DOE/OR/21548-183
CONTRACT NO. DE-AC05-86OR21548

QUARTERLY ENVIRONMENTAL DATA SUMMARY FOURTH QUARTER 1990

For the
Weldon Spring Site Remedial Action Project
Weldon Spring, Missouri

Prepared by MK-Ferguson Company and Jacobs Engineering Group

MARCH 1991 **REV. 0**

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

032291

DOE/OR/21548-161

Weldon Spring Site Remedial Action Project

Quarterly Environmental Data Summary
Fourth Quarter 1990

March 1991

Prepared by

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for the

U.S. DEPARTMENT OF ENERGY
Oak Ridge Operations Office
Under Contract DE-AC05-86OR21548

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Printed in the United States of America. Available from the National Technical Information Service, NTIS, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161

NTIS Price Codes - Printed copy:
Microfiche: A01

ABSTRACT AND WELDON SPRING SITE QUARTERLY SELF ASSESSMENT FOURTH QUARTER 1990

The purpose of this Quarterly Environmental Data Summary is to provide preliminary data acquired as part of the Weldon Spring Site Remedial Action Project (WSSRAP) environmental monitoring program. The document summarizes the environmental data, highlights any potentially significant findings, and offers tentative interpretations. Validated data and final interpretations will appear in the 1990 Annual Site Environmental Report.

This report includes data from environmental monitoring at the Weldon Spring site (WSS) during the fourth quarter of 1990. Groundwater, surface water, and air were sampled in order to monitor potential exposure pathways. Analytical parameters included radionuclides, nitroaromatic compounds, inorganic anions, and direct gamma exposure. The results are used to calculate exposure doses (where applicable) and assess the impact of the contaminants at the site on potentially exposed populations.

No significant differences were observed in off-site exposures during the fourth quarter of 1990 relative to exposures calculated in previous quarters. The WSS experienced a National Pollution Discharge Elimination System (NPDES) noncompliance on fecal coliform in December of 1990. The necessary steps have been taken to return the discharge to a compliance level. Contaminated groundwater did not affect private water supplies or the St. Charles County well field. Surface water containing elevated uranium activity continued to impact the Femme Osage Slough and several lakes in the August A. Busch Memorial Wildlife Area. Off-site gamma, radon and air particulate exposures remained indistinguishable from background. Off-site monitoring demonstrated that exposure levels at the Francis Howell High School, the Busch Wildlife Area Headquarters, and the Weldon Spring Training Area remain indistinguishable from background levels.

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1 INTRODUCTION

This document is the third in a series of documents designed to provide a summary of the findings from the routine environmental monitoring programs at the Weldon Spring Site Remedial Action Project (WSSRAP). These documents supplement the Annual Site Environmental Reports (ASER) by providing interested outside agencies and organizations with more frequent access to WSSRAP data. They provide data resulting from routine environmental sampling as described in the WSSRAP Environmental Monitoring Plan 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 observations made in previous reports. The full interpretation of these data (as well as data in other quarterly summaries) will be undertaken in the 1990 ASER. It is recommended that interested readers refer to previous Environmental Monitoring Plans (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 analytical parameters are 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 quarterly environmental monitoring programs conducted at the WSSRAP including groundwater, surface water, National Pollutant Discharge Elimination System, radon, gamma radiation, and air particulates (including asbestos and radioactive particulates). However, because of delays in data delivery from the analytical laboratories, some of the data that was expected to be included in this report are not yet available for reporting. The unavailability of data is due to a nationwide shortage in analytical services. WSSRAP is taking corrective action to ensure more timely availability of data in the future. These data will be reported in the 1990 Annual Site Environmental Report (ASER). Sludges, soils, and biological specimens 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 1990 ASER.

2 GROUNDWATER MONITORING

The groundwater is sampled regularly at both the Weldon Spring Chemical Plant/raffinate pits/vicinity properties (WSCP/RP/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/RP/VP and WSQ will be discussed separately.

2.1 Chemical Plant/Raffinate Pits/Vicinity Properties

The groundwater at the chemical plant/raffinate pits/vicinity properties area is monitored on a semi-annual basis. Monitoring well locations are shown in Figure 2-1. Data from the semiannual groundwater monitoring for the second half of 1990 are presented in this fourth quarter data summary.

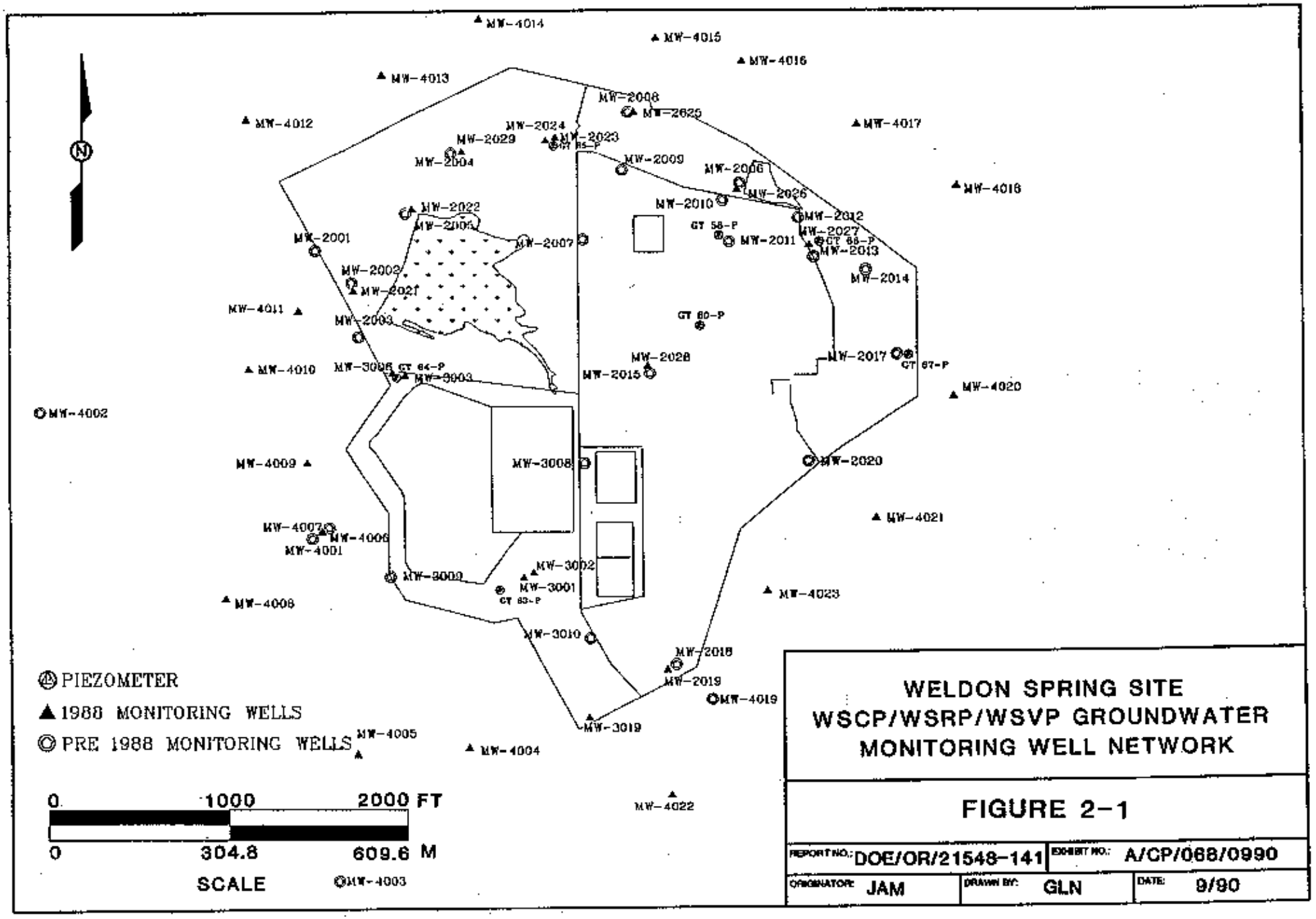
2.1.1 Nitroaromatic Results

Table 2-1 contains nitroaromatic data from samples from the monitoring wells at the CP/RP/VP area. Nitroaromatic compounds were detected in twenty samples. However, the data continue to reflect levels historically found and documented in previous environmental reports.

2.1.2 Radiological Results

The radiological results for samples from wells at the WSCP/RP/VP are presented in Table 2-2. The upper bound for natural uranium background concentrations in groundwater at the WSCP/WSRP/WSVP has been determined to be 3.4 pCi/l. The EPA has not yet established drinking water standards for uranium; however, studies leading to proposed rulemaking are using uranium in the 10 to 40 pCi/l range. The U.S. Department of Energy (DOE) has a derived concentration guideline (DCG) of 550 pCi/l.

The highest uranium level detected was 74.8 pCi/l from a sample obtained from Monitoring Well 3009; however, the data is not yet available from MW-3008 which previously has indicated higher levels. The other concentrations reported in Table 2-2 continue to indicate levels below the proposed drinking water standard for uranium;



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

FIGURE 2-1

REPORT NO.: DOE/OR/21548-141		EXHIBIT NO.: A/CP/068/0990	
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90	

TABLE 2-1 Second Semester Nitroaromatic Data for Groundwater at the WSCP/RP/VP

SAMPLE ID	NB	1,3-DNB	2,4-DNT	2,6-DNT	2,4,6-TNT	1,3,5-TNB
	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)
GW-2001-082190	ND	ND	0.071	0.048	ND	0.032
GW-2002-101190	ND	ND	0.063	0.49	ND	ND
GW-2003-071790	ND	ND	0.28	1.2	ND	ND
GW-2004-090590	ND	ND	ND	ND	ND	ND
GW-2005-071890	ND	ND	0.079	0.050	ND	ND
GW-2006-090690	ND	ND	ND	1.6	0.039	11
GW-2007-090690	ND	ND	ND	ND	ND	ND
GW-2008-090690	ND	ND	ND	0.72	0.036	0.91
GW-2009-081690	ND	ND	ND	0.35	ND	ND
GW-2010-071890	ND	0.20	0.032	0.75	0.55	0.24
GW-2011	Not Available					
GW-2012-082190	ND	ND	ND	1.4	0.74	3.5
GW-2013						
GW-2014	NA					
GW-2015-071990	ND	ND	ND	ND	ND	ND
GW-2017-090490	ND	ND	ND	1.2	ND	0.074
GW-2018-101790	ND	ND	ND	ND	ND	ND
GW-2019-111390	ND	ND	ND	ND	ND	ND
GW-2020						
GW-2021-101190	ND	ND	ND	ND	ND	ND
GW-2022-101190	ND	ND	ND	ND	ND	ND

TABLE 2-1 Second Semester Nitroaromatic Data for Groundwater at the WSCP/RP/VP (Continued)

SAMPLE ID	NB	1,3-DNB	2,4-DNT	2,6-DNT	2,4,6-TNT	1,3,5-TNB
	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)
GW-2023-121990 *	ND	ND	ND	ND	ND	ND
GW-2024-121890 *	ND	ND	ND	ND	ND	ND
GW-2025-101890	ND	ND	ND	ND	ND	ND
GW-2026-121890 *	ND	ND	ND	ND	ND	ND
GW-2027-112090	ND	ND	ND	ND	ND	ND
GW-2028-120490	ND	ND	ND	ND	ND	ND
GW-2029-090590	ND	ND	ND	ND	ND	ND
GW-3001-092090	ND	ND	0.66	0.2	ND	0.14
GW-3002-112090	ND	ND	ND	ND	ND	ND
GW-3003-082290	ND	ND	0.034	0.073	ND	ND
GW-3006-082290	ND	ND	ND	ND	ND	ND
GW-3008	NA					
GW-3009-111390	ND	ND	0.11	0.057	ND	0.11
GW-3010-112890	ND	ND	ND	ND	ND	ND
GW-3019-073190	ND	ND	ND	ND	ND	ND
GW-4001-072490	ND	ND	3.1	3.1	2.0	58.0
GW-4002-091990	ND	ND	ND	0.13	0.2	0.27
GW-4003	ND	ND	ND	ND	ND	ND
GW-4004-121090	ND	ND	ND	ND	ND	ND
GW-4005-110190	ND	ND	ND	ND	ND	ND
GW-4006-072490	ND	ND	ND	3.5	ND	17.0

TABLE 2-1 Second Semester Nitroaromatic Data for Groundwater at the WSCP/RP/VP (Continued)

SAMPLE ID	NB	1,3-DNB	2,4-DNT	2,6-DNT	2,4,6-TNT	1,3,5-TNB
	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)
GW-4007-121190	ND	ND	ND	ND	ND	ND
GW-4008-101890	ND	ND	ND	ND	ND	ND
GW-4009-072690	ND	ND	ND	ND	ND	ND
GW-4010-110190	ND	ND	ND	ND	ND	ND
GW-4011-110890	ND	ND	ND	ND	ND	ND
GW-4012-072590	ND	ND	ND	ND	ND	ND
GW-4013-120590	ND	ND	0.043	1.3	0.067	34.0
GW-4014-120590	ND	ND	ND	0.12	0.057	0.48
GW-4015-120590	ND	ND	0.047	2.2	0.03	0.15
GW-4016-073190	ND	ND	ND	ND	ND	ND
GW-4017-073190	ND	ND	ND	ND	ND	ND
GW-4018-062090	ND	ND	ND	ND	ND	ND
GW-4019-102290	ND	ND	ND	ND	ND	ND
GW-4020-102490	ND	ND	ND	ND	ND	ND
GW-4021-072690	ND	ND	ND	ND	ND	ND
GW-4022-062090	ND	ND	ND	ND	ND	ND
GW-4023-072690	ND	ND	0.075	0.028	ND	0.10

TABLE 2-2 Second Semester Uranium Data in Groundwater at WSCP/RP/VP

SAMPLE ID	Uranium
	pCi/l
GW-2002-101190	ND
GW-2003-071790	1.6
GW-2005-071890	4.7
GW-2010-071890	16.7
GW-2013-070590	0.9
GW-2013-121990	ND
GW-2014-121990	ND
GW-2015-071890	2.5
GW-2018-101790	2.7
GW-2019-111390	4.76
GW-2020-120490	5.4
GW-2021-101190	1.4
GW-2022-101190	1.4
GW-2023-121990	10.9
GW-2024-121890	1.4
GW-2025-101890	ND
GW-2026-121890	0.7
GW-2027-112090	1.4
GW-2028-120490	2.0
GW-3002-112090	3.4
GW-3009-111390	74.8
GW-3010-112890	ND
GW-3019-073190	6.7
GW-4001-072490	1.0
GW-4004-120190	2.7
GW-4005-110190	24.5
GW-4006-072490	1.3
GW-4007-121190	5.4
GW-4008-101890	1.4

TABLE 2-2 Second Semester Uranium Data in Groundwater at WSCP/RP/VP (Continued)

SAMPLE ID	Uranium
	pCi/l
GW-4009-072690	3.7
GW-4010-110190	8.2
GW-4011-110690	3.4
GW-4012-072690	3.5
GW-4013-120590	14.3
GW-4014-120590	1.4
GW-4015-120590	3.4
GW-4016-073190	5.4
GW-4017-073190	1.1
GW-4019-102290	4.6
GW-4020-102490	19.7
GW-4021-072690	7.7
GW-4023-072690	2.0

ND – Not Detected

however, several wells do indicate higher levels than historically present at those locations. The ASER will evaluate these levels and trends.

2.2 Weldon Spring Quarry

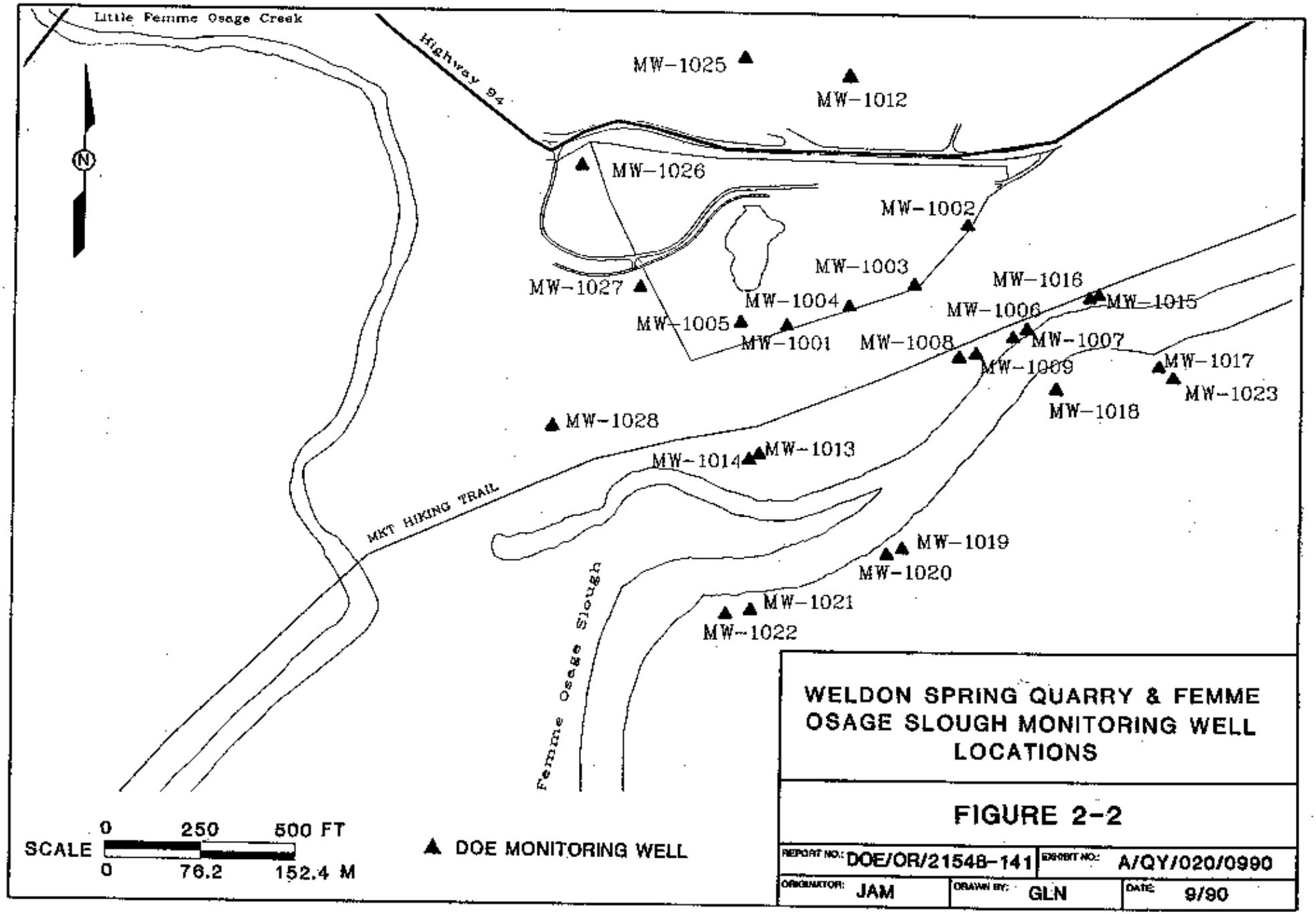
Chemical and radiological wastes at the quarry are of particular concern because of their proximity to the St. Charles County well field. The well field is located approximately one-half mile to the south. Monitoring of contaminants in groundwater and the protection of the well field is a top WSSRAP priority.

Groundwater is monitored in 30 wells in and around the quarry. Twenty-six monitoring wells installed by the U.S. Department of Energy (DOE) currently exist in or near the quarry. Four additional monitoring wells were installed by St. Charles County in 1986. All monitoring well locations are shown in Figures 2-2 and 2-3. These wells currently draw water from both bedrock and alluvial aquifers.

Two separate groundwater monitoring programs have been developed for the quarry. The first program is a semiannual sampling of all wells north of the Femme Osage Slough. The second program monitors the area south of the Femme Osage Slough, including the St. Charles County well field. Active production wells and monitoring wells are sampled quarterly. The raw and treated waters from the St. Charles County water treatment plant are also sampled. This portion of the quarry groundwater monitoring program has been jointly developed by representatives of the DOE, the Missouri Department of Natural Resources (MDNR), the U.S. Environmental Protection Agency (EPA), and St. Charles County.

2.2.1 Radiological Results

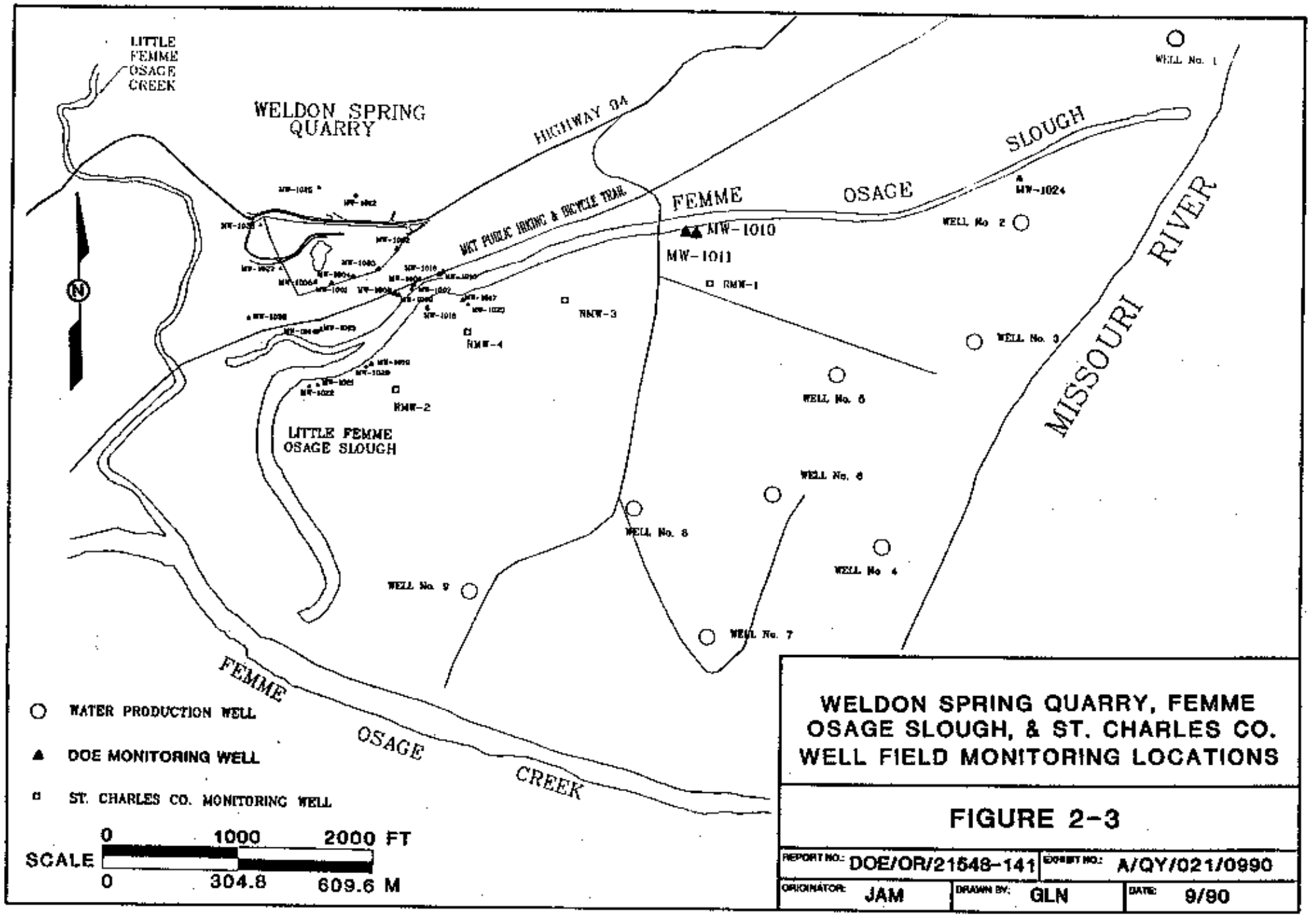
Radiological data are presented in Tables 2-3A and 2-3B for samples collected on semi-annual and quarterly bases, respectively. Some radiological data are not yet received from the analytical laboratory but will be included in the 1990 ASER. The results show fluctuations around the average levels in the WSQ area with no dramatic increases evident. Trend analyses will be presented in the 1990 ASER. The data in Table 2-3B also indicate no uranium levels of concern south of the slough.



WELDON SPRING QUARRY & FEMME OSAGE SLOUGH MONITORING WELL LOCATIONS

FIGURE 2-2

REPORT NO.: DOE/OR/21548-141		EXHIBIT NO.: A/QY/020/0990	
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90	



WELDON SPRING QUARRY, FEMME OSAGE SLOUGH, & ST. CHARLES CO. WELL FIELD MONITORING LOCATIONS

FIGURE 2-3

REPORT NO.: DOE/OR/21548-141		DOCKET NO.: A/QY/021/0990	
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90	

TABLE 2-3A Second Semester Results of Analyses for Inorganic Anions and Radiological Parameters in Groundwater for the WSQ

QUARRY	Nitrate (mg/l)	Sulfate (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	Uranium[1] pCi/l	Gross Alpha pCi/l
GW-1002-103190	0.7	55.0	9.4	0.4	0.7	NA
GW-1004-103190	0.6	330	27.8	1.2	5984	NA
GW-1005-103190	ND	268	25.2	1.0	2992	NA
GW-1006-110790	1.3	675	37.0	0.4	3332	NA
GW-1007-110790	ND	28.8	64.5	0.4	177	NA
GW-1008-110690	ND	351	24.0	0.5	3536	NA
GW-1009-110690	ND	268	25.5	0.4	8.2	NA
GW-1010-061490	ND	ND	5.4	ND	0.2 +/- 0.02	NA
GW-1011-061490	ND	34.0	9.4	ND	6.9 +/- 0.7	NA
GW-1012-121290	1.3	36.2	8.1	0.4	2.0	NA
GW-1013-110690	ND	120	20.5	0.5	952	NA
GW-1014-110690	ND	134	23.0	0.5	952	NA
GW-1015-110790	1.9	474	29.0	0.4	639	NA
GW-1016-110790	1.3	229	19.0	0.4	190	NA
GW-1025-121390	ND	134	5.5	ND		NA
GW-1026-121290	ND	ND	2.0	ND	ND	NA
GW-1027-102490	Not Available	NA	NA	NA	653	NA

TABLE 2-3A Second Semester Results of Analyses for Inorganic Anions and Radiological Parameters in Groundwater for the WSQ (Continued)

	Nitrate	Sulfate	Chloride	Fluoride	Uranium	Gross Alpha
QUARRY	(mg/l)	(mg/l)	(mg/l)	(mg/l)	pCi/l	pCi/l
GW-1028-102490	NA	NA	NA	NA	7.5	NA
GW-1027-122090	ND	156	14.8	0.4	NA	NA
GW-1028-122090	ND	50.1	8.9	ND	NA	NA

ND -- Not Detected
NA -- Not Applicable

TABLE 2-3B Fourth Quarter Inorganic Anions and Radiological Data Summary for the WSQ

QUARRY	Nitrate (mg/l)	Sulfate (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	Uranium pCi/l	Gross Alpha pCi/l
GW-PW02-Q490	NA	NA	NA	NA	ND	0 ± 3
GW-PW03-Q490	NA	NA	NA	NA	3.4	2 ± 3
GW-PW04-Q490	NA	NA	NA	NA	2.0	1 ± 3
GW-PW05-Q490	NA	NA	NA	NA	ND	0 ± 3
GW-PW06-Q490	NA	NA	NA	NA	ND	1 ± 4
GW-PW07-Q490	NA	NA	NA	NA	ND	0 ± 4
GW-PW08-Q490	NA	NA	NA	NA	ND	0 ± 4
GW-PW09-Q490	NA	NA	NA	NA	ND	3 ± 4
GW-RAWW-Q490					2.7	2 ± 3
- Untreated water from water treatment plant						
GW-FINW-Q490	NA	NA	NA	NA	ND	1 ± 2
- Treated water from water treatment plant						
GW-RMW1-Q490	ND	23.5	7.75	ND	1.4	2 ± 5
GW-RMW2-Q490	ND	26.8	4.24	0.35	4.6	10 ± 6
GW-RMW3-Q490	ND	61.6	12.2	ND	ND	0 ± 6
GW-RMW4-Q490	ND	18.5	10.2	0.27	3.4	4 ± 6
GW-1024-Q490	ND	11.0	11.7	0.35	ND	1 ± 5
GW-1017-Q490	ND	2.7	18.9	0.2	1.4	NS
GW-1018-Q490	ND	105	22.6	0.2	ND	NS

TABLE 2-3B Fourth Quarter Inorganic Anions and Radiological Data Summary for the WSQ (Continued)

	Nitrate	Sulfate	Chloride	Fluoride	Uranium	Gross Alpha
QUARRY	(mg/l)	(mg/l)	(mg/l)	(mg/l)	pCi/l	pCi/l
GW-1019-Q490	ND	4.5	6.3	0.2	ND	NS
GW-1020-Q490	ND	25.2	9.4	0.3	3.4	NS
GW-1021-Q490	ND	ND	9.4	0.2	ND	NS
GW-1022-Q490	ND	2.0	9.4	0.2	ND	NS
GW-1023-Q490	ND	3.8	5.3	0.3	1.4	NS

ND – Not Detected
NA – Not Analyzed

TABLE 2-4A Fourth Quarter Nitroaromatic Data for Groundwater at the WSQ

SAMPLE ID	NB	1,3-DNB	2,4-DNT	2,6-DNT	2,4,6-TNT	1,3,5-TNB
	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)
GW-1002-103190	ND	0.27	ND	4.4	10.0	52.0
GW-1004-103190	ND	ND	1.6	3.8	4.2	0.79
GW-1005-103190	ND	ND	0.16	0.062	ND	ND
GW-1006-110790	ND	0.19	0.16	7.4	16.0	120
GW-1007-110790	ND	ND	ND	ND	ND	ND
GW-1008-110690	ND	0.14	ND	ND	ND	ND
GW-1009-110690	ND	ND	ND	ND	ND	ND
GW-1010-061490	ND	ND	ND	ND	ND	ND
GW-1011-061490	ND	ND	ND	ND	ND	ND
GW-1012-121290	ND	ND	ND	ND	ND	ND
GW-1013-110690	ND	ND	0.038	ND	ND	ND
GW-1014-110690	ND	ND	0.031	ND	ND	ND
GW-1015-110790	ND	0.22	ND	0.56	4.9	11.0
GW-1016-110790	ND	0.20	ND	0.070	0.26	0.48
GW-1025-121390	ND	ND	ND	ND	ND	ND
GW-1026-121290	ND	ND	ND	ND	ND	ND
GW-1027-102490	ND	ND	12	6.7	26	0.13
GW-1028-102490	ND	ND	ND	ND	ND	ND

ND – Not Detected

TABLE 2-4B Fourth Quarter Nitroaromatic Data for Groundwater at the WSQ

SAMPLE ID	NB	1,3-DNB	2,4-DNT	2,6-DNT	2,4,6-TNT	1,3,5-TNB
	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)
GW-1017-Q490	ND	ND	ND	ND	ND	ND
GW-1018-Q490	ND	ND	ND	ND	ND	ND
GW-1019-Q490	ND	ND	ND	ND	ND	ND
GW-1020-Q490	ND	ND	ND	ND	ND	ND
GW-1021-Q490	ND	ND	ND	ND	ND	ND
GW-1022-Q490	ND	ND	ND	ND	ND	ND
GW-1023-Q490	ND	ND	ND	ND	ND	ND
GW-1024-Q490	ND	ND	ND	ND	ND	ND
GW-RMW1-Q490	ND	ND	ND	ND	ND	ND
GW-RMW2-Q490	ND	ND	ND	ND	ND	ND
GW-RMW3-Q490	ND	ND	ND	ND	ND	ND
GW-RMW4-Q490	ND	ND	ND	ND	ND	ND
GW-PW02-Q490	ND	ND	ND	ND	ND	ND
GW-PW03-Q490	ND	ND	ND	ND	ND	ND
GW-PW04-Q490	ND	ND	ND	ND	ND	ND
GW-PW05-Q490	ND	ND	ND	ND	ND	ND
GW-PW06-Q490	ND	ND	ND	ND	ND	ND
GW-PW07-Q490	ND	ND	ND	ND	ND	ND
GW-PW08-Q490	ND	ND	ND	ND	ND	ND

TABLE 2-4B Fourth Quarter Nitroaromatic Data for Groundwater at the WSQ (Continued)

SAMPLE ID	NB	1,3-DNB	2,4-DNT	2,6-DNT	2,4,6-TNT	1,3,5-TNB
	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)
GW-PW09-Q490	ND	ND	ND	ND	ND	ND
GW-RAWW-Q490	ND	ND	ND	ND	ND	ND
GW-FINW-Q490	ND	ND	ND	ND	ND	ND

2.2.2 Nitroaromatic Compounds Results

Analytical results for nitroaromatic compounds are presented in Tables 2-4A and 2-4B. No monitoring wells south of the Femme Osage Slough showed detectable concentrations of nitroaromatic compounds during the third quarter 1990. The distribution of nitroaromatic contamination near the quarry remains unchanged.

2.2.3 Inorganic Anions Results

Four inorganic anions--nitrate, sulfate, chloride, and fluoride--were measured in quarry wells. Tables 2-3A and 2-3B display the analytical results for the fourth quarter of 1990, which are consistent with data reported in the previous environmental monitoring reports. The WSQ groundwater samples continue to indicate no significant groundwater contamination by nitrate. The groundwater samples continue to indicate background concentrations of sulfate in wells south of the Femme Osage Slough. Results of chloride analyses of groundwater south of the Femme Osage Slough continue to indicate background concentrations. Results of fluoride analyses indicate no detectable levels for fourth quarter 1990.

2.2.4 Metals Results

A selected group of quarry wells located south of the Femme Osage Slough were sampled for arsenic and barium. Analytical results for these metals are presented in Table 2-5. Results from fourth quarter analyses of arsenic and barium continue to indicate elevated concentrations in selected wells. The highest levels reported for the fourth quarter are 37.9 μg/l for arsenic in RMW-3 and 458 μg/l for barium as detected in Monitoring Well RMW-1.

TABLE 2-5 Fourth Quarter Results for Metals in Groundwater at the WSQ

QUARRY	ARSENIC µg/l	BARIUM µg/l
GW-1024-Q390	ND	182
GW-RMW1-Q390	6.8	458
GW-RMW2-Q390	16.1	158
GW-RMW3-Q390	37.9	394
GW-RMW4-Q390	35.3	159
GW-RAWW-Q390	6.4	311
GW-FINW-Q390	ND	69.2

ND - Not Detected

3 SURFACE WATER MONITORING

Routine samples were collected during the fourth quarter of 1990 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.

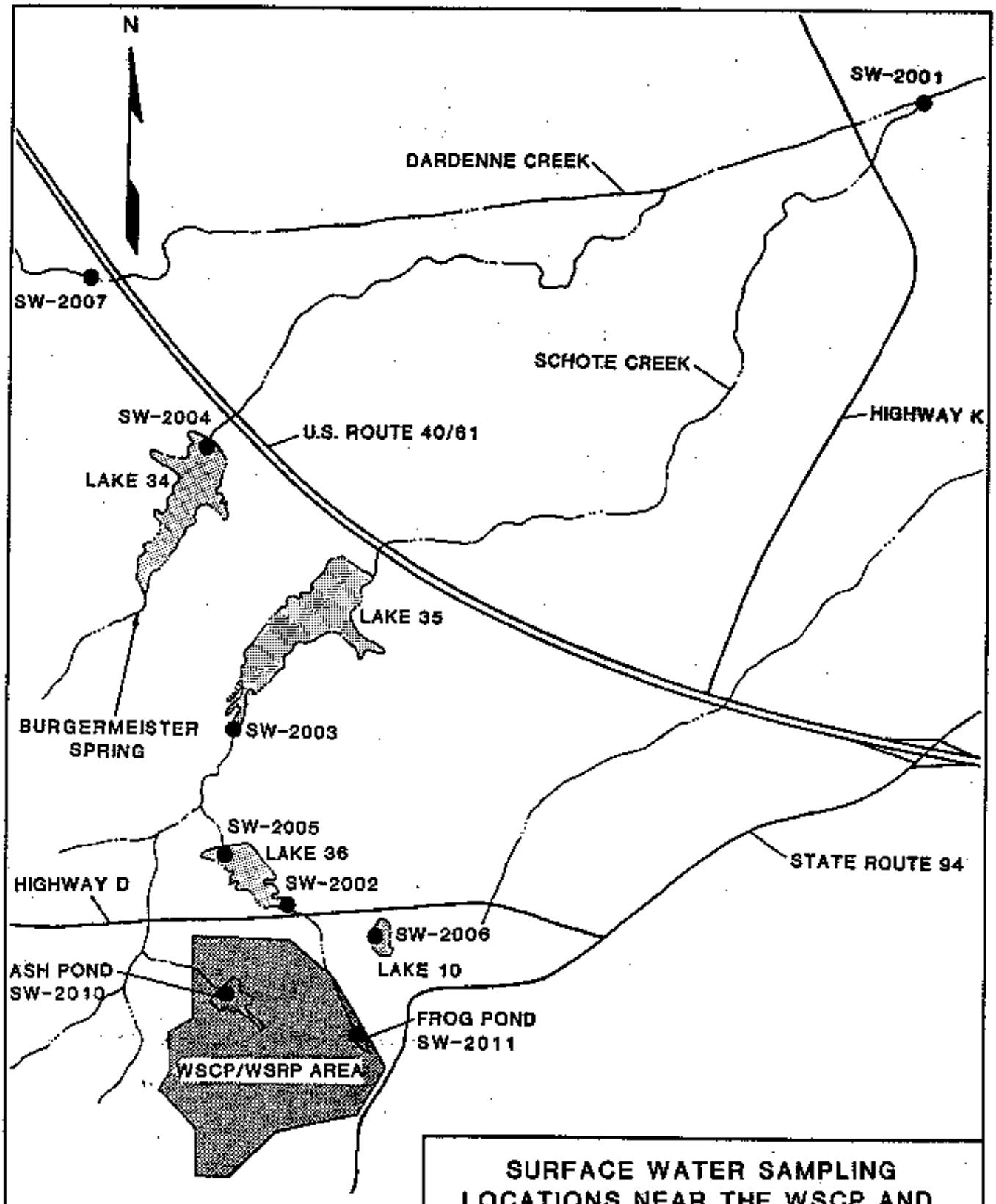
3.1 Chemical Plant/Raffinate Pits/Vicinity Properties

During the fourth quarter, surface water samples were collected from the nine locations shown in Figure 3-1 and analyzed for uranium. The results, presented in Table 3-1, indicate that conditions remain similar with values within the range measured historically with the highest level (102 pCi/l) again detected at inflow to Lake 36 on the Busch Wildlife Area. Dilution and/or other factors within that lake decreased the concentration to 16.32 pCi/l at its outflow. All other values at off-site locations remain relatively low and consistent with historical values.

3.2 Weldon Spring Quarry

Surface water samples were collected from the nine locations shown in Figure 3-2 and three locations in Figure 3-3. Samples were analyzed for uranium and the results are presented in Table 3-1A. The results of all samples except the Missouri River samples indicate no apparent changes in environmental conditions, although the uranium level of the pond within the access-controlled area of the quarry was higher than in previous quarters of 1990. This level is not cause for concern. The uranium levels in the water of the quarry pond have historically fluctuated due to precipitation and dilution within that pond. The concentrations of the six nitroaromatic compounds ranged from below the detection limit to 12.0 µg/l for 2,4,6-TNT. The ponded water will be treated for nitroaromatic compounds and other organics upon completion of the quarry water treatment plant.

The fourth quarter uranium values measured in the Missouri River attract attention due to their apparent upward trend in the downstream direction. Although cause for focused attention, these values are not believed to represent a real influence from site-related uranium sources. The levels of uranium at these locations have historically fluctuated at each of the sampling locations (due to either natural fluctuations or analytical



● -SAMPLE LOCATIONS

1989 ANNUAL ENV. MON. REPORT

0 2000 4000 FEET

0 609.6 1219.2 METERS

SCALE

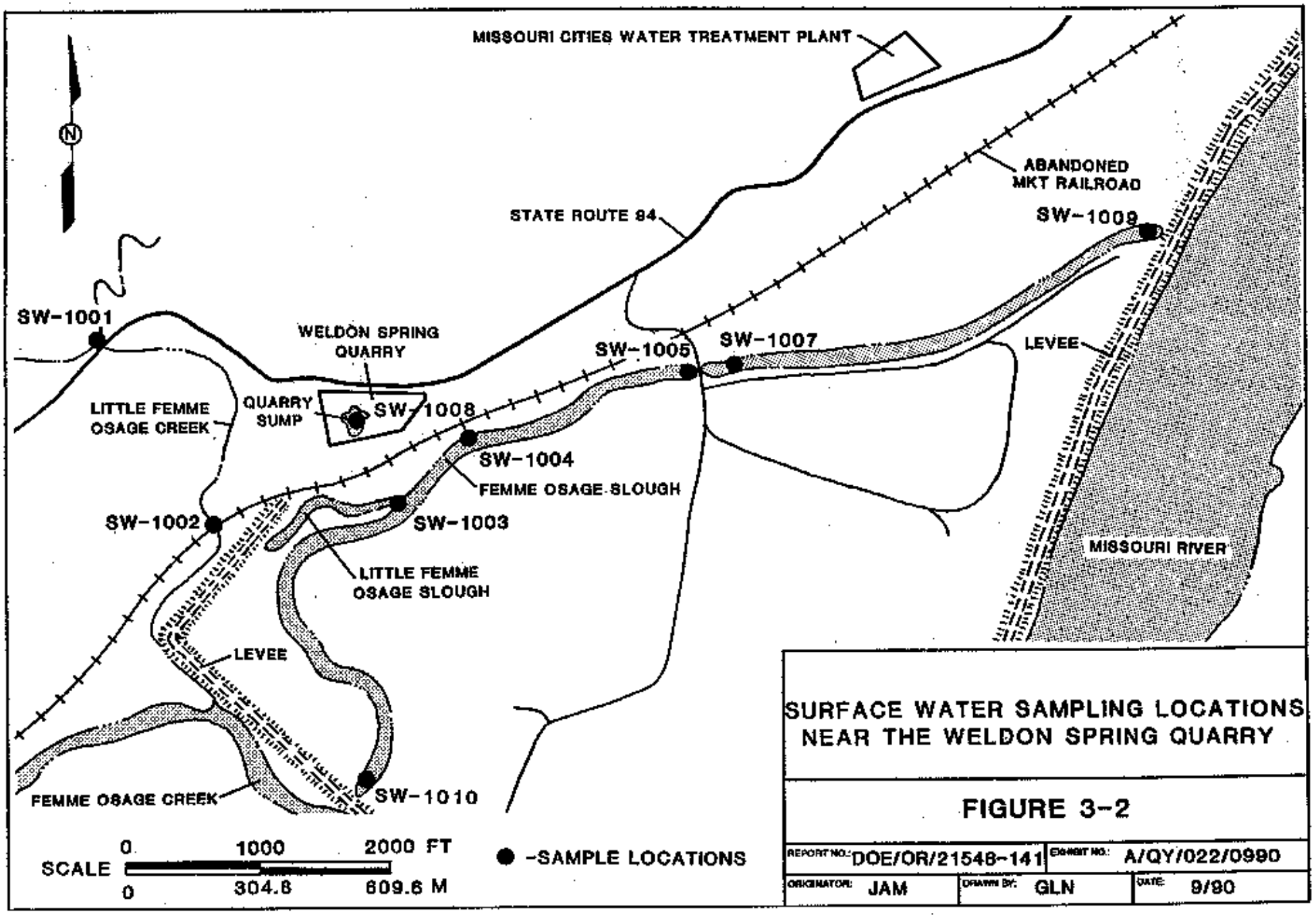
SURFACE WATER SAMPLING LOCATIONS NEAR THE WSCP AND WSRP AREAS OF THE WELDON SPRING SITE

FIGURE 3-1

REPORT NO.: DOE/OR/21548-141	EXHIBIT NO.: A/VP/041/0990	
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90

TABLE 3-1 Fourth Quarter Uranium Results in Surface water at the WSCP/RP Area

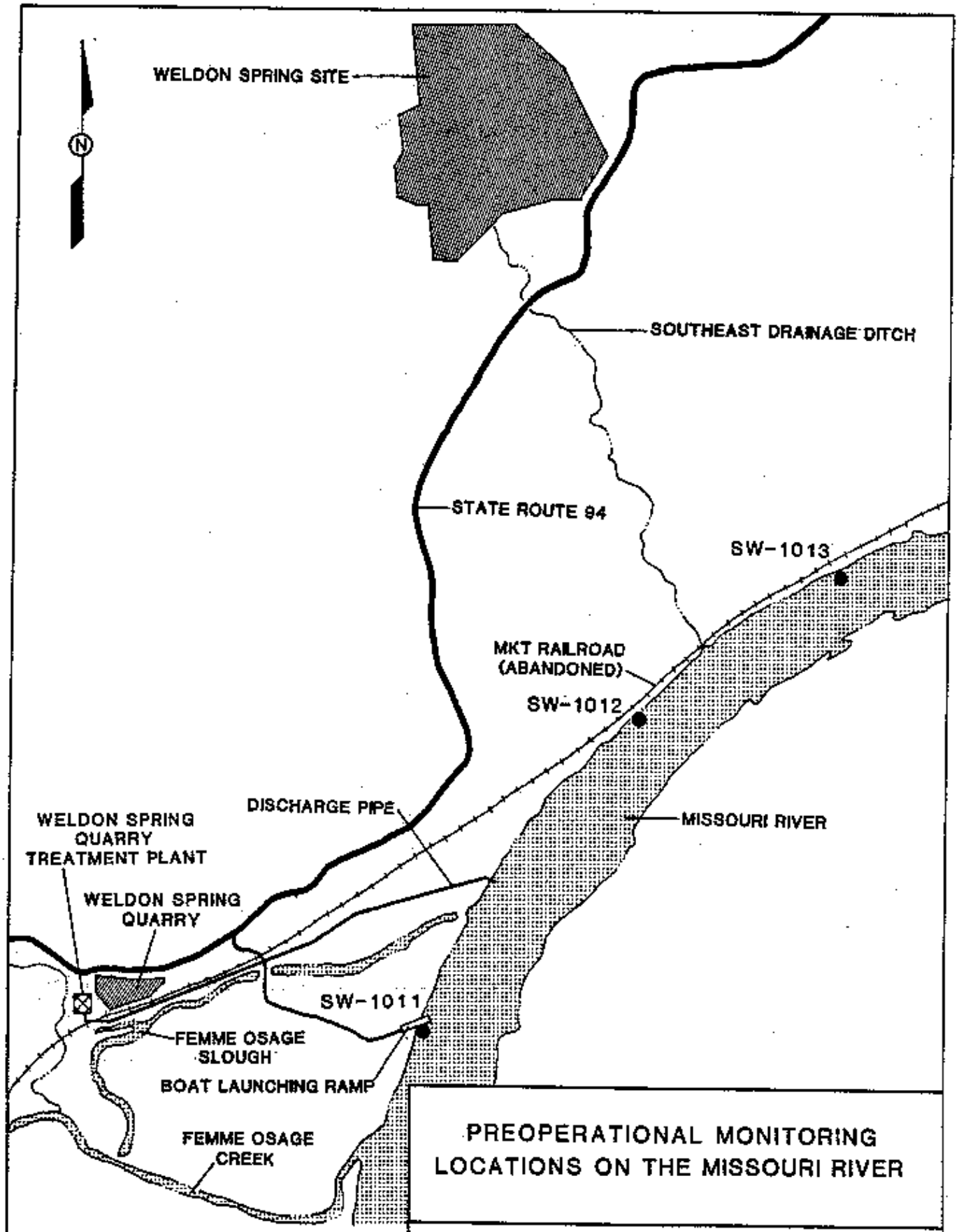
Sampling ID	Uranium
SW-2001	ND
SW-2002	102
SW-2003	12.24
SW-2004	13.6
SW-2005	18.32
SW-2006	ND
SW-2007	4.76
SW-2010	Not Available
SW-2011	170



SURFACE WATER SAMPLING LOCATIONS
NEAR THE WELDON SPRING QUARRY

FIGURE 3-2

REPORT NO.: DOE/OR/21548-141	EXHIBIT NO.: A/QY/022/0990	
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90



PREOPERATIONAL MONITORING LOCATIONS ON THE MISSOURI RIVER

FIGURE 3-3

REPORT NO.: DOE/OR/21548-141		EXHIBIT NO.: A/VP/042/0990	
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90	

variability) such that uranium concentrations have been higher at upstream locations than below the southeast drainage/Missouri River confluence. The U.S. Department of Energy (DOE) has increased monitoring of the Missouri River prior to the operation of the Weldon Spring Site Remedial Action Project (WSSRAP) quarry water treatment plant to ascertain the preoperational (background) levels. In addition, the National Pollution Discharge Elimination System (NPDES) permit for the quarry water treatment plant requires additional monitoring of the river. Permit monitoring will begin in 1991. This monitoring will increase the DOEs capability to ensure the safety of the public and the environment.

3.3 Springs

Eleven springs around the Weldon Spring site (WSS) are sampled quarterly (see Figure 3-4 for spring locations). Previous spring monitoring indicated that waters from six perennial springs and one wet-weather spring are measurably influenced by site-related contaminants. These springs are SP-6301, SP-6302, SP-6306, and SP-5301 through SP-5304. All spring samples are analyzed for uranium.

3.3.1 Uranium

The levels of uranium measured in the springs are consistent with values measured at those locations and drainages in the past. Table 3-1 presents the results of fourth quarter uranium analyses.

3.4 National Pollutant Discharge Elimination System Data Review

Surface water and effluent samples were collected and analyzed in compliance with the Weldon Spring Site National Pollutant Discharge Elimination System (NPDES) permit. This permit (Number MO-0107701) was issued in November 1988 and addresses storm water and wastewater discharges. Six discharge points or outfalls included in this permit are shown in Figure 3-5. Outfalls NP-0001 through NP-0005 represent surface water discharge and NP-0006 represents the treated effluent discharge associated with the administration building sanitary wastewater treatment plant. Currently NP-0006 is the only outfall with effluent limitations. The five surface water outfalls have monitoring requirements only. Fourth quarter 1990 analytical data for each outfall is presented in Table 3-3.

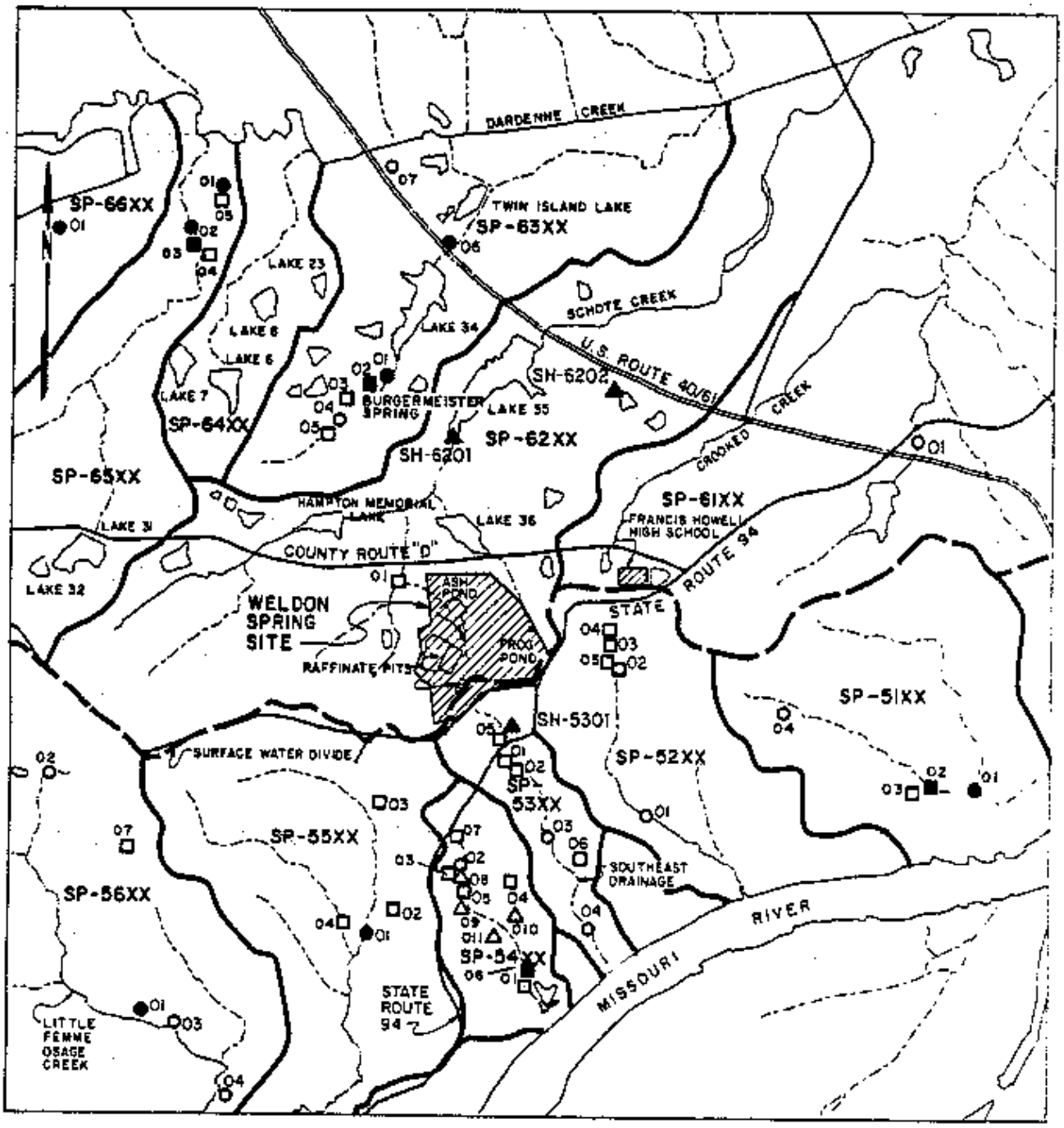
TABLE 3-1A Fourth Quarter Results for Uranium in Surface Water at the WSQ

WSSRAP ID	QUARTER 4
SW-1001	ND
SW-1002	ND
SW-1003	58.5
SW-1004	57.1
SW-1005	13.6
SW-1007	19.0
SW-1008	3130
SW-1009	21.1
SW-1010	41.5
SW-1011	4.1
SW-1012	7.5
SW-1013	9.5

TABLE 3-1B Fourth Quarter Nitroaromatic Concentrations For Surface Water (μg/l)

WSSRAP-ID	QUARTER	1,3,5-TNB	1,3-DNB	2,4,6-TNT	2,4-DNT	2,6-DNT	NITROBENZENE
SW-1008	THIRD	ND	ND	12.0	3.0	1.2	ND

ND - NOT DETECTED



LEGEND:

- SURFACE WATER DIVIDE BETWEEN MISSISSIPPI RIVER AND MISSOURI RIVER
- DRAINAGE BOUNDARY
- CREEK OR SURFACE DRAINAGE
- POND OR LAKE
- ● PERENNIAL SPRING WITH LARGE MAXIMUM FLOW
- ○ PERENNIAL SPRING WITH SMALL MAXIMUM FLOW
- ■ WET WEATHER SPRING WITH LARGE MAXIMUM FLOW
- □ WET WEATHER SPRING WITH SMALL MAXIMUM FLOW
- ▲ SHALLOW HOLE (SH)
- △ SEEP
- SP-63XX SPRING OR SEEP IN DESIGNATED DRAINAGE AREA NUMBER 63. XX REPRESENTS THE DESIGNATED SPRING NUMBER IN DRAINAGE 63.

SOURCE: MDNR, 1989

SCALE 0 3200 6400 FT
0 975.4 1950.7 M

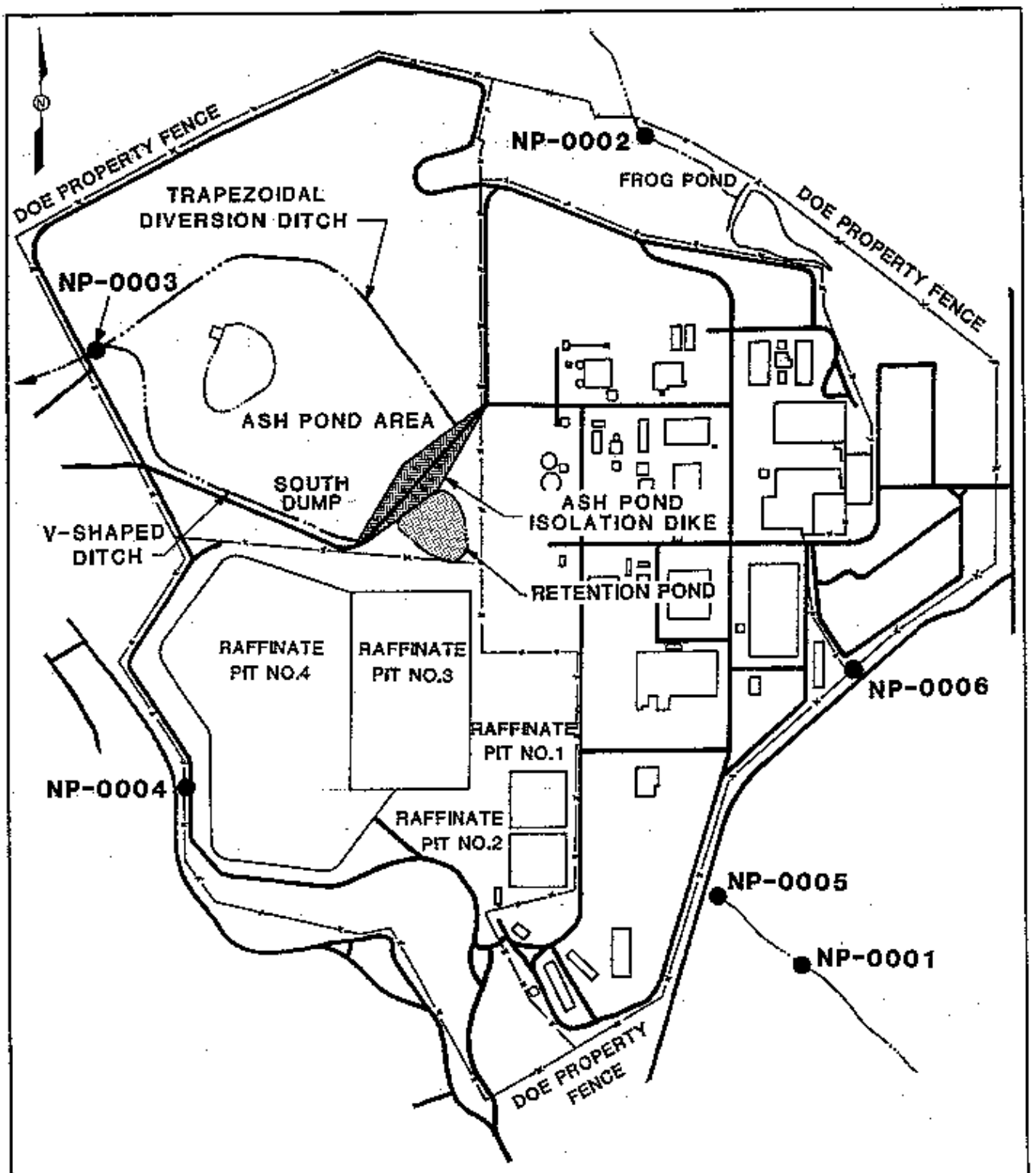
SPRINGS AND SEEPS IN THE VICINITY OF THE WSS

FIGURE 3-4

REPORT NO.: DOE/OR/21548-141		EXHIBIT NO.: A/VP/043/0990	
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90	

TABLE 3-2 Fourth Quarter Uranium Levels in Springs Near the WSS (pCi/l)

WSSRAP-ID	Quarter 4
SP-5203	1.36
SP-5301	592
SP-5302	544
SP-5303	374
SP-5304	221
SP-5503	
SP-6301	102
SP-6302	
SP-6303	ND
SP-6306	6.16



NPDES MONITORING LOCATIONS

FIGURE 3-5

SCALE 0 500 1000 FT
0 152.4 304.8 M

REPORT NO.: DOE/OR/21548-141	EXHIBIT NO.: A/CP/069/0990		
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90	

TABLE 3-3 Results of Monthly NPDES Monitoring for NP-0001 through NP-0006

Outfall NP-0001 NPDES data for Q4 1990

DATE SAMPLED	FLOW	SUSP. SOLIDS	SET. SOLIDS	NITRATE	pH	LITHIUM	GROSS ALPHA	TOTAL URANIUM
	GPD	mg/l	ml/l	mg/l		mg/l	pCi/l	pCi/l
Oct. 4	2880	10	<0.1	1.11	7.36	0.0052	**	**
Oct. 9 *	28800	*	<0.1	*	7.27	*	360	381

*Samples obtained on Oct. 9 for radioactivity analysis only
**Samples obtained in Oct. 4 for chemical analysis only

Outfall NP-0002 NPDES data for Q4 1990

DATE SAMPLED	FLOW	SUSP. SOLIDS	SET. SOLIDS	NITRATE	pH	LITHIUM	GROSS ALPHA	TOTAL URANIUM
	GPD	mg/l	ml/l	mg/l		mg/l	pCi/l	pCi/l
Oct. 4	101678	3.00	<0.1	ND	7.26	0.0116	NA	NA
Oct. 9	532858	NA	<0.1	NA	7.05	NA	170.0	190.0
Nov. 5	371232	18.00	<0.1	0.384	6.30	ND	130.0	10.2
Dec. 12	879840	35.00	<0.1	0.642	6.43	ND	81.0	95.2
Maximum	879840	35.00	<0.1	0.642	7.26	0.0116	170.00	190.00
Minimum	101678	3.00	<0.1	ND	6.30	ND	81.00	10.20
Average	471402	18.67	<0.1	0.513	6.76	0.0116	127.00	96.47

Non-detect values not included in average calculations

*Samples obtained on Oct. 9 for radioactivity analysis only

NA-Not available at time of report

TABLE 3-3 Results of Monthly NPDES Monitoring for NP-0001 through NP-0006 (Continued)

Outfall NP-0003 NPDES data for Q4 1990

DATE SAMPLED	FLOW	SUSP. SOLIDS	SET. SOLIDS	NITRATE	pH	LITHIUM	GROSS ALPHA	TOTAL URANIUM
	GPD	mg/l	ml/l	mg/l		mg/l	pCi/l	pCi/l
Oct. 4	4105	10.00	<0.1	ND	7.13	ND	NA	NA
Oct. 9 *	254880	NA	<0.1	NA	7.00	NA	70.00	82.00
Nov. 5	168624	7.00	<0.1	0.384	6.25	ND	110.00	8.16
Dec. 12	1111680	15.00	<0.1	4.85	6.14	ND	79.00	88.40
Maximum	1111680	15.00	<0.1	4.85	7.13	ND	110.00	88.40
Minimum	4105	7.00	<0.1	ND	6.14	ND	70.00	8.16
Average	384822	10.67	<0.1	2.62	6.63	ND	86.33	59.52

Non-detect values not included in average calculations

*Samples obtained on Oct. 9 for radioactivity analysis only

Outfall NP-0004 NPDES data for Q4 1990

DATE SAMPLED	FLOW	SUSP. SOLIDS	SET. SOLIDS	NITRATE	pH	LITHIUM	GROSS ALPHA	TOTAL URANIUM
	GPD	mg/l	ml/l	mg/l		mg/l	pCi/l	pCi/l
Nov. 12	1440	12.00	<0.1	ND	6.55	ND	10	4.2

TABLE 3-3 Results of Monthly NPDES Monitoring for NP-0001 through NP-0006 (Continued)

Outfall NP-0005 NPDES data for Q4 1990

DATE SAMPLED	FLOW	SUSP. SOLIDS	SET. SOLIDS	NITRATE	pH	LITHIUM	GROSS ALPHA	TOTAL URANIUM
	GPD	mg/l	ml/l	mg/l		mg/l	pCi/l	pCi/l
Oct. 4	5000	7.00	<0.1	0.313	7.13	ND	NA	NA
Oct. 9 *	286000		<0.1	NA	7.03	NA	540.00	551.00
Nov. 5	53128	6.00	<0.1	8.80	6.53	ND	630.00	63.92
Dec. 3	336816	8.00	<0.1	4.54	6.53	ND	430.00	489.60
Maximum	336816	8.00	<0.1	8.800	7.13	ND	630.00	551.00
Minimum	5000	6.00	<0.1	0.313	6.53	ND	430.00	63.92
Average	170236	7.00	<0.1	4.551	6.81	ND	533.33	368.17

Non-detect samples not included in average calculation

*Samples obtained on Oct. 9 analyzed for radioactivity only

Outfall NP-0006 NPDES data for Q4 1990

DATE SAMPLED	FLOW	SUSP. SOLIDS	BOD	FECAL COLIFORMS	pH
	GPD	mg/l	mg/l	No./100 ml	
Nov. 17	2520	ND	<2.0	<1.0	6.4
Dec. 5	2970	4.00	3.3	*7000	6.5
Maximum	2970	4.00	3.3	7000.0	6.5
Minimum	2520	ND	<2.0	ND	6.4
Average	2745	4.00	3.3	7000.0	6.5

* Indicates value which exceeded effluent limitation

Radiological Analysis

Gross Alpha and Total Uranium analyses correspond well with 1989 data. The highest uranium levels were present at NP-0005 (surface flow from the southeast portion of the site combined with discharge from NP-0001) followed by NP-0001 (discharge from the process sewer). These relatively higher levels are consistent with 1989 data. Maximum values for uranium were 381 pCi/l at NP-0001 and 551 pCi/l at NP-0005.

Other outfalls exhibited the following range of uranium concentrations. NP-0002, the drainage from the Frog Pond area, ranged from 10.2 pCi/l to 190 pCi/l. NP-0003, drainage from the Ash Pond diversion, ranged from 8.16 pCi/l to 88.4 pCi/l. A uranium concentration of 4.2 was present in the fourth quarter sample collected from NP-0004, raffinate pit No. 4 area.

Other Analysis

Other analyses include physical analysis (settleable solids and suspended solids) and chemical analysis (nitrate, pH, and lithium). Fourth quarter 1990 values generally correspond to 1989 values for the majority of parameters.

The discharge from the administration building treatment plant, NP-0006, has effluent limitations for quarterly samples. In addition to this quarterly monitoring, the subcontractor monitors the same parameters monthly, to assess plant performance. Outfall NP-0006 is the discharge for the site administration building wastewater treatment facility. The NPDES permit contains effluent limitations on biochemical oxygen demand (BOD), total suspended solids (TSS), and fecal coliform at this outfall. These limits are 15 mg/l (BOD), 10 mg/l (TSS), and 400 colonies/100 ml (fecal coliform). NPDES permit limits were exceeded in fourth quarter 1990 at this outfall. The fecal coliform value for December 5 was 7000 colonies/100 ml. This was due to removal of additional chlorine in the chlorine contact chamber by the Subcontractor. This was done at the direction of Missouri Department of Natural Resources (MDNR) due to a concern that excess residual chlorine might be present in the effluent. The Subcontractor has since replaced this additional chlorine in a more acceptable manner resulting in a return to compliance for fecal coliform levels, while maintaining a minimal level of residual chlorine.

4 AIR MONITORING

4.1 Radon Gas

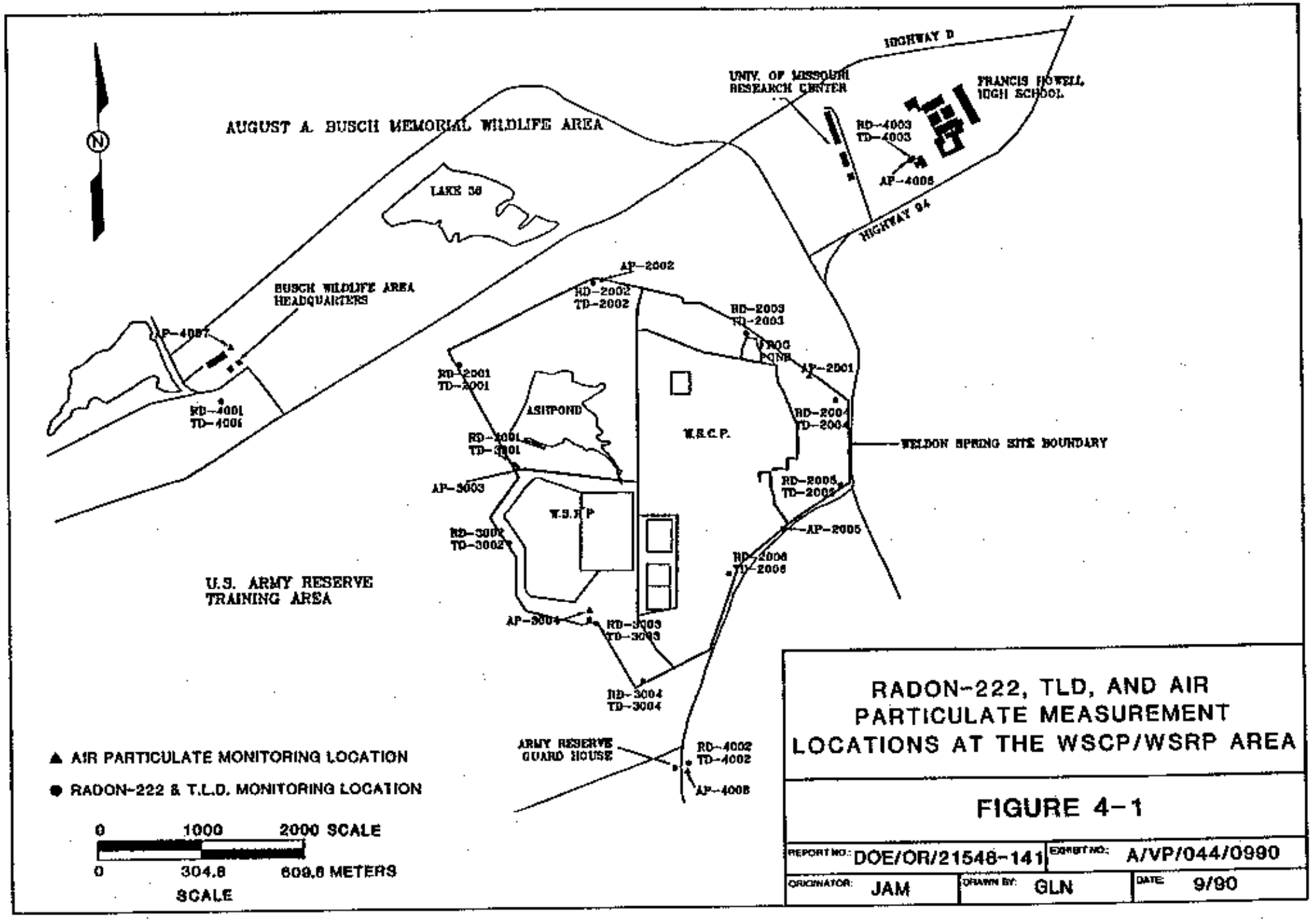
The radon gas monitoring program utilizes a pair of radon detectors at each of 22 permanent locations; each detector is exchanged quarterly. These detectors are deployed at six locations at the Weldon Spring Chemical Plant, six locations at the Weldon Spring quarry, four locations at the Weldon Spring raffinate pits, and six off-site locations. Radon monitoring locations are shown in Figures 4-1, 4-2, and 4-3. On-site detectors are spaced 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, and RD-4006 were used to monitor background levels near the site.

Table 4-1 summarizes the quarterly and year-to-date average radon concentrations detected at all site perimeter and off-site monitoring locations. Also contained in Table 4-1 is a comparison of the measured year-to-date average concentration with the Federally permitted radon concentration for unrestricted areas of 3 pCi/l (110 Bq/m^3) above background as authorized by U.S. Department of Energy (DOE) Order 5400.5.

An average ambient background concentration was determined by calculating the arithmetic average for the four background locations. This data yielded a year-to-date average ambient background radon concentration of 0.17 pCi/l for the first three quarters of 1990. This concentration was then subtracted from the year-to-date average concentration for each monitoring station, and compared to the DOE guideline of 3 pCi/l above background.

Radon concentrations at the site perimeter and at off-site locations for the fourth quarter of 1990 were within the typical range expected during years of normal precipitation. The quarterly radon concentrations (background included) ranged from 0.1 pCi/l at two locations to 1.7 pCi/l at monitoring location RD-1002.

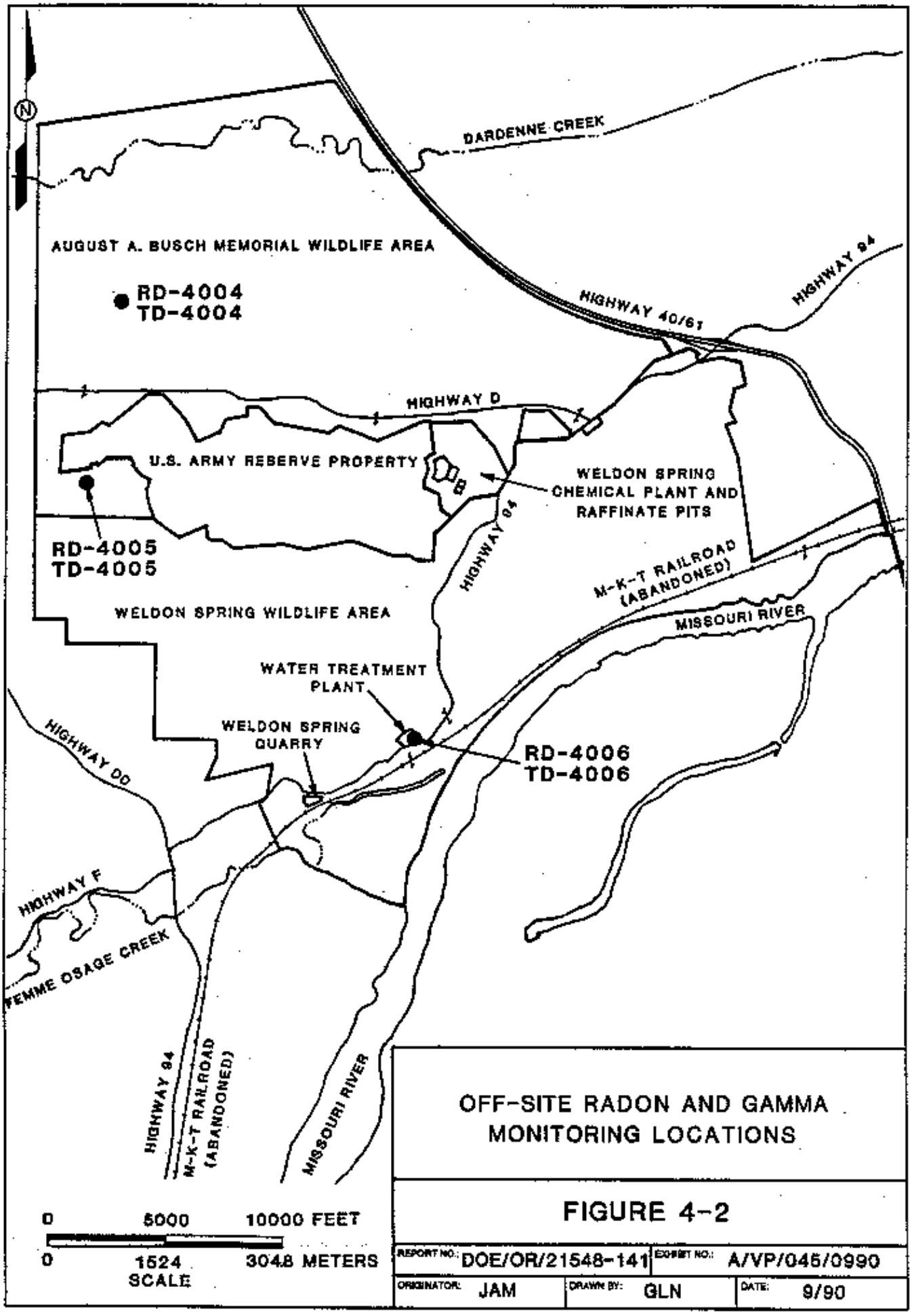
Radon concentrations found in the quarry are higher than concentrations measured at other locations because the radium concentrations in quarry wastes are typically much higher than other areas, and because the quarry is a large depression in the terrain with side walls ranging from 3 to 15 meters (10 to 50 feet) high. In conjunction with stable



RADON-222, TLD, AND AIR PARTICULATE MEASUREMENT LOCATIONS AT THE WSCP/WSRP AREA

FIGURE 4-1

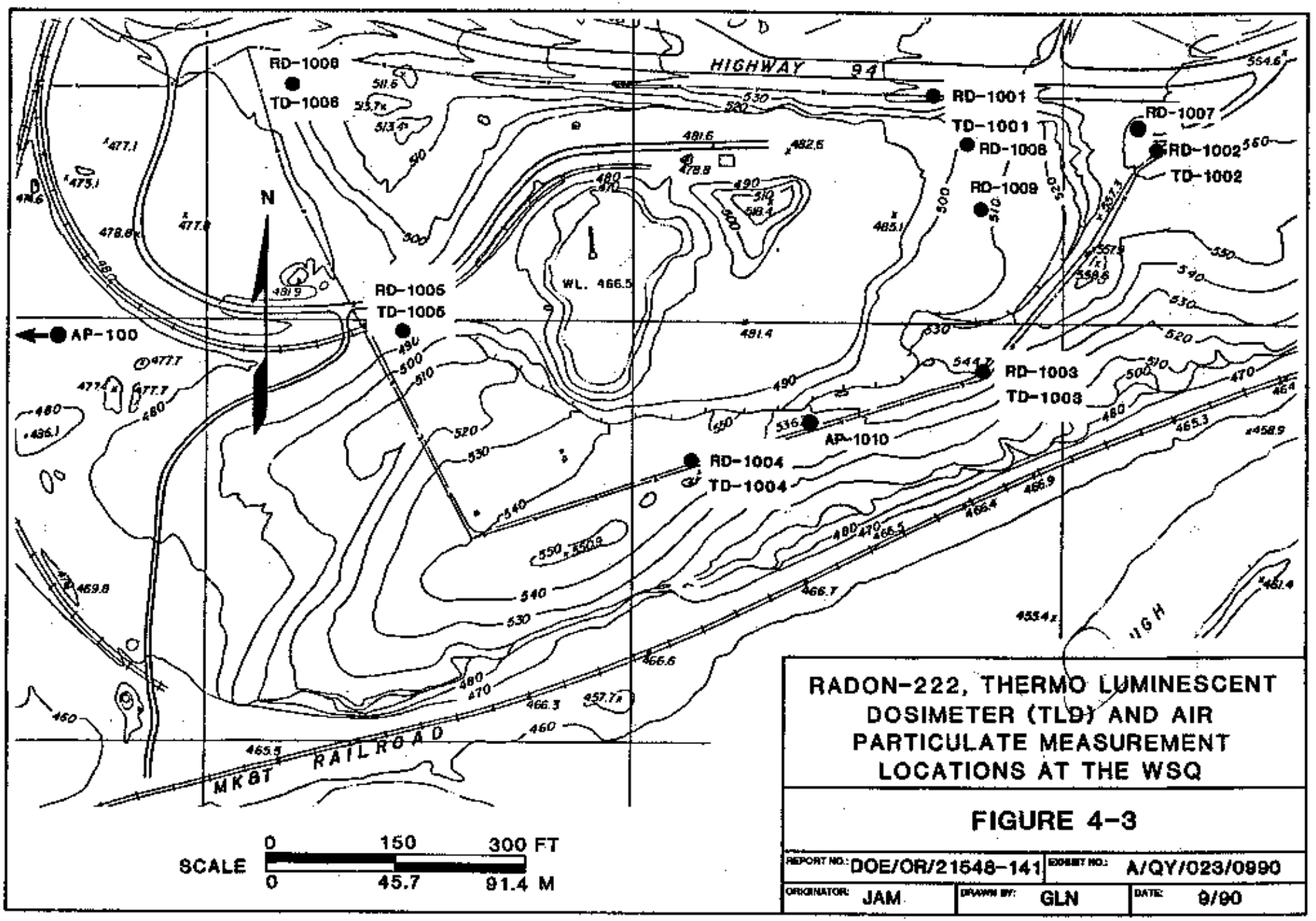
REPORT NO.: DOE/OR/21548-141		EXHIBIT NO.: A/VP/044/0990	
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90	



OFF-SITE RADON AND GAMMA MONITORING LOCATIONS

FIGURE 4-2

REPORT NO.: DOE/OR/21548-141		EXHIBIT NO.: A/VP/045/0990	
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90	



RADON-222, THERMO LUMINESCENT DOSIMETER (TLD) AND AIR PARTICULATE MEASUREMENT LOCATIONS AT THE WSQ

FIGURE 4-3

REPORT NO.: DOE/OR/21548-141		DOSSIER NO.: A/QY/023/0990	
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90	

TABLE 4-1 1990 Track Etch Radon Results[a]

Location I.D.	1st Quarter pCi/l	2nd Quarter pCi/l	3rd Quarter pCi/l	4th Quarter pCi/l	Annual Average		Percent of Guideline[b]
					pCi/l	Dev.	
WSQ							
RD-1001	1.1	1.4	2.4	1.1	1.5	0.3	41
RD-1002	1.4	2.1	3.1	1.7	2.1	0.4	60
RD-1003	1.0	0.5	1.0	1.0	0.9	0.3	20
RD-1004	0.3	0.4	0.8	0.4	0.5	0.2	6
RD-1005	0.8	0.5	0.8	0.6	0.7	0.2	13
RD-1006	0.5	0.3	0.5	0.7	0.5	0.2	7
WSCP							
RD-2001	0.4	0.3	0.5	0.7	0.5	0.2	6
RD-2002	0.4	0.1	0.4	0.2	0.3	0.1	0
RD-2003	0.4	0.1	0.7	0.3	0.4	0.2	3
RD-2004	0.3	0.1	0.4	0.2	0.3	0.1	0
RD-2005	0.5	0.1	0.4	0.2	0.3	0.1	1
RD-2006	0.4	0.2	0.4	0.2	0.3	0.1	0
WSRP							
RD-3001	0.3	0.1	0.5	0.1	0.3	0.1	0
RD-3002	0.3	0.1	0.4	0.1	0.2	0.1	0

TABLE 4-1 1990 Track Etch Radon Results[a] (Continued)

Location I.D.	1st Quarter pCi/l	2nd Quarter pCi/l	3rd Quarter pCi/l	4th Quarter pCi/l	Annual Average		Percent of Guideline[b]
					pCi/l	Dev.	
RD-3003	0.5	0.1	0.5	0.1	0.3	0.1	1
RD-3004	0.3	0.1	0.5	0.1	0.3	0.1	0
OFF-SITE							
RD-4001	0.3	0.1	0.7	0.1	0.3	0.1	1
RD-4002	0.3	0.1	0.3	0.2	0.2	0.1	0
RD-4003	0.3	0.1	0.4	0.4	0.3	0.1	0
RD-4004	0.3	0.1	0.7	0.3	0.4	0.2	2
RD-4005	0.5	0.1	0.3		0.2	0.1	0
RD-4006	0.3	0.1	0.5	0.1	0.3	0.1	0

(a) Results include natural background.
(b) Percent of guideline calculated by taking the year-to-date average minus the average of the background stations divided by the DOE concentration guideline for RN-222 is 3 pCi/l (100 Bq/m^3)(Annual average above background) for uncontrolled areas.
* DENOTES BACKGROUND STATION

meteorological conditions, this configuration tends to trap emanating radon within the quarry and raise the concentrations along the quarry perimeter.

4.2 Gamma Radiation Exposure

To monitor exposure from gamma radiation, 22 monitoring stations using spherical environmental thermoluminescent dosimeters (TLDs) were deployed. The monitoring station locations are the same as the ambient radon monitoring locations (see Section 4.1).

Table 4-2 summarizes the quarterly and year-to-date results of total gamma radiation monitoring at the 16 Weldon Spring site (WSS) perimeter monitoring stations, Francis Howell High School, the Weldon Spring Army Reserve Training Area, and at the four background monitoring stations.

The yearly average background gamma exposure as measured with TLDs in 1989 was 68 mR/year. The yearly average background gamma exposure as measured with TLDs in 1990 was 62 mR/year. This corresponds to 1989 monitoring results and was expected because no significant changes in the configuration or location of the wastes have occurred.

Due to external vandalism, the fourth quarter TLDs were missing for monitoring stations TD-3004, and TD-4005. In order to calculate a year-to-date total gamma exposure rate, the missing quarterly data were replaced with the average of the remaining quarterly TLD results for those monitoring stations.

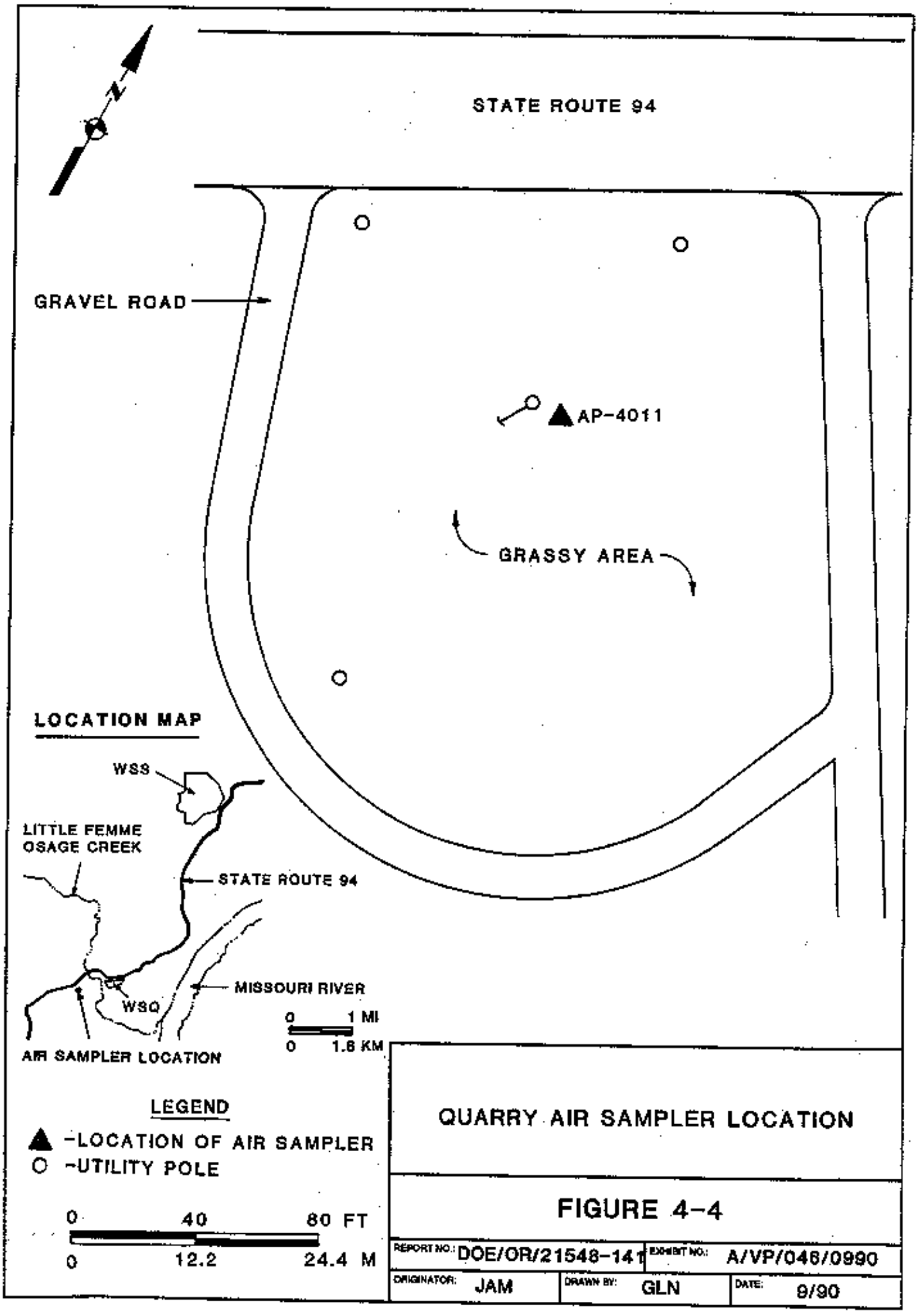
4.3 Radioactive Air Particulates

Eleven air particulate samplers 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 two are located around the quarry perimeter as shown in Figure 4-3. Three monitoring stations (AP-4006, AP-4008, and AP-4011) are located off site at sensitive receptor locations, including Francis Howell High School, the Army Reserve property, and a residential site west of the quarry. 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 off-site monitoring stations are also shown in Figure 4-4.

TABLE 4-2 1990 Environmental TLD Results[a]

Location I.D.	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total[b]	2 Std. Dev.
	MR	MR	MR	MR	MR	
WSQ						
TD-1001	21	21	26	24	92	4
TD-1002	17	17	22	20	76	5
TD-1003	20	16	24	15	76	7
TD-1004	18	15	21	19	72	4
TD-1005	18	17	-	21	74	4
TD-1006	15	14	21	19	69	5
WSCP						
TD-2001	16	16	18	16	66	2
TD-2002	15	14	22	17	68	6
TD-2003	15	15	18	17	66	3
TD-2004	16	17	18	18	68	2
TD-2005	-	14	17	17	64	3
TD-2006	17	15	19	17	67	3
WSRP						
TD-3001	-	16	20	19	73	4
TD-3002	13	12	-	14	53	2
TD-3003	17	17	20	18	71	3
TD-3004	12	13	18	-	57	5
OFF-SITE						
TD-4001	15	16	-	18	66	2
TD-4002	14	13	15	14	57	1
TD-4003	12	11	13	13	51	2
TD-4004	14	16	20	18	69	4
TD-4005	12	-	-	-	48	0
TD-4006	13	13	19	18	64	6

(a) Results include natural background.
- Denotes loss of TLD.
* Denotes background station.
(b) Year-to-date totals for locations where some quarterly data is unavailable were calculated using the average of the existing quarterly data in place of the unavailable data. Due to rounding of values, the sum of the quarterly data may not equal the year-to-date total.


STATE ROUTE 94
GRAVEL ROAD
AP-4011
GRASSY AREA
LOCATION MAP
WSS
LITTLE FEMME OSAGE CREEK
STATE ROUTE 94
MISSOURI RIVER
WSQ
0 1 MI
0 1.6 KM
AIR SAMPLER LOCATION
LEGEND
-LOCATION OF AIR SAMPLER
-UTILITY POLE
0 40 80 FT
0 12.2 24.4 M
QUARRY AIR SAMPLER LOCATION
FIGURE 4-4
REPORT NO.: DOE/OR/21548-141
EXHIBIT NO.: A/VP/046/0990
ORIGINATOR: JAM
DRAWN BY: GLN
DATE: 9/90

The sampling station near the August A. Busch Wildlife Area (ABWA) headquarters is used as a background air monitoring station. This station is approximately 0.8 km (0.5 mile) from the WSCP perimeter in a northwestern direction. The terrain between the WSCP and this sampling station is hilly and forested, providing a significant physical barrier to airborne particulates originating from the WSCP/ Weldon Spring raffinate pits (WSRP). In addition, winds from the southeast are relatively rare at the WSCP.

Table 4-3 summarizes the quarterly average concentrations and the standard deviations for the 11 air monitoring locations. The quarterly average concentration for each monitoring location was calculated by averaging either the weekly air particulate analysis results or the counting instrument's lower limit of detection (LLD), whichever was greater. The "<" sign in Table 4-3 appears when the actual average is less than the calculated average due to the use of LLD values in the calculation. Locations AP-1009 and AP-1010 were not in operation for five weeks due to vandalism. All of the other measurements at the two locations were above the LLD values. The standard deviation for each of the monitoring locations was calculated using only results that were above the LLD.

The third quarter net alpha concentrations ranged from $<1.34 \times 10^{-15}$ μCi/ml to 2.12×10^{-15} μCi/ml with $<1.69 \times 10^{-15}$ μCi/ml detected at the background station.

4.4 Asbestos

Air sampling for asbestos has been performed on a routine basis for two years. The monitoring data indicate no elevated levels of airborne asbestos during both asbestos abatement operations and during periods when no asbestos activities were in progress at the site. Since asbestos removal and handling operations were not in progress during the third quarter, perimeter asbestos sampling was not performed. Upon commencement of any additional asbestos abatement activities, asbestos air particulate monitoring will resume.

TABLE 4-3 Radiological Air Particulate 1990

MONITOR IDENTIFICATION NUMBER	ANNUAL AVG. CONCENTRATION (1E-15 µCi/ml)	STANDARD DEVIATION	NUMBER OF VALUES ABOVE LLD
AP-2001	2.10e-15	2.00e-15	42
AP-2002	2.50e-15	8.60e-16	45
AP-3003	2.20e-15	1.00e-15	41
AP-3004	2.30e-15	1.20e-15	43
AP-2005	2.40e-15	1.40e-15	48
AP-4006	2.20e-15	1.00e-15	39
AP-4007*	2.20e-15	7.50e-16	49
AP-4008	2.40e-15	1.50e-17	47
AP-1009	2.40e-15	7.40e-16	45
AP-1010	2.70e-15	8.00e-16	43
AP-4011	2.10e-15	1.30e-15	45

* Indicates background monitor station.
To convert µCi/ml to Bq/M ^ 3 multiply by 3.7E10.

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