6.0

TABLE 6.1

NRC GROUND WATER PROTECTION STANDARDS
AND THEIR EXCEEDANCES
BY FORMATION OF CONCERN (a)

Chemical Constituent	Ground Water (b) Protection Standard	Zone 3	Zone 1	Southwest Alluvium
Arsenic	= 0.05	X	--	--
Beryllium	= 0.05	X	X	--
Cadmium	= 0.01	X	X	--
Chloroform	= 0.001	X	--	--
Cyanide	= 0.005	X	X	X
Gross alpha (c)	= 15.0 (pCi/l)	X	X	X
Lead	= 0.05	X	--	X
Lead-210	= 1.0 (pCi/l)	X	X	--
Naphthalene	= 0.001	X	--	--
Nickel	= 0.05	X	X	--
Selenium	= 0.01	X	X	X
Combined Radium-226 and Radium-228	= 5.0 (pCi/l)	X	X	X
Uranium	= 0.3	X	--	--
Thorium-230	= 5.0 (pCi/l)	X	X	X
Vanadium	= 0.1	X	--	--

(a) X denotes that the NRC Standard is exceeded in the indicated formation.
-- denotes that the standard has not been exceeded.

(b) mg/l except as noted.

(c) Minus gross alpha contribution from radon and uranium.

TABLE 6.2

EPA CONTAMINANT-SPECIFIC GROUND WATER ARARs
AND THEIR EXCEEDANCES BY
FORMATION OF CONCERN (a)

Chemical Constituent	Applicable or Relevant and Appropriate Requirements (ARARs) (b)	Zone 3	Zone 1	Southwest Alluvium
Aluminum	5.0	X	X	--
Antimony	0.014	--	--	--
Arsenic (c)	0.05	X	X	--
Barium	1.0	--	--	--
Beryllium	0.017	--	--	--
Cadmium (c)	0.01	X	X	X
Chromium	0.05	--	--	--
Cobalt (c)	0.05	X	X	X
Copper	1.0	--	--	--
Iron	5.5	--	--	--
Lead	0.05	--	--	--
Manganese	2.6	X	X	X
mercury	0.002	--	--	--
Molybdenum	1.0	X	X	X
Nickel (c)	0.2	X	X	X
Selenium (c)	0.01	X	X	X
Silver	0.05	--	--	--
Thallium	0.014	--	--	--
Vanadium	0.7	--	--	--
Zinc	10.0	--	--	--
Chloride	250.0	--	--	--
Sulfate	2,160.0	--	--	--
Nitrate as N	30.0	X	X	X
TDS	3,170.0	X	X	X
Uranium-238	5.0	--	--	--
Thorium-230	15 pCi/l	--	--	--
Gross Alpha (c)	15 pCi/l (d)	X	X	X
Combined Radium-226 and Radium-228 (c)	5 pCi/l	X	--	--

(a) X denotes that the NRC Standard is exceeded in the indicated formation.
-- denotes that the standard has not been exceeded.

(b) mg/l except as noted.

(c) These constituents are of primary concern as identified in EPA's ROD (EPA, 1988a).

(d) Minus gross alpha contribution from radon and uranium.

TABLE 6.3

PERFORMANCE MONITORING ANALYTES (a)

Arsenic
Aluminum
Cadmium
Chloride
Cobalt
Nitrate
Sulfate
Ammonia
Manganese
Molybdenum
Calcium
Magnesium
Sodium bicarbonate
Potassium
TDS
Beryllium
Chloroform
Cyanide
Lead
Lead 210
Naphthalene
Nickel
Combined Radium-226, Radium-228
Selenium
Thorium-230
Uranium
Gross Alpha
Vanadium

(a) Field pH and water levels will be measured when samples are collected.

TABLE 6.4

IMPLEMENTATION OF THE CORRECTIVE ACTION PROGRAM
UNITED NUCLEAR CHURCH ROCK SITE

	Activity	Date Started or Submitted	Date Completed	Date Start Operation
1.	Installation of Evaporation Disposal System o Two-cell Evaporation Pond o Pond Misters o Distribution lines connecting the extraction wells to the system o Distribution lines to the mist evaporation system on the tailings	10/88	1/89	1/5/89
2.	Dewater Borrow Pit No. 2 o Originally scheduled to be completed by 10/89 o Continue operation of Zone 1 wells although borrow pit is dry	1/5/89	4/29/89	N/A
3.	Installation of Zone 3 Extraction Wells o Install Wells 708 - 712 o Aquifer Test using Wells 708 - 712 o Refine system design based on test; eliminate Well 704 from system	5/3/89	6/29/89	8/7/89
4.	Install Southwest Alluvium Extraction and Monitoring Wells o Install Extraction Wells 801 - 803 o Install Monitoring Wells 804 - 807 o Aquifer test o Install and test distribution lines to evaporation disposal system	8/3/89	8/30/89	10/16/89
5.	Submit 1989 Annual Review o Well Installation o Dewater Borrow Pit No. 2 o Performance monitoring evaluation of Zone 3 and Zone 1 (water levels and water quality) o Performance monitoring evaluation of Southwest Alluvium not applicable because system had not operated long enough to generate data for this report o Evaporation disposal system performance o Recommendations for continued operation	12/31/89	N/A	N/A

TABLE 6.4

IMPLEMENTATION OF THE CORRECTIVE ACTION PROGRAM
UNITED NUCLEAR CHURCH ROCK SITE
(Continued)

	Activity	Date Started or Submitted	Date Completed	Date Start Operation
6.	NRC and EPA submit comments to the 1989 Annual Review o Zone 3 system operating as designed o Add additional monitoring well to Zone 3 system o Continue operation of Zone 1 extraction wells although Borrow Pit No. 2 is dry; propose a modified pumping program o Continue operation of Southwest Alluvium system	2/90	N/A	N/A
7.	United Nuclear Response to Comments o Add Well 126 as performance monitoring well for Zone 3 o Demonstrate that mound in Zone 1 is dissipating in response to dewatering; however, the process is slow because of the low hydraulic conductivity of the formation o Request permission to turn off existing Zone 1 wells. o Continue operation of Southwest Alluvium system	3/90	N/A	
8.	Modified Zone 1 Pumping Program o Required by NRC and EPA, request to turn off Zone 1 pumping wells denied. o Decommission existing east and north cross-dike pump-back wells o Operate revised east pump-back system consisting of Wells 615, 616, 617, and EPA 7 o Continue to monitor performance monitoring wells designated in the RD	6/11/90	Agency Approval	9/24/90
9.	Submit 1990 Annual Review o Zone 3 system continues to perform as designed o Zone 1 revised east pump-back system performance further demonstrates that active remediation is not feasible o Southwest Alluvium system performs as designed	12/31/90		

TABLE 6.4

IMPLEMENTATION OF THE CORRECTIVE ACTION PROGRAM
UNITED NUCLEAR CHURCH ROCK SITE
(Continued)

	Activity	Date Started or Submitted	Date Completed	Date Start Operation
10.	NRC and EPA submit comments to the 1990 Annual Review o Zone 3 performing as designed o Requires installation of the Zone 3 Stage II wells as designed in the RD o Requires proposal for final demonstration that active remediation in Zone 1 is not feasible o Requires proposal for additional extraction well(s) in Southwest Alluvium to enhance the hydraulic barrier currently created by the system o Requires revision to the data presentation in the next annual reviews including: - Calculate the mass of hazardous constituents removed by the corrective action systems in all three formations - Include water quality data for all wells monitored in tabular form within the main body of the report - Include an isopach map of saturated thickness	2/91		
11.	United Nuclear response to comments o Amendment request for installation of the Zone 3 Stage II wells (Wells 714 - 720) at the locations designated on Figure 2-4 of the RD o Amendment request for installation of a well o Presentation of data in future annual reviews will be modified as requested	4/91		
12.	United Nuclear proposes program for ALARA Demonstration	7/91		
13.	NRC and EPA approve proposals for amendments to Zone 3 and Southwest Alluvium systems, incorporated as Amendment 12	7/91		
14.	Install Wells o Zone 3 Stage II, Wells 714-720 o Southwest Alluvium Well 808	5/20/91	6/14/91	6/24/91

TABLE 6.5

DATA FROM ZONE 3 WELLS
USED TO GENERATE ISOPACH MAP
OF SATURATED THICKNESS (FIGURE 6-6)

Well Number	Top of Zone 3 (elevation, feet)	Bottom of Zone 3 (elevation, feet)	Water Level October 1987 (elevation, feet)	Saturated Thickness (feet)
TWQ-121	6,959.9	6,879.9	6,918.6	18.7
TWQ-125	6,938.4	6,883.4	6,902.5	19.1
TWQ-126	6,931.2	6,866.2	6,905.4	39.2
TWQ-127	6,926.3	6,851.3	6,900.4	49.1
510B	6,948.8	6,868.8	6,892.2	23.4
502B	6,913.9	6,943.9	6,896.3	52.4
503B	6,928.4	6,855.4	6,896.6	41.2
518	6,924.0	6,860.0	6,902.1	42.1
EPA-3	6,939.3	6,887.3	6,899.2	11.9
EPA-6	6,950.1	6,901.1	6,914.0	12.9
EPA-9	6,952.9	6,902.9	6,911.1	8.2
EPA-13	6,920.5	6,856.5	6,882.7	26.2
EPA-15	6,895.4	6,829.4	6,895.8	66.4
EPA-18	6,938.9	6,881.9	6,488.7	2.8
EPA-19	6,939.2	6,878.2	6,887.5	9.3

Source: United Nuclear NRC monitoring program and well logs (United Nuclear, personal communication).

TABLE 6.6

PUMPING RATES FOR ZONE 3
COMPUTER MODEL PERFORMANCE SIMULATION

Well Number	Year 1 Pumping Rate (gpm) (b)	Year 2 Pumping Rate (gpm) (b)	Year 3 Pumping Rate (gpm) (b)
701	5	4	2
702	5	4	0
703	5	2	0
704	5	2	0
705	5	2	0
706	5	2	1.5
707	5	2	1.5
708	2.5	2	0
709	5	4	1.5
710	5	4	0
711	2.5	2	0
712	5	4	1.5
713	5	2	2
714	0	0	2
715	0	0	5
716	0	0	5
717	0	0	2
718	0	0	5
719	0	0	5
720	0	0	5
Total	60	36	39

3–year average pumping rate: 45 gpm

(a) These pumping rates utilized from the end of year 2 to the end of the model simulation at time equals 2.5 years.

(b) Well showing a zero pumping rate is either decommissioned or not installed.

TABLE 6.7

ZONE 3 PERFORMANCE MONITORING WELLS

Wells Specified in License Condition Parts A and B (a)	Extraction System Wells (b)
TWQ 106D	701
TWQ 9D	702
517	703
518	704 (c)
504-B	705
502-B	706
501-B	707
420	708
411	709
EPA-18	710
EPA-17	711
EPA-15	712
EPA-14	713
EPA-13	714
EPA-12	715
EPA-11 (d)	716
EPA-9	717
EPA-3	718
EPA-1	719
	720
	TWQ 126 (e)

(a) Wells in this column will be sampled quarterly for water level and constituents specified in Table 6.3.

(b) Wells in this column will be monitored for water level only.

(c) Well 704 was not installed because the results of the aquifer test conducted during installation of the Stage I wells indicated that inclusion of this well would detract from the performance of the system.

(d) Well EPA 11 was abandoned after second quarter 1990 with approval from the NRC and EPA. The water level had dropped below the pump intake and the pump could not be lowered in the well.

(e) Well TWQ 126 was added to monitor water levels at the request of the NRC and EPA in their comments to the 1989 Annual Review (Canonie, 1989c).

TABLE 6.8

IMPLEMENTATION OF THE ZONE 3 CORRECTIVE ACTION PROGRAM

	Activity	Date Started or Submitted	Date Completed
1.	Install Zone 3 Stage I Extraction Wells o Install Wells 708 - 712 o Aquifer Test using Wells 708 - 712 o Refine system design based on test; eliminate Well 704 from system o Install Wells 701 - 707 excluding Well 704	5/3/89	6/29/89
2.	Start Zone 3 Stage I well operation	8/89	N/A
3.	Submit 1989 Annual Review o Description of Zone 3 Stage I Well Installation o Performance monitoring evaluation of Zone 3 (water levels and water quality) o Recommendations for continued operation	12/89	N/A
4.	NRC and EPA submit comments to the 1989 Annual Review o Zone 3 system operating as designed o Add additional monitoring well to Zone 3 system	2/90	N/A
5.	United Nuclear Response to Comments o Add Well 126 as performance monitoring well for Zone 3	3/90	7/90
6.	Well 126 added to Performance Monitoring Program o Included in Amendment 7 to the NRC License		4/90
7.	Submit 1990 Annual Review o Zone 3 system continues to perform as designed o Well EPA 11 abandoned	12/90	
8.	NRC and EPA submit comments to the 1990 Annual Review o Zone 3 performing as designed o Requires installation of the Zone 3 Stage II wells as designed in the RD	2/91	N/A

TABLE 6.8

IMPLEMENTATION OF THE ZONE 3 CORRECTIVE ACTION PROGRAM
(Continued)

	Activity	Date Started or Submitted	Date Completed
9.	United Nuclear Response to Comments o Amendment request for installation of the Zone 3 - Stage II wells (Wells 714 - 720) at the locations designated on Figure 2-4 of the RD (Canonie, 1989d)	4/91	N/A
10.	NRC and EPA approve proposals for amendment to Zone 3 o Included in Amendment 12 to the NRC License	7/91	N/A
11.	Install Zone 3 - Stage II Wells o Install and test Wells 714-720	5/91	6/91
12.	Start operation of Zone 3 - Stage II wells	8/91	N/A

TABLE 6.9

SUMMARY OF 1989 OPERATIONAL DATA
ZONE 3 - STAGE I WELLS

Well Number	Automatic Control (yes/no)	(a) Initial Pumping Rate (gpm)	Current Pumping Rate (gpm)	(b) Average Pumping Rate (gpm)	(c) Design Pumping Rate (gpm)	(d)
701	No	4.2	6.3	5.4	5	
702	Yes	1.3	0.4	~1.0	5	
703	No	3.7	2.0	3.0	5	
705	No	1.0	1.4	1.7	5	
706	No	5.0	8.0	8.2	5	
707	No	4.0	3.8	4.3	5	
708	No	2.5	4.0	4.7		2.5
709	No	5.0	2.4	2.8	5	
710	No	2.0	0.8	1.1	5	
711	No	3.8	5.3	5.0		2.5
712	Yes	4.3	2.1	~2.7	5	
713	Yes	3.0	2.6	3.0	5	
			Total	43	55	

Total Volume Pumped = 5.6 million gallons (c)

(a) Wells equipped with the automatic control pump in cycles. If the well is not pumping at the time of inspection, then the pumping rate cannot be recorded. The well meters record the cumulative flow and the flow rate is calculated based on these readings and the time elapsed between readings.

(b) Average pumping rate reported for the week of November 10 through November 17, 1989.

(c) Pumping rate and total volume pumped estimated for the period between August 7 through November 17, 1989.

(d) The total design pumping rate presented in the RD (Canonie, 1989a) was 60 gpm. This rate included 5 gpm for Well 704, which has been excluded from the system.

TABLE 6.10

SUMMARY OF 1990 OPERATIONAL DATA
ZONE 3 - STAGE I WELLS

Well Number	Automatic Control (yes/no)	(a) Average Pumping Rate (gpm) (b)	Current Pumping Rate (gpm) (c)	Design Pumping Rate (gpm) (d)
701	Yes	3.9	0.0	4
702	Yes	0.2	0.1	4
703	Yes	1.3	1.1	2
705	Yes	1.5	1.4	2
706	No	7.1	0.0	2
707	No	3.2	0.0	2
708	No	3.2	2.6	2
709	Yes	1.9	0.0	4
710	Yes	0.6	0.0	4
711	No	3.7	3.6	2
712	Yes	1.4	1.0	4
713	Yes	2.0	1.0	2
	Total	30.0	10.8	34.0

Total Volume Pumped = 15.3 million gallons (b)

(a) Wells equipped with the automatic control pump in cycles. If the well is not pumping at the time of inspection, then the pumping rate cannot be recorded. The flow rate is calculated based on the cumulative flow recorded on the meters at each well and the time elapsed between readings.

(b) Average pumping rate and total volume pumped calculated for the period between October 13, 1989 and October 12, 1990.

(c) Current pumping rate reported for the week of October 5 through October 12, 1990.

(d) The total design pumping rate presented in the RD (Canonie, 1989a) was 34 gpm, which excludes 2 gpm for Well 704 that was not included in the system.

TABLE 6.11

ZONE 1 PERFORMANCE MONITORING WELLS

515A
516A
604
614
EPA-2
EPA-4
EPA-5
EPA-7 (a)
EPA-8
TWQ-141
TWQ-142
TWQ-143

(a) Well EPA-7 is also a pumping well. In accordance with NRC and EPA comments to the 1989 Annual Review (Canonie, 1989c), EPA-7 began pumping in September 1990 as part of the revised east pump-back system.

Notes:

1. All wells listed are included in the monitoring program required by NRC under License Condition 30, Parts A and B.

TABLE 6.12

IMPLEMENTATION OF THE ZONE 1 CORRECTIVE ACTION PROGRAM

	Activity	Date Started or Submitted	Date Completed
1.	Dewater Borrow Pit No. 2	1/5/89	4/29/89
2.	Operate east and north cross-dike pump-back wells	1/1/89	9/24/90 (See Activity No. 6 below)
3.	Submit 1989 Annual Review o Complete dewatering of Borrow Pit No. 2 o Performance monitoring evaluation of Zone 1 (water levels and water quality) o Recommend decommissioning pump-back wells	12/89	N/A
4.	NRC and EPA submit comments to the 1989 Annual Review o Zone 1 mound not dissipating as fast as the agencies anticipated o United Nuclear required to continue pumping o Request proposal for modification of the current pumping system	2/90	N/A
5.	United Nuclear Response to Comments o Provide data demonstrating that the mound is dissipating at the rate expected given the hydraulic properties of the formation o Request that the existing wells be turned off	3/90	N/A
6.	Modified Zone 1 pumping program o Required by NRC and EPA; denied request to turn off the pump-back wells o Proposed by United Nuclear o Included as Amendment 7 to the license	6/90	7/90 (Agency Approval)