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DOE-0320-00

Mr. James A. Saric, Remedial Project Manager
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Region V-SRF-5J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911

Ms. Val Orr
Division of Drinking and Ground Waters - UIC Unit
P.O. Box 1049
1800 Watermark Drive
Columbus, Ohio 43216-1049

Dear Mr. Saric, Mr. Schneider, and Ms. Orr:

**SEPTEMBER 1999 OPERATING REPORT FOR THE RE-INJECTION DEMONSTRATION**

This correspondence submits the Re-Injection Demonstration Operation Report for the month of September 1999.

As specified in the Re-Injection Demonstration Test Plan, monthly operating reports for the re-injection demonstration are to be prepared and submitted to the U.S. Environmental Protection Agency (U.S. EPA), Ohio Environmental Protection Agency (OEPA) Office of Federal Facilities Oversight, and the OEPA Division of Drinking and Ground Waters-UIC Unit.

If you have any questions regarding this submittal, please contact Robert Janke at (513) 648-3124.

Sincerely,

Johnny W. Reising
Fernald Remedial Action
Project Manager

FEMP:R.J. Janke

Enclosure

cc w/enclosure:
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# MONTHLY OPERATING REPORT
# RE-INJECTION DEMONSTRATION
# SEPTEMBER 1999

## OVERVIEW

The FEMP Re-Injection Demonstration began on September 2, 1998. The controlling document for the Re-Injection Demonstration is the Re-Injection Demonstration Test Plan, Rev. 0. A requirement of Section 6 of the test plan is that monthly operating reports be submitted to the U.S. EPA, Ohio EPA Office of Federal Facilities Oversight and the Division of Ohio EPA Drinking and Ground Waters - UIC Unit. The monthly operating reports are to include the following information:

I. Analysis of the injectate
II. The volume and rate of re-injection
III. A description of any well maintenance and rehabilitation procedures which were conducted
IV. Results of groundwater monitoring at the re-injection test site.

This report serves to fulfill this commitment for the month of September 1999. It covers operation of the Re-Injection Demonstration from September 1, 1999 through October 1, 1999.

On September 2, 1999, DOE completed one year of active groundwater re-injection as part of a one-year groundwater re-injection demonstration. DOE is currently in the process of preparing a final report.

Although the data are still being analyzed, operational experience gained over the last year indicates that DOE can effectively operate the re-injection wells. A cursory review of the data collected from the aquifer over the past year indicates that groundwater re-injection has not had any adverse effects on the aquifer.

However, the issues surrounding the added costs and operational demands due to the regeneration process for ion exchange resin used in treating injectate will play a key role in determining the viability of the re-injection process. This and other issues will be evaluated over the next few months as part of the comprehensive analysis of the data and to address specific issues on, and objectives of re-injection, as outlined in the test plan. DOE anticipates that the conclusions reached from this final analysis will support the preliminary decision to continue with the use of re-injection.

## ANALYSIS OF THE INJECTATE

Groundwater which is being extracted from the great Miami Aquifer is being treated for uranium removal and re-injected back into the Great Miami Aquifer. The groundwater is being treated in the FEMP Advanced Waste Water Treatment (AWWT) Expansion Facility. The effluent from the AWWT Expansion Facility is being sampled monthly for the parameters listed in Table 2.1 of the Re-Injection Demonstration Test Plan, Rev. 0. Monthly injectate grab sampling is focusing on the final remediation level (FRL) constituents that have had an exceedance of their FRL in the area of the aquifer from which the groundwater is being pumped. The monthly injectate grab samples are being sent to an off-site laboratory for analysis.

Preliminary results from the monthly injectate grab sample collected in September are provided in Table 1. These results indicate that all the constituent concentrations are below their respective FRLs.

Figure 1 shows the composite daily uranium results from the AWWT Expansion Facility effluent. These results are derived from the 24-hour composite sampler, which samples the combined effluent from the active treatment trains comprising the facility. The results are used by plant management as process control; they provide a daily evaluation of the quality of the water that is being re-injected back into the Aquifer. As discussed in the well maintenance and rehabilitation section, re-injection was not taking place on September 24, 25 and 26, when composite daily results indicated that the uranium concentration of the AWWT Expansion Facility effluent was above 20 $\mu$g/L.

## VOLUME AND RATE OF RE-INJECTION

Treated groundwater is being re-injected into the Great Miami Aquifer in five re-injection wells at a rate of 200 gallons per minute, per well. Figure 2 illustrates the location of the five re-injection wells. Re-Injection Well 8 is 8 inches in diameter. Re-Injection Well 9 is 12 inches in diameter. The other re-injection wells are all 16 inches in diameter. The combined design re-injection rate for all five wells is 1000 gallons per minute. Operational data specific to each re-injection well are provided in Tables 2 through 6.

Figure 3 illustrates the water level rise in each of the five re-injection wells from September 1, 1999 through October 1, 1999, as measured by the operators at the AWWT Expansion Facility Distributed Control System (DCS). Water levels are recorded three times per day. Water levels inside the re-injection wells are monitored as an indicator of plugging within the wells. Given a constant

re-injection rate, as a well screen becomes plugged, the water level in the well rises to compensate for the greater pressure needed to move the same volume of water through a smaller opening.

While it is not the intent of this report to discuss operational efficiency issues, the following information is provided to aid in the interpretation of Figure 3. As discussed in the next section, Re-Injection Wells 8 and 10 underwent rehabilitation during September to address plugging. From September 20, 1999 to September 28, 1999 (readings 1152 to 1175) all of the re-injection wells were down (not operating) to facilitate a planned upgrade to the DCS system. Although re-injection resumed on September 28, DCS water level readings in the re-injection wells were not recorded until September 30, 1999 (reading 1182).

## WELL MAINTENANCE AND REHABILITATION

Re-Injection Well 8 underwent rehabilitation to address plugging from September 9, 1999 to September 13, 1999 (readings 1113 through 1130). When the well began operating back on September 2, 1998, the initial water level rise in the well was 5.34 feet. Just prior to September 9, 1999, the water level rise in the well was 15.80 feet. This is the fourth time that Re-Injection Well 8 has been rehabilitated to address plugging.

Re-Injection Well 8 was rehabilitated using the same procedure that was used the three previous times. Approximately 2 gallons of sodium hypochlorite (12.5 percent chlorine) were added to the well. The well screen was swabbed and surged and approximately 9,250 gallons of water were pumped from the well. The chlorine concentration of the pumped water from the well at the end of rehabilitation was 0.03 ppm. Upon return to service on September 13, 1999 the water level rise in the well was approximately 4.92 feet. The water level rise following the first three rehabilitations were 4.02 feet, 7.48 feet, and 7.62 feet respectively.

Re-Injection Well 10 underwent rehabilitation to address plugging from September 13, 1999 to September 21, 1999 (readings 1113 to 1181). When the well began operating back on September 2, 1998 the initial water level rise in the well was 4.92 feet. Just prior to September 9, 1999 (the day that re-injection was stopped for the latest rehabilitation) the water level rise in the well was 51.23 feet. This is the second time that Re-Injection Well 10 has been rehabilitated to address plugging.

Re-Injection Well 10 was rehabilitated using the same procedure that was used the first time. Approximately 5 gallons of sodium hypochlorite were added to the well. The well screen was swabbed

and surged and approximately 14,450 gallons of water were pumped from the well. The chlorine concentration of the pumped water from the well at the end of rehabilitation was 0.04 ppm. The well was returned to service on September 28, 1999. Re-injection did not take place from September 20 to September 23, to facilitate an upgrade to the DCS, and to regenerate a treatment vessel. Re-injection remained shut down from September 23 to September 28, to verify that the uranium concentration of the treated effluent was at acceptable levels (i.e. $<20$ $\mu$g/L) prior to resuming re-injection. Although re-injection resumed on September 28, 1999, DCS water level readings in the re-injection wells were not recorded until September 30, 1999 (reading 1182). The water level rise in the well on September 30, was approximately 4.29 feet. The water level rise following the first rehabilitation was 8.54 feet.

## GROUNDWATER MONITORING RESULTS

Water quality samples during the Re-Injection Demonstration were collected quarterly and analyzed for major anions, cations, and total uranium. The first round of water quality data was collected in August 1998, prior to the start of re-injection. Results of the August sampling event were reported in the September monthly report. The second round of water quality samples was collected in December 1998. Results of the December sampling event were reported in the January monthly report. The third round of water quality samples for the Re-Injection Demonstration was collected in March 1999. Results of the March sampling event were reported in the April monthly report. The fourth round of sampling took place from June 7, 1999 to August 11, 1999. The sampling was integrated with ongoing IEMP sampling activities to improve efficiency in the field. Data from the fourth round of sampling are presented in Table 7.

As explained in the overview section of this report the one-year groundwater Re-Injection Demonstration officially ended on September 2, 1999. No water quality sampling, other than IEMP sampling, is planned at this time. Results from the demonstration will be presented in a report, which will be issued in June of 2000. The final report will make recommendations concerning additional monitoring if it is determined that additional monitoring is warranted.

# TABLE 1

## ANALYSIS OF INJECTATE - PRELIMINARY RESULTS
## Sample Collected September 13, 1999

| Constituents[a] | Result[b] | Groundwater FRL[c] | Detection Limit | Constituent Type[e] | Basis for FRL[f] |
|---|---|---|---|---|---|
| **General Chemistry** | | mg/L | | | |
| Nitrate | 0.6 | 11.0 | | MP | B |
| **Inorganics** | | mg/L | | | |
| Antimony | U | 0.006 | 0.00062 | N | A |
| Arsenic | 0.0012 B | 0.05 | | N | A |
| Barium | 0.0486 | 2.0 | | N | A |
| Beryllium | U | 0.004 | 0.00002 | N | A |
| Cadmium | U | 0.014 | 0.00008 | N | B |
| Total Chromium | 0.0015 B | 0.022[d] | | MP | R |
| Cobalt | U | 0.17 | 0.00012 | N | R |
| Lead | U | 0.015 | 0.00052 | N | A |
| Manganese | 0.0008 B | 0.9 | | N | B |
| Mercury | U | 0.002 | 0.0001 | MP | A |
| Nickel | 0.00037 B | 0.1 | | N | A |
| Selenium | U | 0.05 | 0.00092 | N | A |
| Silver | U | 0.05 | 0.00025 | N | R |
| Vanadium | U | 0.038 | 0.00015 | N | R |
| Zinc | U | 0.021 | 0.0002 | N | B |
| **Radionuclides** | | pCi/L | | | |
| Neptunium-237 | U | 1.0 | -0.027 | MP | R* |
| Radium-226 | 0.087 | 20.0 | | N | A |
| Strontium-90 | U | 8.0 | 0.101 | MP | A |
| Thorium-228 | U | 4.0 | 0.085 | N | R* |
| Thorium-232 | U | 1.2 | 0 | N | R* |
| | | µg/L | | | |
| Total Uranium | 9.56 | 20.0 | | MP | A |
| **Organics** | | µg/L | | | |
| Bis(2-ethylhexyl)phthalate | U | 6.0 | 5 | N | A |
| Carbon disulfide | U | 5.5 | 1 | N | A |
| 1, 1-Dichloroethene | U | 7.0 | 1 | N | A |
| 1, 2-Dichloroethane | U | 5.0 | 1 | MP | A |
| Trichloroethene | U | 5.0 | 1 | N | A |

[a]Constituents taken from Table 2-1 of Re-Injection Demonstration Test Plan. Constituents are those previously detected in aquifer zones 2 and 4 at concentrations above their FRL.

[b]If a duplicate sample was analyzed the highest concentration between the regular sample and duplicate sample is reported.
B = Lab qualifier(inorganic). Reported value was obtained from a reading that was less than the contract required detection limit but greater than or equal to the instrument detection limit.
U = Nondetect

[c]From Table 9-4 in OU5 ROD.

[d]FRL is for hexavalent chromium.

[e]Constituent types from Appendix A of IEMP. MP indicates that the constituent has been identified as being able to migrate to the aquifer. N indicates that the constituent has been identified as not being able to migrate to the aquifer.

[f]A - Applicable or relevant and appropriate requirement based (MCL, PMCL, etc.).
B - Based on 95th percentile background concentrations.
R - Risk-based
R* - Risk-based radionuclide cleanup levels include constituent specific 95th percentile background concentration.

## TABLE 2

## RE-INJECTION WELL 22107 (IW-8)
## OPERATIONAL SUMMARY SHEET
## SEPTEMBER 1999

Reference Elevation (feet AMSL) - 539.92 (top of casing)
Northing Coordinate ('83) - 476196.22
Easting Coordinate ('83) - 1347978.25

Hours in reporting period[a] = 720.47
Hours not injecting[b] = 360.00
Hours injecting[c] = 360.47
Operational percent[d] = 50.0

Target Injection Rate = 200 gpm

| Monthly Measurements | | |
|---|---|---|
| Month | Million Gallons Injected[e] | Average Operating Injection Rate (gpm)[f] |
| 9/98 | 8.16 | 206 |
| 10/98 | 5.78 | 203 |
| 11/98 | 8.47 | 196 |
| 12/98 | 5.76 | 222 |
| 1/99 | 5.35 | 227 |
| 2/99 | 7.06 | 196 |
| 3/99 | 7.34 | 205 |
| 4/99 | 7.75 | 197 |
| 5/99 | 7.46 | 216 |
| 6/99 | 8.42 | 197 |
| 7/99 | 8.93 | 201 |
| 8/99 | 8.64 | 199 |
| 9/99 | 3.92 | 181 |

[a]First operational shift reading on 9/1/99 to first operational shift reading on 10/1/99
[b]Downtime. IW-8 was being rehabilitated from 9/7/99 to 9/13/99. All injection wells were not operating from 9/20/99 to 9/30/99 to facilitate a DCS upgrade.
[c]Hours in reporting period - Hours not injecting
[d](Hours injecting/Hours in reporting period) x 100
[e]Summation of daily totalizer differences
[f]Million Gallons Injected/(Hours Injecting x 60)

## TABLE 3

## RE-INJECTION WELL 22108 (IW-9)
## OPERATIONAL SUMMARY SHEET
## SEPTEMBER 1999

Reference Elevation (feet AMSL) - 578.025 (top of casing)
Northing Coordinate ('83) - 476255.74
Easting Coordinate ('83) - 1348384.49

Hours in reporting period[a] = 721.85
Hours not injecting[b] = 216.00
Hours injecting[c] = 505.85
Operational percent[d] = 70.1

Target Injection Rate = 200 gpm

| Monthly Measurements | | |
|---|---|---|
| Month | Million Gallons Injected[e] | Average Operating Injection Rate (gpm)[f] |
| 9/98 | 8.17 | 206 |
| 10/98 | 8.30 | 201 |
| 11/98 | 8.53 | 197 |
| 12/98 | 5.66 | 214 |
| 1/99 | 4.33 | 181 |
| 2/99 | 6.07 | 156[g] |
| 3/99 | 5.93 | 178[h] |
| 4/99 | 6.66 | 184 |
| 5/99 | 7.83 | 200 |
| 6/99 | 8.41 | 197 |
| 7/99 | 8.79 | 198 |
| 8/99 | 8.63 | 198 |
| 9/99 | 5.68 | 187 |

[a]First operational shift reading on 9/1/99 to first operational shift reading on 10/1/99
[b]Downtime. All injection wells were not operating from 9/20/99 to 9/30/99 to facilitate a DCS upgrade.
[c]Hours in reporting period - Hours not injecting
[d](Hours injecting/Hours in reporting period) x 100
[e]Summation of daily totalizer differences
[f]Million Gallons Injected/(Hours Injecting x 60)
[g]Injection out of smaller downcomer in February. Target Injection rate of smaller downcomer is 150 gpm.
[h]Injection out of smaller downcomer up until March 8. Large downcomer was used from March 11 to April 1, 1999.

## TABLE 4

## RE-INJECTION WELL 22109 (IW-10)
## OPERATIONAL SUMMARY SHEET
## SEPTEMBER 1999

Reference Elevation (feet AMSL) - 576.92 (top of casing)
Northing Coordinate ('83) - 476175.65
Easting Coordinate ('83) - 1348860.53

Hours in reporting period[a] = 721.77 Target Injection Rate = 200 gpm
Hours not injecting[b] = 528.00
Hours injecting[c] = 193.77
Operational percent[d] = 26.9

| Monthly Measurements | | |
|---|---|---|
| Month | Million Gallons Injected[e] | Average Operating Injection Rate (gpm)[f] |
| 9/98 | 8.13 | 205 |
| 10/98 | 8.28 | 200 |
| 11/98 | 8.50 | 196 |
| 12/98 | 5.72 | 217 |
| 1/99 | 5.48 | 229 |
| 2/99 | 8.09 | 208 |
| 3/99 | 8.13 | 204 |
| 4/99 | 5.35 | 190 |
| 5/99 | 8.25 | 197 |
| 6/99 | 8.36 | 196 |
| 7/99 | 8.81 | 199 |
| 8/99 | 8.52 | 196 |
| 9/99 | 1.97 | 169 |

[a]First operational shift reading on 9/1/99 to first operational shift reading on 10/1/99
[b]Downtime. IW-10 was being rehabilitated from 9/7/99 to 9/20/99. All injection wells were not operating from 9/20/99 to 9/30/99 to facilitate a DCS upgrade.
[c]Hours in reporting period - Hours not injecting
[d](Hours injecting/Hours in reporting period) x 100
[e]Summation of daily totalizer differences
[f]Million Gallons Injected/(Hours Injecting x 60)

## TABLE 5

## RE-INJECTION WELL 22240 (IW-11)
## OPERATIONAL SUMMARY SHEET
## SEPTEMBER 1999

Reference Elevation (feet AMSL) - 577.14 (top of casing)
Northing Coordinate ('83) - 476422.82
Easting Coordinate ('83) - 1349386.92

Hours in reporting period[a] = 720.15
Hours not injecting[b] = 216.00
Hours injecting[c] = 504.15
Operational percent[d] = 70.0

Target Injection Rate = 200 gpm

| Monthly Measurements | | |
|---|---|---|
| Month | Million Gallons Injected[e] | Average Operating Injection Rate (gpm)[f] |
| 0/98 | 8.39 | 211 |
| 10/98 | 8.29 | 199 |
| 11/98 | 8.50 | 197 |
| 12/98 | 5.68 | 216 |
| 1/99 | 5.53 | 230 |
| 2/99 | 8.06 | 208 |
| 3/99 | 8.04 | 204 |
| 4/99 | 7.56 | 192 |
| 5/99 | 8.34 | 199 |
| 6/99 | 8.42 | 197 |
| 7/99 | 8.85 | 199 |
| 8/99 | 8.65 | 199 |
| 9/99 | 5.64 | 186 |

[a]First operational shift reading on 9/1/99 to first operational shift reading on 10/1/99
[b]Downtime. All injection wells were not operating from 9/20/99 to 9/30/99 to facilitate a DCS upgrade.
[c]Hours in reporting period - Hours not injecting
[d](Hours injecting/Hours in reporting period) x 100
[e]Summation of daily totalizer differences
[f]Million Gallons Injected/(Hours Injecting x 60)

## TABLE 6

## RE-INJECTION WELL 22111 (IW-12)
## OPERATIONAL SUMMARY SHEET
## SEPTEMBER 1999

Reference Elevation (feet AMSL) - 583.01 (top of casing)
Northing Coordinate ('83) - 476518.64
Easting Coordinate ('83) - 1350105.39

Hours in reporting period[a] = 720.15
Hours not injecting[b] = 216.00
Hours injecting[c] = 504.15
Operational percent[d] = 70.0

Target Injection Rate = 200 gpm

| Monthly Measurements | | |
|---|---|---|
| Month | Million Gallons Injected[e] | Average Operating Injection Rate (gpm)[f] |
| 09/98 | 8.12 | 205 |
| 10/98 | 8.27 | 201 |
| 11/98 | 8.53 | 197 |
| 12/98 | 5.61 | 219 |
| 1/99 | 5.08 | 212 |
| 2/99 | 8.06 | 208 |
| 3/99 | 8.13 | 203 |
| 4/99 | 7.65 | 195 |
| 5/99 | 8.27 | 197 |
| 6/99 | 8.42 | 197 |
| 7/99 | 8.80 | 198 |
| 8/99 | 8.67 | 199 |
| 9/99 | 5.66 | 187 |

[a]First operational shift reading on 9/1/99 to first operational shift reading on 10/1/99
[b]Downtime. All injection wells were not operating from 9/20/99 to 9/30/99 to facilitate a DCS upgrade.
[c]Hours in reporting period - Hours not injecting
[d](Hours injecting/Hours in reporting period) x 100
[e]Summation of daily totalizer differences
[f]Million Gallons Injected/(Hours Injecting x 60)

# TABLE 7

## PRELIMINARY GROUNDWATER MONITORING RESULTS
## SAMPLES COLLECTED JUNE THROUGH AUGUST, 1999 FOR THE RE-INJECTION DEMONSTRATION

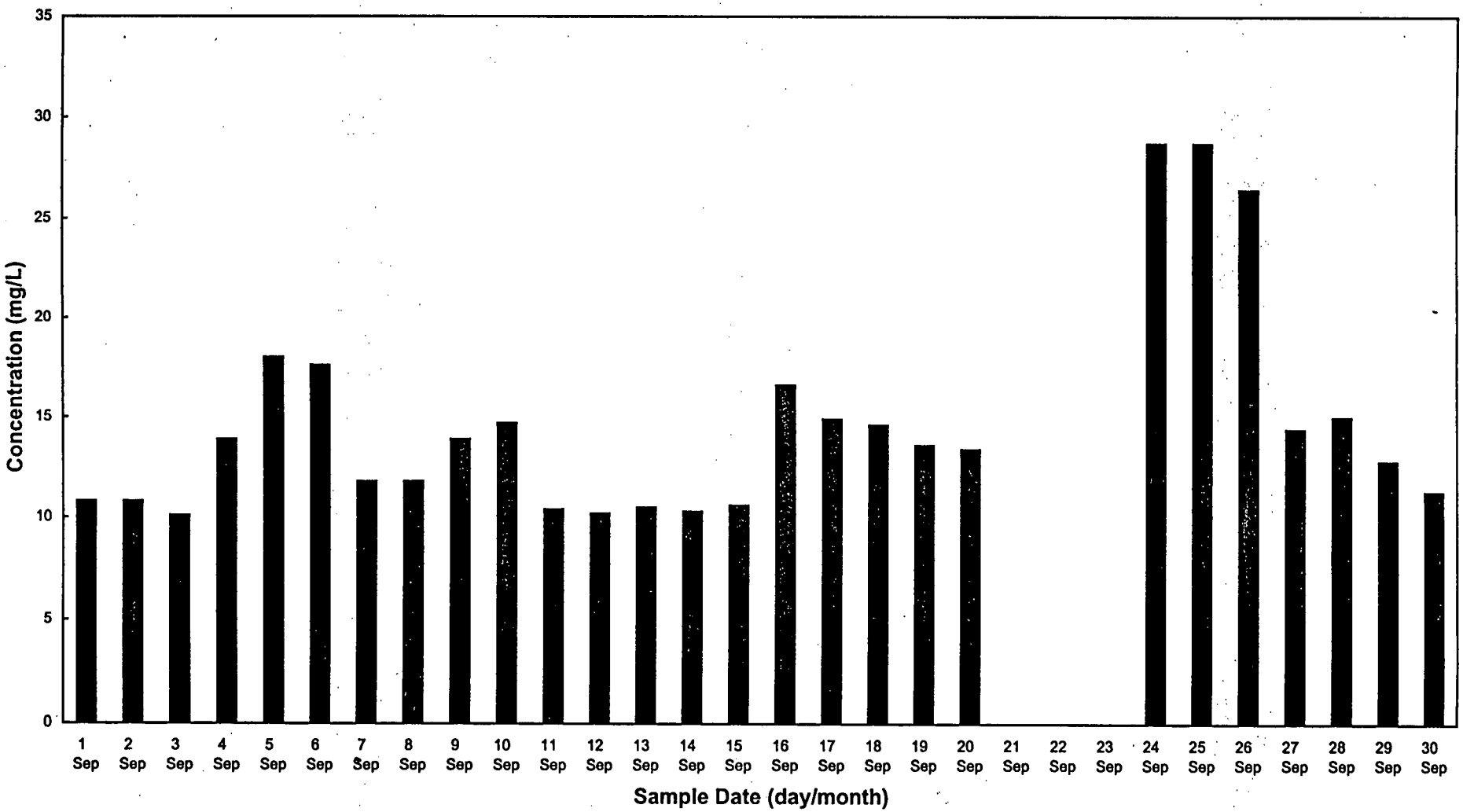
| Constituent | | Well 2015 8/5/99 | Well 2017 8/5/99 | Well 2060 7/28/99 | Well 2070 7/7/99 | Well 2106 7/7/99 | Well 2166 8/11/99 | Well 2166-D 8/11/99 | Well 2398 7/6/99 | Well 2434 7/6/99 | Well 3015 8/5/99 | Well 3069 7/6/99 | Well 3069-D 7/6/99 | Well 3106 7/7/99 | Well 3070 7/7/99 | Well 3398 7/6/99 | Well 4398 7/6/99 | Well 22299 6/8/99 | Well 22300 6/7/99 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| aluminum | mg/L | 0.0232 | 0.086 | U 0.0208 | U 0.0248 | 0.0266 | U 0.0208 | U 0.0208 | U 0.0248 | 0.0815 | U 0.0208 | U 0.0248 | U 0.0248 | U 0.0248 | U 0.0248 | U 0.0248 | U 0.0248 | 4.520 | 4.250 |
| calcium | mg/L | 93 | 142 | 92.6 | 109 | 97.6 | 111 | 1.95 | 89.6 | 89.8 | 96 | 99.3 | 99.9 | 92.1 | 97.4 | 96.5 | 10.7 | 268 | 513 |
| iron | mg/L | 0.0437 | 0.244 | 0.0375 | 2.58 | 0.192 | U 0.0031 | 0.0076 | 0.218 | 0.292 | 1.16 | U 0.0074 | U 0.0074 | 0.0242 | 3.93 | 1.190 | 0.632 | 13.7 | 14 |
| magnesium | mg/L | 24.9 | 32.7 | 23.1 | 31.8 | 25.7 | 28.9 | 0.531 | 25.6 | 23.9 | 23.8 | 24.5 | 24.6 | 24.2 | 25 | 24.2 | 26.9 | 97.3 | 182 |
| manganese | mg/L | 0.003 | 0.0077 | 0.0043 | 0.263 | 0.0052 | 0.0035 | U0.0012 | 0.0223 | 0.0139 | 0.352 | 0.00930 | 0.0092 | 0.0116 | 0.320 | 0.282 | 0.412 | 0.308 | 0.637 |
| potassium | mg/L | 3.22 | 2.840 | 3.75 | 3.42 | 2.72 | 3.410 | U 0.431 | 2.98 | 2.940 | 3.520 | 2.950 | 3.04 | 2.750 | 2.420 | 2.650 | 1.17 | 4.200 | 4.09 |
| silicon | mg/L | 3.46 | 5.450 | 3.13 | 4.17 | 3.59 | 4.540 | 4.44 | 4.45 | 3.640 | 3.7 | 4.480 | 4.4 | 4.190 | 4.990 | 4.150 | 6.32 | 10.2 | 9.66 |
| sodium | mg/L | 16.2 | 22.3 | 164 | 17.3 | 17.6 | 14.7 | 0.407 | 21.7 | 17.6 | 16 | 15.8 | 16.3 | 17.20 | 11.6 | 11.4 | 8.34 | 15.4 | 16.6 |
| ammonia | mg/L | U 0.10 | U 0.10 | U 0.10 | U 0.10 | U 0.10 | U 0.10 | U 0.10 | U 0.1 | U 0.10 | U 0.10 | U 0.1 | U 0.10 | U 0.10 | 0.11 | U 0.10 | 0.12 | U 0.00010 | U 0.00010 |
| nitrate-nitrogen | mg/L | 0.5 | U 0.1 | 0.6 | 0.1 | 0.8 | 1.2 | 1.2 | 1.0 | 1.0 | U 0.1 | 0.6 | 0.6 | 0.8 | U 0.1 | 0.1 | 0.0003 | 0.7 | 0.6 |
| uranium | ug/L | 160 | 3.1 | 106 | 0.858 | 36.8 | 61 | NS | 22 | 1.4 | 1.2 | 242 | 238 | 0.997 | 0.221 | 0.9 | 0.1 J | 12 | 3.7 |
| alkalinity | mg/L | 270 | 360 | 227 | 262 | 247 | 279 | 275 | 0.254 | 237 | 257 | 260 | 2 | 266 | 240 | 264 | 255 | 260 | 269 |
| chloride | mg/L | 32.8 | 72.2 | 36.0 | 76.0 | 36.0 | 31.6 | 31.4 | 34.0 | 32.0 | 36 | 34 | 34.0 | 34.0 | 26.0 | 36.0 | 26.0 | 34 | 32 |
| fluoride | mg/L | 0.50 | 0.14 | 0.35 | 0.15 | 0.27 | 0.16 | 0.16 | 0.13 | 0.22 | 0.15 | 0.24 | 0.14 | 0.14 | 0.11 | 0.12 | 0.13 | 0.23 | 0.24 |
| sulfate | mg/L | 78.5 | 78.0 | 70.6 | 78.6 | 77.4 | 113.5 | 111.5 | 86.1 | 71.1 | 93.5 | 85.9 | 85.0 | 74.4 | 82.6 | 67.0 | 108.1 | 85.2 | 87.6 |
| TDS | mg/L | 496 | 741 | 456 | 655 | 467 | 564 | 554 | 502 | 477 | 533 | 520 | 532 | 456 | 465 | 489 | 554 | 501 | 522 |
| TSS | mg/L | U 2.0 | 9.2 | U 2.0 | 13 | U 2.0 | U 2 | U 2 | 2.0 | 2.8 | 8.0 | U 2 | U 2 | U 2.0 | 13 | 3.2 | 3.6 | 628 | 1114 |
| phosphate(total) | mg/L | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | 0.14 | 0.16 |
| bicarbonate | mg/L | 329.4 | 439.2 | 277 | 262 | 247 | 340.0 | 335.5 | 254 | 237 | 313.5 | 260 | 258 | 266 | 240 | 264 | 255 | 260 | 269 |
| carbonate | mg/L | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1 | U 1.0 |

| | | Well 22301 6/8/99 | Well 22302 6/7/99 | Well 22303 6/7/99 | Well 32304 6/9/99 | Well 32305 6/9/99 | Well 2305-D 6/9/99 | Well 32306 6/8/99 | Well 32307 6/8/99 | FB 6/7/99 | Rinsate 6/7/99 | FB 6/8/99 | FB 6/9/99 | FB 7/6/99 | FB 7/7/99 | FB 7/28/99 | Rinsate 7/28/99 | FB 8/5/99 | FB 8/11/99 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| aluminum | mg/L | 0.0791 | 10.4 | 1.27 | U 0.0248 | 0.0461 | 0.0401 | U 0.0248 | 0.0296 | 0.054 | U 0.0248 | U 0.0248 | 0.0337 | U 0.0248 | U 0.0248 | U 0.0208 | U 0.0208 | U 0.0208 | U 0.0208 |
| calcium | mg/L | 91.5 | 137 | 123 | 91.6 | 85.6 | 87.2 | 93.4 | 94.7 | 2.110 | 1.630 | 0.0377 | 0.316 | 0.0421 | 0.110 | 0.0558 | 1.33 | 2.580 | 110 |
| iron | mg/L | 0.460 | 17.9 | 3.43 | 0.0176 | 0.52 | 0.063 | 1.35 | 1.19 | 0.0979 | 0.0524 | U 0.0074 | 0.0863 | U 0.0074 | 0.0717 | 0.0065 | 0.0078 | 0.128 | 0.0031 |
| magnesium | mg/L | 23.6 | 37.4 | 34.6 | 21.9 | 22.3 | 22.4 | 23.1 | 24.0 | 0.668 | 0.529 | U 0.0369 | 0.104 | U 0.0369 | U 0.0369 | U 0.023 | 0.327 | 0.577 | 28.2 |
| manganese | mg/L | 0.0156 | 0.325 | 0.206 | 0.339 | 0.007 | 0.0066 | 0.322 | 0.459 | U 0.0006 | U 0.0006 | U 0.0006 | 0.002 | U 0.0006 | U 0.0006 | U 0.0012 | U 0.0012 | 0.0089 | 0.0039 |
| potassium | mg/L | 2.850 | 5.05 | 3.53 | 2.870 | 3.160 | 3.220 | 3.77 | 3.290 | U 0.224 | U 0.224 | U 0.224 | U 0.224 | U 0.2224 | U 0.224 | U 0.431 | U 0.431 | U 0.431 | 3.38 |
| silicon | mg/L | 4.560 | 2038 | 5.89 | 3.960 | 3.910 | 3.880 | 4.05 | 3.870 | 0.172 | 0.122 | 0.0398 | 0.441 | 0.065 | U 0.0988 | U 0.0133 | 0.023 | 0.0906 | 0.104 |
| sodium | mg/L | 15.1 | 15.0 | 15.9 | 14.400 | 14.400 | 14.9 | 15.1 | 15.4 | U 0.162 | 0.219 | U 0.162 | U 0.162 | U 0.162 | U 0.162 | U 0.130 | 0.165 | 0.465 | 14.5 |
| ammonia | mg/L | U 0.10 | U 0.00010 | U 0.00010 | U 0.10 | U 0.10 | U 0.1 | U 0.10 | U 0.10 | U 0.00010 | U 0.00010 | U 0.00010 | U 0.10 | U 0.10 | U 0.10 | U 0.0001 | U 0.0001 | U 0.10 | U 0.10 |
| nitrate-nitrogen | mg/L | 0.9 | 0.6 | 0.6 | 0.3 | 0.7 | 0.8 | NR | U 0.1 | U 0.0001 | U 0.0001 | U 0.0001 | U 1.0 | U 0.1 | 0.1 | U 0.0001 | U 0.0001 | U 0.1 | U 0.1 |
| uranium | ug/L | 11 | 11 | 5.4 | 3.9 | 0.7 | 0.7 | 2.1 | 13 | U 0 | 0.1 J | U 0.02 | U 0.02 | U 0 | U 0 | U 0 | U 0 | U 0 | U 0 |
| alkalinity | mg/L | 256 | 253 | 250 | 260 | 258 | 256 | 262 | 259 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 |
| chloride | mg/L | 34.0 | 32.0 | 34.0 | 34 | 34 | 34 | 36 | 36.0 | U 1.0 | U 1.0 | 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 |
| fluoride | mg/L | 0.19 | 0.27 | 0.23 | 0.11 | 0.14 | 0.14 | 00.10 | 0.17 | U 0.1 | U 0.1 | 0.1 | U 0.14 | U 0.10 | U 0.10 | U 0.1 | U 0.1 | U 0.1 | U 0.1 |
| sulfate | mg/L | 82.8 | 80.8 | 84.8 | 77.6 | 87.6 | 86.0 | 108.4 | 102.47 | U 1.0 | U 1.0 | 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 |
| TDS | mg/L | 460 | 472 | 481 | 464 | 400 | 416 | 502 | 441 | U 10 | U 10 | 10 | U 10 | U 10 | 37 | U 10 | U 10 | 18 | U 10 |
| TSS | mg/L | U 2 | 572 | 18.8 | U 2 | U 2 | U 2 | 4.0 | 8.8 | U 2 | U 2 | 2 | U 2 | U 2 | U 2 | U 2.0 | U 2.0 | U 2.0 | U 2.0 |
| phosphate(total) | mg/L | U 0.1 | 0.14 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 | U 0.1 |
| bicarbonate | mg/L | 256 | 253 | 250 | 260 | 258 | 259 | 262 | 259 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 |
| carbonate | mg/L | U 1.0 | U 1 | U 1 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 | U 1.0 |

FB = field blank
NS = not sampled

# FIGURE 1

## URANIUM CONCENTRATION OF AWWT EXPANSION EFFLUENT*
## SEPTEMBER 1999




* Samples derived from combined plant effluent via 24-hour Composite Sampler.

NOTE: System was down from September 20 to September 23 in order to facilitate an upgrade to the DCS and to regenerate a treatment vessel. No samples were collected during this time period. Re-injection did not take place from September 23 to September 28 to document the uranium concentration of the treated effluent prior to resuming injection operations.

F

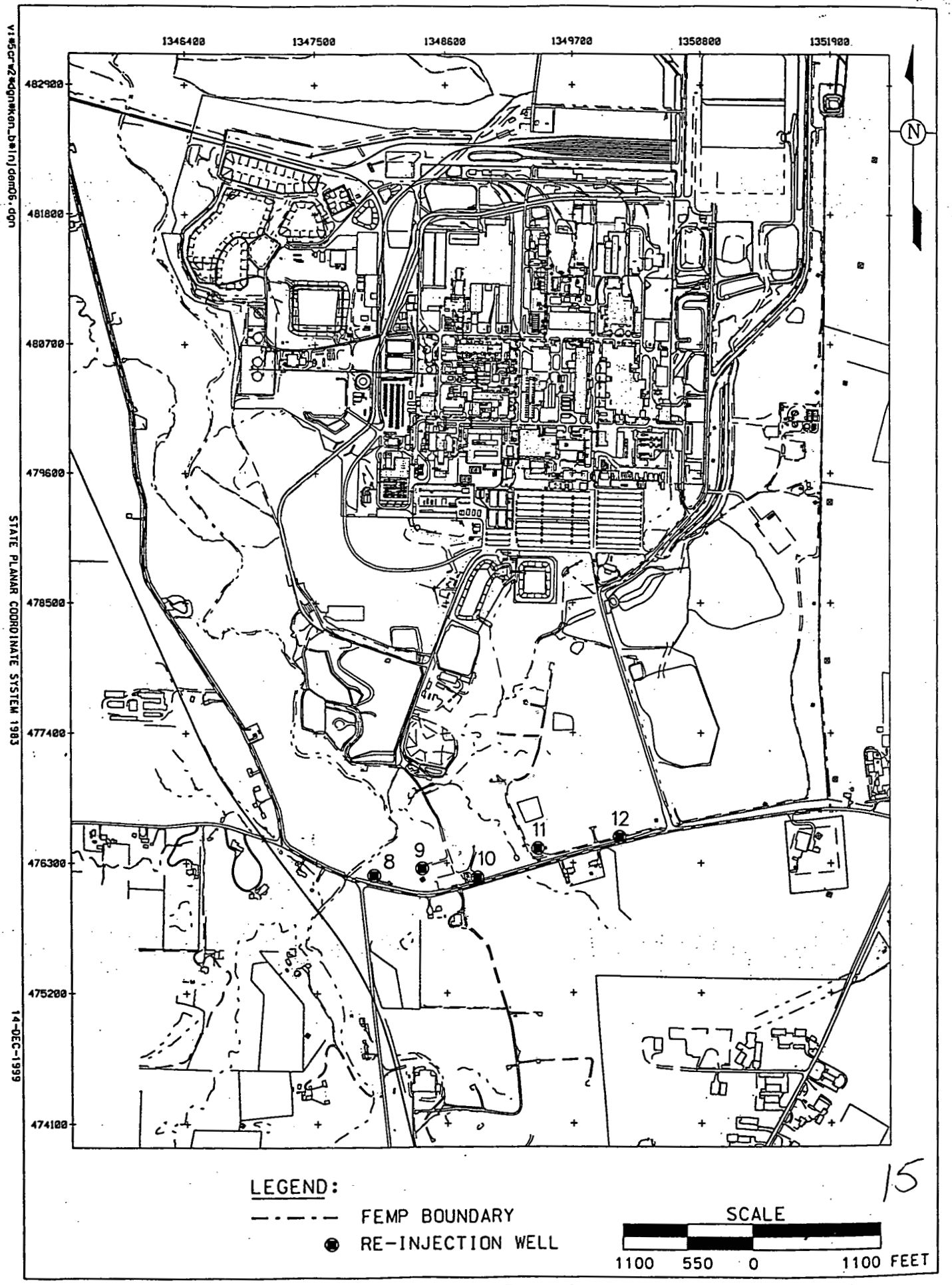



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FIGURE 2. LOCATION OF RE-INJECTION WELLS

**Figure 3**
**Re-Injection Wells, Water Level Rise**
**First Shift September 1, 1999 to October 1, 1999**