9001423

APR 0 2 1990

90-RB-54 0008452

Mr. Paul T. Day
Hanford Project Manager
U. S. Environmental Protection Agency
Region 10
P. O. Box 550, A7-70
Richland, Washington 99352

Mr. Timothy L. Nord
Hanford Project Manager
State of Washington
Department of Ecology
Mail Stop PV-11
Olympia, Washington 98504-8711

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Dear Messrs. Day and Nord:

RCRA WELL DRILLING & PURGEWATER

Enclosed please find copies of the following:

1) Cost breakdown for RCRA monitoring well drilling. This was requested by Mr. Larry Goldstein at the March 1990, Operable Unit Manager Meeting.

2) A matrix showing which Quarterly Reports contain drilling for specific RCRA monitoring wells. This data was requested by Messrs. Toby Michelina and Russ Brown at a March 15, 1990, meeting in Richland, Washington. Submittal of this data was part of the agreements made at the meeting and will assist your staff in finding geology and well completion data for RCRA monitoring wells.

3) Two Pacific Northwest Laboratory (PNL) memoranda describing the relationship of turbidity to iron concentrations during well purging. This data will assist in decisions regarding the use of filtered samples to determine metal concentrations in purgewater management.

4) A PNL memorandum describing computer generated maps of contaminants-of-concern for purgewater management. These data will assist in implementing the Hanford purgewater management strategy.

If you have any questions please contact Mr. K. Michael Thompson on (509) 376-6421.

ORIGINAL SIGNED BY

Sincerely,
Steven H. Wisness
Hanford Project Manager

(Lines deleted on concurrence copy only.)
ERD:KMT

bcc: J. L. Waite, WHC

CORRESPONDENCE DISTRIBUTION COVERSHEET

Author	Addressee	Correspondence No.
S. H. Wisness, DOE-RL	P. T. Day, EPA T. L. Nord, Ecology	9001423

Subject: RCRA WELL DRILLING AND PURGEWATER

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COST BREAKDOWN FOR RCRA MONITORING WELL DRILLING

Activity	$000's/Well
Expense Pre-Drill	
o Groundwater Monitoring Plans	ND
o Engineering Studies	ND
o Pre-Drill activities (e.g. site selection, oversight)	1.1
o Pre Drill activities, Field Services (e.g. permits, Safety reviews, facilities utilization procedures, etc.	5.0
Expense Well Construction	
o QA	2.5
o Cognizant Engineer and Team	13.0
o Environmental Projects	4.0
o PNL Drilling Support	35.0
o Field Services Support for Drilling	2.6
o Misc. (RPT, protective clothing, operators, etc.)	.6
Total Other Costs	
TOTAL EXPENSE	63.8
Capital Well Construction	
o Drilling	25.0
o Title III/Safety	13.0
o KEH	6.7
o Materials(pump, etc.)	10.0
o Complete & Develop*	10.0
TOTAL CAPITAL	64.7
TOTAL COST PER WELL	128.5

Enclosure

Summary of Drilling Records Contained in Quarterly Reports

Facility/Well #	Document	Geologist Logs	As-Built Diagram	Geophysical Log	Completion Report
300 Area Process Trenches					
399-1-12(S5)	1-3/87, V2[1]	x	x	x(3)[2]	x
399-1-13(S6)	1-3/87, V2	x	x	x(3)	x
399-1-14(S7)	1-3/87, V2	x	x	x(3)	x
399-1-15(S8)	1-3/87, V2	x	x	x(3)	x
399-1-18A(C3A)	1-3/87, V2	x	x	x(3)	x
399-1-18B(C3B)	1-3/87, V2	x	x	x(3)	x
399-1-18C(C3C)	1-3/87, V2	x	x	x(4)	x
399-1-16A(C1A)	1-3/87, V2	x	x	x(3)	x
399-1-16C(C1B)	1-3/87, V2	x	x	x(3)	x
399-1-16D(C1C)	1-3/87, V2	x	x	x(4)	x
399-1-16B(C1D)	1-3/87, V2	x	x	x(3)	x
399-4-11(S1)	1-3/87, V2	x	x	x(3)	x
399-1-9(S2)	1-3/87, V2	x	x	x(3)	x
399-1-10(S3)	1-3/87, V2	x	x	x(3)	x
399-1-11(S4)	1-3/87, V2	x	x	-	x
399-1-17A(C2A)	1-3/87, V2	x	x	x(3)	x
399-1-17B(C2B)	1-3/87, V2	x	x	x(3)	x
399-1-17C(C2C)	1-3/87, V2	x	x	x(3)	x
Total Wells for the 300 Area Process Trenches - 18					
183-H Solar Evaporation Basins					
199-H4-7(W1)	5-9/86	x	x	x(3)	x
199-H4-8(W2)	5-9/86	x	x	x(3)	x
199-H4-9(W3)	5-9/86	x	x	x(3)	x
199-H4-10(W4)	5-9/86	x	x	x(3)	x
199-H4-15C(C2C)	10-12/86, V2	x	x(V1)	x(4)(V3)	x
199-H4-12C(C1C)	10-12/86, V2	x	x(V1)	x(4)(V3)	x
199-H3-2C(C3C)	10-12/86, V2	x	x(V1)	x(4)(V3)	x
199-H4-11(W5)	10-12/86, V2	x	x(V1)	x(3)(V3)	x
199-H4-12A(C1A)	10-12/86, V2	x	x(V1)	x(3)(V3)	x
199-H4-15A(C2A)	10-12/86, V2	x	x(V1)	x(3)(V3)	x
199-H3-2A(C3A)	10-12/86, V2	x	x(V1)	x(3)(V3)	x
199-H4-12B(C1B)	10-12/86, V2	x	x(V1)	x(3)(V3)	x
199-H4-15B(C2B)	10-12/86, V2	x	x(V1)	x(3)(V3)	x
199-H3-2B(C3B)	10-12/86, V2	x	x(V1)	x(3)(V3)	x
199-H4-13(W6)	10-12/86, V2	x	x(V1)	x(3)(V3)	x
199-H4-14(W7)	10-12/86, V2	x	x(V1)	x(3)(V3)	x
199-H4-16	4-6/87	x	x	x(3)	x
199-H4-17	4-6/87	x	x	x(3)	x
199-H4-18	4-6/87	x	x	x(3)	x
Total Wells for the 183-H Solar Evaporation Basins - 19					

[1]V2 indicates volume number and applies to all entries for the well, unless another volume is indicated.

[2]Number in parenthesis indicates the number of logs.

...y of Drilling Records Contained in Quarterly Reports

Facility/Well #	Document	Geologist Logs	As-Built Diagram	Geophysical Log	Completion Report
Low-Level Burial Grounds					
299-E27-8	1-3/88, V2	x	x	x(3)	x
299-E27-9	1-3/88, V2	x	x	x(3)	x
299-E27-10	1-3/88, V2	x	x	x(3)	x
299-E28-26	1-3/88, V2	x	x	x(3)	x
299-E28-27	1-3/88, V2	x	x	x(3)	x
299-E32-2	1-3/88, V3	x	x	x(3)	x
299-E32-3	1-3/88, V3	x	x	x(3)	x
299-E32-4	1-3/88, V3	x	x	x(3)	x
299-E33-28	1-3/88, V3	x	x	x(3)	x
299-E33-29	1-3/88, V3	x	x	x(3)	x
299-E33-30	1-3/88, V4	x	x	x(3)	x
299-E34-2	1-3/88, V4	x	x	x(3)	x
299-E34-3	1-3/88, V4	x	x	x(3)	x
299-E34-4	1-3/88, V4	x	x	x(3)	x
299-E34-5	1-3/88, V4	x	x	x(3)	x
299-E34-6	1-3/88, V4	x	x	x(3)	x
299-W6-2	1-3/88, V5	x	x	x(3)	x
299-W7-1	1-3/88, V5	x	x	x(2)	x
299-W7-2	1-3/88, V5	x	x	x(3)	x
299-W7-3	1-3/88, V5	x	x	x(3)	x
299-W7-4	1-3/88, V5	x	x	x(3)	x
299-W7-5	1-3/88, V6	x	x	x(3)	x
299-W7-6	1-3/88, V6	x	x	x(3)	x
299-W8-1	1-3/88, V6	x	x	x(3)	x
299-W9-1	1-3/88, V6	x	x	x(3)	x
299-W10-13	1-3/88, V6	x	x	x(3)	x
299-W10-14	1-3/88, V7	x	x	x(3)	x
299-W15-15	1-3/88, V7	x	x	x(3)	x
299-W15-16	1-3/88, V7	x	x	x(3)	x
299-W15-17	1-3/88, V7	x	x	x(3)	x
299-W15-18	1-3/88, V7	x	x	x(3)	x
299-W18-21	1-3/88, V8	x	x	x(3)	x
299-W18-22	1-3/88, V8	x	x	x(3)	x
299-W18-23	1-3/88, V8	x	x	x(3)	x
299-W18-24	1-3/88, V8	x	x	x(4)	x
Total Wells for the Low-Level Burial Grounds - 35					
Nonradioactive Dangerous Waste Landfill					
699-26-35A(SM-1)	5-9/86	x[3]	x	x[3]	x[3]
699-26-34(SM-2)	5-9/86	x[3]	x	x[3]	x[3]
699-25-34A(SM-3)	5-9/86	x[3]	x	x[3]	x[3]
699-26-33(SM-4)	5-9/86	x[3]	x	x[3]	x[3]
699-25-34B(SM-5)	5-9/86	x[3]	x	x[3]	x[3]

[3]This information can be found in Document 1-3/87, V3.

Summary of Drilling Records Contained in Quarterly Reports

Facility/Well #	Document	Geologist Logs	As-Built Diagram	Geophysical Log	Completion Report
699-26-35B(DO-1)	5-9/86	x[4]	x	x[3]	x[4]
699-25-33B(DO-2)	5-9/86	x[4]	x[4]	x[3]	x[4]
699-35-26C(DM-1)	10-12/86, V3	x	x	x[3]	x[3]
699-25-33A(DM-2)	10-12/86, V3	x	x	–	x[3]
699-26-35D(DO-1A)	10-12/86, V3	x	x	x[3]	x[3]
Total Nonradioactive Dangerous Waste Landfill Wells - 10					
1301-N Liquid Waste Disposal Facility					
199-N-67	1-3/88, V9	x	x	x(3)	x
199-N-69	4-6/88, V2	x	x	x(3)	x
Total Wells for the 1301-N Liquid Waste Disposal Facility - 2					
1324-N/NA Facilities					
199-N-58	1-3/88, V9	x	x	–	x
199-N-59	1-3/88, V9	x	x	–	x
199-N-60	1-3/88, V9	x	x	x(3)	x
199-N-61	1-3/88, V9	x	x	–	x
Total Wells for the 1324-N/NA Facilities - 4					
1325-N Liquid Waste Disposal Facility					
199-N-70	4-6/88, V2	x	x	x(3)	x
Total Wells for the 1325-N Liquid Waste Disposal Facility - 1					
216-A-10 Crib					
299-E17-19	10-12/88, V2	x	x	x(3)	x
299-E17-20	10-12/88, V2	x	x	x(3)	x
299-E24-16	10-12/88, V2	x	x	x(3)	x
299-E24-17	10-12/88, V2	x	x	x(4)	x
299-E24-18	10-12/88, V2	x	x	x(3)	x
299-E25-36	10-12/88, V2	x	x	x(3)	x
Total Wells for the 216-A-10 Crib - 6					
216-A-29 Ditch					
299-E25-34	10-12/88, V2	x	x	–	x
299-E25-35	10-12/88, V2	x	x	x(3)	x
Total Wells for the 216-A-29 Ditch - 2					

[4]This information can be found in Document 10-12/88, V3.

Summary of Drilling Records Contained in Quarterly Reports

Facility/Well #	Document	Geologist Logs	As-Built Diagram	Geophysical Log	Completion Report
216-A-36B Crib					
299-E17-14	4-6/88, V2	x[5]	x	x(3)	x[5]
299-E17-15	4-6/88, V2	x[5]	x	x(3)	x[5]
299-E17-16	4-6/88, V2	x[5]	x	x(3)	x[5]
299-E17-17	4-6/88, V2	x[5]	x	x(3)	x[5]
299-E17-18	4-6/88, V2	x[5]	x	x(3)	x[5]
Total Wells for the 216-A-36B Crib - 5					
216-B-3 Pond					
699-44-42(BP-3)	10-12/88, V2	x	x	x(1)	x
699-43-42J(BP-7)	10-12/88, V2	x	x	x(3)	x
699-43-43(BP-8)	10-12/88, V2	x	x	x(3)	x
699-42-42B(BP-10)	10-12/88, V2	x	x	x(3)	x
699-43-45(BP-1)	7-9/89, V2	x	x	x(1)	x
699-44-43B(BP-2)	7-9/89, V2	x	x	x(1)	x
699-43-41E(BP-4)	7-9/89, V2	x	x	x(1)	x
699-40-39(BP-5)	7-9/89, V2	x	x	x(2)	x
699-41-40(BP-6)	7-9/89, V2	x	x	x(2)	x
699-43-41F(BP-9)	7-9/89, V2	x	x	x(2)	x
Total Wells for the 216-B-3 Pond - 10					
2101-M Pond					
299-E18-1	7-9/88, V2	x	x	x(3)	x
299-E18-2	7-9/88, V2	x	x	x(3)	x
299-E18-3	7-9/88, V2	x	x	x(3)	x
299-E18-4	7-9/88, V2	x	x	x(3)	x
Total Wells for the 2101-M Pond - 4					
Grout Treatment Facility					
299-E25-37	7-9/89, V2	x	x	x(2)	x
299-E25-38	7-9/89, V2	x	x	x(1)	x
Total Wells for the Grout Treatment Facility - 2					
Single-Shell Tanks					
299-E24-19	10-12/89, V2	x	x	x(3)	x
299-E25-40	10-12/89, V2	x	x	x(2)	x
299-E25-41	10-12/89, V2	x	x	x(2)	x
299-E27-12	10-12/89, V2	x	x	x(2)	x
299-E27-13	10-12/89, V2	x	x	x(2)	x

[5]This information can be found in Document 7-9/88, V2.

Facility/Well #	Document	Geologist Logs	As-Built Diagram	Geophysical Log	Completion Report
299-E27-14	10-12/89, V2	x	x	x(2)	x
299-E27-15	10-12/89, V2	x	x	x(2)	x
299-E33-31	10-12/89, V2	x	x	x(1)	x
299-E33-32	10-12/89, V2	x	x	x(2)	x
299-E33-33	10-12/89, V2	x	x	x(1)	x
299-W10-15	10-12/89, V2	x	x	x(2)	x
299-W10-16	10-12/89, V2	x	x	x(2)	x
Total Wells for the Single-Shell Tanks - 12					

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Pacific Northwest Laboratories

Project Number

Enclosure 3

Internal Distribution

RW Bryce
PG Doctor
File/LB

Date March 15, 1990

To K. B. Olsen

From S. H. Hall SHHall

Subject IRON AND TURBIDITY IN GROUND-WATER SAMPLES

Per your request, I have reviewed the evidence which shows that most (if not all) iron in unfiltered ground-water samples from the Hanford Site is an artifact of well installation, is one component of measured turbidity, and does not represent colloidal mass transport within the aquifer. The evidence is summarized below, and is supported by the attached memo and figures. All analytical work described here was performed on unfiltered samples.

EXPERIMENTAL

The memo describes time-series field analysis performed during extended purging (i.e., redevelopment) of wells E18-2 and E18-4 (near the 2101-M Pond) in November 1988. The experiment showed that both iron and turbidity were significantly reduced during pumping. After five standing bore volumes were pumped from well E18-2, the total iron concentration was 0.13 mg/L. As pumping continued (see attached Figure 1), the iron concentration was reduced to about 0.02 or 0.03 mg/L. Six days after this experiment was concluded, this well was purged and sampled using routine procedures described in PNL-MA-567 (pH, temperature, and conductivity stabilized; at least three bore volumes removed), and the reported iron concentration for the unfiltered sample collected at that time was 0.14 mg/L. This recurrence of "high" iron concentration is probably the result of some combination of continued corrosion of materials introduced during well installation, inefficient development near the top of the saturated zone (see memo), and continued removal of iron-bearing sediments disturbed by drilling.

Figure 2 shows a logarithmic plot of turbidity measurements made during the above experiments (well #1 in the figure is E18-2, and well #2 is E18-4). From the figure, it is clear that turbidity did not approach a stable value for either well. If any of the measured turbidity were due to colloidal transport within the aquifer, approach to a steady-state value would be expected.

Figures 3, 4, and 5 illustrate the results of field measurements made during the initial development of wells installed in the vicinity of B-Pond (wells BP-1, BP-2, and BP-9, respectively). Note that wells BP-1 and BP-2 were pumped at constant rates, but that the pumping rate for BP-9 was varied several times. From these figures, it is apparent that turbidity and iron follow parallel trends, so at least part of the measured turbidity is due to suspended iron-bearing material (probably oxides or hydroxides).

DISCUSSION

From the above, it is seen that both iron concentration and turbidity are reduced as a well is pumped, that iron is a component of the turbidity, and that measured turbidity in test wells is not due to colloidal transport within the aquifer. Therefore, iron (at least in concentrations greater than about 0.02 or 0.03 mg/L), like turbidity, must be an artifact of well installation, and is not representative of in situ geochemistry.

For initial well development, the common criterion for successful development is that the pumped ground-water must display turbidity less than or equal to 5 NTU. It is apparent from the above evidence that this criterion is not sufficient to ensure that iron concentrations in collected unfiltered samples are representative of true ground-water chemistry.

Similarly, purging criteria used for periodic sampling of Hanford wells (see Figures 1, 3, and 4) are not sufficient to avoid false high iron concentrations in unfiltered samples. Similar arguments seem to apply where chromium and manganese concentrations are significantly higher in unfiltered samples than in filtered samples.

The presence of such artifacts may not be objectionable if they do not mask or alter ground-water geochemistry. That is, artifacts can be ignored if they are identified as such, and do not bias the interpretation of actual ground-water quality. The key to identifying artifacts is time-series sampling and analysis as illustrated here.

SHH/dla

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Internal Distribution

RW Bryce
MD Freshley
GV Last
KB Olsen
RM Smith
SS Teel
File/LB

Date November 10, 1988

To M. A. Chamness

From S. H. Hall

Subject REDEVELOPMENT OF WELLS E18-2 AND E18-4 AT 2101-M POND

Per your request, I assisted Mr. S. S. Teel during the redevelopment of wells E18-2 and E18-4 at the 2101-M Pond, by providing field chemical analysis of the effluent stream during pumping.

The parameters measured were sulfate, hexavalent chromium, total iron, pH, conductivity, temperature, and turbidity. Sulfate was chosen because, of all the "major" ions, it provides the best contrast between ground water and pond water in the vicinity of the 2101-M pond. Chromium and iron were chosen because these metals have been detected in excess of drinking water standards in samples previously collected from these wells (the standards are 50 and 300 ppb, respectively). Solution pH, conductivity, temperature, and turbidity are commonly used as the only indicators of the state of well development, so they were included for the purpose of comparison. All of the field analysis was performed using unfiltered, unpreserved samples.

It is important to note that analytical results for samples collected from these wells prior to the development campaign described here show that all of the chromium and most of the iron was removed by filtration. That is, the metals were present in the collected samples as suspended particulate matter that can be retained by a 0.45 micron filter. In addition, arsenic was detected in samples collected from both wells, although not in excess of the 50 ppb drinking water standard. Selenium was detected in well E18-2, but below the 10 ppb drinking water standard. Neither the arsenic nor selenium detected in samples from these wells was affected by filtration. Manganese was detected in both wells (below the 50 ppb standard), and similar to iron, was partially removed by filtration.

The attached tables summarize the results of field analysis during redevelopment, as well as pertinent results of previous sampling and analysis. Also, the composition of the waste water discharged to the 2101-M Pond is included.

WELL E18-2

On November 4, well E18-2 was pumped at the rate of 34 L/min. Samples were periodically collected and analyzed during the first 117 min. of pumping, with the first sample collected 5 min. after pumping started. Drawdown after 117 min. was 54 cm. Except for the first sample, the pH remained at 8.16+/-0.02 throughout the pumping campaign, and the conductivity remained at 259 to 264 uS/cm. The temperature remained at 19.4+/-0.1 degrees Centigrade throughout

pumping, and the turbidity smoothly declined from 9.9 to 0.67 NTU. No hexavalent chromium was detected with certainty. Iron was detected, and decreased from 0.13 mg/L to an apparently stable concentration value of 0.03 mg/L. The mean sulfate value of 24 mg/L compares well with the previously reported value (23.5 mg/L) for this well.

WELL E18-4

On November 2, well E18-4 was pumped at the rate of 34 L/min, and samples were collected over a period of 167 min., with the first sample collected 5 min. after pumping started. Drawdown after 167 min. was 2.4 cm. An apparent decrease in pH during the first hour of pumping was due to deliberately not recalibrating the pH meter. The final pH value, 8.16, was measured after recalibration, and compares closely with the results from well E18-2 (where the meter was recalibrated prior to each measurement). The conductivity appeared stable throughout pumping, at a mean value of 234 uS/cm. The temperature was similarly stable, at 19.6+/-0.3 degrees Centigrade, and the mean sulfate concentration was 13 mg/L, which is very close to the previously reported concentration of 13.5 mg/L. Turbidity decreased smoothly from 21 to 0.13 NTU. No hexavalent chromium was detected with certainty, and iron concentration was stable at about 0.03 mg/L (the first sample showed an iron concentration of 0.04 mg/L, but the precision of the field method precludes a declaration that the difference is real).

DISCUSSION AND RECOMMENDATIONS

The stability of the measurements of pH, conductivity, and sulfate during the pumping campaigns shows that these wells have probably been developed sufficiently to determine major ion chemistry, and to measure the concentrations of potential contaminant species that are not likely to have been introduced to the aquifer during well construction. However, chromium and iron (and manganese) are associated with steel alloys, and can easily be introduced during well construction. Their presence in water samples can reflect ground-water composition, or it can reflect either the presence of residual wear metals (drill bits, casing, etc.), or corrosion of construction or pump materials.

Previous sampling and analysis of unfiltered samples shows iron-to-chromium ratios of about 10:1 for well E18-4, and about 7:1 for well E18-2. Considering these ratios, it seems likely that chromium should have been easily detected in the first sample collected during the redevelopment of well E18-2 if the metal were in the hexavalent state often associated with chromium ground-water contamination at the Hanford Site. Further, the particulate nature of the chromium, and of most of the iron and manganese, along with the decrease of the iron concentration during development pumping, suggests that the occurrence of these metals in samples collected from these wells is an artifact of well installation, and not of ground-water composition.

When well development is conducted prior to ground-water sampling, its main purpose is to flush contaminants introduced during well construction from the well bore, packing, and surrounding aquifer. However, the drawdown associated with water table aquifers prevents the uppermost part of the aquifer from being flushed as thoroughly as that part of the aquifer that remains saturated. Well E18-2 was drawn down considerably more than well E18-4, and its initial iron concentration was considerably higher. This suggests that the source of the iron in E18-2 samples lies in the uppermost part of the aquifer, which may not have been sufficiently developed. Because samples from well E18-4 did not show elevated iron concentration, it may be inferred that residual contamination within the aquifer (perhaps wear metals), and not continuing corrosion of the well casing, is the source of the iron contamination. (Prior to redevelopment, well E18-4 showed the higher iron concentrations, but data sufficient for an interpretation are not available.)

The "stable" iron concentration of 0.03 mg/L established for each well during redevelopment compares favorably with the iron concentrations found in filtered samples from earlier sampling episodes. However, the data are not sufficient to conclude that these concentrations actually represent ground-water composition.

In order to confidently separate the effects of residual contamination from actual ground-water composition, it will be necessary to perform additional development pumping and time-series sampling. Samples (unfiltered) should be submitted to the laboratory for determination of iron and chromium as well as of other elements of interest, such as arsenic and selenium. All four of the wells surrounding the 2101-M Pond should be pumped and sampled.

Samples should, at a minimum, be collected at 100, 200, 400, 800, 1600, 3200, and 6400 liters (about 3 hr at 34 L/min.). The pumping rate should remain constant throughout. Samples should be preserved as appropriate.

Finally, comparison of the iron data from well E18-2 with the corresponding pH, conductivity, turbidity, and temperature data shows that stabilization of these latter parameters during purging or pumping does not ensure that collected samples are representative of ground-water.

SHH/dla

Well E18-2

November 4, 1988 Redevelopment — Pumping Rate: 34 L/min

Time (min)	pH	Conductivity (µS/cm)	Temperature (°C)	SO_4 (mg/L)	Cr(VI) (mg/L)	Fe (mg/L)	Turbidity (NTU)
+5	8.27	247	19.4	27	0.00	0.13	9.9
15	8.16	259	19.5	26	0.01	0.06	2.8
36	8.16	266	19.3	22	0.00	0.02	1.4
56	8.17	267	19.4	24	0.00	0.03	1.1
117	8.14	264	19.5	21	0.00	0.03	0.67
August 16, 1988 Sample:				23.5	0.03(a)	0.25	
September 22, 1988 Sample:					0.09(a)	0.54	

(a) Total chromium

Well E18-4

November 2, 1988 Redevelopment — Pumping Rate: 34 L/min

Time (min)	pH	Conductivity (µS/cm)	Temperature (°C)	SO_4 (mg/L)	Cr(VI) (mg/L)	Fe (mg/L)	Turbidity (NTU)
+5	8.19	237	18.4	13	0.00	0.04	21
11	8.18	236	19.6	12	0.00	0.03	0.8
17	8.14	234	19.8	14	0.00	0.03	0.47
27	8.12	221	19.7	11	0.00	0.03	0.43
59	8.08	241	19.4	13	0.00	0.03	0.22
107	8.16	233	19.3	14	0.00	0.02	0.18
167				12	0.00	0.03	0.13
August 16, 1988 Sample:				13.5	0.05(a)	0.49	
September 22, 1988 Sample:					0.16(a)	1.58	

(a) Total chromium

Waste Water Discharged to 2101-M Pond

Sampling Date	pH	Conductivity (μS/cm)	SO_4 (mg/L)	Cr (mg/L)	Fe (mg/L)
09/17/85	7.51	130	13	0.01	0.09
05/23/86	7.10		13	<0.01	0.50
07/17/86	6.07	130	14	<0.01	0.28
10/30/86	5.10	92	9	<0.01	1.30
01/26/87	5.24	63	5	<0.01	0.24

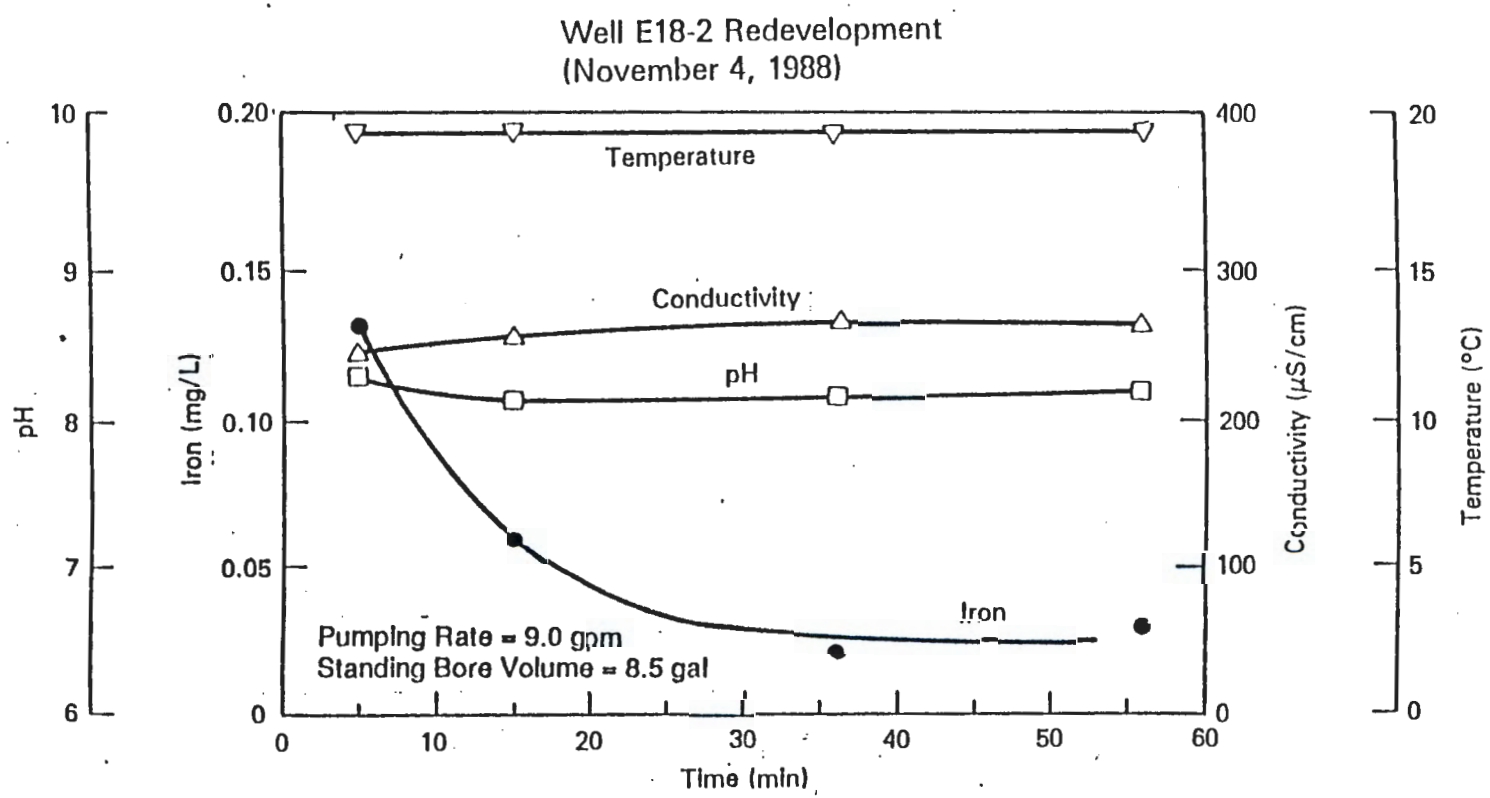

FIGURE 1. Results of Time-Series Sampling and Field Analysis During Extended Purging of a Monitoring Well at 2101-M Pond

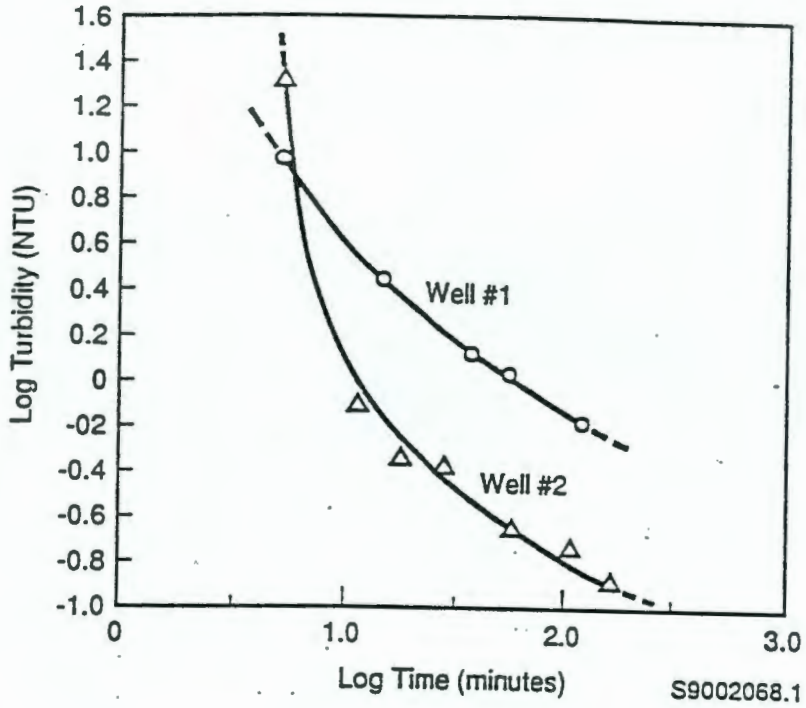

FIGURE 2. Reduction of Turbidity During Extended Purging of Two Monitoring Wells at 2101-M Pond.

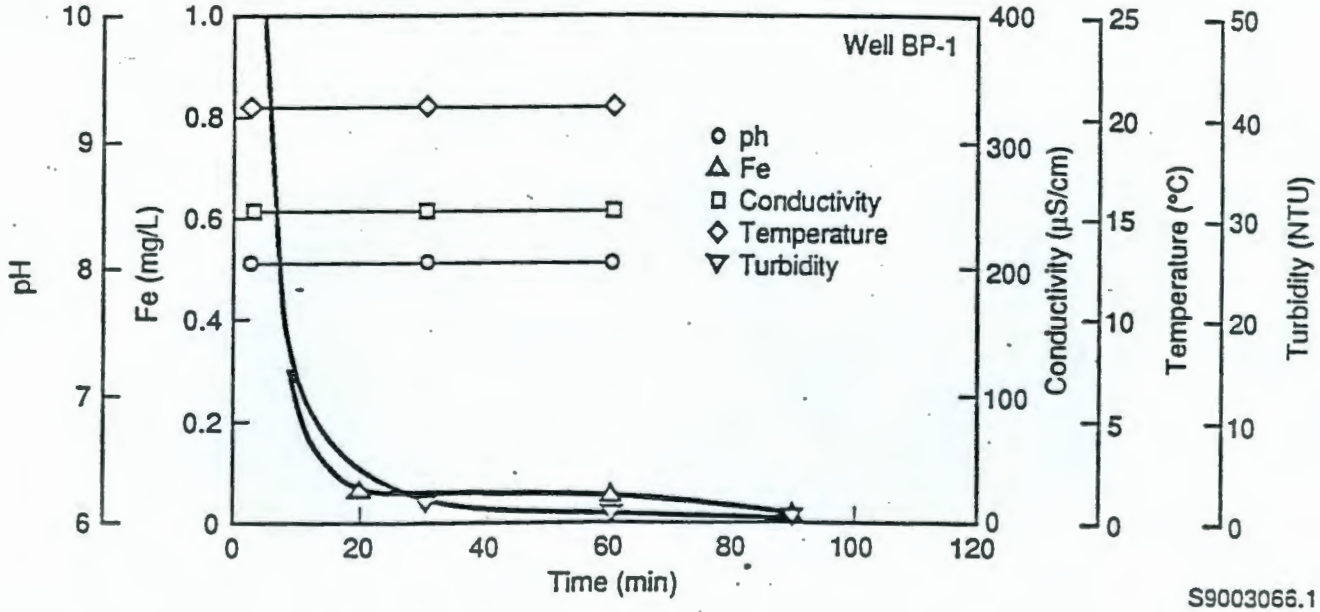

FIGURE 3. Results of Time-Series Sampling and Field Analysis During Initial Development of a Monitoring Well at B-Pond. Pumping rate was 26 L/min., and the standing bore volume is 36 L.

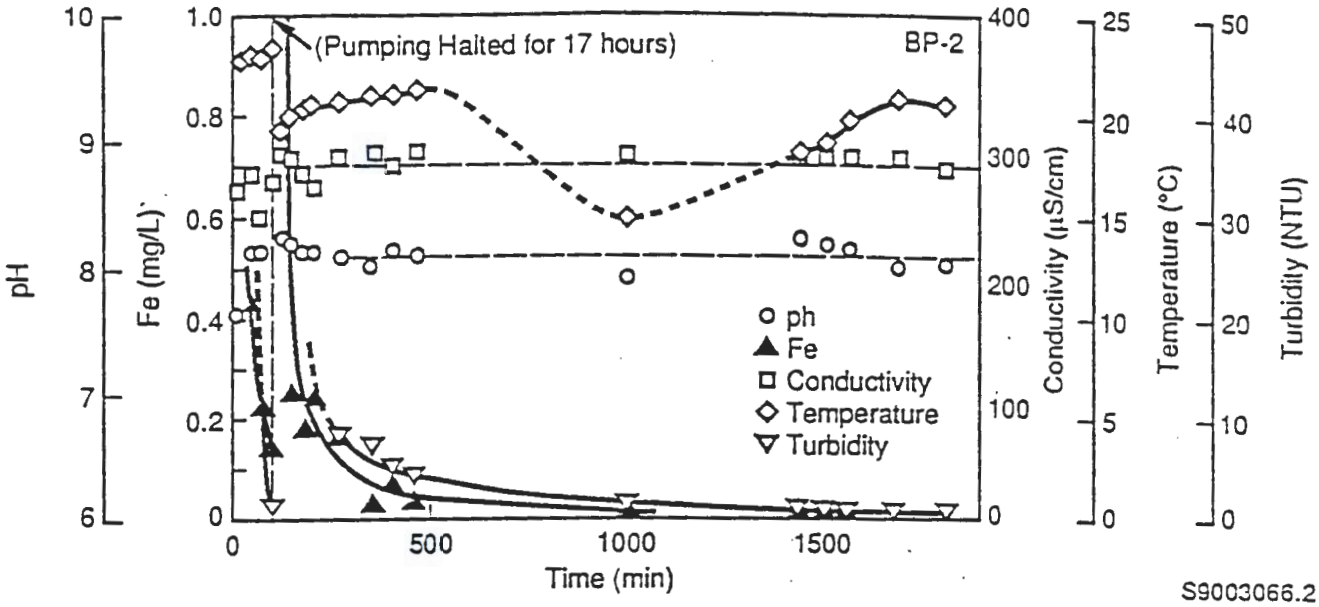

FIGURE 4. Results of Time-Series Sampling and Field Analysis During Initial Development of a Monitoring Well at B-Pond. Pumping rates before and after the 17-hour halt were 19 L/min, and 15 L/min, respectively. Standing bore volume is 36 L.

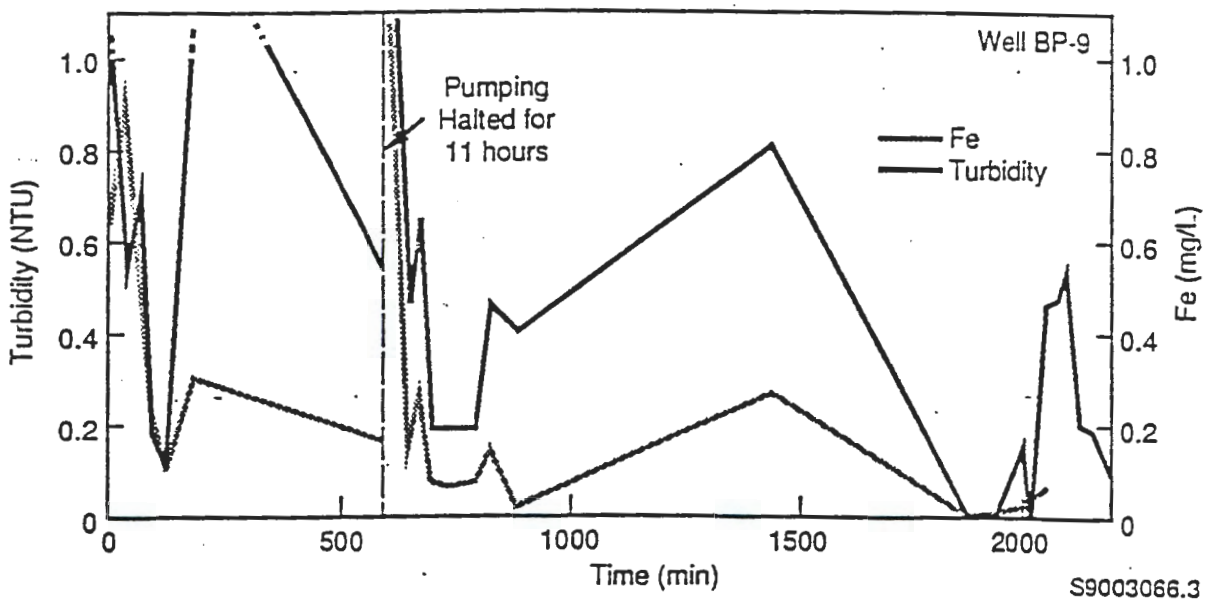

FIGURE 5. Results of Time-Series Sampling and Field Analysis During Initial Development of a Monitoring Well Near B-Pond. (The irregular variations in both the iron and turbidity plots correspond to variations in pump flow rate.)

Enclosure 4

Battelle
Pacific Northwest Laboratories

Project Number _____

Internal Distribution

RW Bryce
RH Gray
EJ Jensen
File/LB

Date March 23, 1990

To Roy Gephart

From Khris Olsen KB O

Subject Develop Plume Maps to Evaluate Groundwater Constituents of Concern Relating to Purge Water Strategy

INTRODUCTION

To implement the purge water strategy outlined in "Strategy for Handling and Disposing of Purgewater at the Hanford Site, Washington", Revision 5, (WHC-MR-0039), a minimum list of constituents of concern will be required to be measured in groundwater on an area by area basis. During the March 7 meeting with DOE, EPA, WDOE, WHC, and PNL, an attempt was made to develop such a list; however, it was recognized that analytical data not available at the meeting was needed to develop a minimum list of constituents. In the attempt to initiate the development of such a list, PNL has reviewed the existing Hanford groundwater data base and produced plume maps of selected constituents of concern on the Hanford Site. A discussion of the data and the plume maps for selected constituents of concern will be presented.

RESULTS AND DISCUSSION

The constituents in Table 1 are a condensed list of constituents from the purge water strategy document described above and corresponding action levels. These constituents were selected because they exceed release limits criteria identified in the purge water document and are known problems on the Hanford Site. The action levels are 10 times the limits set by the MCLs, FWCTC, and 1/25 of the DCG for radionuclides.

Table 1. List of Constituents of Concern On the Hanford Site and Action Levels

Constituent	Action Level
Carbon Tetrachloride	50 ppb
Chloroform	1000 ppb
Chromium	500 ppb
Cyanide	52 ppb
Gross Alpha	40 pCi/l
Nitrate	450 ppm
Strontium-90	40 pCi/l
Technetium-99	4000 pCi/l
Uranium (U-Chem)	60 ppb
Uranium	40 pCi/l

Plume maps were generated for carbon tetrachloride, gross alpha, uranium, nitrate, strontium-90, and technetium-99. The plume maps were generated from data from groundwater samples collected from January 1, 1987 through December 31, 1989. Initially, site-wide maps with concentration isopleths set at the action level were generated for constituents in Table 1. After reviewing these maps, the areas which had concentrations of constituents exceeding the action levels in Table 1 could be significantly reduced in size. For example, nitrate is found in groundwater from the 200 Area to the Columbia River; however the only area where the concentration in the ground water exceeds 450 ppm (action level) is in the 200 West Area. Therefore, the nitrate data in the attached plume map (Figure 3) is restricted to the area around 200 West Area and vicinity.

No plume maps were produced for chromium, chloroform and cyanide because only one to three wells were identified in the data base that exceeded the action level for each of those constituents. The only well that exceeded the 500 ppb action level for chromium was 199-D5-12 at 1382 ± 464 ppb. Three wells exceeded the 52 ppb action level for cyanide: well 699-49-55A at 196 ± 100 ppb, well 699-50-53 at 781 ± 449 ppb and well 299-W14-2 at 67.2 ± 31.7 ppb. The only well that exceeded the 1000 ppb action level for chloroform was well 299-W15-8 at 1650 ppb.

Figure 1 identifies the extent of dispersion of carbon tetrachloride in groundwater that exceeds the 50 ppb action level. Most of the area resides within the boundary of the 200 West Area and its immediate vicinity.

Figure 2 identifies the areal distribution of gross alpha values exceeding 40 pCi/l in the groundwater. Initially a concentration isopleth map was generated for the Hanford Site. After review of the map and associated data, the only area which had gross alpha activity exceeding the action level was the 100-F Area.

Figure 3 identifies the areal distribution of nitrate in groundwater on the Hanford Site that exceeds the 450 ppm action level. The 200 West Area is the only area that exceeds this level. Further review of Figure 3 limits the area to three small locations within the 200 West Area.

Figures 4 and 5 identify the areal distribution of strontium-90 in groundwater on the Hanford Site that exceeds 40 pCi/l action level. Figure 4 is a concentration isopleth map of the 100-N Area and immediate vicinity. The 100-N Area has a known Sr-90 groundwater contamination problem. However, after reviewing Figure 4 the 40 pCi/l isopleth was found not to close within the map area. Figure 5 is the result of expanding the area under investigation to include 4 other 100 Areas (K, D, H, and F). Figure 5 identifies that the 100-D and 100-F Areas also have concentrations of Sr-90 exceeding 40 pCi/l. The 40 pCi/l isopleth to the east of 100-N may be over extended because of the lack of wells in that area to produce an accurate contour. The 40 pCi/l isopleth in the 100-F Area may also be over extended to the north for the same reason.

Figure 6 identifies the areal distribution of Tc-99 in groundwater that exceeds the 4000 pCi/l action level. The eastern portion of 200 West Area and the 600 Area have values exceeding the action level. In addition three wells in and around the 200 East Area have Tc-99 exceeding the 4000 pCi/l limit: well 299-E33-7 at 4303 ± 465 pCi/l, well 699-50-53 at 26383 ± 6593 pCi/l, and well 699-49-55A at 8146 ± 4684 pCi/l.

Figures 7 and 8 identify specific areas on the Hanford Site that exceed the action level of 40 pCi/l or 60 ppb for uranium. Only the 200 West (Figure 7) and 300 Area (Figure 8) have uranium concentrations exceeding the action levels. The maps of the 200 West Area identify the southeast portion of that site and the adjoining 600 Area as the area with uranium concentrations above the action level. The uranium plot generated with laser fluorescence data of the 300 Area (Figure 8) identify two distinct regions of uranium contamination above the action level. One region is located to the north of the enclosed 300 Area and the second region is centrally located on the eastern boundary of the 300 Area adjacent to the Columbia River.

CONCLUSIONS

Based upon the data presented on the 8 concentration isopleth maps, the areas that would require containment of purge water will be limited to only a small number of wells on the Hanford Site (based on this criteria alone). Most of the wells with concentration of selected constituents above action levels are located within the 100 Areas, 200 Areas and 300 Area.

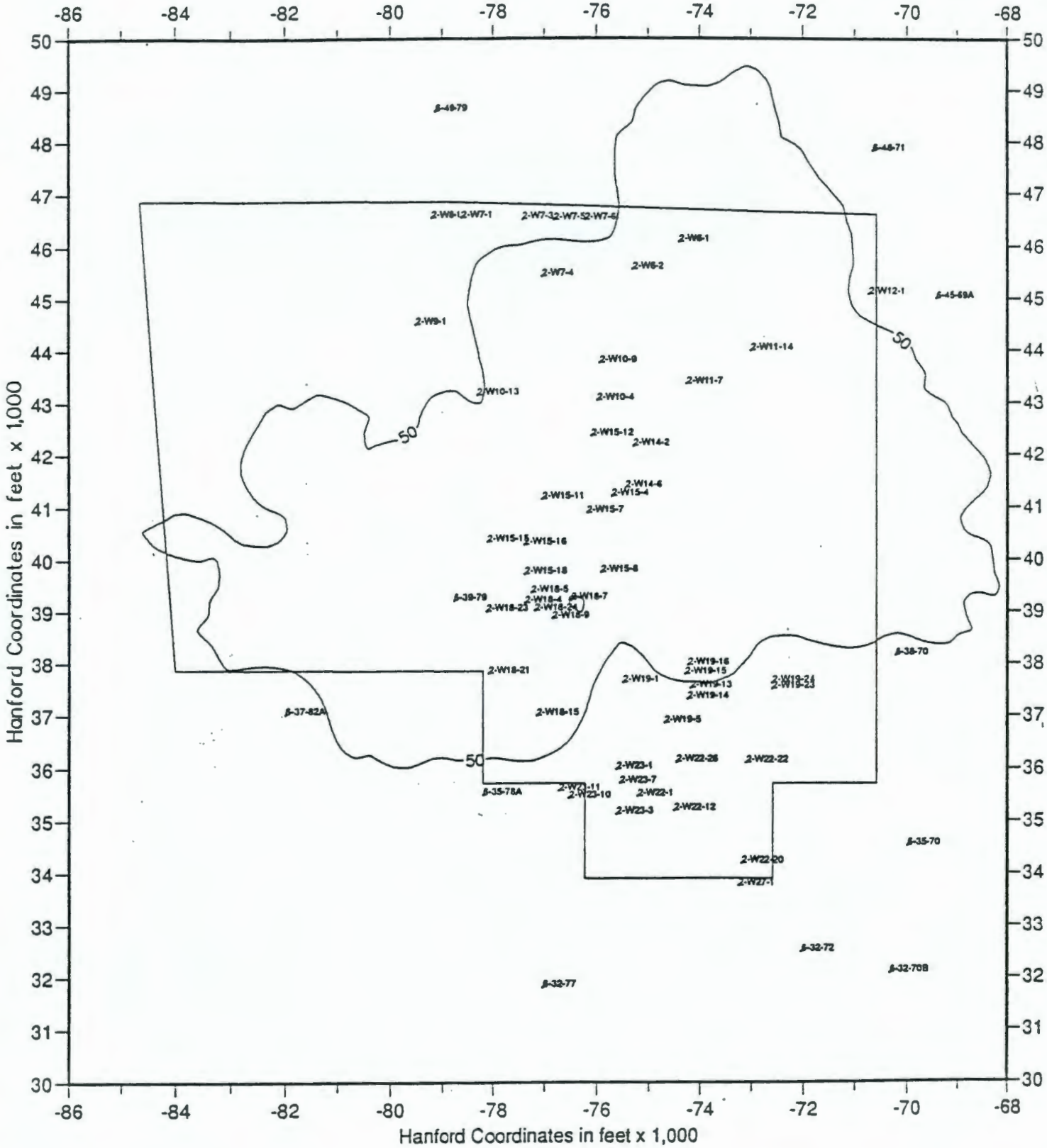

Figure 1. Carbon Tetrachloride (ppb) - 200 West Area (1987-1989 data)

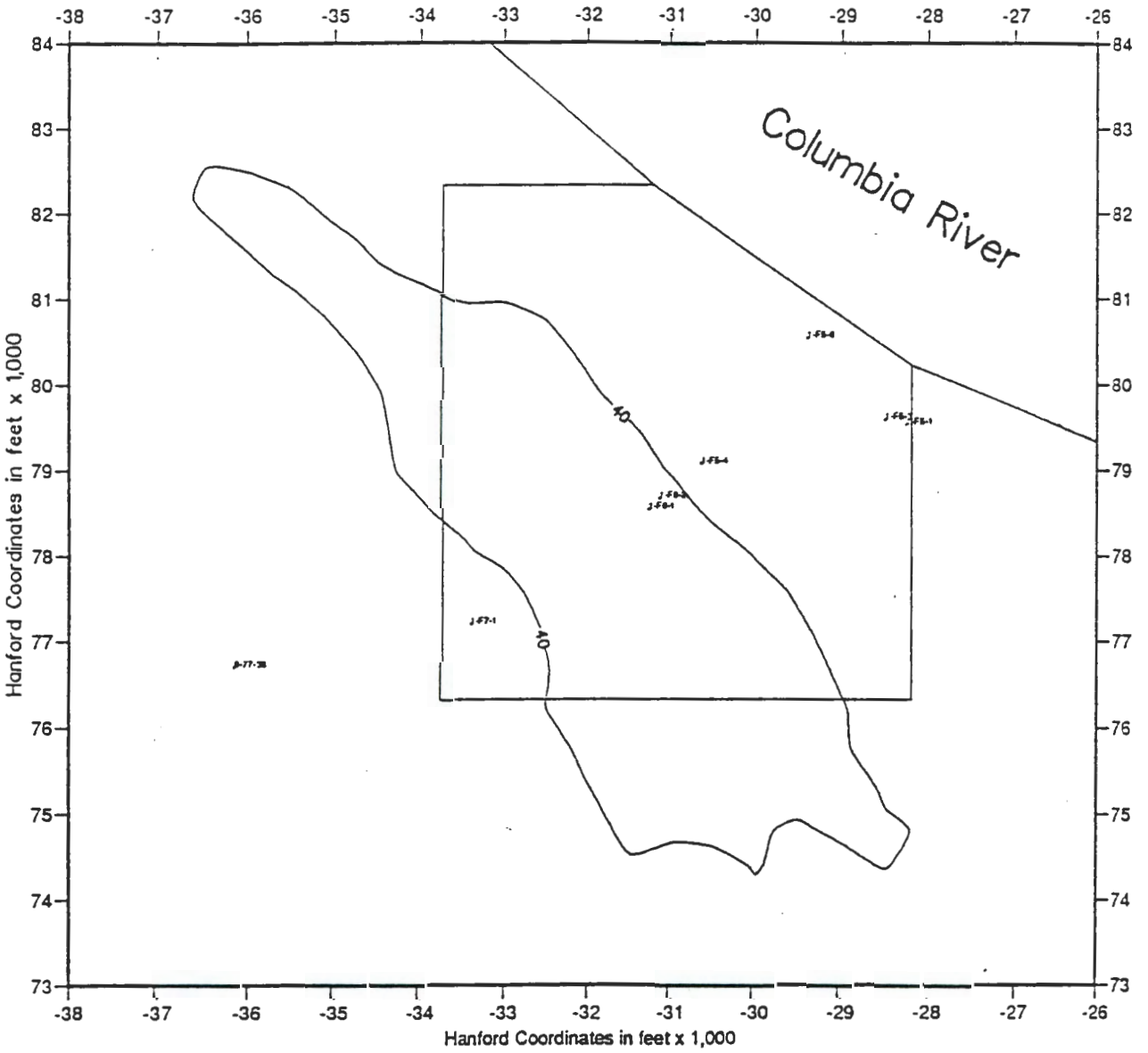

Figure 2. Gross Alpha (pCi/l) - 100F Area (1987-1989 data)

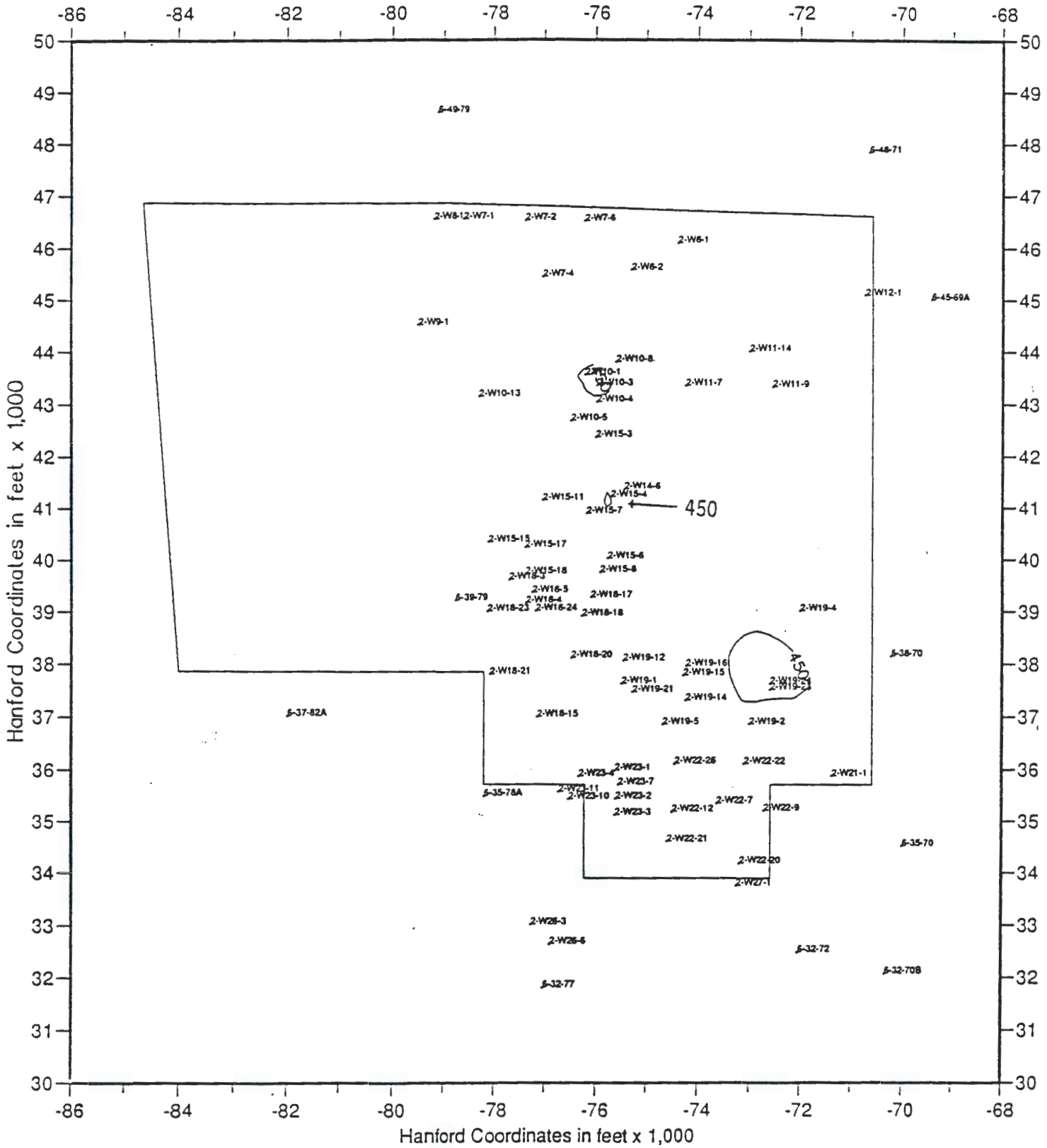

Figure 3. Nitrate (ppm) - 200 West Area (1987-1989 data)

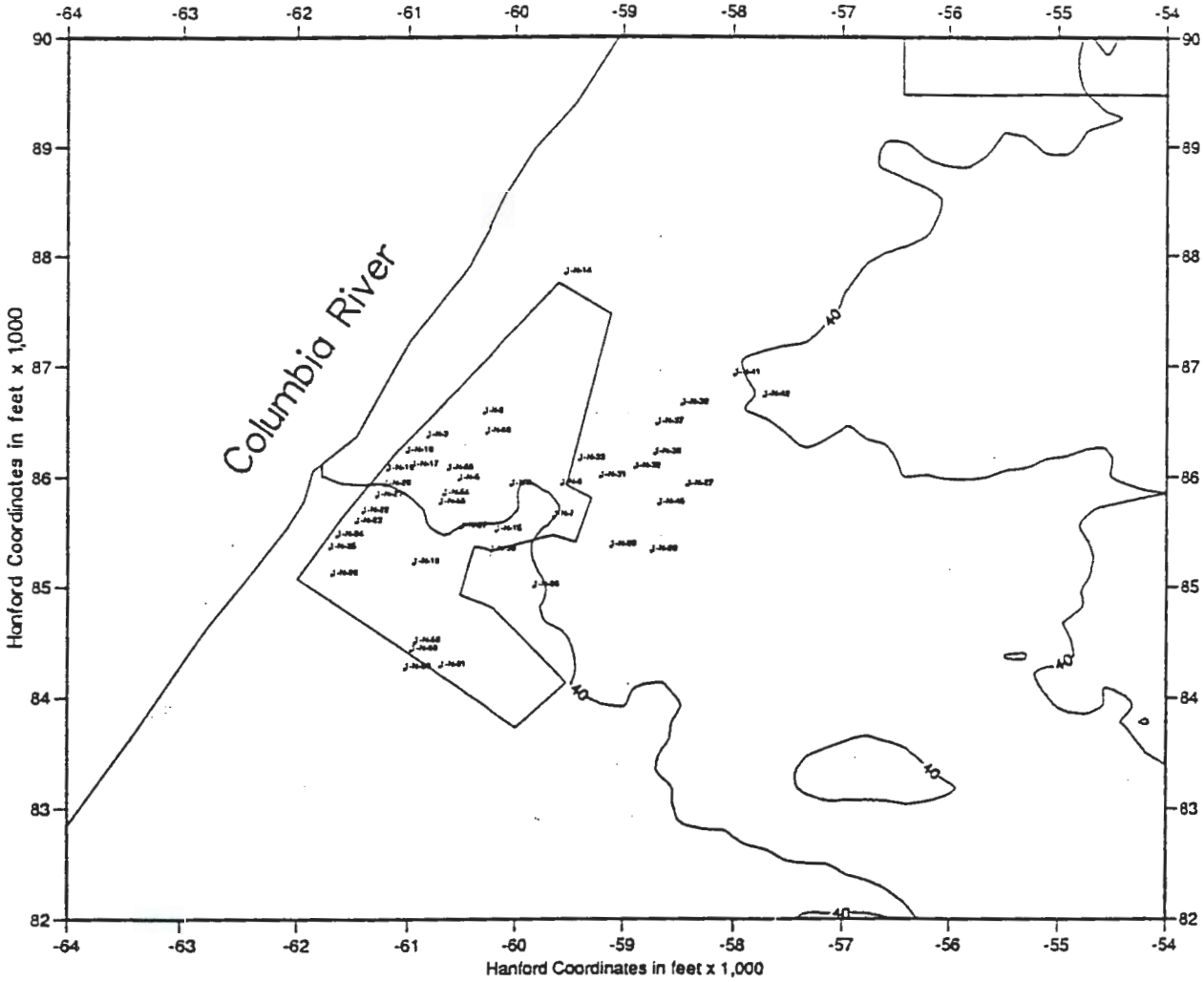

Figure 4. Strontium-90 (pCi/l) - 100 N Area (1987-1989 data)

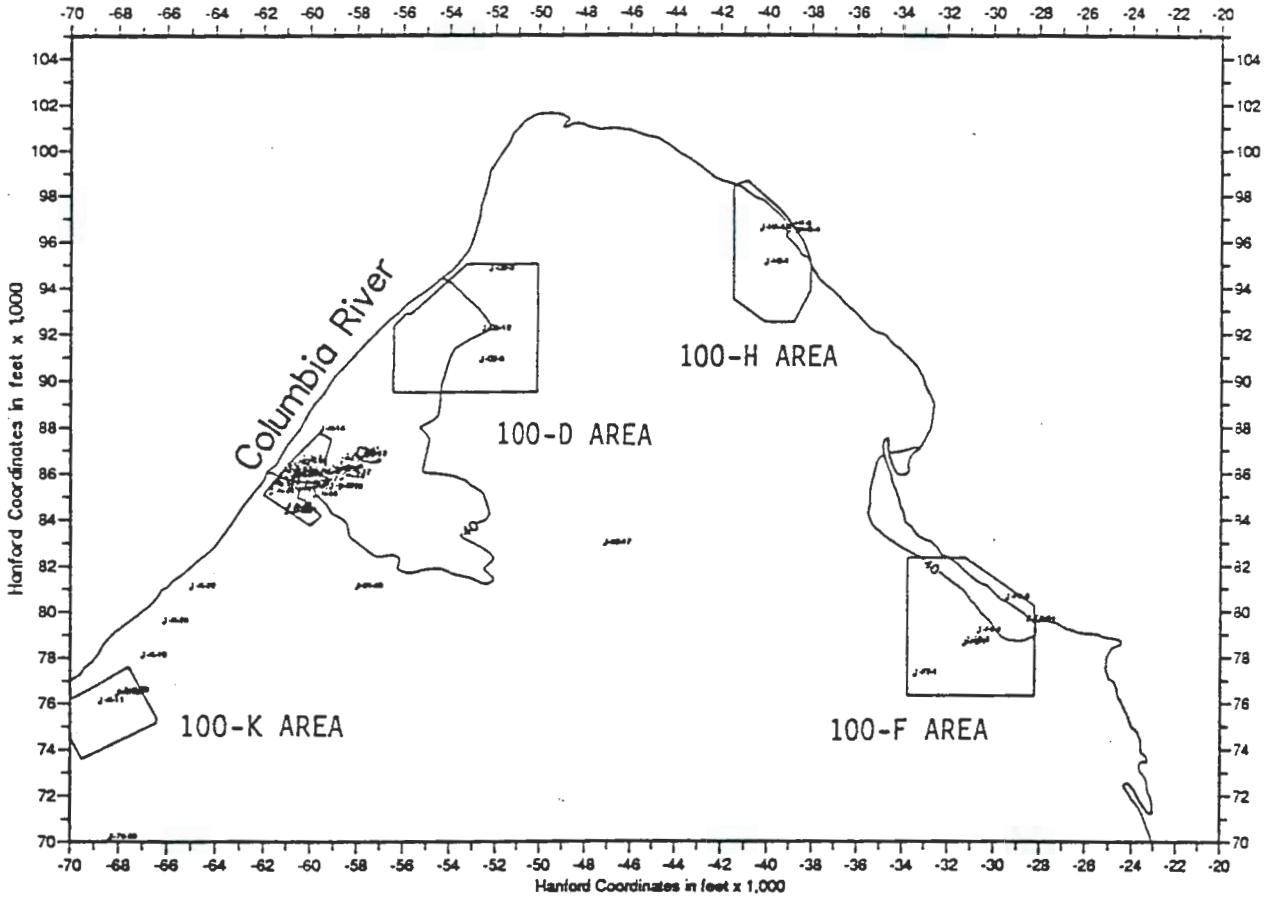

Figure 5. Strontium-90 (pCi/l) - 100 Areas (1987-1989 data)

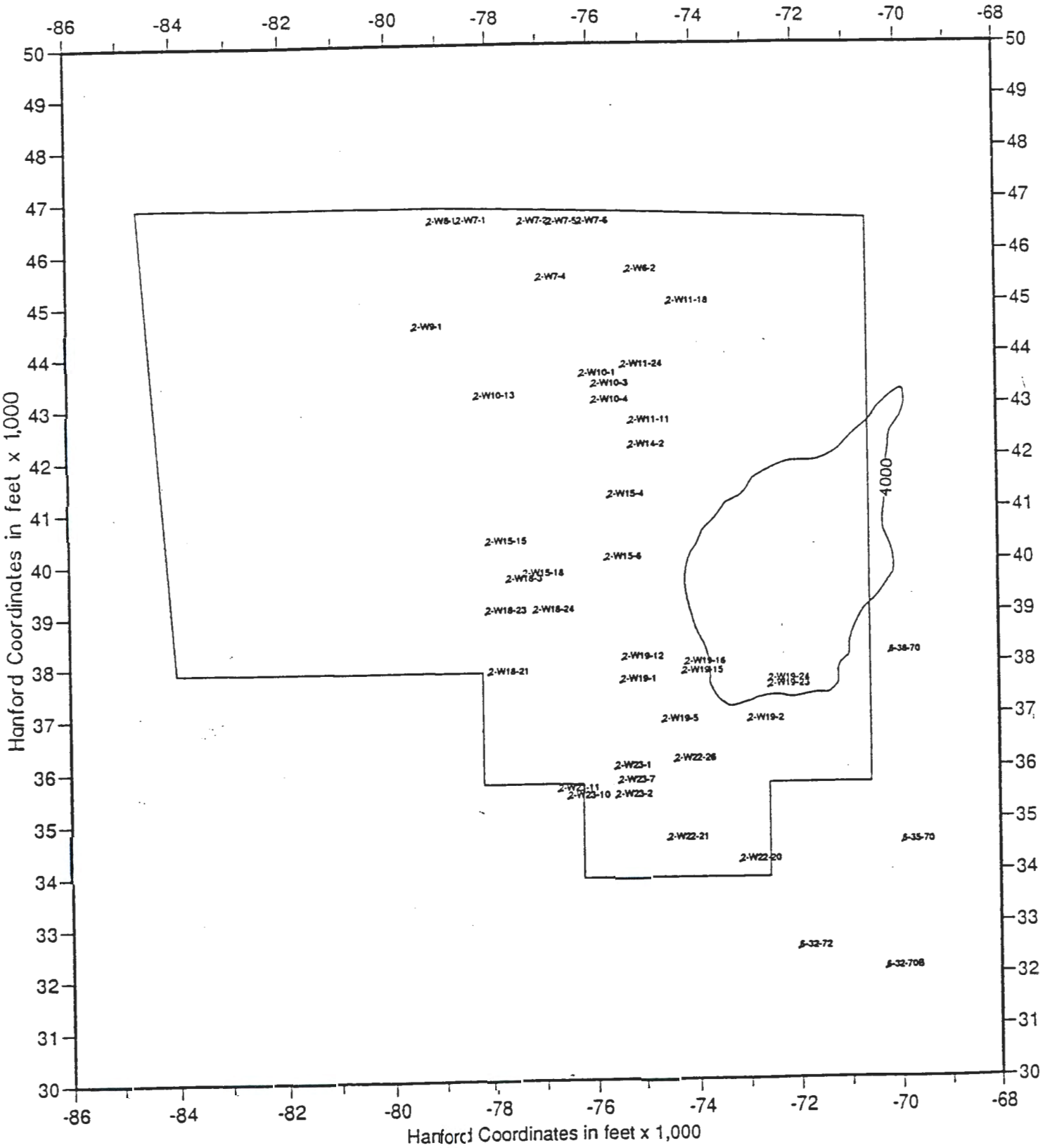

Figure 6. Technetium-99 (pCi/l) - 200 West Area (1987-1989 data)

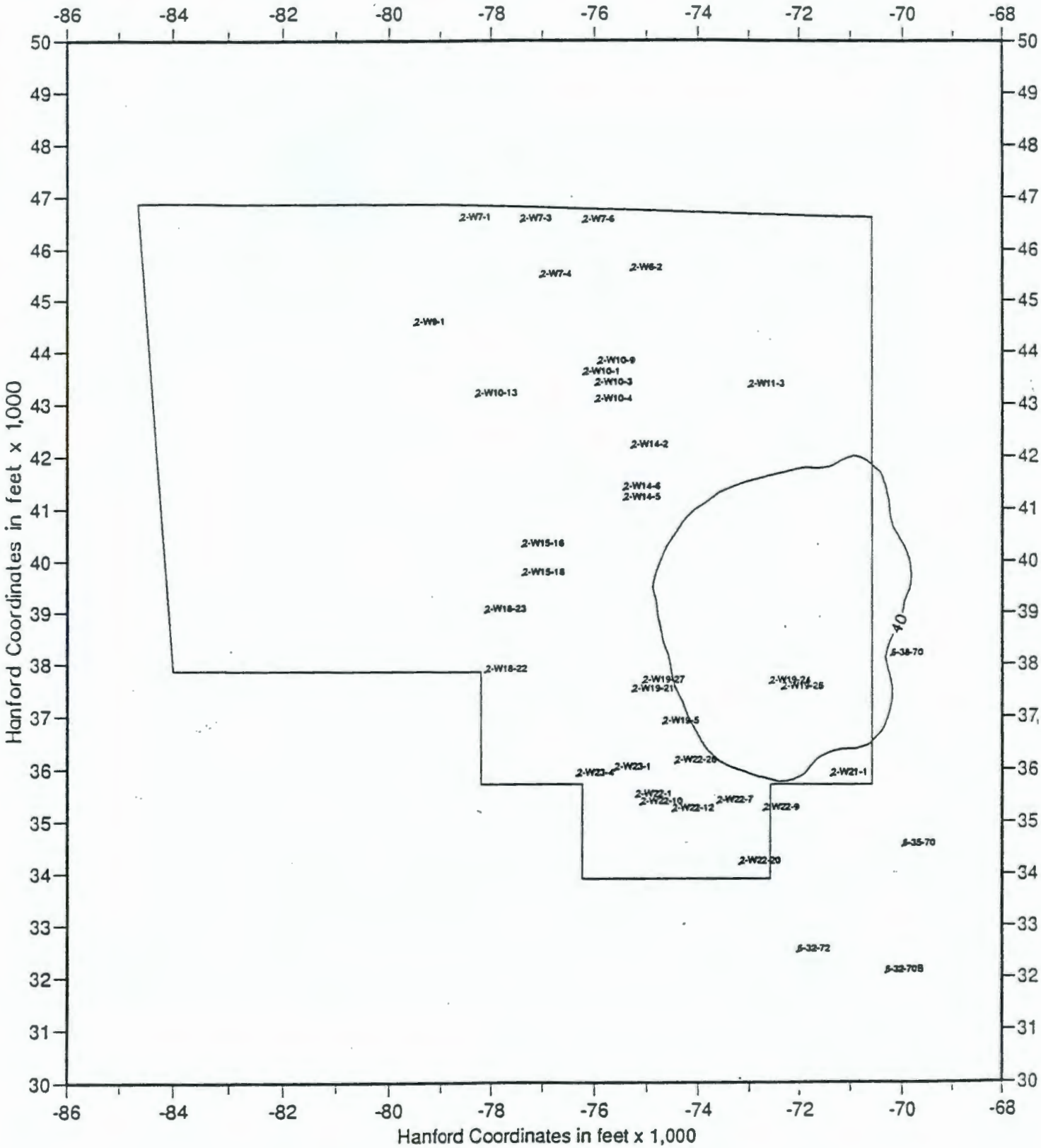

Figure 7. Uranium (pCi/l) - 200 West Area (1987-1989 data)

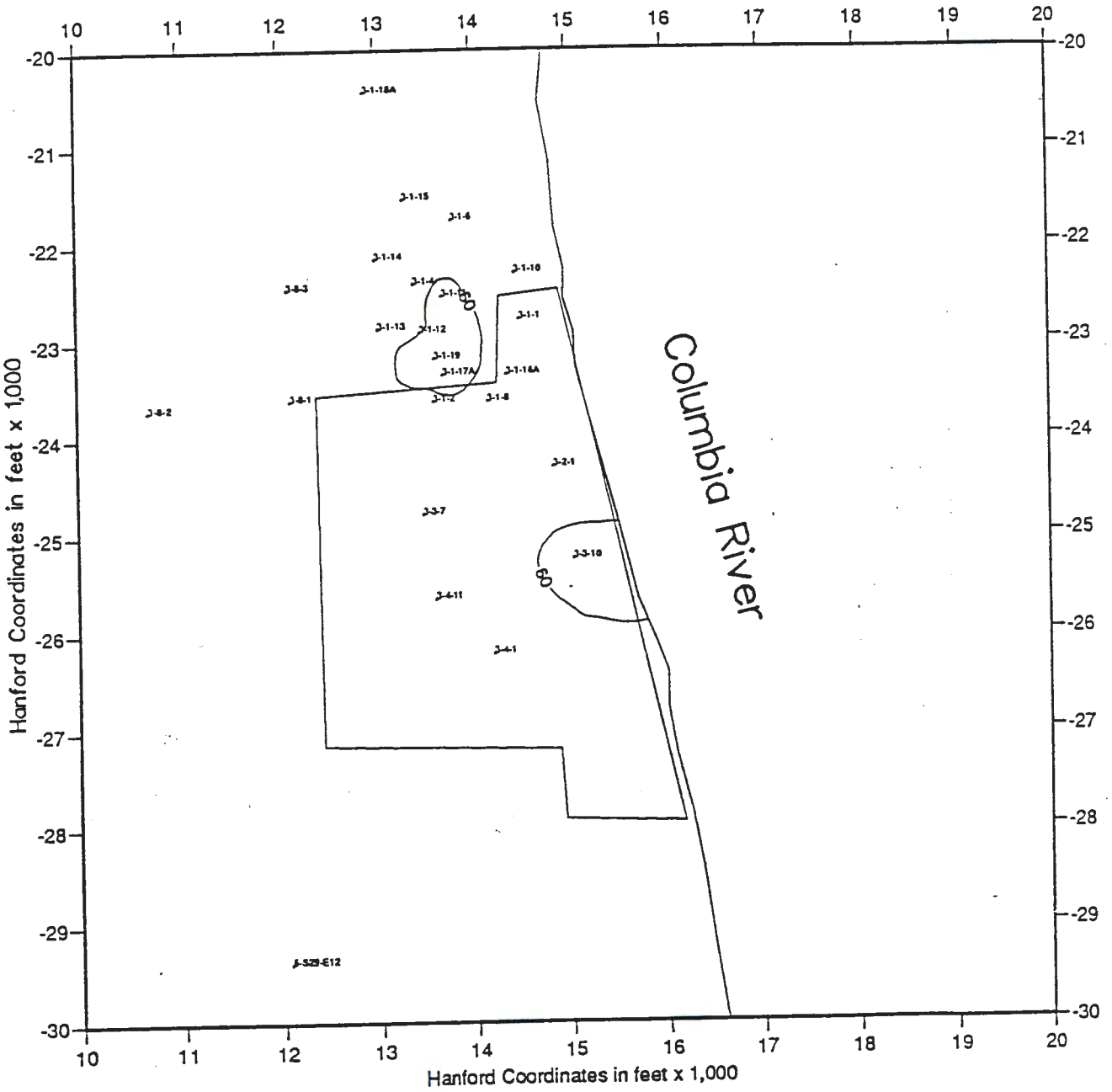

Figure 8. Chemical Uranium (U-chem ppb) - 300 Area (1987-1989 data)