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QUARTERLY ENVIRONMENTAL DATA SUMMARY — FOURTH QUARTER 1992

Weldon Spring Site Remedial Action Project
Weldon Spring, Missouri

MARCH 1993 **REV. 0**

U.S. Department of Energy
Oak Ridge Field Office
Weldon Spring Site Remedial Action Project

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Department Manager	3/12/93 Date
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Deputy Project Director	3/12/93 Date
Project Director	3/12/93 Date

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Weldon Spring Site Remedial Action Project

Quarterly Environmental Data Summary - Fourth Quarter 1992

Revision 0

March 1993

Prepared by

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and
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for the

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ABSTRACT

The purpose of this *Quarterly Environmental Data Summary* is to provide to the public preliminary data acquired as part of the Weldon Spring Site Remedial Action Project (WSSRAP) environmental monitoring program. The document summarizes the preliminary environmental data, highlights any potentially significant findings, and offers tentative interpretations. Validated data and final interpretations will appear in the 1992 annual site environmental report.

This report includes preliminary data from environmental monitoring activities at the Weldon Spring site (WSS) during the fourth quarter of 1992. Groundwater, surface water, and air samples were collected in order to monitor potential exposure pathways. Analytical parameters included radionuclides, nitroaromatic compounds, metals, inorganic anions, and direct gamma exposure. The results are used to evaluate possible exposure scenarios and assess the impact of the contaminants at the site on potentially exposed populations.

Contaminated ground water did not affect the St. Charles County well field.

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1 INTRODUCTION

This quarterly report summarizes the findings from the routine environmental monitoring programs at the Weldon Spring Site Remedial Action Project (WSSRAP). These quarterly reports supplement the annual site environmental report (ASER) by providing interested outside agencies and organizations with more frequent access to WSSRAP data (Appendix A). They provide data resulting from routine environmental sampling as described in the WSSRAP *Environmental Monitoring Plan* (EMP) (MKF and JEG 1992a) and a brief interpretation of that data.

It is the goal of this document to summarize and briefly discuss the data, highlighting data that differ significantly from historical observations. The full interpretation of these data (as well as data in other quarterly summaries) will be undertaken in the 1992 ASER. It is recommended that interested readers refer to previous EMPs, ASERs, and project documents for more information on existing site conditions, site history, transport mechanisms, and quantified contaminant levels. The monitoring scheme for every calendar year is established prior to that year in the annual EMP. Each sampling location to be monitored during the upcoming year is identified in the EMP and the schedule of analytical parameters is tabulated for easy reference. These reports may be obtained by visiting the WSSRAP reading room or contacting the WSSRAP Community Relations Manager at (314) 441-8086.

These quarterly reports are intended to include data from all environmental monitoring programs conducted at the WSSRAP including groundwater, springs, surface water, National Pollutant Discharge Elimination System (NPDES), radon gas, gamma radiation, and air particulates (including asbestos and radioactive particulates). This document summarizes the preliminary environmental data, highlights any potentially significant findings, and offers tentative interpretations. Validated data and final interpretations will appear in the 1992 annual site environmental report. Because standard turnaround time to receive data from the laboratories is 45 days, not all fourth quarter data are available for reporting. These data will be reported in the 1992 ASER. Sludges and soils are not sampled on a routine basis; therefore, analytical results for these parameters are not included in this report. Trend analyses are being prepared from historical data for surface water, groundwater, and air pathways. These analyses will be presented in the 1992 ASER. Quality control (QC) data for the fourth quarter and fifth and sixth bimonthly periods, along with all other periods, will be presented in the 1992 ASER.

2 GROUNDWATER MONITORING

The groundwater is sampled regularly at both the Weldon Spring Chemical Plant/raffinate pits/vicinity properties (WSCP/WSRP/VP) and the Weldon Spring Quarry (WSQ). Due to differences in the environmental settings and sources of contaminants, separate monitoring schedules are followed. Therefore, results of groundwater monitoring at the WSCP/WSRP/VP and WSQ will be discussed separately.

2.1 Chemical Plant/Raffinate Pits/Vicinity Properties

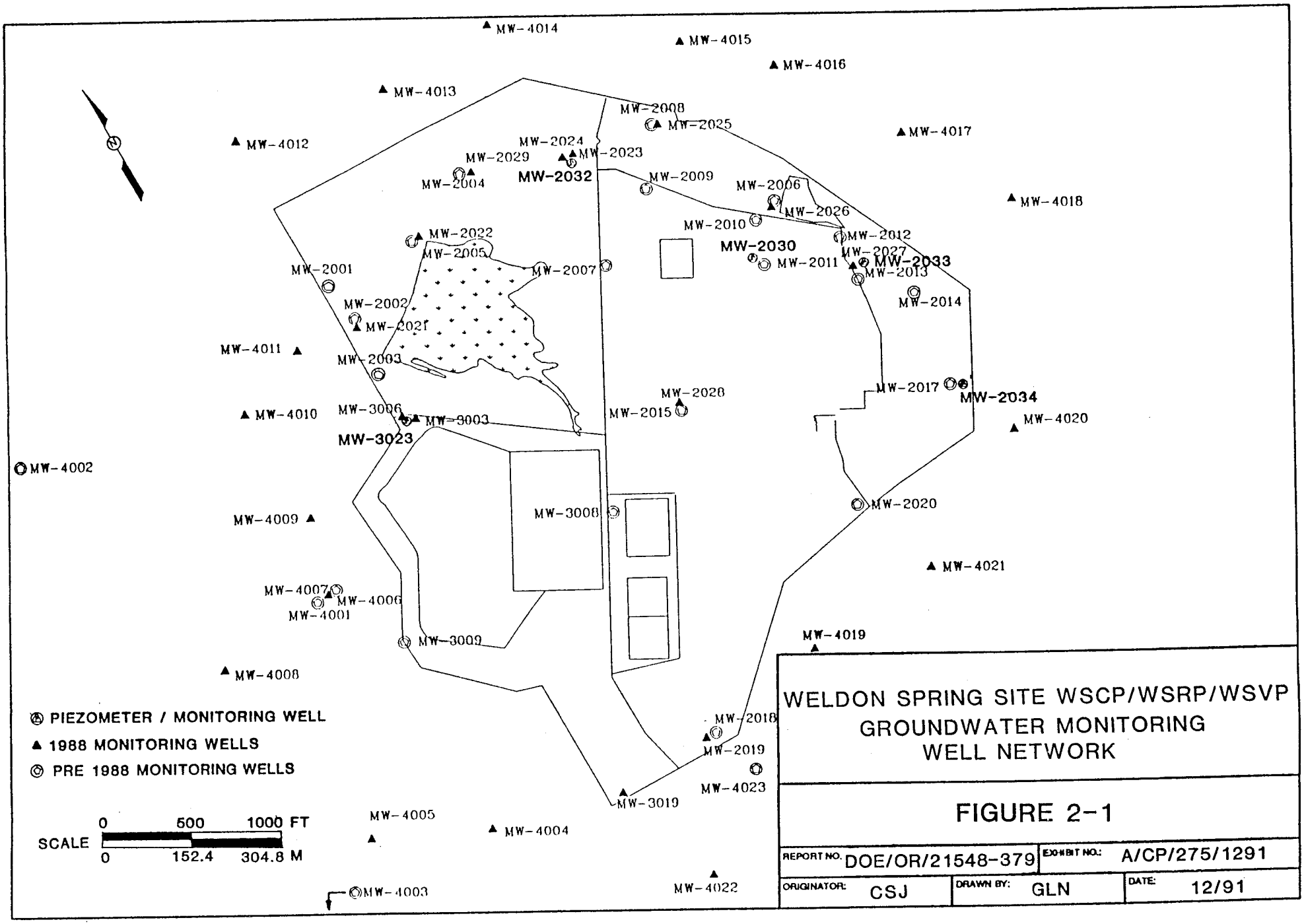
Groundwater at the WSCP/WSRP/VP area is monitored on a quarterly or semiannual basis. Locations are given in Figure 2-1. The number of wells sampled quarterly has increased substantially; a complete list of wells scheduled for quarterly and semiannual sampling is given in the 1992 *Environmental Monitoring Plan* (MKF and JEG 1992a). Total uranium, inorganic anions, and nitroaromatic compounds are measured during each monitoring period for both quarterly and semiannual wells. Other radiological parameters are measured annually during the first period for all wells.

2.1.1 Nitroaromatic Results

Table 2-1 contains nitroaromatic data from samples collected from the groundwater wells monitored quarterly. Nitroaromatic compounds were detected in 15 of the 34 locations. Table 2-2 contains nitroaromatic data from samples collected from the groundwater wells monitored semi-annually. Nitroaromatic compounds were detected in 9 of the 27 locations. Concentration levels for these compounds are within their historical range, with the following exceptions: a new 2,4,6-trinitrotoluene (TNT) high is recorded in well MW-2006 and a new 1,3,5-trinitrobenzene (TNB) low was measured in MW-4013.

2.1.2 Radiological Results

The upper bound for natural uranium background concentration in groundwater at the WSCP/WSRP/VP has been determined to be 3.4 pCi/l (0.13 Bq/l) (MKF and JEG 1989). The U.S. Environmental Protection Agency (EPA) has not yet established a drinking water standard for uranium; however, the proposed maximum contaminant level (MCL) is 20 μg/l, which



WELDON SPRING SITE WSCP/WSRP/WSVP
GROUNDWATER MONITORING
WELL NETWORK

FIGURE 2-1

REPORT NO. DOE/OR/21548-379		EXHIBIT NO.: A/CP/275/1291	
ORIGINATOR: CSJ	DRAWN BY: GLN	DATE: 12/91	

TABLE 2-1 Fourth Quarter Nitroaromatic Results for Groundwater at the WSCP/WSRP/VP

Sample ID	NB (µg/l)	1,3-DNB (µg/l)	2,4-DNT (µg/l)	2,6-DNT (µg/l)	2,4,6-TNT (µg/l)	1,3,5-TNB (µg/l)
GW-2001-Q492	ND	ND	0.098	0.051	ND	0.034
GW-2002-Q492	ND	ND	0.11	0.51	ND	ND
GW-2003-Q492	ND	ND	0.19	1.2	ND	ND
GW-2030-Q492	ND	ND	0.15	12	14	10
GW-2032-Q492	NA	NA	NA	NA	NA	NA
GW-2033-Q492	ND	ND	3.8	7.8	2.9	9.4
GW-3003-Q492	ND	ND	0.058	0.098	ND	ND
GW-3006-Q492	ND	ND	ND	ND	ND	ND
GW-3008-Q492	ND	ND	0.12	0.29	ND	ND
GW-3009-Q492	ND	ND	0.30	0.17	ND	0.36
GW-3023-Q492	ND	ND	7.0	7.1	0.040	ND
GW-4001-Q492	ND	0.13	6.5	3.9	1.3	48
GW-4002-Q492	NA	NA	NA	NA	NA	NA
GW-4003-Q492	ND	ND	ND	ND	ND	ND
GW-4004-Q492	ND	ND	ND	ND	ND	ND
GW-4005-Q492	ND	ND	ND	ND	ND	ND
GW-4006-Q492	ND	ND	0.15	3.3	ND	17
GW-4007-Q492	NA	NA	NA	NA	NA	NA
GW-4008-Q492	ND	ND	ND	ND	ND	ND
GW-4009-Q492	NA	NA	NA	NA	NA	NA
GW-4010-Q492	ND	ND	ND	ND	ND	ND
GW-4011-Q492	ND	ND	ND	ND	ND	ND
GW-4012-Q492	ND	ND	ND	ND	ND	ND
GW-4013-Q492	ND	ND	0.051	0.63	0.032	28
GW-4014-Q492	ND	ND	ND	0.076	0.036	0.50
GW-4015-Q492	ND	ND	0.084	0.90	ND	0.85
GW-4016-Q492	ND	ND	ND	ND	ND	ND
GW-4017-Q492	ND	ND	ND	ND	ND	ND
GW-4018-Q492	NA	NA	NA	NA	NA	NA

TABLE 2-1 Fourth Quarter Nitroaromatic Results for Groundwater at the WSCP/WSRP/VP (Continued)

Sample ID	NB (μg/l)	1,3-DNB (μg/l)	2,4-DNT (μg/l)	2,6-DNT (μg/l)	2,4,6-TNT (μg/l)	1,3,5-TNB (μg/l)
GW-4019-Q492	NA	NA	NA	NA	NA	NA
GW-4020-Q492	ND	ND	ND	ND	ND	ND
GW-4021-Q492	ND	ND	ND	ND	ND	ND
GW-4022-Q492	ND	ND	ND	ND	ND	ND
GW-4023-Q492	ND	ND	0.087	0.042	ND	0.16

NA - Not Available
ND - Not Detected

converts to 13.6 pCi/l (0.50 Bq/l) using a new site-specific conversion factor of 0.68 pCi/μg (assuming isotopic equilibrium). The increase to 13.6 pCi/l (0.50 Bq/l) from the previously reported value of 12 pCi/l (0.44 Bq/l) reflects improved quantification of the average U-234/U-238 activity ratios for uranium present at the Weldon Spring Site Remedial Action Project (WSSRAP).

Total uranium results for samples from the wells monitored quarterly and semi-annually at the WSCP/WSRP/VP are presented in Tables 2-3 and 2-4. Uranium concentrations remained within historical ranges at locations for which data are presently available except for wells MW-3003 and MW-2030, where a new high and low were recorded, respectively.

2.1.3 Sulfate and Nitrate Results

Sulfate and nitrate concentrations are measured during each monitoring period. Results from the wells monitored quarterly are shown in Tables 2-3 and 2-4. Fourth quarter and semi-annual results are within historical ranges with the exception of a new nitrate low in MW-2003. The nitrate level in MW-3003 and sulfate level in MW-4023 were the highest recorded values in these wells since 1989. These values are thought to reflect natural fluctuation in these wells.

TABLE 2-2 Semi-annual Nitroaromatic Results for Groundwater at the WSCP/WSRP/VP

Sample ID	NB (µg/l)	1,3-DNB (µg/l)	2,4-DNT (µg/l)	2,6-DNT (µg/l)	2,4,6-TNT (µg/l)	1,3,5-TNB (µg/l)
GW-2004-S292	ND	ND	ND	ND	ND	ND
GW-2005-S292	ND	ND	0.082	0.14	ND	ND
GW-2006-S292	ND	ND	ND	3.02	2.18	8.53
GW-2007-S292	ND	ND	ND	ND	ND	ND
GW-2008-S292	ND	ND	0.080	1.0	ND	0.85
GW-2009-S292	NA	NA	NA	NA	NA	NA
GW-2010-S292	ND	ND	0.079	0.53	0.40	0.17
GW-2011-S292	0.042	ND	0.10	1.6	ND	0.42
GW-2012-S292	ND	ND	0.30	2.4	0.68	2.8
GW-2013-S292	ND	0.22	0.30	9.1	0.76	5.8
GW-2014-S292	0.033	ND	0.17	0.90	ND	2.2
GW-2015-S292	ND	ND	ND	ND	ND	ND
GW-2017-S292	ND	ND	ND	ND	ND	ND
GW-2018-S292	ND	ND	ND	ND	ND	ND
GW-2019-S292	ND	ND	ND	ND	ND	ND
GW-2020-S292	ND	ND	0.031	ND	ND	ND
GW-2021-S292	ND	ND	ND	ND	ND	ND
GW-2022-S292	ND	ND	ND	ND	ND	ND
GW-2023-S292	ND	ND	ND	ND	ND	ND
GW-2024-S292	ND	ND	ND	ND	ND	ND
GW-2025-S292	ND	ND	ND	ND	ND	ND
GW-2026-S292	ND	ND	ND	ND	ND	ND
GW-2027-S292	ND	ND	ND	ND	ND	ND
GW-2028-S292	ND	ND	ND	ND	ND	ND
GW-2029-S292	ND	ND	ND	ND	ND	ND
GW-2034-S292	ND	ND	ND	ND	ND	ND
GW-3019-S292	ND	ND	ND	ND	ND	ND

NA - Not Available
ND - Not Detected

TABLE 2-3 Fourth Quarter Uranium and Inorganic Anion Results for Groundwater at the WSCP/WSRP/VP

Sample ID	Nitrate (mg/l)	Sulfate (mg/l)	Uranium (pCi/l)
GW-2001-Q492	34.6	8.60	0.68
GW-2002-Q492	450	126	ND
GW-2003-Q492	209	137	1.2
GW-2030-Q492	0.84	42.7	8.0
GW-2032-Q492	111	60.3	4.8
GW-2033-Q492	1.00	28.7	1.8
GW-3003-Q492	467	172	23
GW-3006-Q492	0.24	22.4	0.2
GW-3008-Q492	698	82.8	3.3
GW-3009-Q492	236	20.7	6.7
GW-3023-Q492	454	323	7.6
GW-4001-Q492	31.8	59.4	0.95
GW-4002-Q492	2.70	19.6	0.95
GW-4003-Q492	0.79	31.9	1.5
GW-4004-Q492	0.76	19.1	3.1
GW-4005-Q492	9.70	25.5	0.88
GW-4006-Q492	4.90	27.5	ND
GW-4007-Q492	0.10	11.2	1.8
GW-4008-Q492	ND	13.8	1.6
GW-4009-Q492	0.13	13.3	4.4
GW-4010-Q492	0.16	21.9	2.4
GW-4011-Q492	46.7	59.4	5.8
GW-4012-Q492	0.30	47.2	0.3
GW-4013-Q492	62.8	51.7	ND
GW-4014-Q492	5.30	27.0	ND
GW-4015-Q492	1.60	13.2	0.68
GW-4016-Q492	37.0	21.4	3.2
GW-4017-Q492	0.48	7.60	1.4

TABLE 2-3 Fourth Quarter Uranium and Inorganic Anion Results for Groundwater at the WSCP/WSRP/VP (Continued)

Sample ID	Nitrate (mg/l)	Sulfate (mg/l)	Uranium (pCi/l)
GW-4018-Q492	2.10	7.70	0.4
GW-4019-Q492	0.28	9.20	1.6
GW-4020-Q492	ND	119	13
GW-4021-Q492	ND	245	3.6
GW-4022-Q492	0.24	37.5	3.9
GW-4023-Q492	4.40	145	2.0

ND - Not Detected
NA - Not Available

TABLE 2-4 Semi-annual Uranium and Inorganic Anion Results for Groundwater at the WSCP/WSRP/VP

Sample ID	Nitrate (mg/l)	Sulfate (mg/l)	Uranium (pCi/l)
GW-2004-S292	0.26	1.90	0.89
GW-2005-S292	62.8	25.6	0.66
GW-2006-S292	1.00	32.2	ND
GW-2007-S292	ND	14.7	ND
GW-2008-S292	0.84	38.0	0.68
GW-2009-S292	NA	NA	NA
GW-2010-S292	0.77	30.7	0.68
GW-2011-S292	4.90	13.0	0.5
GW-2012-S292	0.37	67.1	0.8
GW-2013-S292	0.60	20.2	0.4
GW-2014-S292	0.82	33.3	0.81
GW-2015-S292	0.15	125	ND
GW-2017-S292	0.28	701	8.0
GW-2018-S292	0.40	9.70	0.88
GW-2019-S292	ND	41.7	2.5
GW-2020-S292	0.23	139	3.1
GW-2021-S292	ND	14.0	1.1
GW-2022-S292	ND	14.0	ND
GW-2023-S292	0.11	14.4	2.4
GW-2024-S292	0.10	28.7	ND
GW-2025-S292	0.08	15.8	0.95
GW-2026-S292	ND	14.0	NA
GW-2027-S292	NA	NA	0.2
GW-2028-S292	NA	NA	1.3
GW-2029-S292	0.31	24.5	1.3
GW-2034-S292	0.13	645	15
GW-3019-S292	ND	6.40	2.0

ND - Not Detected
NA - Not Available

2.2 Weldon Spring Quarry

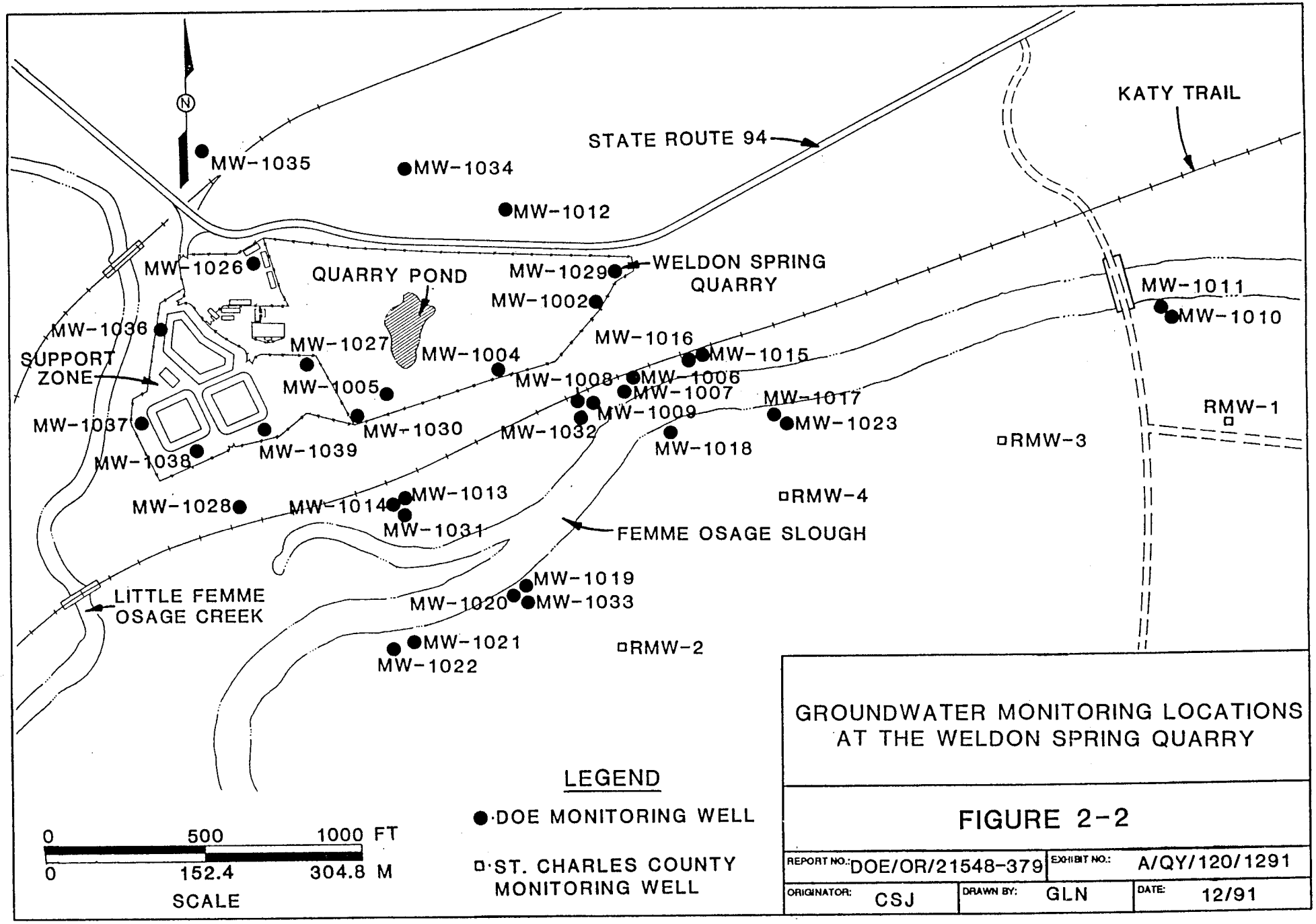
Groundwater at the WSQ has become radiologically and chemically contaminated as a result of contact with, or migration from, wastes present in the WSQ. Monitoring of the groundwater at and near the WSQ is of particular concern because of the proximity of the St. Charles County well field. The well field is located approximately 0.8 km (0.5 mi) to the south of the WSQ. Monitoring of contaminants in groundwater and the protection of the well field is a priority at the WSSRAP.

Groundwater is currently being monitored at 48 wells located in and around the quarry area. Groundwater at the WSQ and surrounding areas is monitored on a bimonthly or quarterly basis as detailed in the 1992 *Environmental Monitoring Plan* (MKF and JEG 1992a). All monitoring well locations are shown in Figures 2-2 and 2-3. These wells monitor groundwater in both the bedrock and alluvial aquifers associated with the WSQ.

2.2.1 Radiological Results

Radiological data are presented in Tables 2-5 through 2-7 for samples collected for the fifth and sixth bimonthly periods and the fourth quarter. The results show typical fluctuations near the average levels in the WSQ area, except for an elevated uranium level that was reported in the sixth bimonthly period in MW-1028 (1,000 pCi/l). This value is considered to be an erroneous laboratory value based on historic averages and has been submitted for validation. Detectable concentrations of uranium were indicated from the St. Charles County RMW-series and production wells. In addition to being within historic averages and representative of background levels, these levels are the result of lower detection limits for uranium during analytical testing.

The St. Charles County RMW-series and production wells are also sampled annually for gross alpha. The results of this analysis are presented in Table 2-7. The concentrations in the St. Charles County well field are consistent with background values of waters in or near the WSQ.



GROUNDWATER MONITORING LOCATIONS AT THE WELDON SPRING QUARRY

FIGURE 2-2

REPORT NO.: DOE/OR/21548-379		EXHIBIT NO.: A/QY/120/1291	
ORIGINATOR: CSJ	DRAWN BY: GLN	DATE: 12/91	

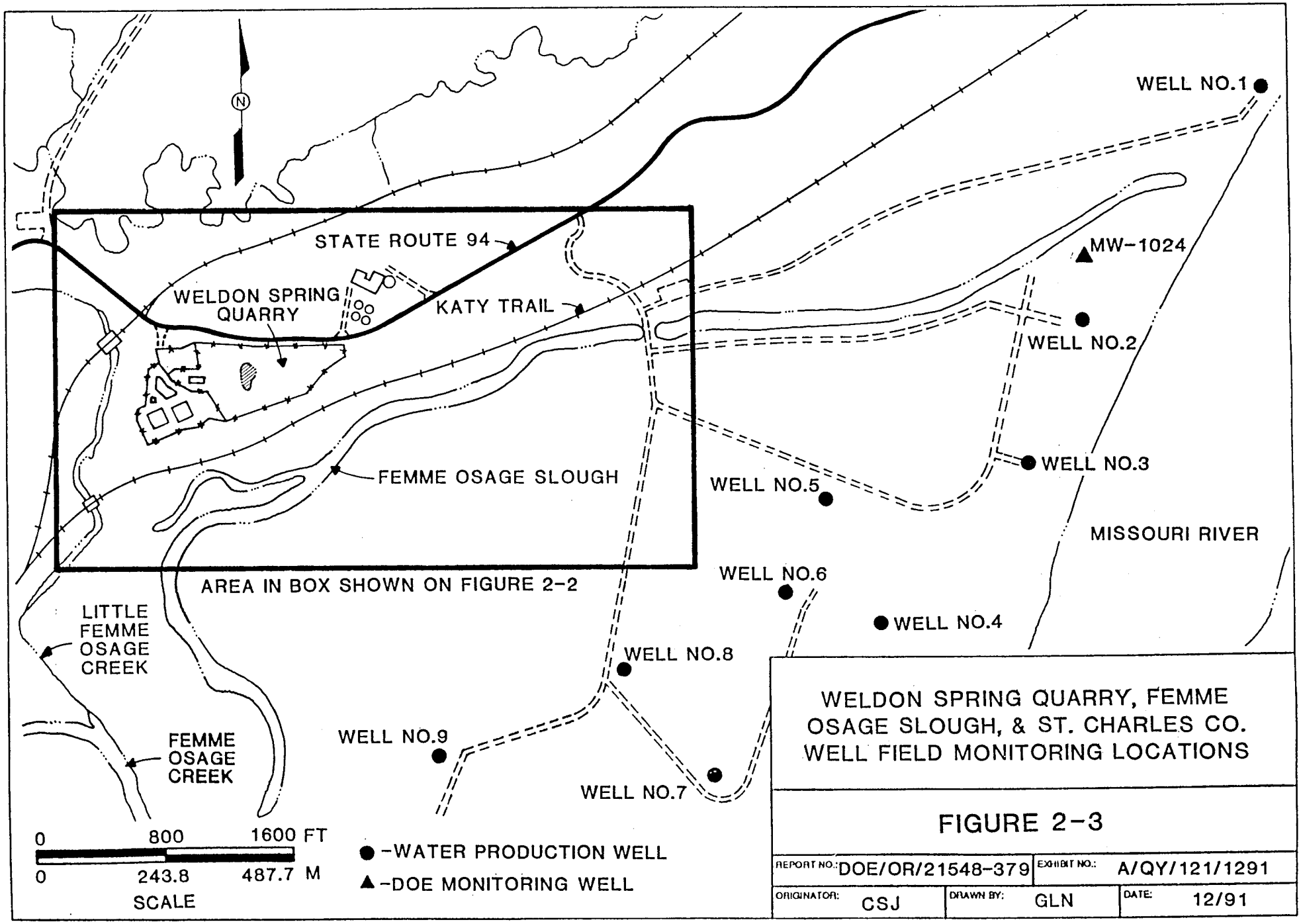

N
STATE ROUTE 94
WELDON SPRING QUARRY
KATY TRAIL
FEMME OSAGE SLOUGH
AREA IN BOX SHOWN ON FIGURE 2-2
LITTLE FEMME OSAGE CREEK
FEMME OSAGE CREEK
WELL NO.1
MW-1024
WELL NO.2
WELL NO.3
WELL NO.5
MISSOURI RIVER
WELL NO.6
WELL NO.4
WELL NO.8
WELL NO.9
WELL NO.7
0 800 1600 FT
0 243.8 487.7 M
SCALE
● -WATER PRODUCTION WELL
▲ -DOE MONITORING WELL
WELDON SPRING QUARRY, FEMME OSAGE SLOUGH, & ST. CHARLES CO. WELL FIELD MONITORING LOCATIONS
FIGURE 2-3
REPORT NO.: DOE/OR/21548-379
EXHIBIT NO.: A/QY/121/1291
ORIGINATOR: CSJ
DRAWN BY: GLN
DATE: 12/91

TABLE 2-5 Fifth Bimonthly (Sept/Oct) Uranium and Inorganic Anion Results for Groundwater at the WSQ

Sample ID	Nitrate (mg/l)	Sulfate (mg/l)	Uranium (pCi/l)
GW-1002-B592	0.57	40.7	2.2
GW-1004-B592	0.30	238	3800
GW-1005-B592	ND	180	2100
GW-1006-B592	0.22	208	2300
GW-1007-B592	0.21	126	140
GW-1008-B592	ND	270	3700
GW-1009-B592	ND	271	4.7
GW-1010-B592	ND	0.49	ND
GW-1011-B592	ND	19.7	15
GW-1012-B592	0.80	62.4	4.1
GW-1013-B592	0.22	106	750
GW-1014-B592	0.22	102	870
GW-1015-B592	0.32	297	1300
GW-1016-B592	0.15	242	480
GW-1026-B592	ND	0.69	0.41
GW-1027-B592	0.22	109	540
GW-1028-B592	ND	81.7	1.30
GW-1029-B592	0.15	69.2	2.4
GW-1030-B592	0.52	81.4	NA
GW-1031-B592	ND	30.8	23
GW-1032-B592	ND	246	1300
GW-1034-B592	0.95	73.1	2.2
GW-1035-B592	0.17	40.5	0.75
GW-1036-B592	ND	55.0	5.6
GW-1037-B592	ND	16.7	0.6
GW-1038-B592	ND	42.9	2.7
GW-1039-B592	ND	52.0	1.2

ND - Not Detected
NA - Not Available

TABLE 2-6 Sixth Bimonthly (Nov/Dec) Uranium and Inorganic Anion Results for Groundwater at the WSQ

Sample ID	Nitrate (mg/l)	Sulfate (mg/l)	Uranium (pCi/l)
GW-1002-B692	1.50	60.8	2.7
GW-1004-B692	0.29	238	2700
GW-1005-B692	0.15	164	1600
GW-1006-B692	ND	406	3300
GW-1007-B692	1.10	80.3	300
GW-1008-B692	ND	228	6000
GW-1009-B692	ND	257	0.82
GW-1010-B692	ND	1.20	ND
GW-1011-B692	ND	43.3	9.5
GW-1012-B692	1.10	63.8	2.3
GW-1013-B692	NA	NA	830
GW-1014-B692	NA	NA	930
GW-1015-B692	1.00	251	880
GW-1016-B692	0.45	243	470
GW-1026-B692	ND	0.71	ND
GW-1027-B692	0.34	111	410
GW-1028-B692	NA	NA	1000
GW-1029-B692	ND	67.9	1.8
GW-1030-B692	0.76	70.1	8.8
GW-1031-B692	ND	29.0	17
GW-1032-B692	ND	241	980
GW-1034-B692	0.93	62.9	2.2
GW-1035-B692	0.12	40.1	ND
GW-1036-B692	ND	55.2	4.5
GW-1037-B692	ND	58.0	0.95
GW-1038-B692	ND	64.3	3.1
GW-1039-B692	ND	17.3	1.3

ND - Not Detected
NA - Not Available

TABLE 2-7 Fourth Quarter Uranium, Gross Alpha and Inorganic Anion Results for Groundwater at the WSQ

Sample ID	Nitrate (mg/l)	Sulfate (mg/l)	Uranium (pCi/l)	Gross Alpha (pCil)
GW-1017-Q492	ND	0.51	ND	NR
GW-1018-Q492	ND	96.0	ND	NR
GW-1019-Q492	ND	0.39	ND	NR
GW-1020-Q492	ND	11.0	ND	NR
GW-1021-Q492	ND	1.50	0.54	NR
GW-1022-Q492	ND	0.43	ND	NR
GW-1023-Q492	ND	3.90	ND	NR
GW-1024-Q492	0.15	3.30	ND	ND
GW-1033-Q492	ND	9.60	1.2	NA
GW-RMW1-Q492	0.15	16.2	1.4	3.5
GW-RMW2-Q492	0.19	23.2	5.1	8.7
GW-RMW3-Q492	0.16	10.5	0.3	7.4
GW-RMW4-Q492	1.10	24.7	1.3	ND
GW-PW02-Q492	NR	NR	ND	ND
GW-PW03-Q492	NR	NR	0.6	ND
GW-PW04-Q492	NR	NR	ND	ND
GW-PW05-Q492	NR	NR	ND	2.5
GW-PW06-Q492	NR	NR	ND	ND
GW-PW07-Q492	NR	NR	0.2	ND
GW-PW08-Q492	NR	NR	0.2	2.2
GW-PW09-Q492	NR	NR	ND	ND
GW-RAWW-Q492	NR	NR	ND	ND
GW-FINW-Q492	NR	NR	0.2	ND

ND - Not Detected
NA - Not Available
NR - Sampling Not Required During Fourth Quarter

2.2.2 Nitroaromatic Compounds Results

Analytical results for the fifth and sixth bimonthly periods and the fourth quarter for nitroaromatic compounds are presented in Tables 2-8 through 2-10. No monitoring locations south of the Femme Osage Slough showed detectable concentrations of nitroaromatic compounds during the fourth quarter of 1992. Nitroaromatic levels have increased in the sixth period monitoring well MW-1002 located on the quarry rim. The distribution and magnitude of nitroaromatic contamination in the remainder of the wells near the quarry remain consistent with historical levels.

2.2.3 Inorganic Anions Results

Two inorganic anions, nitrate and sulfate, are sampled in all of the wells monitored at the WSQ. The analytical results for the fifth and sixth bimonthly periods and the fourth quarter are presented in Tables 2-5 through 2-7. The nitrate and sulfate results for the WSQ groundwater samples continue to be within historic ranges. The results continue to indicate that elevated sulfate levels are present in groundwater within the WSQ and north of the Femme Osage Slough.

2.2.4 Metals Results

All wells in the WSQ monitoring program are sampled for arsenic and barium. The results for the fifth and sixth bimonthly periods and the fourth quarter are presented in Tables 2-11 through 2-13. Arsenic levels were consistent with historical and background values for groundwater in the vicinity of the WSQ. Barium levels have remained elevated, but within historical ranges in the wells in the vicinity of the Femme Osage Slough. Elevated metal concentrations have been indicated in monitoring well MW-1010 located adjacent to the Femme Osage Slough. An elevated concentration of barium has been detected in monitoring well MW-1037 during the sixth bimonthly period and is considered to be erroneous based on the historic average for this and surrounding monitoring wells.

TABLE 2-8 Fifth Bimonthly (Sept/Oct) Nitroaromatic Results for Groundwater at the WSQ

Sample ID	NB (µg/l)	1,3-DNB (µg/l)	2,4-DNT (µg/l)	2,6-DNT (µg/l)	2,4,6-TNT (µg/l)	1,3,5-TNB (µg/l)
GW-1002-B592	ND	0.33	0.10	8.3	30	200
GW-1004-B592	ND	ND	3.5	4.3	12	6.2
GW-1005-B592	ND	ND	0.092	0.028	ND	ND
GW-1006-B592	ND	ND	0.080	0.63	1.7	6.0
GW-1007-B592	ND	ND	ND	ND	ND	ND
GW-1008-B592	ND	ND	ND	ND	ND	ND
GW-1009-B592	ND	ND	ND	ND	ND	ND
GW-1010-B592	ND	ND	ND	ND	ND	ND
GW-1011-B592	ND	ND	ND	ND	ND	ND
GW-1012-B592	ND	ND	ND	ND	ND	ND
GW-1013-B592	ND	ND	ND	ND	ND	ND
GW-1014-B592	ND	ND	0.036	ND	ND	ND
GW-1015-B592	ND	0.22	0.062	0.64	20	120
GW-1016-B592	ND	ND	ND	0.12	1.8	9.0
GW-1026-B592	ND	ND	ND	ND	ND	ND
GW-1027-B592	ND	ND	19	5.8	6.5	ND
GW-1028-B592	ND	ND	ND	ND	ND	ND
GW-1029-B592	ND	ND	ND	ND	ND	ND
GW-1030-B592	ND	ND	0.044	ND	ND	ND
GW-1031-B592	ND	ND	ND	ND	ND	ND
GW-1032-B592	ND	ND	0.15	0.24	0.38	ND
GW-1034-B592	ND	ND	ND	ND	ND	ND
GW-1035-B592	ND	ND	ND	ND	ND	ND
GW-1036-B592	ND	ND	ND	ND	ND	ND
GW-1037-B592	ND	ND	ND	ND	ND	ND
GW-1038-B592	ND	ND	ND	ND	ND	ND
GW-1039-B592	ND	ND	ND	ND	ND	ND

NA - Not Available
ND - Not Detected

TABLE 2-9 Sixth Bimonthly (Nov/Dec) Nitroaromatic Results for Groundwater at the WSQ

Sample ID	NB (µg/l)	1,3-DNB (µg/l)	2,4-DNT (µg/l)	2,6-DNT (µg/l)	2,4,6-TNT (µg/l)	1,3,5-TNB (µg/l)
GW-1002-B692	ND	0.47	0.26	42	120	680
GW-1004-B692	ND	ND	3.2	3.5	9.5	5.8
GW-1005-B692	ND	ND	0.11	0.026	ND	ND
GW-1006-B692	ND	ND	0.12	0.68	1.2	5.5
GW-1007-B692	ND	ND	ND	ND	ND	ND
GW-1008-B692	ND	ND	ND	0.051	0.26	0.041
GW-1009-B692	ND	ND	ND	ND	ND	ND
GW-1010-B692	ND	ND	ND	ND	ND	ND
GW-1011-B692	ND	ND	ND	ND	ND	ND
GW-1012-B692	ND	ND	ND	ND	ND	ND
GW-1013-B692	ND	ND	0.030	ND	ND	ND
GW-1014-B692	ND	ND	0.044	ND	ND	ND
GW-1015-B692	ND	0.45	0.062	0.46	15	75
GW-1016-B692	ND	ND	ND	0.096	1.4	5.8
GW-1026-B692	ND	ND	ND	ND	ND	ND
GW-1027-B692	ND	ND	1.6	1.3	9.5	0.058
GW-1028-B692	ND	ND	ND	ND	ND	ND
GW-1029-B692	ND	ND	ND	ND	ND	ND
GW-1030-B692	ND	ND	0.045	ND	ND	ND
GW-1031-B692	ND	ND	ND	ND	ND	ND
GW-1032-B692	ND	ND	0.11	0.11	0.098	ND
GW-1034-B692	ND	ND	ND	ND	ND	ND
GW-1035-B692	ND	ND	ND	ND	ND	ND
GW-1036-B692	ND	ND	ND	ND	ND	ND
GW-1037-B692	ND	ND	ND	ND	ND	ND
GW-1038-B692	ND	ND	ND	ND	ND	ND
GW-1039-B692	ND	ND	ND	ND	ND	ND

NA - Not Available
ND - Not Detected

TABLE 2-10 Fourth Quarter Nitroaromatic Results for Groundwater at the WSQ

Sample ID	NB (µg/l)	1,3-DNB (µg/l)	2,4-DNT (µg/l)	2,6-DNT (µg/l)	2,4,6-TNT (µg/l)	1,3,5-TNB (µg/l)
GW-1017-Q492	ND	ND	ND	ND	ND	ND
GW-1018-Q492	ND	ND	ND	ND	ND	ND
GW-1019-Q492	ND	ND	ND	ND	ND	ND
GW-1020-Q492	ND	ND	ND	ND	ND	ND
GW-1021-Q492	ND	ND	ND	ND	ND	ND
GW-1022-Q492	ND	ND	ND	ND	ND	ND
GW-1023-Q492	ND	ND	ND	ND	ND	ND
GW-1024-Q492	ND	ND	ND	ND	ND	ND
GW-1033-Q492	ND	ND	ND	ND	ND	ND
GW-RMW1-Q492	ND	ND	ND	ND	ND	ND
GW-RMW2-Q492	ND	ND	ND	ND	ND	ND
GW-RMW3-Q492	ND	ND	ND	ND	ND	ND
GW-RMW4-Q492	ND	ND	ND	ND	ND	ND
GW-PW02-Q492	ND	ND	ND	ND	ND	ND
GW-PW03-Q492	ND	ND	ND	ND	ND	ND
GW-PW04-Q492	ND	ND	ND	ND	ND	ND
GW-PW05-Q492	ND	ND	ND	ND	ND	ND
GW-PW06-Q492	ND	ND	ND	ND	ND	ND
GW-PW07-Q492	ND	ND	ND	ND	ND	ND
GW-PW08-Q492	ND	ND	ND	ND	ND	ND
GW-PW09-Q492	ND	ND	ND	ND	ND	ND
GW-RAWW-Q492	ND	ND	ND	ND	ND	ND
GW-FINW-Q492	ND	ND	ND	ND	ND	ND

NA - Not Available
ND - Not Detected

TABLE 2-11 Fifth Bimonthly (Sept/Oct) Metal Results for Groundwater at the WSQ

Sample ID	Arsenic (µg/l)	Barium (µg/l)
GW-1002-B592	ND	118
GW-1004-B592	ND	33.3
GW-1005-B592	ND	61.7
GW-1006-B592	3.70	83.4
GW-1007-B592	11.4	324
GW-1008-B592	ND	55.6
GW-1009-B592	ND	337
GW-1010-B592	120	439
GW-1011-B592	ND	271
GW-1012-B592	ND	125
GW-1013-B592	2.60	151
GW-1014-B592	ND	161
GW-1015-B592	ND	104
GW-1016-B592	ND	133
GW-1026-B592	19.6	401
GW-1027-B592	ND	134
GW-1028-B592	ND	278
GW-1029-B592	ND	107
GW-1030-B592	ND	82.0
GW-1031-B592	ND	110
GW-1032-B592	ND	105
GW-1034-B592	ND	144
GW-1035-B592	ND	203
GW-1036-B592	ND	279
GW-1037-B592	ND	673
GW-1038-B592	ND	254
GW-1039-B592	ND	488

ND - Not Detected
NA - Not Available

TABLE 2-12 Sixth Bimonthly (Nov/Dec) Metal Results for Groundwater at the WSQ

Sample ID	Arsenic (µg/l)	Barium (µg/l)
GW-1002-B692	ND	119
GW-1004-B692	ND	30.4
GW-1005-B692	ND	61.4
GW-1006-B692	ND	84.0
GW-1007-B692	17.2	370
GW-1008-B692	ND	45.0
GW-1009-B692	9.09	481
GW-1010-B692	130	503
GW-1011-B692	ND	295
GW-1012-B692	ND	138
GW-1013-B692	NA	NA
GW-1014-B692	NA	NA
GW-1015-B692	ND	98.1
GW-1016-B692	ND	133
GW-1026-B692	19.4	434
GW-1027-B692	ND	98.5
GW-1028-B692	NA	NA
GW-1029-B692	ND	152
GW-1030-B692	ND	122
GW-1031-B692	ND	103
GW-1032-B692	ND	89.9
GW-1034-B692	ND	156
GW-1035-B692	ND	198
GW-1036-B692	ND	315
GW-1037-B692	ND	569
GW-1038-B692	ND	250
GW-1039-B692	ND	489

ND - Not Detected
NA - Not Available

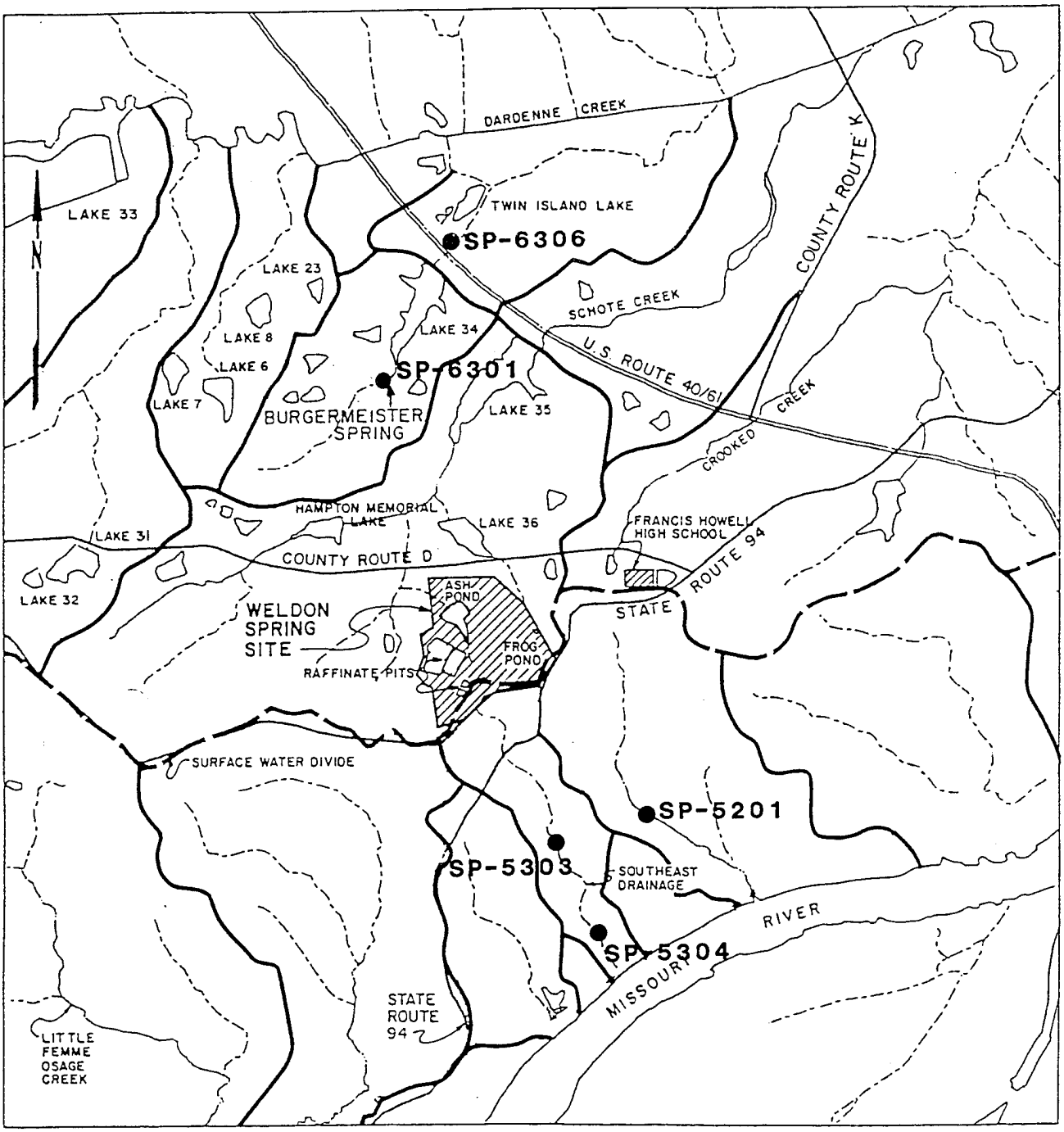
TABLE 2-13 Fourth Quarter Metal Results for Groundwater at the WSQ

Sample ID	Arsenic (µg/l)	Barium (µg/l)
GW-1017-Q492	179	950
GW-1018-Q492	103	674
GW-1019-Q492	79	842
GW-1020-Q492	22.2	411
GW-1021-Q492	78.2	761
GW-1022-Q492	169	567
GW-1023-Q492	71.2	320
GW-1024-Q492	7.00	513
GW-1033-Q492	ND	596
GW-RMW1-Q492	5.40	542
GW-RMW2-Q492	15.5	260
GW-RMW3-Q492	28.3	640
GW-RMW4-Q492	8.40	167
GW-PW02-Q492	ND	304
GW-PW03-Q492	ND	284
GW-PW04-Q492	ND	311
GW-PW05-Q492	ND	341
GW-PW06-Q492	ND	322
GW-PW07-Q492	ND	346
GW-PW08-Q492	2.98	462
GW-PW09-Q492	4.98	519
GW-RAWW-Q492	ND	349
GW-FINW-Q492	ND	90

ND - Not Detected
NA - Not Available

2.3 Springs

Five springs near the Weldon Spring site (WSS), which are measurably influenced by site-related contaminants, were sampled during the fourth quarter (see Figure 2-4). During the fourth quarter, spring samples were analyzed for uranium and inorganic anions. Results are presented in Table 2-14. SP-6301 and SP-6306 were sampled during high and low flow to evaluate the groundwater (which is thought to dominate low flow) and surface water (which is thought to dominate high flow) components of flow. Results for the fourth quarter remain consistent with historical values.



● SPRING

0 3200 6400 FT
0 975.4 1950.7 M
SCALE

SPRINGS IN THE VICINITY OF THE WSS

FIGURE 2-4

REPORT NO.: DOE/OR/21548-379		EXHIBIT NO.: A/VP/040/0592	
ORIGINATOR: MGT	DRAWN BY: GLN	DATE: 5/92	

TABLE 2-14 Fourth Quarter Uranium and Inorganic Anion Results for Springs Near the Weldon Spring Site

Sample ID	Nitrate (mg/l)	Sulfate (mg/l)	Uranium (pCi/l)
SP-6301-Q492-H	21.8	73.1	110
SP-6301-Q492-L	73.2	59.2	79
SP-6306-Q492-H	ND	5.20	2.0
SP-6306-Q492-L	0.23	13.3	2.0
SP-5303-Q492	0.50	64.0	73
SP-5304-Q492	0.81	52.3	88
SP-5201-Q492	0.30	56.5	0.82

3 SURFACE WATER MONITORING

Routine samples were collected during the fourth quarter and fifth and sixth bimonthly periods of 1992 from both on-site and off-site surface water locations. All surface water samples were analyzed without filtering, unless a specific comparison of dissolved versus total contaminant concentrations was desired. Some analytical results are not available at this time; however, they will be presented in the 1992 annual site environmental report (ASER).

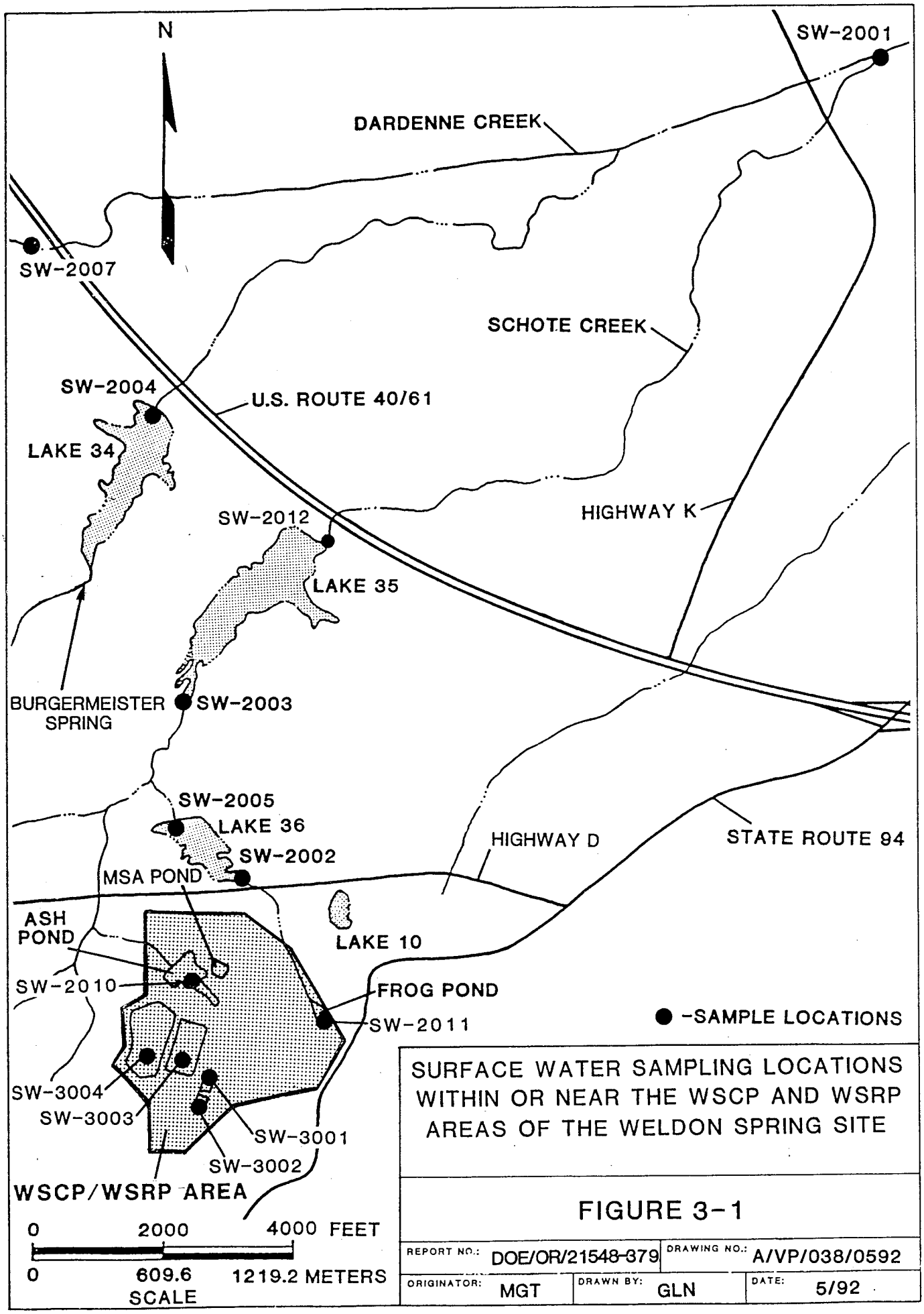
3.1 Chemical Plant/Raffinate Pits/Vicinity Properties

During the fourth quarter, surface water samples were collected from the 15 surface water sampling locations and analyzed for uranium (Figure 3-1). Monitoring points SW-2016 and SW-5311 are not shown in Figure 3-1. Location SW-2016 is located at the intersection of Dardenne Creek and County Highway N. This is the furthest location downstream at which contaminants are sampled for in Dardenne Creek after it has received the Schote Creek contribution. Location SW-5311 is located just above the confluence of the Southeast Drainage to the Missouri River. The results, presented in Table 3-1, indicated that conditions at sampling locations remain consistent with historical values.

3.2 Weldon Spring Quarry

During fifth and sixth bimonthly periods, surface water samples were collected from 13 locations shown in Figures 3-2 and 3-3 and analyzed for uranium. Results remain within historical ranges and are presented in Tables 3-2 and 3-3.

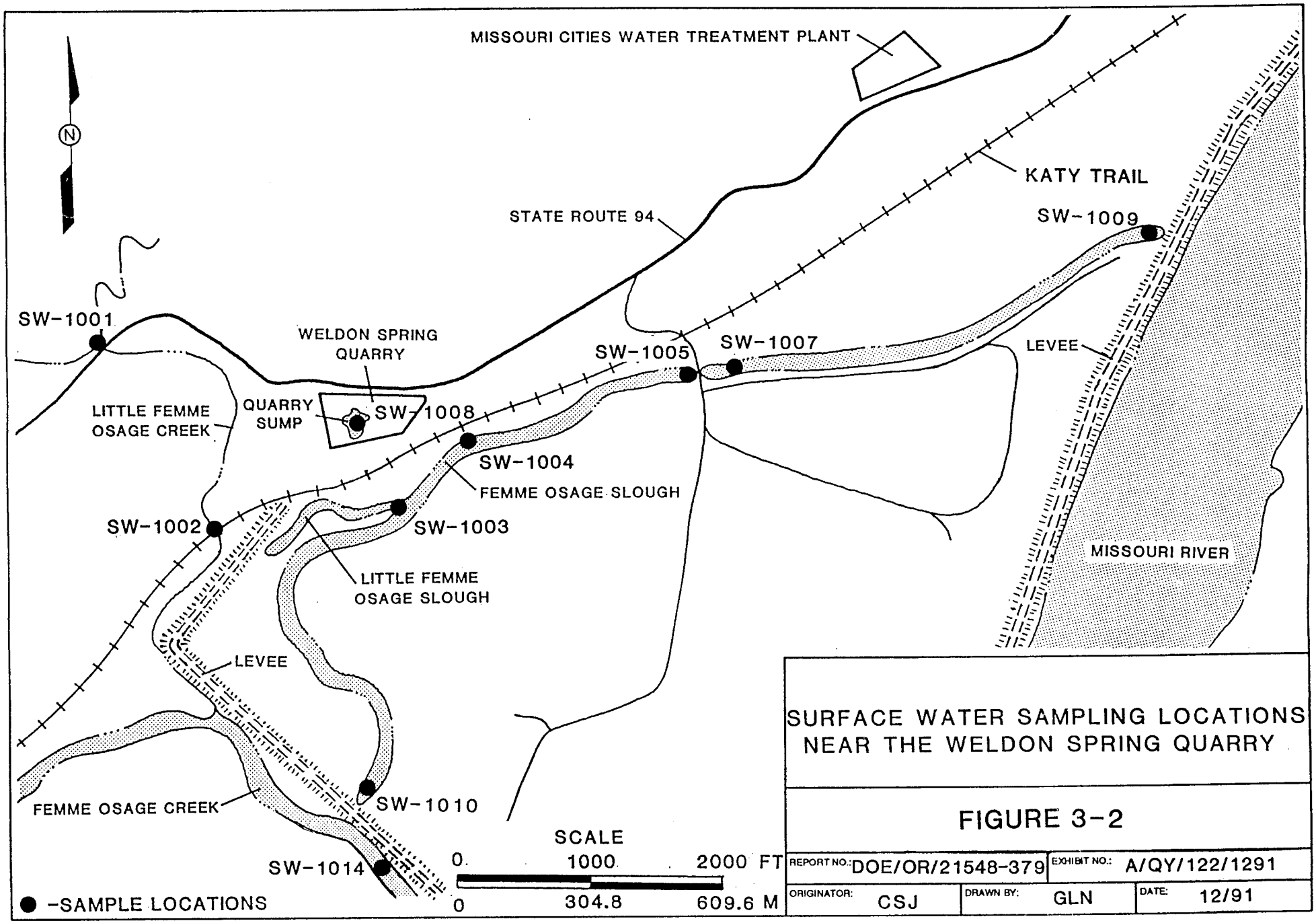
In addition to uranium samples, the Weldon Spring Quarry pond was sampled for nitroaromatics, isotopic radium, isotopic thorium, and inorganic anions during the fifth and sixth bimonthly periods. The results for fifth and sixth bimonthly periods are within historic ranges for all parameters analyzed and are presented in Table 3-4.



SURFACE WATER SAMPLING LOCATIONS WITHIN OR NEAR THE WSCP AND WSRP AREAS OF THE WELDON SPRING SITE

FIGURE 3-1

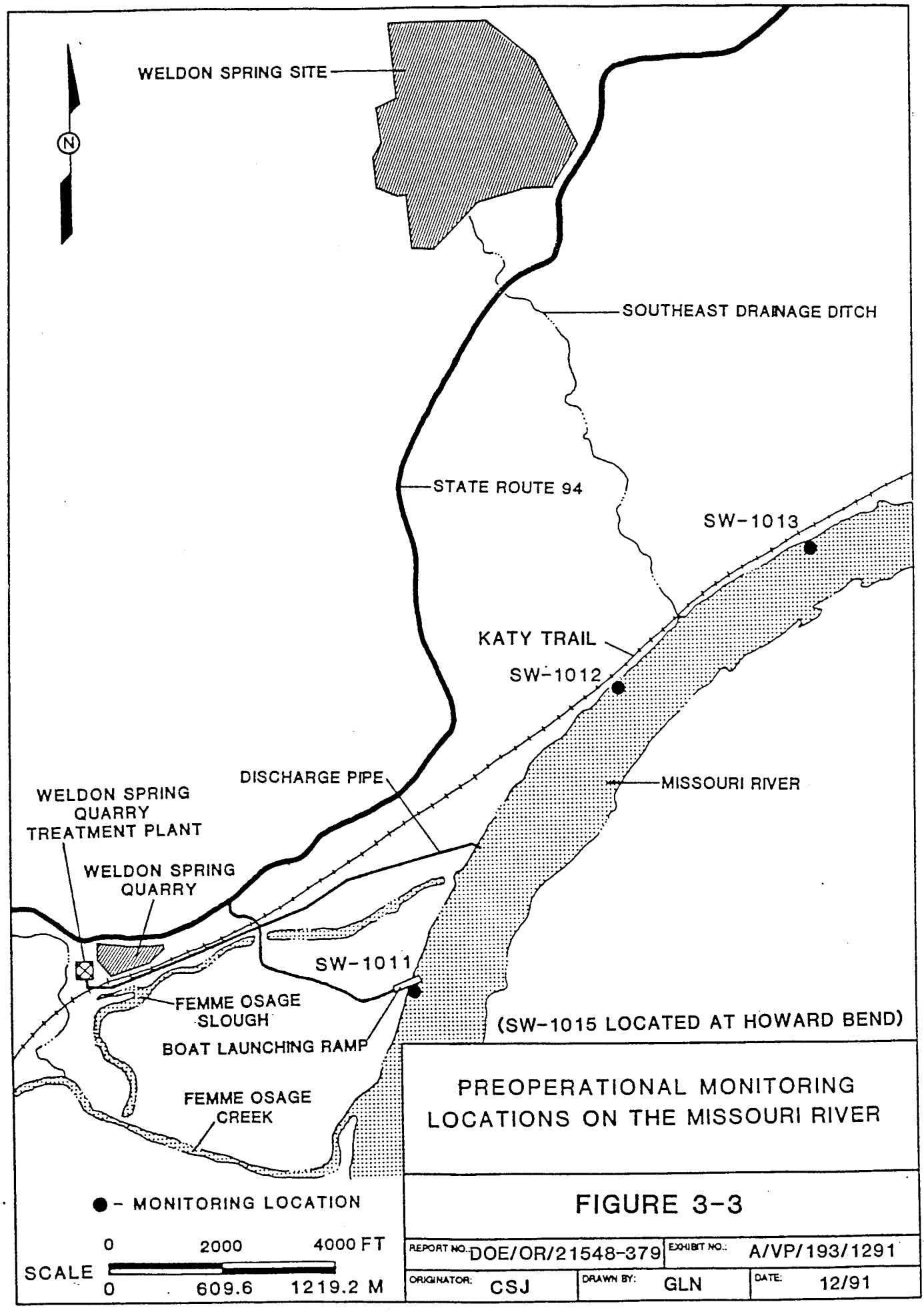
REPORT NO.: DOE/OR/21548-379		DRAWING NO.: A/VP/038/0592	
ORIGINATOR: MGT	DRAWN BY: GLN	DATE: 5/92	



SURFACE WATER SAMPLING LOCATIONS NEAR THE WELDON SPRING QUARRY

FIGURE 3-2

REPORT NO.: DOE/OR/21548-379		EXHIBIT NO.: A/QY/122/1291	
ORIGINATOR: CSJ	DRAWN BY: GLN	DATE: 12/91	



PREOPERATIONAL MONITORING LOCATIONS ON THE MISSOURI RIVER

FIGURE 3-3

REPORT NO.: DOE/OR/21548-379		EXHIBIT NO.: A/VP/193/1291	
ORIGINATOR: CSJ	DRAWN BY: GLN	DATE: 12/91	

TABLE 3-1 Fourth Quarter Uranium Results in Surface Water at the WSCP/WSRP

Sample ID	Uranium (pCi/l)
SW-2001-Q492	0.68
SW-2002-Q492	80
SW-2003-Q492	NA
SW-2004-Q492	14
SW-2005-Q492	24
SW-2007-Q492	ND
SW-2010-Q492	NA
SW-2011-Q492	270
SW-2012-Q492	NA
SW-2016-Q492	2.8
SW-3001-Q492	55
SW-3002-Q492	920
SW-3003-Q492	170
SW-3004-Q492	1000
SW-5311-Q492	NA

NA - Not Available
ND - Not Detected

TABLE 3-2 Fifth Bimonthly (Sept/Oct) Uranium Results in Surface Water at the WSQ

Sample ID	Uranium (pCi/l)
SW-1001-B592	1.6
SW-1002-B592	ND
SW-1003-B592	8.2
SW-1004-B592	18
SW-1005-B592	10
SW-1007-B592	11
SW-1008-B592	58
SW-1009-B592	5.7
SW-1010-B592	22
SW-1011-B592	4.2
SW-1012-B592	4.0
SW-1013-B592	4.5
SW-1014-B592	1.8

ND - Not Detected

TABLE 3-3 Sixth Bimonthly (Nov/Dec) Uranium Results in Surface Water at the WSQ

Sample ID	Uranium (pCi/l)
SW-1001-B692	1.7
SW-1002-B692	1.4
SW-1003-B692	45
SW-1004-B692	44
SW-1005-B692	18
SW-1007-B692	15
SW-1008-B692	470
SW-1009-B692	3.6
SW-1010-B692	32
SW-1011-B692	3.8
SW-1012-B692	2.2
SW-1013-B692	2.1
SW-1014-B692	0.82

TABLE 3-4 Fifth and Sixth Bimonthly Results for SW-1008

Parameter	Fifth Bimonthly Concentrations	Sixth Bimonthly Concentrations
1,3,5-Trinitrobenzene (μg/l)	0.079	0.031
1,3-Dinitrobenzene (μg/l)	ND	ND
2,4,6-TNT (μg/l)	10	16
2,4-DNT (μg/l)	7	10
2,6-DNT (μg/l)	0.66	0.50
Nitrobenzene (μg/l)	ND	ND
Uranium (pCi/l)	58	470
Ra-226 (pCi/l)	0.7	0.1
Ra-228 (pCi/l)	ND	0.9
Th-228 (pCi/l)	NA	ND
Th-230 (pCi/l)	0.9	ND
Th-232 (pCi/l)	ND	ND
Nitrate (mg/l)	ND	ND
Sulfate (mg/l)	67.9	57.0

ND - Not Detected

4 EFFLUENT MONITORING

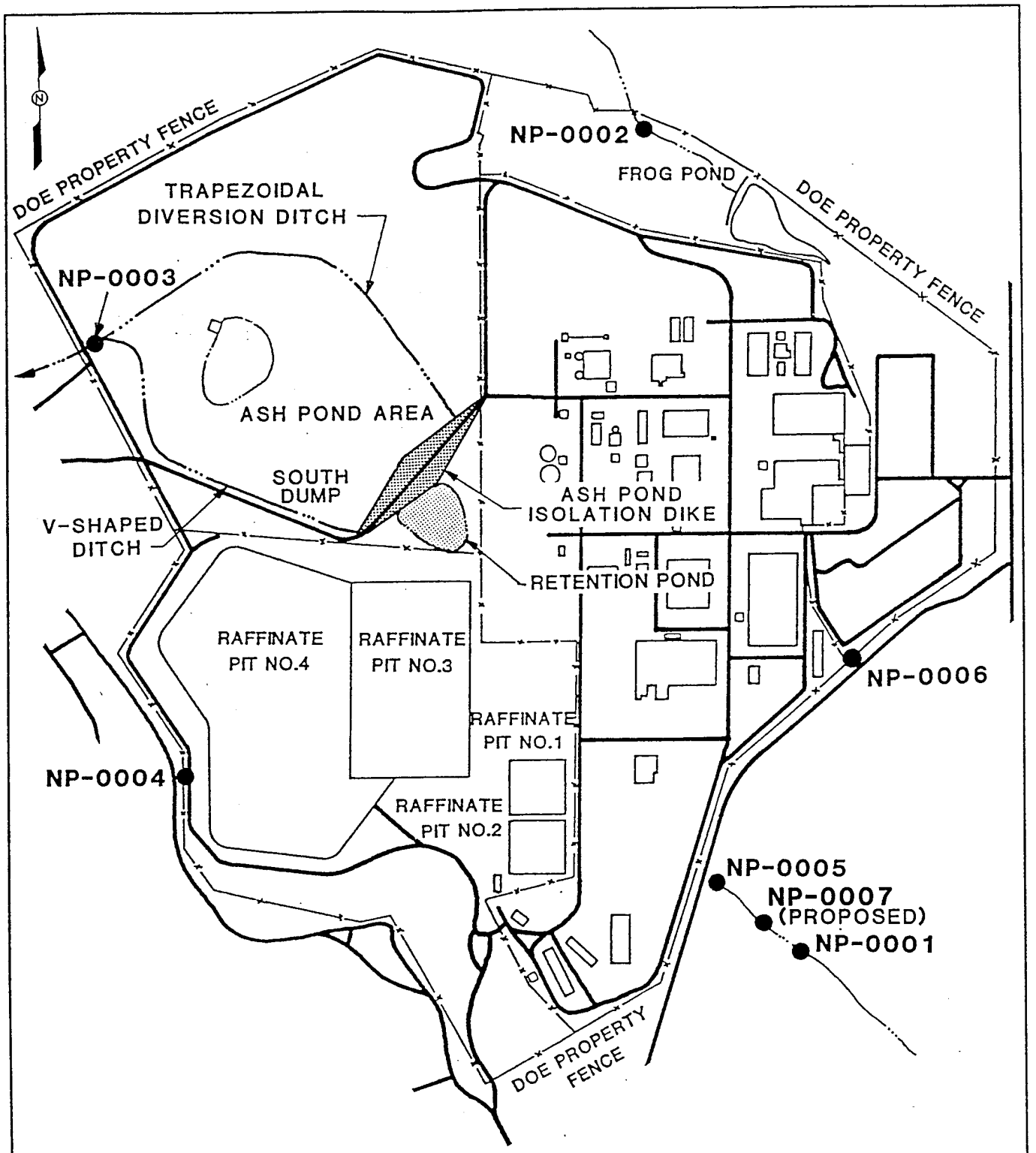
The National Pollutant Discharge Elimination System (NPDES) permit process is authorized by Section 402(a)(1) of the *Clean Water Act of 1977*. The authority to issue permits is delegated to the State of Missouri by the U.S. Environmental Protection Agency (EPA). The State of Missouri has issued seven NPDES permits to the U.S. Department of Energy (DOE) allowing the discharge of storm water, hydrostatic test water, and treated wastewater to waters of the state. The permits require that samples of the water be collected periodically and the results reported to the Missouri Department of Natural Resources. The following sections contain the analytical results for samples collected during October, November, and December of 1992. No NPDES permit limits were violated during the fourth quarter 1992.

4.1 National Pollutant Discharge Elimination System Data Review

Effluent samples were collected and analyzed in compliance with the Weldon Spring site NPDES permits. Permit No. MO-0107701 was issued on October 1, 1990, and currently addresses the five storm water and two wastewater discharges shown in Figure 4-1. Outfalls NP-0001 through NP-0005 represent storm water discharges; Outfall NP–0006 represents the treated wastewater discharge associated with the administration building sanitary wastewater treatment plant; and Outfall NP-0007 represents the site water treatment plant, which is under construction, and nearing completion. There was no discharge from Outfall NP-0007. Outfalls NP-0006 and NP-0007 have effluent limitations. The five storm water outfalls have "monitoring only" requirements for permitted parameters. Fourth quarter 1992 analytical data for each outfall are presented in Table 4-1.

In addition, storm water was pumped from the temporary storage area (TSA) basin to an area just west of the TSA itself. The location of the basin prevented the water from being pumped through a permitted outfall. Under the direction of the Missouri Department of Natural resources, this water was sampled as if it were flowing from the site through a permitted outfall. These results are included in Table 4-1.

Permit No. MO-0108987 was issued on May 5, 1989, for Outfall NP-1001 of the Weldon Spring Quarry water treatment plant. The first batch (approximately 541,000 gallons) of water from the Weldon Spring Quarry was treated in November 1992. Comprehensive sampling of the treated water was conducted on November 19, 1992. The *Discharge Monitoring Report* —



NPDES SURFACE WATER SAMPLING LOCATIONS AT THE WSCP/RP

FIGURE 4-1

SCALE 0 500 1000 FT
0 152.4 304.8 M

REPORT NO.: DOE/OR/21548-379		EXHIBIT NO.: A/CP/050/0592	
ORIGINATOR: TW	DRAWN BY: GLN	DATE: 5/92	

TABLE 4-1 Results of NPDES Monitoring for NP-0001 through NP-0006

Outfall NP-0001 NPDES data for Q4 1992

Date Sampled	Flow	Susp. Solids	Set. Solids	Nitrate	pH	Lithium	Gross Alpha	Total Uranium	
Units	GPD**	mg/l	ml/l/hr	mg/l	pH units	mg/l	pCi/l	mg/l	pCi/l
October 30	22,000	64.0	<0.1	0.63	7.38	ND (0.027)	306	0.692	471

Outfall NP-0002 NPDES data for Q4 1992

Date Sampled	Flow	Susp. Solids	Set. Solids	Nitrate	pH	Lithium	Gross Alpha	Total Uranium	
Units	GPD**	mg/l	ml/l/hr	mg/l	pH units	mg/l	pCi/l	mg/l	pCi/l
October 20	17,000	7.0	<0.1	0.66	7.47	ND (0.024)	240	0.381	259
November 3	163,500	26.00	<0.1	0.40	8.26	ND (0.027)	220	0.312	212
December 9	1,500	11.0	<0.1	60.5	8.27	ND (0.009)	300	0.407	277

Outfall NP-0003 NPDES data for Q4 1992

Date Sampled	Flow	Susp. Solids	Set. Solids	Nitrate	pH	Lithium	Gross Alpha	Total Uranium	
Units	GPD**	mg/l	ml/l/hr	mg/l	pH units	mg/l	pCi/l	mg/l	pCi/l
October 30	14,000	27.0	<0.1	0.38	7.95	ND (0.027)	120	0.2	136
November 3	184,700	25.0	<0.1	0.96	7.98	ND (0.027)	30	0.0787	54
December 10	26,000	9.0	<0.1	1.30	7.61	ND (0.027)	510	0.889	604

TABLE 4-1 Results of NPDES Monitoring for NP-0001 through NP-0006 (Continued)

Outfall NP-0004 NPDES data for Q4 1992

Date Sampled	Flow	Susp. Solids	Set. Solids	Nitrate	pH	Lithium	Gross Alpha	Total Uranium	
Units	GPD**	mg/l	ml/l/hr	mg/l	pH units	mg/l	pCi/l	mg/l	pCi/l
December 9	1,500	41.0	<0.1	562	8.56	ND (0.009)	20	0.0178	12

Outfall NP-0005 NPDES data for Q4 1992

Date Sampled	Flow	Susp. Solids	Set. Solids	Nitrate	pH	Lithium	Gross Alpha	Total Uranium	
Units	GPD**	mg/l	ml/l/hr	mg/l	pH units	mg/l	pCi/l	mg/l	pCi/l
October 30	3,000	65.0	<0.1	0.58	7.31	ND (0.027)	320	0.571	388
November 3	258,000	197	1.1	0.17	8.13	ND (0.027)	270	0.372	253
November 10	231,900	600	<0.1	0.84	6.89	0.039	250	0.343	233
December 8	7,200	38.0	0.1	0.41	7.63	ND (0.027)	230	0.339	231

Outfall NP-0006 NPDES data for Q4 1992

Date Sampled	Flow	Susp. Solids	BOD	Fecal Coliform	pH
Units	GPD**	mg/l	mg/l	Colonies/100 ml	pH units
October	a	a	a	a	a
November	a	a	a	a	a
December	a	a	a	a	a

TABLE 4-1 Results of NPDES Monitoring for NP-0001 through NP-0006 (Continued)

Outfall Near Temporary Storage Area Basin Data for Q4 1992

Date Sampled	Total Flow	Susp. Solids	Oil and Grease	Settleable Solids	Nitrate	pH	Lithium	Gross Alpha	Total Uranium	
Units	GPD	mg/l	mg/l	mg/l/hr	mg/l	pH units	mg/l	pCi/l	mg/l	pCi/l
October 3	1,000	24.0	NS	0.2	0.25	8.33	ND(0.024)	2.8	0.0035	2.38
October 8	50,000	165.0	NS	<0.1	0.89	7.44	ND(0.024)	9.7	0.0070	4.76
November 12	700,000	30.0	NS	NS	3.46	6.43	ND(0.009)	5.4	0.0074	5.03
November 25	50,000	19.0	ND (5.0)	<0.1	1.30	7.43	ND(0.027)	1.4	0.0039	2.65
December 7	100,000	ND(5.0)	ND (5.0)	<0.1	1.80	7.52	ND(0.027)	2.2	0.0094	6.4
December 10	25,000	11.0	ND (5.0)	<0.1	2.3	7.96	ND(0.027)	1.2	0.0044	3.0
December 16	50,000	35.0	NS	<0.1	1.48	8.08	0.009	2.1	0.0014	0.952

* Data not yet received from contract laboratory.
** Indicates flow rate at time of sample collection.
ND Not detected, detection limit is in parentheses.
[a] No effluent discharge due to construction improvements to treatment plant. Influent sewage was removed daily by Ace Septic Service -- Approximately 4,000 gallons per day.
NS Not sampled.

Fourth Quarter 1992 contains all results of the treated water sampling and has been transmitted to the Missouri Department of Natural Resources. The treated water was in compliance with all applicable limits and was discharged to the Missouri River on January 7, 1992, and January 8, 1992. Analytical results for the treated water are presented in Table 4-2.

Under the NPDES permits MO-G680001, MO-G680002, MO-680004, and MO-680005, potable water used to hydrostatically test vessels, basins, and pipelines at the quarry and site water treatment plants, was discharged a total of 23 times during the fourth quarter of 1992. All discharges were within NPDES permit limits. Analytical results of these discharges will be included in the 1992 site environmental report.

4.1.1 Radiological Analysis

Gross alpha and uranium analyses corresponded well with past data with the following exception. Analysis of the December 9, 1992, sample at NP-0004 demonstrated a uranium concentration of 12 pCi/l. This concentration is slightly above the previous highest concentration at NP-0004.

The other storm water outfalls had the following ranges of uranium concentrations. The process sewer outfall NP-0001 had a sample value of 471 pCi/l (0.692 mg/l). Frog Pond outfall, NP-0002, had values from 259 pCi/l (0.381 mg/l) to 277 pCi/l (0.407 mg/l). Ash Pond outfall, MP-0003, had values from 54 pCi/l (0.0787) to 604 pCi/l (0.889 mg/l). The southeast drainage outfall, NP-0005, had values from 231 pCi/l (0.339 mg/l) to 388 pCi/l (0.571 mg/l).

4.1.2 Other Analysis

Other analyses for NP-0001 through NP-0005 include physical analyses (settleable solids and total suspended solids) and chemical analyses (nitrate, lithium, and pH). Fourth quarter 1992 values are displayed in Table 4-1 and correspond well with past values for all parameters with the following two exceptions.

Laboratory analysis demonstrated an elevated nitrate concentration of 60.5 mg/l for the December 9, 1992, sample at NP-0002. Also on December 9, 1992, laboratory analysis demonstrated a nitrate concentration of 562 mg/l at NP-0004. Previous and subsequent samples

TABLE 4-2 Results of Treated Quarry Water Analysis

Parameter	Permit Limit	Concentration in Treated Quarry Water
Chemical Oxygen Demand (mg/l)	60	1.0
Total Suspended Solids (mg/l)	30	ND(2.00)
pH (Standard Units)	6-9	6.8
2,4 DNT (μg/l)	0.22	ND (0.019)
Cyanide, Total (mg/l)	0.0075	ND (0.005)
Arsenic (mg/l)	0.10	ND (0.020)
Barium (mg/l)	1.5	0.003
Cadmium (mg/l)	0.02	ND (0.005)
Chromium (mg/l)	0.10	ND (0.006)
Copper (mg/l)	1.0	ND (0.017)
Iron (mg/l)	0.6	0.126
Lead (mg/l)	0.10	0.030
Manganese (mg/l)	0.10	0.008
Mercury (mg/l)	0.004	ND (0.001)
Selenium (mg/l)	0.02	ND (0.010)
Silver (mg/l)	0.10	ND (0.001)
Zinc (mg/l)	5.0	ND (0.015)
Fluoride (mg/l)	4.0	ND (0.050)
Sulfate (mg/l)	500	28.0
Whole Effluent Toxicity	10% Mortality	0% Mortality
Asbestos (MAS/l)	Monitor	ND (0.16)
Nitrate - N (mg/l)	Monitor	ND (0.020)
Chloride (mg/l)	Monitor	29.3
Gross Alpha (pCi/l)	Monitor	ND (2.0)
Gross Beta (pCi/l)	Monitor	7.0
Uranium, Total (pCi/l)	Monitor	ND (0.0003)

TABLE 4-2 Results of Treated Quarry Water Analysis (Continued)

Parameter	Permit Limit	Concentration in Treated Quarry Water
Radium 226 (pCi/l)	Monitor	ND (0.3)
Radium 228 (pCi/l)	Monitor	1.1
Thorium 230 (pCi/l)	Monitor	ND (0.4)
Thorium 232 (pCi/l)	Monitor	ND (0.4)
Priority Pollutants*	Monitor	ND

ND Not detected. Detection limit is in parentheses.
* Results of all "priority pollutants" were non-detect.

at both locations show substantially lower nitrate levels. These two data points are under investigation and data from these locations will be closely reviewed.

The permit for the discharge from the administration building treatment plant at outfall NP-0006 has effluent limitations and a requirement to monitor once per quarter. There was no discharge from the administration building's sewage treatment plant during the fourth quarter of 1992 because construction activities were taking place during this time to improve the new flow equalization system that was recently added to the plant. During this time, all sewage was collected from the plant and disposed of by Ace Septic Services of O'Fallon, Missouri.

5 AIR MONITORING

5.1 Radon Gas

The radon gas monitoring program utilizes a pair of alpha track radon detectors at each of the 28 permanent locations; each detector is exchanged quarterly. These detectors are deployed at seven locations at the Weldon Spring Chemical Plant, eight locations at the Weldon Spring Quarry, five locations at the Weldon Spring raffinate pits, and at eight off-site locations. Radon monitoring locations are shown in Figures 5-1, 5-2, and 5-3. On-site detectors are distributed around the perimeter fences to ensure adequate detection of radon dispersing from the properties under various atmospheric conditions. Locations RD-4001, RD-4004, RD-4005, RD-4006, and RD-4007 monitor background levels near the site.

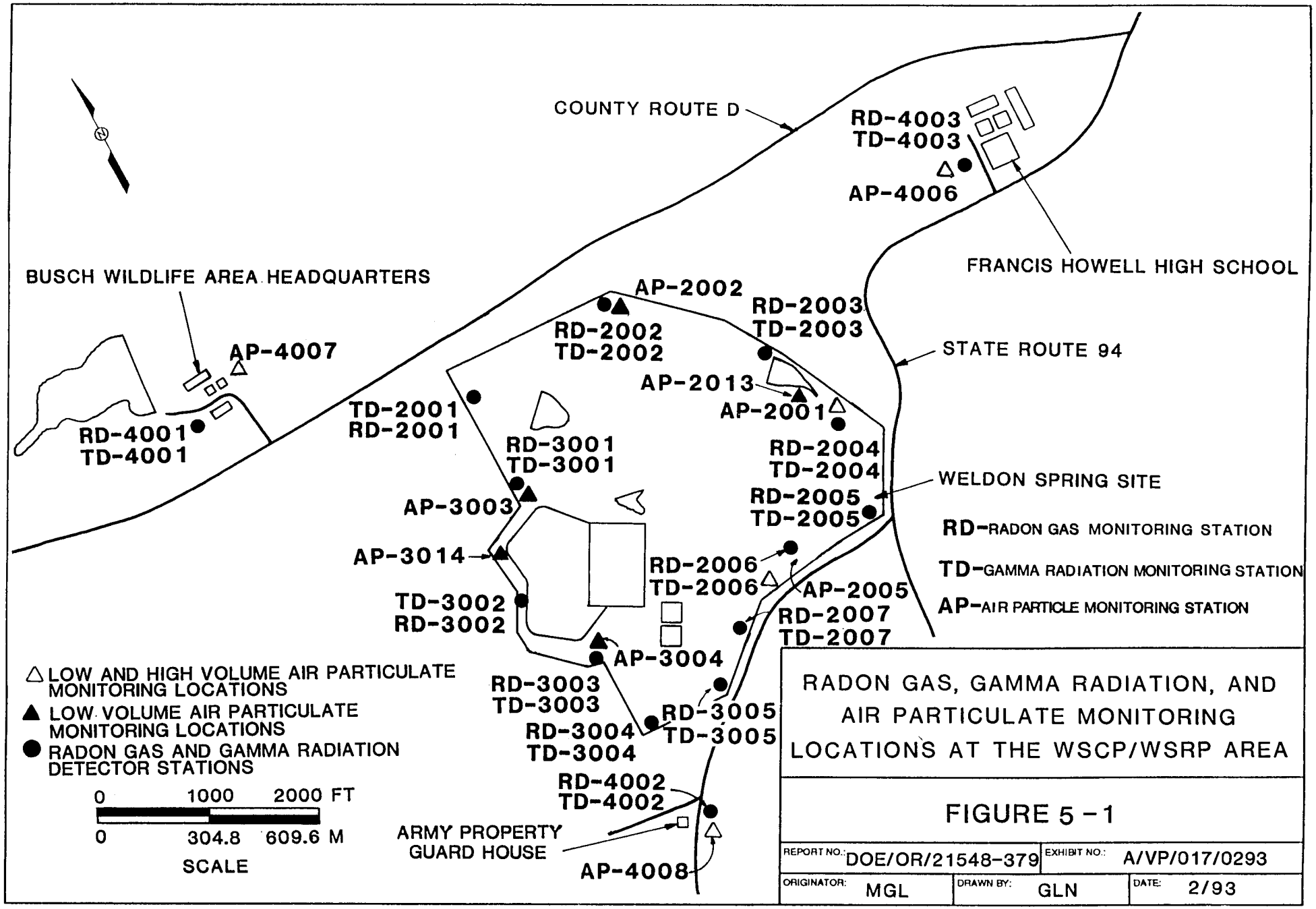
Landauer Type F track etch detectors were used for radon monitoring during the fourth quarter of 1992. The Type F detector is designed especially for outdoor monitoring of airborne radon concentrations. The detection mechanism consists of counting tracks generated by alpha particles in detector media to determine the radon concentration.

Table 5-1 summarizes the fourth quarter 1992 radon concentrations detected at all site perimeter and off-site monitoring locations. These concentrations represent the average of the two radon detectors placed at each location. Also contained in the third column of Table 5-1 is a comparison of the measured concentration with the Federally permitted radon concentration (for unrestricted areas) of 3 pCi/l (111 Bq/m^3)[1] above background as authorized by DOE Order 5400.5.

Three stations RD-3005, RD-2007, and RD-4008, were added to the radon track etch detector network for the fourth quarter of 1992. RD-2007 and RD-3005 were placed at the WSCP perimeter. RD-4008 was placed near the Femme Osage Slough where low levels of radiological contamination is known to exist.

An average ambient background concentration was determined by calculating the arithmetic average for the five background locations. These data yielded an average ambient background radon concentration of 0.14 pCi/l (5.18 Bq/m^3) for the fourth quarter of 1992. This

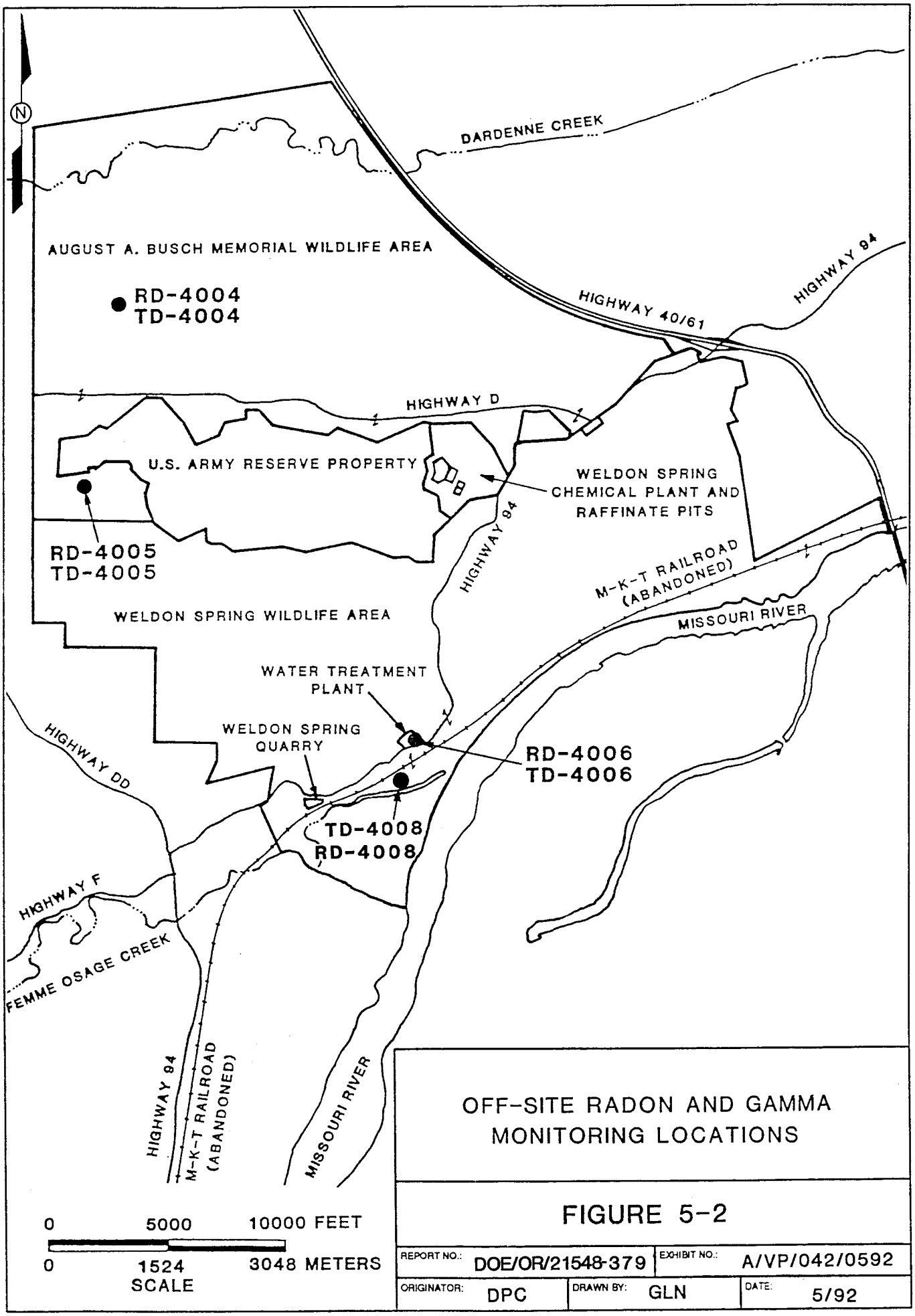
[1] To convert μCi/ml to Bq/m^3, multiply by 3.7E10.



RADON GAS, GAMMA RADIATION, AND AIR PARTICULATE MONITORING LOCATIONS AT THE WSCP/WSRP AREA

FIGURE 5 - 1

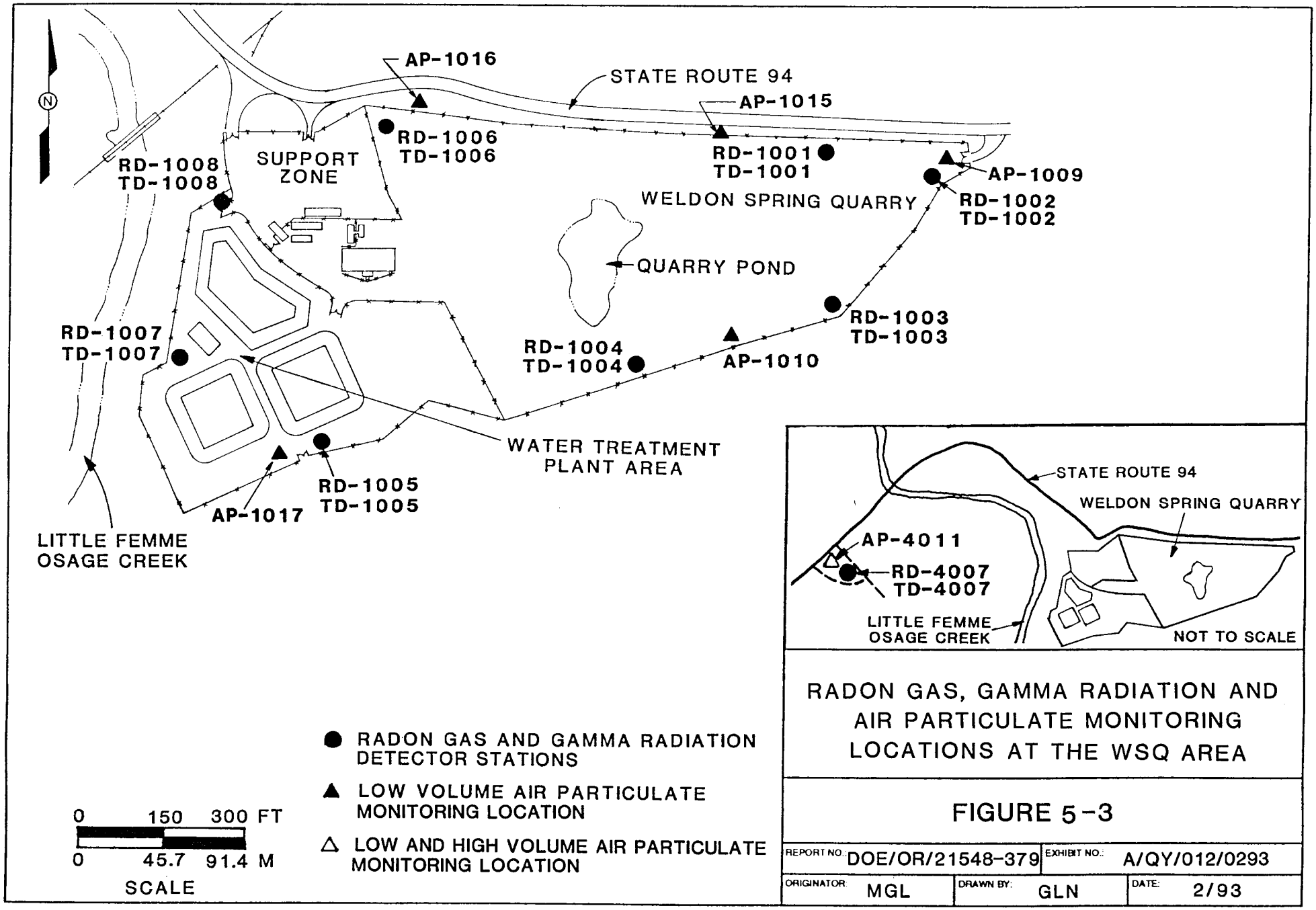
REPORT NO.: DOE/OR/21548-379		EXHIBIT NO.: A/VP/017/0293	
ORIGINATOR: MGL	DRAWN BY: GLN	DATE: 2/93	

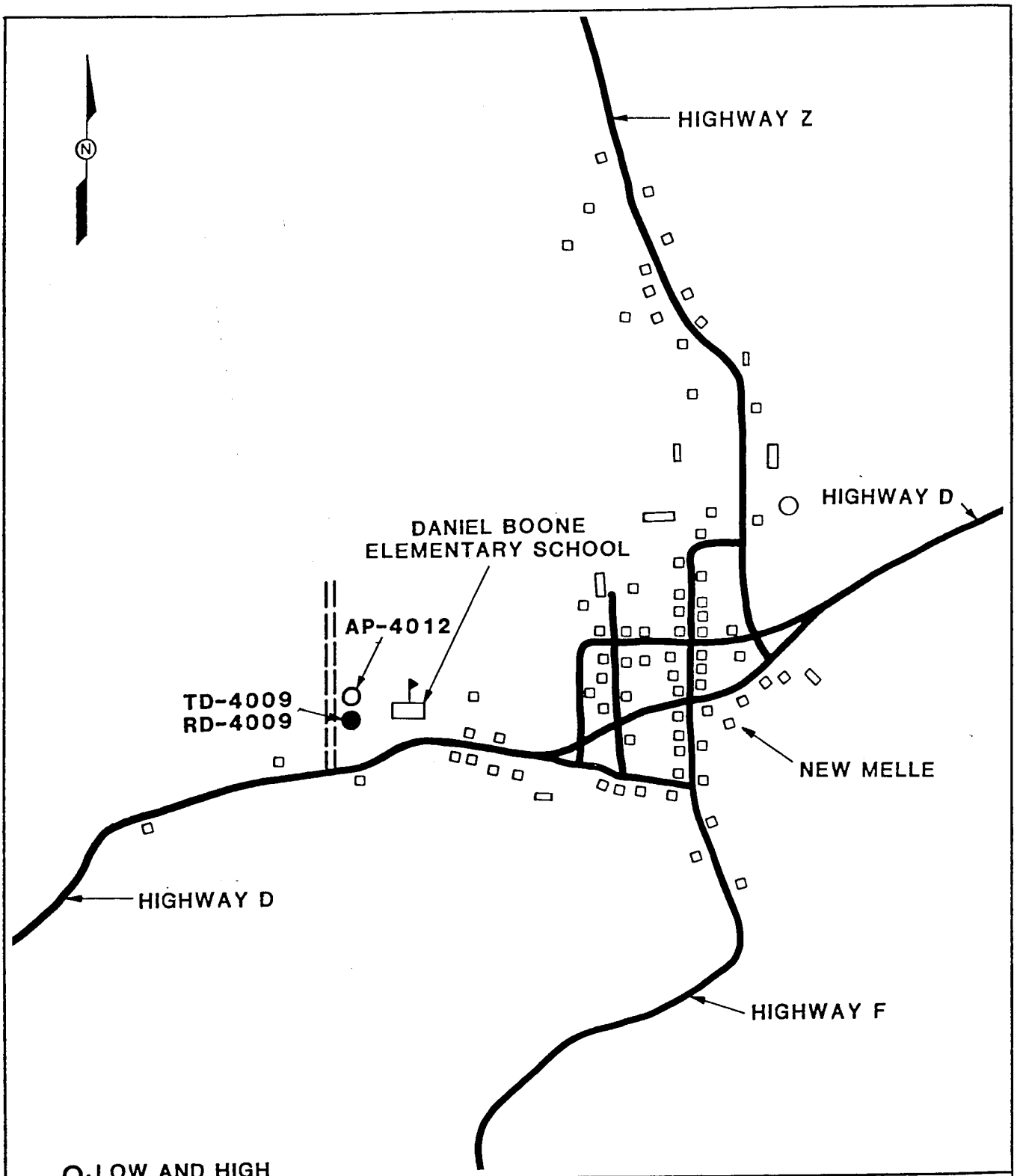


OFF-SITE RADON AND GAMMA MONITORING LOCATIONS

FIGURE 5-2

REPORT NO.: DOE/OR/21548-379		EXHIBIT NO.: A/VP/042/0592	
ORIGINATOR: DPC	DRAWN BY: GLN	DATE: 5/92	


AP-1016
STATE ROUTE 94
AP-1015
RD-1006
TD-1006
RD-1001
TD-1001
AP-1009
RD-1002
TD-1002
RD-1008
TD-1008
SUPPORT ZONE
WELDON SPRING QUARRY
QUARRY POND
RD-1003
TD-1003
RD-1007
TD-1007
RD-1004
TD-1004
AP-1010
WATER TREATMENT PLANT AREA
RD-1005
TD-1005
AP-1017
LITTLE FEMME OSAGE CREEK
N
STATE ROUTE 94
WELDON SPRING QUARRY
AP-4011
RD-4007
TD-4007
LITTLE FEMME OSAGE CREEK
NOT TO SCALE
RADON GAS AND GAMMA RADIATION DETECTOR STATIONS
LOW VOLUME AIR PARTICULATE MONITORING LOCATION
LOW AND HIGH VOLUME AIR PARTICULATE MONITORING LOCATION
0 150 300 FT
0 45.7 91.4 M
SCALE
RADON GAS, GAMMA RADIATION AND AIR PARTICULATE MONITORING LOCATIONS AT THE WSQ AREA
FIGURE 5-3
REPORT NO.: DOE/OR/21548-379
EXHIBIT NO.: A/QY/012/0293
ORIGINATOR: MGL
DRAWN BY: GLN
DATE: 2/93



O·LOW AND HIGH VOLUME AIR PARTICULATE, RADON/THORON GAS, AND RADON/THORON DAUGHTER SAMPLERS

●·RADON GAS DETECTOR AND GAMMA RADIATION DETECTOR STATION

0 .25 MI
0 SCALE .40 KM

BACKGROUND AIR MONITORING STATION

FIGURE 5-4

REPORT NO.: DOE/OR/21548-379		EXHIBIT NO.: A/VP/110/1192	
ORIGINATOR: RC	DRAWN BY: GLN	DATE: 11/92	

TABLE 5-1 Fourth Quarter 1992 Track Etch Radon Monitoring Results[a]

Location ID	4th Quarter pCi/l	Percent of Guideline [b]
WSQ		
RD-1001	0.7	19
RD-1002	1.5	45
RD-1003	0.8	22
RD-1004	0.4	9
RD-1005	0.4	9
RD-1006	0.4	9
RD-1007	0.3	5
RD-1008	0.2	2
WSCP		
RD-2001	0.3	5
RD-2002	0.2	2
RD-2003	0.2	2
RD-2004	0.2	2
RD-2005	0.1	0
RD-2006	0.1	0
RD-2007	0.2	2
WSRP		
RD-3001	0.1	0
RD-3002	0.2	2
RD-3003	0.2	2
RD-3004	0.1	0
RD-3005	0.3	5

TABLE 5-1 Fourth Quarter 1992 Track Etch Radon Monitoring Results[a] (Continued)

Location ID	4th Quarter pCi/l	Percent of Guideline [b]
OFF-SITE		
RD-4001*	0.1	NA
RD-4002	0.2	2
RD-4003	0.2	2
RD-4004*	0.1	NA
RD-4005*	0.2	NA
RD-4006*	0.1	NA
RD-4007*	0.2	NA
RD-4008	0.4	9

(a) Results include natural background.

(b) Percent of guideline calculated by taking the quarterly average minus the average of the background stations divided by the DOE concentration guideline for Rn-222 which is 3 pCi/l (111 Bq/m^3)(Annual average above background) for uncontrolled areas.

* Denotes Background Station; therefore, percent of guideline not applicable (NA).

concentration was then subtracted from the concentration for each monitoring station, and compared to the U.S. Department of Energy (DOE) guideline of 3 pCi/l (111 Bq/m^3) above background.

Radon concentrations at the site and quarry perimeters and at off-site locations for the fourth quarter of 1992 were within the typical range expected during periods of normal precipitation. The quarterly radon concentrations at the Weldon Spring Chemical Plant/raffinate pit (WSCP/RP) area averaged 0.2 pCi/l (7.4 Bq/m^3), while the quarterly radon concentrations at the Weldon Spring Quarry (WSQ) averaged 0.6 pCi/l (22.2 Bq/m^3). The quarterly radon concentrations from each individual detector (background included) ranged from less than the detection limit of 0.06 pCi/l (2.22 Bq/m^3) to 1.5 pCi/l (55.5 Bq/m^3).

Radon concentrations found at the quarry are higher than concentrations measured at other locations, because the radium concentrations in quarry wastes are typically higher than in other areas. Also, the quarry is a large depression with side walls ranging from 3 m to 15 m (10 ft to 50 ft) high, which tends to trap emanating radon within the quarry and raise the concentrations along the quarry perimeter.

5.2 Gamma Radiation Exposure

This data is currently unavailable, however, it will be reported in the *1992 Annual Site Environmental Report*.

5.3 Radioactive Air Particulates

Seventeen low volume air particulate samplers continuously monitor the Weldon Spring site. Five of these (AP–2001, AP-2002, AP-3003, AP-3004, and AP-2005) are located around the Weldon Spring Chemical Plant (WSCP) perimeter and five are located around the quarry perimeter. There are five critical receptor monitoring stations, AP-4006, AP-4008, AP-2001, AP-2005 and AP-4011, located off-site at the Francis Howell high School, the Army Reserve property, the highway maintenance facility, the Weldon Spring Site Remedial Action Project (WSSRAP) administration building, and near a residential site west of the quarry, respectively. Three new monitoring stations were recently added during the second quarter of 1992. Two of the new monitoring stations, AP-2013 and AP-3014, were installed at the WSCP perimeter. The other new station, AP-1017, was installed at the WSQ perimeter. At the end of the fourth quarter three additional samplers were added to the low volume sampling network and one sampler was relocated. Two of the stations were added to the WSQ perimeter, AP-1015 and AP-1016. The third sampler, AP-4012 (Figure 5-4), located approximately 12 km from the WSCP will be used as the background monitoring station and replaces AP-4007 in that capacity. As a result, AP-4007 was relocated from behind the large hill which shielded the station from potential emissions from the WSCP to a location near the Busch Wildlife headquarters building and will serve as an off-site monitoring station in the future. The monitoring station at the August A. Busch Wildlife Area (AP-4007) is used to monitor background levels in the vicinity of the WSCP. The air particulate monitoring station locations are shown in Figures 5-1 and 5-3.

Table 5-2 summarizes the quarterly average concentrations and the standard deviations for the 17 air monitoring locations. The quarterly average concentration for each monitoring location was calculated by averaging all weekly air particulate analysis results including results lower than the instruments lower limit of detection (LLD). The corresponding standard deviation for each monitoring location was also calculated using all weekly air particulate

TABLE 5-2 Fourth Quarter 1992 Low Volume Radiological Air Particulate Monitoring Results

Monitor Identification Number	Quarterly Average Gross Alpha Concentration (μCi/ml)	Standard Deviation (μCi/ml)	Number of Weeks Collected	Number of Values Above LLD
AP-2001	1.34E-15	1.02E-15	13	9
AP-2002	1.60E-15	8.19E-16	13	13
AP-3003	N/A	N/A	0	0
AP-3004	1.14E-15	7.28E-15	13	12
AP-2005	1.15E-15	5.54E-16	12	11
AP-4006	1.44E-15	1.41E-15	13	12
AP-4007	1.31E-15	6.41E-16	13	13
AP-4008	1.15E-15	6.51E-16	13	11
AP-1009	1.24E-15	6.91E-16	13	12
AP-1010	1.73E-15	4.28E-16	6	6
AP-4011	1.03E-15	5.62E-16	13	11
AP-4012	1.18E-15	7.49E-16	2	2
AP-2013	1.11E-15	6.29E-16	13	11
AP-3014	1.15E-15	7.14E-16	13	12
AP-1015	9.51E-16	5.83E-16	3	2
SP-1016	8.47E-16	4.38E-16	3	2
AP-1017	1.23E-15	5.01E-16	10	8

* Indicates background monitor station.
N/A Not available.

analysis results. Due to maintenance and installation of new samplers, all samplers were not operating the entire 13 weeks, as indicated in the fourth column of Table 5-2. The WSSRAP has deployed high volume air samplers, as well as low volume air samplers, at critical receptor locations. These high volume samplers are used in accordance with the *Plan for Monitoring Radionuclide Emissions Other Than Radon at the Weldon Spring Site Critical Receptors*

(MKF and JEG 1992b). The high volume monitoring results will be presented in the 1992 annual site environmental report.

The fourth quarter average long-lived gross alpha concentrations ranged from 7.96×10^{-16} μCi/ml to 1.60×10^{-15} μCi/ml for perimeter and off site locations. The average background concentration measured at AP-4007 and AP-4012 was 1.34×10^{-15} μCi/ml.

5.4 Asbestos

In accordance with the *Environmental Monitoring Plan* (MKF and JEG 1992a) the WSSRAP collected environmental airborne asbestos samples. These samples were collected at both the FHHS and the WSSRAP perimeter during bulk asbestos removal operations.

The samples collected at the perimeter locations all showed results of 0.001 fibers/cc or less. Fourteen samples were collected at the perimeter of which four had measured concentrations below the detection limit.

The samples collected at the FHHS all showed results of 0.002 fibers/cc or less. Thirty-five samples were collected at the FHHS of which 12 were less than the detection limit.

6 REFERENCES

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MK-Ferguson Company and Jacobs Engineering Group, 1992a. *Environmental Monitoring Plan*, Rev. 1. DOE/OR/21548-237. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office. St. Charles, MO. January.

MK-Ferguson Company and Jacobs Engineering Group, 1992b. *Plan for Monitoring Radionuclide Emissions Other Than Radon at the Weldon Spring Site Critical Receptors*, Rev. 1. DOE/OR/21548-127. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office, Weldon Spring Site Remedial Action Project. St. Charles, MO.

DOE Orders

5400.5 *Radiation Protection of the Public and the Environment*

Procedures

ES&H 4.4.1s *Groundwater Sampling*
ES&H 4.3.1s *Surface Water Sampling*

APPENDIX A

Letter from DOE to PMC regarding
Preparation of Environmental Monitoring Summaries

Department of Energy
Oak Ridge Operations
Weldon Spring Site
Remedial Action Project Office
Route 2, Highway 94 South
St. Charles, Missouri 63303

3589-90-I-DOE-418
MU-01-01

RECEIVED
JUL 02 1990
WSSRAP CONTRACT OFFICE

July 2, 1990

Mr. R.E. Hlavacek
Project Director
MK-Ferguson Company
7295 Highway 94 South
St. Charles, Missouri 63303

Dear Mr. Hlavacek:

PREPARATION OF ENVIRONMENTAL MONITORING SUMMARIES

With the upcoming increase in remedial action work at the site, it will be necessary to disseminate environmental monitoring data in a timely manner to the Francis Howell High School (FHHS), St. Charles Countians Against Hazardous Waste (SCCAHW), Missouri Department of Natural Resources (MDNR), U.S. Environmental Protection Agency (EPA) and others. Therefore, you are requested to prepare a plan for DOE review which would result in preparation of a document that summarizes our environmental monitoring data on a quarterly basis.

I would like the document to be brief but contain appropriate explanation and discussion of the data. Issuance of the quarterly report should begin as soon as possible and include the first two quarters of FY 90 data, in order to get caught up with this fiscal year.

Sincerely,

Stephen H. McCracken
Project Manager
Weldon Spring Site
Remedial Action Project

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