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QUARTERLY ENVIRONMENTAL DATA SUMMARY THIRD QUARTER 1990

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

Prepared by MK-Ferguson Company and Jacobs Engineering Group

JANUARY 1991 **REV. 0**

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

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Weldon Spring Site Remedial Action Project

Quarterly Environmental Data Summary
Third Quarter 1990

January 1991

Prepared by

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and
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Prepared for

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ABSTRACT AND WELDON SPRING SITE QUARTERLY SELF ASSESSMENT THIRD QUARTER 1990

This is the second Quarterly Environmental Data Summary for the Weldon Spring Site Remedial Action Project (WSSRAP). The purpose of this document is to provide preliminary data acquired as part of the 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 during the third 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 third quarter of 1990 relative to exposures calculated in previous quarters. 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. No EPA reportable spills or releases of hazardous or radioactive materials occurred at the Weldon Spring Site during the third quarter of 1990.

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1 INTRODUCTION

This document is the second 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 those which 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 used 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 Mr. James McKee (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, much of the data which 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 fourth quarter data summary or 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.

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 will be presented in its entirety in the fourth quarter data summary which will allow the reader to see the whole picture of groundwater quality conditions.

Nitroaromatic and radiological data from first semester semiannual sampling which was not available in the previous data summary is presented in Tables 2-1 and 2-2. These results are discussed in Sections 2.1.1 and 2.1.2.

2.1.1 Nitroaromatic Results

Table 2-1 contains nitroaromatic data from samples of 25 monitoring wells for which data was unavailable in the previous quarterly environmental data summary. Nitroaromatic compounds were detected in nine of these samples. However, the data continues to reflect historical trends found in previous environmental reports.

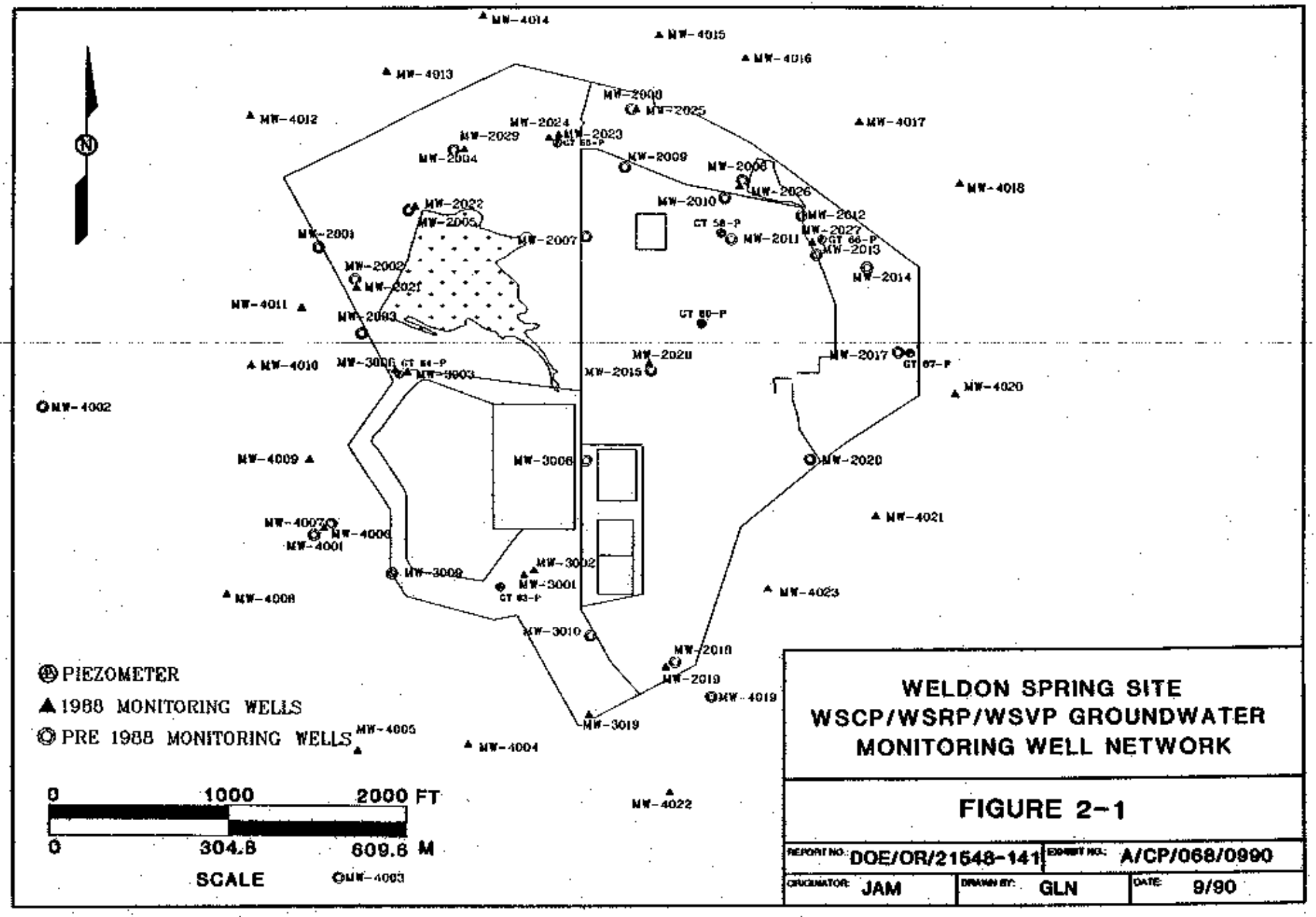
MW-4014
MW-4015
MW-4016
MW-4013
MW-4012
MW-4017
MW-4018
MW-2000
MW-2025
MW-2024
MW-2023
MW-2029
MW-2004
MW-2009
MW-2008
MW-2026
MW-2010
MW-2012
MW-2027
MW-2011
MW-2013
MW-2014
MW-2022
MW-2005
MW-2007
MW-2001
MW-2002
MW-2021
MW-4011
MW-2003
MW-2018
MW-2015
MW-2017
MW-4010
MW-3006
MW-3003
MW-4020
MW-4002
MW-4009
MW-3006
MW-2020
MW-4021
MW-4007
MW-4006
MW-4001
MW-3002
MW-3009
MW-3001
MW-4008
MW-4023
MW-3010
MW-2016
MW-2019
MW-4019
MW-3019
MW-4005
MW-4004
MW-4022
MW-4003
PIEZOMETER
1988 MONITORING WELLS
PRE 1988 MONITORING WELLS
0
1000
2000 FT
0
304.8
609.6 M
SCALE
WELDON SPRING SITE
WSCP/WSRP/WSVP GROUNDWATER
MONITORING WELL NETWORK
FIGURE 2-1
REPORT NO. DOE/OR/21548-141
A/CP/068/0990
JAM
GLN
9/90

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

SAMPLE ID	1,3,5-TNB (µG/l)	1,3-DNB (µG/l	2,4,6-TNT (µG/l)	2,4-DNT (µG/l)	2,6-DNT (µG/l)	NB (µG/l)
GW-2004-061990	ND	ND	ND	ND	ND	ND
GW-2005-061390	ND	ND	ND	0.08	0.07	ND
GW-2006-061190	12.0	0.14	ND	0.06	1.4	ND
GW-2008-061190	12.0	0.14	ND	ND	1.6	ND
GW-2019-062590	ND	ND	ND	ND	ND	ND
GW-2020-062190	ND	ND	ND	ND	ND	ND
GW-2021-062590	ND	ND	ND	ND	ND	ND
GW-2022-062590	ND	ND	ND	ND	ND	ND
GW-2023-062190	ND	ND	ND	ND	ND	ND
GW-2025-061390	ND	ND	ND	ND	ND	ND
GW-2026-061290	ND	ND	ND	ND	ND	ND
GW-2028-062690	ND	ND	ND	ND	ND	ND
GW-2029-061990	ND	ND	ND	ND	ND	ND
GW-3001-062690	0.09	ND	ND	0.38	0.17	ND
GW-3002-062590	ND	ND	ND	ND	ND	ND
GW-3003-061290	ND	ND	ND	ND	ND	ND
GW-3006-061290	ND	ND	ND	0.06	0.11	ND
GW-3008-062790	ND	ND	ND	0.08	0.04	ND
GW-3009-062090	0.36	ND	ND	0.17	0.14	ND
GW-3010-062690	ND	ND	ND	ND	ND	ND
GW-4002-061490	0.20	ND	1.90	ND	0.56	ND
GW-4003-061490	ND	ND	ND	ND	ND	ND
GW-4010-021490	ND	ND	ND	ND	ND	ND
GW-4015-062190	0.48	ND	ND	ND	1.80	ND
GW-4020-062190	ND	ND	ND	ND	ND	ND

ND - Not Detected

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

SAMPLE ID	URANIUM, TOTAL (pCi/l)
GW-2002-053190	3.40
GW-2015-053190	6.80
GW-2019-062590	3.40
GW-2020-062190	9.52
GW-2021-062590	2.04
GW-2022-062590	ND
GW-2023-062190	3.40
GW-2028-062690	1.36
GW-3001-062690	1.36
GW-3002-062590	2.04
GW-3008-062790	231.2
GW-3009-062090	29.92
GW-3010-062690	2.722
GW-4015-062190	3.40
GW-4020-062190	13.6

ND - Not Detected

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 guidelines (DCG) of 550 pCi/l.

The highest uranium level detected was 231.2 pCi/l from a sample obtained from Monitoring Well 3008. This level indicates a higher value than has previously been detected from MW-3008. The second semester sample results to be reported in the fourth quarter environmental data summary will provide more insight to this elevated level. The other concentrations reported in Table 2-2 are consistent with data from previous environmental reports.

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 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. The 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.

Data from the second semiannual semester groundwater sampling in the quarry area will be presented in their entirety in the fourth quarter data summary. Second quarter data that were not available for the previous quarterly summary are presented in this report with third quarter data.

2.2.1 Radiological Results

Radiological data from groundwater samples taken from quarry wells south of the Femme Osage Slough are exhibited on Table 2-3. Some uranium data for third quarter have not yet been received from the analytical laboratory and will be reported in the 1990 ASER. The available results of third quarter 1990 groundwater monitoring are consistent with historical results in that they continue to indicate background uranium levels in the

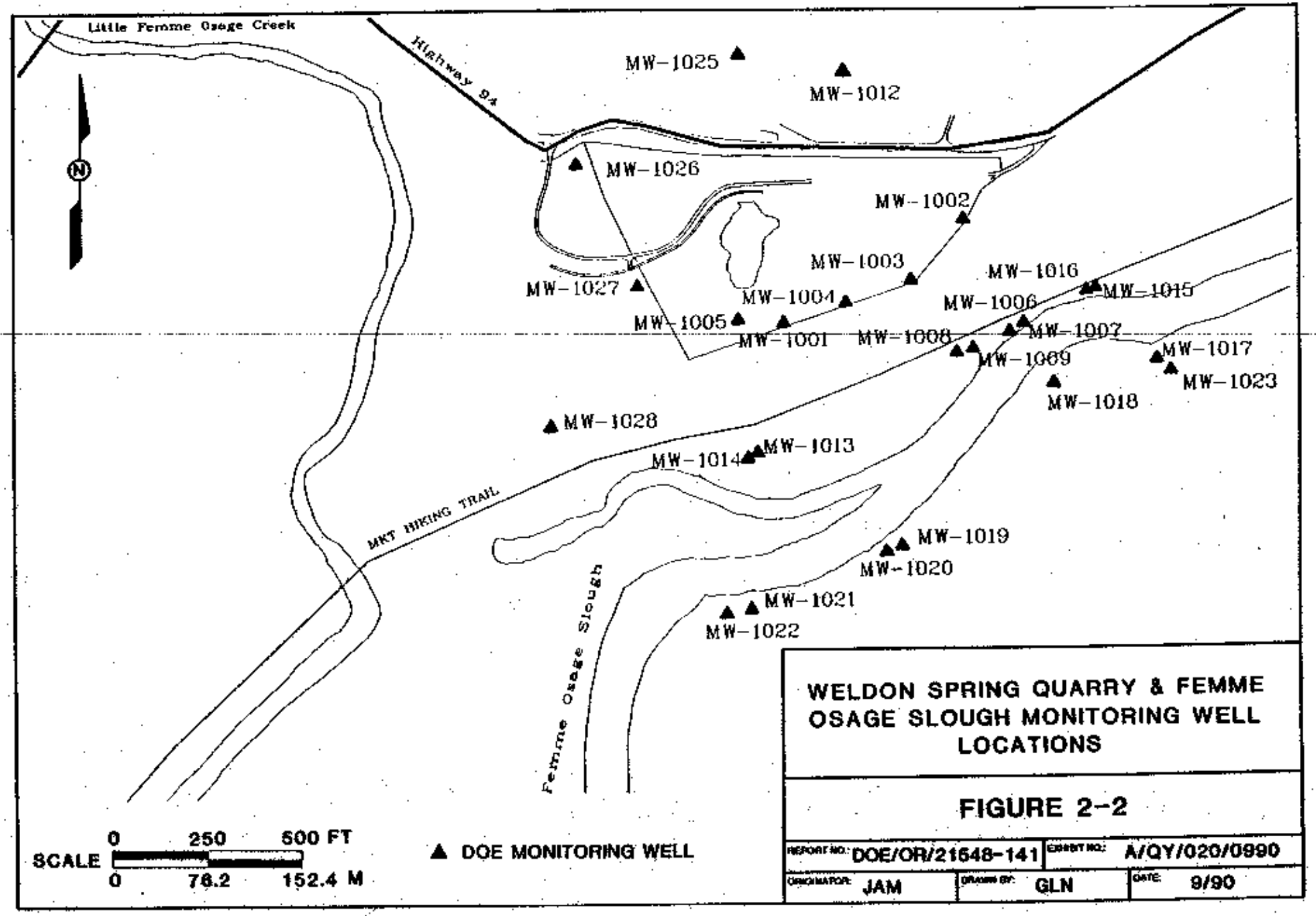
Little Femme Osage Creek
Highway 94
MW-1025
MW-1012
MW-1026
MW-1002
MW-1003
MW-1016
MW-1015
MW-1027
MW-1004
MW-1006
MW-1005
MW-1001
MW-1008
MW-1007
MW-1009
MW-1017
MW-1023
MW-1018
MW-1028
MW-1013
MW-1014
MKT HIKING TRAIL
MW-1019
MW-1020
MW-1021
MW-1022
Femme Osage Slough
N
SCALE
0 250 500 FT
0 76.2 152.4 M
DOE MONITORING WELL
WELDON SPRING QUARRY & FEMME OSAGE SLOUGH MONITORING WELL LOCATIONS
FIGURE 2-2
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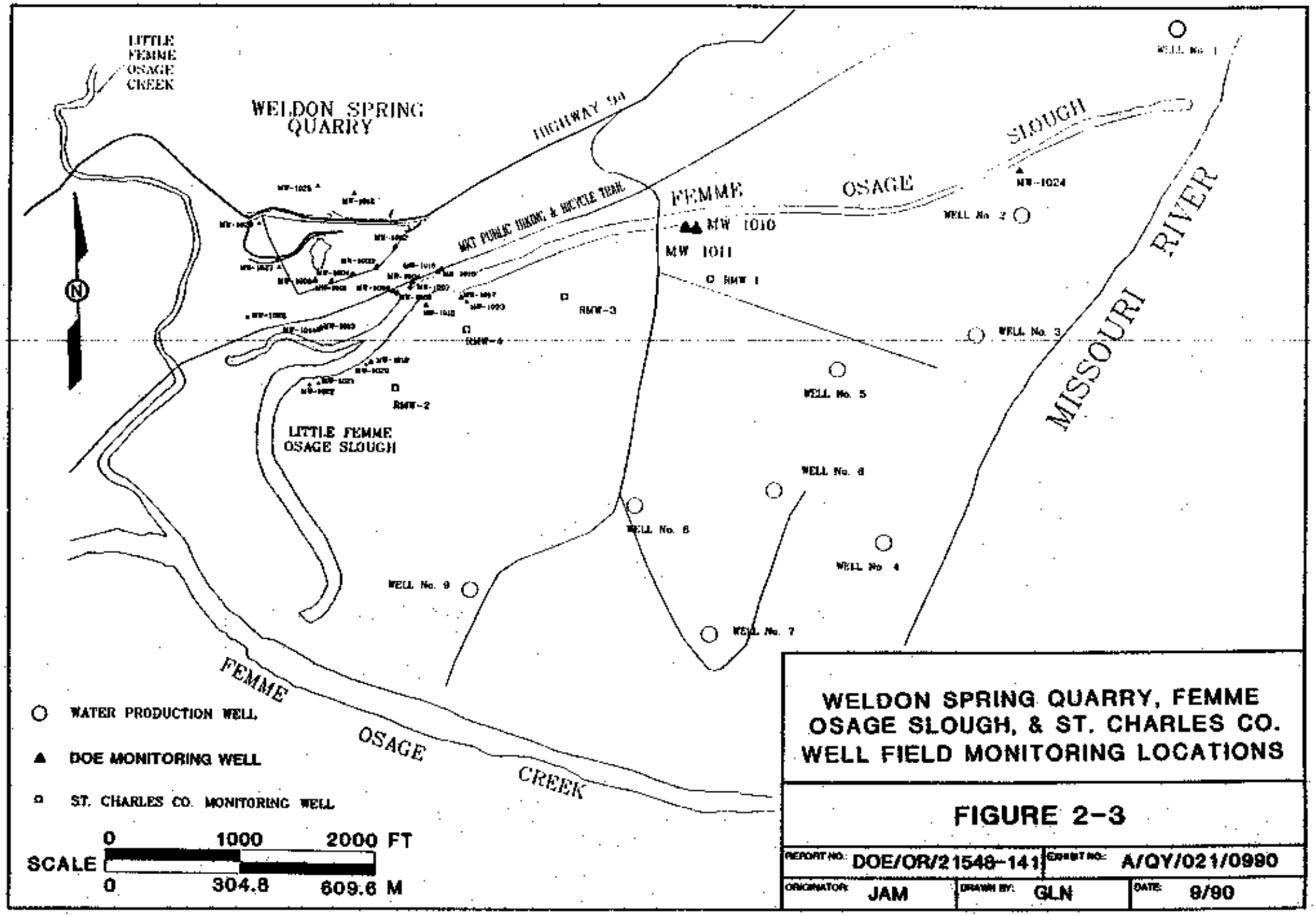
EXHIBIT NO: A/QY/020/0990
ORIGINATOR: JAM
DRAWN BY: GLN
DATE: 9/90



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

FIGURE 2-3

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

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

3rd Quarter	Nitrate (mg/l)	Sulfate (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	Uranium (pCi/l)	Gross Alpha (pCi/l)
GW-1017-Q390	ND	14.0	19.0	ND	ND	NA
GW-1018-Q390	ND	21.0	5.9	ND	NR	NA
GW-1019-Q390	ND	ND	6.1	ND	NR	NA
GW-1020-Q390	ND	20.0	9.2	ND	NR	NA
GW-1021-Q390	ND	1.6	12.0	ND	NR	NA
GW-1022-Q390	ND	ND	6.0	ND	NR	NA
GW-1023-Q390	ND	4.0	4.4	ND	ND	NA
GW-1024-Q390	ND	5.5	8.9	ND	ND	ND
GW-RMW1-Q390	ND	29.0	6.9	ND	1.1	ND
GW-RMW2-Q390	ND	32.0	2.1	ND	7.1	13.1
GW-RMW3-Q390	ND	36.0	9.0	ND	ND	ND
GW-RMW4-Q390	ND	10.0	5.4	ND	2.3	ND
GW-PW02-Q390	NA	NA	NA	NA	0.1	ND
GW-PW03-Q390	NA	NA	NA	NA	0.08	ND
GW-PW04-Q390	NA	NA	NA	NA	0.01	ND
GW-PW06-Q390	NA	NA	NA	NA	0.17	ND
GW-PW07-Q390	NA	NA	NA	NA	0.12	ND
GW-PW08-Q390	NA	NA	NA	NA	0.32	ND
GW-PW09-Q390	NA	NA	NA	NA	0.22	ND
GW-RAWW-Q390	NA	NA	NA	NA	ND	ND
GW-FINW-Q390	NA	NA	NA	NA	ND	ND

ND - Not Detected

NA - Not Applicable

NR - Data Not Received

alluvium on the south side of the Femme Osage Slough. Analytical results from St. Charles County Monitoring Well RMW-2 indicate a level of 7.1 pCi/l which is the highest uranium level detected in the wellfield for third quarter, but agrees with historical data from the well field.

The results of third quarter gross alpha monitoring south of the Femme Osage Slough indicated only one detected level of 13.1 pCi/l. This result was found in RMW-2 which corresponds to the highest uranium level detected from third quarter monitoring.

These findings indicate that the groundwater quality south of the Femme Osage Slough remains uncompromised.

2.2.2 Nitroaromatic Compounds Results

Analytical results for nitroaromatic compounds are presented in Table 2-4. No monitoring wells south of the Femme Osage Slough showed detectable concentrations of nitroaromatic compounds during the third quarter 1990. The scenario for 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. Table 2-3 displays the analytical results for the third quarter of 1990, which are consistent with data reported in the 1989 Annual Site Environmental Report, as well as previous environmental monitoring reports.

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

SAMPLE ID	1,3,5-TNB (µg/l)	1,3-DNB (µg/l)	2,4,6-TNT (µg/l)	2,4-DNT (µg/l)	2,6-DNT (µg/l)	NB (µg/l)
GW-1017-Q390	ND	ND	ND	ND	ND	ND
GW-1018-Q390	ND	ND	ND	ND	ND	ND
GW-1019-Q390	ND	ND	ND	ND	ND	ND
GW-1020-Q390	ND	ND	ND	ND	ND	ND
GW-1021-Q390	ND	ND	ND	ND	ND	ND
GW-1022-Q390	ND	ND	ND	ND	ND	ND
GW-1023-Q390	ND	ND	ND	ND	ND	ND
GW-1024-Q390	ND	ND	ND	ND	ND	ND
GW-RMW1-Q390	ND	ND	ND	ND	ND	ND
GW-RMW2-Q390	ND	ND	ND	ND	ND	ND
GW-RMW3-Q390	ND	ND	ND	ND	ND	ND
GW-RMW4-Q390	ND	ND	ND	ND	ND	ND
GW-PW02-Q390	ND	ND	ND	ND	ND	ND
GW-PW03-Q390	ND	ND	ND	ND	ND	ND
GW-PW04-Q390	ND	ND	ND	ND	ND	ND
GW-PW06-Q390	ND	ND	ND	ND	ND	ND
GW-PW07-Q390	ND	ND	ND	ND	ND	ND
GW-PW08-Q390	ND	ND	ND	ND	ND	ND
GW-PW09-Q390	ND	ND	ND	ND	ND	ND
GW-RAWW-Q390	ND	ND	ND	ND	ND	ND
GW-FINW-Q390	ND	ND	ND	ND	ND	ND

ND - Not Detected

2.2.3.1 Nitrate

The groundwater samples continue to indicate no significant groundwater contamination by nitrate.

2.2.3.2 Sulfate

The groundwater samples continue to indicate background concentrations of sulfate in wells south of the Femme Osage Slough.

2.2.3.3 Chloride and Fluoride

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 third 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 third quarter analyses of arsenic and barium continue to indicate elevated concentrations in selected wells. The highest levels reported for the third quarter are 51.2 µg/l for arsenic and 630 µg/l for barium as detected in Monitoring Well RMW-3.

TABLE 2-5 Results for Metals in Groundwater for WSQ

QUARRY	ARSENIC µg/l	BARIUM µg/l
2ND QUARTER		
GW-RMW2-Q290	19.4	195
GW-RMW3-Q290	30.7	560
3RD QUARTER		
GW-1024-Q390	8.0	423
GW-RMW1-Q390	6.4	478
GW-RMW2-Q390	19.3	244
GW-RMW3-Q390	51.2	630
GW-RMW4-Q390	23.2	219
GW-RAWW-Q390	ND	366
GW-FINW-Q390	ND	84.8 B

ND - Not Detected
B - Contamination found in lab blank

3 SURFACE WATER MONITORING

Routine samples were collected during the third 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

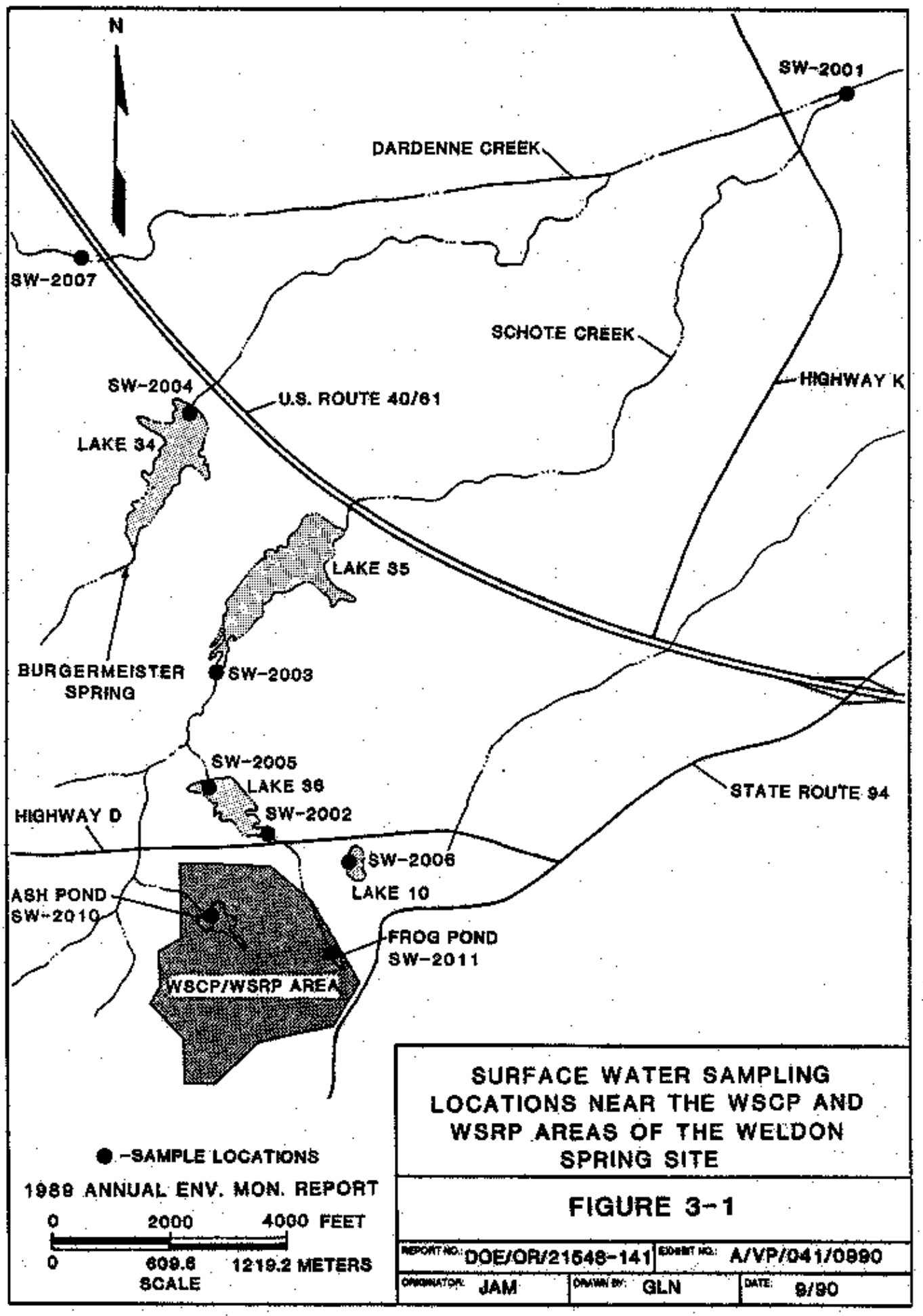
During the third quarter, surface water samples were collected from the nine locations shown in Figure 3-1; however, radiological and chemical analyses are not yet available from the contract laboratory. Sampling results for uranium, chloride, flouride, nitrate, and sulfate for the nine locations will be presented in the 1990 Annual Site Environmental Report.

3.2 Weldon Spring Quarry

Samples from the nine surface water locations in Figure 3-2, and three surface water locations in Figure 3-3, were analyzed for uranium. Certain locations were also analyzed for radium-226, thorium-230, thorium-232, nitrate, sulfate, chloride, flouride, 1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, and Nitrobenzene. Only the results of analyses for nitroaromatic compounds are presently available from the laboratory. Results of all other analyses will be presented in the 1990 Annual Site Environmental Report.

3.2.1 Nitroaromatics

A sample was collected at one location, the quarry sump (SW-1008), to quantify nitroaromatic concentrations. Results of



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

FIGURE 3-1

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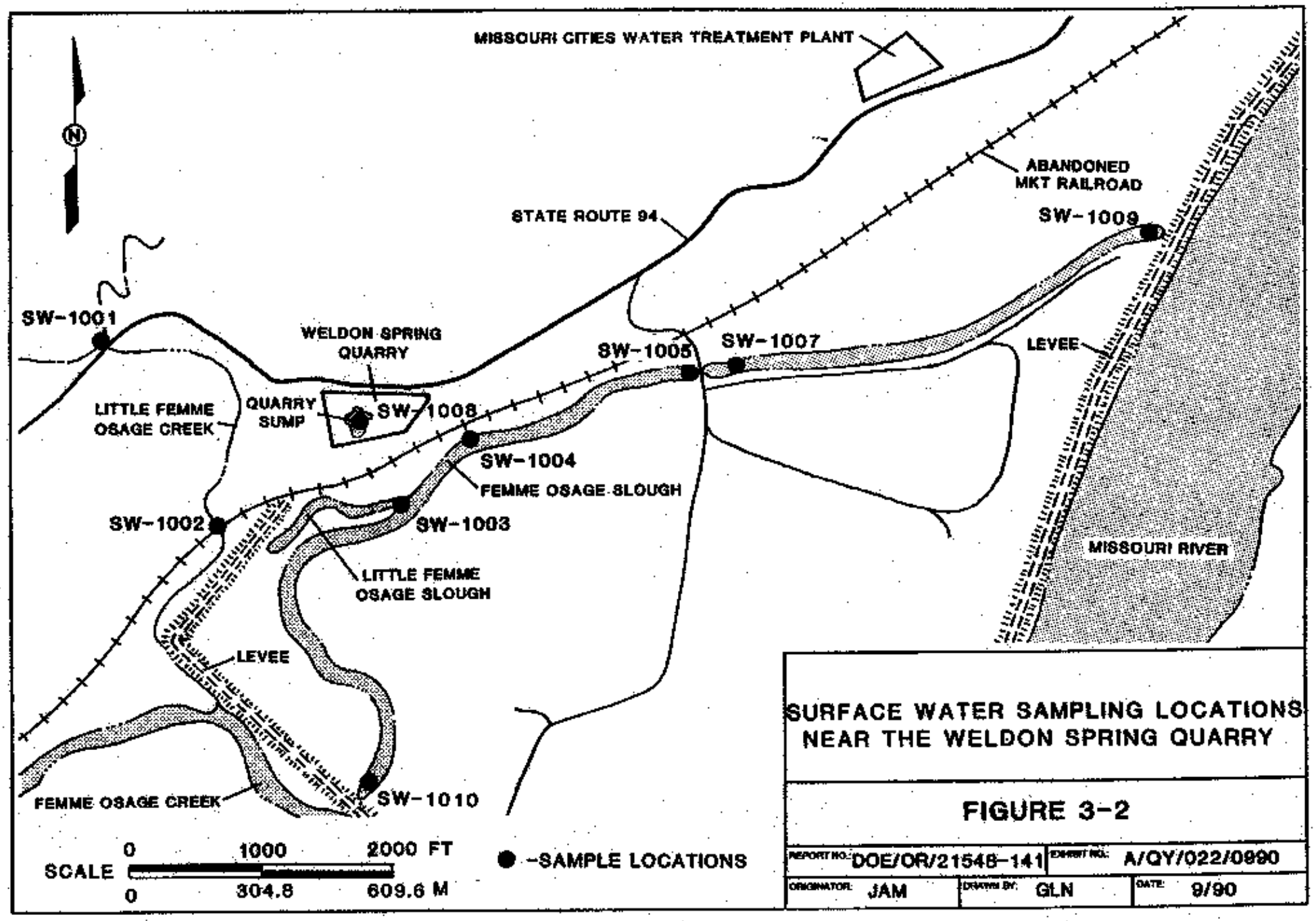
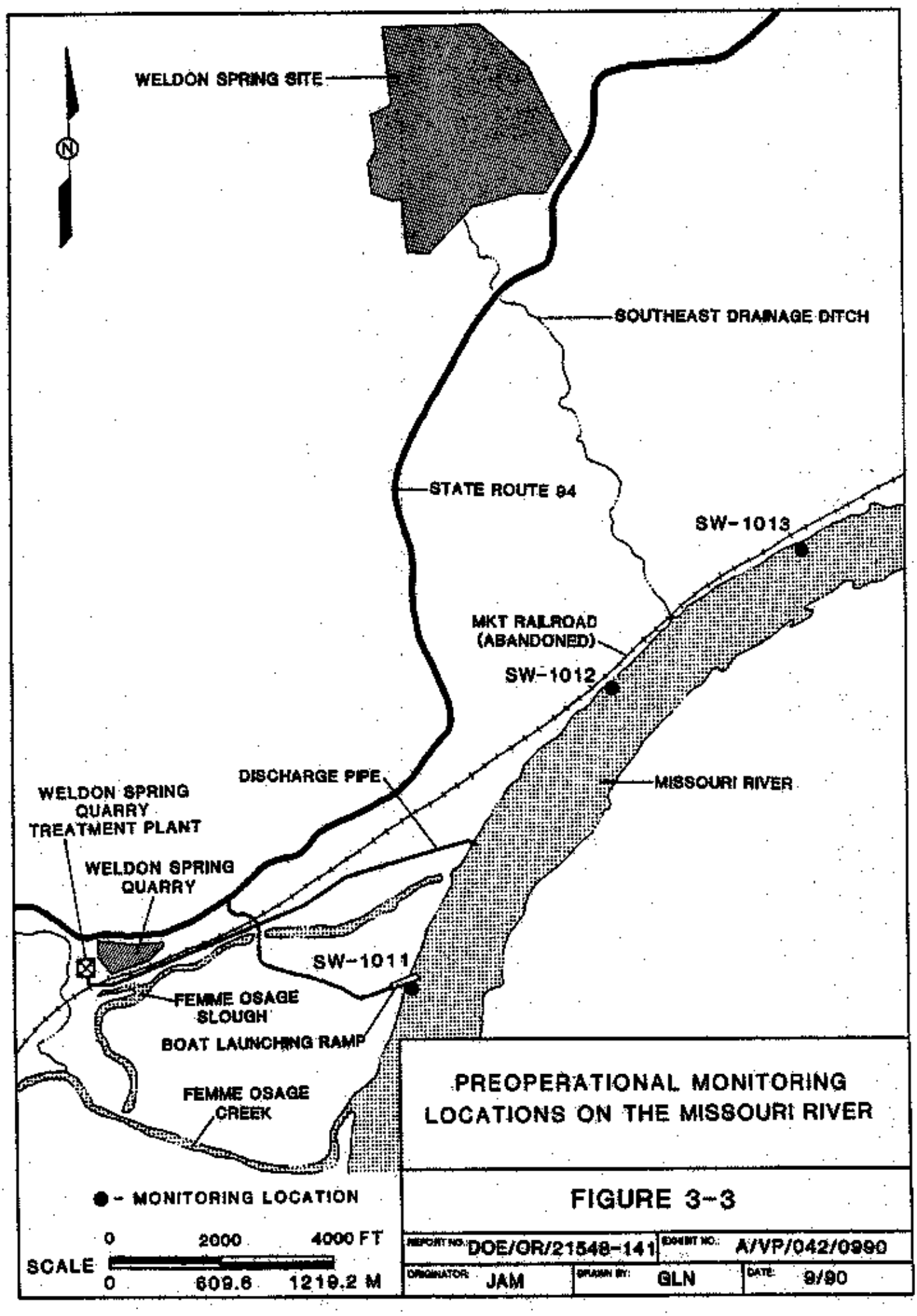
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90



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	

this sampling are presented in Table 3-1. The quantified concentrations of the six nitroaromatic compounds ranged from below the detection limit to 35.0 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. Nitroaromatic results for the third quarter of 1990 were near the values reported in the 1989 ASER, but were higher than the values during the first and second quarters of 1990.

3.3 Springs

Eleven springs around the WSS are sampled on a quarterly basis. (See Figure 3-4 for spring locations). Previous spring monitoring has indicated that waters from six perennial springs and one wet-weather spring are measurably influenced by site-related contaminants. These springs include SP-6301, SP-6302, SP-6306, and SP-5301 through SP-5304. All spring samples are analyzed for uranium, and select spring samples are analyzed for inorganic ions, metals, and nitroaromatics. Results for nitroaromatics only are available from the laboratory at this time. All other results will be presented in the 1990 Annual Site Environmental Report.

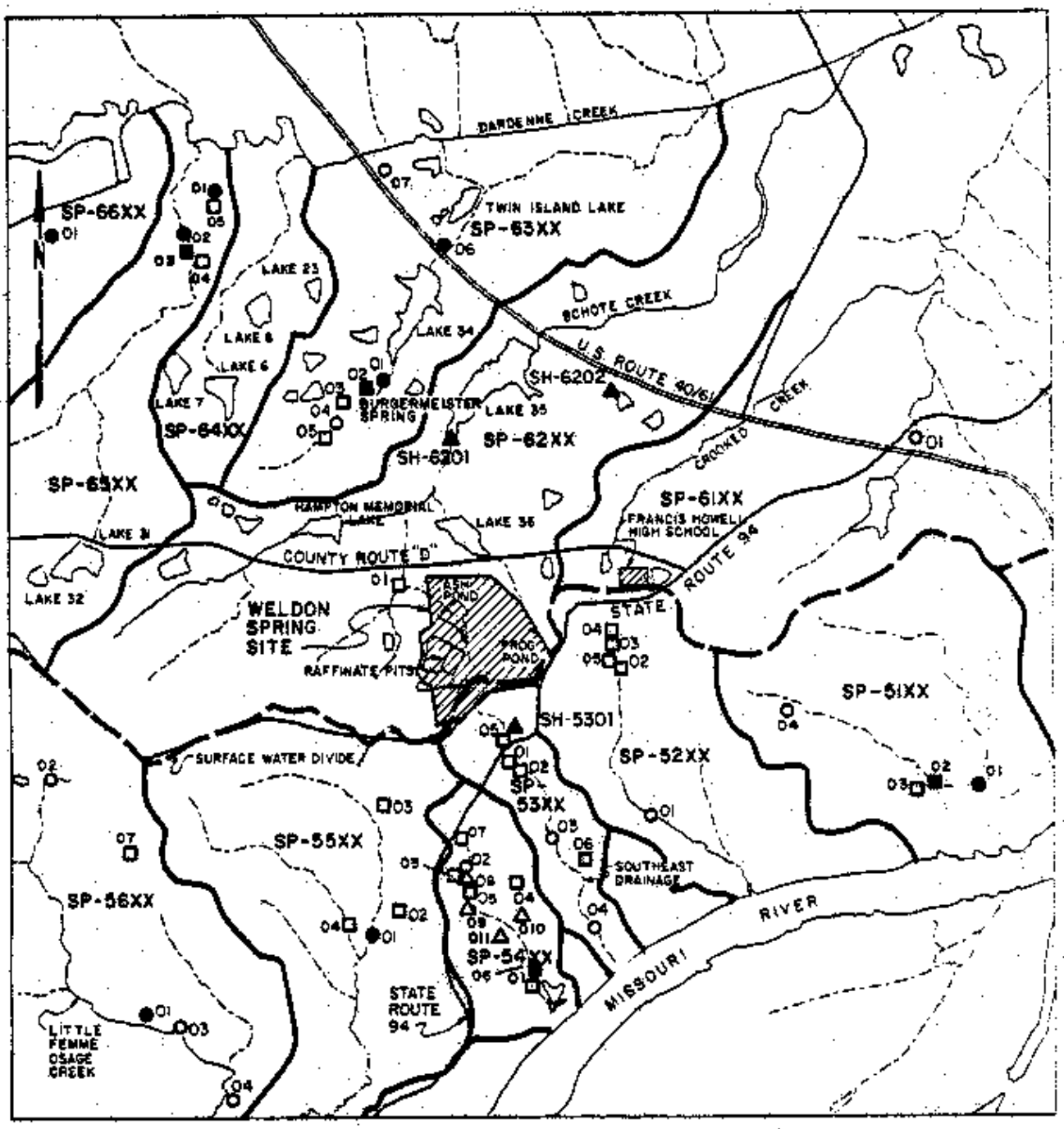
3.3.1 Nitroaromatics

Of the five routinely monitored springs, four were analyzed for nitroaromatic compounds because of the historical presence of nitroaromatic compounds at those locations. Spring SP-6302 was dry; therefore, a sample could not be collected. The results of these analyses are in Table 3-2 and are consistent with previous results.

TABLE 3-1 Third 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	0.28	ND	35.0	24.0	4.1	ND

NS - NOT SAMPLED, DRY
ND - NOT DETECTED



SOURCE: MDNR, 1989

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.

SCALE 0 3200 6400 FT
0 976.4 1950.7 M

SPRINGS AND SEEPS IN THE VICINITY OF THE WSS

FIGURE 3-4

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

TABLE 3-2 Third Quarter Nitroaromatic Concentrations for Surface Water (µg/l)

WSSRAP-ID	1,3,5-TNB	1,3-DNB	2,4,6-TNT	2,4-DNT	2,6-DNT	NITROBENZENE
SP-5201	ND	ND	1.8	ND	0.49	ND
SP-6301	0.031	ND	0.23	ND	0.48	ND
SP-6302	NS	NS	NS	NS	NS	NS
SP-6303	ND	ND	0.24	0.056	0.66	ND
SP-6306	ND	ND	ND	ND	ND	ND

NS - NOT SAMPLED, DRY
ND - NOT DETECTED

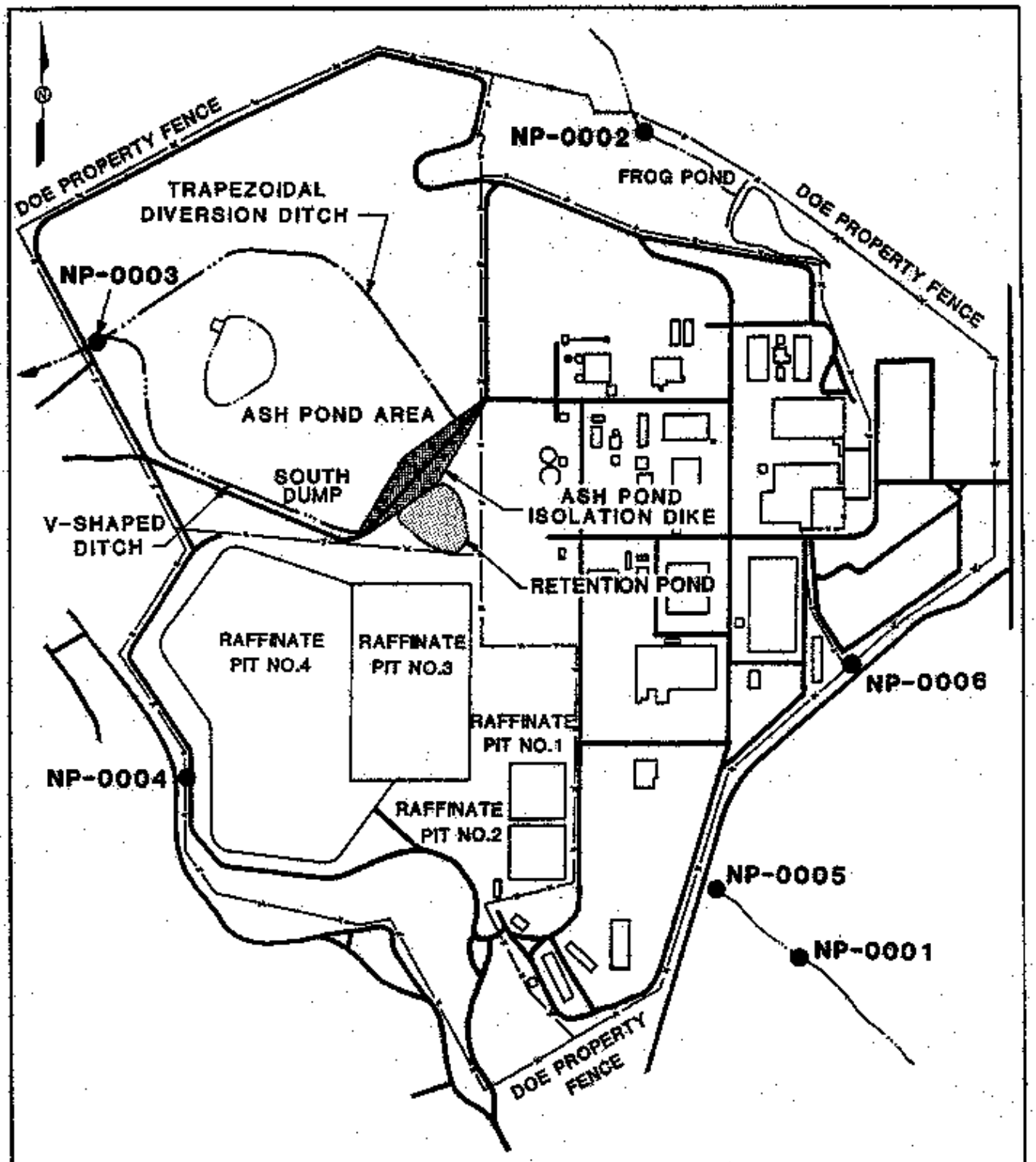
3.4 National Pollutant Discharge Elimination System Data Review

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 are included in this permit, and are shown on 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. Analytical data for the third quarter of 1990 is presented for each outfall in Table 3-3.

Radiological analyses of samples collected on September 27 are not yet available. This is indicated on the data tables for outfalls NP-0001, NP-0002, and NP-0005. No discharge due to precipitation occurred in September. Samples obtained on September 27 were associated with artificial flow events. Water hydrants supplied by the St. Charles County distribution system were utilized in performing flow studies during this time. Flow studies were conducted in the southeast drainage by the PMC and in the Frog Pond drainage by MDNR/DGLS. For this reason, these values may not be representative of normal flows associated with precipitation events.

Radiological Analysis

Gross Alpha and Total Uranium analyses correspond well with 1989 data. The highest uranium levels were present at NP-0001



NPDES MONITORING LOCATIONS

FIGURE 3-5

SCALE 0 500 1000 FT
0 152.4 304.8 M

REPORT NO. DOE/OR/21548-141		DRAWING 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 Q3 1990

DATE SAMPLED	FLOW GPD	SUSP. SOLIDS mg/l	SET. SOLIDS ml/l	NITRATE mg/l	pH mg/l	LITHIUM µg/l	GROSS ALPHA pCi/l	TOTAL URANIUM pCi/l
Jul. 11	28800	2.00	<0.1	1.09	6.84	ND	204.00	197.20
Sep. 27	14400	3.00	<0.1	1.67	7.28	0.0226	*	*
Maximum	28800	3.00	0.00	1.67	7.28	0.023	204.00	197.28
Minimum	14400	2.00	0.00	1.09	6.84	0.000	0.00	0.00
Average	21600	2.50	0.00	1.38	7.06	0.011	102.00	98.60

*Indicates data not yet available

Outfall NP-0002 NPDES data for Q3 1990

DATE SAMPLED	FLOW GPD	SUSP. SOLIDS mg/l	SET. SOLIDS ml/l	NITRATE mg/l	pH mg/l	LITHIUM µg/l	GROSS ALPHA pCi/l	TOTAL URANIUM pCi/l
Jul. 11	119687	380.00	<0.1	0.920	6.80	0.0070	113.00	86.00
Aug. 3	315260	488.00	0.1	0.560	6.55	0.0110	29.90	20.40
Sep. 27	159906	7.00	<0.1	0.208	8.60	0.0104	*	*
Maximum	315260.00	488.00	0.10	0.920	8.60	0.0110	113.00	86.00
Minimum	119687.00	7.00	0.00	0.208	6.55	0.0070	0.00	0.00
Average	198284.33	291.67	0.03	0.563	7.32	0.0095	47.63	35.47

* Indicates data not yet available

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

Outfall NP-0003 NPDES data for Q3 1990

DATE SAMPLED	FLOW GPD	SUSP. SOLIDS mg/l	SET. SOLIDS ml/l	NITRATE mg/l	pH mg/l	LITHIUM µg/l	GROSS ALPHA pCi/l	TOTAL URANIUM pCi/l
Jul. 11	11183	12.80	0.1	0.19	6.84	ND	70.30	95.00
Aug. 3	369540	104.00	<0.1	0.10	6.65	ND	6.09	6.24
Maximum	369540	104.00	0.10	0.19	6.84	0.000	70.30	95.00
Minimum	11183	12.80	0.00	0.10	6.65	0.000	6.09	6.24
Average	190361.5	58.40	0.05	0.15	6.75	0.000	38.20	51.12

Outfall NP-0004 NPDES data for Q3 1990

DATE SAMPLED	FLOW GPD	SUSP. SOLIDS mg/l	SET. SOLIDS ml/l	NITRATE mg/l	pH mg/l	LITHIUM µg/l	GROSS ALPHA pCi/l	TOTAL URANIUM pCi/l
Aug. 8	2880	34.00	<0.1	0.20	7.31	ND	9.38	6.45

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

Outfall NP-0005 NPDES data for Q3 1990

DATE SAMPLED	FLOW GPD	SUSP. SOLIDS mg/l	SET. SOLIDS ml/l	NITRATE mg/l	pH mg/l	LITHIUM mg/l	GROSS ALPHA pCi/l	TOTAL URANIUM pCi/l
Jul. 11	15300	<1.0	<0.1	0.93	6.58	ND	115.00	135.00
Aug. 3	243216	42.00	<0.1	1.90	6.74	ND	22.10	28.97
Sep. 27	330426	3.00	<0.1	1.29	7.39	0.0256	*	*
Maximum	330426	42.00	0.00	1.90	7.39	0.0256	115.00	135.00
Minimum	15300	8.00	0.00	0.93	6.58	0.0000	0.00	0.00
Average	196314	15.00	0.00	1.37	6.90	0.0085	45.70	54.66

* Indicates data not yet available

Outfall NP-0006 NPDES data for Q3 1990

DATE SAMPLED	FLOW GPD	SUSP. SOLIDS mg/l	BOD mg/l	FECAL COLIFORMS No./100ml	pH
Jul. 11	1890	3.00	3.00	<1.0	6.8

(discharge from the process sewer) followed by NP-0005 (surface flow from the southeast portion of the site combined with discharge from NP-0001). These relatively higher levels are consistent with 1989 data. Maximum values for uranium were 197.2 pCi/l at NP-0001 and 135 pCi/l at NP-0005, which are lower than maximum values for 1989.

Other outfalls exhibited the following range of uranium concentrations. NP-0002, the drainage from the Frog Pond area, ranged from 20.4 pCi/l to 88 pCi/l, which is slightly lower than 1989 values. NP-0003, drainage from the Ash Pond Diversion, ranged from 6.24 pCi/l to 96 pCi/l, which is lower than the 1989 values indicating the continued positive effect of the Ash Pond Diversion project. A uranium concentration of 6.45 was present in the third third quarter sample collected from NP-0004, raffinate pit #4 area.

Other Analysis

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

Settleable solids were less than 0.1 ml/l with the following two exceptions which were measured at 0.1 ml/l: NP-0003 on Jul. 11 and NP-0002 on Aug. 3. Suspended solids ranged from <1.0 mg/l (NP-0005 on Jul. 11) to 488 mg/l (NP-0002 on Aug. 3). The high suspended solids measurement for NP-0002 was caused in part by an accumulation of silt in the small basin above the weir. This accumulation of silt has been removed and subsequent suspended solids measurements have decreased significantly.

Nitrate values are slightly lower than 1989 values for all surface water outfalls and ranged from 0.1 mg/l (NP-0003 on August 3) to 1.90 mg/l (NP-0005 on August 3). Lithium was detected in outfalls NP-0001, NP-0002, and NP-0005 during the third quarter of 1990 and ranged from 0.0070 mg/l (NP-0002 on July 11) to 0.0256 mg/l (NP-0005 on September 27). These levels are relatively low and no Maximum Contaminant Level (MCL) exists for lithium in drinking water. Lithium levels were detected at all three outfalls in samples obtained on September 27. The sources of flow on this date were water hydrants supplied by the St. Charles County distribution network. As a control measurement during future flow study, additional samples will be collected directly from the hydrant source and analyzed for NPDES parameters. Lithium was detected in all three samples for third quarter 1990 at NP-0002. The PMC will continue to monitor these levels and attempt to determine the source of lithium in this drainage.

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. All data reported for third quarter 1990 was in compliance with permit effluent limitations.

Sampling was conducted in the Little Femme Osage Creek, near the Weldon Spring Quarry in order to assess erosion control measures associated with construction of the Quarry Staging Area and Water Treatment Plant Facilities. Although the treatment plant has not yet been constructed, the NPDES permit for this discharge (MO-0108987) requires that all runoff from construction and material storage areas remain within the following limits:

Total Suspended Solids: Less than 50.0 mg/l
pH greater than 6.0 and less than 9.0 (standard units)

Samples were collected from SW-1001 and SW-1002 on August 29 (See Figure 3-2). SW-1001 is located upstream of the Quarry Staging Area, and represents normally occurring concentrations in this drainage. SW-1002 is located immediately downstream of the Quarry Staging Area. Water quality impacts from QSA construction erosion are assessed by comparing values from these two locations. Results from these samples were as follows:

SW-1001	pH = 6.90	TSS=1.6 mg/l
SW-1002	pH = 7.17	TSS=<1.0 mg/l

These results indicate compliance with permit requirements.

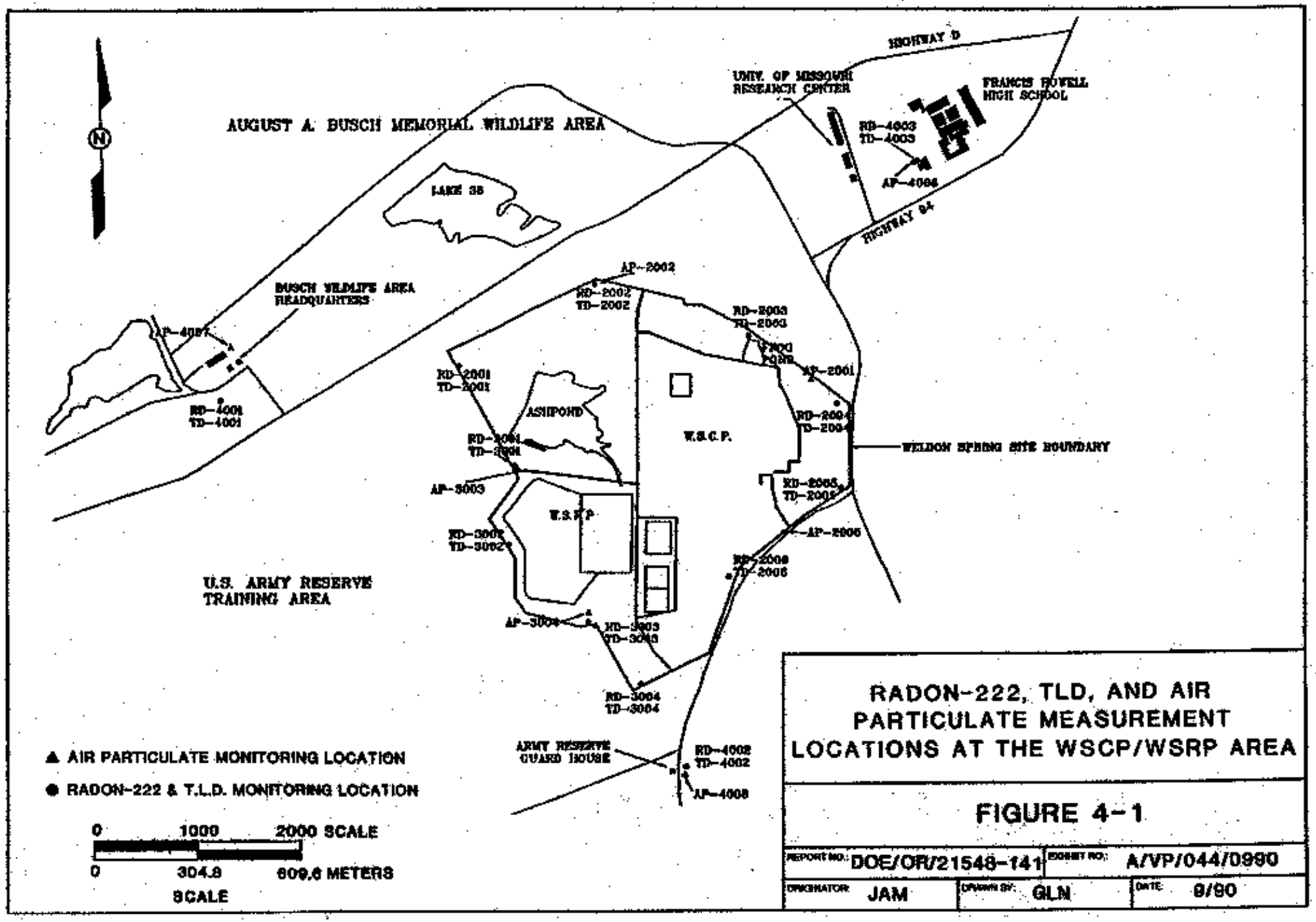
4 AIR MONITORING

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.

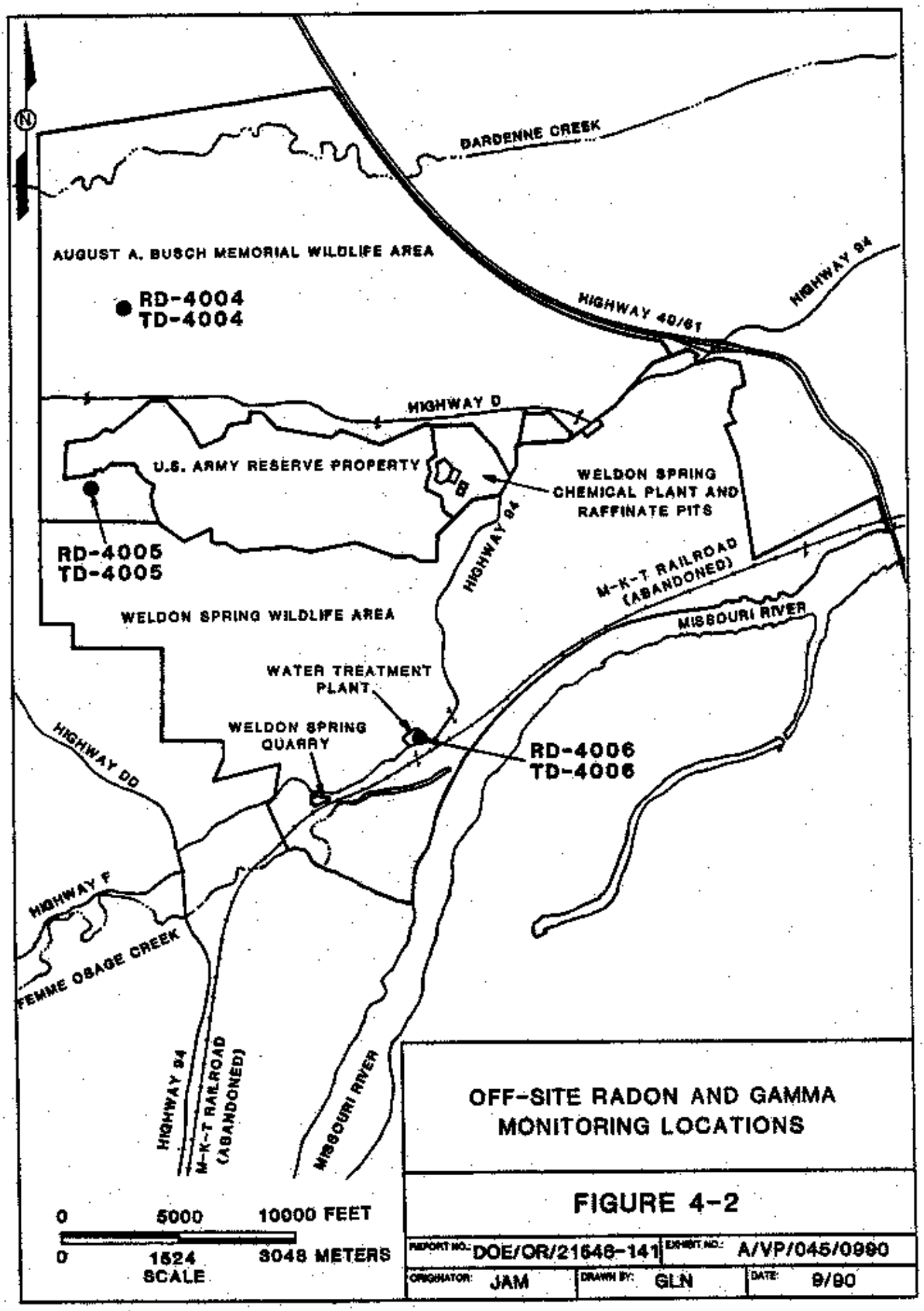
An average ambient background concentration was determined by calculating the arithmetic average for the four background locations. This data yielded a year-to-date average ambient background radon concentration of 0.33 pCi/l for the first three quarter of 1990. This concentration was then subtracted from the year-to-date average concentration for each monitoring station, and then compared to the DOE guideline of 3 pCi/l above background.



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

FIGURE 4-1

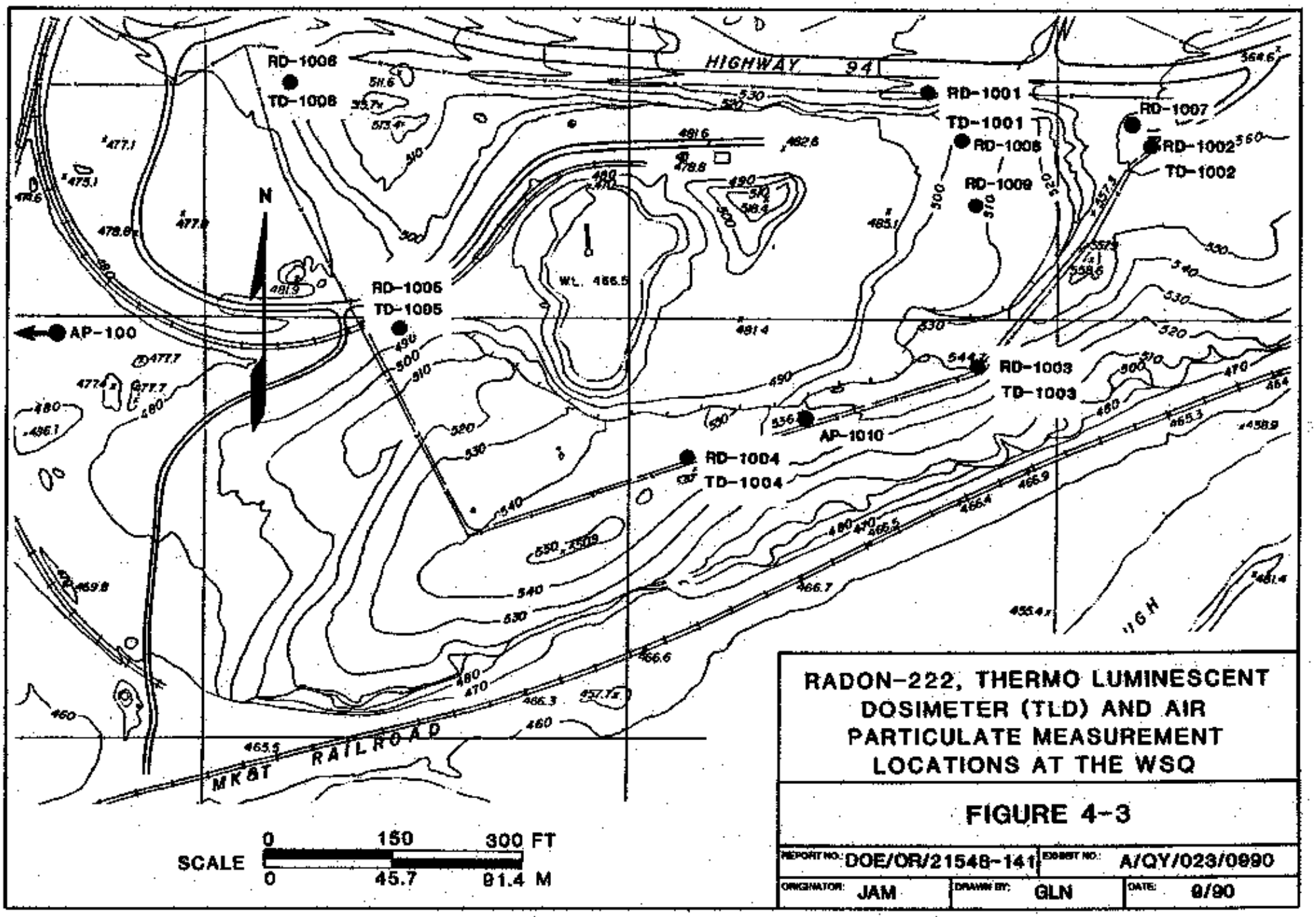
REPORT NO: DOE/OR/21548-141		DOCUMENT NO: A/VP/044/0990	
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90	



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		EXHIBIT NO.: A/QY/023/0990	
ORIGINATOR: JAM	DRAWN BY: GLN	DATE: 9/90	

TABLE 4-1 Calander Quarters 1, 2, and 3, 1990
Track Etch Radon Results (a)

LOCATION ID	1st QUARTER pCi/l	2nd QUARTER pCi/l	3rd QUARTER pCi/l	YEAR TO DATE AVERAGE pCi/l	PERCENT OF GUIDELINE (b)
WSQ					
RD-1001	1.1	1.4	2.4	1.6	43
RD-1002	1.4	2.1	3.1	2.2	62
RD-1003	1.0	0.5	1.0	0.8	17
RD-1004	0.3	0.4	0.8	0.5	6
RD-1005	0.8	0.5	0.8	0.7	12
RD-1006	0.5	0.3	0.5	0.4	3
WSCP					
RD-2001	0.4	0.3	0.5	0.4	2
RD-2002	0.4	0.1	0.4	0.3	0
RD-2003	0.4	0.1	0.7	0.4	2
RD-2004	0.3	0.1	0.4	0.3	0
RD-2005	0.5	0.1	0.4	0.3	0
RD-2006	0.4	0.2	0.4	0.3	0
WSRP					
RD-3001	0.3	0.1	0.5	0.3	0
RD-3002	0.3	0.1	0.4	0.3	0
RD-3003	0.5	0.1	0.5	0.4	1
RD-3004	0.3	0.1	0.5	0.3	0
OFF-SITE					
*RD-4001	0.3	0.1	0.7	0.4	1
RD-4002	0.3	0.1	0.3	0.2	0
RD-4003	0.3	0.1	0.4	0.3	0
*RD-4004	0.3	0.1	0.7	0.4	1
*RD-4005	0.5	0.1	0.3	0.3	0
*RD-4006	0.3	0.1	0.5	0.3	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

Radon concentrations at the site perimeter and at off-site locations were lower for the third quarter of 1990 than for the third quarter of 1989. However, they are within the typical range expected during years of normal precipitation. The quarterly radon concentrations (background included) ranged from 0.3 pCi/l at two locations to 3.1 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 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 WSS perimeter monitoring stations, Francis Howell High School, the Weldon Spring Army Reserve Training Area, and at the four background monitoring stations.

TABLE 4-2 1990 Environmental TLD Results (a)

LOCATION ID	1ST QUARTER MR	2ND QUARTER MR	3RD QUARTER MR	YEAR TO DATE TOTAL (b) MR
WSQ				
TD-1001	21	21	26	68
TD-1002	17	17	22	56
TD-1003	20	16	24	60
TD-1004	18	15	21	54
TD-1005	18	17	-	53
TD-1006	15	14	21	50
WSCP				
TD-2001	16	16	18	50
TD-2002	15	14	22	51
TD-2003	15	15	18	48
TD-2004	16	17	18	51
TD-2005	-	14	17	47
TD-2006	17	15	19	51
WSRP				
TD-3001	-	16	20	54
TD-3002	13	12	-	38
TD-3003	17	17	20	54
TD-3004	12	13	18	43
OFF-SITE				
*TD-4001	15	16	-	47
TD-4002	14	13	15	42
TD-4003	12	11	13	36
*TD-4004	14	16	20	50
*TD-4005	12	-	-	36
*TD-4006	13	13	19	45

(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 was 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.

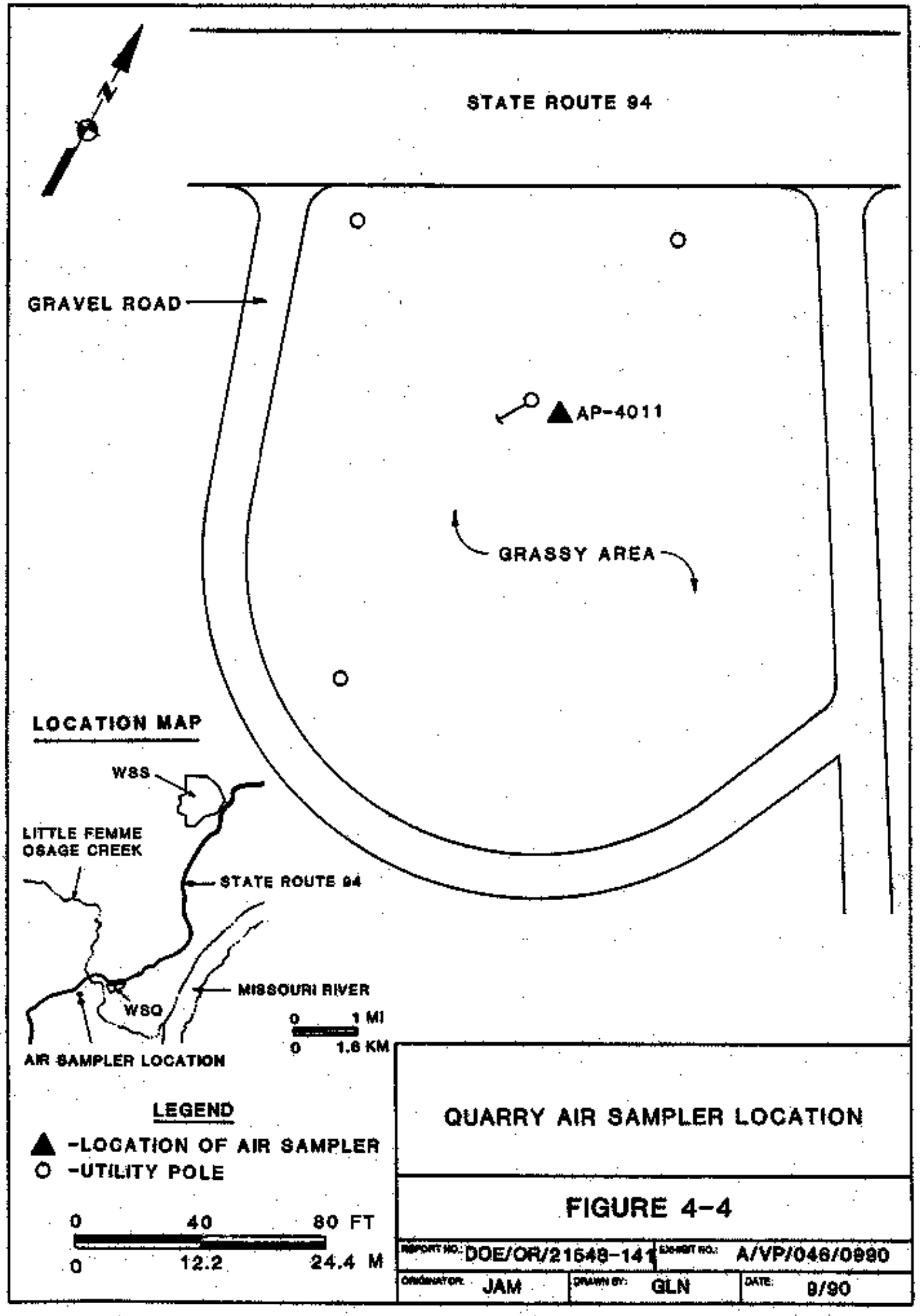
The yearly average background gamma exposure as measured with TLDs in 1989 was 68 mR/year. This would be equivalent to 51 mR/9 months which is comparable to the monitoring results of 45 mR/9 months obtained in the third quarter of 1990. This agreement with 1989 monitoring results was expected because no significant changes in the configuration or location of the wastes has occurred.

Due to external vandalism, the third quarter TLDs were missing for monitoring stations TD-1005, TD-3002, TD-4001, 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 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.

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


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
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between the WSCP and this sampling station is hilly and forested, providing a significant physical barrier to airborne particulates originating from the WSCP/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

TABLE 4-3 Third Quarter 1990 Radiological Air Particulate Results

IDENTIFICATION NUMBER	QUARTERLY AVG. CONCENTRTION (1E-15 µCi/ml)	STANDARD DEVIATION (1E-15 µCi/ml)	NUMBER OF VALUES ABOVE LLD
AP-1009	1.57	4.24	8
AP-1010	2.12	7.96	8
AP-2001	<1.36	3.5	9
AP-2002	<1.72	5.17	12
AP-2005	<1.59	3.08	11
AP-3003	<1.19	1.89	8
AP-3004	<1.36	4.54	10
AP-4006	<1.4	3.37	8
*AP-4007	<1.51	6.36	12
AP-4008	<1.56	6.57	11
AP-4011	<1.3	4.25	10

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

of any additional asbestos abatement activities, asbestos air particulate monitoring will resume.

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