PAP-70-602, Rev. 3
EXHIBIT 2

PACIFIC NORTHWEST NATIONAL LABORATORY
INTERIM CHANGE NOTICE
(ICN)

A. Document No.: PNNL 11665 **Revision No.:** Addition

Document Title: Tritium Monitoring In Groundwater and Evaluation of Model Predictions for the Hanford Site 200 Area Effluent Treatment Facility

Document's Original Author(s): D.B. Barnett, M.P. Bergeron, C.R. Cole, M.D. Freshley, S.K. Wurstner

Effective Date of ICN: 10 / 19 / 98

Change Requested By: DB Barnett

B. Action: Append the attached report, "Summary of Tritium Tracking and Groundwater Monitoring at the Hanford Site 200 Area SALDS - FY 1998," to the back of the document. Attach this ICN to the front of the document.

C. Effect of Change: The results of groundwater monitoring for the SALDS facility will be updated. New provisions for groundwater monitoring are also presented.

D. Reason for Change/Description of Change:

Reason for Change: Update report results.

Description of Change: Append 1998 groundwater monitoring results and recommended modifications to monitoring.

E. Approval Signatures

(Please Sign and Date)

Type of Change: {Check (X) one}

( ) Minor Change (X) Major Change

Approval Authority: _____ Date: 10 /21 / 98

Other Approvals: _____ Date: / /

_____ Date: / /

DISCLAIMER

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Distribution

No. of Copies

OFFSITE

2 DOE/Office of Scientific and Technical Information

ONSITE

5 Waste Management Hanford, Inc.

D.L Flyckt	S6-71
P.C. Mohondro	S6-72
D.W. Lindsey	T3-07
P.M.Olson	S6-72
R.D. Haggard	H6-25

No. of Copies

12 Pacific Northwest National Laboratory

D.B. Barnett	K6-81
M.P. Bergeron	K9-36
C.R. Cole	K9-36
M.D. Freshley	K9-36
S.K. Wurstner	K9-36
Information Release (7)	K1-06

Summary of Tritium Tracking and Groundwater Monitoring at the Hanford Site 200 Area SALDS—FY 1998

D. B. Barnett

Summary of Tritium-Tracking and Groundwater Monitoring at the Hanford Site 200 Area SALDS—FY 1998

Introduction

Treated water from the 200 Area Effluent Treatment Facility (ETF) is discharged to a disposal site in accordance with the State Waste Discharge Permit ST-4500. This disposal site is referred to as the State-Approved Land Disposal Site (SALDS). In accordance with the discharge permit, the groundwater at the SALDS is routinely sampled. The results of the groundwater sampling are reported in quarterly discharge monitoring reports. In 1997, the USDOE also committed to the issuance of an annual summary report of groundwater monitoring results and evaluation, with updates to the groundwater monitoring plan, as appropriate. This report summarizes the groundwater information for FY 1998.

Wells in the groundwater monitoring network (Figure 1) are sampled quarterly to annually for constituents regulated by the State Waste Discharge Permit. Wells 299-W8-1, 699-48-77A, 699-48-77C, and 699-48-77D are part of the upgradient/downgradient monitoring network designed to detect proximal effects on groundwater of the SALDS operation. These four wells are sampled quarterly for tritium and a list of constituents governed by State Waste Discharge Permit No. ST-4500. An additional 17 wells are sampled semiannually to annually for tritium only. Wells 299-W6-8, 299-7-1, 299-7-6, and 299-7-11 are sampled semiannually; all others are sampled annually. Figure 1 shows the locations of these wells, all of which are near the northern boundary of the 200 West Area of the Hanford Site. Two wells in the original network, 299-W6-5 and 299-W7-2, were dropped in 1997. Well 299-W6-5 was dropped because static water level measurements can no longer be made due to damage to the well casing. Well 299-W7-2 became dry in 1997. The coverage of the remaining monitoring wells is such that the loss of the two defective wells does not materially affect the monitoring efficiency of the network.

Water Level Measurement Results

Water levels are measured in wells prior to each sampling event. Additionally, water levels have been measured monthly, since January 1997, in the dedicated SALDS facility wells (299-W8-1, 699-48-77A, 699-48-77C, and 699-48-77D). Well 299-W8-1 is currently operating as an upgradient well for the SALDS. Hydrographs for these wells since 1992 are shown in Figure 2. Hydraulic head in well 699-48-77A has surpassed the head in "upgradient" well 299-W8-1. This is a result of the continuing general decline in water levels in the 200 West Area combined with the increased head near the SALDS resulting from SALDS operation. This situation will become more pronounced as head continues to decline in the vicinity of 200 West Area. The final measurement shown for well 699-48-77C, which is greater than 138 m, is probably a measurement error.

Tritium Analyses of Groundwater

Results of tritium analyses in the SALDS tritium-tracking well network for FY 1998 are shown on Figure 3 and listed in Table 1. The only wells in the network that have been affected thus far by SALDS tritium discharges are wells 699-48-77A, 699-48-77C, and 699-48-77D. These wells registered increases in maximum tritium concentrations compared with 1997. All other wells in the network indicate unchanged or declining concentrations of tritium in groundwater. Wells 299-W6-7 and 299-W6-11 show the effects of the decaying tritium plume originating from the northeast portion of the 200 West Area.

Figure 4 illustrates the trends in tritium activities in the four SALDS facility wells. Well 699-48-77A was first affected by discharges in August of 1996. Although this well is furthest from the facility of the three "downgradient" facility wells, subsurface geologic factors allow the effluent to reach this well before any others (see Barnett et al. 1997). This well continues to be affected intermittently, as dictated by the discharge schedule of the SALDS, and produced a maximum tritium concentration of 1.7M pCi/L for FY 1998. Well 699-48-77D is nearest the SALDS, but registered tritium incursion only as recently as September 1997. The maximum tritium result for this well in FY 1998 was 2.1M pCi/L, which is also the highest result observed thus far in groundwater in the vicinity of the SALDS. Well 699-48-77C is screened ~20m deeper in the aquifer than the 77A and 77D. Because of the vertical separation, tritium incursion from SALDS operation is observed only intermittently in this well. During times of high hydraulic head beneath the SALDS effluent may be forced deeper into the aquifer. The screen in this well is likely at the tenuous bottom edge of the tritium plume, and is thus affected much less than the two shallow wells. Well 299-W8-1 is nearly 1 km away from the facility, and is unaffected by discharges to the SALDS.

Other Constituents in Groundwater

In addition to tritium, groundwater from the four SALDS facility wells (299-W8-1, 699-48-77A, 699-48-77C, and 699-48-77D) is analyzed for a list of 16 constituents required by the State Waste Discharge Permit ST 4500 Special Condition S1 (A). Enforcement limits are set for most of these constituents (acetone, ammonia, benzene, cadmium (total), chloroform, copper (total), lead (total), mercury (total), pH, sulfate, tetrahydrofuran, total dissolved solids (TDS)). Gross alpha, gross beta, strontium-90, and tritium are not assigned enforcement limits, but are monitored and reported.

Of the 12 constituents with permit limits, all were below the highest allowable concentrations during FY 1998[1]. Ammonia, benzene, and tetrahydrofuran results were all below detection limits. Gross alpha and gross beta results were all <2.1 pCi/L and

[1] Period reported is September 1997 through July 1998

<5.0 pCi/L, respectively. The maximum strontium-90 result was 7.1 pCi/L in well 699-48-77C.

Coincident with the first detection of elevated tritium in late 1996, concentrations of sulfate and a few other parameters were also found to have increased in groundwater from well 699-48-77A. These occurrences were interpreted to be a result of the effluent from SALDS dissolving soluble mineral species (mostly gypsum) in the vadose zone during infiltration (Thornton 1997, Barnett et al. 1997). Figures 5 and 6 show the trends for some of the parameters that reflect this phenomenon; e.g., sulfate, conductivity, and TDS. Other species, such as calcium, show a more subdued response during the same time period, probably as a result of cation adsorption. The trends are most pronounced in wells 699-48-77A and 699-48-77D because these wells are screened at the water table. Well 699-48-77C is screened ~20 m below the water table. Since the period of late 1996 to late 1997, these parameters have trended downward. Occasional "spikes" of these and related parameters may be expected to occur sporadically, but at lower levels of concentration than in the original occurrences.

Supplemental Activities

During August 1997, six sage plants (Artemisia tridentata) growing near the SALDS facility were sampled for tritium. This was done because the roots of these plants are known to extend to considerable depth (up to 3 meters) and could potentially intercept SALDS effluent or vadose-zone moisture with high concentrations of tritium. The locations of the sampled plants in relation to the SALDS are shown in Figure 7. Branches of the plants were covered with plastic bags to collect transpiration. The bags were left on for two days, then the water (transpiration) that had collected in the bags was decanted to sample bottles and analyzed for tritium.

Results of the sage brush sampling were received in December 1997. All results of these analyses were below detection at an MDA of 312 pCi/L. Specimen no. 6, north of the facility(top of Figure 7), did not produce a sample sufficient for analysis.

Recommendations for Continued Monitoring

Water levels in upgradient well 299-W8-1 and nearby RCRA wells continue to decline from the cessation of operations in the 200 West Area. Because this well is occasionally lower in head than SALDS downgradient wells (699-48-77A, C, D), and does not accurately represent background groundwater quality, it is recommended that this well be dropped from the network. Alternatively, groundwater quality in downgradient wells at the SALDS (699-48-77A, C, D) could be evaluated individually through intrawell (within-well) comparisons methods (ASTM 1996) or similar means.

In view of the low levels of strontium-90 that have been observed thus far, it may be appropriate to discontinue analyses for this species in favor of gross beta analysis.

REFERENCES

ASTM, 1996 *Provisional Standard Guide for Developing Appropriate Statistical Approaches for Groundwater Detection Monitoring Programs*, Committee D-18 on Soil and Rock, Designation PS 64-96, American Society for Testing and Materials, West Coshocton, Pennsylvania.

Barnett, D. B., M. P. Bergeron, C. R. Cole, M. D. Freshley, S. K. Wurstner, 1997, *Tritium Monitoring in Groundwater and Evaluation of Model Predictions for the Hanford Site 200 Area Effluent Treatment Facility*, PNNL-11665, Pacific Northwest National Laboratory, Richland, Washington.

Thornton, E. C., 1997, *Origin of Increased Sulfate in Groundwater at the ETF Disposal Site*, PNNL-11633, Pacific Northwest National Laboratory, Richland, Washington.

TABLE 1. SALDS TRITIUM RESULTS DURING FY 1998 (through July 1998)

Well	Result	Total Error	Units	Qualifier	Collect Date	Comments
299-W6-11	6200		pCi/L		13-Nov-97	Down from previous result
299-W6-12	480		pCi/L		13-Nov-97	unchanged from previous result
299-W6-6	160		pCi/L	U	12-Nov-97	unchanged
299-W6-7	36000		pCi/L		12-Nov-97	Down from previous result
299-W6-8	700		pCi/L		13-Nov-97	unchanged
299-W6-8	920		pCi/L		05-Mar-98	
299-W6-8	860		pCi/L		05-Mar-98	
299-W7-1	162		pCi/L	U	17-Nov-97	
299-W7-1	10.8	191	pCi/L	U	12-Mar-98	unchanged
299-W7-1	180		pCi/L	U	05-Mar-98	unchanged
299-W7-11	162		pCi/L	U	17-Nov-97	
299-W7-11	111	200	pCi/L	U	10-Mar-98	
299-W7-11	52.2	197	pCi/L	U	10-Mar-98	
299-W7-11	180		pCi/L	U	05-Mar-98	
299-W7-12	43	196	pCi/L	U	10-Mar-98	unchanged
299-W7-2	168		pCi/L	U	19-Nov-97	unchanged
299-W7-3	35.8	197	pCi/L	U	10-Mar-98	unchanged
299-W7-5	27.1	198	pCi/L	U	11-Mar-98	unchanged
299-W7-6	270		pCi/L		17-Nov-97	unchanged
299-W7-6	150000		pCi/L		17-Nov-97	Invalid result
299-W7-6	361	220	pCi/L	J	11-Mar-98	
299-W7-6	240		pCi/L		05-Mar-98	
299-W7-7	18.9	198	pCi/L	U	11-Mar-98	unchanged
299-W7-8	422	225	pCi/L		11-Mar-98	unchanged
299-W7-9	81.9	200	pCi/L	U	10-Mar-98	unchanged
299-W8-1	173		pCi/L	U	17-Dec-97	unchanged
299-W8-1	200		pCi/L	U	06-Feb-98	
299-W8-1	95	196	pCi/L	U	12-Mar-98	
299-W8-1	227		pCi/L	U	15-Apr-98	
299-W8-1	263		pCi/L	U	09-Jul-98	
699-48-71	147	219	pCi/L	U	18-Mar-98	unchanged
699-48-77A	1700000		pCi/L		17-Dec-97	down from previous result
699-48-77A	1600000		pCi/L		17-Dec-97	
699-48-77A	920000		pCi/L		06-Feb-98	
699-48-77A	270000		pCi/L		15-Apr-98	
699-48-77A	260000		pCi/L		15-Apr-98	
699-48-77A	970000		pCi/L		09-Jul-98	
699-48-77C	4100		pCi/L		17-Dec-97	up from previous result
699-48-77C	1300		pCi/L		06-Feb-98	
699-48-77C	630		pCi/L		06-Feb-98	
699-48-77C	310		pCi/L		15-Apr-98	
699-48-77C	261		pCi/L	U	09-Jul-98	
699-48-77D	970000		pCi/L		17-Dec-97	up from previous result
699-48-77D	2100000		pCi/L		06-Feb-98	
699-48-77D	1800000		pCi/L		15-Apr-98	
699-48-77D	1100000		pCi/L		09-Jul-98	
699-48-77D	1100000		pCi/L		09-Jul-98	
699-49-79	162		pCi/L	U	17-Nov-97	unchanged
699-49-79	238	226	pCi/L	U	18-Mar-98	
699-51-75	-34.9	222	pCi/L	U	18-Mar-98	unchanged

U = nondetect, J = estimated quantity

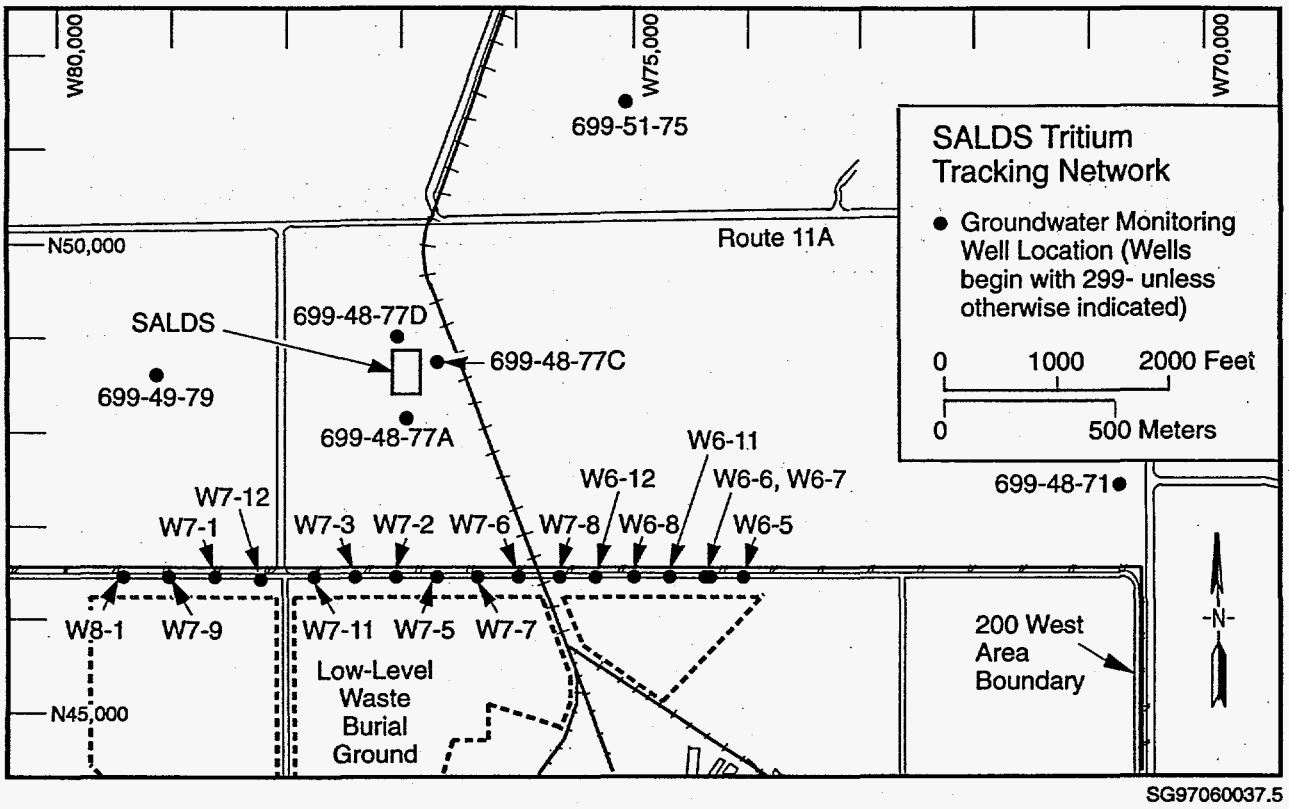


Figure 1. Locations of SALDS Tritium-Tracking Network Wells.

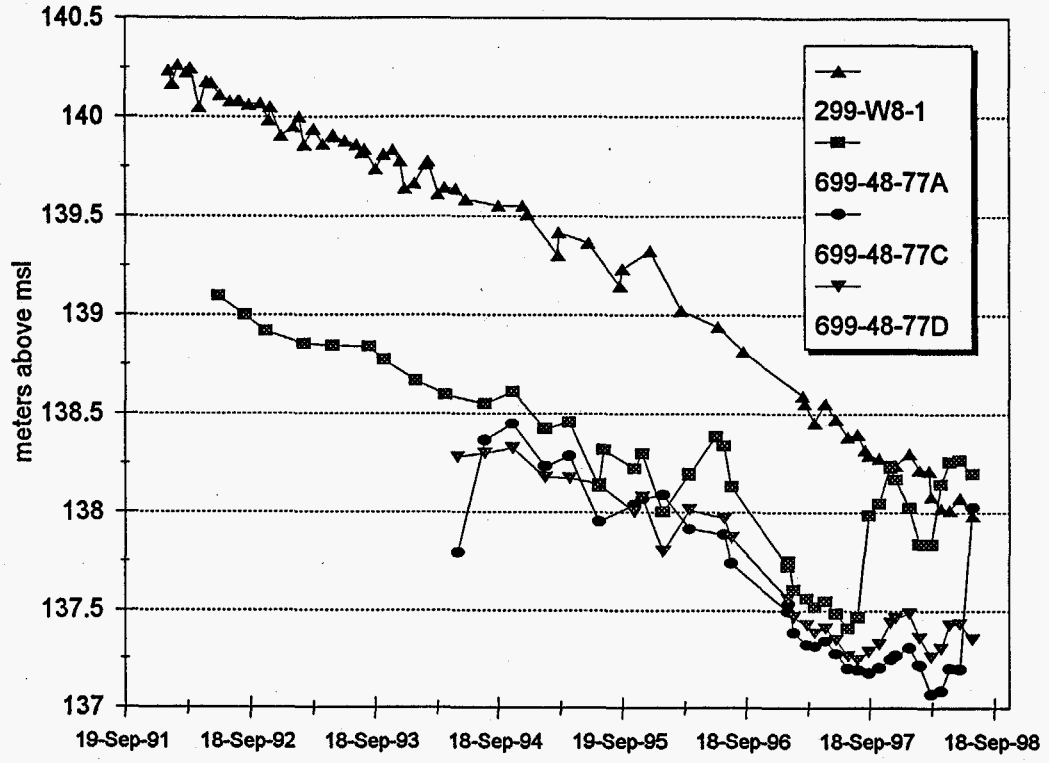


Figure 2. Hydrographs for SALDS wells

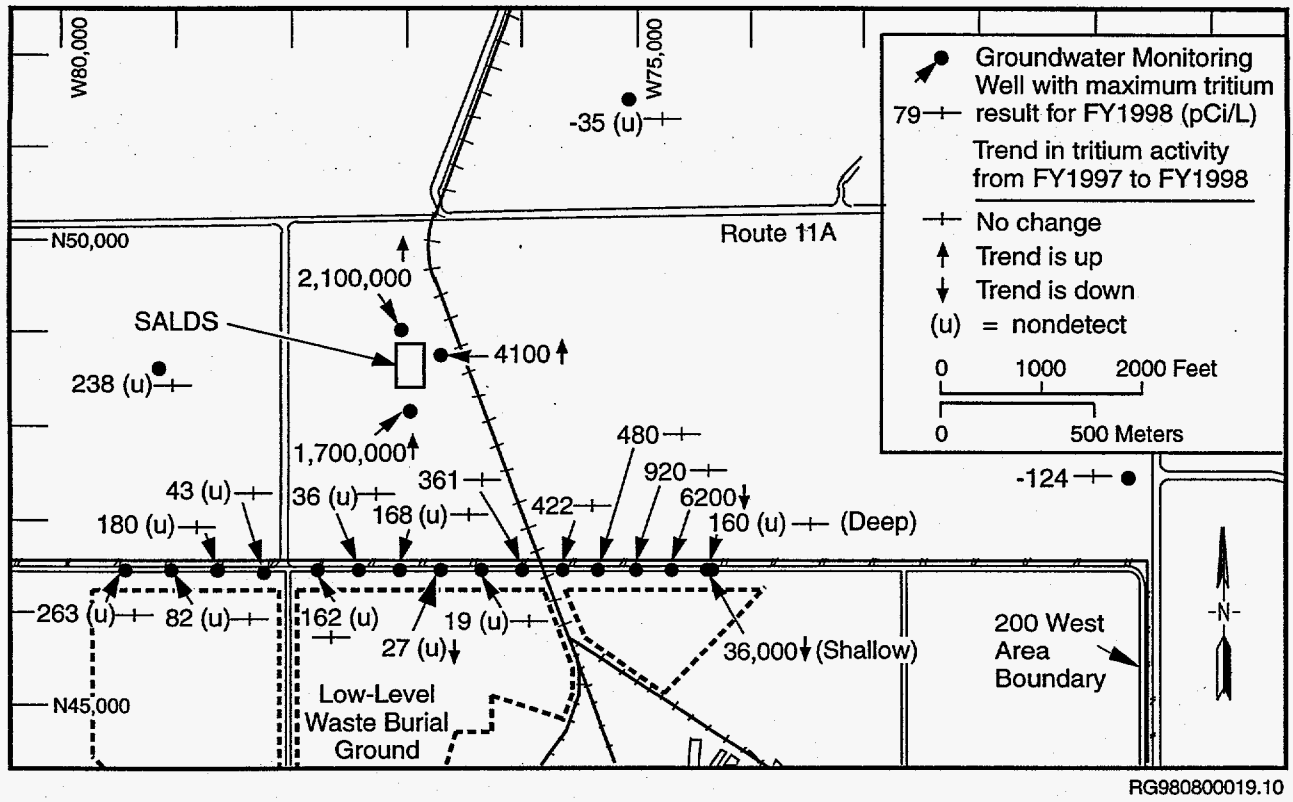
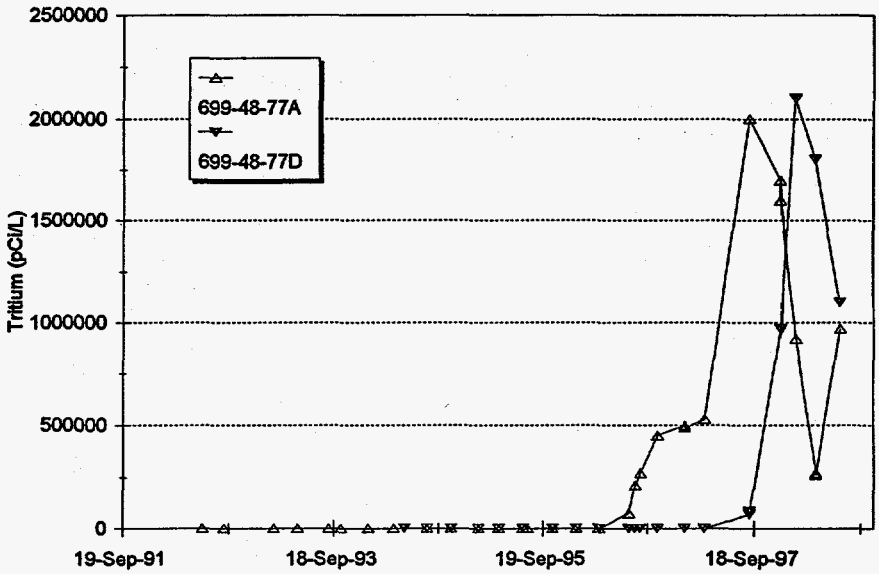


Figure 3. Tritium Results and Trends for SALDS Tritium-Tracking Wells, FY 1998.



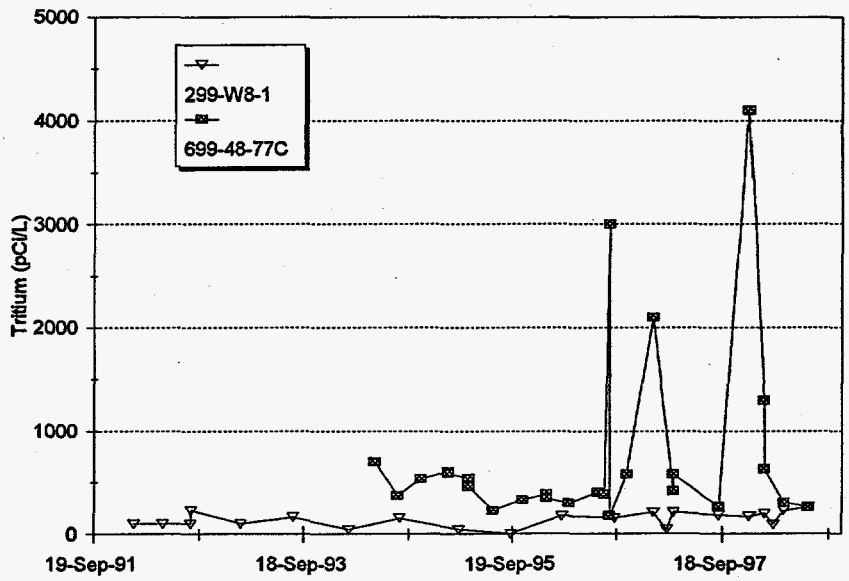


Figure 4. Trends for Tritium in Dedicated SALDS Wells Through July 1998.

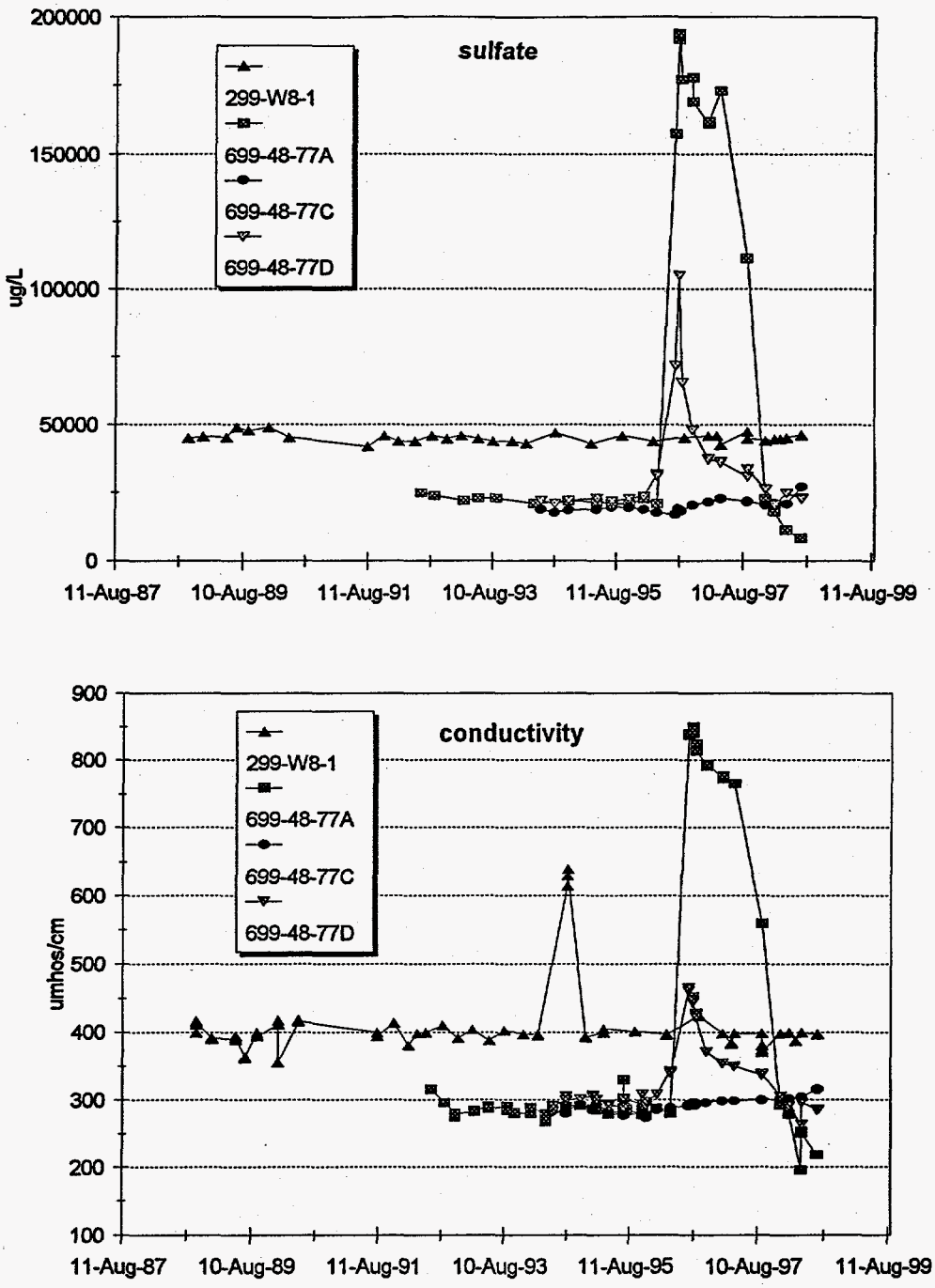


Figure 5. Trends for Sulfate and Conductivity in SALDS wells

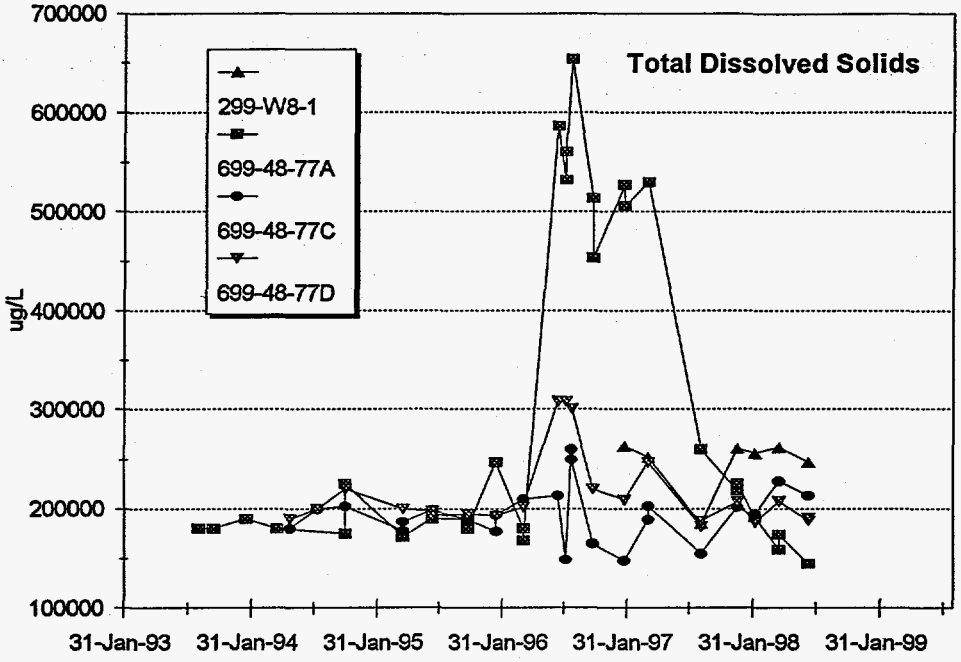


Figure 6. Trends for Total Dissolved Solids (TDS) in SALDS Wells

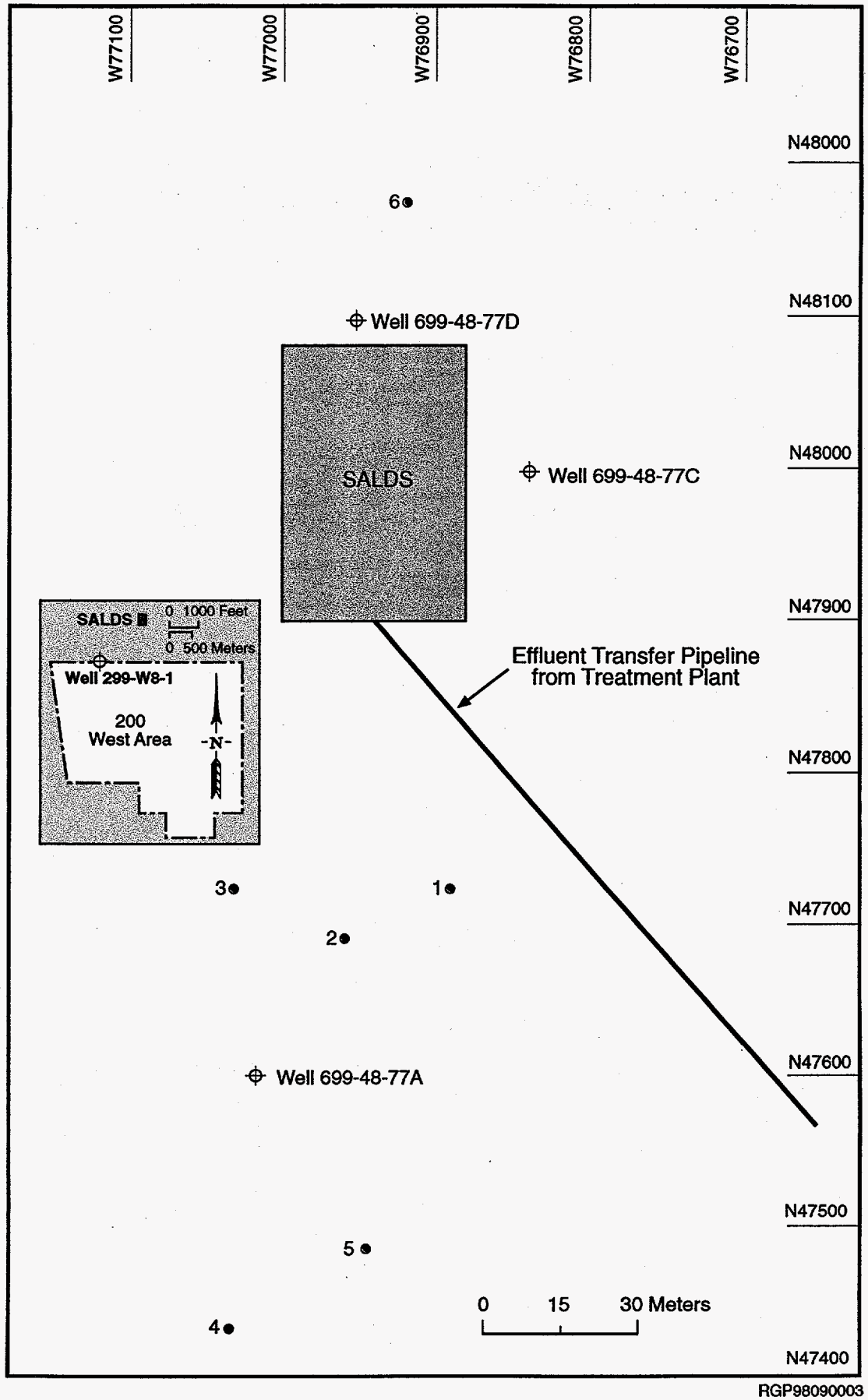


Figure 7. Locations of Sage Samples Near SALDS, August 1997.