

May 23, 2001

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judge Thomas S. Moore

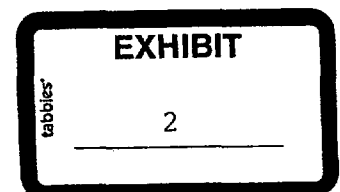
In the Matter of)	
)	
HYDRO RESOURCES, INC.)	Docket No. 40-8968-ML
P.O Box 15910)	
Rio Rancho, NM 87174)	ASLBP No. 95-706-01-ML
)	

**WRITTEN TESTIMONY OF DR. RICHARD J. ABITZ IN SUPPORT OF
INTERVENORS' REPLY TO HRI's AND NRC STAFF'S JANUARY 22, 2001,
RESPONSES TO INTERVENORS' PRESENTATION ON HRI'S
RESTORATION ACTION PLAN AND COST ESTIMATES**

On behalf of Eastern Navajo Diné Against Uranium Mining ("ENDAUM") and Southwest Research and Information Center ("SRIC"), Dr. Richard J. Abitz submits the following testimony regarding the Nuclear Regulatory Commission ("NRC") Staff's and Hydro Resources Inc.'s ("HRI's") responses to Intervenor's response to HRI's Restoration Action Plan (RAP) and Cost Estimates of November 21, 2000.

1. I am competent to give this testimony, and the factual statements herein are true and correct to the best of my knowledge, information and belief. The opinions expressed herein are based on my best professional judgment and extensive expertise and experience in geochemistry, groundwater treatment and aquifer restoration, with particular emphasis on the treatment of groundwater contaminated with uranium and other heavy metals.

2. I am giving this testimony on behalf of ENDAUM and SRIC to respond to the NRC Staff's and HRI's responses to Intervenor's response on the HRI RAP for the Church Rock Section 8 site of the proposed Crownpoint Uranium Project (CUP).



3. My qualifications to give this testimony are contained in my résumé, which is appended hereto as **Attachment A**.¹ I previously submitted testimony in this proceeding with respect to groundwater protection issues.² My relevant education, training and experience are summarized on pages 1-3 of my January 1999 Testimony. As stated therein, I have a Ph.D. in geology and extensive professional experience in the remediation of soil and groundwater contaminated by uranium and hazardous metals (e.g., arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver). Currently, I am the senior geochemist overseeing restoration of uranium-contaminated groundwater at the U.S. Department of Energy ("DOE") former uranium plant in Fernald, Ohio, where approximately 100 million gallons of groundwater are extracted and treated each month. I have also reviewed and evaluated clean-up plans for groundwater contamination at the United Nuclear Corporation uranium mill tailings site located 2.5 miles from the proposed HRI Section 8 *in situ* leach ("ISL") mining operation.

4. In preparing this testimony, I reviewed the following documents:

- A. NRC Staff's Response to Intervenor's Financial Assurance Brief (January 22, 2001) ("Staff's Response"), with the attached affidavit of Mr. William H. Ford ("Ford January Affidavit");
- B. Reply of Hydro Resources, Inc. (HRI) to Intervenor's Response to HRI's Cost Estimates for Decommissioning and Restoration Action Plan (January 22, 2001) ("HRI Response"), with the attached affidavits of Mr. Mark S. Pelizza (January 18, 2001) ("Pelizza January Affidavit") and Mr. Richard A. Van Horn (January 19, 2001) ("Van Horn Affidavit");
- C. Intervenor's Motion for Leave to Submit Reply Brief and Rebuttal Testimony in Response to HRI's and Staff's Presentations Regarding HRI's Restoration Plan and Cost Estimates (January 29, 2001);

¹ Attachments to the testimony will hereinafter be designated as ("Att. ____").

² See Exhibit 1 of Intervenor's Brief With Respect to Groundwater Protection, Written Testimony Dr. Richard J. Abitz (January 11, 1999) ("Abitz January 1999 Testimony"); Affidavit of Dr. Richard J. Abitz, In Response to the Presiding Officer's Questions In the Memorandum and Order of April 21, 1999 (May 21, 1999) ("Abitz May 1999 Affidavit").

- D. NRC Staff's "Request for Additional Information Concerning Restoration Costs for Hydro Resources *In Situ* Uranium Mining Project" (February 16, 2001) ("NRC RAI");
- E. HRI's Response to NRC Staff's Request for Additional Information (March 16, 2001) ("HRI RAI Response");
- F. Intervenor's Renewed Motion for Leave to Submit Reply Brief and Rebuttal Testimony (April 24, 2001);
- G. Presiding Officer's order granting Intervenor's leave to file a reply brief (April 26, 2001); and
- H. Various briefs and documents associated with the filing record, as noted in my previous affidavits.

I am also familiar with the contents of the December 19, 2000, testimony of Steven Ingle ("Ingle Affidavit") in support of the Intervenor's Response to HRI's RAP and Cost Estimates and the May 23, 2001, testimony of April Lafferty ("Lafferty Affidavit") in support of Intervenor's Reply to HRI's and the NRC Staff's responses to the Intervenor's Response to HRI's RAP and Cost Estimates.

A. Response to Affidavit of Mr. Pelizza

5. Mr. Pelizza is incorrect when he asserts that groundwater restoration at the Fernald site and Church Rock *in situ* mining site is not comparable (Pelizza January Affidavit, ¶ E.1). Mr. Pelizza admits that he does not "know" the Fernald site, but then conjectures on the "significant" differences that he would expect between the Fernald and Church Rock sites. *Id.* at 23. In his response, Mr. Pelizza completely misses the key point I made in my December 2000 testimony (¶ 7): the physiochemical processes responsible for mobilizing uranium will occur in any part of the world if sufficient oxygen is available to oxidize uranium to the plus six (VI+) oxidation state and bicarbonate ions are present in groundwater, regardless of the physical similarities of the aquifer. This is the scenario for the Fernald site and will be the scenario for the Church Rock site as soon as lixiviant is injected into the uranium ore zones.

6. As Mr. Pelizza is no doubt aware, HRI's proposed lixiviant contains oxygen and bicarbonate salts and that the addition of this lixiviant to the uranium ore zone results in the formation of the aqueous complexes $\text{UO}_2(\text{CO}_3)_2^{-2}$ and $\text{UO}_2(\text{CO}_3)_3^{-4}$ (see, FEIS Table 2.2 at 2-6), which are identical to those that exist at the Fernald site. Therefore, I am perplexed as to why Mr. Pelizza is comparing the *pre-mining* conditions at the Church Rock site with the Fernald site when the clear intention of uranium *in situ* leach mining is to transform the geochemical environment to one that is similar to Fernald. In contrast to Mr. Pelizza's contention (Pelizza January Affidavit, ¶ E.1) that I make no comparison of the geochemistry at the Fernald and Church Rock Section 8 sites, I clearly state in my previous testimony that, "[i]f mining occurs at the CUP, the aqueous form of the uranium contamination in the Westwater Canyon Aquifer will be identical to that in the aquifer below the Fernald site (i.e., $\text{UO}_2(\text{CO}_3)_2^{-2}$ and $\text{UO}_2(\text{CO}_3)_3^{-4}$)" (Abitz December 2000 Testimony, ¶ 7). There is a voluminous public record on the Fernald site that contains thousands of groundwater analyses that demonstrate uranium, oxygen and bicarbonate ions are present in the Fernald groundwater. If HRI injects lixiviant into the uranium ore zone, the Church Rock and Fernald sites will have similar geochemical environments with respect to uranium mobilization. Therefore, in contrast to Mr. Pelizza's conjecture, the two aquifers are indeed comparable when discussing groundwater remediation as it pertains to the aqueous uranium complexes $\text{UO}_2(\text{CO}_3)_2^{-2}$ and $\text{UO}_2(\text{CO}_3)_3^{-4}$.

7. I disagree with the implication of Mr. Pelizza's testimony that a "fundamental regulatory distinction" between the Fernald site and the Church Rock site make the two sites incomparable (Pelizza January Affidavit, ¶ E.2 at 24-25). The fact that HRI will have to obtain an aquifer exemption from EPA pursuant to requirements of the federal Safe Drinking Water Act's ("SDWA") Underground Injection Control ("UIC") regulations (40 CFR 144) is irrelevant to the issue of the *geochemical* similarities between the sites and the implications of those similarities for *restoration of uranium-contaminated groundwater*. As Mr. Pelizza asserts, the aquifer at the Fernald site indeed

“does not contain producible minerals” and therefore would not be eligible for an aquifer exemption under the UIC rules (*id.* at 25). But his insistence that Section 8 would qualify for an aquifer exemption³ has nothing to do with the technicalities and costs of restoring the groundwater at the site following ISL mining. Indeed, the common goal of restoration at the two sites is returning contaminated groundwater to baseline levels or drinking water standards.

8. Mr. Pelizza is wrong when he states that drinking water limitations have been demonstrated for the aquifer below the Church Rock site (Pelizza January Affidavit, ¶ E.3 at 25). In previous testimony, Mr. Ford clearly stated:

“Pursuant to HRI License Condition 10.21, restoration goals will be established before lixiviant is injected into a well field, and how these goals are established will be subject to NRC inspection. Moreover, HRI License Condition 10.21 also specifies that groundwater restoration goals shall be established by analyzing three groundwater samples of formation water from: (1) each monitor well in the well field; and (2) a minimum of one production/injection well per acre of well field. Accordingly, pre-mining water quality from non-ore zone monitor wells will be averaged with the pre-mining ore-zone water quality, which will result in a more stringent primary restoration goal than if only ore-zone water quality values were used.” (Ford February 1998 Testimony, ¶ 40.)

9. In Table 2 of my January 1999 testimony (at p. 14), I summarized average uranium values for four wells placed in the Section 8 ore bodies (CR-3, CR-4, CR-5 &

³ I detect, here, an inference by Mr. Pelizza that HRI already possesses an aquifer exemption from EPA, or will obtain one soon. This suggestion was also made in HRI’s Response Brief at 4-5 (“Section 8 operations are proposed for a roll-front uranium deposit in a heavily mineralized, *exempt aquifer*”) (emphasis added)). HRI and Mr. Pelizza are wrong on two counts. First, HRI does not now possess a valid aquifer exemption for the Church Rock site as a result of a January 2000 10th Circuit Court of Appeals decision in *HRI Inc. v. EPA*. (See, Intervenor’s Motion to Supplement the Record (January 27, 2000), wherein Intervenor informed the NRC that the United States Court of Appeals for the Tenth Circuit established that HRI has no valid UIC permit, nor a valid aquifer exemption under SDWA for Section 8 of the Crownpoint Uranium Project.). Second, as discussed in ¶¶ 8-10, the Westwater Canyon Aquifer below the Church Rock site may well qualify as a future source of drinking water.

CR-6) and one well in the non-ore portion of the aquifer (CR-7). A portion of this table is reproduced below as Table I. Clearly, most uranium concentrations measured in the ore bodies show levels nearly an order of magnitude below NRC's secondary restoration standard of 0.44 mg/L and some results are near or below EPA's uranium drinking-water standard of 0.030 mg/L. The uranium concentration in the non-ore portion of the aquifer is well below the EPA drinking water standard of 0.030 mg/L. Therefore, averaging uranium concentrations in water samples obtained from non-ore zone and ore-zone wells will most likely result in a uranium baseline level that is less than the NRC secondary standard of 0.44 mg/L, and may meet the EPA drinking water standard. Mr. Pelizza is premature to conclude that drinking water limitations have been demonstrated.

Table I
Uranium Concentrations in Westwater Canyon Groundwater Below Section 8

Monitor Well #	CR-3*	CR-4*	CR-5*	CR-6*	CR-7**
Uranium (mg/L)	0.060	0.035	0.013	0.474	0.002
* ore-zone monitor wells; ** non-ore zone monitor wells					

10. Mr. Pelizza is incorrect when he contends that the pre-mining uranium concentrations at the Church Rock site are greater than the maximum observed Fernald level of 1 mg/L (Pelizza January Affidavit, ¶ E.4). As clearly shown in Table I, pre-mining uranium concentrations in the Section 8 ore bodies are below 1 mg/L. In support of this clearly erroneous conclusion, Mr. Pelizza cites data on Church Rock water quality contained in his February 19, 1999,⁴ affidavit on groundwater protection issues. "There it was established that Churchrock water quality was high in naturally occurring radionuclides and high in naturally occurring baseline concentrations of uranium" (*id.*, ¶ E.3). To ascertain the basis and accuracy of this statement, I reviewed Mr. Pelizza's

⁴ The date of this affidavit is given in Mr. Pelizza's January 18, 2001, affidavit as "February 19, 1997." I believe that "1997" was a typographical error.

February 1999 testimony, and in particular, Attachment 4 thereto, which contains water quality data for four mine shafts located on the Section 17 mining site located directly south of and contiguous to the Section 8 site. The water quality in the four shafts is clearly poorer than the water quality in the Section 8 ore-zone and non-ore zone wells. In fact, the average uranium concentration of four samples from the shafts is 2.5 mg/L. Perhaps Mr. Pelizza thinks that the high uranium levels measured in the *post-underground mining* waters associated with the Old Church Rock Mine in Section 17 are part of the *pre-mining conditions* at Section 8. Clearly, higher uranium concentrations measured at the Old Church Rock Mine workings are not indicative of pre-mining conditions below Section 8.

11. In my December 2000 testimony (§ 10), I expressed concern that the high concentrations of uranium in the pregnant lixiviant could make post-mining restoration efforts more difficult. Mr. Pelizza responded by asserting that I do not understand that uranium levels of 50 mg/L to 250 mg/L are the levels of uranium in production lixiviant (Pelizza January Affidavit, § E.5). However, in my December 2000 testimony (§ 10), I clearly referenced the range of uranium levels in pregnant lixiviant to FEIS Table 2.1, which is titled, "Anticipated concentrations of principal chemical species in HRI's pregnant lixiviant from the well fields for processing" (FEIS at 2-6). Mr. Pelizza also argued that when the ore body has been economically depleted and lixiviant injection has ceased, uranium levels typically drop quickly and are generally found to be about 10 mg/L, thereby facilitating initiation of restoration (*id.*). Yet the Mobil Section 9 data cited frequently by Mr. Pelizza and attached to his January testimony as Attachment 1 show clearly that uranium concentrations typical of those in lixiviant (i.e., 142-145 mg/L) were present in the Mobil Section 9 groundwater at the start of restoration on October 8, 1980. (See, HRI Section 9 Pilot Summary Report, Attachment C, table titled "Mobil Section 9 Pilot Cumulative Results".) The uranium level in the Mobil Section 9 groundwater did not decrease to less than 10 mg/L until May 1981, or seven months later.

After six years of restoration efforts by Mobil, the “restored” value for uranium was 0.319 mg/L, or more than 30 times the pre-mining baseline level of 0.01 mg/L. (See, FEIS Table 4.13 at 4-38.) Against this background, then, I am not dissuaded from my December concern that the high uranium levels in the groundwater at the beginning of restoration will make restoration take longer, and therefore, be more expensive.

12. Mr. Pelizza misconstrues my concern regarding high contaminant levels for uranium, radium, arsenic, selenium and molybdenum as a concern for only high TDS levels (Pelizza January Affidavit, ¶ E.6). He completely ignores the relevant point of my discussion, which is that many of these contaminants are mobilized by the injection of lixiviant into the ore body, and that the diversity of these contaminants makes groundwater restoration much more challenging at the Church Rock site relative to the Fernald site, which only deals with uranium contamination. Notably, Mr. Pelizza does not refute my statement that “the mix of contaminants [will be] far more complex than at Fernald” (Abitz, December 2000 Testimony, ¶ 10). Yet, he addresses only the restoration of TDS levels, rather than the remediation efforts required to return the listed contaminants to their baseline levels.

13. Mr. Pelizza is wrong when he asserts that I present no facts or other basis to compare restoration costs at Fernald to the remediation scenario proposed for Church Rock (Pelizza January Affidavit, ¶¶ E.7, E.11 and E.12). In Attachment C of my December testimony, I present fiscal year 2000 costs for labor associated solely with the restoration of groundwater at the Fernald site. I appropriately scaled the labor value for Fernald to Church Rock, based on the total number of processed gallons. Given that labor is generally the highest cost associated with restoration activities, my method of using a scaled comparison of labor costs, based the volume of water processed, is a reasonable method for evaluating the labor costs that are likely to be incurred by HRI for groundwater restoration at Church Rock. In fact, I believe my comparison is

conservative, given that many more contaminants will be remediated at Church Rock relative to Fernald. (See, ¶ 12 above.)

14. As noted in my December testimony (¶ 20), the operating efficiency of the water treatment facility at Fernald is approximately 80 percent, which is considered excellent by industry standards. HRI failed to account for operating efficiency in its cost estimate, instead making the unreasonable assumption of 100 percent efficiency in processing the groundwater. This leads to an inaccurate estimate of the time and cost required for restoration. Mr. Pelizza seems disingenuous when he responds that, although downtime due to repair and maintenance is expected, “there is simply not enough operating data to specify what the efficiency will be” for groundwater restoration activities (Pelizza January Affidavit, ¶ E.10). Given that Mr. Pelizza relies on the affidavit of Mr. Van Horn (Van Horn Affidavit, ¶¶ C.1 through C.3) for a detailed operational and cost accounting of the URI South Texas operations, it is remarkable that he was able to obtain no information from Mr. Van Horn on the efficiency of the South Texas restoration treatment equipment. Contrary to Mr. Pelizza’s assertion, omitting the margin of inefficiency in a uranium restoration operation is not a small matter than can be cured sometime later in a “surety update.” The information should have been provided in the RAP.

15. Mr. Pelizza is incorrect when he opines that labor costs for Fernald cannot be compared to estimates for Church Rock (Pelizza January Affidavit, ¶¶ E.11 and E.12). At Fernald, groundwater restoration is being performed by an independent contractor, which is a requirement similar to that stated in Criterion 9 of Appendix A, “In establishing specific surety arrangements, the licensee’s cost estimates must take into account total costs that would be incurred if an independent contractor were hired to perform the decommissioning and reclamation work” (emphasis added). Mr. Pelizza’s basis for not comparing the costs seems to rest on HRI’s use of its “multiple hats” labor pool, which performs both mining and groundwater restoration efforts simultaneously

(RAP, ¶ E.2.d). In his response to the Mr. Ingle's December testimony, Mr. Pelizza cites the RAP language that indicates HRI personnel will be performing the restoration in parallel with mining operations:

“HRI assumed employment of technical professionals whose expertise is needed on a limited basis during the restoration mode. Anticipated positions are listed in the Restoration Budget rows 1-15. However, to justify their full time status and utilize their time on the job, it is assumed that they are required to provide a multitude of services, i.e., every employee will be wearing multiple hats. As such, individual job descriptions are difficult.”

(Pelizza Affidavit, ¶ D.15.) This approach of restoration being performed in-house using mining personnel does not seem to comport with the spirit or the language of Criterion 9's mandate to take into account costs incurred if an independent contractor performed the work. In effect, HRI is avoiding adding independent contractor costs to the total surety estimate by substituting its own mining employees for those of an independent contractor.⁵

16a. Mr. Ingle (December Affidavit, ¶ 28 at 19-20) and I (Abitz December Testimony, ¶ 26 at 16) both raised concerns that the well plugging method chosen by HRI in the RAP is not consistent with more costly method recommended by EPA. In response, Mr. Pelizza stated that the method it proposes to use has been applied successfully at ISL sites in Texas and has been approved by Texas regulatory agencies

⁵ In its March 16, 2001, response to NRC's February 16 Request for Additional Information, HRI provided a revised RAP Attachment A-1 ("Financial Assurance Plan for Churchrock Section 8 and Crownpoint Central Plant Summary"). The replacement sheet differs from the original Attachment A-1 in that the total surety was *decreased* by about \$27,000, and a new column titled "Contingency/Profit 25%" was added. However, nowhere on this summary sheet or in the text that accompanies it or in Mr. Pelizza's written responses to the NRC's RAI does HRI explicitly address independent contractor costs. Hence, I remain of the mind that HRI is not calculating its

(Pelizza January Affidavit, ¶ D.14 at 18 and ¶ E.13 at 28). But what works and is acceptable in Texas's poorer-quality groundwater may not work or be acceptable for protection of the higher-quality groundwater at the Section 8 site in New Mexico. My central point, which Mr. Pelizza does not address, is that HRI should use the plugging method best suited for the special conditions at the Church Rock site — high-quality groundwater and well depths ranging from 600 to 800 feet. Both Mr. Ingle and I agreed that the tremie line method recommended by EPA is the most appropriate to use at Section 8.

16b. Even the NRC Staff was not convinced that the plugging and abandonment method proposed by HRI would be acceptable in New Mexico. In its February 16, 2001, Request for Additional Information ("RAI"), the Staff directed HRI to "[c]onfirm that HRI's proposed well plugging methodology is acceptable to the New Mexico State Engineer," and if it's not, "provide a description of the methodology acceptable to the New Mexico State Engineer and a revised cost estimate" (HRI RAI Response, Item No. 3 at 3). HRI's response was to cite certain applicable provisions of the New Mexico State Engineer Office ("NMSEO") rules and regulations governing well drilling and assert that its plugging methodology is designed to satisfy the rules' broad performance standard (id.). HRI did *not* state, nor provide any documentation, that its methodology is acceptable to the NMSEO. In light of the fact that HRI cites no information that the plugging and abandonment method it uses in Texas will be approved by authorities in New Mexico, its cost estimate for plugging and abandonment cannot be justified.

surety based on the costs of a third party carrying out decommissioning, decontamination and restoration. As such, I do not believe that the RAP, as amended, complies with Criterion 9.

17. Mr. Pelizza does not refute my conclusion (December 2000 Testimony, ¶ 25 at 15) that proper plugging and abandonment of wells is essential to prevent the creation of preferential flow paths between the poorer-quality water in mined ore zones and good-quality water outside of the production area and in underlying and overlying non-ore zones (Pelizza January Affidavit, ¶ E.14). He simply notes that the FEIS (at 3-35) states that the hydrostatic pressure in the overlying Dakota Sandstone aquifer is greater than the underlying Westwater Canyon aquifer, inferring that leaks from improperly plugged wells are not much of a concern because their effects will be confined to the Westwater and controlled by the overlying strata. Mr. Pelizza does *not* say specifically how his plugging method will prevent leaks in the first place.

B. Response to Affidavit of Mr. Van Horn

18. Mr. Van Horn presents manpower requirements and operating costs for URI's sites in Kingsville and Rosita, Texas, and concludes that these costs are representative of costs that will be incurred at Church Rock (Van Horn Affidavit, ¶¶ C.2 and C.3). Absent from his testimony is information on the total gallons of water processed on a month-to-month basis and detailed data to support his contention of minimal down time. In my comparison of Fernald labor costs to those proposed by HRI for Church Rock, I assumed labor costs were linear to the total number of gallons processed each year (Abitz December 2000 Testimony, ¶ 22). Since the total volume of restoration water that must be processed controls most of the labor cost associated with groundwater remediation, a comparison between the Texas sites and Church Rock must take into consideration the volume of water processed at the Texas sites and the efficiency factor for the groundwater

treatment equipment. Mr. Van Horn has not provided this crucial information to support his extrapolation of URI costs in Texas to proposed operations at Church Rock.

C. Response to Affidavit of Mr. Ford

19. Mr. Ford incorrectly concludes that I do not provide sufficient detail to support a comparison of groundwater restoration at the Fernald site and the proposed Church Rock *in situ* mining site (Ford January Affidavit, ¶ 23). In particular, he said I should have provided “[d]ata on the number of wells at Fernald, the location of those wells, pumping efficiencies, management efficiencies, and contractor administration costs” (*id.*). Making a comparison based on the information suggested by Mr. Ford would have been difficult given that HRI has not presented information on pumping and management efficiencies and contractor administrative costs. Even the exact number of wells that are planned to be installed at Section 8 is up in the air (*see, e.g.,* Ingle Affidavit, ¶ 27 at 19; Pelizza January Affidavit, ¶ D.3 at 17-18; COP Rev. 2.0, Fig. 1.4-8 at 22). The comparison I made (*see, Abitz December 2000 Testimony, ¶ 9-11*) was based on the *relevant restoration characteristics* and *restoration costs* of the two sites, and was and remains a reasonable comparison.

20. Mr. Ford is wrong to speculate that “existing baseline levels of uranium at HRI’s Section 8 site may be higher than (1) HRI’s secondary restoration goal for uranium of 0.44 mg/L stated in HRI’s license (see LC 10.21A); and (2) EPA’s new drinking water standard for uranium” (Ford January Affidavit, ¶ 24). First, as I mentioned in Paragraphs 8 and 9 above — by citing, in part, language from Mr. Ford’s February 1998 affidavit — the uranium baseline has not been established for the Church Rock Section 8 site; that will be done before lixiviant is injected pursuant to License Condition 10.21. Second, as

demonstrated in Table I above, the average uranium concentration for four Section 8 ore-zone wells (CR-3, CR-4, CR-5 & CR-6) is nearly an order of magnitude below HRI's proposed restoration standard of 0.44 mg/L and some results are near or below EPA's drinking-water standard of 0.030 mg/L. Furthermore, there is no reasonable expectation that uranium baseline levels in the Section 8 ore bodies would greatly exceed the values in Table I. Mr. Pelizza's testimony (§ E.1 at 24) supports this statement by noting, "[u]ranium deposition in the Churchrock area, and in roll front uranium deposits in general, result from strong natural reducing conditions that render uranium insoluble" in undistributed rocks (emphasis added). It is also noteworthy that all baseline uranium levels at the URI Benavides and Longoria Mines in Texas were below the NRC's proposed uranium restoration standard of 0.44 mg/L (see, Table III below) for the Church Rock Section 8 site. These facts belie Mr. Ford's erroneous view that uranium levels are likely to be much higher than 0.44 mg/L in undisturbed uranium ore zones at Section 8. Accordingly, given the low-to-moderate concentrations of uranium in the ore-body groundwater of in Section 8 (Table I), and the known reducing conditions in pre-mined ore bodies, I can reasonably infer that baseline uranium levels are likely to be below the proposed secondary uranium restoration standard of 0.44 mg/L. This condition will make the restoration task more challenging than Mr. Ford predicts.

21. Mr. Ford incorrectly concludes that restoration efforts at Fernald are not comparable to Church Rock because the uranium restoration goal at Fernald is much lower than the baseline level that will be established at Church Rock (Ford January Affidavit, § 25). As noted in Paragraphs 8, 9 and 20 above, Mr. Ford's conclusion has no basis at this time because the baseline level for uranium at Church Rock has not been

established. Based on known information presented in Table I, it is likely that the baseline uranium levels at Church Rock will be of the same order of magnitude as the EPA drinking water standard, which justifies my comparison of the Fernald restoration effort to the Church Rock site.

D. Flare Factors and Pore Volumes

22. Mr. Pelizza and Mr. Ford both advance the peculiar and confusing notion that that flare factors and pore volumes are *inversely related*, that is, as the flare factor is increased, the number of pore volumes needed to achieve restoration standards goes down. (See, Pelizza January Affidavit, ¶ D-3 at 8-9; Ford January Affidavit, ¶¶ 15-17). They both advance this notion to discredit Mr. Ingle's application of a higher horizontal flare factor ("HFF") to the Section 8 restoration water volume estimate without lowering the number of pore volumes needed to "flush" the aquifer. In her testimony supporting the Intervenor's Reply, Ms. Lafferty explains in substantial detail why Mr. Pelizza's and Mr. Ford's analysis of the relationship between flare factors and pore volumes has no technical merit, and obfuscates the real issue — that HRI has not accurately estimated the total volume of its restoration water because it has no basis for the flare factors it chose. In the paragraphs that follow, I explain why Mr. Pelizza's and Mr. Ford's analysis is patently misleading.

23. First, I will explain how a pore volume is derived, using Table 1 in ¶ E.2 of the RAP as a guide. By definition, a pore volume is the volume of water, expressed in gallons, that is contained within the pore, or void, space between the tiny grains of sand in a given volume of rock. As shown in the second through sixth columns of RAP Table 1, the pore volume is derived by multiplying the area and thickness of each ore zone by

the porosity (or percentage of void space) of the rock and by a conversion factor for gallons per cubic foot. The resulting value is also referred to as the *initial pore volume* ("IPV"). The IPV is then *increased* to account for fluids that spread both horizontally (i.e., laterally) and vertically (i.e., up and down) throughout the mining area. This spread, or dispersion, is informally called the "flare" and is accounted for by multiplying the IPV by the horizontal and vertical dispersion factor values to derive a *corrected pore volume* ("CPV"). In RAP Table 1, the CPV is shown in Column 10 and the HDF and VDF are accounted for in the columns headed "H-PIF" and "V-PIF". The CPV is then multiplied by the number of pore volumes that must be processed to restore the groundwater to baseline conditions. By license condition, the NRC has decided that 9 pore volumes will be sufficient to achieve restoration to primary and secondary restoration standards at Section 8. That is why the CPV is multiplied by 9 in Column 11 of RAP Table 1. The resulting value is the total volume of restoration water, expressed in gallons, for each ore zone. The restoration water volumes for each zone are summed to derive the total volume of restoration water that will have to be processed at Section 8. Restoration of this total volume of 1.33 *billion* gallons accounts for at least 75% of the total costs of decommissioning, decontamination, and restoration of the Section 8 site (RAP, Attachment A-1, Cost Summary).

24. For Section 8, the total restoration volume must be estimated because, since no mining operations have started, the total volume of groundwater that will have to be processed to restore the aquifer is not now known. That is exactly why RAP Table 1 was constructed as it is, with the total volume of restoration water needing processing the *end product* of the calculation. Yet, mysteriously, Mr. Pelizza and Mr. Ford both insist that

the total restoration volume must be *known* in order to accurately compare restoration experience from one site to another (Pelizza January Affidavit, ¶ D-3 at 9; Ford January Affidavit, ¶¶ 9-10). Using the Mobil Section 9 project as his example, Mr. Pelizza (January Affidavit, Table 1 at 9) *starts* with the total volume of restoration water processed by Mobil and *back-calculates* pore volumes needed to restore the aquifer by *altering* the horizontal flare factor.⁶ He does this to support his argument that, “[r]egardless of the HDF, the gallons processed and the cost of the test remain unchanged” (Pelizza January Affidavit at 9). But Mr. Pelizza’s exercise means nothing for the Section 8 site because the total restoration water volume is *not known*, and is in fact the variable that must be calculated. As shown clearly in RAP Table 1 and in Attachment 3 to Mr. Pelizza’s January affidavit (“Churchrock Pore Volume Calculation”), changing the HDF or the initial pore volume *will* change the volume of water that must be processed and the costs associated with processing that groundwater.

25. A simple illustration of this linear relationship between flare factors and corrected pore volumes is shown in Table II below. The first row of data shown in Table II is taken directly from the first row of RAP Table 1 for the “UA” ore zone. Then, in row 2 of Table II, I substituted an HDF of 3.0 for HRI’s value of 1.5 to show the effect of an increased flare factor on the CPV for the UA zone and the total restoration volume for

⁶ In trying to show an inverse relationship between HDFs and number of PVs needed to achieve restoration standards, Mr. Pelizza omitted a key value from Table 1 of his January affidavit — the Initial Pore Volume (IPV), which is 1,817,101 gallons.

the UA zone after 9 pore volumes of flushing.⁷ In Row 3 of Table II, I changed the initial pore volume by arbitrarily changing the thickness of the unit to simply illustrate that by changing the initial pore volume, the amount of water that must be restored also changes. This simple exercise alone refutes Mr. Pelizza's contention that increasing the HDF does not effect the total restoration process volume and illustrates why an accurate flare factor is so important in estimating total restoration water, and in turn, the total estimated cost of restoration.

Table II
Effect of Changes in Initial Pore Volume and Horizontal Dispersion Factors
on the Total Volume of Restoration Water that Must be Processed

ZONE	Area (Ft ²)	Thick (ft)	Volume (ft ³)	Porosity	gal/ft ³	IPV (gal)	HDF	VDF	CPV (gal)	9*CPV (gal)
Church Rock, Section 8										
UA	318700	8.6	2740820	0.25	7.48	5125333	1.5	1.3	9994400	89949601
UA	318700	8.6	2740820	0.25	7.48	5125333	3.0	1.3	19988800	179899202
UA	318700	10.5	3346350	0.25	7.48	6257675	1.5	1.3	12202465	109822188

Mobil, Section 9									
Area	Thick (ft)	Porosity	gal/ ft ³	IPV	HDF	VDF	CPV	# PVs flushed	Total Restoration Volume
40488	24	0.25	7.48	1817101	1.5	1.3	3543321	16.7	59173469
40488	24	0.25	7.48	1817101	1.4	1.4	3561519	16.6	59173469
40488	24	0.25	74.8	1817101	1.9	1.0	3452493	17.1	59173469

IPV = initial pore volume

HDF = horizontal dispersion factor, or flare factor

VDF = vertical dispersion factor, or flare factor

CPV = corrected pore volume

26. As shown in Table II, the formula to calculate the total restoration water volume that must be processed is:

⁷ This is virtually the same example used by Mr. Ingle in his December affidavit (at 12-18), except that he used an HDF of 2.94, based on a technical evaluation of flare factors at the Power Resources, Inc., Highland Uranium Mine in Wyoming.

$$\text{IPV} * \text{HDF} * \text{VDF} * \text{number of pore volumes processed} = \text{total restoration volume}$$

What Mr. Pelizza and Mr. Ford should have said about using the Mobil Section 9 data is that the aquifer had to be flushed 16.7 times to obtain compliance with *less than half* of the primary restoration standards established for the project. (See, Ford January Affidavit, ¶ 7; FEIS, Table 4.13.) More important, though, is what Mr. Pelizza and Mr. Ford did not say: the HDF and VDF attributed to the Mobil Section 9 experience were not based on site-specific analysis of restoration there, but picked by HRI based on what Mr. Pelizza said was “operating experience at other restoration demonstrations and commercial operations” (Pelizza January Affidavit at 5). As noted by Ms. Lafferty in her testimony (¶¶ 10a and 12), the HRI horizontal and vertical flare factor values of 1.5 and 1.3, respectively, have no basis in Mobil’s documentation, and appear only in the Section 9 Summary Report *prepared by HRI* and attached to Mr. Pelizza’s January affidavit. As I show in Table II in the rows using the Mobil data, HRI could have picked virtually any combination of horizontal and vertical flare factors to match Mobil’s actual total volume. The number of pore volumes that Mobil flushed through its aquifer could have been 16.6 or 17.1, depending on the flare values selected.

27. I conducted this exercise to demonstrate that Mr. Pelizza’s and Mr. Ford’s notions about the relationships between flare factors and pore volumes (1) are not appropriate for a site where the total restoration volume is not known; (2) make no mathematical or technical sense; and (3) served only to obscure and confuse the correctness of the principal finding of Mr. Ingle and myself in December and Ms. Lafferty today: HRI has substantially underestimated the total volume of restoration water that it must process at Section 8, and therefore, underestimated the total cost of restoration.

E. Comparability of URI's Restoration Efforts in South Texas with Future Restoration Conditions at the Church Rock Section 8 Site.

28. HRI notes that its sister company, URI, has completed groundwater restoration activities at its Longoria and Benavides projects in Texas, and that the restoration requirements at these South Texas operations are similar to those proposed at the Church Rock site (Pelizza January Affidavit, ¶ C.1). As I discuss in the paragraphs that follow, URI's purported successful restoration at Longoria and Benavides was due in large part to a relaxation of restoration standards for key constituents, especially uranium. However, with respect to water quality, I still do not believe that the Texas sites are comparable to the Church Rock site. As shown several times in previous testimony in this case,⁸ the baseline water quality at the Longoria and Benavides sites is characterized by high levels of dissolved solids that range from more than two times to as much as eight times the TDS levels in *production area* monitor wells in Section 8. Radium-226 concentrations also are much higher than those observed at the Church Rock site.⁹ As a general matter, the aquifers in Texas have poorer water quality than is found in the Westwater Canyon aquifer at the Church Rock site. Moreover, as I discussed above in Footnote 3, HRI does not have a valid aquifer exemption for the Westwater Canyon Aquifer at the Church Rock site. Accordingly, HRI's restoration target for uranium may be the newly promulgated EPA uranium drinking-water standard of 0.03 mg/L, which is

⁸ See, e.g., Abitz January 1999 Testimony at 25 and Exhibit H; Testimony of William Staub (January 11, 1999) (at 23-25) in support of Intervenor's Groundwater Presentation; and Affidavit of Mark Pelizza, February 19, 1999, Table 3 at 29 (attached as Exhibit 1 to HRI's response to Intervenor's Groundwater Presentation).

⁹ Id.

comparable to the uranium restoration standard at the Fernald site. Therefore, total restoration costs associated with the poor quality water at the south Texas projects cannot be used as a template for the cost to restore the higher-quality drinking water in the Westwater Canyon aquifer below the Church Rock Section 8 property.

29. As HRI asserts, Texas regulatory agencies approved final restoration for the six production areas at the URI Benavides and Longoria ISL mines between 1986 and 1991. (See, HRI Response at 2, n.3, and Attachment 1; Pelizza January Affidavit, ¶ C.1) However, HRI fails to acknowledge important information about how restoration was achieved at these sites. As demonstrated in Table III for uranium (below), in Tables 1 and 2 in **Attachment B** to this testimony, and in the relevant supporting documentation contained in **Attachment C**, achieving restoration goals at Benavides and Longoria was enabled when URI obtained regulatory approval to increase the restoration standards over the original, or baseline, levels for the constituents bicarbonate, calcium, sulfate and uranium. The increases in uranium restoration levels approach two orders of magnitude. In virtually all of the cases, the final restoration levels certified by Texas regulatory agencies achieved the revised standards, but exceeded the original standard established by the baseline levels. If the original standards had remained in effect, restoration would have undoubtedly taken longer and been considerably more expensive.

30. Texas's rationale for approving the increased uranium levels was based in part on "achievability" of compliance, use of the groundwater at the mine sites, and what was known at the time about uranium toxicity. Here are some examples:

Table III
Summary of Changes in Uranium Groundwater Restoration Standards for
URI Benavides and Longoria Uranium ISL Mines in Duval, County, Texas

	Baseline Level mg/L	Revised Restoration Level mg/L	Final Restoration Value mg/L	EPA Drinking Water Standard mg/L
Benavides Mine (UR02312)				
PAA1	0.083	2	1.04	0.030
PAA2	0.078	2	0.279	
PAA3	0.120	3	1.50	
Longoria Mine (UR02222)				
PAA1	0.047	2	1.20	0.030
PAA2	0.037	3	1.80	
PAA3	----	----	----	

“The new uranium value requested [by URI] is more realistic in terms of achievability in comparison with TWC [Texas Water Commission] approved levels for other restoration parameters. No federal drinking water limits exist for uranium. Considering baseline water quality and pre-mining uses of water at the Longoria site, we feel that raising the uranium value as requested will not render the aquifer unsuitable for any purpose for which it was reasonably suited prior to mining.” (Thiel, 1987b, appended hereto as **Attachment C-10**.)

“Although the recommended [uranium] value [of 2 mg/L] is above baseline average values for all three production areas [Benavides PAA-1 and Longoria PAA-1 and PAA-2], it is equal to or less than many uranium drinking water standards. Moreover, the average quality of the production zone water is considerably only marginally suitable for drinking water purposes (average TDS content ranges from about 1100 to 1900 mg/L).” (Thiel, 1987a, appended hereto as **Attachment C-9**.)

“We don’t entirely understand the company’s reasons for splitting old production area 1 [at the Benavides Mine] into two parts, especially since no further production is contemplated. There are certainly some questions on the validity of applying the original baseline values to both new production areas. If the sole reason is to enable URI to claim they have indeed restored a wellfield, then we see little merit in it. . . . Similar requests for departures from baseline to 2 mg/L have been made by other *in situ* operators for production aquifers with much worse water quality. We have granted those requests because 2 mg/L has been cited as a common drinking water standard and because *companies appear to have no problems in achieving that level*” (emphasis added). (Thiel, 1986, 9, appended hereto as **Attachment C-11**.)

When making these determinations, Texas regulators did not have the benefit of the results of recent health studies that demonstrate that long-term ingestion of uranium at even low levels in drinking water is associated with subclinical kidney damage.¹⁰ Nor were they aware at that time that EPA eventually would propose a drinking water standard for uranium of 0.02 mg/L and later promulgate a standard of 0.03 mg/L.

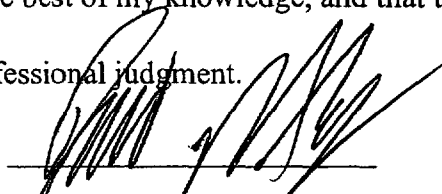
31. In summary, the Benavides and Longoria restoration data are not reliable indicators of whether HRI will be able to restore the Section 8 high-quality aquifer to the NRC's "secondary" uranium restoration standard of 0.44 mg/l, or to an even more restrictive value based on the new federal drinking water standard.

32. This concludes my testimony.

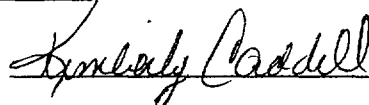
¹⁰ I discussed the basis for uranium standards in my January 1999 testimony (at 44-47; see, also, Exhibits O, P and Q). In his two affidavits filed in support of Intervenor's Motion to Reopen the Record on the uranium restoration standard (March 23, 2000, and April 15, 2000), Dr. John Fogarty summarized the findings of the recent health studies on uranium ingestion and point out what we see as flaws in NRC's adoption of the 0.44 mg/l restoration standard for uranium.

AFFIRMATION

I declare on this 23 day of May 2001 at Ross, Ohio, under penalty of perjury that the foregoing is true and correct to the best of my knowledge, and that the opinions expressed herein are based on my best professional judgment.


Richard J. Abitz

Sworn and subscribed before me, the undersigned, a Notary Public in and for the State of Ohio, on this 23 day of May 2001 at Ross, Ohio.



Notary Public

KIMBERLY CADDELL, Notary Public
In and for the State of Ohio
My Commission Expires February 17, 2005

Richard J. Abitz

Professional Qualifications

Dr. Abitz is a geochemist with over twelve years of experience in the analysis of chemical and radiological data, modeling of soil/water systems and radioactive waste streams with experimental methods and geochemical computer codes, and development of work plans for CERCLA and RCRA sites. His expertise includes the application of geochemical principles, experimental methods, and computer models to problems involving the solubility and mobility of hazardous and radioactive elements in the environment, the remediation of waters and soil contaminated by hazardous and radioactive wastes, and the design and treatment of mixed and radioactive waste streams. Dr. Abitz has published over twenty-five technical papers in his area of expertise.

In his twelve years of environmental consulting, Dr. Abitz has developed a thorough understanding of geochemical processes responsible for the mobilization of radioactive and hazardous wastes associated with a number of environmental programs administered by the U.S. Department of Energy (DOE). At Los Alamos National Laboratory (LANL), Dr. Abitz developed waste analysis and radioactive material management plans for transuranic and low-level mixed wastes generated, treated, and stored on site. For the Idaho National Engineering Laboratory (INEL), he evaluated the waste characterization program for high-level radioactive and hazardous waste processed at the Idaho Chemical Processing Plant (ICPP). Dr. Abitz also directed geochemical studies at the Waste Isolation Pilot Plant (WIPP) that evaluated the composition and origin of saline groundwater and brine in the vicinity of and within this underground repository for transuranic waste.

Presently, Dr. Abitz serves with Fluor Fernald, Inc on the Fernald Environmental Restoration Management Contract (FERMCO). Dr. Abitz serves FERMCO and DOE as the project manager responsible for remediation of the former production area, where uranium metal was produced for over 30 years, and as the senior geochemist for groundwater restoration activities associated with removal of uranium from the Great Miami aquifer. He is also a senior consultant to the DOE Technology Development Program and oversees active research projects at several universities. These projects include laboratory studies on the mobilization and removal of uranium from soil/water systems, including the passive removal of uranium from groundwater using inorganic and organic systems.

Education and Training

Ph.D., Geology, University of New Mexico, Albuquerque; 1989

M.S., Geology, University of New Mexico, Albuquerque; 1984

B.A., Geology, Humboldt State University, Arcata, California; 1981

Environmental Risk Assessment Communication and Application Workshop, INEL
Oversight Program, Boise, Idaho; 1992

OSHA Hazardous Waste Operations Training, 29 CFR 1910.120 (40 hours, IT
Corporation, 1994)

Experience and Background

1998 -
present

Project Manager/Senior Consultant, Fluor Fernald, Inc., Cincinnati, Ohio.

- As a project manager, Dr. Abitz oversees a remediation design budget of six million dollars and is responsible for Title I/II/III design work that will lead to removal of all contaminated soil and subgrade structures within the former Production Area. Dr. Abitz leads a team of engineers and scientists who integrate the remedial design with regulatory issues, sampling and analysis plans, waste management operations, demolition and construction activities, health and safety issues, radiological controls, and quality assurance protocols.

- Dr. Abitz serves as a senior consultant to the DOE Technology Development Program, where he is tasked with technical oversight of several university studies dealing with the mobilization of uranium and its removal from groundwater. Laboratory investigations examine the leaching behavior of uranium from contaminated soil, contaminated soil treated with phosphate, and aggregate materials used to construct liners in the Fernald On-Site Disposal Facility (OSDF). This research established baseline levels for uranium in OSDF construction materials and evaluated the effectiveness of phosphate in reducing the solubility and mobility of uranium in the disposal cell.

Dr. Abitz also participates in research that evaluates the natural attenuation of uranium by the using a combination of passive inorganic and organic systems. The inorganic systems include rip-rap channels constructed with rock containing iron oxyhydroxide phases (e.g., goethite and hematite) or phosphate minerals (e.g., apatite) and flow-through cells using zero-valent iron. Organic systems that show potential promise include sulfate-reducing bacteria, microbial mats, lichen, and phytoextraction. A combination of these systems may prove to be practical and cost effective in the treatment of low leachate volumes generated by the OSDF after its closure.

President/Owner, Geochemical Consulting Services, Albuquerque, New Mexico.

1997 -
1998

Dr. Abitz served as a geochemical consultant to FERMCO and the WIPP Project.

- At FERMCO, he evaluated the efficiency of selected alternatives for soil and groundwater remediation, including *in situ* uranium leaching methods. This effort involved supervising the technical team, assisting in the negotiation of clean-up levels with DOE and EPA, developing soil-treatment protocols, and interacting with public-interest groups as needed.
- At the WIPP site, Dr. Abitz provided the operating contractor with expertise in the area of brine geochemistry. He was responsible for oversight of laboratory analyses

and QA/QC, data analysis, and geochemical interpretation of the composition and origin of fluids in the vicinity of underground operations. Dr. Abitz also provided knowledge on the solubility of transuranic elements in sodium-chloride brine and in brine containing organic-complexing agents such as citric acid, oxalic acid, and EDTA.

Project Manager/Senior Staff Consultant, IT Corporation, Albuquerque, New Mexico.

1994 -
1997

Dr. Abitz served as project scientist/manager on geochemical tasks associated with the WIPP Project, Norton AFB Groundwater Study, FERMCO Operable Units 5 and 3 RI/FS, and Wright-Patterson AFB RI/FS. Specific activities include:

- Conducted a rerun of the chemical compatibility analysis of TRU waste forms and container materials for Appendix C1 of the WIPP RCRA Part B permit. The chemical compatibility analysis was carried out with all defense generated, contact-handled (CH) and remote-handled (RH) transuranic-mixed waste streams reported in the 1995 WIPP Transuranic Waste Baseline Inventory Report (WTWBIR). Chemicals reported by the generator sites were classified into reaction groups as defined by the U.S. Environmental Protection Agency (EPA) document "A Method for Determining the Compatibility of Hazardous Wastes." The list of potential chemical incompatibilities reported by the program was hand checked using the EPA document as a reference to assure proper functioning of the program. All potential chemical incompatibilities were then evaluated on a case-by-case basis to identify which of the reactions could occur, given the nature of the waste, its chemical constituents, and final waste form.
- Assisted in evaluating the geochemical performance of backfill configurations proposed in the WIPP Compliance Certification Application. Modeled the interaction of Salado Formation brine with MgO placed in the backfill to estimate the quantity of MgO required to buffer the pH of the indigenous brine between 8 and 9. This pH range is desirable for minimizing the solubility of plutonium and neptunium contained within the waste forms, and lowers the solubility of uranium and americium relative to lower pH values found in Salado Formation brine.
- Project scientist responsible for developing the background groundwater report for Norton AFB. This report established background radionuclide concentrations in local and regional groundwater and provided a robust scientific model to explain the presence of elevated levels of naturally-occurring uranium. The task required coordination of scientific and support staff to produce a principal milestone document that was delivered to the client one week ahead of schedule.
- Project manager and scientist on FERMCO OU5 FS task to evaluate aqueous reactions of metal and radionuclide complexes in proposed injection zones of the Great Miami Aquifer. Responsible for oversight of technical tasks, budget, schedule, and final technical report.

- Senior staff consultant responsible for oversight on geochemical issues related to the mobility of 15 metals in the soil/groundwater environment at Wright-Patterson AFB. Provided guidance on evaluating the control of pH, Eh, groundwater chemistry, and adsorption on contaminant mobility.
- Project scientist tasked with overseeing archive activities and development of sampling and analysis plans for two RFI Work Plans at SNL/NM. The work plans deal with historical and active SNL/NM test ranges where a variety of DoD and DOE weapons testing was/is conducted. Archive activities include record searches, personnel interviews, and abstracting classified documents. Sampling and analysis plans cover sites that include detonation and burn tests with mock nuclear weapons containing HE and DU, anti-armor munitions, calibration of target sensing equipment for naval gun fire, impact testing of containers and weapons accelerated with rocket pulldown techniques, and hazardous and mixed-waste disposal mounds.
- Project manager and scientist on FERMCO OU3 RI/FS task to evaluate the release of radionuclides and metals from the proposed on-site disposal facility. Responsible for oversight of technical tasks, budget, schedule, and final technical report.

1991 -
1994

Senior Geochemist, IT Corporation, Albuquerque, New Mexico Dr. Abitz evaluated the radiochemistry of transuranic elements in sodium-chloride brine for the WIPP Project and served as the project geochemist for four operable units on the FERMCO RI/FS. He was also active setting up the LANL RMMA concept and provided radiochemistry support to INEL in developing a No Migration Variance Petition (NMVP) for the INEL calcine facility.

- Developed solubility database for the WIPP EATF. Evaluated the solubility of thorium, uranium, neptunium, plutonium, and americium in sodium-chloride brine and in the presence of organic complexing agents, such as EDTA and citric acid. Prepared charts that plotted the solubility curves of the radionuclides over the pH range of 2 to 12.
- Authored white paper on geochemistry of FERMCO site for OU 5 RI/FS. This paper discusses leaching, dissolution, and desorption processes that release uranium and its progeny from surface sources, adsorption and aqueous complexation of the solubilized uranium and progeny with subsurface soils and groundwater, and predicts secondary uranium phases that may form in the soils.
- Conducted site-surveys and interviewed LANL personnel on radiation practices associated with the handling, packaging, labeling, storage, transport, and disposal of transuranic materials. Information was used to develop LANL RMMA concept, where each RMMA is held accountable for all radioactive materials that enter and exit the area.

- Developed waste analysis plans for transuranic and low-level mixed wastes present at LANL. This activity was conducted to complete RCRA Part B permits and ensure regulatory compliance to DOE orders for all LANL facilities that generate, store, or dispose of mixed waste.
- Managed and had technical oversight on \$250,000 geochemical program associated with FEMP RI/FS. Program tasks include the characterization of soil mineralogy by polarized light microscopy and x-ray diffraction studies, design and implementation of laboratory tests to characterize the composition of leachate derived from cemented and vitrified waste samples, evaluation of contaminant adsorption ratios, data validation, and tracking of labor and material costs.
- Designed laboratory experiments for FEMP RI/FS to measure adsorption ratios of radionuclides and metals and implemented ANSI/ANS-16.1 leach tests to evaluate the performance of cemented waste forms. Results were used to evaluate the most effective alternative for immobilizing radionuclides and metals from a near surface disposal cell.
- Led INEL waste characterization program on calcined solid waste. Responsible for evaluating radiochemistry data on uranium fission products and transuranic elements in aqueous and calcined waste forms. Provided assistance in the development of EPA approved sampling and analytical plans to support a NMVP for the radioactive calcined waste stored at the ICPP.

1988 -
1991

Geochemist, IT Corporation, Albuquerque, New Mexico Dr. Abitz played the principal role in providing geochemical support to the Fernald Environmental Management Project (FEMP). He also established his expertise in geochemical modeling by applying geochemical models to the study of the fate and transport of radionuclides and metals at the FEMP, investigating cement seals and backfill at Yucca Mountain, and elucidating the origin and evolution of brines present at the WIPP repository horizon.

- Modeled geochemistry of leachate, groundwater, and surface waters to support FEMP RI/FS Program. Remedial investigation work includes solubility, speciation and reaction-path modeling with the EQ3/6 code to assess the mobility of buried and stored mixed-waste forms. This activity includes the development of conceptual models, the simulation of geochemical scenarios, and the evaluation and analysis of migration pathways. In support of the feasibility study, modeling was conducted to estimate the optimum pH for removal of uranium from groundwater by anion exchange or precipitation. This information was used in laboratory bench-scale experiments to minimize schedule delays and costs and to achieve full-scale capabilities in the shortest period of time.
- Authored sampling and analytical plans and reports issued as part of the FEMP RI/FS Programs, and coordinated review and resolution of all technical comments.

- Assessed the performance of cement seals and backfill in volcanic rock for the Yucca Mountain high-level nuclear waste repository program. This assessment consisted of computer simulations to evaluate the chemical integrity and longevity of cement seals in the presence of site groundwater and to rank a variety of ash-flow tuff/clay mixtures for their ability to seal drifts and prevent the migration of radionuclides.
- Managed project on interlaboratory comparison of synthetic brine samples to assess precision and accuracy of analytical techniques used to characterize WIPP brine samples.
- Evaluated analytical data obtained on brine samples recovered from the WIPP repository horizon. Task responsibilities include the monitoring of laboratory QA/QC procedures to ensure database integrity, supervision of the statistical and geochemical modeling conducted on the database, and development of hypotheses and conceptual models to investigate the origin of the brine.
- Conducted geochemical modeling with the EQ3/6 code to calculate solubility limits of toxic metals in Salado Formation brine and Culebra groundwater. This data was used to support work carried out for the WIPP Supplemental Environmental of the Pretest Waste Characterization Plan, SEIS, and NMVP documents.
- Participated in the SW-846 Sampling and Monitoring Working Group assisting the EPA in the development of mixed-waste protocols for DOE sites that generate and store transuranic waste, and ensuring that the developed protocols are integrated with the WIPP Pretest Waste Characterization Plan.

1987 - **Geology Instructor, University of New Mexico, Albuquerque, New Mexico.** Developed lectures for Physical Geology and Historical Geology, supervised 30-40 students in class and field projects, organized and conducted field-trips, and evaluated student performance.

1985 - **Research Technician, Department of Geology, University of New Mexico, Albuquerque, New Mexico.** Instructed and supervised students in the proper and safe use of analytical instruments (x-ray fluorescence and solid-source mass spectrometer). Maintained ultra-clean rock digestion laboratory and prepared a variety of solutions and distilled acids used in ion-exchange columns. Developed computer programs for analytical equipment and data base analysis.

1981 - **Teaching Assistant, Department of Geology, University of New Mexico, Albuquerque, New Mexico.** Supervised 10-20 students in mineralogy and petrology laboratories, developed laboratory exercises, evaluated student performance, and maintained mineral and rock collections.

- 1981 **Field Geologist, California Department of Water Resources, Red Bluff, California.**
Conducted field investigations and developed slope stability maps of the drainage basins for the South Fork Trinity and Middle Fork Eel Rivers, California.

Professional Affiliations

American Geophysical Union
Geological Society of America
International Association of Geochemistry and Cosmochemistry

Publications

- Abitz, R., 1996, "Novel Use of Geochemical Models in Evaluating Treatment Trains for Radioactive Waste Streams" *Second International Symposium on Extraction and Processing for the Treatment and Minimization of Wastes*, The Minerals, Metals, and Materials Society, pp 167-176, Phoenix, Arizona.
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Attachment B

Table 1.

**Changes in Ground-water Restoration Standards and Final Restoration Levels
at URI Benavides ISL Mine, Duval County, Texas (TNRCC Permit No. UR02312)**

Table 2.

**Changes in Ground-water Restoration Standards and Final Restoration Levels
at URI Longoria ISL Mine, Duval County, Texas
(TDH/BRC Lic. No. L02704 [or, 8-2704]; TNRCC Permit No. UR02222)**

TABLE 1. Changes in Ground-water Restoration Standards and Final Restoration Levels at URI Benavides ISL Mine, Duval County, Texas (TNRCC Permit No. UR02312)

	PAA-011 (Areas A and B)			PAA-021 (Area C)			PAA-031 (Area D)			PAA-041			Federal Drinking Water Stds.
Constituent (mg/l), unless indicated	1979	1987	1988	1981	1990	1991	1982	1988	1989	1986	na	1986	
References	ORL	RRL	FLR	ORL	RRL	FRL	ORL	RRL	FRL	ORL	PRL	FRL	
	13	2	3,4	5	5,6	6,7	8	9	9,10	10	11	12	16,17
Calcium	22	75	67	35	100	39	32	76	76	50	PAA041	37	
Magnesium	6.2	6.2	13	13.1	13	20	9.4	9.4	18.6	15	was split	9	
Sodium	402	402	418	559	559	601	475	475	442	410	from	372	
Potassium	14	14	11.5	19.9	19.9	16	13.6	13.6	12.6	14	PAA011 in	7	
Carbonate	2	2	0	0.1	0.1	0	5	5	0	2	1986.	0	
Bicarbonate	239	350	303	181	325	176	218	300	224	400	Original	254	
Sulfate	69	300	265	85	300	105	86	300	188	250	restora-	107	250
Chloride	517	517	432	814	814	903	653	650	629	517	tion levels	497	250
Fluoride	0.48	0.48	0.29	0.43	0.43	0.44	0.55	0.55	0.32	0.48	for	0.37	1.6
Nitrate-N	2.87	2.87	0.53	1.3	1.3	2.1	2.25	2.55	0.41	2.87	PAA041	0.1	10
Silica	26	26	14	20.4	20.4	23	21	21	18	26	were esta-	16	
pH (std units)	6.0 - 9.0	6.5 - 8.5	8.36	8.1	8.1	8.17	8.6	8.6	8	7	blished at	7.7	
TDS	1211	1211	1359	1663	2100	1875	1356	1356	1560	1211	that time.	1088	500
EC (umhos)	2161	ns	2383	2689	2982	3448	2269	2269	2715	2161	No	2173	
Alkalinity (std unit)	199	ns	253	149	149	145	184	184	184	199	revisions	208	
Arsenic	0.004	0.004	0.002	0.008	0.008	0.004	0.037	0.037	0.002	0.004	to those	<0.01	0.05
Cadmium	0.0003	0.0003	<0.01	0.01	0.01	0.0001	0.01	0.01	<0.001	0.003	levels	<0.01	0.01
Iron	2.45	2.45	0.01	1.2	1.2	0.01	0.1	0.01???	<0.01	2.45	were	2.37	0.3
Lead	0.023	0.023	0.03	0.05	0.05	0.004	0.05	0.05	<0.001	0.023	made	<0.02	0.05
Manganese	0.365	0.365	0.01	0.41	0.41	0.01	0.01	0.01	0.18	0.365	prior to	0.18	0.05
Mercury	0.0003	0.0003	<0.001	0.001	0.001	0.0001	0.001	0.0001??	<0.001	0.0003	the end of	<0.001	0.002
Selenium	0.004	0.004	0.005	0.01	0.01	0.033	0.025	0.025	0.04	0.004	restora-	0.01	0.01
Ammonia	0.03	0.03	0.1	0.03	0.03	0.04	0.05	0.05	0.16	0.03	tion.	nv	
Uranium	0.083	2	1.04	0.078	2	0.279	0.12	3	1.5	2		0.95	0.03
Molybdenum	0.01	0.01	0.05	0.1	0.1	0.01	0.1	0.1	0.02	0.01		<0.01	0.1
Radium (pCi/l)	ns	83	17.4	45.17	83	5.2	ns	173.1	40.5	83		61.3	5

Abbrev'ns.: EC = Electrical conductivity. FRL = Final Restoration Level, based on HRI-reported data. mg/l = milligrams per liter. ns = no standard established; nv = no value given. ORL = Original Restoration Level, based on average levels within Mine Area or Production Area, whichever was higher. pCi/l = picoCuries per liter. RRF = Revised Restoration level, based on regulatory determinations. TDS = Total Dissolved Solids.

Notes: **Boldface** numbers in "RRL" columns indicate restoration standards that were increased from Original Restoration Levels. *Italicized* numbers indicate Final Restoration Levels that exceeded Original Restoration Levels only. **Boldface italicized** numbers indicate Final Restoration Levels that were greater than both Original and Revised levels.

**TABLE 2. Changes in Ground-water Restoration Standards and Final Restoration Levels at URI Longoria ISL Mine, Duval County, Texas
(TDH/BRC Lic. No. L02704 [or, 8-2704]; TNRCC Permit No. UR02222)**

Constituent (mg/l), unless otherwise indicated	PAA-1				PAA-2			Federal Drinking Water Stds.
	1979	1987	1988	1988	1980	1987	1988	
	ORL	1RRL	2RRL	FRL	ORL	RRL	FRL	
References	9, 10	9	2, 10	2, 6	2, 10	2	2, 7	16, 17
Calcium	54.5	100	100	85	77	100	116	
Magnesium	15.5	15.5	15.5	20.6	19	19	29	
Sodium	619.3	619	619	562	610	610	652	
Potassium	20.2	20	20	13	23	23	17	
Carbonate	nv	2.33 [213]		6	3.4	3	3	
Bicarbonate	239.6	400	400	315	238	400	366	
Sulfate	182.5	350	450	265	206	450	381	250
Chloride	854.5	854	856	712	856	856	905	250
Fluoride	0.56	0.56	0.56	0.55	0.62	0.62	0.51	1.6
Nitrate-N	0.82	0.82	0.82	0.28	2.68	2.68	0.59	10
Silica	36	36	36	30	42	42	30	
pH (std units)	6.0-9.0	6.5-8.5	8	8.33	8.28	8	8.27	
TDS	1928	1928	1920	1860	2013	2200	2208	500
EC (umhos)	nv	nv	nv	3200	3509	nv	3697	
Alkalinity (std units)	nv	nv	nv	269	201	nv	307	
Arsenic	0.023	0.023	0.023	0.025	<.01	<.01	<.01	0.05
Cadmium	0.0001	0.0001	<0.01	<0.01	0.0001 [0.24]		<.01	0.01
Iron	0.04	0.04	0.04	<0.01	0.26 [0.03]		<.02	0.3
Lead	0.003	0.003	0.003	0.04	0.028 [0.111]		<.01	0.05
Manganese	0.02	0.02	0.02	0.1	0.111	0.11	<.01	0.05
Mercury	0.0003	0.0003	<0.001	<0.001	0.0003	<0.001	<0.001	0.002
Selenium	0.002	0.002	0.002	0.003	0.003	0.003	0.008	0.01
Ammonia	0.01	0.01	0.05	0.16	0.01	0.01	0.17	
Uranium	0.047	2	3	1.2	0.037	3	1.8	0.03
Molybdenum	0.03	0.03	0.03	<0.01	0.03	0.03	<.01	0.1
Radium (pCi/l)	97	97	97	49.7	36.72	37	27	5

Abbrev'ns.: EC = Electrical conductivity. FRL = Final Restoration Level, based on HRI-reported data. mg/l = milligrams per liter. ns = no standard established; nv = no value given. ORL = Original Restoration Level, based on average levels within Mine Area or Production Area, whichever was higher. pCi/l = picoCuries per liter. RRF = Revised Restoration level, based on regulatory determinations. TDS = Total Dissolved Solids.

Notes: **Boldface** numbers in "RRL" columns indicate restoration standards that were increased from Original Restoration Levels. *Italicized* numbers indicate Final Restoration Levels that exceeded Original Restoration Levels only. **Boldface italicized** numbers indicate Final Restoration Levels that were greater than both Original and Revised levels.

Attachment C

References to Tables 1 and 2 in Attachment B to Abitz Reply Testimony

- (1) Greene, 1986. Greene, C.J. (Texas Water Commission), letter to D.K. Lacker (Bureau of Radiation Control, Texas Department of Health), re: "Radiological Parameter Levels to be met during Restoration at Uranium Resources, Inc.'s Benavides Site, Permit No. UR02312-041, Duval County, Texas" (March 3, 1986).
- (2) HRI, 1996. HRI Response to NRC Request for Additional Information (April 1, 1996); Response to Question 52, Attachment 52-6 at 1-6. (In Hearing Record Notebook 9.1.)
- (3) Pruett, 1991. Pruett, H.D. (Texas Water Commission), Restoration Determination Letter for Benavides Mine PAA-021 (May 16, 1991); contained in Attachment 1 (fourth page) to HRI Financial Assurance Response (January 22, 2001).
- (4) Pruett, 1989. Pruett, H.D. (Texas Water Commission), Restoration Determination Letter for Benavides Mine PAA-031 (June 5, 1989); contained in Attachment 1 (fifth page) to HRI Financial Assurance Response (January 22, 2001).
- (5) Pruett, 1988a. Pruett, H.D. (Texas Water Commission), Restoration Determination Letter for Benavides Mine PAA-011 (Feb. 10, 1988); contained in Attachment 1 (third page) to HRI Financial Assurance Response (January 22, 2001).
- (6) Pruett, 1988b. Pruett, H.D. (Texas Water Commission), Restoration Determination Letter for Longoria Mine PAA-011 (Feb. 11, 1988); contained in Attachment 1 (first page) to HRI Financial Assurance Response (January 22, 2001).
- (7) Pruett, 1988c. Pruett, H.D. (Texas Water Commission), Restoration Determination Letter for Longoria Mine PAA-021 (Feb. 11, 1988); contained in Attachment 1 (second page) to HRI Financial Assurance Response (January 22, 2001).
- (8) Pruett, 1986. Pruett, H.D. (Texas Water Commission), Restoration Determination Letter for Benavides Mine PAA-041 (October 31, 1986); contained in Attachment 1 (sixth page) to HRI Financial Assurance Response (January 22, 2001).
- (9) Thiel, 1987a. Thiel, J.F. (director, Division of Environmental Programs, Texas Department of Health), memorandum to License File #8-2704

through E.D. Bailey (director, Division of Licensing, Registration and Standards), subject: "Recommended Radiological Restoration Values for Uranium Resources Inc.'s (URI) Benavides and Longoria Projects" (May 4, 1987).

- (10) Thiel, 1987b. Thiel, J.F. (director, Division of Environmental Programs, Texas Department of Health), memorandum to License File #8-2704 through E.D. Bailey (director, Division of Licensing, Registration and Standards), subject: "Modification to URI Longoria Restoration Table for Uranium to 3.0 mg/l" (May 29, 1987).
- (11) Thiel, 1986. Thiel JF (director, Division of Environmental Programs, Texas Department of Health), memorandum to E.D. Bailey (director, Division of Licensing, Registration and Standards), subject: "Radiological Parameters for Amended Restoration Table: Uranium Resources, Inc., Benavides Mine (Lic. # 8-2704)" (March 25, 1986).
- (12) TWC, 1990. Texas Water Commission, UIC Permit No. UR02312-021, URI Benavides Mine, Production Area Authorization 21 (June 28, 1990), Attachment G at 9 for PAA021 ORL, and Attachment A at 2 for PAA021 RRL.
- (13) TWC, 1987. Texas Water Commission, UIC Permit No. UR02312-011, URI Benavides Mine, Production Area Authorization 11 (Aug. 6, 1987), Table 4 at 9 for PAA01 ORL, and Attachment A at 3 for PAA01 RRL.
- (14) TWC, 1986a. Texas Water Commission, UIC Permit No. UR02312-031, URI Benavides Mine, Production Area Authorization 31 (April 26, 1982), Attachment F at 7 and Attachment G at 9 for ORL.
- (15) TWC, 1986b. Texas Water Commission, UIC Permit No. UR02312-041, URI Benavides Mine, Production Area Authorization 41 (May 6, 1986).
- (16) USEPA U.S. Environmental Protection Agency. National Primary Drinking Water Regulations, 40 CFR 141 Subpart B; National Secondary Drinking Water Standards, 40 CFR 143; 65 *Federal Register* 76708 (December 7, 2000), inclusive of 0.03 mg/l standard for uranium.
- (17) USEPA U.S. Environmental Protection Agency. 40 CFR 192 Subpart A – Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites (molybdenum standard of 0.1 mg/L.)

Handwritten: H. E. B. ft
TEXAS WATER COMMISSION *Handwritten: JIC - Please coordinate response as*

Paul Hopkins, Chairman
Ralph Roming, Commissioner
John O. Houchins, Commissioner



Larry R. Soward, Executive Director
Mary Ann Hefner, Chief Clerk
James K. Rourke, Jr., General Counsel

March 3, 1986

Mr. David K. Lackner, Chief
Bureau of Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, Texas 78756-3189

Dear Mr. Lackner:

Re: Radiological Parameter Levels to be met during Restoration
at Uranium Resources, Inc.'s Benavides Site, Permit
No. UR02312-041, Duval County, Texas

Pursuant to the Memorandum of Understanding on In Situ Uranium Mining between the Texas Department of Health and the Texas Department of Water Resources (now the Texas Water Commission), the Texas Department of Health is responsible for specifying the radiological parameters to be met for aquifer restoration.

Uranium Resources, Inc. (URI) has requested an amendment to the Restoration Table in Production Area Number 1. Production Area No. 1 is being split with half of it remaining as PAA No. 1 and the other half becoming a new production area, PAA #4. The amended restoration table will be incorporated into PAA #4. URI feels they have restored the aquifer in the PAA #4 area to the requested Restoration Table values. Once the table is amended, verification sampling will begin. If the Commission certifies that the aquifer is restored, the wells in this area can be plugged and abandoned.

Enclosed is a copy of baseline conditions at the site, the existing restoration table values and the values proposed by URI. We are presently processing the application and would appreciate receiving restoration values for Radium 226 and Uranium at your earliest convenience.

Attachment
C-1

Mr. David K. Lacker
Page 2
March 3, 1986

If you have any questions or comments, please call Mr. Dale P. Kohler of the Solution Mining Unit at 512/463-8278.

Sincerely,

A handwritten signature in cursive script, appearing to read "Charles J. Greene".

Charles J. Greene, Head
Solution Mining Unit
Underground Injection Control Section

Enclosures

cc w/encl.: TWC District 11 Office - Weslaco

Attachment F Restoration Table

<u>Proposed</u> <u>Parameter</u>	<u>Unit</u>	<u>Concentration</u>
Calcium	mg/l	50
Magnesium	mg/l	15
Sodium	mg/l	410
Potassium	mg/l	14
Carbonate	mg/l	2
Bicarbonate	mg/l	400
Sulfate	mg/l	250
Chloride	mg/l	517
Nitrate	mg/l	2.87
Fluoride	mg/l	.48
Silica	mg/l	26
TDS	mg/l	1211
PH pH	Std. Unit	6.5 6.5-8.5
Arsenic	mg/l	.004
Cadmium	mg/l	.003
Iron	mg/l	2.45
Lead	mg/l	.023
Manganese	mg/l	.365
Mercury	mg/l	.0003
Molybdenum	mg/l	.01
Selenium	mg/l	.004
Uranium	mg/l	4.0
Radium 226	pCi/l	83
Ammonia	mg/l	.03

GROUND WATER ANALYSIS REPORT SUMMARY
 BASEL TO WATER QUALITY TABLE - 1. ON JAN 1 1979

TABLE 4

Company: URANIUM RESOURCES INC.
 Mine Name: BENAVIDES
 Mine Area: A & B Production Area No. 1
 Date Summarized: 1 NOVEMBER 79

	PARAMETER	UNIT	NON PRODUCTION ZONE**			PRODUCTION ZONE						WELL I.D. BY AREA*		
						MINE AREA **			PRODUCTION AREA			NON PROD. ZONE	PROD. ZONE	
			Low	Average	High	Low	Average	High	Low	Average	High		Mine	Product.
1	Calcium	mg/l	15	46	58	13	22	42	9.7	20	51	U-51	U-55	U-5
2	Magnesium	mg/l	6.1	21.8	28	2.6	6.2	14	.88	4.8	9.1	U-52	U-160	U-6
3	Sodium	mg/l	533	556	568	311	402	527	305	366	454	U-53	U-161	U-10
4	Potassium	mg/l	18	19	20	10	14	19	8.7	12	20	U-54	U-162	U-14
5	Carbonate	mg/l	0	3	6	0	2	7	0	2	7		U-163	U-20
6	Bicarbonate	mg/l	128	166	187	165	215	283	190	239	273		U-164	U-23
7	Sulfate	mg/l	123	132	143	40	61	87	41	69	95		U-175	U-28
8	Chloride	mg/l	746	812	850	296	517	789	288	431	670		U-176	U-35
9	Fluoride	mg/l	0.25	.30	0.36	0.30	0.48	0.89	.38	.45	.59		U-177	U-47
10	Nitrate - N	mg/l	6.9	7.6	7.9	0.01	2.87	11	.02	.59	4.2		U-178	U-75
11	Silica	mg/l	11	14	16	10	26	58	15	26	111		U-179	U-79
12													U-180	U-93
13	pH	Std. unit	8.24	8.35	8.5	7.98	8.37	8.60	7.98	8.33	8.63		U-181	U-101
14	TDS	mg/l	1590	1752	1850	938	1211	1620	905	1103	1430		U-182	U-106
15	Conductivity	µmhos	2950	3185	3320	1590	2161	3000	1540	1924	2580			U-113
16	Alkalinity	Std. Unit	105	141	153	125	180	240	158	199	224			U-137
17														U-144
18	Arsenic	mg/l	0.004	0.008	0.012	<.001	.004	.016	<.001	.003	.014			U-155
19	Barium	mg/l	0.06	0.10	0.13	0.16	0.28	0.58	.05	.23	.44			U-167
20	Boron	mg/l	.86	.97	1.04	0.65	0.89	1.12	.71	.91	1.2			U-172
21	Cadmium	mg/l	<.0001	<.0001	<.0001	<.0001	.0003	.0008	<.0001	.0001	.0003			
22	Chromium	mg/l	.001	.002	.002	.002	.004	.008	.001	.003	.008			
23	Copper	mg/l	.003	.006	.010	.004	.012	.033	.003	.011	.027			
24	Iron	mg/l	<.01	.11	.29	0.04	2.45	9.4	.06	1.55	6.7			
25	Lead	mg/l	<.001	.027	.074	<.001	.016	.040	<.001	.023	.16			
26	Manganese	mg/l	<.001	.009	.026	.005	.365	1.14	.006	.238	.903			
27	Mercury	mg/l	<.0001	.0001	.0002	<.0001	.0002	.0006	<.0001	.0003	.0008			
28	Nickel	mg/l	<.01	<.01	<.01	<.01	0.01	0.02	<.01	.01	.02			
29	Selenium	mg/l	<.001	<.001	<.001	<.001	.004	.030	<.001	.003	.017			
30	Silver	mg/l	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01			
31	Zinc	mg/l	.001	.013	.036	.003	.020	.051	.004	.020	.068			
32														
33	Ammonia	mg/l	.01	.01	.01	<.01	0.02	0.09	<.01	.03	.17			
34	Uranium	mg/l	.003	.004	.005	.001	.015	.049	.001	.083	.314			
35	Molybdenum	mg/l	<.01	<.01	<.01	<.01	.01	.01	.01	.01	.02			
36	Vanadium	mg/l	.01	.03	.04	<.01	.01	.01	<.01	.01	.01			

GROUNDWATER ANALYSIS REPORT SUMMARY AND
BASELINE WATER QUALITY TABLE - IN S.W. Chromium Mining

TABLE 5

"E" Sand

Company URANIUM RESOURCES INC.
Mine Name: BENAVIDES
Mine Area: A & B Production Area No. 1
Date Summarized: 1 NOVEMBER 79

			NON PRODUCTION I ZONE **			PRODUCTION ZONE						WELL ID BY AREA *			
PARAMETER			UNIT				MINE AREA **			PRODUCTION AREA			NON PROD. ZONE	PROD ZONE	
				Low	Average	High	Low	Average	High	Low	Average	High		Mine	Product.
1	Calcium	mg/l		15	18	20							U-183		
2	Magnesium	mg/l		4.6	5.2	5.7							U-184		
3	Sodium	mg/l		306	314	322									
4	Potassium	mg/l		10	12	13									
5	Carbonate	mg/l		10	11	12									
6	Dicarbonate	mg/l		266	288	309									
7	Sulfate	mg/l		113	119	124									
8	Chloride	mg/l		238	267	296									
9	Fluoride	mg/l		.83	.93	1.03									
10	Nitrate - N	mg/l		.04	.06	.07									
11	Silica	mg/l		20	25	29									
12															
13	pH	Std. unit		8.62	8.66	8.69									
14	TDS	mg/l		932	961	989									
15	Conductivity	µmhos		1520	1580	1640									
16	Alkalinity	Std. Unit		234	254	273									
17															
18	Arsenic	mg/l		<.001	.001	.001									
19	Barium	mg/l		.07	.09	.10									
20	Boron	mg/l		1.23	1.26	1.29									
21	Cadmium	mg/l		<.0001	.0001	.0001									
22	Chromium	mg/l		.003	.005	.006									
23	Copper	mg/l		.006	.007	.008									
24	Iron	mg/l		.16	.35	.53									
25	Lead	mg/l		<.001	<.001	<.001									
26	Manganese	mg/l		.012	.020	.047									
27	Mercury	mg/l		<.0001	<.0001	<.0001									
28	Nickel	mg/l		<.01	<.01	<.01									
29	Selenium	mg/l		<.001	<.001	<.001									
30	Silver	mg/l		<.01	<.01	<.01									
31	Zinc	mg/l		.005	.014	.022									
32															
33	Ammonia	mg/l		.05	.06	.06									
34	Uranium	mg/l		<.001	.003	.005									
35	Molybdenum	mg/l		.02	.03	.03									
36															

Table 6

ExistingRESTORATION TABLE

Benavides Production Area No. 1

<u>Parameter</u>	<u>Concentration mg/l</u>		
	<u>Production Zone</u>	<u>Overlying "D" Sand</u>	<u>Overlying "E" Sand</u>
Calcium	22	46	18
Magnesium	6.2	21.8	5.2
Sodium	402	556	314
Potassium	14	19	12
Carbonate	2	3	11
Bicarbonate	239	166	288
Sulfate	69	132	119
Chloride	517	812	267
Fluoride	0.48	0.30	0.93
Nitrate-N	2.87	7.6	0.06
Ammonia-N	0.03	0.01	0.06
Arsenic	.004	0.008	0.001
Barium	0.28	0.10	0.09
Boron	0.91	0.97	1.26
Cadmium	0.0003	0.0001	0.0001
Chromium	0.004	0.002	0.005
Copper	0.012	0.006	0.007
Iron	2.45	0.11	0.35
Lead	0.023	0.027	0.001
Manganese	0.365	0.009	0.030
Mercury	0.0003	0.0001	0.0001
Molybdenum	0.01	0.01	0.03
Nickel	0.01	0.01	0.01
Selenium	0.002	0.001	0.001
Silica	26	14	25
Silver	0.01	0.01	0.01
Uranium	0.033	0.004	0.003
Vanadium	0.01	0.03	0.02
Zinc	0.020	0.013	0.014
pH, std. unit	6-9	6-9	6-9
Total Dissolved Solids	1,211	1,752	961
Specific Conductivity, μ mhos	2,161	3,185	1,580
Alkalinity, std. unit	199	141	254

HRI, INC.

(A Subsidiary of Uranium Resources, Inc.)

5656 South Staples
Suite 250, LB 8
Corpus Christi, Texas 78411
Telephone: (512) 993-7731
Fax: (512) 993-5744

12750 Merit Drive
Suite 1020, LB 12
Dallas, Texas 75251
Telephone: (214) 387-7777
Fax: (214) 387-7779

P.O. Box 777
Crownpoint, New Mexico 87313
Telephone: (505) 786-5845
Fax: (505) 786-5555

April 1, 1996

Mr. Joe Holonich, Chief
High-Level Waste and Uranium Recovery Projects Branch
United States Nuclear Regulatory Commission
Division of Waste Management
Office of Nuclear Materials Safety and Safeguards
Mail Stop T-7-J9
11545 Rockville Pike
Rockville, MD 20850

40-8968

RE: Request for Additional Information, Questions 49-91, Water Resources and Protection and Cost/Benefit Analysis; Safety Analysis Review and Environmental Review for Hydro Resources, Inc. (HRI) Uranium Solution Mining License Application, Crownpoint, New Mexico.

Dear Mr. Holonich:

Please find attached the responses to the subject request for additional information. The response to question #92 will be mailed under separate cover.

The responses addressed herein cover many different technical concerns, however, they all are centered around two basic questions pertaining to the proposed mining operations, namely:

1. Can water be controlled during mining?
2. Can restoration be accomplished after mining is completed?

In the case of the Crownpoint properties, these questions require careful consideration due to the location of the community water supply wells.

We believe that our operations will not affect water supply wells because mine solutions cannot reach them during mining activities. We have documented through conservative model output in these responses, that under static conditions, (i.e., mine or restoration bleed is shut off) that water in the Crownpoint mine zone would require 35+ years to migrate to the closest community water

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9604030208 960401
PDR ADDCK 04008968
B PDR

NKOS
11

Attachment
C-2

Letter to Joe Holonich

April 1, 1996

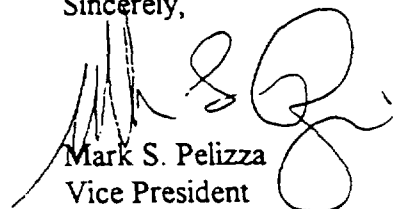
Page 2 of 2

supply well. Thirty-five years is effectively two times the anticipated life of the mine. It is unrealistic to assume that thirty-five years of static conditions would occur under any circumstance because either a minimum bleed would be required, or if HRI was not performing mining or restoration properly, NRC would step in and redeem the financial assurance and have the required remediation performed by a third party contractor. Should a third party be necessary, such remediation action would be undertaken over months, not years. Therefore, when considering the potential impact of mining on local wells, the realistic evaluation should be framed over months, not years. During such a time frame, mining impact on local wells is physically impossible. While ongoing mining or restoration activities are conducted, a bleed will be maintained, and with such bleed, it is physically impossible for mine solution to reach community wells, even after long periods.

If hydrodynamic control during operation is indisputable - and we believe it is - the other question involves the adequacy of the restoration demonstration, which is presented in the attached response. HRI has presented a number of laboratory studies, and field studies and has reviewed industry experience as it relates to the level of restoration which can be expected for the proposed operations. We believe that both NRC and HRI agree that restoration will be achieved after mining. We also believe that NRC and HRI agree, in principal, to the degree to which restoration will occur. Restoration to baseline on a parameter-by-parameter basis has not been the historical standard of either the industry at large, our tests, nor is it our proposal. Restoration, to what we believe is pre-mine water quality conditions, has been successfully demonstrated in all of the presented tests, and by the industry in general. The Company believes it will be achieved to these standards at the proposed mines. The question of the NRC is, in this particular application, does restoration to the level presented in our applications and this response meet the regulatory standards? If so, then what remains is the establishment of the proper bonding level to achieve restoration. This is calculated by determining the volume of water which will require processing and the applicable costs to complete such processing.

Please feel free to contact me with additional questions. We look forward to working with you and your staff to bring this review to a conclusion.

Sincerely,



Mark S. Pelizza
Vice President

Health, Safety and Environmental Affairs

MSP/dlg

Enclosures (via Federal Express)

ATTACHMENT 52-6
TEXAS PROJECTS
RESTORATION RESULTS

LONGORIA PRODUCTION AREA #1
BEFORE, DURING AND AFTER LEACH
WATER QUALITY SUMMARY

PARAMETER	BASELINE	PREG.LIX.	RESTORED	DRINKING
CALCIUM	100.0	286.0	85.0	
MAGNESIUM	15.50	71.00	20.60	
SODIUM	619	982	562	
POTASSIUM	20.00	38.00	13.0	
CARBONATE	213	0	6	
BICARB	400	604	315	
SULFATE	450	1231	265	600
CHLORIDE	856.0	1,025.0	712.0	250.0
NITRATE	0.56	0.23	0.28	10.00
FLUORIDE	0.82	0.35	0.55	1.60
SILICA	36	34	30	
TDS(180)	1920	3970	1860	1000
EC(25C)		5820	3200	
ALK		495	269	
PH	8.00	6.97	8.33	
ARSENIC	0.023	0.007	0.025	0.100
CADMIUM	<.01	0.0004	<.01	0.0100
IRON	0.04	0.17	<.01	1.00
LEAD	0.0030	0.0050	0.0400	0.0500
MANGANESE	0.02	0.23	0.1	0.20
MERCURY	<.001	0.0002	<.001	0.0020
MOLY.	0.03	0.03	<.01	
SELENIUM	0.002	0.034	0.003	0.050
URANIUM	3.000	12.700	1.210	5.000
AMMONIA	0.05	0.08	0.16	
RA226	97.0	66.0	49.7	30.0

LONGORIA PRODUCTION AREA #2
BEFORE, DURING AND AFTER LEACH
WATER QUALITY SUMMARY

PARAMETER	BASELINE	PREG.LIX.	RESTORED	DRINKING
CALCIUM	100.0	286.0	116.0	
MAGNESIUM	19.00	71.00	29.00	
SODIUM	610	982	652	
POTASSIUM	23.00	38.00	17.0	
CARBONATE	3	0	3	
BICARB	400	604	366	
SULFATE	450	1231	381	600
CHLORIDE	856.0	1,025.0	905.0	250.0
NITRATE	2.60	0.23	0.59	10.00
FLUORIDE	0.62	0.35	0.51	1.60
SILICA	42	34	30	
TDS(180)	2200	3970	2208	1000
EC(25C)		5820	3697	
ALK		495	307	
PH	8.00	6.97	8.27	
ARSENIC	<.01	0.007	<.01	0.100
CADMIUM	0.2400	0.0004	<.01	0.0100
IRON	0.03	0.17	<.02	1.00
LEAD	0.1110	0.0050	<.01	0.0500
MANGANESE	0.11	0.23	<.01	0.20
MERCURY	<.001	0.0002	<.001	0.0020
MOLY.	<.01	0.03	<.01	
SELENIUM	0.003	0.034	0.008	0.050
URANIUM	3.000	12.700	1.800	5.000
AMMONIA	0.01	0.08	0.17	
RA226	37.0	66.0	27.0	30.0

BENAVIDES PRODUCTION AREA 1
BEFORE, DURING AND AFTER LEACH
WATER QUALITY SUMMARY

ALL VALUES MG/L EX. RA226 - PC/L, EC - mMHO, PH - SU

PARAMETER	BASELINE	PREG.LIX.	RESTORED	Ref. Std.
CALCIUM	75.0	218.0	67.0	
MAGNESIUM	6.20	64.00	13.00	
SODIUM	402	926	418	
POTASSIUM	14.00	33.00	11.5	
CARBONATE	2	0	0	
BICARB	350	531	303	
SULFATE	300	1123	265	250
CHLORIDE	517.0	942.0	432.0	250
NITRATE	2.87	0.37	0.53	10.00
FLUORIDE	0.48	0.30	0.29	1.6
SILICA	26	15	14	
TDS(180)	1211	3710	1359	500
EC(25C)		5460	2383	
ALK		435	253	
PH	8.00	7.00	8.36	
ARSENIC	0.004	<.01	0.002	0.05
CADMIUM	<.01	<.01	<.01	0.010
IRON	2.45	5.90	0.01	0.3
LEAD	0.0230	<.02	0.0300	0.05
MANGANESE	0.37	0.04	0.01	0.05
MERCURY	<.001	<.001	<.001	0.002
MOLY.	0.01	0.02	0.05	
SELENIUM	0.004	0.020	0.005	0.01
URANIUM	2.000	41.600	1.040	
AMMONIA	0.03	0.12	0.10	
RA226	83.0		17.4	30.0

BENAVIDES PRODUCTION AREA 2
BEFORE, DURING AND AFTER LEACH
WATER QUALITY SUMMARY

ALL VALUES PPM EX. RA226 - PCI/L, EC - mMHO, PH -SU

PARAMETER	BASELINE	PREG.LIX.	RESTORED	Ref. Std.
CALCIUM	100.0	218.0	39.0	
MAGNESIUM	13.00	64.00	20.00	
SODIUM	559	926	601	
POTASSIUM	19.90	33.00	16.0	
CARBONATE	0	0	0	
BICARB	325	531	176	
SULFATE	300	1123	105	250
CHLORIDE	814.0	942.0	903.0	250
NITRATE	1.30	0.37	2.10	10.00
FLUORIDE	0.43	0.30	0.44	1.6
SILICA	8	15	23	
TDS(180)	2100	3710	1875	500
EC(25C)	2982	5460	3448	
ALK	149	435	145	
PH	8.10	7.00	8.17	
ARSENIC	0.008	<.01	0.004	0.05
CADMIUM	0.0100	<.01	0.0001	0.010
IRON	1.20	5.90	0.01	0.3
LEAD	0.0500	<.02	0.0040	0.05
MANGANESE	0.41	0.04	0.01	0.05
MERCURY	0.0010	<.001	0.0001	0.002
MOLY.	0.10	0.02	0.01	
SELENIUM	0.010	0.020	0.033	0.01
URANIUM	2.000	41.600	0.279	
AMMONIA	0.03	0.12	0.04	
RA226	83.0		5.2	30.0

BENAVIDES PRODUCTION AREA 3
BEFORE, DURING AND AFTER LEACH
WATER QUALITY SUMMARY

ALL VALUES PPM EX. RA226 - PCII/L, EC - mMHO, PH - SU

PARAMETER	BASELINE	PREG.LIX.	RESTORED	Ref. Std.
CALCIUM	76.0	218.0	76.0	
MAGNESIUM	9.40	64.00	18.60	
SODIUM	475	926	442	
POTASSIUM	13.60	33.00	12.6	
CARBONATE	5	0	0	
BICARB	300	531	224	
SULFATE	300	1123	188	250
CHLORIDE	650.0	942.0	629.0	250
NITRATE	2.55	0.37	0.41	10.00
FLUORIDE	0.55	0.30	0.32	1.6
SILICA	21	15	18	
TDS(180)	1356	3710	1560	500
EC(25C)	2269	5460	2715	
ALK	184	435	184	
PH	8.60	7.00	8.00	
ARSENIC	0.037	<.01	0.002	0.05
CADMIUM	0.0100	<.01	<.0001	0.010
IRON	0.01	5.90	<.01	0.3
LEAD	0.0500	<.02	<.001	0.05
MANGANESE	0.01	0.04	0.18	0.05
MERCURY	0.0001	<.001	<.0001	0.002
MOLY.	0.10	0.02	0.02	
SELENIUM	0.025	0.020	0.040	0.01
URANIUM	3.000	41.600	1.500	
AMMONIA	0.05	0.12	0.16	
RA226	173.1		40.5	30.0

BENAVIDES PRODUCTION AREA 4
BEFORE, DURING AND AFTER LEACH
WATER QUALITY SUMMARY

ALL VALUES PPM EX. RA226 - PCI/L, EC - mMHO, PH - SU

PARAMETER	BASLINE	PREG.LIX.	RESTORED	Ref. Std.
CALCIUM	50.0	218.0	37.0	
MAGNESIUM	15.00	64.00	9.00	
SODIUM	410	926	372	
POTASSIUM	14.00	33.00	7.0	
CARBONATE	2	0	0	
BICARB	400	531	254	
SULFATE	250	1123	107	250
CHLORIDE	517.0	942.0	497.0	250
NITRATE	2.87	0.37	0.10	10.00
FLUORIDE	0.48	0.30	0.37	1.6
SILICA	26	15	16	
TDS(180)	1211	3710	1088	500
EC(25C)	2161	5460	2173	
ALK	199	435	208	
PH	7.00	7.00	7.70	
ARSENIC	<.01	<.01	<.01	0.05
CADMIUM	<.01	<.01	<.01	0.010
IRON	2.45	5.90	2.37	0.3
LEAD	0.0200	<.02	<.02	0.05
MANGANESE	0.37	0.04	0.18	0.05
MERCURY	<.001	<.001	<.001	0.002
MOLY.	0.01	0.02	<.01	
SELENIUM	<.01	0.020	0.010	0.01
URANIUM	2.000	41.600	0.950	
AMMONIA		0.12		
RA226	83.0		61.3	30.0

TEXAS WATER COMMISSION



B. J. Wynne, III, Chairman
John E. Birdwell, Commissioner
Cliff Johnson, Commissioner

Allen Beinke, Executive Director

John J. Vay, General Counsel
Michael E. Field, Chief Hearings Examiner
Gloria A. Vasquez, Chief Clerk

May 16, 1991

Mr. Mark Pelizza
URI, Inc.
12377 Merit Drive
Suite 750, LB14
Dallas, Texas 75251

BEN
TWC → URI

Re: Restoration Determination of Production Area No. 2 of the
Benavides Mine Site, Permit No. UR02312-021

Dear Mr. Pelizza:

The Texas Water Commission has received the restoration data for Production Area No. 2 of the Benavides Mine Site. A review of the data indicates that Production Area No. 2 has been restored in accordance with the specifications contained in permit number UR02312-021 as required by 31 TAC Section 331.107. You are hereby authorized to cease any restoration activities, including monitoring, at Production Area No. 2.

Within 120 days of receipt of this letter closure of the wellfield shall be accomplished in accordance with the approved plugging and abandonment plans for this Production Area. Any modifications to the plugging and abandonment procedures must be approved in writing by the Commission.

Please notify the Commission prior to commencing plugging activities to provide the opportunity for TWC personnel to be present. If you have any questions please contact Dale P. Kohler of the Ground Water Section at 512/371-6322.

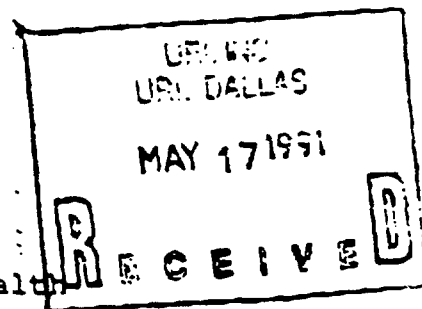
Sincerely,

James Lewis for

Harry D. Pruett, P.E.
Director, Water Rights & Uses Division

HDP/DPK/km

cc: TWC District Office #11 - Weslaco
David Lacker - Texas Department of Health
Bureau of Radiation Control



Attachment
C-3

AS WATER COMMISSION.

J. Wynne, III, Chairman
Paul Hopkins, Commissioner
John O. Houchins, Commissioner



Allen Beinke, Executive Director
Michael E. Field, General Counsel
Brenda W. Foster, Chief Clerk

June 5, 1989

TWC 7 URI
e

Mr. Mark S. Pelizza
Environmental Manager
Uranium Resources, Inc.
12377 Merit Drive
Suite 750, LB14
Dallas, Texas 75251

Re: Restoration Determination of Production Area No. 3 of the
Benavides Mine Site, Permit No. URD2312-031

Dear Mr. Pelizza:

The Texas Water Commission has received the restoration data for Production Area No. 3 of the Benavides Mine Site. A review of the data indicates that Production Area No. 3 has been restored in accordance with the specifications contained in permit number URD2312-031 as required by 31 TAC Section 331.107. You are hereby authorized to cease any restoration activities, including monitoring, at Production Area No. 3.

Within 120 days of receipt of this letter closure of the wellfield shall be accomplished in accordance with the approved plugging and abandonment plans for this Production Area. Any modifications to the plugging and abandonment procedure must be approved in writing by the Commission.

Please notify the Commission prior to commencing plugging activities to provide the opportunity for TWC personnel to be present. If you have any questions please contact Dale P. Kohler of the In Situ Uranium Mining Unit at (512) 463-8278.

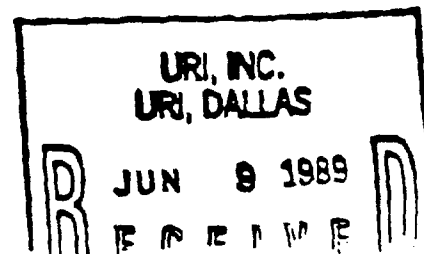
Sincerely,

A handwritten signature in black ink, appearing to read "Harry D. Pruett (for)".

Harry D. Pruett
Director, Water Rights & Uses Division

DPK:aa

cc: TWC District 11 Office - Weslaco
Mr. David Lacker - Texas Department of Health
Bureau of Radiation Control



TEXAS WATER COMMISSION



Paul Hopkins, Chairman
John O. Houchins, Commissioner
B. J. Wynne, III, Commissioner

Allen Beinke, Executive Director
February 10, 1988

J. D. Head, General Counsel
Michael E. Field, Chief Examiner
Karen A. Phillips, Chief Clerk

Mr. Mark S. Pelizza
Environmental Manager
Uranium Resources, Inc.
12377 Merit Drive
Suite 750, LB14
Dallas, Texas 75251

Re: Restoration Determination of Production Area No. 1 of the Benavides Mine
Site, Permit No. UR02312-011

Dear Mr. Pelizza:

The Texas Water Commission has received the restoration data for Production Area No. 1 of the Benavides Mine Site. A review of the data indicates that Production Area No. 1 has been restored in accordance with the specifications contained in permit number UR02312-011 as required by 31 TAC Section 331.107. You are hereby authorized to cease any restoration activities, including monitoring, at Production Area No. 1.

Within 120 days of receipt of this letter closure of the wellfield shall be accomplished in accordance with the approved plugging and abandonment plans for this Production Area. Any modifications to the plugging and abandonment procedure must be approved in writing by the Commission.

Please notify the Commission prior to commencing plugging activities to provide the opportunity for TWC personnel to be present. If you have any questions please contact Dale P. Kohler of the In Situ Uranium Mining Unit at (512) 463-8278.

Sincerely,


Harry D. Gruett

Director, Water Rights & Uses Division

DK:jt

cc TWC District 11 Office - Weslaco
Mr. David Lacker - Texas Department of Health
Bureau of Radiation Control

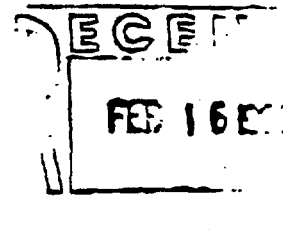
TEXAS WATER COMMISSION



Paul Hopkins, Chairman
John O. Houchins, Commissioner
B. J. Wynne, III, Commissioner

Allen Beinke, Executive Director
February 11, 1988

J. D. Head, General Counsel
Michael E. Field, Chief Examiner
Karen A. Phillips, Chief Clerk



Mr. Mark S. Pelizza
Environmental Manager
Uranium Resources, Inc.
12377 Merit Drive
Suite 750, LB14
Dallas, Texas 75251

Re: Restoration Determination of Production Area No. 1 of the Longoria Mine Site,
Permit No. URO2222-011

Dear Mr. Pelizza:

The Texas Water Commission has received the restoration data for Production Area No. 1 of the Longoria Mine Site. A review of the data indicates that Production Area No. 1 has been restored in accordance with the specifications contained in permit number URO2222-011 as required by 31 TAC Section 331.107. You are hereby authorized to cease any restoration activities, including monitoring, at Production Area No. 1.

Within 120 days of receipt of this letter closure of the wellfield shall be accomplished in accordance with the approved plugging and abandonment plans for this Production Area. Any modifications to the plugging and abandonment procedure must be approved in writing by the Commission.

Please notify the Commission prior to commencing plugging activities to provide the opportunity for TWC personnel to be present. If you have any questions please contact Dale P. Kohler of the In Situ Uranium Mining Unit at (512) 463-8278.

Sincerely,

Harry D. Pruett
Harry D. Pruett

Director, Water Rights & Uses Division

DK:jt

cc: TWC Dist 11 Office - Weslaco
Mr. David Lacker - Texas Department of Health
Bureau of Radiation Control

TEXAS WATER COMMISSION



Paul Hopkins, Chairman
John O. Houchins, Commissioner
B. J. Wynne, III, Commissioner

J. D. Head, General Counsel
Michael E. Field, Chief Examiner
Karen A. Phillips, Chief Clerk

Allen Beinke, Executive Director

February 11, 1988

Mr. Mark S. Pelizza
Environmental Manager
Uranium Resources, Inc.
12377 Merit Drive
Suite 750, LB14
Dallas, Texas 75251

Re: Restoration Determination of Production Area No. 2 of the Longoria Mine Site,
Permit No. URO2222-021

Dear Mr. Pelizza:

The Texas Water Commission has received the restoration data for Production Area No. 2 of the Longoria Mine Site. A review of the data indicates that Production Area No. 2 has been restored in accordance with the specifications contained in permit number URO2222-021 as required by 31 TAC Section 331.107. You are hereby authorized to cease any restoration activities, including monitoring, at Production Area No. 2.

Within 120 days of receipt of this letter closure of the wellfield shall be accomplished in accordance with the approved plugging and abandonment plans for this Production Area. Any modifications to the plugging and abandonment procedure must be approved in writing by the Commission.

Please notify the Commission prior to commencing plugging activities to provide the opportunity for TWC personnel to be present. If you have any questions please contact Dale P. Kohler of the In Situ Uranium Mining Unit at (512) 463-8278.

Sincerely,


Harry D. Pruett

Director, Water Rights & Uses Division

DK:jt

cc: TWC Dist 11 Office - Weslaco
Mr. David Lacker - Texas Department of Health
Bureau of Radiation Control

TEXAS WATER COMMISSION

Paul Hopkins, Chairman
Ralph Roming, Commissioner
John O. Houchins, Commissioner



Larry R. Soward, Executive Director
Mary Ann Hefner, Chief Clerk
James K. Rourke, Jr., General Counsel

October 31, 1986

Mr. Mark S. Pelizza
Environmental Manager
Uranium Resources, Inc.
Suite 735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

FIL

Ben
Corr
TWC 7UR1

Re: Restoration determination, Uranium Resources, Inc., Benavides Mine Site, Permit No. UR02312-041, Duval County

Dear Mr. Pelizza:

The Texas Water Commission has received the three consecutive sampling sets as required by 31 TAC Section 331.107. A review of the restoration data indicates that Production Area No. 4 at the Benavides Mine Site has been restored in accordance with the specifications contained in permit number UR02312-041 and as required by 31 TAC Section 331.107. You are hereby authorized to cease any restoration activities including monitoring at this production area.

Within 120 days of receipt of this letter, closure of the wellfield shall be accomplished in accordance with the approved plugging and abandonment plans submitted as part of the permit application. Any modification to plugging and abandonment plans must be approved in writing by the Commission. Please notify the Commission prior to conducting plugging activities.

If you have any questions, please call Mr. Dale Kohler of the Commission's Ground Water Conservation Section at (512) 463-8278.

Sincerely,

A handwritten signature in cursive script, reading "Larry R. Soward".

Larry R. Soward
Executive Director

cc: TWC District 11, Weslaco
Mr. David Locker, Chief, Bureau of Radiation Control,
Texas Department of Health

TEXAS DEPARTMENT OF HEALTH

AUSTIN

TEXAS

INTER-OFFICE

ATTACHMENT

THRU: David K. Lacker, Chief
Bureau of Radiation Control

THRU: *W.B.* Edgar D. Bailey, C.H.P., P.E., Director
Division of Licensing, Registration,
and Standards

FROM: Joseph F. Thiel, Director
Division of Environmental Programs TO: License File #8-2704

SUBJECT: Recommended Radiological Restoration Values for Uranium Resources Inc.'s
(URI) Benavides and Longoria Projects

Environmental Programs staff have reviewed the request from the TWC to specify radiological parameters to be included in amended restoration tables for URI's Benavides (PA No. 1) and Longoria (PA Nos. 1 and 2) projects. We make the following recommendations:

Uranium: 2mg/l.

Although the recommended value is above baseline average values for all three production areas, it is equal to or less than many uranium drinking water standards. Moreover, the average quality of the production zone water is considered only marginally suitable for drinking purposes (average TDS content ranges from about 1100 to 1900 mg/l).

Radium 226: Benavides No. 1, 83 pCi/l; Longoria No. 1, 97 pCi/l;
Longoria No. 2, 37 pCi/l.

The recommended Ra-226 values are baseline levels.

Attachment

SDE/cal

cc: Board/JFT/SDE/CDR/Inspector's File (#8-2704)

SDE
5/4

SIGNED

Joseph F. Thiel

Attachment

DATE

May 4, 1987

C-9

TEXAS DEPARTMENT OF HEALTH

AUSTIN

TEXAS

INTER-OFFICE

THRU: David K. Lacker, Chief
Bureau of Radiation Control

THRU: Edgar D. Bailey, C.H.P., P.E., Director
Division of Licensing, Registration,
and Standards

FROM Joseph F. Thiel, Director
Division of Environmental Programs TO License File #8-2704

SUBJECT Modification to URI Longoria Restoration Table for Uranium to 3.0 mg/l

Division of Environmental Programs staff have reviewed the letter dated 5/12/87 from the Texas Water Commission (TWC), enclosing a request from URI for increasing the uranium value in the restoration table for the Longoria production area No. 1 aquifer to 3.0 mg/l. The earlier uranium value was 2.0 mg/l (see memo dated 5/4/87), which itself was a revision from the baseline value of 0.047 mg/l.

The new uranium value requested is more realistic in terms of achievability in comparison with TWC approved levels for other restoration parameters. No federal drinking water limits exist for uranium. Considering baseline water quality and pre-mining uses of water at the Longoria site, we feel that raising the uranium value as requested will not render the aquifer unsuitable for any purpose for which it was reasonably suited prior to mining.

Any questions should be referred to Stephen D. Etter.

CDR/cal

SDE

cc: Board/CDR/SDE/JFT/Inspector's File (#8-2704)

5/29

SIGNED

Joseph F. Thiel

DATE May 29, 1987

Attachment
C-10

FORM NO. AG-2

TEXAS DEPARTMENT OF HEALTH

AUSTIN

TEXAS

INTER-OFFICE

THRU: David K. Lackner, Chief
Bureau of Radiation Control

Edgar D. Bailey, P.E., C.H.P., Director
Division of Licensing, Registration,
and Standards

FROM Joseph F. Thiel, Director
Division of Environmental Programs

TO Warren D. Snell *WDS 3/23/86*

SUBJECT Radiological Parameters for Amended Restoration Table: Uranium Resources, Inc.,
Benavides Mine (Lic. # 8-2704)

Environmental Programs staff have reviewed the request from the Texas Water Commission to set radiological parameters for an amended restoration table for PAA Nos. 1 and 4 at Uranium Resources, Inc.'s (URI) Benavides in situ mine. The company requests limits of 83 pCi/l and 4 mg/l for RA-226 and uranium respectively. Staff concurs with 83 pCi/l for radium but recommends 2 mg/l for uranium.

We don't entirely understand the company's reasons for splitting old production area 1 into two parts, especially since no further production is contemplated. There are certainly some questions on the validity of applying the original baseline values to both new production areas. If the sole reason is to enable URI to claim they have indeed restored a wellfield, then we see little merit in it. However, we have no objection as long as the TWC concurs.

The radium value requested is the baseline value and we have no objection to using it.

The 4 mg/l requested for uranium, however, is much higher than baseline (.083 mg/l). Overall the water quality in the production aquifer is quite good. The baseline TDS content of 1211 mg/l indicates quality comparable to drinking water sources in other areas of the state. Similar requests for departures from baseline to 2 mg/l have been made by other in situ operators for production aquifers with much worse water quality. We have granted those requests because 2 mg/l has been cited as a common drinking water standard and because companies appear to have had no problems in achieving that level. We feel 2 mg/l is appropriate as well in this instance. If 2 mg/l uranium is not acceptable to URI, then we would request a report from the company specifying the number of pore volumes already pumped, the current average uranium level, and an explanation as to why a level of 2 mg/l could not be achieved.

SDE:lk

cc:Board, SDE, TWD, JFT, Lic. No. 8-2704, Inspectors file

SIGNED

DATE

Joseph F. Thiel
3/25/86

Attachment

C-11

Prod. Area C



TEXAS WATER COMMISSION
Stephen F. Austin State Office Building
Austin, Texas

PRODUCTION AREA AUTHORIZATION
Mine: Benavides
Production Area: UR02312-021

This production area
authorization supersedes and
replaces PAA UR02312-021 approved
April 26, 1982.

AUTHORIZATION to conduct underground
injection under provisions of
Permit No. UR0 UR02312

I. Name of Permittee:

- A. Name URI, Inc.
- B. Address 12377 Merit Drive
 Suite 750, LB14
 Dallas, Texas 75251

II. Name of Mine: Rosita

III. Standard Provisions

- A. Restoration Table
- B. Control Parameter Upper Limits Table
- C. Designated Monitor Well Table
- D. Permit Area Map
- E. Mining and Restoration Schedule
- F. Plan View of Mine Area
- G. Baseline Water Quality Table

CONTINUED on Pages 2 through 9.

The permittee is authorized to conduct injection activity in accordance with limitations, requirements, and other conditions set forth herein. This Authorization is granted subject to the provisions of Permit No. UR02312. This Authorization is valid until amended or revoked by the Commission.

APPROVED, ISSUED, AND EFFECTIVE this 28th day of June 1990

ATTEST:

Blanca A. Varguez

For the Commission

ATTACHMENT A
RESTORATION TABLE

<u>Parameter</u>	<u>Unit</u>	<u>Concentration</u>
Calcium	mg/l	100
Magnesium	mg/l	13
Sodium	mg/l	559
Potassium	mg/l	19.9
Carbonate	mg/l	0.1
Bicarbonate	mg/l	325
Sulfate	mg/l	300
Chloride	mg/l	814
Fluoride	mg/l	.43
Nitrate-N	mg/l	1.3
Silica	mg/l	20.4
pH	Std. Unit	8.1
TDS	mg/l	2100
Conductivity	umhos	2982
Alkalinity	Std. Unit	149
Arsenic	mg/l	.008
Cadmium	mg/l	.01
Iron	mg/l	1.2
Lead	mg/l	.05
Manganese	mg/l	.41
Mercury	mg/l	.001
Selenium	mg/l	.01
Ammonia	mg/l	.03
Uranium	mg/l	2.0
Molybdenum	mg/l	0.1

Attachment B

CONTROL PARAMETER UPPER LIMITS TABLE

Wells 690 through 699

<u>Control Parameter</u>	<u>Production Zone</u>	<u>First Overlying Non-Production Zone</u>	<u>Second Overlying Non-Production Zone</u>
Conductivity (μ mhos)	4,338	4,588	3,775
Chloride (mg/l)	1,088	1,254	1,013
Uranium (mg/l)	5.07	5.009	5.006

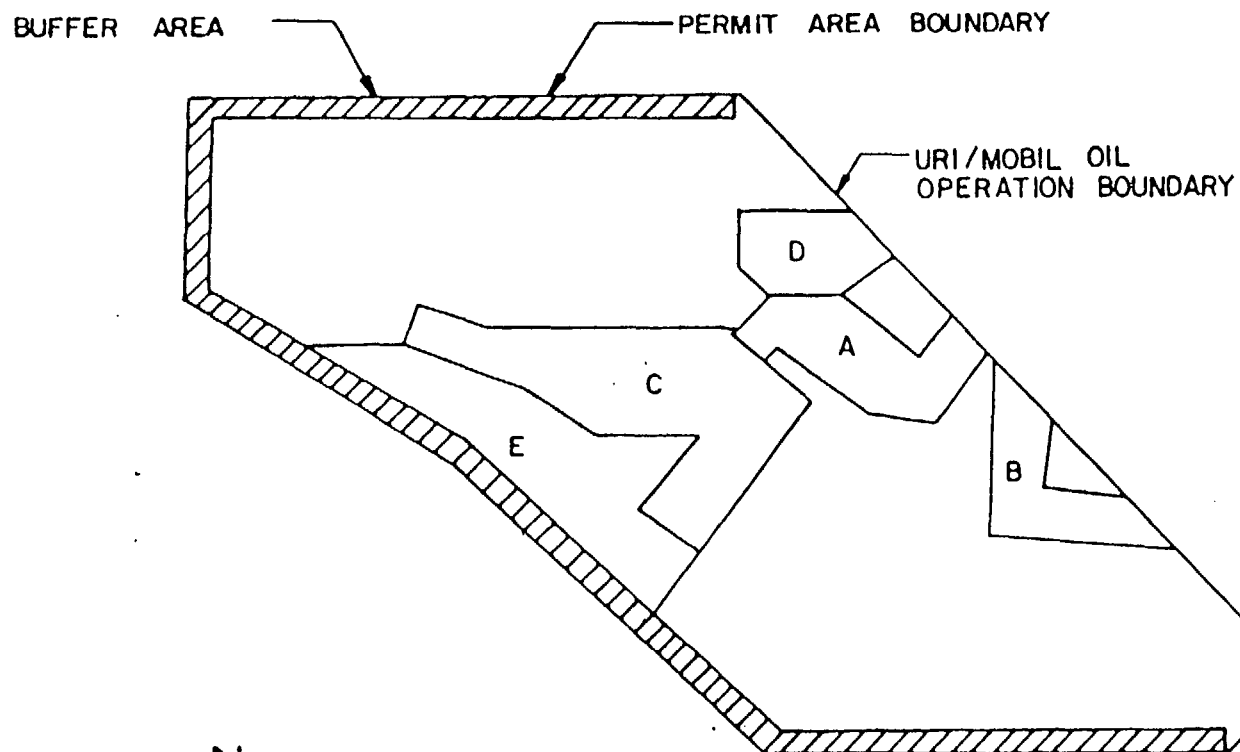
Wells 841 through 844, and 62

Conductivity (μ mhos)	4,919	4,588	3,775
Chloride (mg/l)	1,331	1,254	1,083
Uranium (mg/l)	5.87	5.009	5.006

Attachment C

DESIGNATED MONITOR WELL TABLE

Production Zone	First Overlying Non-Production Zone	Second Overlying Non-Production Zone
690	681	676
691	682	677
692	683	678
693	684	680
694	685	847
695	687	
698	846	
699		
62		
841		
842		
843		
844		



MINE AREA	ACREAGE
A	9.17
B	7.06
C	22.22
D	8.45
E	22.95
<u>TOTAL</u>	<u>69.86</u>



AVERAGE DEPTH - PRODUCTION ZONE: 230'
 AVERAGE ELEVATION - PRODUCTION ZONE: 460' msl

URANIUM RESOURCES INC.

BENAVIDES PROJECT
 MINE PLAN

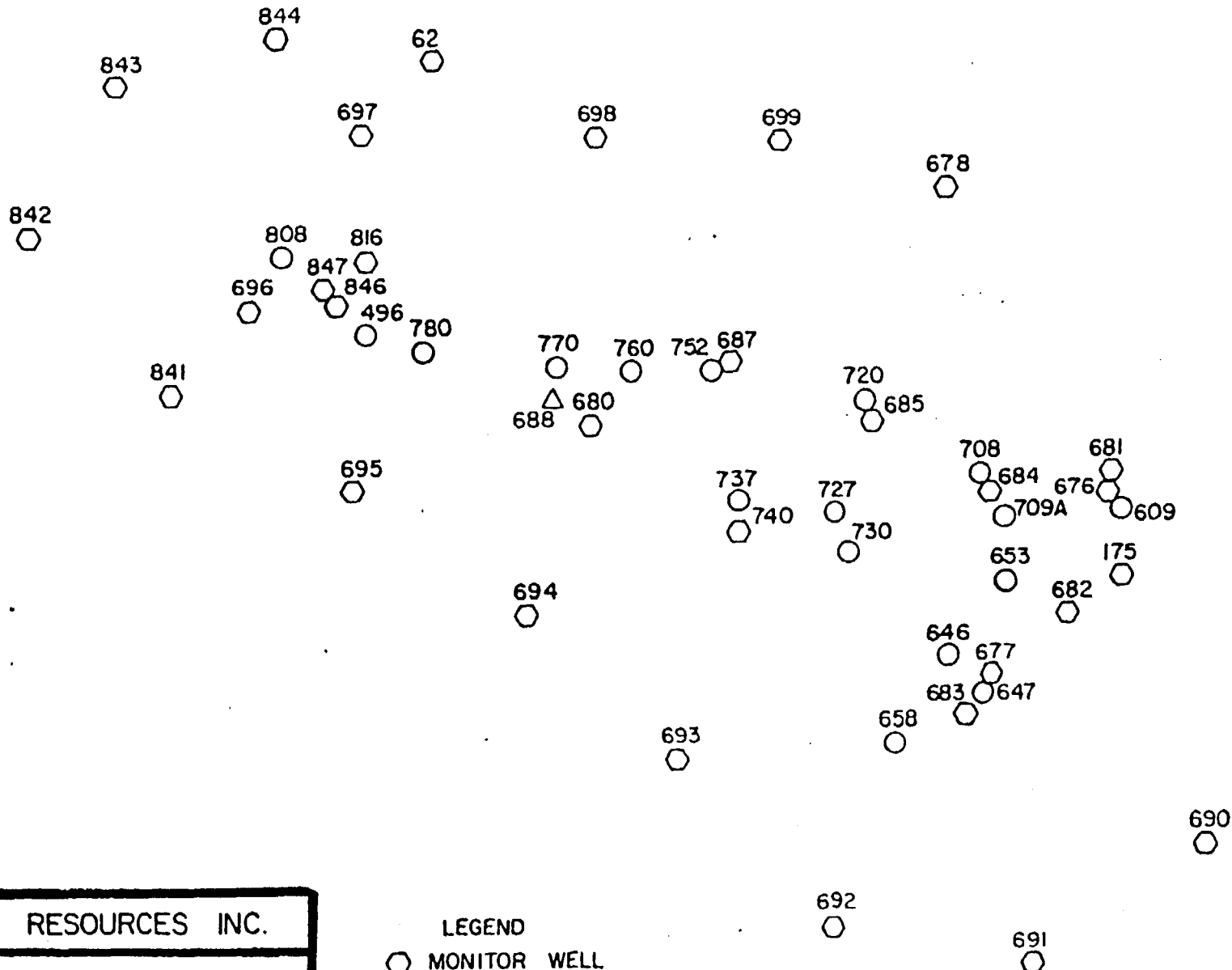
CONFIGURATION OF MINE AREAS

SCALE: 1" = 1000'

Attachment E

MINING AND RESTORATION SCHEDULE

Mine Area	<u>Production</u>		<u>Restoration</u>	
	Begin	Complete	Begin	Complete
A	March 1980	December 1981	January 1982	June 1983
B	March 1980	December 1981	January 1982	June 1983
C	May 1981	June 1983	July 1983	November 1984
D	March 1982	February 1984	March 1984	August 1985
E	January 1983	December 1984	January 1985	January 1987



GROUND WATER ANALYSIS REPORT SUMMARY And
BASELINE WATER QUALITY – In Situ Mining

Company: Uranium Resource, Inc
Mine Name: Benavides
Mine Area: C (revised)
Date Summarized: 12/28/81

"E" Sand

	PARAMETER	UNIT		NON PRODUCTION ZONE**			PRODUCTION ZONE						WELL I.D. BY AREA*		
							MINE AREA**			PRODUCTION AREA			NON PROD. ZONE	PROD. ZONE	
				Low	Average	High	Low	Average	High	Low	Average	High		Mine	Product.
1	Calcium	mg/l		22.0	50.1	82.6							676		
2	Magnesium	mg/l		7.9	20.6	32.0							677		
3	Sodium	mg/l		393	466	520							678		
4	Potassium	mg/l		18.0	19.3	24.0							680		
5	Carbonate	mg/l		0	1	5							847		
6	Bicarbonate	mg/l		31	155	212									
7	Sulfate	mg/l		84	146.8	184									
8	Chloride	mg/l		508	688	866									
9	Fluoride	mg/l		.31	.36	.43									
10	Nitrate - N	mg/l		<.01	.76	5.2									
11	Silica	mg/l		10.0	17.8	22.0									
12	pH	Std. unit		7.89	8.27	8.99									
13	TDS	mg/l		1240	1517	1730									
14	Conductivity	µmhos		2110	2728	3020									
15	Alkalinity	Std. unit		33	129	174									
16	Arsenic	mg/l		<.001	.002	.012									
17	Cadmium	mg/l		<.001	.001	.001									
18	Iron	mg/l		<.02	.19	.51									
19	Lead	mg/l		.007	.010	.015									
20	Manganese	mg/l		.005	.015	.037									
21	Mercury	mg/l		<.001	.001	.001									
22	Selenium	mg/l		<.001	.002	.004									
23	Ammonia	mg/l		<.01	.02	.049									
24	Uranium	mg/l		<.001	.003	.006									
25	Molybdenum	mg/l		<.01	.01	.1									
26	Radium 226	mg/l		.6	2.37	4.9									

* LIST THE IDENTIFICATION NUMBERS OF WELLS USED TO OBTAIN THE LOW, AVERAGE AND HIGH VALUES.

**MONITOR WELLS

GROUND WATER ANALYSIS REPORT SUMMARY And
BASELINE WATER QUALITY - In Situ Mining

Company: Uranium Resource Inc.
Mine Name: Benavides
Mine Area: C (revised)
Date Summarized: 12/28/81

"D" Sand

	PARAMETER	UNIT		NON PRODUCTION ZONE**			PRODUCTION ZONE						WELL I.D. BY AREA*		
							MINE AREA**			PRODUCTION AREA			NON PROD. ZONE	PROD. ZONE	
				Low	Average	High	Low	Average	High	Low	Average	High		Mine	Product.
1	Calcium	mg/l		42.0	66.2	91.0	13.0	35.0	70.1	11.0	30.3	53.0	681	690	609
2	Magnesium	mg/l		13.0	30.0	49.0	3.7	13.1	22.8	1.0	9.0	23.5	682	691	646
3	Sodium	mg/l		522	593	632	441	559	693	437	507	632	683	692	647
4	Potassium	mg/l		18.0	25.0	32.0	11.0	19.90	35.4	14.3	19.8	29.0	684	693	653
5	Carbonate	mg/l		0	0	0	0	0	0	0	1	1	685	694	658
6	Bicarbonate	mg/l		165	189	222	113	181	218	96	181	306	687	695	708
7	Sulfate	mg/l		113	161	187	41	85	220	42	85	286	846	698	709A
8	Chloride	mg/l		768	905	1003	570	814	1065	590	732	998		699	720
9	Fluoride	mg/l		.28	.30	.35	.33	.43	.50	.11	.37	.46		62	727
10	Nitrate - N	mg/l		1.00	4.34	5.50	<.01	1.30	3.60	<.01	.73	3.20		841	730
11	Silica	mg/l		10.0	21.0	34.0	11.0	20.4	27.2	6.0	19.0	36.0		842	737
12	pH	Std. unit		7.72	8.04	8.34	7.84	8.10	8.41	7.68	8.07	8.48		843	740
13	TDS	mg/l		1670	1962	2150	1250	1663	2174	1240	1521	1990		844	752
14	Conductivity	µmhos		2890	3372	3670	2256	2982	3935	2210	2689	3470			760
15	Alkalinity	Std. unit		135	155	182	92	149	179	105	149	251			770
16	Arsenic	mg/l		.009	.034	.068	.001	.008	.026	<.001	.008	.038			780
17	Cadmium	mg/l		<.01	.001	.001	<.01	.01	.01	<.0001	.0001	.0013			175
18	Iron	mg/l		<.02	1.18	5.30	<.02	.08	.20	<.02	1.2	4.8			496
19	Lead	mg/l		<.01	.025	.072	<.02	.017	.05	<.01	.05	.290			808
20	Manganese	mg/l		<.01	.141	.470	<.02	.012	.06	<.01	.41	4.30			816
21	Mercury	mg/l		.0001	.0002	.0003	<.001	.001	.001	<.0001	.0001	.0003			696
22	Selenium	mg/l		.003	.005	.008	<.001	.001	.025	<.001	.01	.042			
23	Ammonia	mg/l		<.01	.03	.089	<.02	.03	.158	<.01	.02	.144			
24	Uranium	mg/l		.003	.006	.009	<.001	.078	.87	<.01	.05	.36			
25	Molybdenum	mg/l		<.01	.01	.01	<0.1	0.1	0.1	<.01	.01	.02			
26	Radium 226	mg/l		1.97	3.62	6.0	1.5	13.38	95.1	6.5	15.17	132			

* LIST THE IDENTIFICATION NUMBERS OF WELLS USED TO OBTAIN THE LOW, AVERAGE AND HIGH VALUES.

**MONITOR WELLS



TEXAS WATER COMMISSION
Stephen F. Austin State Office Building
Austin, Texas

PRODUCTION AREA AUTHORIZATION
Mine: Benavides
Production Area: UR02312-011

This authorization supersedes
and replaces Production Area
Authorization No. UR02312-011
issued May 6, 1986

AUTHORIZATION to conduct underground
injection under provisions of
Permit No. UR02312

I. Name of Permittee:

- A. Name Uranium Resources, Inc.
- B. Address Suite 735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

II. Name of Mine: Benavides

III. Standard Provisions

- A. Restoration Table
- B. Control Parameter Upper Limits Table
- C. Designated Monitor Well Table
- D. Permit Area Map
- E. Mining and Restoration Schedule
- F. Plan View of Mine Area
- G. Baseline Water Quality Table

CONTINUED on Pages 2 through 10.

The permittee is authorized to conduct injection activity in accordance with limitations, requirements, and other conditions set forth herein. This Authorization is granted subject to the provisions of Permit No. UR02312. This Authorization is valid until amended or revoked by the Commission.

APPROVED, ISSUED AND EFFECTIVE this 11th day of August, 19 87.

ATTEST:

May Ann Hefner

Paul Hopkins
For the Commission

Production Area Authorization
Permit No. UR02312-011
Uranium Resources, Inc.
Benavides Mine

Page 2

IV. Special Provisions

- A. This authorization regulates activities only in the area presently known as URI Wellfield II (shown on the Mine Area Map as PAA No. 1).
- B. The monitor wells for this production area no longer function in conjunction with the monitor wells of Mobil's production area III contiguous to this area on the northeast side.

ATTACHMENT A
RESTORATION TABLE

<u>Parameter</u>	<u>Unit</u>	<u>Concentration</u>
Calcium	mg/l	75
Magnesium	mg/l	6.2
Sodium	mg/l	402
Potassium	mg/l	14
Carbonate	mg/l	2
Bicarbonate	mg/l	350
Sulfate	mg/l	300
Chloride	mg/l	517
Fluoride	mg/l	.48
Nitrate-N	mg/l	2.87
Silica	mg/l	26
pH	Std. Unit	6.5-8.5
TDS	mg/l	1211
Arsenic	mg/l	.004
Cadmium	mg/l	.0003
Iron	mg/l	2.45
Lead	mg/l	.023
Manganese	mg/l	.365
Mercury	mg/l	.0003
Selenium	mg/l	.004
Ammonia	mg/l	.03
Molybdenum	mg/l	.01
Radium 226	pCi/l	83
Uranium	mg/l	2

ATTACHMENT B

CONTROL PARAMETER UPPER LIMITS TABLE

<u>CONTROL PARAMETER</u>	<u>PRODUCTION ZONE</u>
Conductivity (umhos)	3,750.0
Uranium (mg/l)	5.314
Chloride (mg/l)	986.0

<u>CONTROL PARAMETER</u>	<u>NON PRODUCTION ZONE</u>	
	<u>1st Overlying</u>	<u>2nd Overlying</u>
Conductivity (umhos)	4,150	2,050
Uranium (mg/l)	5.005	5.005
Chloride (mg/l)	1,063	370

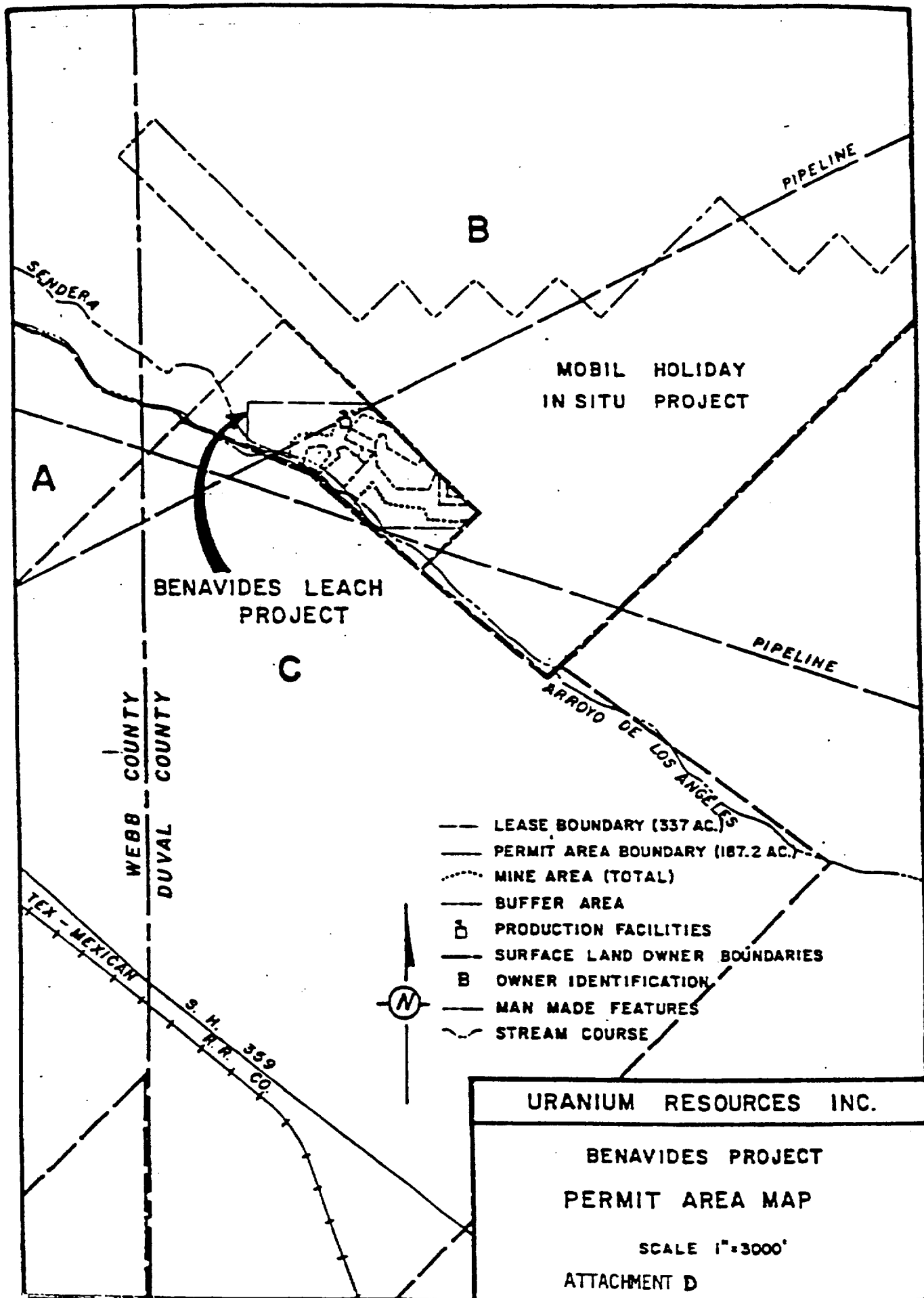
Production Area Authorization
Permit No. UR02312-011
Uranium Resources, Inc.
Benavides Mine

Page 5

ATTACHMENT C

DESIGNATED MONITOR WELL TABLE

<u>Production Zone</u>	<u>Non-Production Zone</u>
	<u>First Overlying</u>
181	51
32	52
47	
163	
164	<u>Second Overlying</u>
699	184

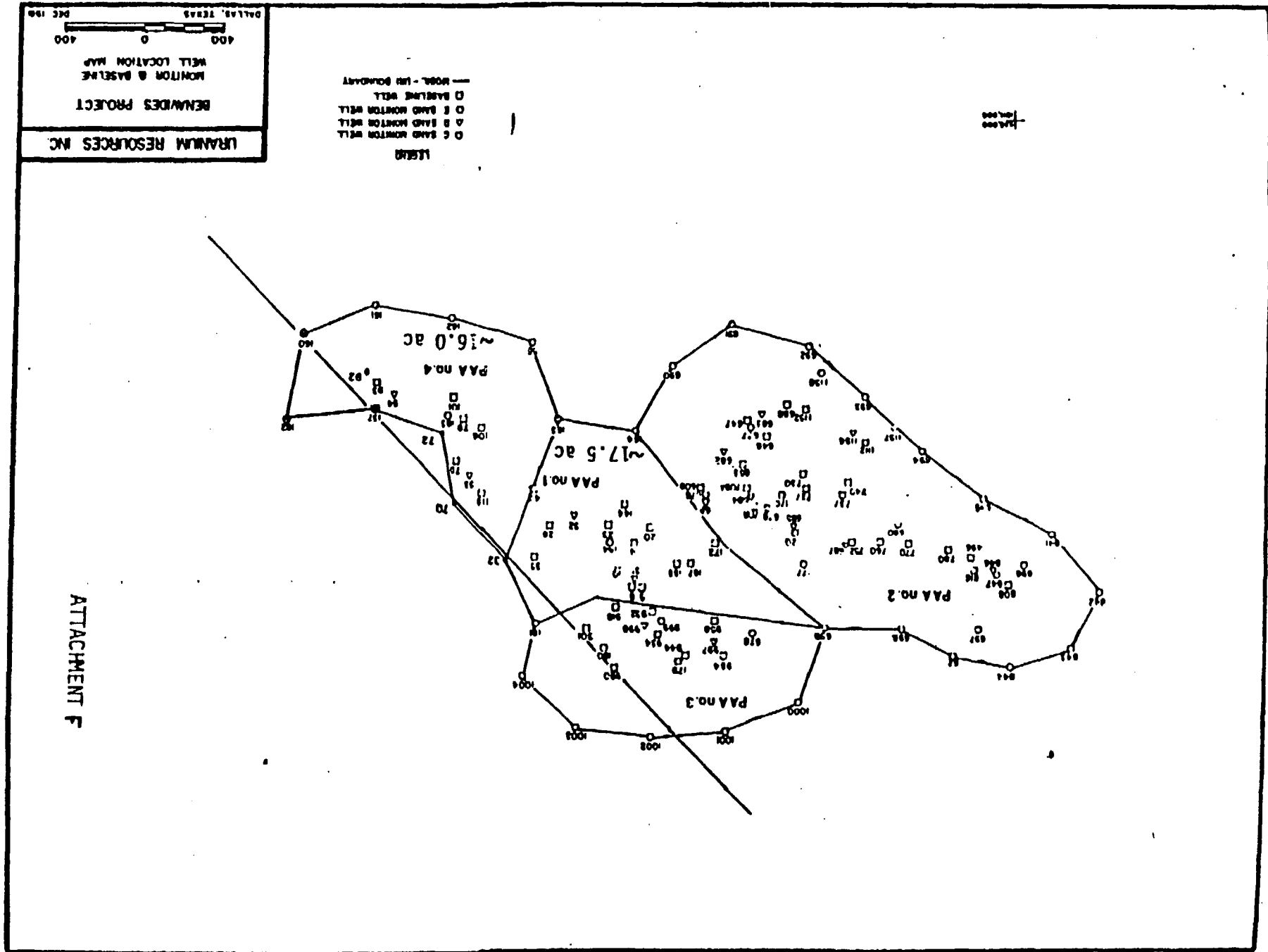


Attachment E

Mining and Restoration Table

All production areas are currently undergoing restoration.

<u>Area</u>	<u>Restoration Schedule</u>
PAA #1	May, 1985 - August, 1987
PAA #2	July, 1986 - July, 1988
PAA #3	Nov., 1985 - Oct., 1987
PAA #4	Plugged



GROUND WATER ANALYSIS REPORT SUMMARY And
BASELINE WATER QUALITY TABLE - In Situ Uranium Mining

TABLE 4

Company: URANIUM RESOURCES INC.
Mine Name: BENAVIDES
Mine Area: A & B Production Area No. 1
Date Summarized: 1 NOVEMBER 79

	PARAMETER	UNIT	NON PRODUCTION ZONE**			PRODUCTION ZONE						WELL I.D. BY AREA*		
						MINE AREA **			PRODUCTION AREA			NON PROD. ZONE	PROD. ZONE	
			Low	Average	High	Low	Average	High	Low	Average	High		Mine	Product.
1	Calcium	mg/l	15	46	58	13	22	42	9.7	20	51	U-51	U-55	U-5
2	Magnesium	mg/l	6.1	21.8	28	2.6	6.2	14	.88	4.8	9.1	U-52	U-160	U-6
3	Sodium	mg/l	533	556	568	311	402	527	305	366	454	U-53	U-161	U-10
4	Potassium	mg/l	18	19	20	10	14	19	8.7	12	20	U-54	U-162	U-14
5	Carbonate	mg/l	0	3	6	0	2	7	0	2	7		U-163	U-20
6	Bicarbonate	mg/l	128	166	187	165	215	283	190	239	273		U-164	U-23
7	Sulfate	mg/l	123	132	143	40	61	87	41	69	95		U-175	U-28
8	Chloride	mg/l	746	812	850	296	517	789	288	431	670		U-176	U-35
9	Fluoride	mg/l	0.25	.30	0.36	0.30	0.48	0.89	.38	.45	.59		U-177	U-47
10	Nitrate - N	mg/l	6.9	7.6	7.9	0.01	2.87	11	.02	.59	4.2		U-178	U-75
11	Silica	mg/l	11	14	16	10	26	58	15	26	111		U-179	U-79
12													U-180	U-93
13	pH	Std. unit	8.24	8.35	8.5	7.98	8.37	8.60	7.98	8.33	8.63		U-181	U-101
14	TDS	mg/l	1590	1752	1850	938	1211	1620	905	1103	1430		U-182	U-106
15	Conductivity	µmhos	2950	3185	3320	1590	2161	3000	1540	1924	2580			U-113
16	Alkalinity	Std. Unit	105	141	153	125	180	240	156	199	224			U-137
17														U-144
18	Arsenic	mg/l	0.004	0.008	0.012	<.001	.004	.016	<.001	.003	.014			U-155
19	Barium	mg/l	0.06	0.10	0.13	0.16	0.28	0.58	.05	.23	.44			U-167
20	Boron	mg/l	.86	.97	1.04	0.65	0.89	1.12	.71	.91	1.2			U-172
21	Cadmium	mg/l	<.0001	<.0001	<.0001	<.0001	.0003	.0008	<.0001	.0001	.0003			
22	Chromium	mg/l	.001	.002	.002	.002	.004	.008	.001	.003	.008			
23	Copper	mg/l	.003	.006	.010	.004	.012	.033	.003	.011	.027			
24	Iron	mg/l	<.01	.11	.29	0.04	2.45	9.4	.06	1.55	5.7			
25	Lead	mg/l	<.001	.027	.074	<.001	.016	.040	<.001	.023	.16			
26	Manganese	mg/l	<.001	.009	.026	.005	.365	1.14	.006	.238	.903			
27	Mercury	mg/l	<.0001	.0001	.0002	<.0001	.0002	.0006	<.0001	.0003	.0008			
28	Nickel	mg/l	<.01	<.01	<.01	<.01	0.01	0.02	<.01	.01	.02			
29	Selenium	mg/l	<.001	<.001	<.001	<.001	.004	.030	<.001	.003	.017			
30	Silver	mg/l	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01			
31	Zinc	mg/l	.001	.013	.036	.003	.020	.051	.004	.020	.068			
32														
33	Ammonia	mg/l	.01	.01	.01	<.01	0.02	0.09	<.01	.03	.17			
34	Uranium	mg/l	.003	.004	.005	.001	.015	.049	.001	.083	.314			
35	Molybdenum	mg/l	<.01	<.01	<.01	<.01	.01	.01	<.01	.01	.02			
36	Vanadium	mg/l	.02	.03	.04	<.01	.01	.03	.01	.01	.03			
37	Radium 226	pCi/l	1.5	3.1	4.6	1.5	6.3	21	1.5	83	546			

EX-100 TREATMENT OF WATER RESOURCES

GROUND WATER ANALYSIS REPORT SUMMARY And
BASELINE WATER QUALITY TABLE - In Situ Uranium Mining

TABLE 5

"E" Sand

Company: URANIUM RESOURCES INC.

Mine Name: BENAVIDES

Mine Area: A & B Production Area No. 1

Date Summarized: 1 NOVEMBER 79

	PARAMETER	UNIT	NON PRODUCTION ZONE **			PRODUCTION ZONE						WELL I.D. BY AREA *	
			Low	Average	High	MINE AREA **			PRODUCTION AREA			NON PROD. ZONE	PHOD. ZONE
						Low	Average	High	Low	Average	High		
1	Calcium	mg/l	15	18	20							U-183	
2	Magnesium	mg/l	4.6	5.2	5.7							U-184	
3	Sodium	mg/l	306	314	322								
4	Potassium	mg/l	10	12	13								
5	Carbonate	mg/l	10	11	12								
6	Bicarbonate	mg/l	266	288	309								
7	Sulfate	mg/l	113	119	124								
8	Chloride	mg/l	238	267	296								
9	Fluoride	mg/l	.83	.93	1.03								
10	Nitrate - N	mg/l	.04	.06	.07								
11	Silica	mg/l	20	25	29								
12													
13	pH	Std. unit	8.62	8.66	8.69								
14	TDS	mg/l	932	961	989								
15	Conductivity	µmhos	1520	1580	1640								
16	Alkalinity	Std. Unit	234	254	273								
17													
18	Arsenic	mg/l	<.001	.001	.001								
19	Barium	mg/l	.07	.09	.10								
20	Boron	mg/l	1.23	1.26	1.29								
21	Cadmium	mg/l	<.0001	.0001	.0001								
22	Chromium	mg/l	.003	.005	.006								
23	Copper	mg/l	.006	.007	.008								
24	Iron	mg/l	.16	.35	.53								
25	Lead	mg/l	<.001	<.001	<.001								
26	Manganese	mg/l	.012	.030	.047								
27	Mercury	mg/l	<.0001	<.0001	<.0001								
28	Nickel	mg/l	<.01	<.01	<.01								
29	Selenium	mg/l	<.001	<.001	<.001								
30	Silver	mg/l	<.01	<.01	<.01								
31	Zinc	mg/l	.005	.014	.022								
32													
33	Ammonia	mg/l	.05	.06	.06								
34	Uranium	mg/l	<.001	.003	.005								
35	Molybdenum	mg/l	.02	.03	.03								
36	Vanadium	mg/l	.01	.02	.02								
37	Radium 226	pCi/l	.2	.5	.8								

PRODUCTION AREA AUTHORIZATION

Mine: Benavides

PRODUCTION AREA: 02312- 031



TEXAS WATER COMMISSION
Stephen F. Austin State Office Building
Austin, Texas

AUTHORIZATION to Conduct Underground
Injection Under Provisions of
Permit No. 02312

- I. Permittee:
- A. Name Uranium Resources, Incorporated
Suite 735, Promenade Bank Tower
 - B. Address 1600 Promenade Center
Richardson, Texas 75080
- II. Name of Mine Benavides
- III. Standard Provisions
- A. Mine Plan Map
 - B. Mining and Restoration Schedule
 - C. Plan View of Mine Area D
 - D. Designated Monitor Well Table
 - E. Control Parameter Upper Limits Table
 - F. Restoration Table
 - G. Baseline Water Quality Table
- IV. Special Provisions
- Rule 156.27.02.003(b)(2) (demonstration of mechanical integrity by temperature or noise log) is waived in accordance with rule 156.27.02.007(b). Mechanical integrity for all injection wells shall be demonstrated by pressure testing according to rule 156.27.02.003(b)(1).

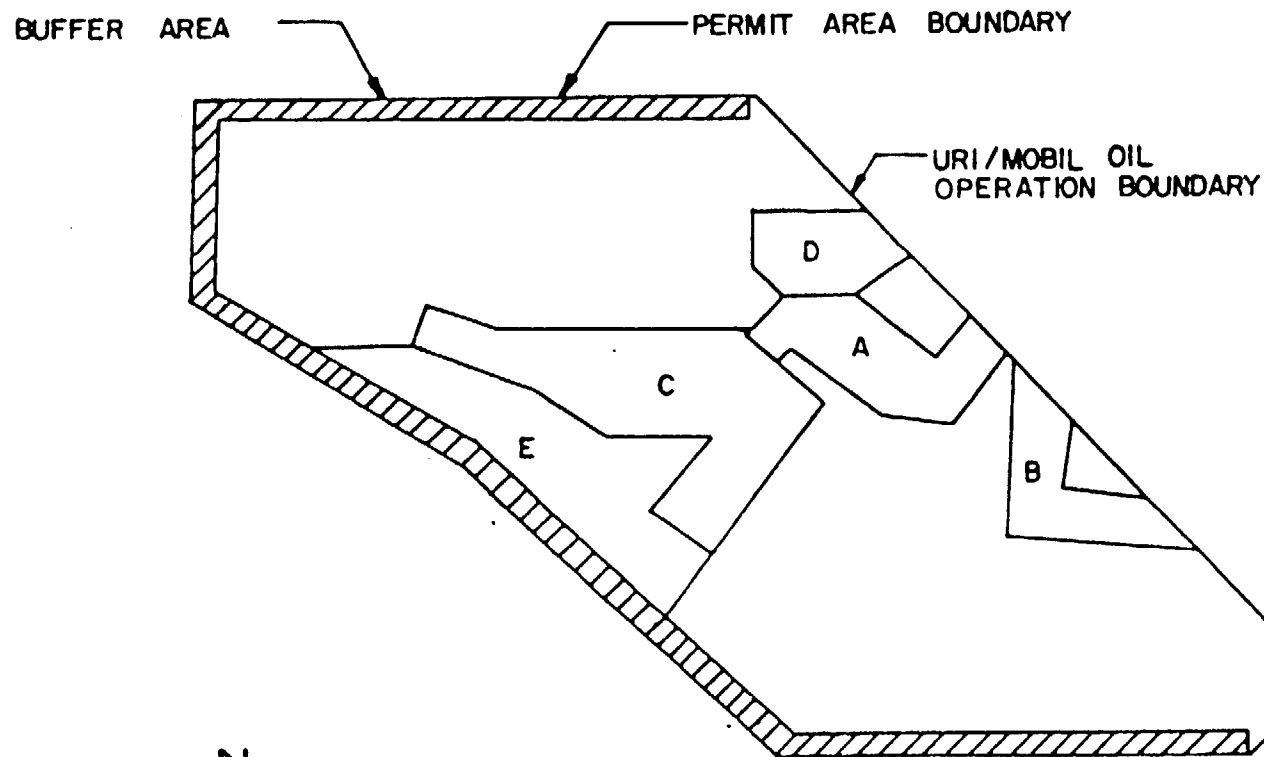
The permittee is authorized to conduct injection activity in accordance with limitations, requirements and other conditions set forth herein. This Authorization is granted subject to the provisions of Permit No. 02312. This Authorization is valid until amended or revoked by the Texas Water Commission.

APPROVED, ISSUED AND EFFECTIVE this 26th day of April, 1982.

ATTEST:

Mary Ann Steyer Lee O.M. Boggins
For The Commission Attachment
C-14

ATTACHMENT A
MINE PLAN MAP



MINE AREA	ACREAGE
A	9.17
B	7.06
C	22.22
D	8.45
E	22.95
<u>TOTAL</u>	<u>69.86</u>

AVERAGE DEPTH - PRODUCTION ZONE: 230'
AVERAGE ELEVATION - PRODUCTION ZONE: 460' msl

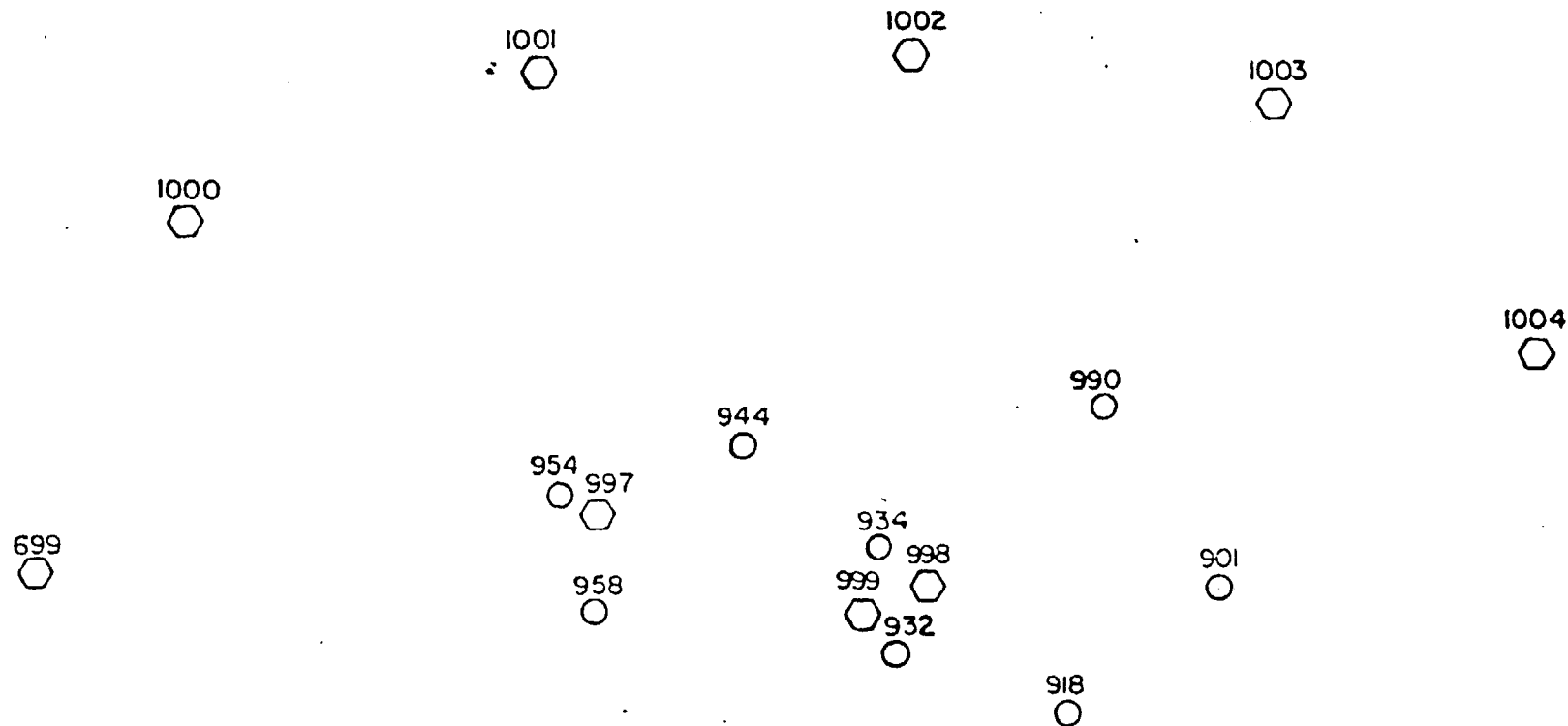
URANIUM RESOURCES INC.

BENAVIDES PROJECT
MINE PLAN
CONFIGURATION OF MINE AREAS

SCALE: 1" = 100'

ATTACHMENT B
MINING AND RESTORATION SCHEDULE

Mine Area	<u>Production</u>		<u>Restoration</u>	
	Begin	Complete	Begin	Complete
A	March 1980	December 1981	January 1982	June 1983
B	March 1980	December 1981	January 1982	June 1983
C	May 1981	June 1983	July 1983	November 1984
D	March 1982	February 1984	March 1984	August 1985
E	January 1983	December 1984	January 1985	January 1987



LEGEND
 ⬡ MONITOR WELL
 ○ BASELINE WELL

URANIUM RESOURCES INC.
 BENAVIDES PROJECT
 AREA D
 BASELINE AND MONITOR WELL LOCATIONS
 SCALE: 1"=200'
 DALLAS, TEXAS
 DEC 1981

ATTACHMENT D
DESIGNATED MONITOR WELL TABLE

Production Zone	First Overlying Non-Production Zone	Second Overlying Non-Production Zone
1000	997	999
1001	998	
1002		
1003		
1004		

ATTACHMENT E

CONTROL PARAMETER UPPER LIMITS TABLE

<u>Control Parameter</u>	<u>Production Zone</u>	<u>First Overlying Non-Production Zone</u>	<u>Second Overlying Non-Production Zone</u>
Conductivity (μ mhos)	4,096	3,870	2,141
Chloride (mg/l)	1,060	1,055	443
Uranium (mg/l)	5.3	5.08	5.01

ATTACHMENT F
RESTORATION TABLE

Parameter	Unit	Value
Calcium	mg/l	32
Magnesium	mg/l	9.4
Sodium	mg/l	475
Potassium	mg/l	13.6
Carbonate	mg/l	5
Bicarbonate	mg/l	218
Sulfate	mg/l	86
Chloride	mg/l	653
Fluoride	mg/l	.55
Nitrate-N	mg/l	2.25
Silica	mg/l	21
pH	Std. Unit	8.6
TDS	mg/l	1356
Conductivity	µmhos	2269
Alkalinity	Std. Unit	184
Arsenic	mg/l	.037
Cadmium	mg/l	.01
Iron	mg/l	.1
Lead	mg/l	.05
Manganese	mg/l	.01
Mercury	mg/l	.001
Selenium	mg/l	.025
Ammonia	mg/l	.05
Uranium	mg/l	.12
Molybdenum	mg/l	.1

GROUND WATER ANALYSIS REPORT SUMMARY And
BASELINE WATER QUALITY — In Situ Mining

ATTACHMENT G

BASELINE WATER QUALITY TABLE

Company: DIAMOND RESOURCES INC.
Mine Name: Benavides
Mine Area: D
Date Summarized: 12/28/81

"D" Sand

	PARAMETER	UNIT	NON PRODUCTION ZONE**			PRODUCTION ZONE						WELL I.D. BY AREA*		
						MINE AREA**			PRODUCTION AREA			NON PROD. ZONE	PROD. ZONE	
			Low	Average	High	Low	Average	High	Low	Average	High		Mine	Product
1	Calcium	mg/l	36.0	41.7	47.4	23.4	32.4	60.8	16.6	21.0	29.6	997	1000	901
2	Magnesium	mg/l	21.6	22.3	22.9	4.8	9.4	22.0	5.0	6.8	8.8	998	1001	918
3	Sodium	mg/l	520	546	572	441	475	545	384	434	533		1002	932
4	Potassium	mg/l	15.5	18.9	22.3	9.40	12.8	16.0	12.0	13.6	17.4		1003	934
5	Carbonate	mg/l	0	0	0	0	5	11	0	2	9		1004	944
6	Bicarbonate	mg/l	95	142	188	151	188.8	219	183	218	239			954
7	Sulfate	mg/l	121	142	163	60	85.6	123	49	70	79			958
8	Chloride	mg/l	790	823	844	573	653	848	477	559	757			990
9	Fluoride	mg/l	0.28	0.32	0.37	0.34	0.50	0.56	0.42	0.55	0.64			
10	Nitrate - N	mg/l	3.80	3.85	3.90	<0.10	2.25	3.5	<0.10	1.51	3.80			
11	Silica	mg/l	17.9	18.9	19.9	19.0	21.0	22.9	19.7	20.7	24.2			
12	pH	Std. unit	8.27	8.31	8.34	8.17	8.60	8.81	8.25	8.42	8.57			
13	TDS	mg/l	1610	1704	1798	1208	1356	1718	1076	1211	1498			
14	Conductivity	µmhos	2873	2985	3096	1297	2269	3277	1958	2193	2766			
15	Alkalinity	Std. unit	78	116	154	136	163	190	150	184	197			
16	Arsenic	mg/l	0.007	0.009	0.011	0.006	0.037	0.011	<0.001	0.003	0.008			
17	Cadmium	mg/l	<0.01	0.01	0.01	<0.01	0.01	0.01	<0.01	0.01	0.01			
18	Iron	mg/l	0.02	0.035	0.05	<0.02	0.10	0.49	<0.02	0.06	0.10			
19	Lead	mg/l	0.02	0.03	0.04	<0.02	0.02	0.02	<0.02	0.05	0.11			
20	Manganese	mg/l	<0.01	0.03	0.06	<0.01	0.01	0.01	<0.01	0.01	0.01			
21	Mercury	mg/l	<0.001	0.001	0.001	<0.001	0.001	0.001	<0.001	0.001	0.001			
22	Selenium	mg/l	<0.001	0.001	0.001	<0.001	0.007	0.031	<0.001	0.025	0.160			
23	Ammonia	mg/l	<0.02	0.14	0.26	<0.02	0.046	0.086	<0.02	0.05	0.137			
24	Uranium	mg/l	0.01	0.05	0.08	<0.01	0.042	0.08	<0.01	0.12	0.30			
25	Molybdenum	mg/l	<0.1	0.1	0.1	<0.1	0.1	0.1	<0.1	0.1	0.1			
26	Radium 226	mg/l	2.72	3.24	3.76	.83	4.27	7.42	4.1	173.1	433			

REVISED

FEB 18 1982

* LIST THE IDENTIFICATION NUMBERS OF WELLS USED TO OBTAIN THE LOW, AVERAGE AND HIGH VALUES.

**MONITOR WELLS

Prod. Areas A, B



TEXAS WATER COMMISSION
Stephen F. Austin State Office Building
Austin, Texas •

PRODUCTION AREA AUTHORIZATION
Mine: Benavides
Production Area: UR02312-041

AUTHORIZATION to Conduct Underground
Injection Under Provisions of
Permit No. UR02312

I. Name of Permittee:

- A. Name Uranium Resources, Inc.
- B. Address Suite 735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

II. Name of Mine: Benavides

III. Standard Provisions

- A. Mine Area Map
- B. Plan View of Mine Area
- C. Mining and Restoration Schedule
- D. Designated Monitor Well Table
- E. Baseline Water Quality Tables
- F. Restoration Table
- G. Control Parameter Upper Limits Table

CONTINUED on Pages 2 through 10.

The permittee is authorized to conduct injection activity in accordance with limitations, requirements, and other conditions set forth herein. This Authorization is granted subject to the provisions of Permit No. UR02312. This Authorization is valid until amended or revoked by the Texas Water Commission.

APPROVED, ISSUED AND EFFECTIVE this 6th day of May, 1986.

ATTEST:

Mary Ann Stegner

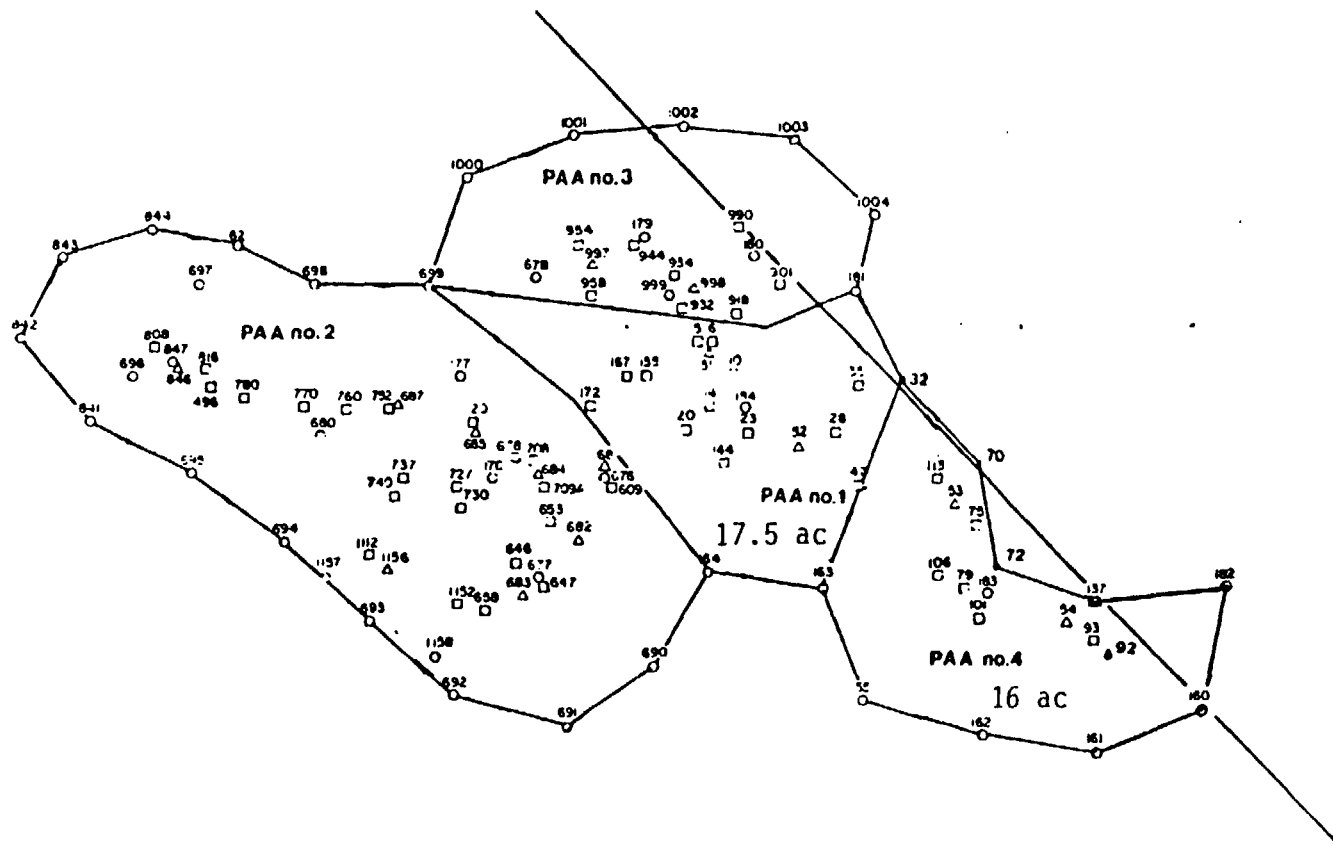
Paul Hopkins
For the Commission

Attachment
C-15

Uranium Resources, Incorporated
Benavides Mine Site

IV. Special Provisions

- A. This authorization regulates activities only in the area known as URI Wellfield III (shown on the Mine Area Map as PAA no. 4).
- B. The monitor wells for this production area no longer function in conjunction with the monitor wells of Mobil's production area III contiguous to this area on the northeast side.
- C. This production area authorization regulates URI's Wellfield III which was previously part of Production Area Authorization No. 1. The Baseline Water Quality Tables included as part of this Authorization (Attachment E) are the same as those in PAA No. 1. The Control Parameter Upper Limits Table (Attachment G) is modified slightly to reflect current water conditions. The Restoration Table (Attachment F) values have been amended from the ones in PAA No. 1 to levels consistent with baseline and in accordance with approved water quality standards.



ATTACHMENT A

LEGEND

- C SAND MONITOR WELL
- △ D SAND MONITOR WELL
- E SAND MONITOR WELL
- BASELINE WELL
- MOBIL - MRI BOUNDARY

URANIUM RESOURCES INC

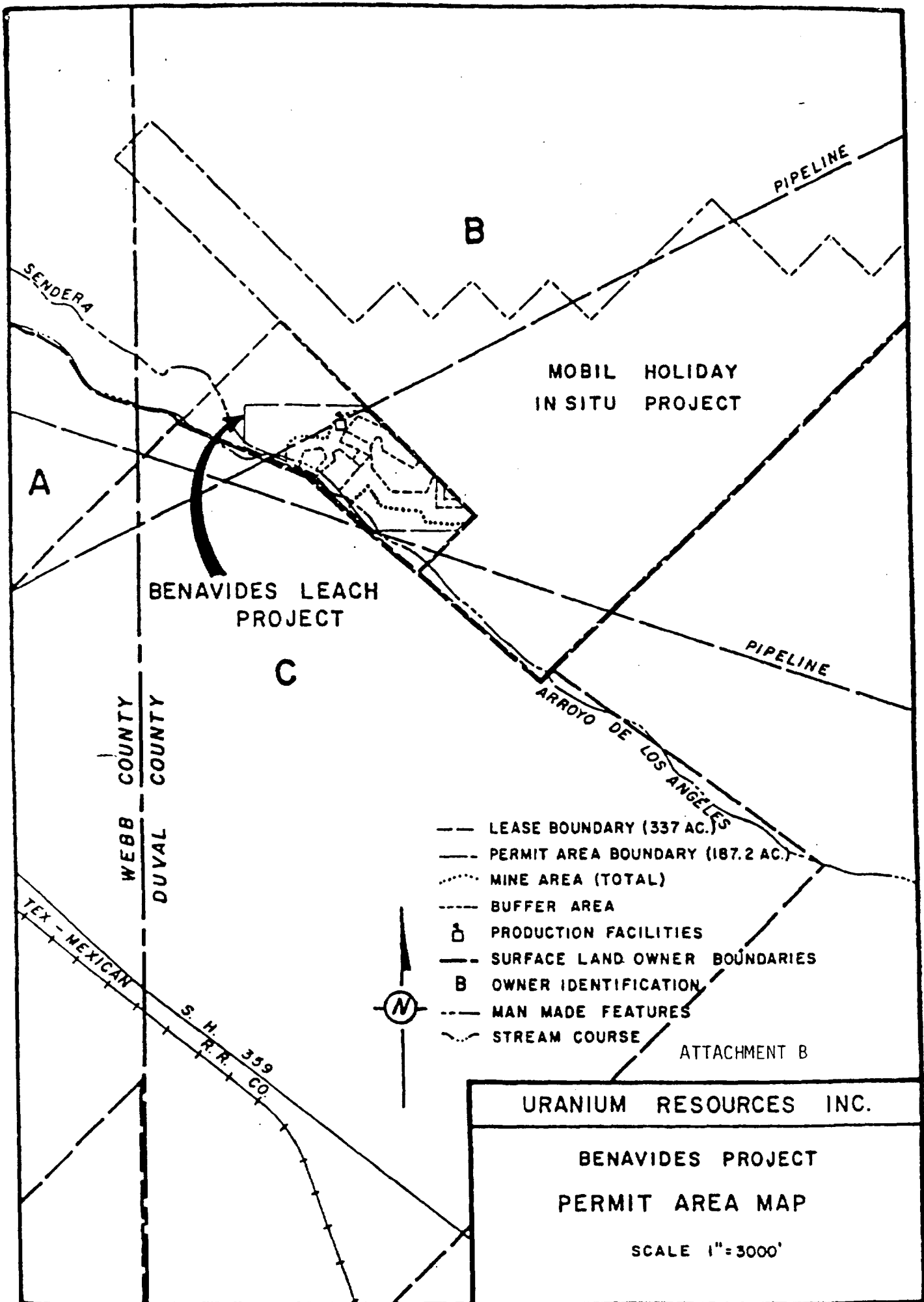
BENAVIDES PROJECT

MONITOR B BASELINE
WELL LOCATION MAP

400 0 400

DALLAS, TEXAS

DEC 1988



ATTACHMENT C

Mining and Restoration Table

<u>Area</u>	<u>Restoration Schedule</u>
PAA #1	May, 1985 - July, 1986
PAA #2	July, 1986 - December, 1987
PAA #3	November, 1985 - December, 1986
PAA #4	January, 1984 - October, 1985

ATTACHMENT D

DESIGNATED MONITOR WELL TABLE

PRODUCTION ZONE

32
70
72
137
182
160
161
162
55
163
47

NON PRODUCTION ZONES

First Overlying

53
54

Second Overlying

183

GROUND WATER ANALYSIS REPORT SUMMARY
BASELINE WATER QUALITY TABLE - BENAVIDES

TABLE 4

Company: URANIUM RESOURCES INC.
Mine Name: BENAVIDES
Mine Area: A & B Production Area No. 1
Date Summarized: 1 NOVEMBER 79

	PARAMETER	UNIT	NON PRODUCTION ZONE **			PRODUCTION ZONE						WELL I.D. BY AREA *		
						MINE AREA **			PRODUCTION AREA			NON PROD. ZONE	PROD. ZONE	
			Low	Average	High	Low	Average	High	Low	Average	High		Mine	Product.
1	Calcium	mg/l	15	46	58	13	22	42	9.7	20	51	U-51	U-55	U-5
2	Magnesium	mg/l	6.1	21.8	28	2.6	6.2	14	.88	4.8	9.1	U-52	U-160	U-6
3	Sodium	mg/l	533	556	568	311	402	527	305	366	454	U-53	U-161	U-10
4	Potassium	mg/l	18	19	20	10	14	19	8.7	12	20	U-54	U-162	U-14
5	Carbonate	mg/l	0	3	6	0	2	7	0	2	7		U-163	U-20
6	Bicarbonate	mg/l	128	166	187	165	215	283	190	239	273		U-164	U-23
7	Sulfate	mg/l	123	132	143	40	61	87	41	69	95		U-175	U-28
8	Chloride	mg/l	746	812	850	296	517	789	288	431	670		U-176	U-35
9	Fluoride	mg/l	0.25	.30	0.36	0.30	0.48	0.89	.38	.45	.59		U-177	U-47
10	Nitrate - N	mg/l	6.9	7.6	7.9	0.01	2.87	11	.02	.59	4.2		U-178	U-75
11	Silica	mg/l	11	14	16	10	26	58	15	26	111		U-179	U-79
12													U-180	U-93
13	pH	Std. unit	8.24	8.35	8.5	7.98	8.37	8.60	7.98	8.33	8.63		U-181	U-101
14	TDS	mg/l	1590	1752	1850	938	1211	1620	905	1103	1430		U-182	U-106
15	Conductivity	µmhos	2950	3185	3320	1590	2161	3000	1540	1924	2580			U-113
16	Alkalinity	Std. Unit	105	141	153	125	180	240	158	199	224			U-137
17														U-144
18	Arsenic	mg/l	0.004	0.008	0.012	<.001	.004	.016	<.001	.003	.014			U-155
19	Barium	mg/l	0.06	0.10	0.13	0.16	0.28	0.58	.05	.23	.44			U-167
20	Boron	mg/l	.86	.97	1.04	0.65	0.89	1.12	.71	.91	1.2			U-172
21	Cadmium	mg/l	<.0001	<.0001	<.0001	<.0001	.0003	.0008	<.0001	.0001	.0003			
22	Chromium	mg/l	.001	.002	.002	.002	.004	.008	.001	.003	.008			
23	Copper	mg/l	.003	.006	.010	.004	.012	.033	.003	.011	.027			
24	Iron	mg/l	<.01	.11	.29	0.04	2.45	9.4	.06	1.55	6.7			
25	Lead	mg/l	<.001	.027	.074	<.001	.016	.040	<.001	.023	.16			
26	Manganese	mg/l	<.001	.009	.026	.005	.365	1.14	.006	.238	.903			
27	Mercury	mg/l	<.0001	.0001	.0002	<.0001	.0002	.0006	<.0001	.0003	.0008			
28	Nickel	mg/l	<.01	<.01	<.01	<.01	0.01	0.02	<.01	.01	.02			
29	Selenium	mg/l	<.001	<.001	<.001	<.001	.004	.030	<.001	.003	.017			
30	Silver	mg/l	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01			
31	Zinc	mg/l	.001	.013	.036	.003	.020	.051	.004	.020	.068			
32														
33	Ammonia	mg/l	.01	.01	.01	<.01	0.02	0.09	<.01	.03	.17			
34	Uranium	mg/l	.003	.004	.005	.001	.015	.049	.001	.083	.314			
35	Molybdenum	mg/l	<.01	<.01	<.01	<.01	.01	.01	<.01	.01	.02			
36	Vanadium	mg/l	.02	.03	.04	<.01	.01	.02	<.01	.01	.02			

GROUND WATER ANALYSIS REPORT SUMMARY AND
BASELINE WATER QUALITY TABLE - In Situ Groundwater Monitors

TABLE 5

"E" Sand

CONTROLLED BY HEARNIM RESEARCH INC.

Line Name: **BENAVIDES**

Mine Area. A & B Production Area No. 1

Date Summarized: 1 NOVEMBER 79

[illegible]

ATTACHMENT F
 Restoration Table

<u>Parameter</u>	<u>Unit</u>	<u>Concentration</u>
Calcium	mg/l	50
Magnesium	mg/l	15
Sodium	mg/l	410
Potassium	mg/l	14
Carbonate	mg/l	2
Bicarbonate	mg/l	400
Sulfate	mg/l	250
Chloride	mg/l	517
Nitrate	mg/l	2.87
Fluoride	mg/l	.48
Silica	mg/l	26
TDS	mg/l	1211
pH	Std. Unit	6.5 - 8.5
Arsenic	mg/l	.004
Cadmium	mg/l	0.1
Iron	mg/l	2.45
Lead	mg/l	.023
Manganese	mg/l	.365
Mercury	mg/l	.0003
Molybdenum	mg/l	.01
Selenium	mg/l	.004
Uranium	mg/l	2.0
Radium 226	pCi/l	83
Ammonia	mg/l	.03

Permit No. UR02312-041
Uranium Resources, Incorporated
Benavides Mine Site

Page 10

ATTACHMENT G

Control Parameter Upper Limits Table

<u>Control Parameter</u>	<u>Production Zone</u>	<u>1st Overlying</u>	<u>2nd Overlying</u>
Uranium (mg/l)	6.6	5.005	5.005
Chloride (mg/l)	1045	1063	370
Conductivity (umhos)	4075	4150	2050

§ 141.6

breakdown of the public water system or a portion thereof; or

(b) Except for intake structures, is within the floodplain of a 100-year flood or is lower than any recorded high tide where appropriate records exist. The U.S. Environmental Protection Agency will not seek to override land use decisions affecting public water systems siting which are made at the State or local government levels.

§ 141.6 Effective dates.

(a) Except as provided in paragraphs (b) through (g) of this section, the regulations set forth in this part shall take effect on June 24, 1977.

(b) The regulations for total trihalomethanes set forth in § 141.12(c) shall take effect 2 years after the date of promulgation of these regulations for community water systems serving 75,000 or more individuals, and 4 years after the date of promulgation for communities serving 10,000 to 74,999 individuals.

(c) The regulations set forth in §§ 141.11 (a), (d) and (e); 141.14(a)(1); 141.14(b)(1)(i); 141.14(b)(2)(i); 141.14(d); 141.21 (a), (c) and (i); 141.22 (a) and (e); 141.23 (a)(3) and (a)(4); 141.23(f); 141.24(a)(3); 141.24 (e) and (f); 141.25(e); 141.27(a); 141.28 (a) and (b); 141.31 (a), (d) and (e); 141.32(b)(3); and 141.32(d) shall take effect immediately upon promulgation.

(d) The regulations set forth in § 141.41 shall take effect 18 months from the date of promulgation. Suppliers must complete the first round of sampling and reporting within 12 months following the effective date.

(e) The regulations set forth in § 141.42 shall take effect 18 months from the date of promulgation. All requirements in § 141.42 must be completed within 12 months following the effective date.

(f) The regulations set forth in § 141.11(c) and § 141.23(g) are effective May 2, 1986. Section 141.23(g)(4) is effective October 2, 1987.

(g) The regulations contained in § 141.6, paragraph (c) of the table in 141.12, and 141.62(b)(1) are effective July 1, 1991. The regulations contained in §§ 141.11(b), 141.23, 141.24, 142.57(b), 143.4(b)(12) and (b)(13), are

40 CFR Ch. I (7-1-92 Edition)

effective July 30, 1992. The regulations contained in the revisions to §§ 141.32(e) (16), (25) through (27) and (46); 141.61(c)(16); and 141.62(b)(3) are effective January 1, 1993. The effective date of regulations contained in § 141.61(c) (2), (3), and (4) is postponed.

[44 FR 88641, Nov. 29, 1979, as amended at 45 FR 57342, Aug. 27, 1980; 47 FR 10998, Mar. 12, 1982; 51 FR 11410, Apr. 2, 1986; 56 FR 30274, July 1, 1991; 57 FR 22178, May 27, 1992]

Subpart B—Maximum Contaminant Levels

§ 141.11 Maximum contaminant levels for inorganic chemicals.

(a) The MCL for nitrate is applicable to both community water systems and non-community water systems except as provided by in paragraph (d) of this section. The levels for the other inorganic chemicals apply only to community water systems. Compliance with MCLs for inorganic chemicals is calculated pursuant to § 141.23.

(b) The following maximum contaminant levels for cadmium, chromium, mercury, nitrate, and selenium shall remain effective until July 30, 1992. The following maximum contaminant level for lead shall remain effective until December 7, 1992.

Contaminant	Level, milligrams per liter
Arsenic	0.05
Barium	1
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10
Selenium	0.01

(c) The maximum contaminant level for fluoride is 4.0 mg/l. See 40 CFR 143.3, which establishes a secondary maximum contaminant level at 2.0 mg/l.

(d) At the discretion of the State, nitrate levels not to exceed 20 mg/l may be allowed in a non-community water system if the supplier of water demonstrates to the satisfaction of the State that:

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(1) Such water will not be available to children under 6 months of age; and

(2) There will be continuous posting of the fact that nitrate levels exceed 10 mg/l and the potential health effects of exposure; and

(3) Local and State public health authorities will be notified annually of nitrate levels that exceed 10 mg/l; and

(4) No adverse health effects shall result.

[40 FR 59570, Dec. 24, 1975, as amended at 45 FR 57342, Aug. 27, 1980; 47 FR 10998, Mar. 12, 1982; 51 FR 11410, Apr. 2, 1986; 56 FR 3578, Jan. 30, 1991; 56 FR 26548, June 7, 1991; 56 FR 30274, July 1, 1991]

EFFECTIVE DATE NOTE 1: At 56 FR 3578, Jan. 30, 1991, § 141.11 was amended by revising the introductory text of paragraph (b), and by removing the entry for "silver" from the table in paragraph (b), effective July 30, 1992. At 56 FR 30274, July 1, 1991, § 141.11 was amended by further revising the introductory text of paragraph (b), effective July 30, 1992. For the convenience of the user, the revised text as of July 30, 1992, reads as follows:

§ 141.11 Maximum contaminant levels for inorganic levels.

(b) The Maximum contaminant levels for cadmium, chromium, mercury, nitrate and selenium shall remain effective until July 30, 1992; the maximum contaminant level for lead shall remain effective until December 7, 1992; the maximum contaminant level for barium shall remain effective until January 1, 1993.

[56 FR 30274, July 1, 1991]

EFFECTIVE DATE NOTE 2: At 56 FR 26548, June 7, 1991, § 141.11 was amended by revising the introductory text of paragraph (b), effective November 6, 1991. At 56 FR 32113, July 15, 1991, § 141.11 was further amended by revising the second sentence of the introductory text and the effective date was corrected to December 7, 1992. For the convenience of the user, the superseded text is set forth below:

§ 141.11 Maximum contaminant levels for inorganic levels.

§ 141.12

(b) The following are the maximum contaminant levels for inorganic chemicals other than fluoride:

§ 141.12 Maximum contaminant levels for organic chemicals.

The following are the maximum contaminant levels for organic chemicals. The maximum contaminant levels for organic chemicals in paragraph (a) of this section apply to all community water systems. Compliance with the maximum contaminant level in paragraph (a) of this section is calculated pursuant to § 141.24. The maximum contaminant level for total trihalomethanes in paragraph (c) of this section applies only to community water systems which serve a population of 10,000 or more individuals and which add a disinfectant (oxidant) to the water in any part of the drinking water treatment process. Compliance with the maximum contaminant level for total trihalomethanes is calculated pursuant to § 141.30.

	Level, milligrams per liter
(a) Chlorinated hydrocarbons: Endrin (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,8,7,8,8-tetrahydro-1,4-endo, endo-5,5-dimethano naphthalene)	0.0002
(b) [Reserved]	
(c) Total trihalomethanes (the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform) and trichloromethane (chloroform))	0.10

[56 FR 3578, Jan. 30, 1991]

EFFECTIVE DATE NOTE: At 56 FR 3578, Jan. 30, 1991, § 141.12 was revised, effective July 30, 1992. For the convenience of the user, the superseded text follows:

§ 141.12 Maximum contaminant levels for organic chemicals.

The following are the maximum contaminant levels for organic chemicals. The maximum contaminant levels for organic chemicals in paragraphs (a) and (b) of this section apply to all community water systems. Compliance with the maximum contaminant levels in paragraphs (a) and (b) of this section, is calculated pursuant to § 141.24. The maximum contaminant level for total trihalomethanes in paragraph (c) of this section

§ 141.13

applies only to community water systems which serve a population of 10,000 or more individuals and which add a disinfectant (oxidant) to the water in any part of the drinking water treatment process. Compliance with the maximum contaminant level for total trihalomethanes is calculated pursuant to § 141.30.

	Level, milligrams per liter
(a) Chlorinated hydrocarbons:	
Endrin (1,2,3,4,10, 10-hexachloro-8, 7-epoxy-1,4, 4a,5,6,7,8,8i-octahydro-1,4-endo, endo-5,6-dimethano naphthalene)	0.0002
Lindane (1,2,3,4,5,6-hexachlorocyclohexane, gamma isomer)	0.004
Methoxychlor (1,1,1-Trichloro-2, 2-bis (p-methoxyphenyl) ethane)	0.1
Toxaphene (C ₁₂ H ₁₀ Cl ₁₂ -Technical chlorinated camphene, 67-69 percent chlorine)	0.005
(b) Chlorophenoxyacetic acids:	
2,4-D, (2,4-Dichlorophenoxyacetic acid)	0.1
2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid)	0.01
(c) Total trihalomethanes (the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromofom) and trichloromethane (chlorofom))	0.10

[40 FR 59570, Dec. 24, 1975, as amended at 44 FR 68641, Nov. 29, 1979; 56 FR 30274, July 1, 1991]

§ 141.13 Maximum contaminant levels for turbidity.

The maximum contaminant levels for turbidity are applicable to both community water systems and non-community water systems using surface water sources in whole or in part. The maximum contaminant levels for turbidity in drinking water, measured at a representative entry point(s) to the distribution system, are:

(a) One turbidity unit (TU), as determined by a monthly average pursuant to § 141.22, except that five or fewer turbidity units may be allowed if the supplier of water can demonstrate to the State that the higher turbidity does not do any of the following:

- (1) Interfere with disinfection;
- (2) Prevent maintenance of an effective disinfectant agent throughout the distribution system; or
- (3) Interfere with microbiological determinations.

(b) Five turbidity units based on an average for two consecutive days pursuant to § 141.22.

[40 FR 59570, Dec. 24, 1975]

40 CFR Ch. I (7-1-92 Edition)

EFFECTIVE DATE NOTE: At 54 FR 27527, June 29, 1989, § 141.13 was amended, adding introductory text, effective December 31, 1990. This section already contains an introductory text. EPA will publish a document at a later date clarifying the status of the current introductory text. For the convenience of the user, the added material follows.

§ 141.13 Maximum contaminant levels for turbidity.

The requirements in this section apply to unfiltered systems until December 30, 1991, unless the State has determined prior to that date, in writing pursuant to § 141.2(b)(7)(C)(iii), that filtration is required. The requirements in this section apply to filtered systems until June 29, 1993. The requirements in this section apply to unfiltered systems that the State has determined, in writing pursuant to § 141.2(b)(7)(C)(iii), must install filtration, until June 29, 1993, or until filtration is installed, whichever is later.

§ 141.15 Maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity in community water systems.

The following are the maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity:

- (a) Combined radium-226 and radium-228—5 pCi/l.
- (b) Gross alpha particle activity (including radium-226 but excluding radon and uranium)—15 pCi/l.

[41 FR 28404, July 9, 1976]

§ 141.16 Maximum contaminant levels for beta particle and photon radioactivity from man-made radionuclides in community water systems.

(a) The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year.

(b) Except for the radionuclides listed in Table A, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a 2 liter per day drinking water

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intake using the 168 hour data listed in "Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure," NBS Handbook 69 as amended August 1963, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 millirem/year.

TABLE A—AVERAGE ANNUAL CONCENTRATIONS ASSUMED TO PRODUCE A TOTAL BODY OR ORGAN DOSE OF 4 MREM/YR

Radionuclide	Critical organ	pCi per liter
Tritium	Total body	20,000
Strontium-90	Bone marrow	8

[41 FR 28404, July 9, 1976]

Subpart C—Monitoring and Analytical Requirements

§ 141.21 Coliform sampling.

(a) *Routine monitoring.* (1) Public water systems must collect total coliform samples at sites which are representative of water throughout the distribution system according to a written sample siting plan. These plans are subject to State review and revision.

(2) The monitoring frequency for total coliforms for community water systems is based on the population served by the system, as follows:

TOTAL COLIFORM MONITORING FREQUENCY FOR COMMUNITY WATER SYSTEMS

Population served	Minimum number of samples per month
25 to 1,000 ¹	1
1,001 to 2,500	2
2,501 to 3,300	3
3,301 to 4,100	4
4,101 to 4,800	5
4,801 to 5,600	6
5,601 to 6,700	7
6,701 to 7,600	8
7,601 to 8,500	9
8,501 to 12,900	10
12,901 to 17,200	15
17,201 to 21,500	20

§ 141.21

TOTAL COLIFORM MONITORING FREQUENCY FOR COMMUNITY WATER SYSTEMS—Continued

Population served	Minimum number of samples per month
21,501 to 25,000	25
25,001 to 33,000	30
33,001 to 41,000	40
41,001 to 50,000	50
50,001 to 59,000	60
59,001 to 70,000	70
70,001 to 83,000	80
83,001 to 98,000	90
98,001 to 130,000	100
130,001 to 220,000	120
220,001 to 320,000	150
320,001 to 450,000	180
450,001 to 600,000	210
600,001 to 780,000	240
780,001 to 970,000	270
970,001 to 1,230,000	300
1,230,001 to 1,520,000	330
1,520,001 to 1,850,000	360
1,850,001 to 2,270,000	390
2,270,001 to 3,020,000	420
3,020,001 to 3,980,000	450
3,980,001 or more	480

¹ Includes public water systems which have at least 15 service connections; but serve fewer than 25 persons.

If a community water system serving 25 to 1,000 persons has no history of total coliform contamination in its current configuration and a sanitary survey conducted in the past five years shows that the system is supplied solely by a protected groundwater source and is free of sanitary defects, the State may reduce the monitoring frequency specified above, except that in no case may the State reduce the monitoring frequency to less than one sample per quarter. The State must approve the reduced monitoring frequency in writing.

(3) The monitoring frequency for total coliforms for non-community water systems is as follows:

(i) A non-community water system using only ground water (except ground water under the direct influence of surface water, as defined in § 141.2) and serving 1,000 persons or fewer must monitor each calendar quarter that the system provides water to the public, except that the State may reduce this monitoring frequency, in writing, if a sanitary survey shows that the system is free of sanitary defects. Beginning June 29, 1994,

days of the date of receipt of proposed administrative compliance order noticed under § 142.204.

(c) For purposes of this subsection, receipt occurs at the time of personal service or three days after the date of mailing or other means of substituted service, except that if receipt is provided by certified mail, return receipt requested, notice occurs when the return receipt is signed. For the purpose of computation of time, the day of the mailing, Saturdays, Sundays, and federal holidays are excluded.

§ 142.206 Conduct of public hearings.

(a) The purpose of the public hearing shall be to determine whether a proposed administrative order:

(1) Has correctly stated the extent and nature of a party's violation of any regulation, schedule, or other requirement of the SDWA referenced in § 142.202(b) and

(2) Has provided, where appropriate, a reasonable time for the party to comply with applicable requirements of the SDWA and its implementing regulations.

(b) Prior to convening a public hearing under this subsection, the Administrator shall appoint a Hearing Officer. The Hearing Officer shall preside over any public hearing convened under this section. The Hearing Officer shall determine the form and procedures of the public hearing, and shall maintain complete and accurate record of the proceedings in written or other permanent form. The Hearing Officer shall provide the Administrator with the record of any public hearing conducted under this subsection.

(c) The party, any member of the public, or the State may present information to the Hearing Officer at the public hearing (or to the Administrator in writing before the date set for the public hearing) relevant to whether:

(1) The party has violated the applicable regulation, schedule, or other requirement referenced in the proposed administrative compliance order;

(2) The party has violated any other applicable regulation, schedule, or other requirement of the SDWA referenced in § 142.202(b); and

(3) The proposed order, where appropriate, provides a reasonable time for the party to comply with applicable requirements of the SDWA and its implementing regulations.

§ 142.207 Issuance, amendment or withdrawal of administrative compliance order.

(a) Based on the administrative record, the Administrator shall either issue the order as proposed, amend the proposed order or withdraw the proposed order.

(b) Any order issued shall require the party to comply with any applicable regulation, schedule, or other requirement of the SDWA referenced in § 142.202(b) and may establish a time or date for compliance which the Administrator determines is reasonable based on the administrative record.

(c) The Administrator shall determine within a reasonable time whether to issue, amend or withdraw the proposed order and shall promptly notify in writing the party, all members of the public participating under § 142.206(c) and the State, in the case of a State with primary enforcement authority over public water systems pursuant to section 1413(a) of the SDWA, or in the case of a State participating under § 142.206(c).

§ 142.208 Administrative assessment of civil penalty for violation of administrative compliance order.

In the event the Administrator decides to seek a penalty under the authority provided in section 1414(g)(3)(B) of the SDWA, 42 U.S.C. 300g-3(g)(3)(B), for violation of, or failure or refusal to comply with, an order, the procedures provided in 40 CFR part 22 shall govern the assessment of such a penalty.

PART 143—NATIONAL SECONDARY DRINKING WATER REGULATIONS

Sec.

143.1 Purpose.

143.2 Definitions.

143.3 Secondary maximum contaminant levels.

143.4 Monitoring.

5 Compliance with secondary maximum contaminant level and public notification for fluoride.

AUTHORITY: 42 U.S.C. 300f et seq.

SOURCE: 44 FR 42198, July 19, 1979, unless otherwise noted.

143.1 Purpose.

This part establishes National Secondary Drinking Water Regulations pursuant to section 1412 of the Safe Drinking Water Act, as amended (42 U.S.C. 300g-1). These regulations control contaminants in drinking water that primarily affect the aesthetic qualities relating to the public acceptance of drinking water. At considerably higher concentrations of these contaminants, health implications may also exist as well as aesthetic degradation. The regulations are not Federally enforceable but are intended as guidelines for the States.

143.2 Definitions.

(a) Act means the Safe Drinking Water Act as amended (42 U.S.C. 300f et seq.).

(b) Contaminant means any physical, chemical, biological, or radiological substance or matter in water.

(c) Public water system means a system for the provision to the public of piped water for human consumption, if such a system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year. Such term includes (1) any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system, and (2) any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. A public water system is either a "community water system" or a "non-community water system."

(d) State means the agency of the State or Tribal government which has jurisdiction over public water systems. During any period when a State does not have responsibility pursuant to section 1443 of the Act, the term "State" means the Regional Administrator, U.S. Environmental Protection Agency.

Agency.

(e) Supplier of water means any person who owns or operates a public water system.

(f) Secondary maximum contaminant levels means SMCLs which apply to public water systems and which, in the judgement of the Administrator, are requisite to protect the public welfare. The SMCL means the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of public water system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition.

[44 FR 42198, July 19, 1979, as amended at 53 FR 37412, Sept. 26, 1988]

§ 143.3 Secondary maximum contaminant levels.

The secondary maximum contaminant levels for public water systems are as follows:

Contaminant	Level
Aluminum.....	0.05 to 0.2 mg/l.
Chloride.....	250 mg/l.
Color.....	15 color units.
Copper.....	1.0 mg/l.
Corrosivity.....	Non-corrosive.
Fluoride.....	2.0 mg/l.
Foaming agents.....	0.5 mg/l.
Iron.....	0.3 mg/l.
Manganese.....	0.05 mg/l.
Odor.....	3 threshold odor number.
pH.....	6.5-8.5.
Silver.....	0.1 mg/l.
Sulfate.....	250 mg/l.
Total dissolved solids (TDS).....	500 mg/l.
Zinc.....	5 mg/l.

These levels represent reasonable goals for drinking water quality. The States may establish higher or lower levels which may be appropriate dependent upon local conditions such as unavailability of alternate source waters or other compelling factors, provided that public health and welfare are not adversely affected.

[44 FR 42198, July 19, 1979, as amended at 51 FR 11412, Apr. 2, 1986; 56 FR 3597, Jan. 30, 1991]

EFFECTIVE DATE N. At 56 FR 3597, Jan. 30, 1991, §143.3 was amended by revising the table, effective July 30, 1992. For the convenience of the user, the superseded text follows:

§ 143.3 Secondary maximum contaminant levels.

Contaminant	Level
Chloride	250 mg/l.
Color	15 color units.
Copper	1 mg/l.
Corrosivity	Noncorrosive.
Fluoride	2.0 mg/l.
Foaming agents	0.5 mg/l.
Iron	0.3 mg/l.
Manganese	0.05 mg/l.
Odor	3 threshold odor number.
pH	8.6-8.5.
Sulfate	250 mg/l.
Total dissolved solids (TDS)	500 mg/l.
Zinc	5 mg/l.

§ 143.4 Monitoring.

(a) It is recommended that the parameters in these regulations should be monitored at intervals no less frequent than the monitoring performed for inorganic chemical contaminants listed in the National Interim Primary Drinking Water Regulations as applicable to community water systems. More frequent monitoring would be appropriate for specific parameters such as pH, color, odor or others under certain circumstances as directed by the State.

(b) Analyses conducted to determine compliance with § 143.3 should be made in accordance with the following methods:

(1) Chloride—Potentiometric Method, "Standard Methods for the Examination of Water and Wastewater," 14th Edition, p. 306.

(2) Color—Platinum-Cobalt Method, "Methods for Chemical Analysis of Water and Wastes," p. 36-38, EPA, Office of Technology Transfer, Washington, DC, 20460, 1974, or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 160-162, 14th Edition, p. 64-66.

(3) Copper—Atomic Absorption Method, "Methods for Chemical Analysis of Water and Wastes," pp. 108-

109, EPA, Office of Technology Transfer, Washington, DC 20460, 1974, or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 210-215, 14th Edition, pp. 144-147; or Inductively Coupled Plasma Method, "Inductively Coupled Plasma—Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes—Method 200.7," available from EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268.

(4) Foaming Agents—Methylene Blue Method, "Methods for Chemical Analysis of Water and Wastes," pp. 157-158, EPA, Office of Technology Transfer, Washington, DC, 20460, 1974, or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 339-342, 14th Edition, p. 600.

(5) Iron—Atomic Absorption Method, "Methods for Chemical Analysis of Water and Wastes," pp. 110-111, EPA, Office of Technology Transfer, Washington, DC 20460, 1974, or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 210-215, 14th Edition, pp. 144-147; or Inductively Coupled Plasma Method, "Inductively Coupled Plasma—Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes—Method 200.7," available from EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268.

(6) Manganese—Atomic Absorption Method, "Methods for Chemical Analysis of Water and Wastes," pp. 116-117, EPA, Office of Technology Transfer, Washington, DC 20460, 1974, or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 210-215, 14th Edition, pp. 144-147; or Inductively Coupled Plasma Method, "Inductively Coupled Plasma—Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes—Method 200.7," available from EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268.

(7) Odor—Consistent Series Method, "Methods for Chemical Analysis of Water and Wastes," pp. 287-294, EPA, Office of Technology Transfer, Washington, DC, 20460, 1974, or "Standard

Methods for the Examination of Water and Wastewater," 13th Edition, pp. 248-254, 14th Edition, p. 75-82.

(8) pH—Glass Electrode Method, "Methods for Chemical Analysis of Water and Wastes," pp. 239-240, EPA, Office of Technology Transfer, Washington, DC, 20460, 1974, or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 276-281, 14th Edition, pp. 460-465.

(9) Sulfate—Turbidimetric Method, "Methods for Chemical Analysis of Water and Wastes," pp. 277-278, EPA, Office of Technology Transfer, Washington, DC, 20460, 1974, or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 334-335, 14th Edition, p. 496-498.

(10) Total Dissolved Solids—Total Residue Methods, "Methods for Chemical Analysis of Water and Wastes," pp. 270-271, EPA, Office of Technology Transfer, Washington, DC, 20460, 1974, or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 288-290, 14th Edition, p. 91-92.

(11) Zinc—Atomic Absorption Method, "Methods for Chemical Analysis of Water and Wastes," pp. 155-156, EPA, Office of Technology Transfer, Washington, DC 20460, 1974, or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp. 210-215, 14th Edition, pp. 144-147; or Inductively Coupled Plasma Method, "Inductively Coupled Plasma—Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes—Method 200.7," available from EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268.

(12) Aluminum—Method¹ 202.1 Atomic Absorption Technique-Direct

Aspiration; or Method² 36 or Method³ I-3051-85, or Method¹ 202.2 Atomic Absorption-Graphite Furnace Technique; or Method² 304; or Method⁴ 200.7 Inductively-Coupled Plasma Technique; or Method⁵ 200.8 Inductively Coupled Plasma-Mass Spectrometry or Method⁶ 200.9 Platform Technique; or Method⁷ 3120B Inductively-Coupled Plasma Technique.

(13) Silver—Method¹ 272.1 Atomic Absorption Technique-Direct Aspiration; or Method² 324A; or Method³ I-3720-85; or Method¹ 272.2 Atomic Absorption-Graphite Furnace Technique; or Method² 304; or Method⁴ 200.7 Inductively-Coupled Plasma-Technique; or Method⁵ 200.8 Inductively-Coupled Plasma-Mass Spectrometry; or Method⁶ 200.9 Platform Technique; or Method⁷ 3120B Inductively-Coupled Plasma-Technique.

¹ "Standard Methods for the Examination of Water and Wastewater," 16th Ed., American Public Health Association, American Waterworks Association, Water Pollution Control Federation, 1985.

² "Methods for the Determination of Inorganic Substances in Water and Fluvial Sediments," Techniques of Water-Resources Investigations of the United States Geological Survey Books, Chapter A1, 1985. Available from Open File Services Section, Western Distribution Branch, U.S. Geological Survey, Denver Federal Center, Denver, CO 80255.

³ "Determination of Metals and Trace Elements by Inductively Coupled Plasma-Atomic Emission Spectrometry," Method 200.7, version 3.2, August, 1990, EPA Environmental Monitoring and Systems Laboratory, Cincinnati, OH 45268.

⁴ "Determination of and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Mass Spectrometry," Method 200.8, version 4.3, August, 1990, EPA, Environmental Monitoring and Systems Laboratory, Cincinnati, OH 45268. Available from ORD Publication, CERL, EPA, Cincinnati, OH 45268.

⁵ "Determination of Metals and Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption Spectrometry," Method 200.9, version 1.1, August, 1990, EPA, Environmental Monitoring and Systems Laboratory, Cincinnati, OH 45268.

⁷ "Standard Methods for the Examination of Water and Wastewater," 16th ed., American Public Health Association, American Waterworks Association, Water Pollution Control Federation, 1985.

¹ "Methods of Chemical Analysis of Water and Wastes," EPA, Environmental Monitoring and Systems Laboratory, Cincinnati, OH 45268, EPA 600/4-79-020, March, 1983. Available from ORD Publication, CERL, EPA, Cincinnati, OH 45268.



Federal Register

Thursday,
December 7, 2000

Excerpts showing newly promulgated
uranium maximum contaminant level of
30 ug/L (0.03 mg/L).

Part II

Environmental Protection Agency

40 CFR Parts 9, 141, and 142

National Primary Drinking Water
Regulations; Radionuclides; Final Rule

ENVIRONMENTAL PROTECTION AGENCY**40 CFR Parts 9, 141, and 142****[FRL-6909-3]****RIN 2040-AC98****National Primary Drinking Water Regulations; Radionuclides; Final Rule****AGENCY:** Environmental Protection Agency.**ACTION:** Final rule.

SUMMARY: Today, EPA is finalizing maximum contaminant level goals (MCLGs), maximum contaminant levels (MCLs), and monitoring, reporting, and public notification requirements for radionuclides. Today's rule is only applicable to community water systems. Today's rule includes requirements for uranium, which is not currently regulated, and revisions to the monitoring requirements for combined radium-226 and radium-228, gross alpha particle radioactivity, and beta particle and photon radioactivity. Based on an improved understanding of the risks associated with radionuclides in drinking water, the current MCL for combined radium-226/-228 and the current MCL for gross alpha particle radioactivity will be retained. Based on the need for further evaluation of the various risk management issues associated with the MCL for beta particle and photon radioactivity and the flexibility to review and modify standards under the Safe Drinking Water Act (SDWA), the current MCL for beta particle and photon radioactivity will be retained in this final rule, but will be further reviewed in the near future.

Some parts of EPA's 1991 proposal, including the addition of MCLGs and the National Primary Drinking Water Regulation (NPDWR) for uranium, are required under the SDWA. Other portions were intended to make the radionuclides NPDWRs more consistent with other NPDWRs, e.g., revisions to monitoring frequencies and the point of compliance. Lastly, some portions were contingent upon 1991 risk analyses, e.g., MCL revisions to the 1976 MCLs for combined radium-226 and -228, gross alpha particle radioactivity, and beta particle and photon radioactivity. The portions required under SDWA and the portions intended to make the radionuclides NPDWRs more consistent with other NPDWRs are being finalized today. The portions contingent upon the outdated risk analyses supporting the 1991 proposal are not being finalized today, in part based on updated risk analyses.

DATES: This regulation is effective December 8, 2003. The incorporation by reference of the publications listed in today's rule is approved by the Director of the Federal Register as of December 8, 2003. For judicial review purposes, this final rule is promulgated as of 1 p.m. Eastern Time on December 7, 2000.

ADDRESSES: The record for this regulation has been established under the docket name: National Primary Drinking Water Regulations for Radionuclides (W-00-12). The record includes public comments, applicable **Federal Register** notices, other major supporting documents, and a copy of the index to the public docket. The record is available for inspection from 9 a.m. to 4 p.m., Eastern Standard Time, Monday through Friday, excluding Federal holidays, at the Water Docket, 401 M Street SW, East Tower Basement (Room EB 57), Washington, DC 20460. For access to the Docket materials, please call (202) 260-3027 to schedule an appointment.

FOR FURTHER INFORMATION CONTACT: For technical inquiries, contact David Huber, Standards and Risk Management Division, Office of Ground Water and Drinking Water, EPA (MC-4607), 1200 Pennsylvania Avenue, NW., Washington, DC 20460; telephone (202) 260-9566. For general inquiries, the Safe Drinking Water Hotline is open Monday through Friday, excluding Federal holidays, from 9:00 a.m. to 5:30 p.m. Eastern Standard Time. The Safe Drinking Water Hotline toll free number is (800) 426-4791.

SUPPLEMENTARY INFORMATION:**Regulated Entities**

Entities potentially regulated by this rule are public water systems that are classified as community water systems (CWSs). Community water systems provide water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serve an average of at least 25 people year-round. Regulated categories and entities include:

Category	Examples of regulated entities
Industry	Privately-owned community water systems.
State, Tribal, Local, and Federal Governments.	Publicly-owned community water systems.

This table is not intended to be exhaustive, but rather, provides a guide for readers regarding entities likely to be regulated by this action. Other types of entities not listed in the table could also

be regulated. To determine whether your facility is regulated by this action, you should carefully examine the applicability criteria in §§ 141.26(a)(1)(i), 141.26(a)(1)(ii), 141.26(b)(1), and 141.26(b)(2) of this rule. If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

Abbreviations and Acronyms Used in This Document

ASTM: American Society for Testing and Materials
 AWWA: American Water Works Association
 BAT: Best available treatment
 BEIR: Biological effects of ionizing radiation
 CFR: Code of Federal Regulations
 CWS: Community water systems
 EDE: Effective dose equivalent
 EML: Environmental Measurements Laboratory
 FR: Federal Register
 ICRP: International Commission on Radiological Protection
 IE: Ion exchange
 kg: Kilogram
 L/day: Liter per day
 LET: Low energy transfer
 LOAEL: Lowest observed adverse effect level
 MCL: Maximum contaminant level
 MCLG: Maximum contaminant level goal
 mg/L: Milligram per liter
 µg/L: Microgram per liter
 mGy: MilliGray
 mrem: Millirem
 mrem/yr: Millirem per year
 NBS: National Bureau of Standards
 NDWAC: National Drinking Water Advisory Committee
 NIRS: National Inorganic and Radionuclide Survey
 NIST: National Institute of Standards and Technology
 NODA: Notice of Data Availability
 NPDWRs: National Primary Drinking Water Regulations
 NRC: National Research Council
 NTIS: National Technical Information Service
 NTNC: Non-transient, non-community
 NTNCWS: Non-transient, non-community water systems
 pCi: Picocurie
 pCi/L: Picocurie per liter
 PE: Performance evaluation
 PNR: Public Notification Rule
 POE: Point-of-entry
 POU: Point-of-use
 PQL: Practical quantitation level
 PT: Performance testing
 RADRISK: A computer code for radiation risk estimation
 RfD: Reference dose
 RO: Reverse osmosis
 SM: Standard methods
 SMF: Standardized monitoring framework
 SSCTL: "Small Systems Compliance Technology List"
 SWTR: Surface Water Treatment Rule
 TAW: Technical Advisory Workgroup
 UCMR: Unregulated Contaminant Monitoring Rule

of gross alpha, while keeping the gross alpha MCL at 15 pCi/L, since the proposed radium-226 MCL was greater than the gross alpha MCL.

- Change dose limit from critical organ dose (millirems) to "weighted whole body dose" (millirems-effective dose equivalent).
- Require community water systems which are determined by the State to be vulnerable or contaminated to monitor for beta particle and photon radioactivity, rather than at all surface water systems serving a population over 100,000 people (as under the current 1976 rule).
- Establish a monitoring framework more in line with the standardized monitoring framework used for other contaminants.
- Exclude compositing for beta particle and photon emitters.
- Include non-transient, non-community water systems (NTNCWSs) in the regulation.
- Require that each entry point to the distribution system be monitored to ensure that each household in the system received water protective at the MCL.

B. Why Did EPA Propose Changes to the Radionuclides Drinking Water Regulations in 1991?

In 1976, National Interim Primary Drinking Water Regulations were promulgated for radium-226 and -228, gross alpha particle radioactivity and beta particle and photon radioactivity. The health risk basis for the 1976 radionuclides MCLs was described in the recent radionuclides Notice of Data Availability (NODA), (65 FR 21575, April 21, 2000). The 1986 reauthorization of the Safe Drinking Water Act (SDWA) required EPA to promulgate MCLGs and National Primary Drinking Water Regulations (NPDWRs) for the above radionuclides, radon and uranium. Also in 1986, EPA published an Advance Notice of Proposed Rulemaking for the radionuclides NPDWRs (EPA 1986), which stated EPA's intent to accomplish this goal. In 1991, EPA proposed changes to the current radionuclides standards and new standards for radon and uranium. EPA determined that both combined radium-226 and -228 and uranium could be analytically quantified and treated to 5 pCi/L. However, EPA concluded that, given the

much greater cost-effectiveness of reducing risk through radon water treatment relative to radium and uranium, the feasible levels were 20 pCi/L each for radium-226 and -228 and 20 µg/L (or 30 pCi/L) for uranium. Between 1986 and 1991, EPA made risk estimates based on then-current models and information, as described in the NODA (EPA 2000e) and its Technical Support Document (USEPA 2000h). The 1991 risk estimates¹ indicated that the proposed MCL changes would result in lifetime cancer risks within the risk range of 10^{-6} and 10^{-4} (one in one million to one in ten thousand) that EPA considers in establishing NPDWRs. The 1991 proposed uranium MCL was based on both kidney toxicity risk and cancer risk. All MCLGs for radionuclides were proposed as zero pCi/L, based on a linear no-threshold cancer risk model for ionizing radiation. A summary of the difference between the 1976 rule and the 1991 proposal are presented in Table I-1. The detailed differences between the 1976 rule and the 1991 proposal can be found in the record for this rulemaking (EPA 1976; 1986; 1991; 2000a).

TABLE I-1.—COMPARISON OF THE 1976 RULE, 1991 PROPOSAL, AND 2000 FINAL RULE

Provision	1976 rule (current rule)	1991 proposal	2000 final rule
Affected Systems	CWS	CWS + NTNC	CSW.
MCLG for all radionuclides.	No MCLG	MCLG of zero	MCLG of zero.
Radium MCL	Combined Ra-226 + Ra-228 MCL of 5pCi/L	Ra-226 MCL of 20 pCi/L Ra-228 MCL of 20 pCi/L	Maintain current MCL based on the newly estimated risk level associated with the 1991 proposed MCL.
Beta/Photon Radioactivity MCL	<ul style="list-style-type: none"> • ≤ 4 mrem/y to the total body or any given internal organ • Except for H-3 and Sr-90, derived radionuclide-specific activity concentrations yielding 4 mrem/y based on NSB Handbook 69 and 2L/d • H-3 = 20,000 pCi/L; Sr-90 = 8 pCi/L • Total dose from co-occurring beta/ photon emitters must be ≤ 4 mrem/y to the total body of any internal organ 	<ul style="list-style-type: none"> • 4 mrem/y effective dose equivalent (ede) • Re-derived radionuclide-specific activity concentrations yielding 4 mrem/y ede based on EPA RADRISK code and 2 L/d • Total dose from co-occurring beta/ photon emitters must be < 4 mrem/y ede 	Maintain current MCL based on the newly estimated risk level associated with the 1991 proposed MCL. This MCL will be reviewed within 2 to 3 years based on a need for further re-evaluation of risk management issues.
Gross alpha MCL	15 pCi/L excluding U and Rn, but including Ra-226.	"Adjusted" gross alpha MCL of 15 pCi/L, excluding Ra-226, radon, and uranium.	Maintain current MCL based on the newly estimated risk level associated with the 1991 proposed MCL.
Polonium-210	Included in gross alpha	Included in gross alpha	Included under gross alpha, as in current rule. Monitoring required under the UCMR rule. Further action may be proposed at a later date.
Lead-210	Not Regulated	Included in beta particle and photon radioactivity; concentration limit proposed at 1 pCi/L.	No changes to current rule. Monitoring required under the UCMR rule. Further action may be proposed at a later date.
Uranium MCL	Not Regulated	20 g/L or 30 pCi/L w/ option for 5 pCi/L-80 g/L.	30 µL

¹ The 1991 cancer risk estimates were based on the now-outdated RADRISK model (see the NODA

and its Technical Support Document, USEPA 2000e and h).

Appendix A to Subpart O—Regulated Contaminants

Contaminant units	Traditional MCL in mg/L	To convert for CCR, multiply by	MCL in CCR units	MCLG	Major sources in drinking water	Health effects language
Radioactive contaminants:						
Beta/photon emitters (mrem/yr).	4 mrem/yr	—	4	0	Decay of natural and man-made deposits.	Certain minerals are radioactive and may emit forms of radiation known as photons and beta radiation. Some people who drink water containing beta particle and photon radioactivity in excess of the MCL over many years may have an increased risk of getting cancer.
Alpha emitters (pCi/L).	15 pCi/L	—	15	0	Erosion of natural deposits.	Certain minerals are radioactive and may emit a form of radiation known as alpha radiation. Some people who drink water containing alpha emitters in excess of the MCL over many years may have an increased risk of getting cancer.
Combined radium (pCi/L).	5 pCi/L	—	5	0	Erosion of natural deposits.	Some people who drink water containing radium-226 or -228 in excess of the MCL over many years may have an increased risk of getting cancer.
Uranium (pCi/L)	30 µg/L	—	30	0	Erosion of natural deposits.	Some people who drink water containing uranium in excess of the MCL over many years may have an increased risk of getting cancer and kidney toxicity.

Subpart Q—[Amended]

9. Appendix A to subpart Q under I.F. "Radioactive contaminants" is amended by:

a. Revising entries 1, 2, and 3;

b. Adding entry 4;

c. Redesignating endnotes 9 through 17 as endnotes 11 through 19; and

d. Adding new endnotes 9 and 10.

Appendix A to Subpart Q—NPDWR Violations and Other Situations Requiring Public Notice ¹

Contaminant	MCL/MRDL/TT Violations ²		Monitoring and testing procedure violations	
	Tier of public notice required	Citation	Tier of public notice required	Citation
I. Violations of National Primary Drinking Water Regulations (NPDWR) ³				
F. Radioactive contaminants				
1. Beta/photon emitters	2	141.66(d)	3	141.25(a) 141.26(b)
2. Alpha emitters	2	141.66(c)	3	141.25(a) 141.26(a)
3. Combined radium (226 and 228)	2	141.66(b)	3	141.25(a) 141.26(a)
4. Uranium	⁹ 2	141.66(e)	¹⁰ 3	141.25(a) 141.26(a)

Appendix A—Endnotes

* * * * *

1. Violations and other situations not listed in this table (e.g., reporting violations and failure to prepare Consumer Confidence

Reports), do not require notice, unless otherwise determined by the primary agency. Primacy agencies may, at their option, also

require a more stringent public notice tier (e.g., Tier 1 instead of Tier 2 or Tier 2 instead of Tier 3) for specific violations and situations listed in this Appendix, as authorized under Sec. 141.202(a) and Sec. 141.203(a).

2. MCL—Maximum contaminant level. MRDL—Maximum residual disinfectant level. TT—Treatment technique.

3. The term Violations of National Primary Drinking Water Regulations (NPDWR) is used

here to include violations of MCL, MRDL, treatment technique, monitoring, and testing procedure requirements.

* * * * *

9. The uranium MCL Tier 2 violation citations are effective December 8, 2003 for all community water systems.

10. The uranium Tier 3 violation citations are effective December 8, 2000 for all community water systems.

* * * * *

10. Appendix B to Subpart Q is amended by:

a. Redesignating entries 79 through 84 and 86 through 88 as 80 through 85 and 87 through 89, respectively, and entries 85a and 85b as 86a and 86b, respectively;

b. Adding a new entry 79 for uranium under "G. Radioactive contaminants";

c. Redesignating endnote entries 16 through 21 as 17 through 22; and

d. adding a new endnote 16.

Appendix B to Subpart Q—Standard Health Effects Language for Public Notification

Contaminant	MCLG ¹ mg/L	MCL ² mg/L	Standard health effects language for public notification
National Primary Drinking Water Regulations (NPDWR)			
G. Radioactive contaminants			
79. Uranium ¹⁶	Zero	30 µg/L	Some people who drink water containing uranium in excess of the MCL over many years may have an increased risk of getting cancer and kidney toxicity.

Appendix B—Endnotes

1. MCLG—Maximum contaminant level goal

2. MCL—Maximum contaminant level

16. The uranium MCL is effective December 8, 2003 for all community water systems.

PART 142—NATIONAL PRIMARY DRINKING WATER REGULATIONS IMPLEMENTATION

1. The authority citation for part 142 continues to read as follows:

Authority: 42 U.S.C. 300f, 300g-1, 300g-2, 300g-3, 300g-4, 300g-5, 300g-6, 300j-4, 300j-9, and 300j-11.

Subpart B—Primary Enforcement Responsibility

2. Section 142.16 is amended by adding and reserving paragraphs (i), (j), and (k) and adding a new paragraph (l) to read as follows:

§ 142.16 Special primacy requirements.

(i)–(k) [Reserved]

(l) An application for approval of a State program revision for radionuclides which adopts the requirements specified in § 141.26(a)(2)(ii)(C) of this chapter must contain the following (in

addition to the general primacy requirements enumerated in this part, including that State regulations be at least as stringent as the Federal requirements):

(1) If a State chooses to use grandfathered data in the manner described in § 141.26(a)(2)(ii)(C) of this chapter, then the State must describe the procedures and criteria which it will use to make these determinations (whether distribution system or entry point sampling points are used).

(i) The decision criteria that the State will use to determine that data collected in the distribution system are representative of the drinking water supplied from each entry point to the distribution system. These determinations must consider:

(A) All previous monitoring data.

(B) The variation in reported activity levels.

(C) Other factors affecting the representativeness of the data (e.g. geology).

(ii) [Reserved]

(2) A monitoring plan by which the State will assure all systems complete the required monitoring within the regulatory deadlines. States may update their existing monitoring plan or use the same monitoring plan submitted for the requirements in § 142.16(e)(5) under the national primary drinking water

regulations for the inorganic and organic contaminants (i.e. the phase II/V rules). States may note in their application any revision to an existing monitoring plan or note that the same monitoring plan will be used. The State must demonstrate that the monitoring plan is enforceable under State law.

Subpart G—[Amended]

3. Section 142.65 is added to read as follows.

§ 142.65 Variances and exemptions from the maximum contaminant levels for radionuclides.

(a)(1) Variances and exemptions from the maximum contaminant levels for combined radium-226 and radium-228, uranium, gross alpha particle activity (excluding Radon and Uranium), and beta particle and photon radioactivity. (i) The Administrator, pursuant to section 1415(a)(1)(A) of the Act, hereby identifies the following as the best available technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant levels for the radionuclides listed in § 141.66(b), (c), (d), and (e) of this chapter, for the purposes of issuing variances and exemptions, as shown in Table A to this paragraph.

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- 192.41 Provisions.
192.42 Substitute provisions.
192.43 Effective date.

APPENDIX I TO PART 192—LISTED CONSTITUENTS

AUTHORITY: Sec. 275 of the Atomic Energy Act of 1954, 42 U.S.C. 2022, as added by the Uranium Mill Tailings Radiation Control Act of 1978, Pub. L. 95-604, as amended.

SOURCE: 48 FR 602, Jan. 5, 1983, unless otherwise noted.

Subpart A—Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites

§ 192.00 Applicability.

This subpart applies to the control of residual radioactive material at designated processing or depository sites under section 108 of the Uranium Mill Tailings Radiation Control Act of 1978 (henceforth designated "the Act"), and to restoration of such sites following any use of subsurface minerals under section 104(h) of the Act.

§ 192.01 Definitions.

(a) *Residual radioactive material* means:

- (1) Waste (which the Secretary determines to be radioactive) in the form of tailings resulting from the processing of ores for the extraction of uranium and other valuable constituents of the ores; and
 - (2) Other wastes (which the Secretary determines to be radioactive) at a processing site which relate to such processing, including any residual stock of unprocessed ores or low-grade materials.
- (b) *Remedial action* means any action performed under section 108 of the Act.
- (c) *Control* means any remedial action intended to stabilize, inhibit future misuse of, or reduce emissions or effluents from residual radioactive materials.
- (d) *Disposal site* means the region within the smallest perimeter of residual radioactive material (excluding cover materials) following completion of control activities.
- (e) *Depository site* means a site (other than a processing site) selected under Section 104(b) or 105(b) of the Act.

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(f) *Curie (Ci)* means the amount of radioactive material that produces 37 billion nuclear transformation per second. One picocurie (pCi) = 10^{-12} Ci.

(g) *Act* means the Uranium Mill Tailings Radiation Control Act of 1978, as amended.

(h) *Administrator* means the Administrator of the Environmental Protection Agency.

(i) *Secretary* means the Secretary of Energy.

(j) *Commission* means the Nuclear Regulatory Commission.

(k) *Indian tribe* means any tribe, band, clan, group, pueblo, or community of Indians recognized as eligible for services provided by the Secretary of the Interior to Indians.

(l) *Processing site* means:

(1) Any site, including the mill, designated by the Secretary under Section 102(a)(1) of the Act; and

(2) Any other real property or improvement thereon which is in the vicinity of such site, and is determined by the Secretary, in consultation with the Commission, to be contaminated with residual radioactive materials derived from such site.

(m) *Tailings* means the remaining portion of a metal-bearing ore after some or all of such metal, such as uranium, has been extracted.

(n) *Disposal period* means the period of time beginning March 7, 1983 and ending with the completion of all subpart A requirements specified under a plan for remedial action except those specified in § 192.03 and § 192.04.

(o) *Plan for remedial action* means a written plan (or plans) for disposal and cleanup of residual radioactive materials associated with a processing site that incorporates the results of site characterization studies, environmental assessments or impact statements, and engineering assessments so as to satisfy the requirements of subparts A and B of this part. The plan(s) shall be developed in accordance with the provisions of Section 108(a) of the Act with the concurrence of the Commission and in consultation, as appropriate, with the Indian Tribe and the Secretary of Interior.

(p) *Post-disposal period* means the period of time beginning immediately after the disposal period and ending at

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termination of the monitoring period established under § 192.03.

(q) *Groundwater* means water below the ground surface in a zone of saturation.

(r) *Underground source of drinking water* means an aquifer or its portion:

(1)(i) Which supplies any public water system as defined in § 141.2 of this chapter; or

(ii) Which contains a sufficient quantity of groundwater to supply a public water system; and

(A) Currently supplies drinking water for human consumption; or

(B) Contains fewer than 10,000 mg/l total dissolved solids; and

(2) Which is not an exempted aquifer as defined in § 144.7 of this chapter.

[48 FR 602, Jan. 5, 1983, as amended at 60 FR 2865, Jan. 11, 1995]

§ 192.02 Standards.

Control of residual radioactive materials and their listed constituents shall be designed¹ to:

(a) Be effective for up to one thousand years, to the extent reasonably achievable, and, in any case, for at least 200 years; and,

(b) Provide reasonable assurance that releases of radon-222 from residual radioactive material to the atmosphere will not:

(1) Exceed an average² release rate of 20 picocuries per square meter per second, or

(2) Increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half picocurie per liter.

(c) Provide reasonable assurance of conformance with the following groundwater protection provisions:

¹Because the standard applies to design, monitoring after disposal is not required to demonstrate compliance with respect to § 192.02(a) and (b).

²This average shall apply over the entire surface of the disposal site and over at least a one-year period. Radon will come from both residual radioactive materials and from materials covering them. Radon emissions from the covering materials should be estimated as part of developing a remedial action plan for each site. The standard, however, applies only to emissions from residual radioactive materials to the atmosphere.

(1) The Secretary shall, on a site-specific basis, determine which of the constituents listed in Appendix I to Part 192 are present in or reasonably derived from residual radioactive materials and shall establish a monitoring program adequate to determine background levels of each such constituent in groundwater at each disposal site.

(2) The Secretary shall comply with conditions specified in a plan for remedial action which includes engineering specifications for a system of disposal designed to ensure that constituents identified under paragraph (c)(1) of this section entering the groundwater from a depository site (or a processing site, if residual radioactive materials are retained on the site) will not exceed the concentration limits established under paragraph (c)(3) of this section (or the supplemental standards established under § 192.22) in the uppermost aquifer underlying the site beyond the point of compliance established under paragraph (c)(4) of this section.

(3) *Concentration limits:*

(i) Concentration limits shall be determined in the groundwater for listed constituents identified under paragraph (c)(1) of this section. The concentration of a listed constituent in groundwater must not exceed:

(A) The background level of that constituent in the groundwater; or

(B) For any of the constituents listed in Table 1 to subpart A, the respective value given in that Table if the background level of the constituent is below the value given in the Table; or

(C) An alternate concentration limit established pursuant to paragraph (c)(3)(ii) of this section.

(ii)(A) The Secretary may apply an alternate concentration limit if, after considering remedial or corrective actions to achieve the levels specified in paragraphs (c)(3)(i)(A) and (B) of this section, he has determined that the constituent will not pose a substantial present or potential hazard to human health and the environment as long as the alternate concentration limit is not exceeded, and the Commission has concurred.

(B) In considering the present or potential hazard to human health and the

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environment of alternate concentration limits, the following factors shall be considered:

- (j) Potential adverse effects on groundwater quality, considering:
 - (i) The physical and chemical characteristics of constituents in the residual radioactive material at the site, including their potential for migration;
 - (ii) The hydrogeological characteristics of the site and surrounding land;
 - (iii) The quantity of groundwater and the direction of groundwater flow;
 - (iv) The proximity and withdrawal rates of groundwater users;
 - (v) The current and future uses of groundwater in the region surrounding the site;
 - (vi) The existing quality of groundwater, including other sources of contamination and their cumulative impact on the groundwater quality;
 - (vii) The potential for health risks caused by human exposure to constituents;
 - (viii) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to constituents;
 - (ix) The persistence and permanence of the potential adverse effects;
 - (x) The presence of underground sources of drinking water and exempted aquifers identified under § 144.7 of this chapter; and
- (2) Potential adverse effects on hydraulically-connected surface-water quality, considering:
 - (i) The volume and physical and chemical characteristics of the residual radioactive material at the site;
 - (ii) The hydrogeological characteristics of the site and surrounding land;
 - (iii) The quantity and quality of groundwater, and the direction of groundwater flow;
 - (iv) The patterns of rainfall in the region;
 - (v) The proximity of the site to surface waters;
 - (vi) The current and future uses of surface waters in the region surrounding the site and any water quality standards established for those surface waters;
 - (vii) The existing quality of surface water, including other sources of contamination and their cumulative impact on surface water quality;

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- (viii) The potential for health risks caused by human exposure to constituents;
- (ix) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to constituents; and
- (x) The persistence and permanence of the potential adverse effects.
- (4) Point of compliance: The point of compliance is the location at which the groundwater concentration limits of paragraph (c)(3) of this section apply. The point of compliance is the intersection of a vertical plane with the uppermost aquifer underlying the site, located at the hydraulically downgradient limit of the disposal area plus the area taken up by any liner, dike, or other barrier designed to contain the residual radioactive material.
- (d) Each site on which disposal occurs shall be designed and stabilized in a manner that minimizes the need for future maintenance.

[60 FR 2865, Jan. 11, 1995]

§ 192.03 Monitoring.

A groundwater monitoring plan shall be implemented, to be carried out over a period of time commencing upon completion of remedial actions taken to comply with the standards in § 192.02, and of a duration which is adequate to demonstrate that future performance of the system of disposal can reasonably be expected to be in accordance with the design requirements of § 192.02(c). This plan and the length of the monitoring period shall be modified to incorporate any corrective actions required under § 192.04 or § 192.12(c).

[60 FR 2866, Jan. 11, 1995]

§ 192.04 Corrective action.

If the groundwater concentration limits established for disposal sites under provisions of § 192.02(c) are found or projected to be exceeded, a corrective action program shall be placed into operation as soon as is practicable, and in no event later than eighteen (18) months after a finding of exceedance. This corrective action program will restore the performance of the system of disposal to the original concentration limits established under

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§ 192.02(c)(3), to the extent reasonably achievable, and, in any case, as a minimum shall:

- (a) Conform with the groundwater provisions of § 192.02(c)(3), and
- (b) Clean up groundwater in accordance with subpart B, modified as appropriate to apply to the disposal site.

[60 FR 2866, Jan. 11, 1995]

TABLE 1 TO SUBPART A—MAXIMUM CONCENTRATION OF CONSTITUENTS FOR GROUNDWATER PROTECTION

Constituent concentration ¹	Maximum
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium	0.05
Lead	0.05
Mercury	0.002
Selenium	0.01
Silver	0.05
Nitrate (as N)	10.
Molybdenum	0.1
Combined radium-226 and radium-228	5 pCi/liter
Combined uranium-234 and uranium-238	30 pCi/liter
Gross alpha-particle activity (excluding radon and uranium)	15 pCi/liter
Endrin (1,2,3,4,10,10-hexachloro-6,7-exposy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo-endo-5,8-dimethanonaphthalene)	0.0002
Lindane (1,2,3,4,5,6-hexachlorocyclohexane, gamma isomer)	0.004
Methoxychlor (1,1,1-trichloro-2,2'-bis(p-methoxyphenyl)ethane)	0.1
Toxaphene (C ₁₈ H ₁₄ Cl ₈ , technical chlorinated camphene, 67-69 percent chlorine)	0.005
2,4-D (2,4-dichlorophenoxyacetic acid)	0.1
2,4,5-TP Silvex (2,4,5-trichlorophenoxypropionic acid)	0.01

¹ Milligrams per liter, unless stated otherwise.
² Where secular equilibrium obtains, this criterion will be satisfied by a concentration of 0.044 milligrams per liter (0.044 mg/l). For conditions of other than secular equilibrium, a corresponding value may be derived and applied, based on the measured site-specific ratio of the two isotopes of uranium.

[60 FR 2866, Jan. 11, 1995]

Subpart B—Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites

§ 192.10 Applicability.

This subpart applies to land and buildings that are part of any processing site designated by the Secretary of Energy under section 102 of the Act.

§ 192.11

section 101 of the Act, states, in part, that "processing site" means—

- (a) Any site, including the mill, containing residual radioactive materials at which all or substantially all of the uranium was produced for sale to any Federal agency prior to January 1, 1971, under a contract with any Federal agency, except in the case of a site at or near Slick Rock, Colorado, unless—
 - (1) Such site was owned or controlled as of January 1, 1978, or is thereafter owned or controlled, by any Federal agency, or

(2) A license (issued by the (Nuclear Regulatory) Commission or its predecessor agency under the Atomic Energy Act of 1954 or by a State as permitted under section 274 of such Act) for the production at site of any uranium or thorium product derived from ores is in effect on January 1, 1978, or is issued or renewed after such date; and

(b) Any other real property or improvement thereon which—

- (1) Is in the vicinity of such site, and
- (2) Is determined by the Secretary, in consultation with the Commission, to be contaminated with residual radioactive materials derived from such site.

§ 192.11 Definitions.

(a) Unless otherwise indicated in this subpart, all terms shall have the same meaning as defined in subpart A.

(b) *Land* means any surface or subsurface land that is not part of a disposal site and is not covered by an occupiable building.

(c) *Working Level (WL)* means any combination of short-lived radon decay products in one liter of air that will result in the ultimate emission of alpha particles with a total energy of 130 billion electron volts.

(d) *Soil* means all unconsolidated materials normally found on or near the surface of the earth including, but not limited to, silts, clays, sands, gravel, and small rocks.

(e) *Limited use groundwater* means groundwater that is not a current or potential source of drinking water because (1) the concentration of total dissolved solids is in excess of 10,000 mg/l,



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

April 16, 2001

Mr. Mark S. Pelizza, President
Hydro Resources, Inc.
12750 Merit Drive
Suite 720, LB 12
Dallas, TX 75251

SUBJECT: ACCEPTANCE OF RESTORATION ACTION PLAN FOR HYDRO
RESOURCES IN-SITU URANIUM MINING PROJECT, LICENSE SUA-1580

Dear Mr. Pelizza:

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the Hydro Resources, Inc. (HRI) responses, dated March 16, 2001, to the NRC's February 16, 2001, "Request for Additional Information Concerning Restoration Costs for Hydro Resources In-Situ Uranium Mining Project." The specific questions in the staff's Request for Additional Information (RAI) were based on its review of the November 21, 2000, Restoration Action Plan (RAP) submitted by HRI in response to the Commission's Memorandum and Order, CLI-00-08, dated May 25, 2000.

The Commission's Order added a condition to HRI's license prohibiting HRI from using its license "until the NRC Staff has approved its decontamination, decommissioning, and reclamation plan, including the requisite financial-assurance plan and cost estimate." CLI-00-8, 51 NRC 227, at 242. With respect to the cost estimates on which HRI's initial surety would be based, the Commission further stated that HRI need only address anticipated costs related to operations at its Church Rock Section 8 site, and that an NRC-approved surety arrangement need not be in place until HRI is ready to begin its mining operations at Section 8. See *id.*, at 242 and n.19, citing HRI License Condition 9.5. Pursuant to Condition 9.5, the initial surety will be subject to annual updates.

The RAP, and the Crownpoint Uranium Project Consolidated Operations Plan, Rev. 2.0, August 15, 1997 (COP), which is referenced throughout the RAP, state that the preliminary well field design(s) for Church Rock Section 8 will be further refined based on the results of additional exploratory drilling prior to the start of operation. The well fields will be sequentially developed, and HRI anticipates that reclamation of the well field(s) will be in phases. The COP predicts that four Church Rock Section 8 well fields will be operated and reclaimed over five-and-a-half years.

At this time, HRI has not established a projected date to begin work at the Church Rock Section 8 site, and it has not obtained other regulatory agency permits required prior to operation. Consequently, before mining begins at Section 8, HRI must update the RAP and submit to the NRC for review and approval of any changes as part of the process of establishing the requisite NRC-approved surety mechanism. After the start of operations at the Church Rock Section 8 site, information gained on the site characteristics will be factored in to each annual surety update.

EXHIBIT

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April 16, 2001
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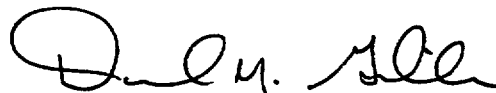
Mr. M. Pelizza

The staff has determined that the HRI responses to the RAI are adequate. These responses, in combination with the information in the RAP and the COP, provide an acceptable plan and cost estimate for the decontamination, decommissioning, and restoration of the first well field that could be established at Church Rock Section 8, and the related processing area located in Crown Point, New Mexico. Accordingly, the staff is hereby approving the RAP.

Please contact Ken Hooks, the NRC Project Manager for the Hydro Resources, Inc. site, at 301- 415-7777 or by e-mail at krh1@nrc.gov, if you have any questions concerning this matter.

In accordance with 10 CAR 2.790 of the NRC's "Rules of Practice," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the PUBLICLY Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/NRC/ADAMS/index.html> (the Public Electronic Reading Room).

Sincerely,



Daniel M. Gillen, Acting Chief
Fuel Cycle Licensing Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Docket No.: 40-8968
License No.: SUA-1580

cc: See attached mailing list