclear and NMED) in the northwestern upgradient area

2. Two independent sets of samples (United Nuclear and NMED) in the northeastern upgradient area

3. Four sets of samples at the location of the 600-Series Wells

4. One set of samples in the southeast downgradient area

5. One set of samples in the southwest downgradient area

It should be noted that NMED collected its data independently of United Nuclear. The NMED sample locations shown on Figure 3-1 are approximately located based on

information received from NRC and appear to be coincident with United Nuclear's Sample Locations NR-1 and NR-2.

Figures 3-2 through 3-4 graphically present the results of analyses of soil samples collected from these locations. Figure 3-2 presents the data from the 1986 Billings study, Figure 3-3 presents the data from the 1988 Canonie investigation and Figure 3-4 presents the data from the 1990-1991 Canonie investigation and the 1995 NMED study. As shown, the soils from all five locations had similar ranges and variability in concentrations of nitrate. This includes the data collected by NMED in July 1995 which, as shown on Figure 3-4, produced soil nitrate levels very similar to those documented in the BWQ Report (Canonie, 1992a) at the NR-1 and NR-2 locations. Therefore, the NMED data corroborate the data collected 4 to 5 years earlier by United Nuclear.

The fact that the samples were collected from such a broad area throughout the site clearly demonstrates that nitrates are present in the soils at this site in elevated concentrations ranging from 0 to almost 200 parts per million. How the nitrates originated is not the issue. The issue is that nitrates are naturally present and contribute nitrate to the ground water at much higher levels than the tailings.

In conclusion, United Nuclear's investigations, NRC's evaluation of background presented in the ESB, and Jacob's evaluations of background concentrations in the referenced documents all demonstrate that the nitrate is present in background concentrations and is not related to tailings seepage. No further information is needed to take the next step of selecting appropriate background/cleanup standards for the site.

As an additional comment, United Nuclear would like to point out that the statement on page 11, in line 4 of the third paragraph "The oxidation of ammonium species, whether sourced from the tailings liquor ..." is misleading because it implies that the tailings liquor contributed to the nitrate in the background soils. As reported in "Evolution of Ground Water Chemistry" (Canonie, 1988), the ammonium in the tailings is trapped in the underlying soils under geochemical conditions that do not allow for it to convert to nitrate. Also, as discussed above, higher levels of nitrate have been documented in the upgradient areas where tailings seepage physically could not be present.

4.0 OTHER CONSTITUENTS EVALUATED FOR BACKGROUND LEVELS

This section presents United Nuclear's comments on the evaluation of background levels for other constituents in the ESB. This includes manganese and iron, discussed on pages 12, 13 and 17 of the ESB, and selenium, aluminum, uranium and radium, addressed on page 17.

4.1 Manganese and Iron

United Nuclear generally agrees with the NRC's assessment of background levels for manganese. However, the inclusion of iron in a discussion of background water quality for this site does not make sense because iron is not included in the list of performance monitoring analytes in the Remedial Design Report (Canonie, 1989a). Although an ARAR for iron was established by EPA in the ROD (EPA, 1988), it was not exceeded in any water samples from the three formations. Therefore, with the approval of EPA and NRC, it was not included as one of the performance monitoring analytes for the corrective action at this site. The performance monitoring analytes, listed in Table 1.3 of the Remedial Design Report, are the only constituents for which United Nuclear's corrective action is required to meet cleanup standards.

On page 17 of the ESB, NRC recommends monitoring for iron to better understand the geochemical behavior of manganese at the site for the purpose of establishing a new ARAR for manganese. Monitoring for iron, while academically interesting, would be counterproductive at this late stage of the remedial action, especially considering that manganese is a secondary Maximum Contaminant Level. Manganese is a concern primarily for aesthetic reasons rather than health reasons.

4.2 Other Constituents

NRC indicates in Outstanding Issue No. 1 (ESB, page 17) that background levels for selenium, aluminum, uranium and radium were not evaluated. United Nuclear has not previously requested a reevaluation of these constituents, or several others, because we

wished to first resolve the outstanding issue of establishing appropriate background and remediation standards for nitrate, sulfate and TDS.

5.0 EVALUATION OF BACKGROUND FOR ZONE 1 AND ZONE 3

United Nuclear reviewed the Methodology section on pages 13 and 14 of the ESB which presents an analysis of background water quality for Zone 1 and Zone 3. United Nuclear agrees with the NRC's statement that establishing background water quality for Zones 1 and 3 is less critical than the need to set the appropriate ARARs for nitrate, sulfate and TDS. This is because the background water in the alluvium is the source of the water for the two bedrock formations. However, United Nuclear's review also noted that several parts of the discussion were confusing and/or made some broad conclusions without providing supporting data. These include the following:

1. The statement that "Several wells have been identified that may be considered in determining background for Zones 1 and 3 ..." is confusing for the reader without a figure to show the identity and location of these wells.

2. The statement that "As evident from Figures 20 and 21, Zone 1 was already contaminated at the time of sampling." is also confusing. The figures show that elevated levels of sulfate and nitrate were present in Zone 1 in 1982. However, the reader has no information about the location of the well(s) where these data were collected. Detailed review of the Zone 1 data, such as that presented in United Nuclear's Annual Reviews of corrective action performance (Canonie, 1989b, 1990, 1991, 1992b, 1993b, 1995, and Smith Technology, 1995), shows that the extent of seepage impacts is very limited because of the low permeability of the Zone 1 formation. As a result, background water quality can be determined from the wells that are located outside the seepage-impacted area.

3. The same comments apply to the discussion of Zone 3 and Figures 22 and 23. Also, relationships between parameters such as pH and constituents such as bicarbonate provide a good delineation of the extent of seepage impacts.

United Nuclear is concerned that this section of the report makes conclusions about background water quality in Zone 1 and Zone 3 without a thorough technical assessment of the water quality conditions in these two formations.

6.0 OTHER ISSUES OF CONCERN

United Nuclear has identified several locations in the text where information was incorrect. These are discussed below.

INTRODUCTION - Page 3, Paragraph 2, Lines 1-4:

The information in these first two sentences is incorrect. First, the only facility existing at the site in 1968 was the NECR Mine. The Old Church Rock Mine and Quivira mines were not constructed until mid-1970. The mill was constructed between 1976 and 1977. Also, the ore from the Quivira mine was not processed in the United Nuclear mill.

METHODOLOGY - Page 8, Paragraph 3, Lines 1 and 2:

The statement that Smith Technology used only the pre-milling data is incorrect. For the reasons discussed in Section 2.0 of these comments, Smith Technology did not use <u>any</u> of the 1977 data for the evaluation of background water quality. When Smith Technology performed the statistical analysis of background water quality, NRC approved of the wells (600-Series, EPA-22 and GW-4) and data set (1989 through 1992) used by Smith Technology. This decision was made based on the results of the background water quality presentation made December 4, 1992, and NRC's review of the data set prior to Smith Technology initiating the analysis.

REFERENCES

REFERENCES

Billings and Associates, Inc., 1986, "Geochemical Background Investigation", prepared for United Nuclear Corporation Mining and Milling.

Canonie Environmental Services Corp., 1995, "EPA Remedial Action and NRC Ground Water Corrective Action, Five-Year Review (1989-1994)", January.

Canonie Environmental Services Corp., 1993a, "Statistical Analysis of Alluvial Water Quality Report, Church Rock Site, Gallup, New Mexico", April.

Canonie Environmental Services Corp., 1993b, "Ground Water Corrective Action, Annual Review - 1993, Church Rock Site, Gallup, New Mexico", December.

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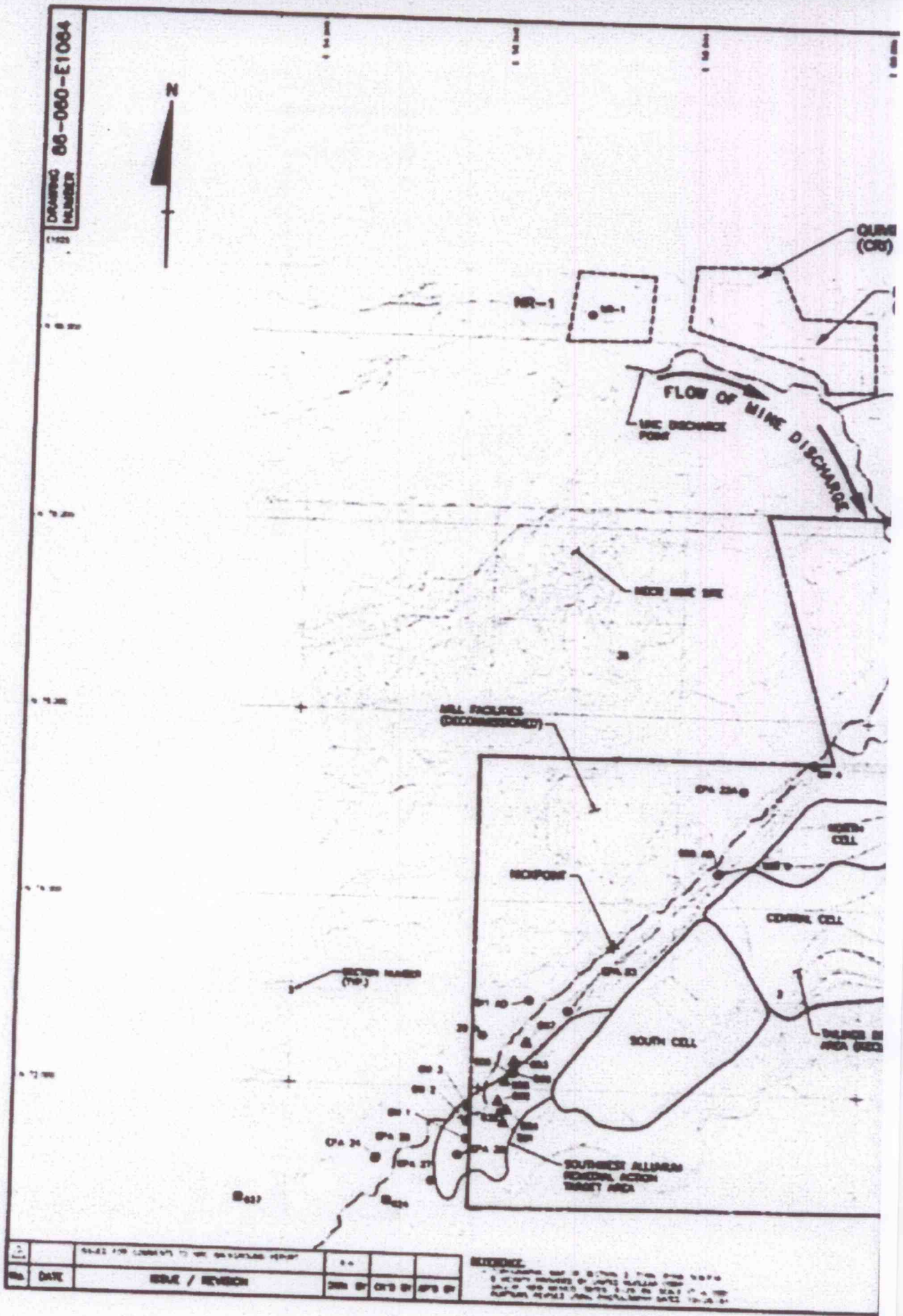
Quivira Mining Company, 1988, "Re: UNC Church Rock Superfund Site", letter to U.S. Environmental Protection Agency, July 29.

Smith Technology Corporation (Smith Environmental Technologies Corporation), 1995,"Ground Water Corrective Action, Annual Review - 1995, Church Rock Site, Gallup, New Mexico", December.

U.S. Environmental Protection Agency, 1988, "Record of Decision, United Nuclear Corporation, Ground Water Operable Unit, McKinley County, New Mexico", U.S. Environmental Protection Agency, Region VI, Dallas, Texas, September.

FIGURES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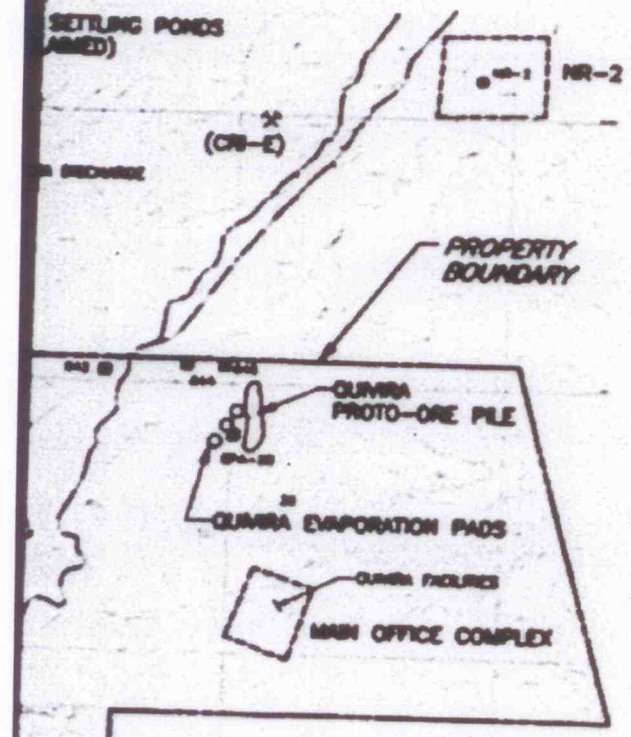
DATE
ISSUE / REVISION



LEGEND:

- GROUP 1 – CURRENT MONITORING WELL LOCATION AND NUMBER, LICENSE CONDITION 30, PARTS A & B CRWDRA
- GROUP 2 – SYSTEM WELL LOCATION AND NUMBER
- GROUP 3 – ADDITIONAL ALLUVIAL WELL LOCATION AND NUMBER
- BACKGROUND MONITORING WELL LOCATION AND NUMBER
- QUIVIRA WELL LOCATION AND NUMBER
- PIPELINE ARROYO

LOCATION OF QUIVIRA MINE FACILITIES
PREPARED FOR
UNC MINING AND MILLING
GALLUP, NEW MEXICO

96120606223-01

DATE 11-18-88	FIGURE 2-1	DRAWING NUMBER 88-080-E1084
SCALE AS SHOWN		

BACKGROUND INVESTIGATION LOCATION MAP

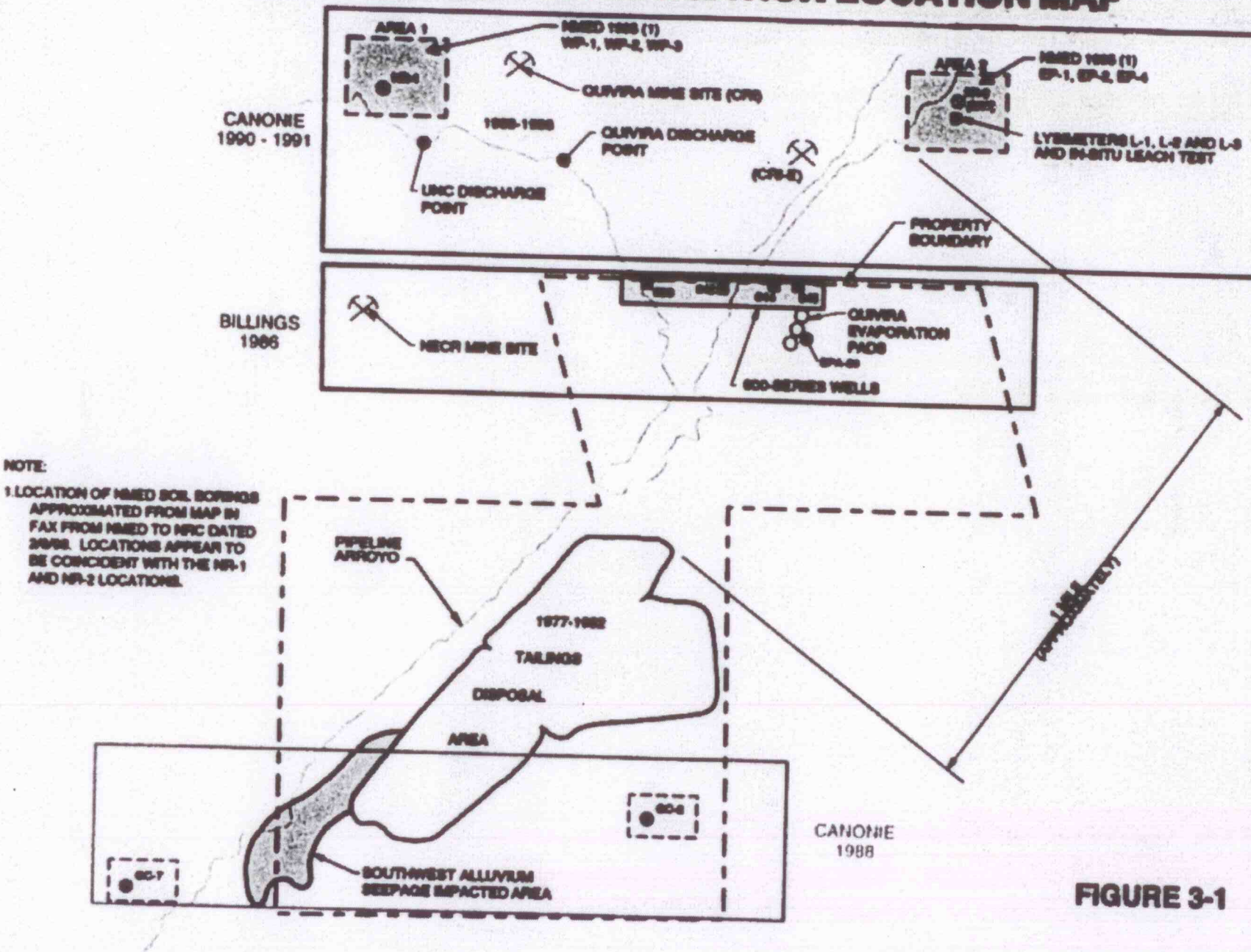


FIGURE 3-1

NITRATE CONCENTRATIONS FROM LEACH TESTS - BILLINGS (1986)

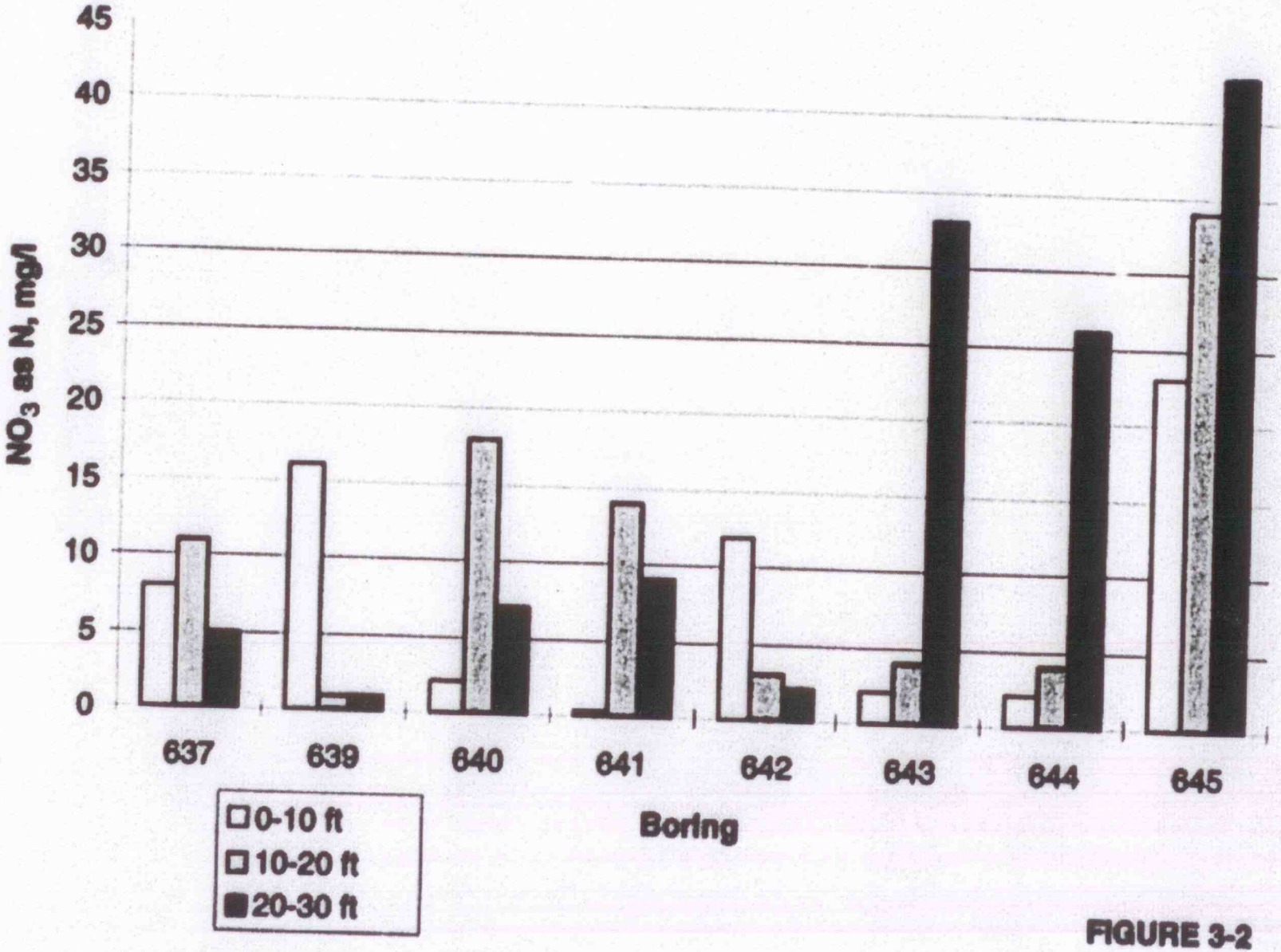
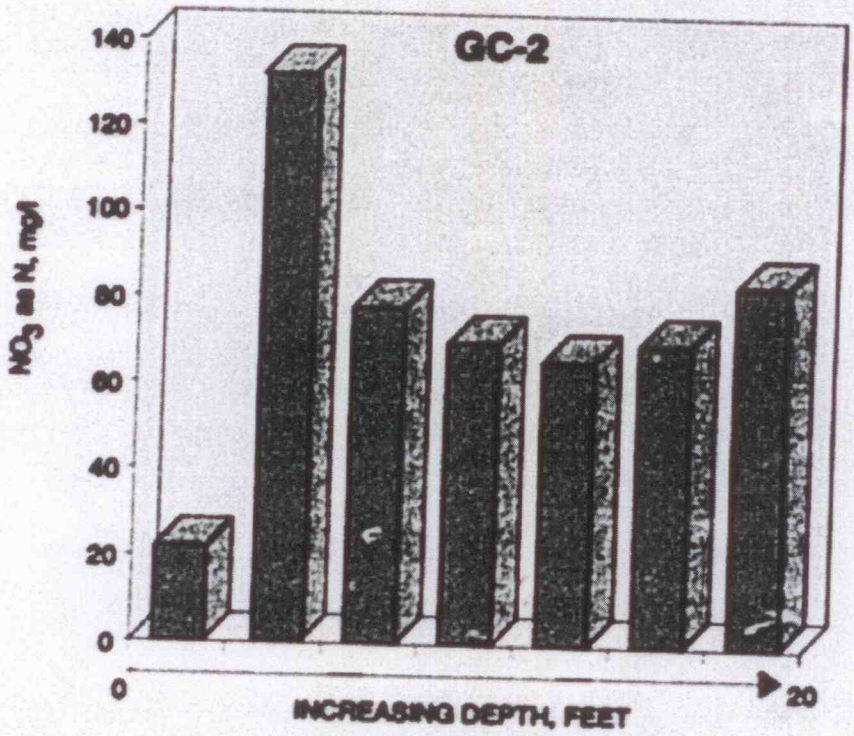


FIGURE 3-2

88-000-A588

NITRATE CONCENTRATION IN SOILS (1988 INVESTIGATION)



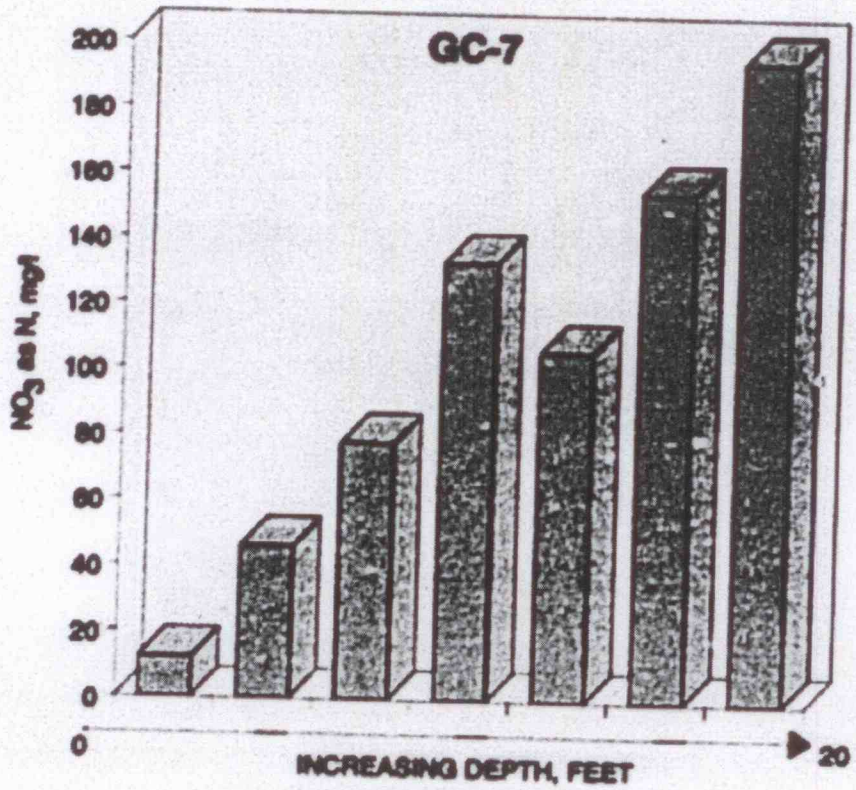


FIGURE 3-3

NITRATE CONCENTRATIONS IN SOILS AT NR-1 AND NR-2 LOCATIONS

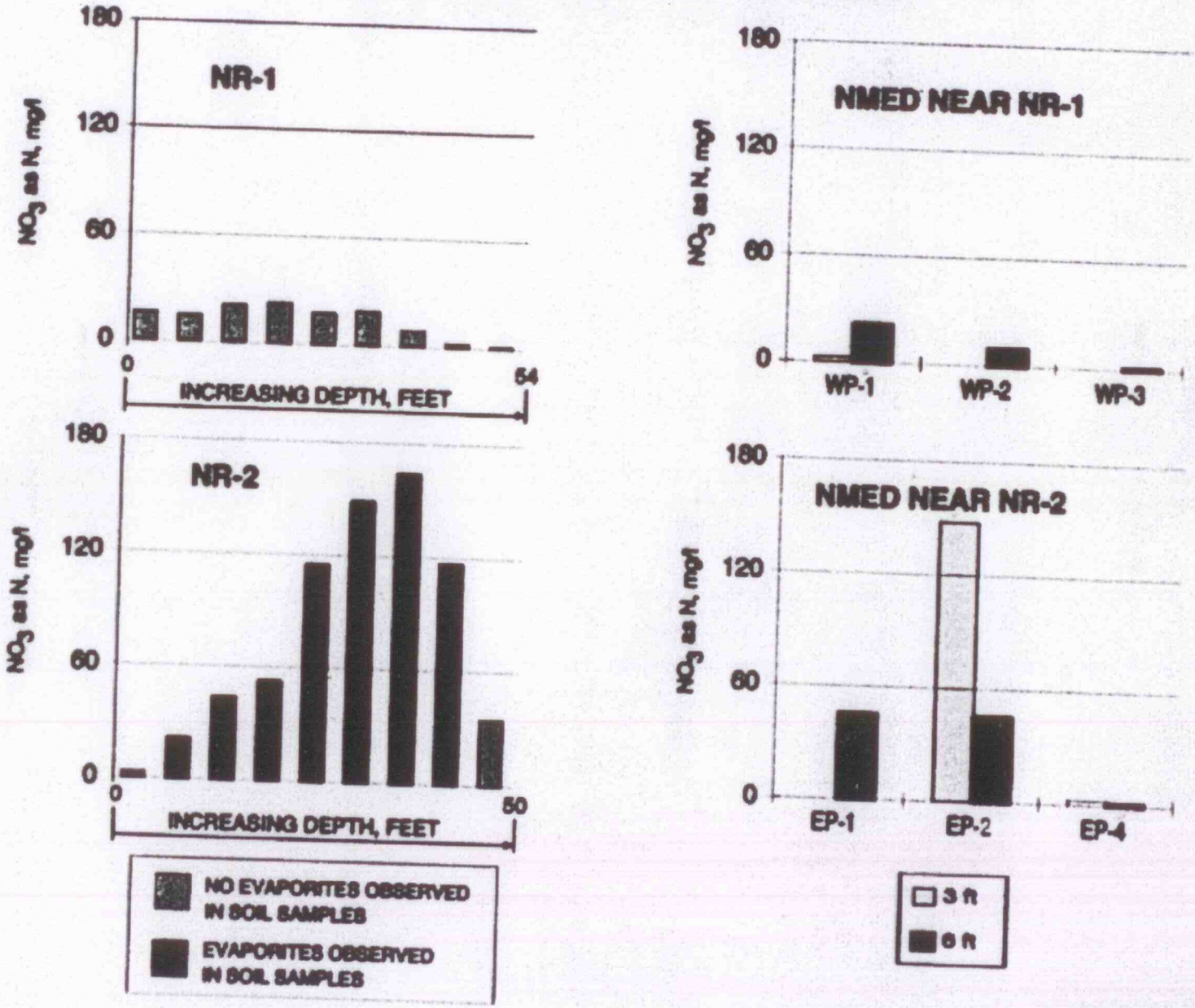


FIGURE 3-4