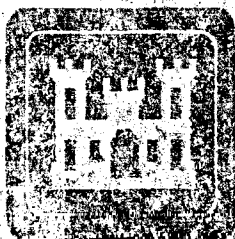

FINAL

POST-REMEDIAL ACTION REPORT FOR THE ST. DENIS BRIDGE AREA

ST. LOUIS, MISSOURI

JULY 1999



U.S. Army Corps of Engineers
St. Louis District Office
Formerly Utilized Sites Remedial Action Program



Science Applications International Corporation
An Employee-Owned Company

1526.19990713.001

July 15, 1999

Mr. Thomas R. Freeman III, P.E.
U.S. Army Corps of Engineers, St. Louis District
Contracting Officer's Technical Representative
CEMVS-ED-P
1222 Spruce Street
St. Louis, MO 63103-2833

**Subject: Contract DACW45-098-D-0029, Delivery Order No. 7, Task 1d
FINAL - POST-REMEDIATION ACTION REPORT FOR THE ST. DENIS BRIDGE AREA**

Dear Mr. Freeman:

Enclosed please find 25 copies of the final version of the Post-Remedial Action Report for the St. Denis Bridge Area which incorporates comments made by the Missouri Department of Natural Resources on the Review Draft. Also included in this transmittal is a copy of MDNR's comments and the SAIC prepared comment resolution package.

If you have any questions or comments, please call me at (423) 481-4720 or Sherry Gibson at (314) 209-2005.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

for Joseph G. Wood, Jr.
Sr. Project Manager

JGW/tpj

Encl.

cc: See Document Distribution Sheet

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**MDNR COMMENTS AND RESPONSES FOR
THE POST REMEDIAL ACTION REPORT (PRAR) FOR THE ST. DENIS BRIDGE AREA
ST. LOUIS, MISSOURI (April 1999 Draft)**

Comments received 10/27/98			
Comment No.	Page/§/¶	Comments	Responses
1		In general the level of detail included in the PRAR for the St. Denis Bridge Area was satisfactory for review by Federal Facilities Section (FFS). There does need to be consistency in the document. One example is the fact that the clean up criteria is listed in several areas of the report but if you look at page 6 it is stated "The concentration-based remedial action guidelines set forth in the EE/CA are 15 pCi/g for Ra-226 and Th-230 (subsurface soils, below 15 cm depth), and 50 pCi/g for U-238 for all depths" then look at page A-3 it is stated "The site specific cleanup levels were 5 pCi/g Th-230 in the top 15 cm of soil and 15 pCi/g of Th-230 in any 15 cm layer of soil below that." Another example is the differences between the Sum-of-Ratio (SOR) equations found on page B-3 and on page 6.	The document will be revised to include the EE/CA criteria for both surface and subsurface soils. Th-232 and Ra-228 will be added to both Table 1 and the SOR equation to clarify the calculation of the SOR.
2		The report should include results from all environmental monitoring done for the specific area. That would include but is not limited to radon monitoring, air monitoring, and stormwater monitoring. During a site visit on October 22, 1998 I didn't observe any air monitoring being done by Bechtel, Inc. I was told by Bechtel, Inc. and the U.S. Army Corps of Engineers (USACE) that the air monitoring had been done. The monitoring data was not included in this report, just a statement on page A-5 that stated "The air results were below criteria".	The St. Denis Street Bridge PRAR has been developed following EPA's guidance "Remedial Action Report, Documentation for Operable Unit Completion" (PB92-963364, June 1992). As such, only those elements of the remediation that are applicable to documenting that the remedial action has met its objectives (i.e., that document the final status of the remediated area) are included. The primary objective of the PRAR is, therefore, to document that material contaminated above the EE/CA criteria has been satisfactorily removed and that the remaining material is in compliance with the site criteria. Environmental Monitoring data for the St. Louis FUSRAP sites is included in other documents where appropriate.
3		The section "Chronology of events" outlines the sequence of events, which is good but I would also like to see information on any event, which caused a change in any health & safety procedure or excavation boundaries, etc. An example would be that during the Department of Energy work on the West End they required workers at the Eva Load out who work in the back of the trucks removing the liners to wear respirators because the air monitoring indicated an exceedence of the 10% DAC limit. Another example would be finding a drum filled with an unknown material or unusual weather event, which stops work. A brief description of how those events were handled by the contractor or USACE. While observing the work at the St. Denis Bridge on October 22, 1999 I observed the excavator operator stop work because of the constant movement of personnel around the excavator. How was that handled to insure a safe work environment? See comment #6 for an outtake from FFS site notes from that October 22, 1998 visit.	No significant "off normal" events occurred during the remediation to necessitate inclusion in the PRAR as a lessons learned.

**MDNR COMMENTS AND RESPONSES FOR
THE POST REMEDIAL ACTION REPORT (PRAR) FOR THE ST. DENIS BRIDGE AREA
ST. LOUIS, MISSOURI (April 1999 Draft) (continued)**

Comments received 10/27/98			
Comment No.	Page/§/¶	Comments	Responses
4	Page 12, Table 1	Summary of Final Status Samples Results from the St. Denis Street Bridge Area; I used the equation on page 6 to calculate the gross SOR for several of the sample points. I couldn't get the same results as listed in the gross SOR column in table 1. For SVP00060 I calculated an SOR _G of 0.22 pCi/g while the table has an SOR _G of 0.28 pCi/g. The problem was that I didn't include the greater of Th-232 or Ra-228 in the calculation. A solution to this problem is to include a sample calculation in the document.	As per comment #1 above, both Th-232 and Ra-228 concentrations will be included in Table 1 and the equation in Section 3.0.
5	Page A-3 & A-4	Several references are made to elevated levels found on the east bank after the initial remediation effort. What radioisotopes and levels were detected which caused the additional excavation work? The preliminary samples corresponding to the elevated readings should be included in the text along with which final samples corresponding to those same areas. The information may be in the tables in the back of the report but the maps with the preliminary sample locations are not clear. Attachment A has two maps, which give different locations for SVP0933 and SVP0934. An example of what could be included in the text "The preliminary gamma spec data provided after page A-9 showed several samples which exceeded the Th-230 cleanup criteria specifically SVP0603 19.12 pCi/g, SVP0606 21.22 pCi/g, and SVP0832 21.41 pCi/g. After additional excavation, additional samples were taken the new results are SVPXXXX 15 pCi/g as shown in Table B-1. There are different concerns if the levels detected were 17 pCi/g (including background) or 300 pCi/g (including background). Table E-2 lists several samples which have a net SOR greater than 1.0, do those samples from Table B-2 correspond to the areas with elevated readings?	<p>The objective of the PRAR is to document the final condition of the remediated area, rather than to document each excavation/sampling iteration that occurred prior to verifying (via the final status surveys and sampling) that the criteria had been achieved. Data contained in Appendix A is "remedial action support data" rather than final status data. As described in MARSSIM, remedial action support samples and surveys 1) support remediation activities, 2) determine when a survey unit is ready for final status survey, and 3) provide updated estimates of the site-specific parameters to use for planning the final status survey. The results recorded on page A-9 document BNI's determination that the excavation was ready for final status sampling. They are not the samples obtained to properly document the final condition of the site.</p> <p>The figure depicting sample number SVP0933 was determined to be in error and subsequently removed from the document.</p> <p>Table B-2 represents the maximum possible concentrations for each of the individual samples making up the composites (which were all below the SOR criteria). The concentrations in Table B-2 are not actual analytical results but rather theoretical maximums determined by assigning background concentrations to two of the composite samples and determining the concentration of the third sample that would be required to obtain the actual composite result. None of the composite final status sample results exceeded a SOR of 1.0.</p>

**MDNR COMMENTS AND RESPONSES FOR
THE POST REMEDIAL ACTION REPORT (PRAR) FOR THE ST. DENIS BRIDGE AREA
ST. LOUIS, MISSOURI (April 1999 Draft) (continued)**

Comments received 10/27/98			
Comment No.	Page/§/¶	Comments	Responses
6	Page A-5	<p>Second full paragraph; during a site visit of October 22, 1998 I observed both the Bechtel contractor and the city's contractor working in the same area. Access to the site was not being controlled as stated in the paragraph. Comments from FFS personnel site visit of October 22, 1998</p> <p style="text-align: center;">[Text Deleted from original comment]</p> <p>The document doesn't accurately represent site conditions during the remediation efforts at the St. Denis Bridge Vicinity Property. The report should include any data that was taken to verify that there were no health & safety concerns.</p>	The primary objective of the PRAR is to document that material contaminated above the EE/CA criteria has been satisfactorily removed and that the remaining material is in compliance with the site criteria. Health and Safety data for the St. Louis FUSRAP sites is included in other documents where appropriate.
7	Page A-5	Air monitoring data should be included in the report. The report indicates that the air results were below criteria. The only criteria (DAC limit) listed in the report was for Th-230 7.0×10^{-12} $\mu\text{Ci/ml}$. What about the DAC limits for Uranium and Radium?	The primary objective of the PRAR is to document that material contaminated above the EE/CA criteria has been satisfactorily removed and that the remaining material is in compliance with the site criteria. Environmental Monitoring data for the St. Louis FUSRAP sites is included in other documents where appropriate. (The DAC for Th-230 is used as it is the most restrictive of the DACs for the contaminants at the site.)
8	Page A-5	"Measures were also taken to minimize the potential for migration of radioactive contaminated material to adjacent, uncontaminated areas of the site and Coldwater Creek." Please include examples because many of the measures to be implemented were not done at the site. Comments from FFS personnel site visit of October 22, 1998.	The remediation plan specified potential contaminant migration mitigation techniques to be employed during the remediation if needed. During remediation it was determined that, due to the slope of the excavated area and the natural barriers created by sides of the creek bed, no migration barriers would be employed.
9	Page A-5	"All equipment was surveyed, and if above the release criteria, decontaminated before it was removed from the controlled area." Was any equipment required to be decontaminated and how was it done to avoid spreading contamination? The area was not set up like a normal hazardous waste site, e.g., support zone, CRZ, and exclusion zone.	Equipment, and equipment laydown and transfer areas, were surveyed as necessary prior to release. Data from these surveys is considered "operational data" and is therefore beyond the scope of the PRAR. No equipment was found to exceed the limits.
10		Attachment A includes the results of the walkover scans performed at the St. Denis Bridge site along the west and east banks. Were the areas used to stockpile debris and load trucks also scanned before releasing the site? This question arises from the fact that concrete removed from the bank was dropped onto the ground so the excavator could break it up into smaller pieces.	Contaminated material handling and transfer areas, were surveyed as necessary and prior to release. Data from these surveys is "operational data" and is therefore beyond the scope of the PRAR.

**MDNR COMMENTS AND RESPONSES FOR
THE POST REMEDIAL ACTION REPORT (PRAR) FOR THE ST. DENIS BRIDGE AREA
ST. LOUIS, MISSOURI (April 1999 Draft) (continued)**

Comments received 10/27/98			
Comment No.	Page/§/¶	Comments	Responses
11	Page 9, Sect. 5.4	Please clarify this paragraph, specifically this statement "Since no individual sample results (for composite samples) exceeded 1.0, further analysis of the three individual samples comprising the composite was not required." See page B-14 Table B-2 which has two individual samples (SVP0068 & SVP0073) which net SOR exceed 1.0. This fact is handled in two different ways in this report on page 9 and page B-7.	As stated in Appendix B (section 3.1) Table B-2 represents the maximum possible concentrations for each of the individual samples making up the composites (which were all below the SOR criteria). The concentrations in Table B-2 are theoretical maximums rather than actual analytical results. They were determined by assigning background concentrations to two of the composite samples and determining the concentration of the third sample that would be required to obtain the actual composite result. No final status sample results exceeded a SOR of 1.0. The text will be revised in section 5.4 and Appendix B to reiterate that no theoretical maximum for an individual sample (each representing an area of approximately 7.7 m ²) would exceed the EE/CA hot spot criteria nor would it contribute to a dose greater than 1 mrem/yr. i.e., no individual sample result (real or theoretical) would necessitate the removal of additional soil.
12	Page A-9	Was the data on this page preliminary data acquired by Bechtel? Sample results SVP0832, and SVP0933 would cause an exceedence of the SOR less than 1.0 requirement. Does sample SVP0861 replace SVP0832? Was Thorium-230 the only thing that was analyzed for with these samples? Has Bechtel or USACE validated this data?	The BNI results should be considered "remedial action support samples" or screening results, rather than final status samples. The results recorded on page A-9 were used by BNI in determining that the excavation was ready for final status sampling. These results do not document the final condition of the site. Because these samples were used for screening purposes rather than for final documentation of the concentrations of the remaining soils, detailed validation was not necessary.

FINAL

POST-REMEDIAL ACTION REPORT FOR THE ST. DENIS BRIDGE AREA

ST. LOUIS, MISSOURI

JULY 1999

prepared by

U.S. Army Corps of Engineers, St. Louis District Office, Formerly Utilized Sites Remedial Action Program

with technical assistance from

Science Applications International Corporation ESC-FUSRAP
under Contract No. DACA62-94-D-0029

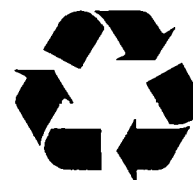


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1.0 INTRODUCTION

This report documents the interim remedial action conducted as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP) at the location where St. Denis Street, in Florissant, Missouri, crosses Coldwater Creek (Figure 1). This remedial action was carried out in support of the replacement of the St. Denis Street Bridge by the city of Florissant.

FUSRAP was established to identify and clean up, or otherwise control, sites where residual radioactive contamination (exceeding current cleanup guidelines) remains from the early years of the nation's atomic weapons program or from commercial (non-governmental) operations that caused conditions necessitating their inclusion in the program by Congress. The U.S. Army Corps of Engineers (USACE) took over the administration and execution of cleanup of FUSRAP sites under the Energy and Water Development Appropriations Act in October of 1997.

The objectives of FUSRAP, as they apply to the St. Louis site, are to

- identify and evaluate sites used to support former Manhattan Engineer District (MED) and U.S. Atomic Energy Commission (AEC) nuclear development activities;
- remove or otherwise control contamination on sites identified as contaminated above current cleanup guidelines;
- achieve and maintain compliance with applicable criteria for the protection of human health and the environment;
- maintain compliance with applicable or relevant and appropriate requirements; and
- certify the site, to the extent practicable, for use without radiological restrictions after remediation.

Bechtel National Inc. (BNI) was contracted by USACE as the remediation contractor for the removal of contaminated material from the St. Denis Street Bridge area. Science Applications International Corporation (SAIC) was contracted by the USACE to prepare and implement the final status survey plan and to evaluate the final status survey results.

The primary objective of this report is to document and assess the effectiveness of the remedial action conducted in the area of the St. Denis Bridge.

2.0 SITE DESCRIPTION AND HISTORY

By 1946 the nation's demand for highly purified uranium necessitated that Mallinckrodt Chemical Works in downtown St. Louis, Missouri, began processing uranium-containing ores (pitchblende), rather than only purifying uranium oxides that had been extracted (and concentrated)

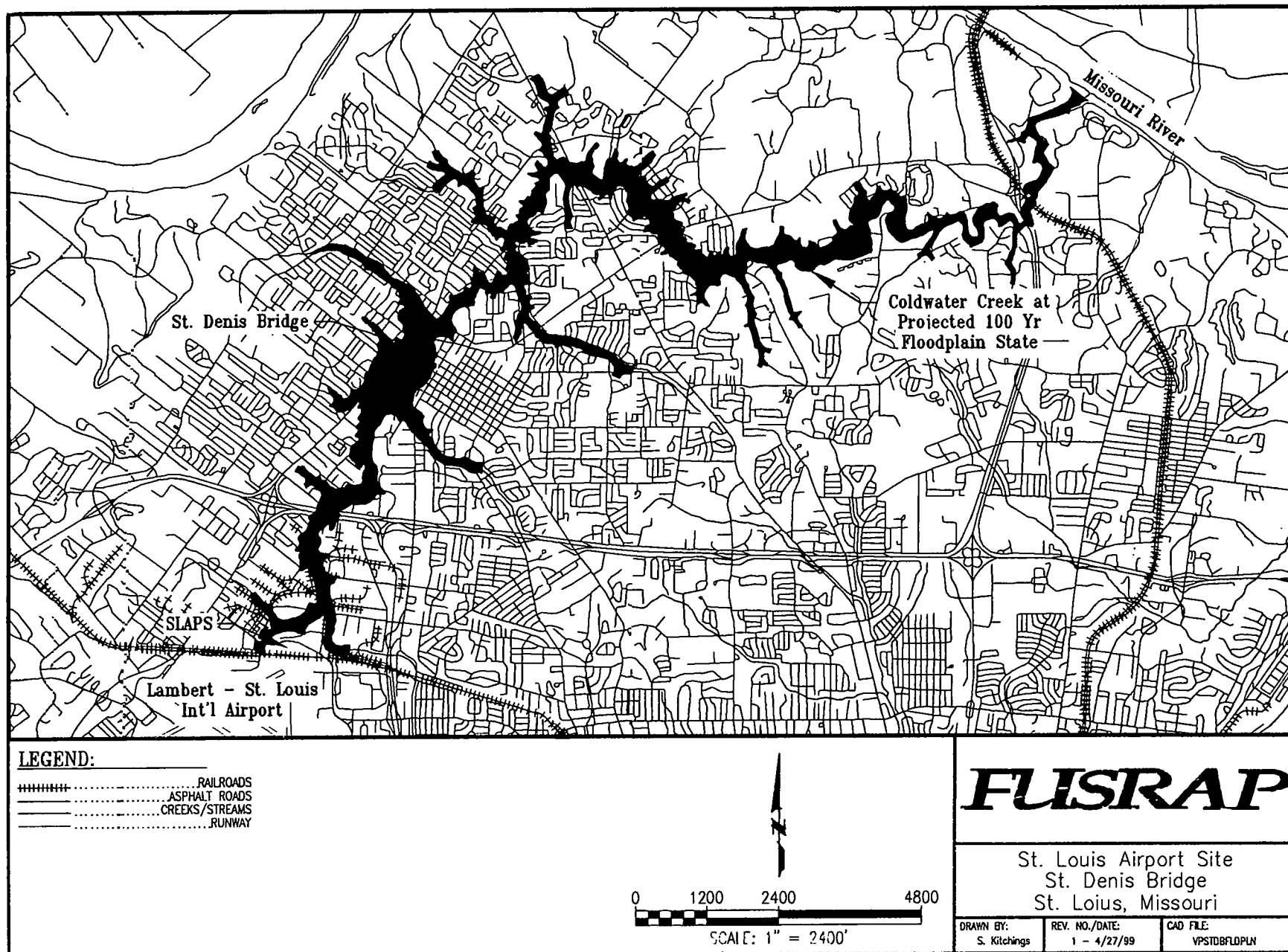


Figure 1. Coldwater Creek Floodplain

from ores by other companies. This change in feed material resulted in the generation of vast quantities of tailings (wastes from the extraction process) by Mallinckrodt. These tailings, however, possessed significant quantities of rare earth minerals as well as other marketable metals. Because of this, the tailings were not disposed of as waste but were retained.

In order to store the tailings while they awaited ultimate disposition, the AEC obtained consent to occupy and use a 21.74 acre site north of the St. Louis Municipal Airport, known now as the St. Louis Airport Site or "SLAPS" (Figure 2). The SLAPS was operated by the MED and the AEC from 1946 until July 1953, when the operation of the site was turned over to Mallinckrodt. Throughout the 1950s residues from uranium extraction operations at Mallinckrodt's facility were stored on the ground at SLAPS. By the time Mallinckrodt ceased uranium operations at their St. Louis site in 1958, the SLAPS contained over 100,000 tons of residues, the majority of which were stored above ground in unconsolidated piles.

Coldwater Creek, which forms the western boundary of the SLAPS, most probably was contaminated when uranium process residues migrated from the SLAPS during significant rainfall events, primarily as stormwater runoff. Bank erosion on the western end of SLAPS, prior to the installation of the gabion wall to stabilize the bank, also contributed to the contamination of the creek.

Coldwater Creek has been the subject of several surveying and sampling investigations since its inclusion in FUSRAP as a vicinity property of the SLAPS. The U.S. Department of Energy (DOE) initially conducted sampling and analysis of Coldwater Creek sediments in 1986 and 1991 as part of the overall St. Louis Remedial Investigation (DOE 1995). During these investigations a total of 939 samples were collected from the center of the creek and at the water's edge on both sides of the creek from SLAPS to the Missouri River. Areas of radioactivity above those concentrations found in nature were detected in the area of the St. Denis Bridge.

The St. Denis Bridge area is located approximately 3 miles downstream (north) of SLAPS along Coldwater Creek (Figure 3). In the spring of 1996, DOE was contacted by the city of Florissant, Missouri informing them that the replacement of the St. Denis Street Bridge was being planned. In September 1997, BNI conducted surveys and sampling activities in the area of the St. Denis Street Bridge and on Fountain Creek near its confluence with Coldwater Creek where new bridge construction was planned (BNI 1997). This sampling activity was conducted in order to ensure worker health and safety would be maintained during construction of the new bridge.

Results of surveys performed on Coldwater Creek in the area of the St. Denis Street Bridge are described in the report, *St. Louis Site VPs – Coldwater Creek Sample Results in the Vicinity of the St. Denis Avenue Bridge* (BNI 1997). This report identifies thorium-230 (Th-230), radium-226 (Ra-226), and natural uranium as the primary radioactive contaminants present in soils along the banks of the creek. Although relative ratios of these radionuclides varied by specific location, with few exceptions Th-230 was the predominant radionuclides present in the collected samples. Smaller quantities of naturally occurring thorium and actinium decay products were also reported in some samples from the St. Denis Bridge area; however, the average concentrations of these radionuclides were significantly lower than concentrations of the primary contaminants. The highest concentration of Th-230 found during this investigation was 38.29 picoCuries per gram

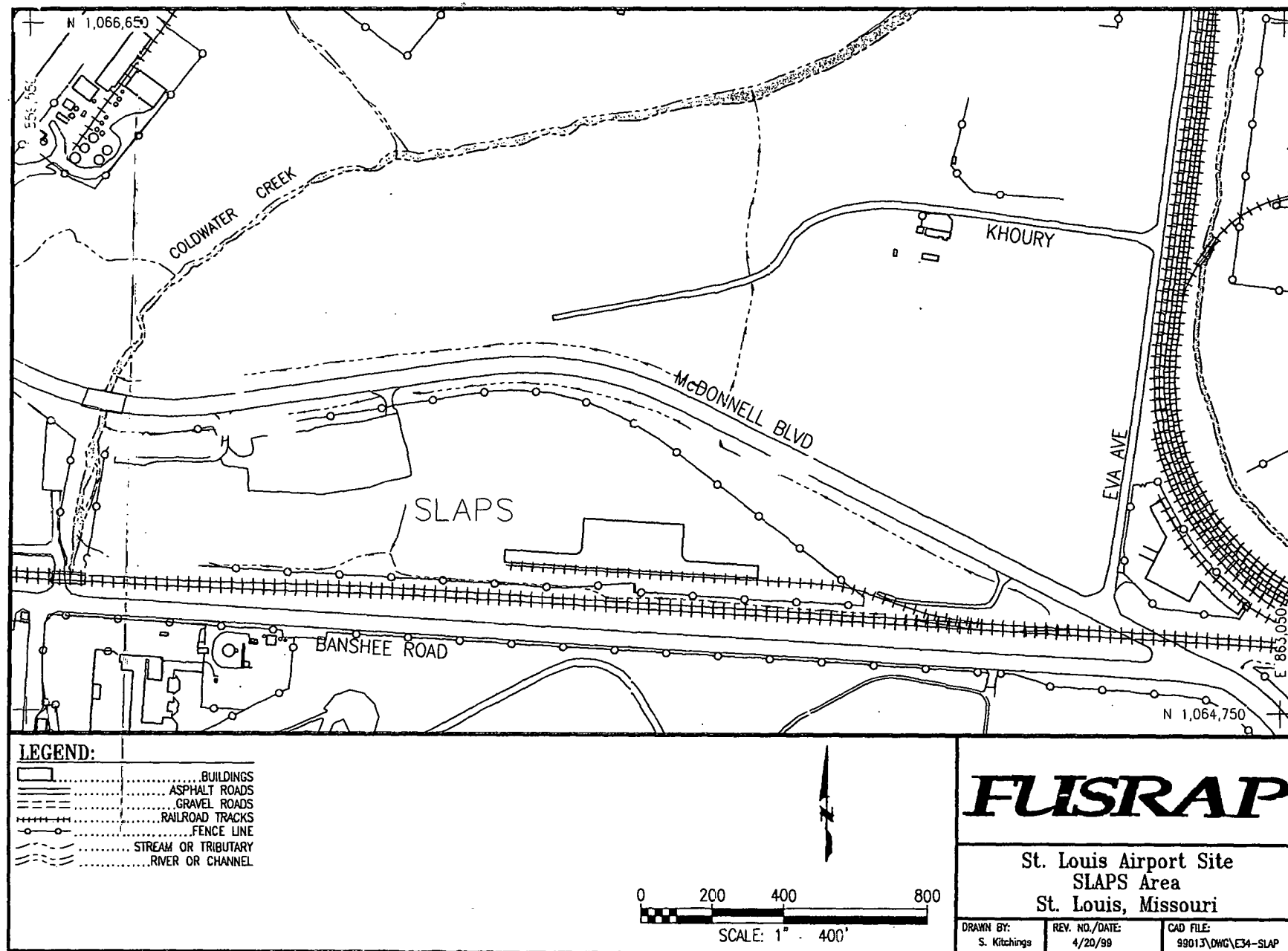


Figure 2. SLAPS General Area Figure

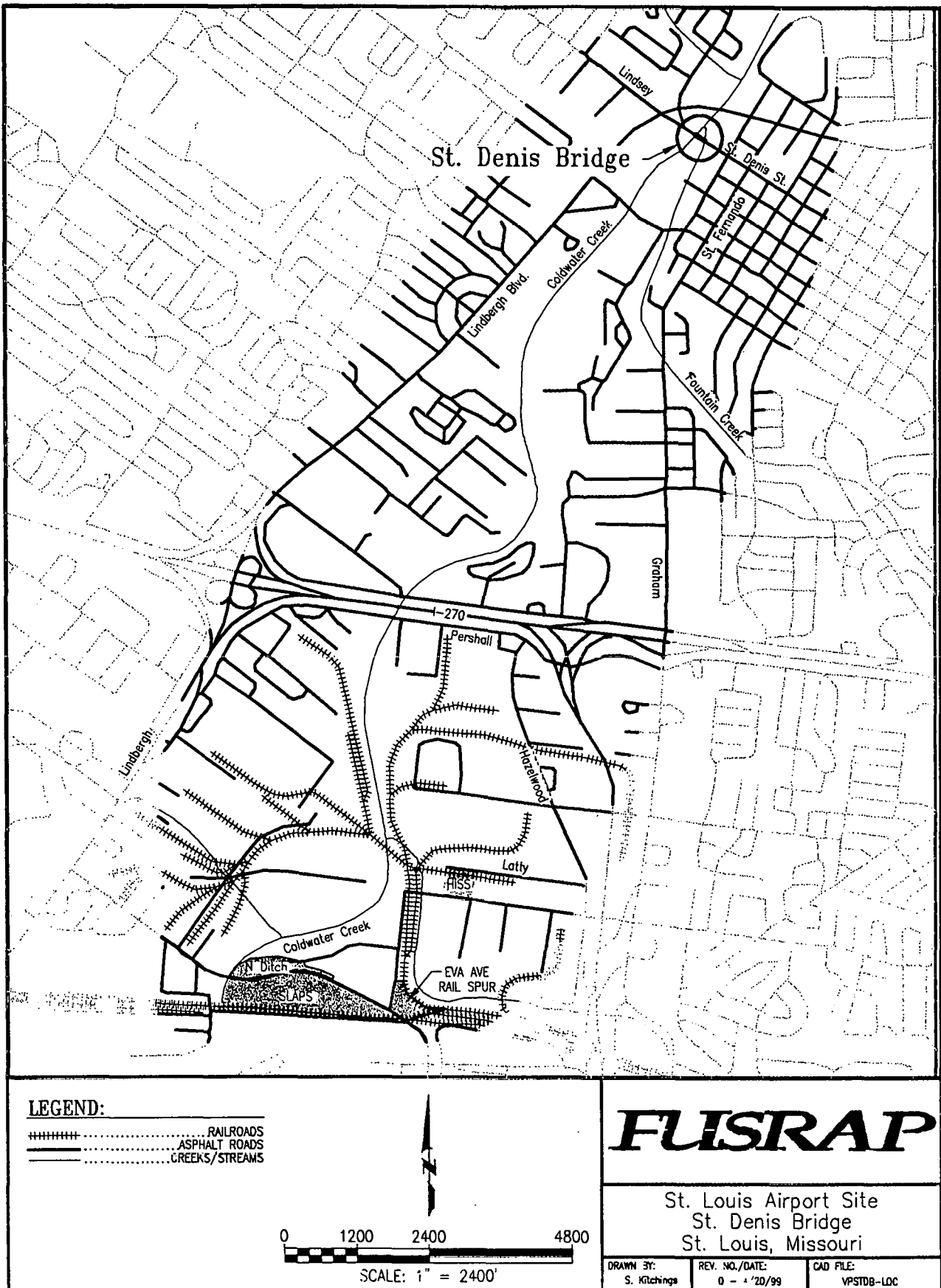


Figure 3. Location of St. Denis Bridge

(pCi/g) and was from a sample taken beneath the concrete placed under the bridge in order to stabilize the creek's bank (Figure 4). No samples collected from Fountain Creek exceeded the concentration-based criteria for the SLAPS vicinity properties (DOE 1997).

Because the results of this sampling activity identified radioactivity levels exceeding guidelines of DOE, the predecessor of the USACE, the area around the St. Denis Street Bridge was designated for remediation prior to the planned construction.

The remediation of the east and west banks of Coldwater Creek was performed from October 21, 1998 through November 12, 1998 by BNI. Details of the remedial action are included in the *Remedial Action Summary Report for the Remediation Activities at St. Denis Bridge – Florissant Missouri* as Appendix A of this document.

After the remedial action was completed, SAIC conducted final status surveys and soil sampling to verify that the residual radioactivity in the remediated area was below the established cleanup goals. Details of the final status survey methodology, and the associated data quality assessment, are included in the *MARSSIM-Based Final Status Survey Plan for the St. Denis Bridge Area – St. Louis, Missouri* (USACE 1998) and the *St. Denis Bridge Final Status Survey Data Quality Assessment* as Appendix B of this document, respectively.

3.0 REMEDIAL ACTION GUIDELINES

The remedial action guideline established for the St. Denis Street Bridge remediation incorporated the guidelines specified in the SLAPS Engineering Evaluation/Cost Analysis (EE/CA) (DOE 1997). The concentration-based remedial action guidelines set forth in the EE/CA are

- 5 pCi/g for Ra-226 or Th-230 and Ra-228 or Th-232 (surface soils, down to 15 cm depth),
- 15 pCi/g for Ra-226 or Th-230 and Ra-228 or Th-232 (subsurface soils, below 15 cm depth), and
- 50 pCi/g for U-238 for all depths.

Because Ra-226 is a decay product of Th-230 and Ra-228 is a decay product of Th-232 and because the radionuclides are not in equilibrium, these individual radionuclides were not compared individually with their respective guideline. Instead, the higher concentration of the Th-230/Ra-226 pair and the Th-232/Ra-228 pair in a particular sample were used for comparison with guidelines (DOE 1997).

The potential presence of multiple contaminants requires that the sum-of-ratios (SOR) criterion for soils be satisfied to meet the guideline specified in the EE/CA. To demonstrate compliance with this criterion the above-background concentration of each of the primary contaminants is divided by the respective guideline level for that radionuclide to determine a ratio to the guideline. The SOR is then determined and compared with unity (1.0) as follows:

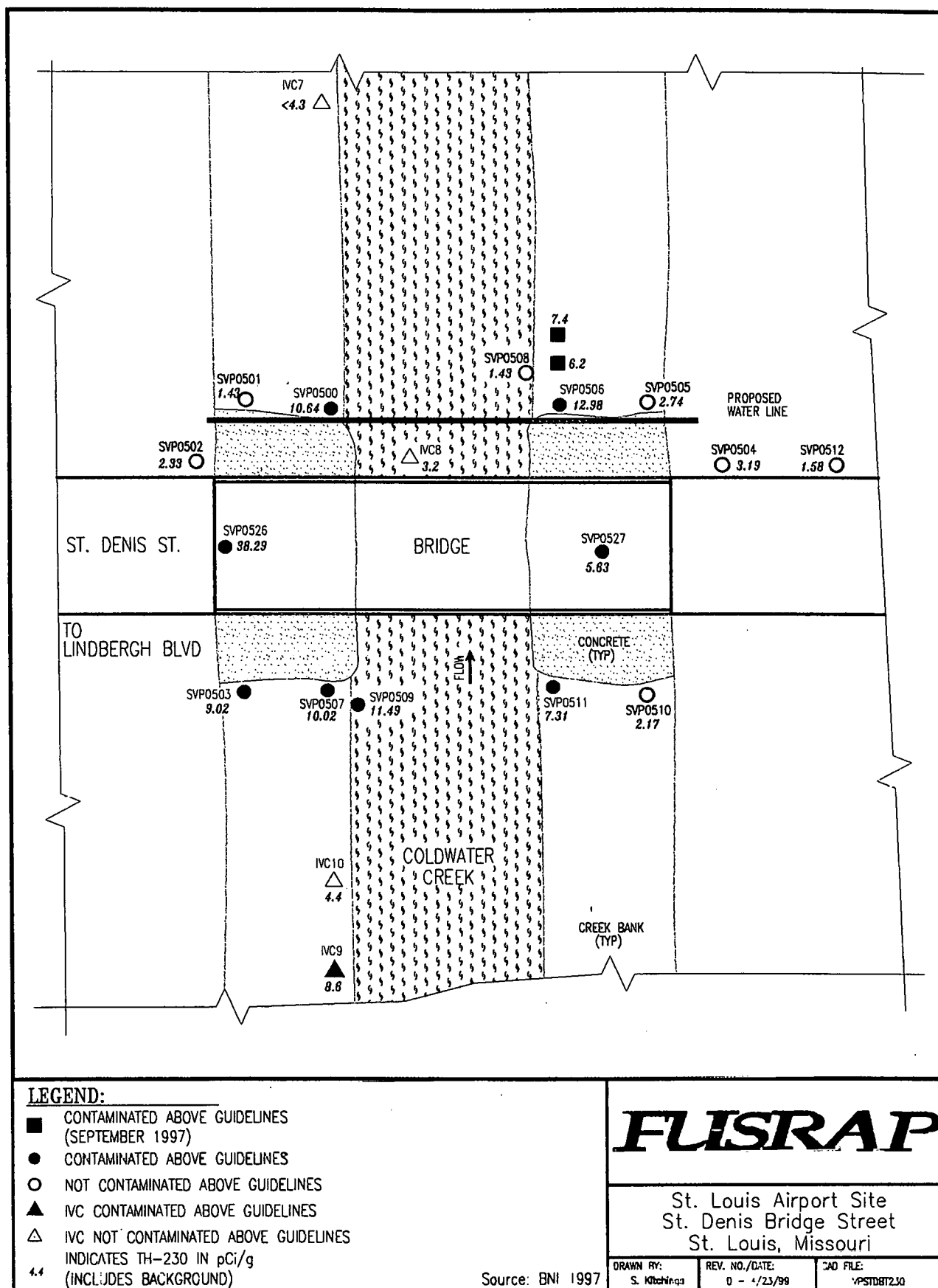


Figure 4. Thorium-230 Concentrations for the Characterization of St. Denis Bridge Area

For the top 15 cm (6 in) of soil,

$$\frac{\text{Higher of Th - 230 or Ra - 226}}{5 \text{ pCi/g}} + \frac{\text{Higher of Th - 232 or Ra - 228}}{5 \text{ pCi/g}} + \frac{\text{U - 238}}{50 \text{ pCi/g}} = \text{SOR}$$

averaged over 100 m².

For 15 cm intervals deeper than the top 15 cm,

$$\frac{\text{Higher of Th - 230 or Ra - 226}}{15 \text{ pCi/g}} + \frac{\text{Higher of Th - 232 or Ra - 228}}{15 \text{ pCi/g}} + \frac{\text{U - 238}}{50 \text{ pCi/g}} = \text{SOR}$$

averaged over 100m².

For an area represented by a particular sample to comply with the soil criteria, the SOR must be less than 1.0.

4.0 REMEDIAL ACTION SUMMARY

The remediation of the area impacted by the replacement of the St. Denis Street Bridge over Coldwater Creek involved the removal of approximately 450 cubic yards (ex-situ) of radioactively contaminated soils and sediments. This material was transported by dump truck to an intermediate loading area near the intersection of McDonnell Boulevard and Eva Avenue in Hazelwood, Missouri (Figure 2), prior to transfer to railroad cars and transport to a licensed radioactively contaminated waste site (Envirocare of Utah) in Clive, Utah.

During the course of the remediation, field surveys were performed and post-remedial action samples were collected. Several post-remedial action samples indicated that there were several small areas of elevated contamination above criteria that required additional remediation beyond the design. After additional soils were removed, these areas were resurveyed and resampled.

After all of the additional areas had been remediated, the areas were subjected to final status verification surveys in accordance with the *MARSSIM-Based Final Status Survey Plan for the St. Denis Bridge Area – St. Louis Missouri* (USACE 1998). Results of the data assessment indicated that the remediated areas could be released to the city of Florissant to begin preparations for the bridge replacement.

Details of the remedial action and post-remedial action survey and sampling activities are included in Appendix A. A detailed discussion of the final status surveys and sampling, as well as the data quality assessment, are included in Appendix B.

5.0 POST-REMEDIAL ACTION MEASUREMENTS

As each area was remediated, a reference grid was established in the remediated area and in the boundary areas. The reference grid for post-remedial action sample collection is described in Appendix A. The reference grid established for the collection of final status samples is described in USACE 1998.

5.1 SURVEY MEASUREMENTS

During the excavation of contaminated soils, sodium iodide radiation detection instruments were used to detect areas of elevated activity. When an area was completely excavated, a 100 percent walkover survey was also performed with the sodium iodide radiation detection instrument and documented prior to the collection of post-remedial action samples. Locations exceeding the action level established in the field were investigated and either sampled or remediated as deemed appropriate. When additional soils were removed, the area was re-scanned to demonstrate effectiveness of the remediation.

The field radiation detection survey instruments (and their functional and performance specifications) used during the surveys are listed in the table below. Detection sensitivities were determined following the guidance of NUREG-1507 (NRC 1998).

Radiological Field Survey Instruments

Description	Application	Approximate Detection Sensitivity (pCi/g)
Ludlum Model 44-10; 2-inch x 2-inch NaI gamma scintillation detector	Gamma scans of all surfaces	Th-230=2120; Ra-226=2.8; and U-238= 39
Ludlum Model 2221; Scaler/ratemeter (with earphones)	Readout instrument for gamma scintillation detector	N/A

Refinements to the detection sensitivity estimates were made, as necessary, on the basis of actual instrument response and background data gathered during site survey activities.

5.2 SOIL SAMPLING

After areas were surveyed using the sodium iodide radiation detector and post-remedial action samples indicated the area was below criteria, a random-start sampling location pattern was established, and soil samples were collected following the Final Status Survey Plan (USACE 1998). Samples were collected (approximately 1 kg of soil per sample) from a depth of 15 cm, packaged and uniquely identified in accordance with chain-of-custody and site-specific procedures and transported to the Hazelwood Interim Storage Site (HISS) onsite laboratory for analysis.

5.3 SAMPLE ANALYSIS

Samples were transferred to the USACE-certified radioanalytical laboratory located at the HISS for analyses in accordance with documented laboratory-specific standard methods (SAIC 1999). Samples were dried, homogenized, and then composited from aliquots of three individual samples obtained from contiguous locations. Figure 5 shows the location for each group of samples that were composited in the laboratory prior to analysis. After aliquots were taken, the remainder of each individual sample was retained for possible further evaluation.

5.4 DATA EVALUATION

The evaluation of final status sample data included the calculation of the sum-of-ratios to determine if the SOR exceeded 1.0 in order to determine compliance with the EE/CA guideline. Since no individual sample results (for composite samples) exceeded 1.0, further analysis of the three individual samples comprising the composite was not required. The maximum possible concentration of each sample comprising the composite was also calculated. Only 2 of the 15 composites could be shown to have the potential for having a sample comprising the composite that exceeded a SOR of 1.

Where additional remediation was performed, based on survey or sampling results, scans and sampling of the re-excavated area were repeated. Where screening analyses did not indicate residual activity in excess of limits, an aliquot was obtained from each composite sample for Th-230 analysis, and the remainder of the composite was sealed in calibrated-geometry containers for high-resolution gamma spectrometry.

A minimum of 5 percent replicate samples were collected for field quality control purposes. Other quality control activities were incorporated into specific field and analytical procedures.

Due to the moisture of the soils being removed and the predominance of alpha-emitting radionuclides present in the soils, decisions regarding the completeness of the excavation were based primarily on soil sample analytical results.

6.0 POST-REMEDIATION STATUS

The analytical results for all post-remediation samples and subsequent final status (verification) samples indicated that the residual radioactivity in the St. Denis Street Bridge construction area meet the requirements of the remedial design and are below the concentration-based guidelines. No SOR calculated for final status survey samples exceeded 1.0. Table 1 summarizes the final status sample results for the primary radionuclides detected in composite samples. Figure 5 presents the Th-230 concentrations in the final status samples collected in the remediated area. The complete final status sample data set is presented in Appendix B of this report.

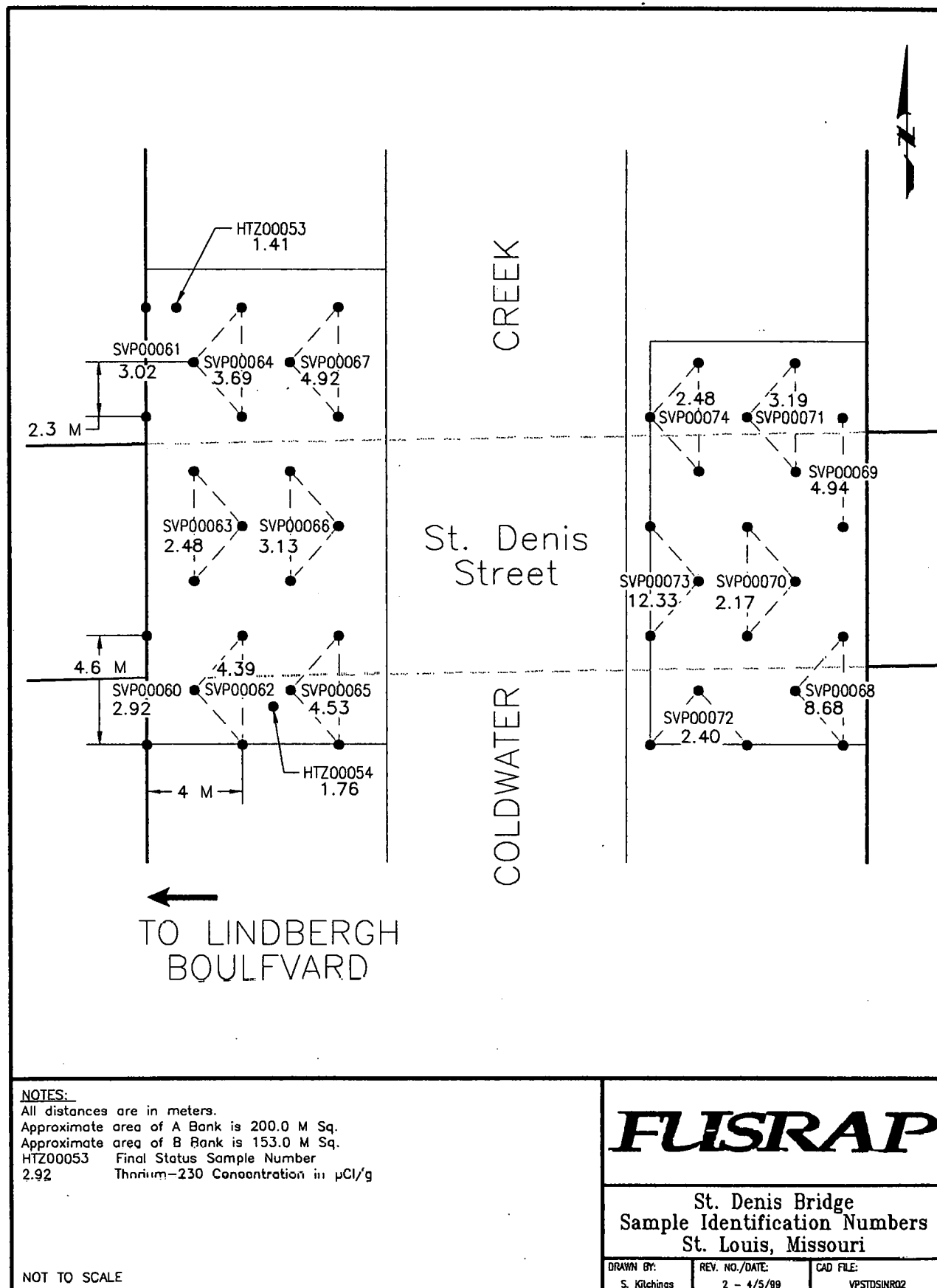


Figure 5. Thorium-230 Concentrations in Final Status Survey Samples

In addition to evaluating the data against the cleanup criteria established by the EE/CA, dose calculations were performed to determine the dose to the potential maximally exposed individual. This assessment revealed that a construction worker involved in the bridge replacement, would receive a dose of less than 1 mrem for the duration of the job (i.e., 1 mrem over 2 months). The detailed evaluations performed to verify compliance with the criteria are included in Appendix B of this report.

On November 23, 1998, the USACE informed the city of Florissant that the soils with residual radioactive contamination above criteria in the areas impacted by the new bridge installation had been removed.

Table 1. Summary of Final Status Samples Results from the St. Denis Street Bridge Area

Statistic/Sample	Area (m ²)	Th-230 (pCi/g)	Ra-226 (pCi/g)	Th-232 (pCi/g)	Ra-228 (pCi/g)	U-238 ^a (pCi/g)	SOR _G (15/15/50)	SOR _N (15/15/50)
SVP00060	18.2	2.92	0.96	0.72	0.88	1.34	0.280	0.086
SVP00061	18.2	3.02	0.80	1.02	0.50	1.75	0.304	0.100
SVP00062	27.3	4.39	1.03	1.10	0.85	1.39	0.394	0.185
SVP00063	27.3	2.48	0.89	0.86	0.57	0.88	0.240	0.054
SVP00064	27.3	3.69	1.07	0.65	0.73	0.08	0.296	0.135
SVP00065	27.3	4.53	1.23	0.76	0.86	1.65	0.392	0.199
SVP00066	27.3	3.13	1.09	1.12	0.88	1.46	0.313	0.102
SVP00067	27.3	4.92	1.24	0.99	0.99	2.21	0.438	0.236
SVP00068	23.1	8.68	0.69	0.69	0.76	2.77	0.685	0.498
SVP00069	15.4	4.94	0.72	0.71	0.68	0.99	0.396	0.218
SVP00070	23.1	2.17	0.68	1.03	0.58	1.12	0.236	0.033
SVP00071	23.1	3.19	0.75	1.04	0.95	0.85	0.299	0.101
SVP00072	23.1	2.40	0.57	0.55	0.62	1.35	0.228	0.051
SVP00073	23.1	12.33	0.74	0.66	0.60	0.80	0.882	0.711
SVP00074	23.1	2.48	0.66	1.68	0.81	0.48	0.287	0.054
HTZ00053	2.8	1.41	0.69	1.05	0.91	1.17	0.187	0.000
HTZ00054	1.1	1.76	0.63	1.50	0.67	1.60	0.249	0.013
Average	NA	4.03	0.85	0.95	0.76	1.29	0.36	0.16
Average Background	NA	1.67	1.21	1.18	1.02	1.23	NA	0.22

^a All measurements were below the minimum detectable activity (MDA).

7.0 REFERENCES

BNI 1997. Memorandum from K.A. Albin (BNI) to S. Honig (MDNR), *St. Louis Site VPs – Coldwater Creek Sample Results in the Vicinity of the St. Denis Avenue Bridge*, December 3, (CCN 134-TBA-GET-00002).

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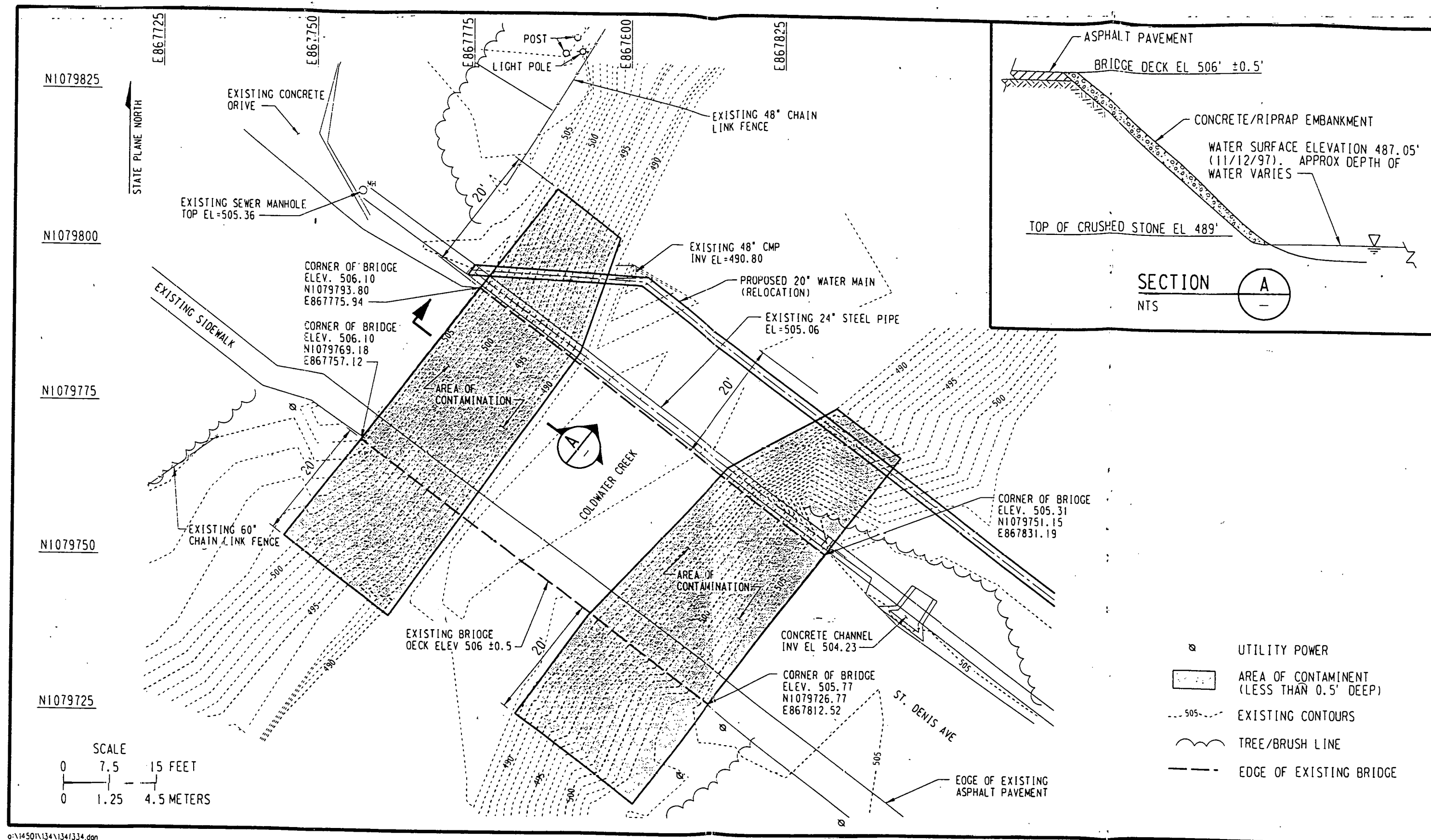
USACE 1998. *MARSSIM-Based Final Status Survey Plan for the St. Denis Bridge Area – St. Louis, Missouri*, draft prepared by Science Applications International Corporation, November.

APPENDIX A

**REMEDIAL ACTION SUMMARY REPORT FOR THE REMEDIATION ACTIVITIES
AT ST. DENIS BRIDGE, FLORISSANT, MISSOURI**

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15 APR 1999

ST. LOUIS VICINITY PROPERTIES
ST. DENIS AVENUE BRIDGE
SITE PLAN AND SECTION

Figure 1

1.0 INTRODUCTION

This report documents the remedial action conducted at the St. Denis Bridge in Florissant Missouri, as part of the United States Army Corps of Engineers (USACE) Formerly Utilized Remedial Action Program (FUSRAP). At the request of the USACE, Bechtel remediated a small portion of the banks along Coldwater Creek in support of the City of Florissant planned replacement of the St. Denis Bridge.

During the summer of 1997, (BNI, 1997) radiological contamination slightly above current cleanup guidelines was detected adjacent to and beneath the St. Denis Bridge. To better define the extent and boundary of contamination in the immediate area of the bridge, Bechtel conducted additional sampling activities within the bridge replacement area. The radiological data from this boundary delineation sampling activity was used to outline and design the original areas requiring remediation (Figure 1). Approximately 450 ex-situ cubic yards of contaminated soil and debris were removed during the remediation of the bridge replacement area. An estimated 200 ex-situ cubic yards of the soil was removed beyond the original design volume of 250 ex-situ cubic yards due to excavation techniques. The contaminated soil was transported by truck to the Eva Road loading area for shipment to an offsite disposal facility. The concrete and metal debris removed from the bridge abutments were shipped to a lay-down area at SLAPS and radiologically surveyed prior to disposal. Disposition of all material removed from St. Denis bridge was handled and determined by the USACE SLAPS remediation contractor. Remediation activities were completed on November 12, 1998. On November 23, 1998, the USACE gave the city's contractor verbal concurrence to begin their intrusive work for the bridge replacement.

2.0 CHRONOLOGY OF EVENTS

In mid-October 1998, the city's contractor performed several tasks in preparation of Bechtel's remediation activities. The bridge replacement area was closed and traffic was redirected. The city's contractor was also required to excavate a small area northwest of the existing bridge to install a shutoff water valve to stop the flow from the 12 - inch water main attached to the bridge. In addition, the contractor was also required to install a replacement water main adjacent to the water valve. This installation involved excavating along both creek banks and underneath the creek sediment. As a precaution, the USACE requested that Bechtel provide radiological monitoring of the city's contractors and their equipment throughout the excavation and water main replacement activities. Once the shutoff water valve was installed, the contractor then removed the bridge decking to expose the creek banks requiring remediation. Bechtel began remediation activities at the site on October 21, 1998.

The final design for remediating the St. Denis Bridge replacement area was completed by Bechtel in mid-October 1998. Once the remediation design drawings were completed, Bechtel held a readiness briefing with representatives from the USACE and Missouri Department of Natural Resources (MDNR) on remediation activities planned

for the St. Denis Bridge remediation. The October 16, 1998 meeting focused on a thorough review of the safety, logistic, transportation, and construction activities involved during remediation activities. In addition, technical issues involving the sampling and the USACE final verification of these areas after the remediation action was completed were also discussed. There were no outstanding issues or concerns raised by the USACE or MDNR resulting from the briefing. Permission to proceed with the remediation was granted by the USACE at the end of the briefing.

The remediation of the west bank of the Coldwater Creek was performed from October 21 through 23 1998. All of the excavated contaminated material removed from the bank was loaded directly onto trucks for shipment to the Eva Road loading area or SLAPS. Once the west bank excavation activities were completed, Bechtel begin their west bank post remedial walkover surveys and sampling activities (Attachment A). On October 26, 1998, the west bank was turned over to the USACE for their final status verification survey.

Excavation activities were started on the east bank on October 27, 1998. The east bank initial excavation was completed on October 28, 1998 and post remedial action samples were taken (Attachment A). On October 29, 1998, results from Bechtel's post remedial action samples taken from the east bank revealed a small area of elevated contamination. On November 4, 1998, site workers began to remediate this area by using hand excavation techniques. After a few days of hand excavation, preliminary radiological field surveys indicated that hand excavation techniques were unsuccessful. On November 6, 1998, Bechtel elected to use heavy equipment to removed the remaining contaminated soil from the creek bank. Field instruments were used to determine that the area was remediated and no post remedial action was performed. On November 12, the east bank was turned over to the USACE for their final status verification survey.

On November 23, 1998, the USACE gave the city's contractors verbal concurrence to begin their intrusive work for the bridge replacement.

3.0 PERFORMANCE STANDARDS

The site specific cleanup levels were 5 pCi/g Th-230 in the top 15 cm of soil and 15 pCi/g of Th-230 in any 15 cm layer of soil below that. These criteria were adopted by USACE following their assumption of the management of FUSRAP from the U.S. Department of Energy (DOE) in 1997. The grid layouts and sampling results are shown in Attachment A.

Table 6 of "Engineering Evaluation/Cost Analysis – Environmental Assessment for the Proposed Decontamination of Properties in the Vicinity of the Hazelwood Interim Storage Site, Hazelwood, Missouri"(USDOE 1992), provides the major mitigative measures required for the proposed action of remediating the vicinity properties in the North County. These measures were implemented as discussed in Section 4.0 of this report.

Approximately 450 ex-situ yd³ of contaminated soil was excavated from this vicinity property. Post remedial action sampling of the excavated areas was conducted in preparation for final status verification survey by the USACE. Each area that was remediated was gridded into areas of approximately 100 m² where possible (Attachment A). A 25 point composite sample was collected from each grid to be analyzed to demonstrate that the area was remediated to below the criteria noted above. Prior to the sampling process, each grid was subject to a gamma-ray walkover scan to detect any residual activity above background in the soil.

4.0 CONSTRUCTION ACTIVITIES

In mid-October 1998, the city's contractor began performing several tasks in preparation of Bechtel's remediation activities. In support of these activities, the USACE requested that Bechtel provide radiological monitoring to the city's contractor throughout these tasks. Radiological support included the surveying of personnel and equipment, ensuring that personal protective equipment (PPE) was provided and used if required, and providing air monitoring during work activities. The city's contractor was required to excavated a small area northwest of the existing bridge to install a shutoff water valve to stop the flow from the 12 - inch water main attached to the bridge. Once the shutoff water valve was installed, the contractor then removed the bridge decking to expose the creek banks requiring remediation. A small amount of clearing and grubbing of vegetation along both sides of the creek bank was also performed. Their next task was to begin the excavation for the installation of a replacement water main adjacent to the water valve. This installation involved excavating along both creek banks and underneath the creek sediment.

Prior to the start of Bechtel's remediation activities at the site on October 21, 1998, all of the underground utilities were located and identified. All of the site workers received a site briefing which included a discussion of the appropriate industrial and radiological safety issues prior to beginning work on the site. In addition, initial radiological entry surveys were conducted on the equipment used to performed excavation activities. Erosion control measures were also put in place to prevent contaminated material from entering the creek.

Remediation activities were conducted along the west bank of Coldwater Creek from October 21 through October 23, 1998. All of the excavated contaminated material removed from the bank was loaded directly onto trucks for shipment to the Eva Road loading area or SLAPS. A total of 18 truck loads of concrete and metal debris were removed and transported for SLAPS for disposition and 9 trucks loads of contaminated soil were transported to the Eva Road loading area for offsite disposal. Each truck was lined and covered with a tarp prior to shipment and held between 15 to 20 cubic yards (ex-situ) of contaminated material. Once the west bank excavation activities were completed, Bechtel utilized applicable DOE standard and guideline sampling protocol (DOE 5400.5) to determine if additional contamination existed within a specific area of excavation. Post remedial surveys included direct surface measurements and external

gamma exposure rates from the remedial areas. In addition, two 100 m² grids were established along the creek banks and 25 plug composite samples were taken from each grid. Each composite sample was analyzed for the radiological contaminants of concern and compared USACE's current cleanup guidelines. Any areas found to be contaminated above criteria were excavated and re-sampled to ensure that they met the current cleanup guidelines prior to being released to the USACE for their final status verification survey. On October 26, 1998, the west bank was turned over to the USACE for their final status verification survey.

Excavation activities were started at the east bank on October 27, 1998. The east bank initial excavation was completed on October 28, 1998 and post remedial action samples were taken. A total of three truck loads of concrete and metal debris were removed and transported to SLAPS for disposition. Six truck loads of contaminated soil was also transported to the Eva Road Loading Area for offsite disposal. Once the east bank excavation was completed, Bechtel utilized the same applicable DOE standard and guideline sampling protocol (DOE 5400.5) used at the west bank to determine if additional contamination existed within a specific area of excavation. Analytical results received on October 29, 1998, revealed small area of elevated contamination within a small area of the east bank. On November 4, 1998, site workers began to remediate this area by using hand excavation techniques. After a few days of hand excavation, preliminary radiological field surveys indicated that hand excavation techniques were unsuccessful. On November 6, 1998, Bechtel elected to use heavy equipment to removed the remaining contaminated soil from the creek bank. As a result, an additional 12 truck loads of contaminated soil were removed from this area. Approximately 200 ex-situ cubic yards of soil was removed beyond the original design volume of 250 ex-situ cubic yards. On November 12, the east bank was turned over to the USACE for their final status verification survey.

During the St. Denis Bridge remediation project, engineering and administrative controls were used to protect remediation workers and members of the public from potential exposure to radiation in excess of applicable standards. Additionally, PPE was used for protection of workers. These controls were outlined in a site-specific safety and health plan (BNI 1993). Measures were also taken to minimize the potential for migration of radioactive contaminated material to adjacent, uncontaminated areas of the site and Coldwater Creek. Barriers were placed at the bottom of the bank, where possible, below the working areas to prevent soil from reaching the creek.

Restricted work areas were set up around the remediation areas, and access was controlled by physical barriers, postings, and signs. Because the decontamination activities involved potential exposure to radioactivity contaminated material, work was performed under hazardous work permits issued by the site safety and health representative. The hazardous work permits specified PPE to be used and also provided specific safety and health instructions for various tasks. Work in contaminated areas required Tyvek coveralls, gloves, hard hats, safety glasses, and sturdy work boots.

Fugitive dust emissions were controlled to minimize safety and health risks to site workers and the public from radioactive material. Dust-control measures were

implemented during demolition, excavation, loading, and transportation of radioactive materials to prevent the spread of contamination. Dust-control techniques included curtailing activities during unusually windy conditions, employing dust-suppression techniques such as water sprays, and constructing environmental barriers such as silt fences and tarpaulins. Water usage was kept to a minimum to reduce disposal volumes and to prevent the spread of contamination. Ambient air monitoring was also conducted at the excavation sites. The airborne concentrations were compared with the applicable guideline, derived air concentrations (DAC). The DAC is 7.0×10^{-12} $\mu\text{Ci/ml}$ (10 CFR 835) for occupational exposures to airborne thorium-230, the contaminant of concern at St. Denis Bridge. The air results were below criteria. All equipment was surveyed, and if found to be above the release criteria, would have been decontaminated before it was removed from the controlled area. No equipment was surveyed above the release criteria (concentrations in the soil were very low).

Workers exiting controlled areas were subjected to a radiological survey (frisk) at the control point by a health physics technician with a hand-held Geiger-Mueller radiation detection instrument. PPE worn by the workers that was suspected or known to be contaminated was packaged and shipped to a licensed disposal facility.

5.0 FINAL INSPECTION

The final inspection included a review of the results of the grid based sampling results. All grids passed the criteria. The results confirmed that these areas were remediated to current guidelines. Areas were turned over to the USACE for final inspection.

6.0 CERTIFICATION THAT REMEDY IS OPERATIONAL AND FUNCTIONAL

No portion of the remedy for this property required an ongoing treatment of wastes, soils, or water.

7.0 SUMMARY OF PROJECT COSTS

Total cost of the St. Denis Bridge remediation was approximately \$122 K. This cost includes remedial design, excavation, and transportation to SLAPS.

REFERENCES

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Fiore, J.J., 1990, memorandum to L.K. Price, "Uranium Cleanup Guidelines for St. Louis, Missouri, FUSRAP Sites," BNI CCN 072982 (November 6).

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DOE Order 5400.5. Radiation Protection of the Public and the Environment.

ATTACHMENT A
ST. DENIS BRIDGE REMEDIATION
POST REMEDIAL ACTION SAMPLING RESULTS

SCREENING SAMPLE DATA
COMPOSITE SAMPLES^{A,B,C}
MARCH 10, 1999

Sample ID	Vicinity Property	Thorium-230 (pCi/g)	Sample	Explanation of Location
SVP0598	St. Denis Bridge	1.52	Discrete	Waterline
SVP0599	St. Denis Bridge	0.00*	Discrete	Waterline
SVP0612	St. Denis Bridge	2.88	Discrete	Brush removal
SVP0613	St. Denis Bridge	4.77	Discrete	Brush removal
SVP726A	St. Denis Bridge	3.36	Discrete	East Bank Pit
SVP727A	St. Denis Bridge	1.82	Discrete	East Bank Removal
SVP728A	St. Denis Bridge	0.00*	Discrete	East Bank Abutment Removal
SVP729A	St. Denis Bridge	0.34	Discrete	West Bank Abutment Removal
SVP730A	St. Denis Bridge	1.96	Discrete	West Bank Stock Pile
SVP731A	St. Denis Bridge	0.00*	Discrete	East Bank Stock Pile
SVP0832	St. Denis Bridge	21.41	Discrete	West Bank
SVP0861	St. Denis Bridge	14.12	Discrete	West Bank
SVP0862	St. Denis Bridge	3.61	Composite	Grid A West Bank
SVP0863	St. Denis Bridge	6.05	Composite	Grid B West Bank
SVP0864	St. Denis Bridge	5.5	Discrete	Stock Pile
SVP0865	St. Denis Bridge	2.16	Discrete	East Bank
SVP0933	St. Denis Bridge	360	Discrete	North side of East Bank
SVP0934	St. Denis Bridge	48	Discrete	East Bank Center
SVP0935	St. Denis Bridge	2.8	Composite	East Grid Bank Removal

^a Includes background levels for the St. Louis area.

^b Subsurface Soil.

^c See Figures in Attachment A to locate sample locations.

* Analytical results were performed by gamma-spec, and the values came out as negative numbers with an error of \pm that of MDA.

Note 1: DOE Order 5400.5 is the criteria used to compare results.

Note 2: All data is preliminary and final data is being validated by the USACE. See Attachment A.

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RADIOLOGICAL LAB: Hiss On-Site Lab
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 JOB NO: _____
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TEMP: _____

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WORK ORDER NO: 1
COOLER NO: 1

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 JOB NO: _____
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COOLER
TEMP: N/A

NEW BATCH NO: _____
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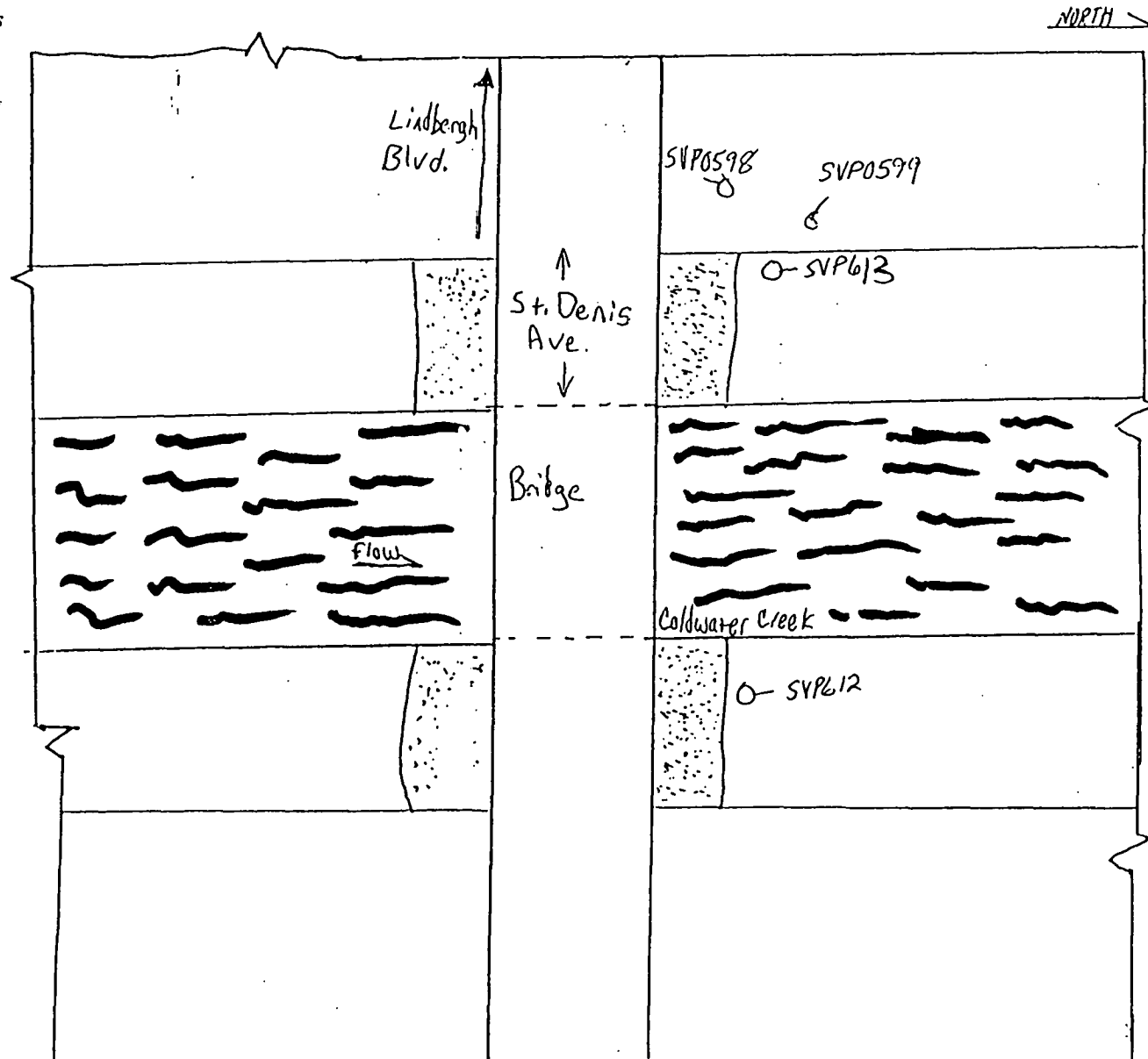
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FUSRAP Survey Information Sheet

JA-RO F2
Version 2 (3/2/97)

Survey Drawing/Description/Comments



General Information

Survey ID:

Site / WBSID: S/aps VP St Denis

Tech(s): C. James

Page: 1 of 1

Comments: Map of sample locations. O = sample locations

Chain of Custody Record

COG ID: 154901009
FACILITY ID: Slaps VP St. Denis
SITE ID: _____
SAMPLING EVENT: _____
SERIAL ID: _____

CHEMICAL LAB: _____
WORK ORDER NO: N/A
COOLER NO: _____
MY MATCH NO: _____
PRIORITY: (1) (5) (2) (3) (4) (5) (6) (7)

RADIOLOGICAL LAB: H155 Unsited 196
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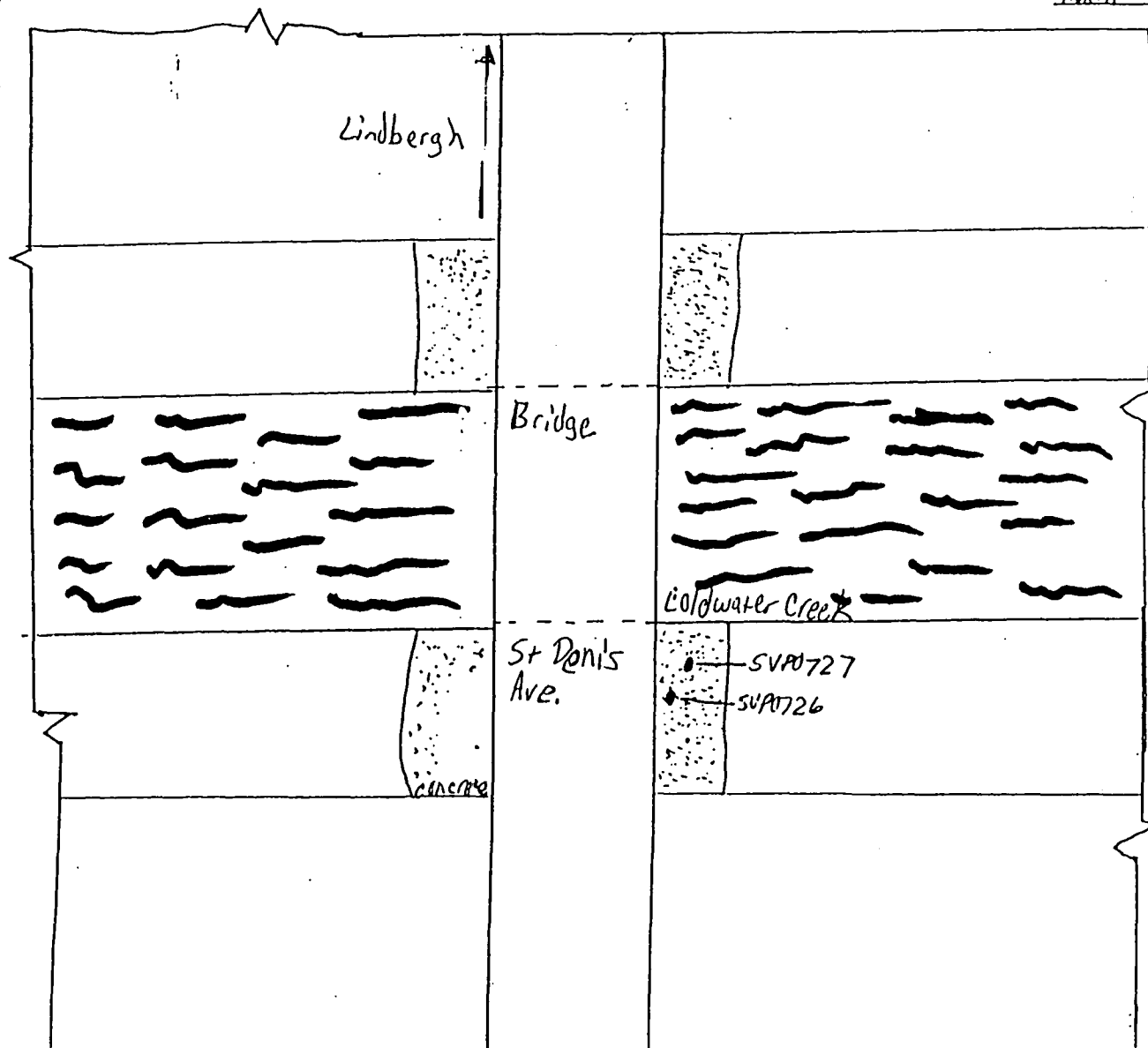

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Survey Drawing/Description/Comments

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General Information

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Site / WBS #: Slaps VP St Denis

Tech(s): C. Samos

Comments: Map of sample locations.

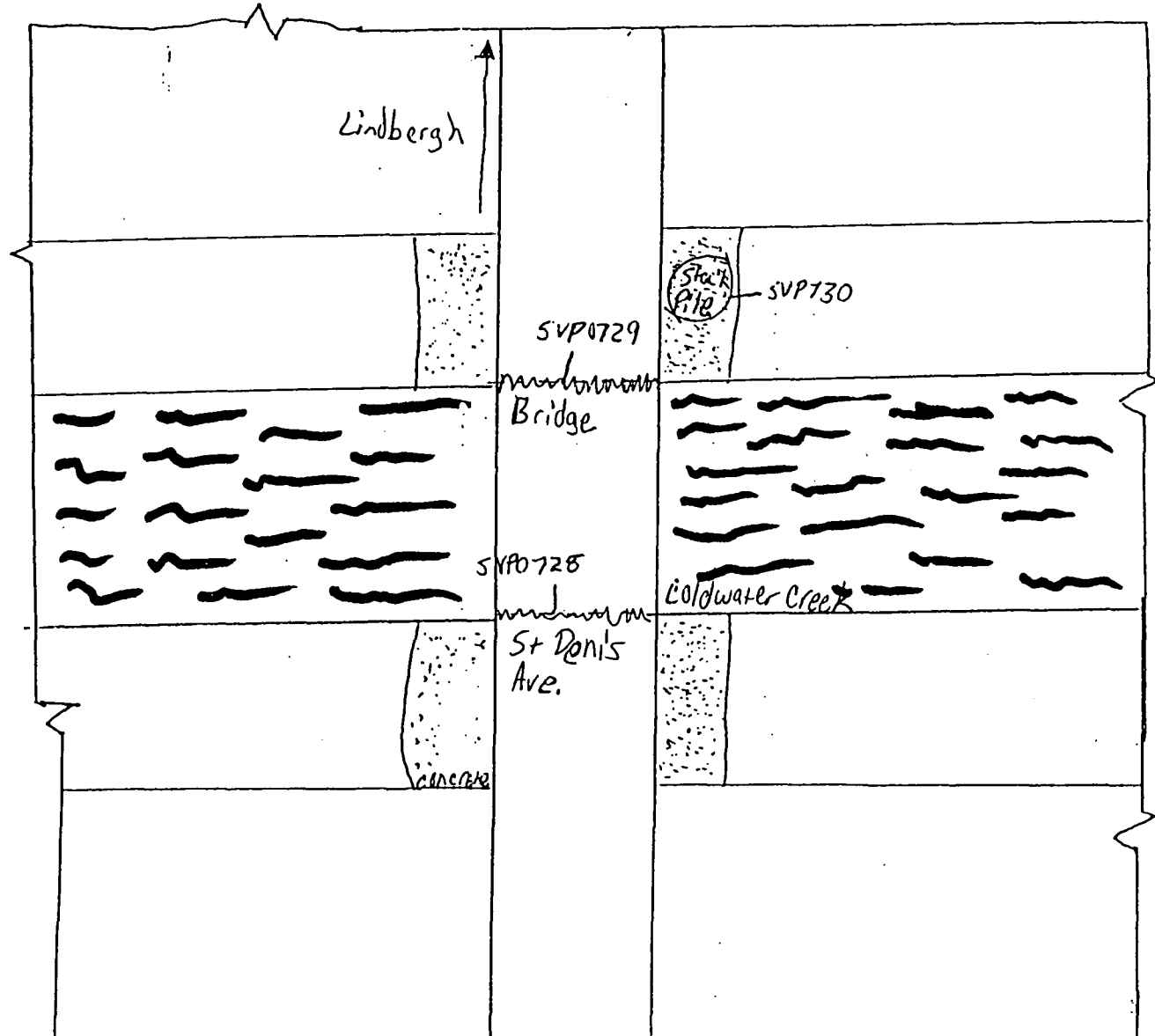
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FUSRAP Survey Information Sheet

JA-RO- F2
Version 2 (5/5/97)

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NORTH →



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Site / WBSII: Slaps VP St Denis

Tech(s): C. James

Comments: Map of Sample Locations.

Page: 1 of 1

101

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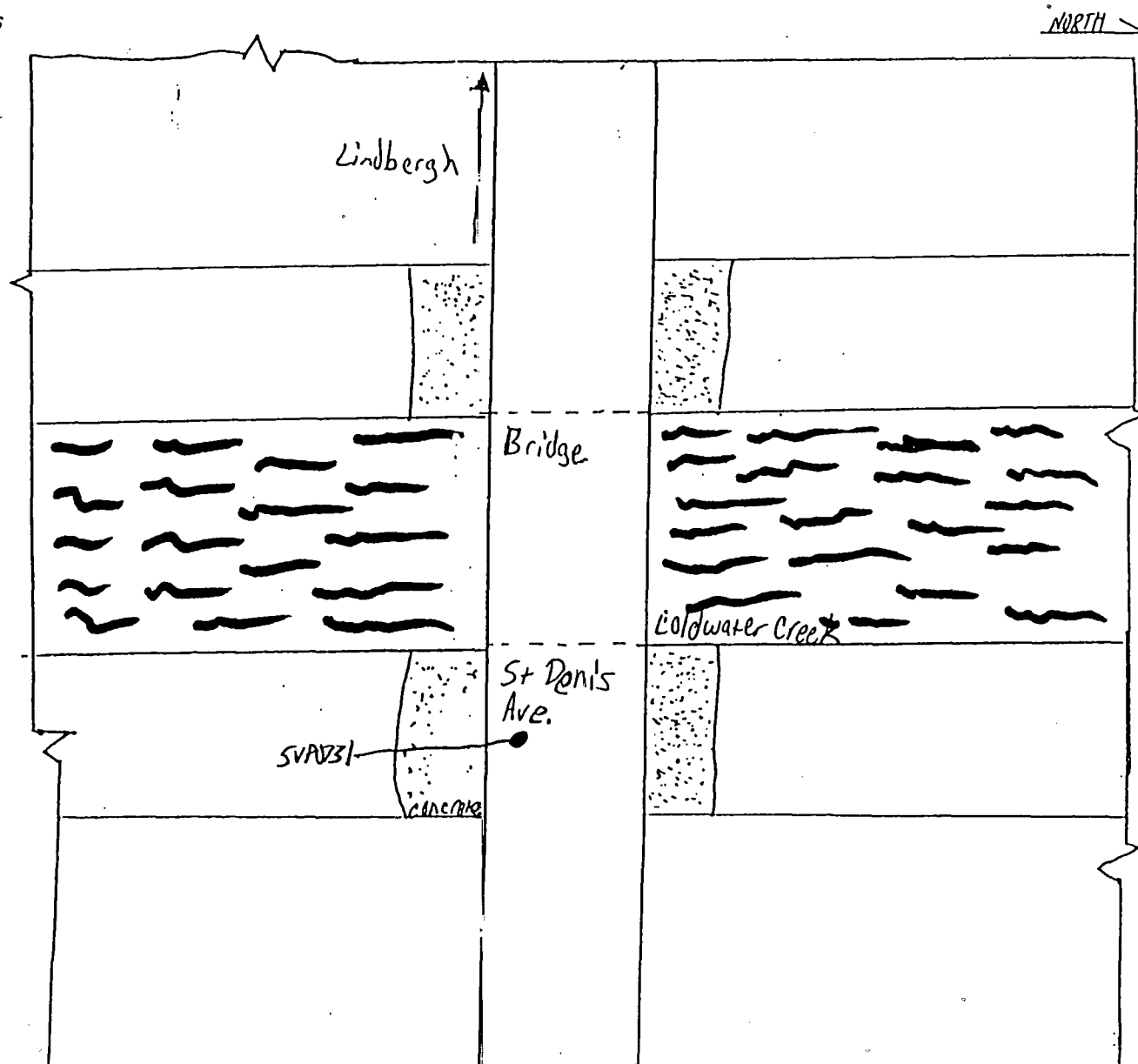
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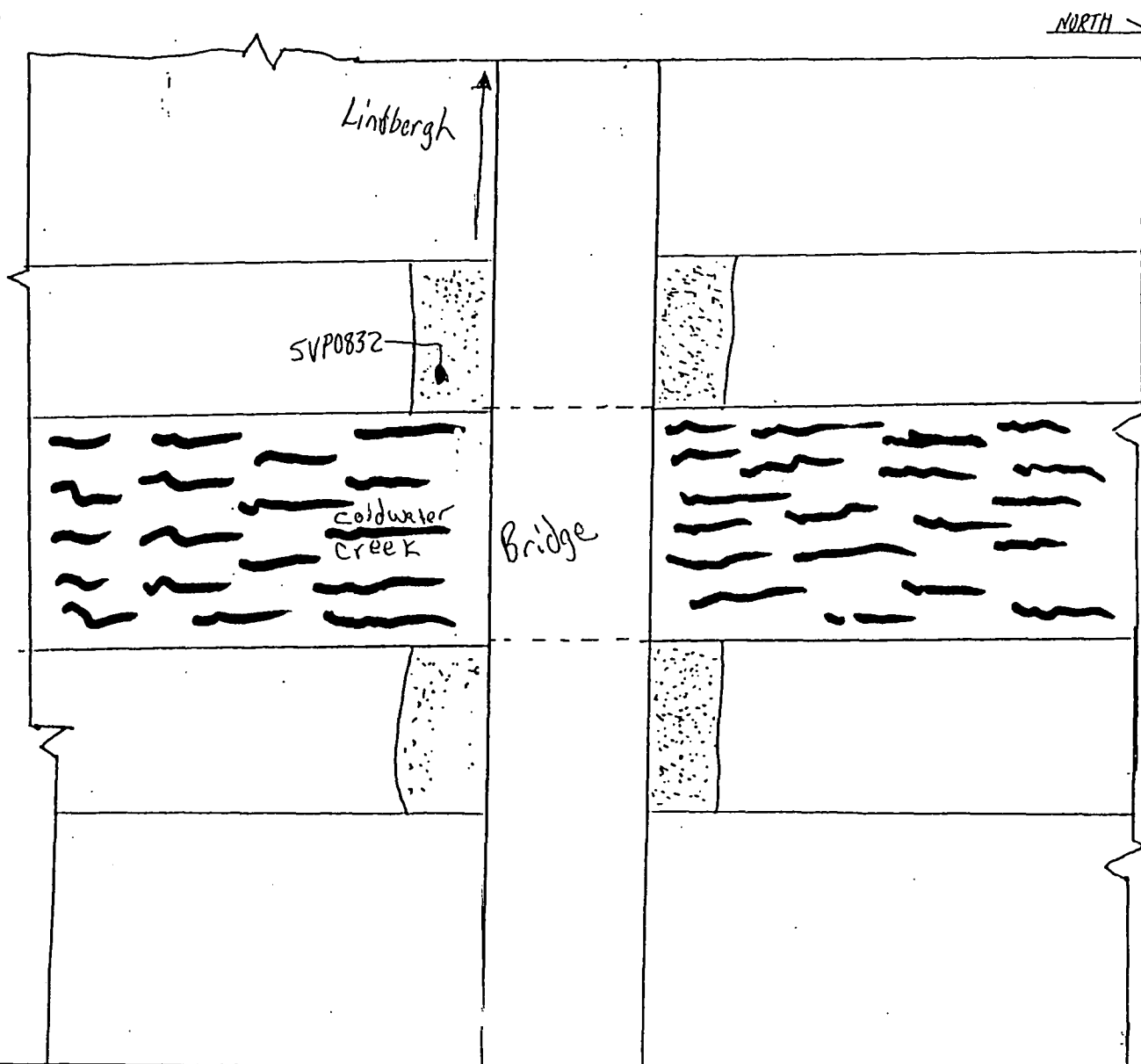
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Site / WNSII: Slops VP St DenisTech(s): C. SamosComments: Map of sample locations.Page: 1 of 1

FUSRAP Survey Information Sheet

JA-RC F2
Version 2 (5/5/97)

Survey Drawing/Description/Comments



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Site / WBSII: Slaps VP St Denis

Tech(s): C. James

Comments: Map of Sample Locations

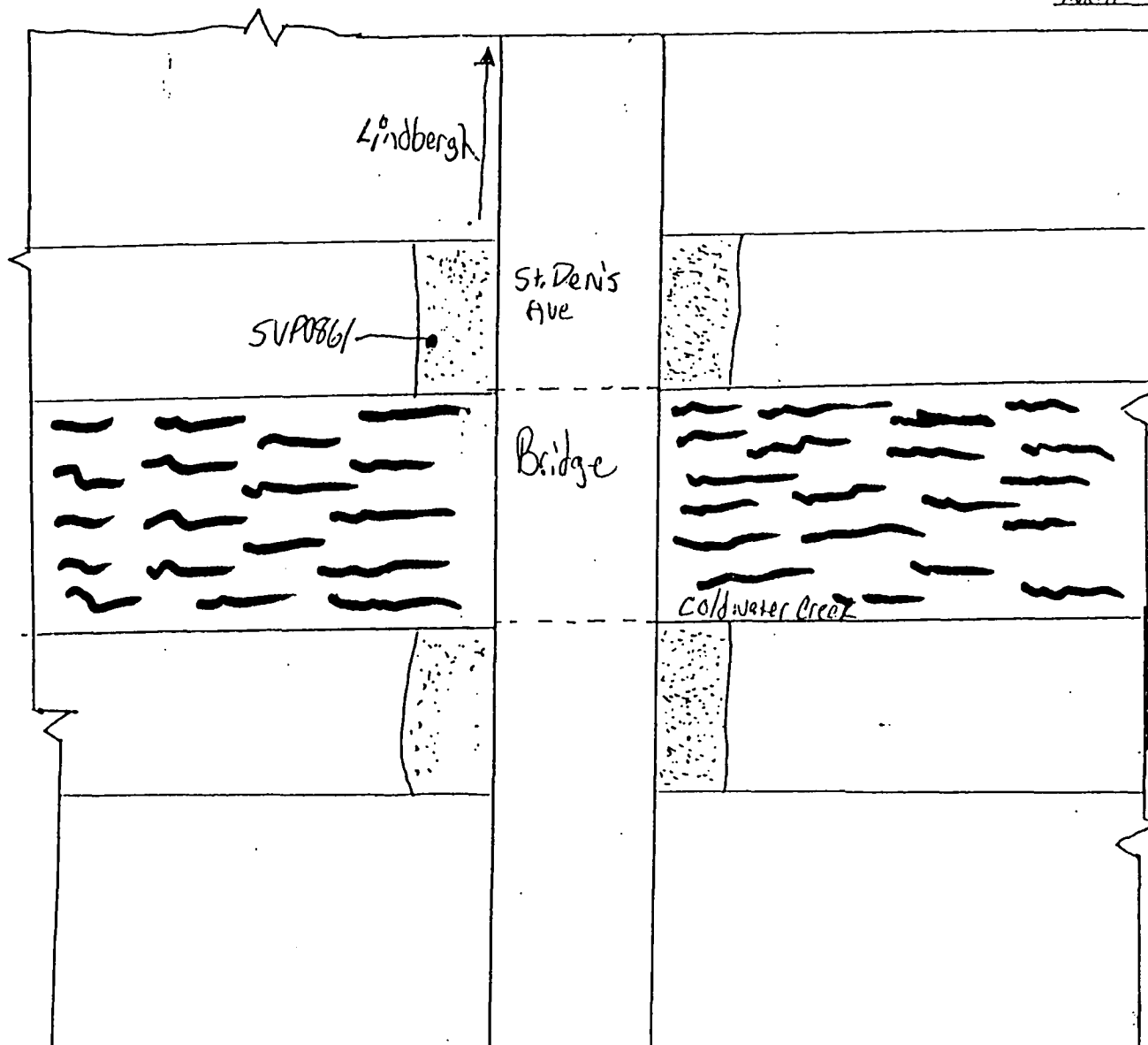
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FUSRAP Survey Information Sheet

JA-RO-11-12
Version 2 (7/97)

Survey Drawing/Description/Comments

NORTH →



General Information

Survey #:

Site / WBSH: Slaps VP St Denis

Tech(s): C. James

Comments: Map of Sample locations.

Page: 1 of 1

101

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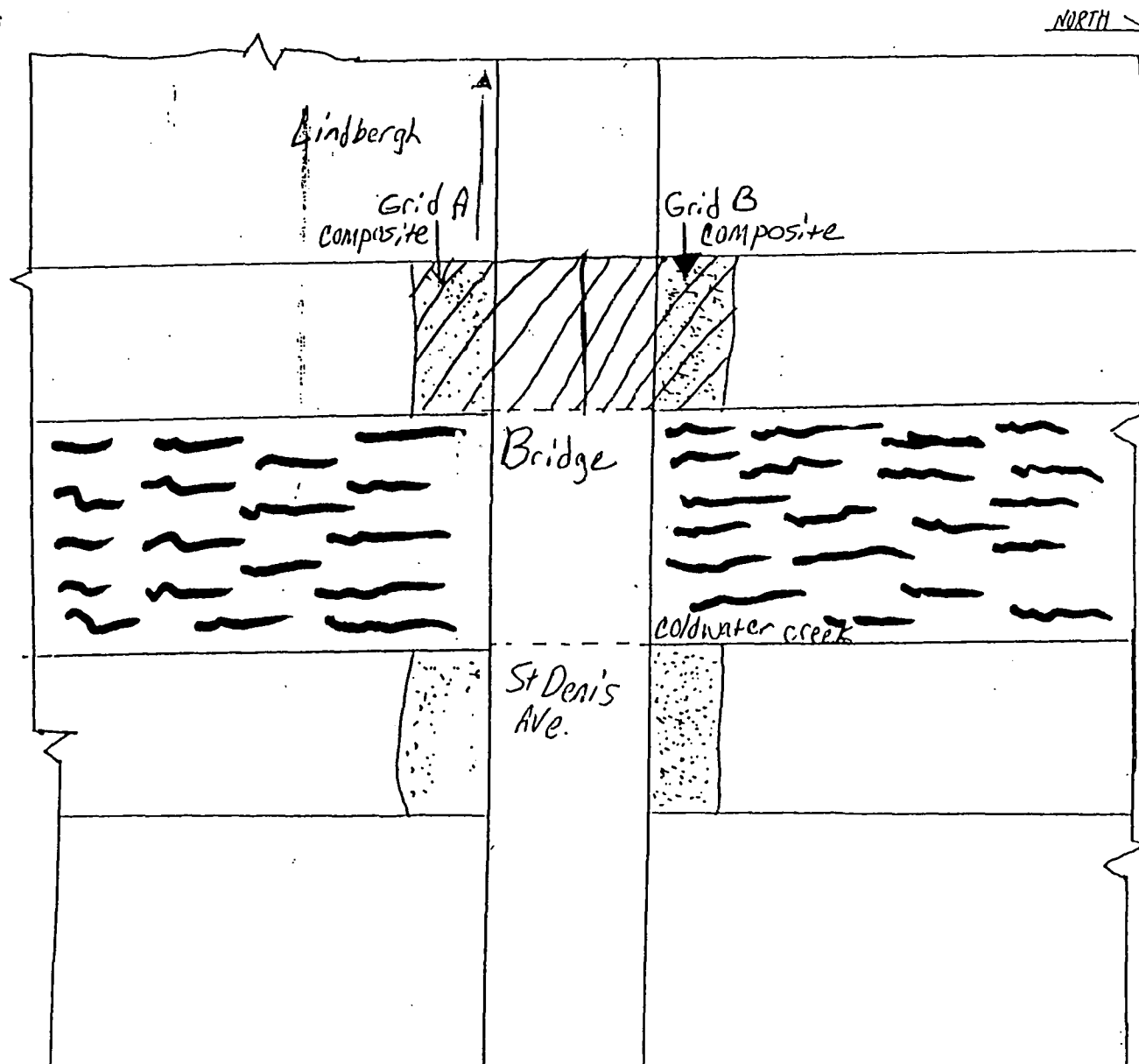
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[Initials]

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Human Data Base

01/1/10

Survey Drawing/Description/Comments



General Information

Survey #:

Site / VNSH: Slaps VP St Denis

Tech(s): C. James

Page: 1 of 1

Comments: Map of sample locations. // - Excavation West Bank

RADIATION SURVEY DATA SHEET

Site Name / WBS ST. DENNIS / SLAPSSurvey Type: ☐ Interior ☐ ExteriorScaler: 2221

Conversion: _____

CRID #: ADetector: SPA-3Bkg: 811 CPMDate: 10/23/98SN: 32335, 32155

(N) →

RUBBLE
CONCRETE
BLOCK

0 ← 1m →	← 1m →			8-12K	8-12K ^A	8-12K	8-12K	8-12K	6-10K	6-10K ^A
				8-11K	8-12K	8-12K	8-12K	8-12K	6-10K ^A	6-10K
				8-12K ^A	9-12K	8-12K	8-12K	8-12K	6-10K	6-10K
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	9-11K	9-11K	9-11K	9-11K	8-12K ^A	8-12K	8-12K	8-12K	6-10K	6-10K
	9-11K	9-11K	9-11K	9-11K	8-12K	8-12K	8-12K	8-12K	6-10K	6-10K
	9-11K ^{8-11K}	9-11K	9-11K	8-12K	8-12K	8-12K	8-12K	8-12K	6-10K	6-10K
	8-12K	8-12K ^A	8-12K	8-12K	8-12K	8-12K	8-12K	8-12K ^A	6-10K	6-10K
	8-12K	8-12K	8-12K	8-12K	8-12K	8-12K	8-12K	8-12K	6-10K	6-10K
	8-10K	8-10K	8-10K	8-10K	8-10K	8-10K	8-10K	8-10K	6-10K	6-10K

Reference E: _____

Coordinates: N: _____

General Location / Description: ST. DENNIS BRIDGE WEST BANK CONCRETE + BANK REMOVAL

Remarks: _____

Physical Conditions: _____

SAMPLE INFORMATION		(SAMPLE LOCATIONS DENOTED BY: Δ)		C = Composite H = Hot Spot	
SAMPLE I.D.	Composite	IN-SITU READING	INSTRUMENT	AREA	
Δ SVPO962	<input checked="" type="checkbox"/> <input type="checkbox"/>	_____ to _____ cpm (Note the high range in cpm)	_____	_____	3'
Δ _____	<input type="checkbox"/> <input type="checkbox"/>	_____ cpm	_____	_____	3'
Δ _____	<input type="checkbox"/> <input type="checkbox"/>	_____ cpm	_____	_____	3'
Δ _____	<input type="checkbox"/> <input type="checkbox"/>	_____ cpm	_____	_____	3'

Exposure Rate Range: _____ to _____ uR/hr

Technician: Chris James / CRJ

Reviewed By: _____

print / sign

GEO. M. WINDLER / GEO. M. Winder

Attachment 2

Revision 5

RADIATION SURVEY DATA SHEET

2nd Name / Yr25

ST. DENNIS / SLAPS 134

Survey Type:

Interior

Exterior ☒

WALKOVER

सूचकः

B

Date:

10/23/98

scalar: 2221¹ 32335

Contractor: SP3 # 32755

SN: 32335/32755

Conversion:

Exg: BIL CPM

6-8	6-8	6-7	6-8	6-8	7-9	7-9	W			
6-8	6-8	6-8	6-8	6-8	7-9	7-9	A			
7-8	6-8	6-8	6-8	7-8	8-10	9-10	T			
7-8	6-8	6-8	6-8	7-8	8-10	10-12	R			
7-8	7-10	7-9	7-10	8-10	8-11	10-11	L			
8-10	7-10	7-9	7-10	8-10	9-11	10-11	N			
8-10	7-10	7-10	8-10	8-10	10-11	10-11	E			
8-9	7-10	8-10	8-10	9-10	9-10	9-10	D			
8-9	7-10	8-10	9-10	9-10	8-10	8-10	B			
8-9	7-10	8-10	9-10	9-10	8-9	8-9	S			

Reference E_

Coordinate: N

General Location / Conclusion: ST. DENNIS BRIDGE WESTBANK CONCRETE + BANK REMOVAL

Remarks:

Physical Conditions :

SAMPLE INFORMATION		(SAMPLE LOCATIONS DENOTED BY: Δ)		C = Composite H = Hot Spot	
SAMPLE ID.	IN-SITU READING	INSTRUMENT	AREA		
gms 12/23/98 SUP 0863	Composite				
Δ SUP 0863	C <input checked="" type="checkbox"/> H <input type="checkbox"/>				
Δ	C <input type="checkbox"/> H <input type="checkbox"/>				
Δ	C <input type="checkbox"/> H <input type="checkbox"/>				

Exposure Rate Range: 3 uR/hr

Chris James

GEO. M. WINDER

Technician:

Ch. 10

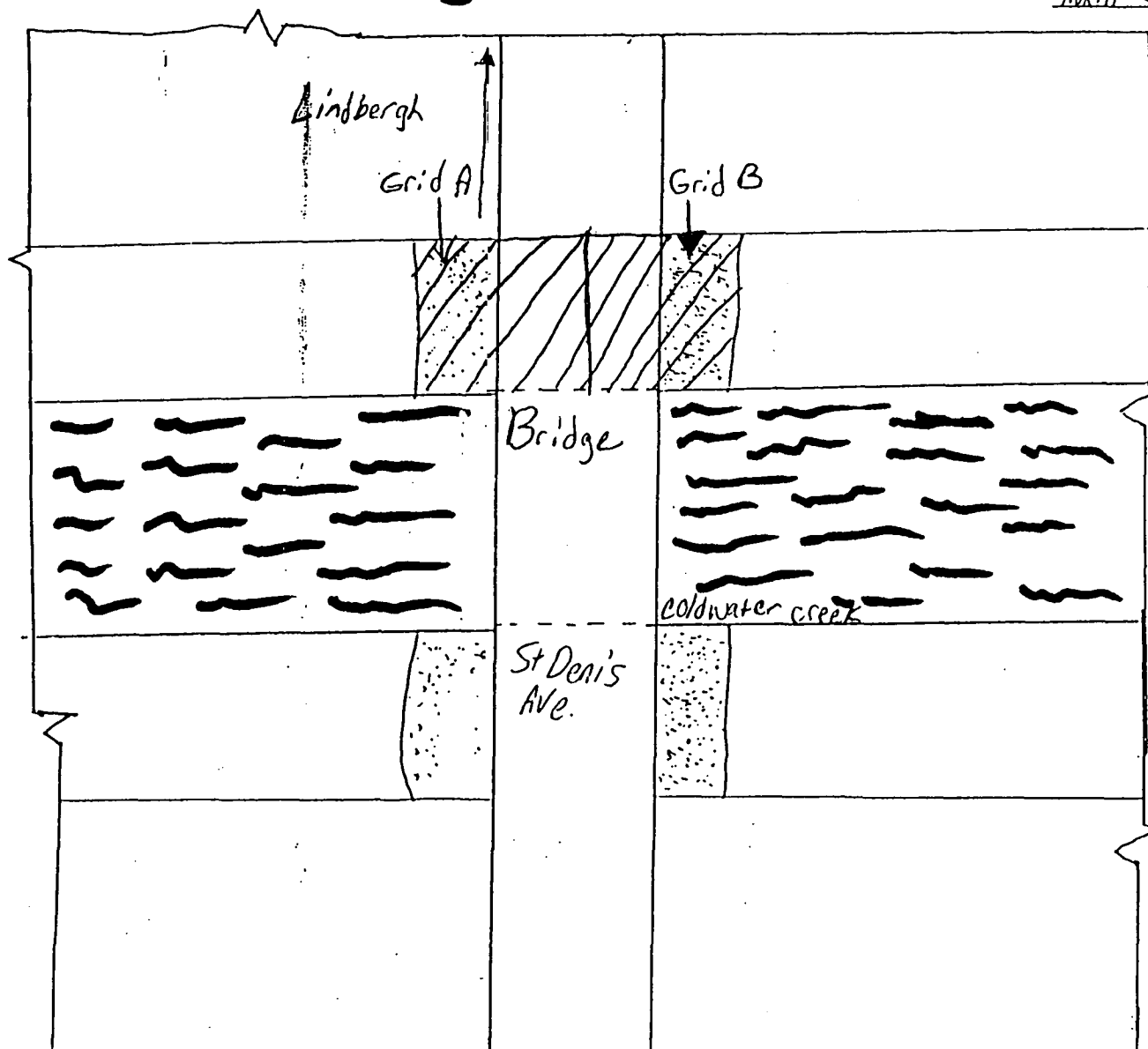
prva / druga

Reviewed By.

```
print / sign
```

Survey Drawing/Description/Comments

NORTH



General Information

Survey #:

Site / WBS#:

Tech(s):

Comments:

Slaps VP St Denis

C. Samis

Map of Sample locations.

Page: 1 of 1

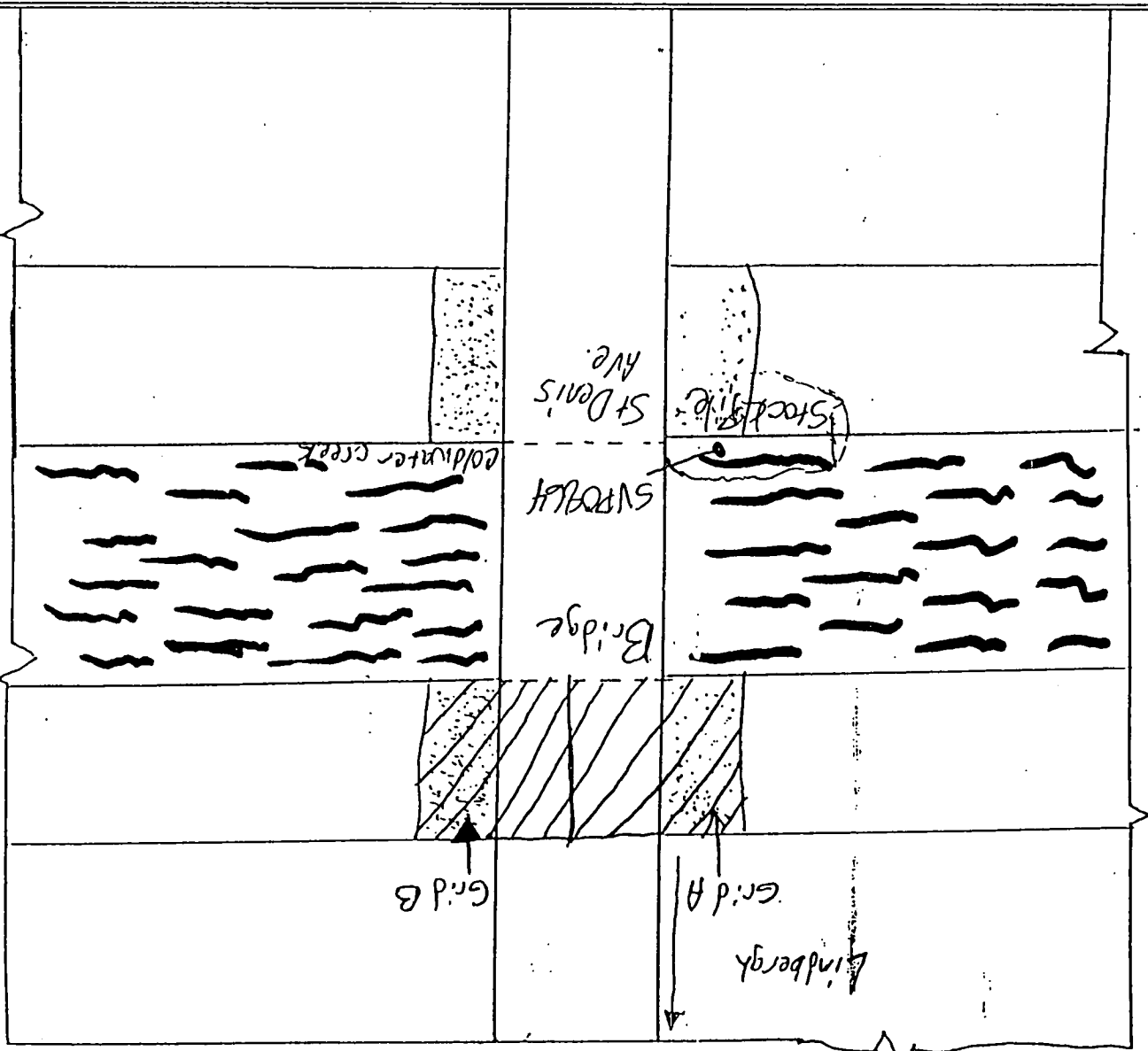
/// - Excavated West Bank

1. 1 1 1

COULEUR: N/A
TEMP: N/A

NEW BATCH NO: _____
PRIORITY: (1) (5) (2) (3) (4) (5) (6) (7)

[illegible]



General Information

Survey #:

Site / WBS#:

Tech(s):

Comments:

Slaps VP 5+ Denis

C. Samos

Page: 1 of 1

Map of Sample Locations
Excavated West Bank

101

CHEMICAL LAB:
WORK ORDER NO:
COOLER NO:

RADIOLOGICAL LAB: HISS onsite lab
HOUTAS HQ: _____
JOB HQ: _____
TAT 2508 days

COOLING
TEMP N/A

NEW BATCH NO: _____
PRIORITY: ☒ 1 ☐ 1.5 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

Sampled by: Chris James CD for
Print Sign Print Sign

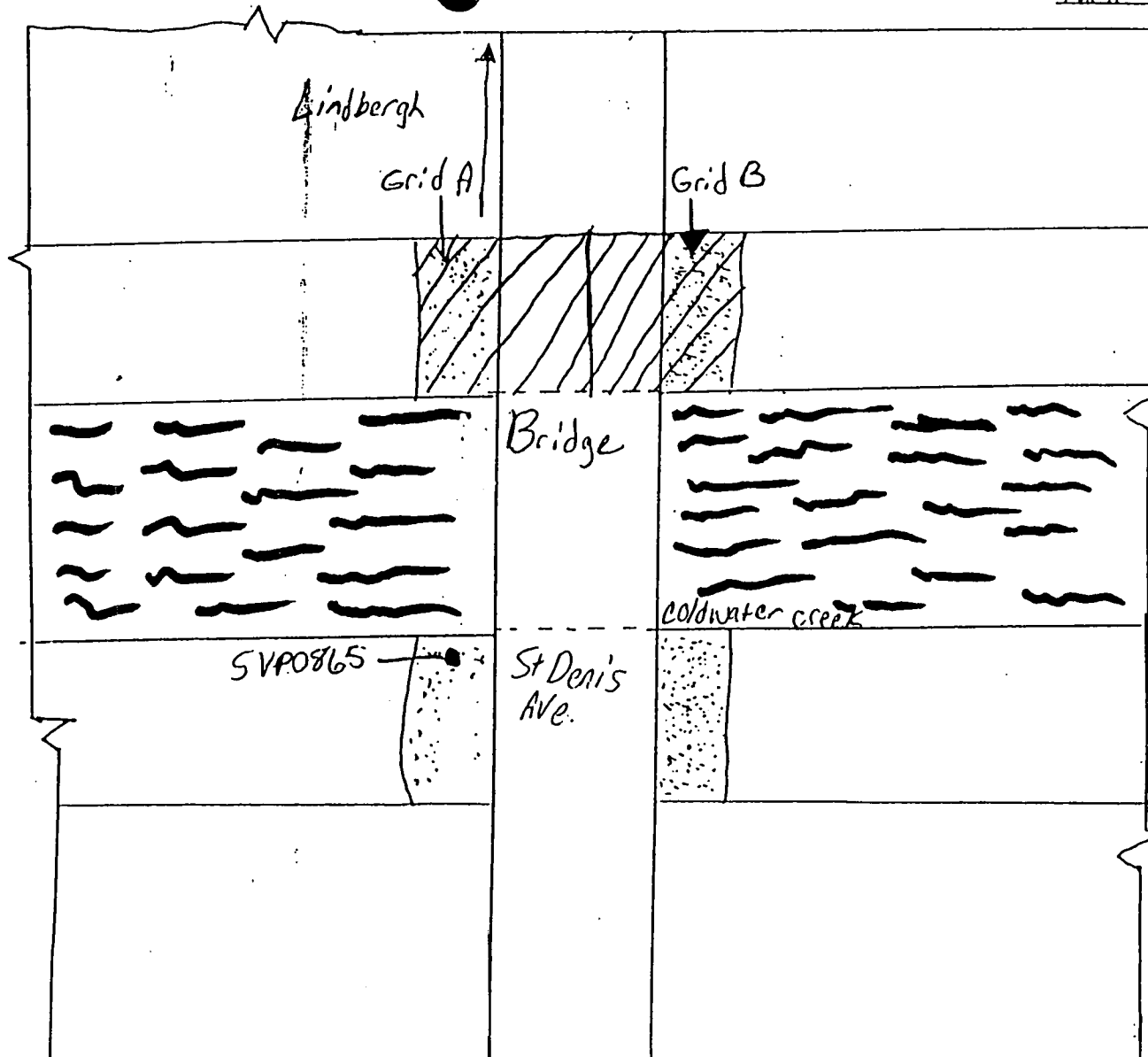
X		IISOUTH
X	Lis+1	Gauwag 50pc

for Coult
Ship 6

< n.?

Survey Draw Description/Comments

NORTH



General Information

Survey #:

Site / WBS #: Slaps VP St Denis

Tech(s): C. James

Page: 1 of 1

Comments: Map of Sample locations. /// - Excavated West Bank

COOLER
TEMP 77
(upon lab receipt)

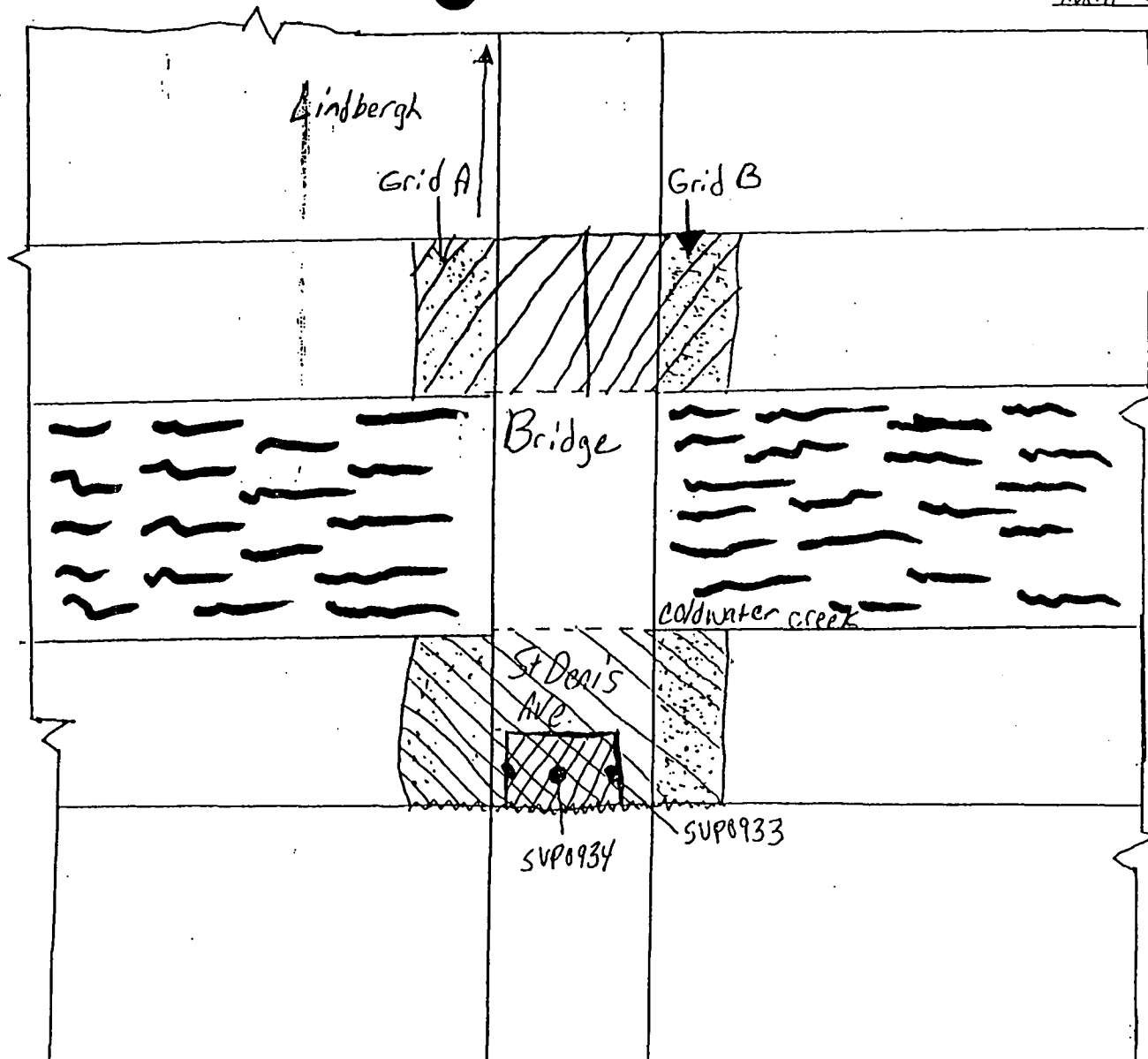
Airbill No

Traffic Report No.

Anal. Level ☐ I ☐ II ☐ III ☐ IV ☐ V

Survey Draw Description/ Comments

NORTH



General Information

Survey #:

Site / WBSH:

Slaps VP St Denis

Tech(s):

C. James

Page: 1 of 1

Comments:

Map of Sample locations.

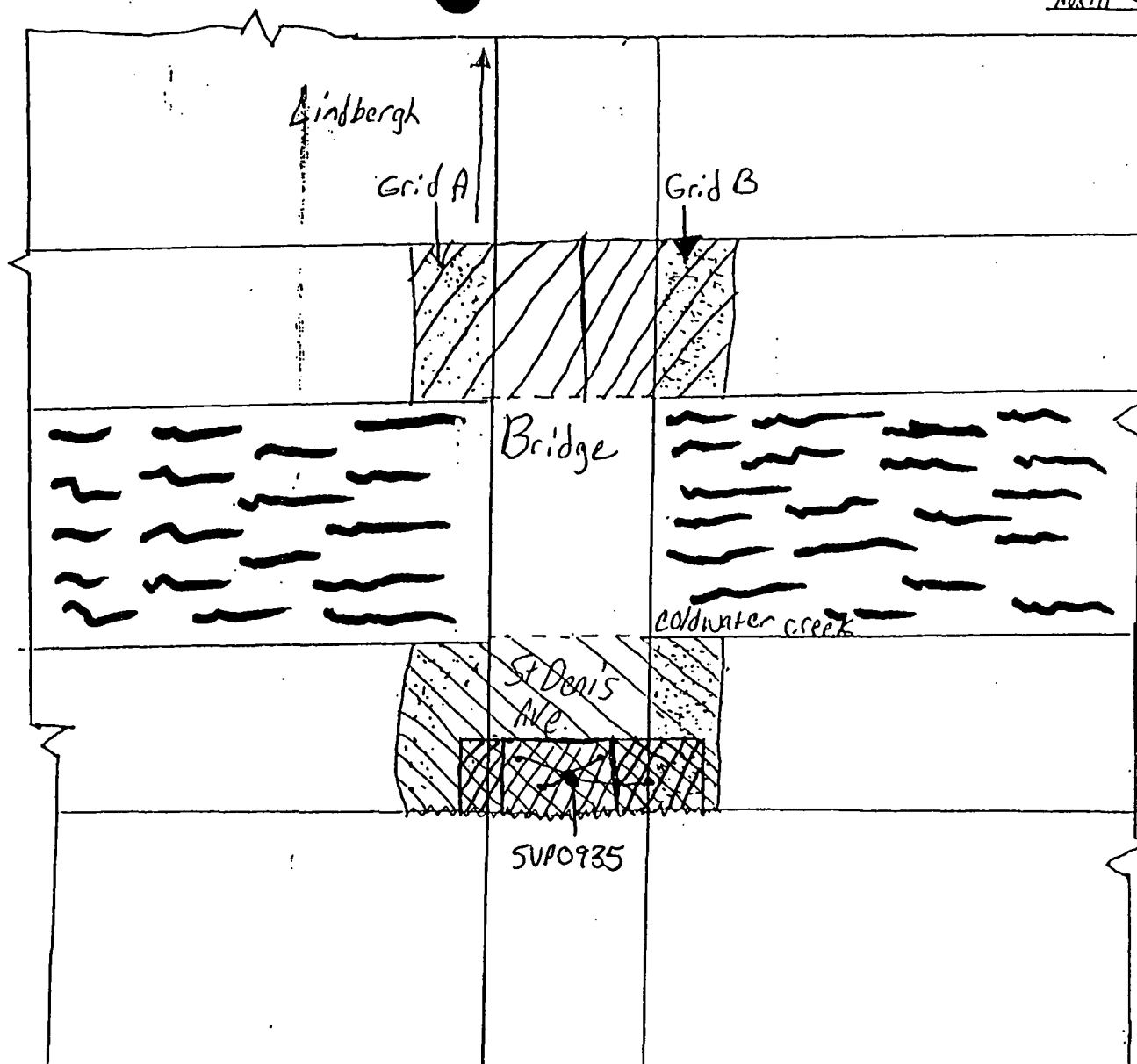
/// - Excavated West Bank



- Continued Removal

Survey Draw Description/Comments

NORTH



General Information

Survey #:

Site / WBS #: Slaps VP St Denis

Tech(s): C. Samos

Comments: Map of Sample Locations.

Page: 1 of 1

/// - Excavated West Bank

- Continued Removal

East Bank

Form 33.4A

Slaps VP RADIATION SURVEY DATA SHEET

Site Name / WBS: St Denis / 134

Survey Type: ☒ Interior ☐ Exterior

CRD: C

Date: 11- -98

Scalers: L2221 / 32335

Detector: SPA-3

SN: 32755

Conversion: N/A

Bag: 6000

← 1m →

↑ 1m

4.5k	4.5k	4.5k	4.5k	4.5k	4.5k	4.5k	4.7k	4.5k	4.5k
4.5k	4.5k	4.5k	4.5k	4.5k	4.5k	4.7k	4.7k	4.5k	4.5k
4.5k	4.5k	4.5k	4.5k	4.5k	4.6k	4.7k	4.7k	4.5k	4.5k
4.5k	4.6k	4.5k	4.5k	4.5k	4.6k	4.6k	4.7k	4.5k	4.5k
4.7k	4.7k	4.6k	4.6k	4.6k	4.6k	4.6k	4.7k	4.5k	4.5k
4.5k	4.5k	4.6k	4.6k	4.5k	4.5k	4.5k	4.5k	4.5k	4.5k
4.5k	4.5k	4.6k	4.6k	4.5k	4.5k	4.5k	4.5k	4.5k	4.5k
4.5k	4.5k	4.6k	4.6k	4.5k	4.5k	4.5k	4.5k	4.5k	4.5k
4.5k	4.5k	4.6k	4.6k	4.5k	4.5k	4.5k	4.5k	4.5k	4.5k
4.5k	4.5k	4.6k	4.6k	4.5k	4.5k	4.5k	4.5k	4.5k	4.5k

Reference E: _____

Coordinate: N: _____

General Location / Conclusion: _____

Remarks: 10m x 9m

Physical Conditions: _____

SAMPLE INFORMATION		(SAMPLE LOCATIONS DEVOTED BY: Δ)		C = Composite H = Hot Spot	
SAMPLE ID.	IN-SITU READING	INSTRUMENT	AREA		
Composite	to _____ cpm	_____	_____ m ²		
Δ _____ C <input type="checkbox"/> H <input type="checkbox"/>	_____ cpm	_____	_____ m ²		
Δ _____ C <input type="checkbox"/> H <input type="checkbox"/>	_____ cpm	_____	_____ m ²		
Δ _____ C <input type="checkbox"/> H <input type="checkbox"/>	_____ cpm	_____	_____ m ²		

Exposure Rate Range: _____ to _____ uR/hr

Technician: Chris James / CRJ

Reviewed By: _____

East Bank

Form 33.4A

RADIATION SURVEY DATA SHEET

Site Name / WGS

Slaps VP / S + Denis / 134

Survey Type:

Interior ☐ Exterior ☐

CRS:

D

Date:

11-98

Scalers:

L2221 / 32335

Detector:

SPA-3

SN:

32755

Conversion:

Bkg:

6000

← 1m →									
← 1m →									
	4.5K	4.5K	4.5K	4.5K	4.5K	4.5K	4.5K	4.5K	4.5K
	4.5K	4.5K	4.5K	4.5K	4.5K	4.5K	4.5K	4.5K	4.5K
	4.5K	4.5K	4.5K	5.7K	6.7K	4.5K	4.5K	4.5K	4.5K
	4.5K	4.5K	4.5K	5.7K	6.7K	4.5K	4.5K	4.5K	4.5K
	4.5K	4.5K	4.5K	4.5K	6.8K	6.8K	6.8K	4.5K	4.5K
	4.5K	4.5K	4.5K	4.5K	6.8K	6.8K	6.8K	4.5K	4.5K
	4.5K	4.5K	4.5K	4.5K	6.8K	6.8K	6.8K	4.5K	4.5K
	4.5K	4.5K	4.5K	4.5K	6.8K	6.8K	6.8K	4.5K	4.5K

Reference E

Coordinate N

OE

10-9/

General Location / Description:

Remarks: 7m x 9m

Physical Conditions:

SAMPLE INFORMATION		(SAMPLE LOCATIONS DENOTED BY: Δ)		C = Composite H = Hot Spot	
SAMPLE ID	Composite	IN-SITU READING	INSTRUMENT	AREA	
		to cm (near to high range in count)			
Δ	C <input type="checkbox"/> H <input type="checkbox"/>	cm			
Δ	C <input type="checkbox"/> H <input type="checkbox"/>	cm			
Δ	C <input type="checkbox"/> H <input type="checkbox"/>	cm			
Δ	C <input type="checkbox"/> H <input type="checkbox"/>	cm			

Exposure Rate Range:

to

Technician

Chris James / CD

print / sign

Reviewed By:

print / sign

Revision 5

RADIATION SURVEY DATA SHEET

Site Name / WGS

Slaps VP
St Denis / 134Survey Type: ☒ Indoor ☐ ExteriorCRS: CDate: 11-19-98Sector: L2221 / 32335Detector: SPA-3SN: 32755Conversion: N/AElev: 6000

1 N

4-5k	4-5k	4-5k	4-5k	4-5k	4-5k	4-5k	4-7k	4-5k	4-5k
4-5k	^Δ 4-5k	4-5k	4-5k	4-5k	^Δ 4-5k	4-7k	4-7k	4-5k	^Δ 4-5k
4-5k	4-5k	4-5k	4-5k	4-5k	4-6k	4-7k	4-7k	4-5k	4-5k
4-5k	4-6k	4-5k	^Δ 4-5k	4-5k	4-6k	4-6k	^Δ 4-7k	4-5k	4-5k
4-7k	4-7k	4-6k	4-6k	4-6k	4-6k	4-6k	4-7k	4-5k	4-5k
4-5k	^Δ 4-5k	4-6k	4-6k	4-5k	^Δ 4-5k	4-5k	4-5k	4-5k	^Δ 4-5k
4-5k	4-5k	4-6k	4-6k	4-5k	4-5k	4-5k	4-5k	4-5k	4-5k
4-5k	4-5k	4-6k	^Δ 4-6k	4-5k	4-5k	4-5k	^Δ 4-5k	4-5k	4-5k
4-5k	4-5k	4-6k	4-6k	4-5k	4-5k	4-5k	4-5k	4-5k	4-5k
4-5k	^Δ 4-5k	4-6k	4-6k	4-5k	^Δ 4-5k	4-5k	4-5k	4-5k	^Δ 4-5k

0 S

0-E

Reference E
Coordinate: N

General Location / Description:

Remarks: 10m X 9m0936, 0937, 0938, 0940, 0941, 0944, 0945, 0946, 0948, 0949, 0952, 0953, 0954

Physical Conditions:

SAMPLE INFORMATION		SAMPLE LOCATIONS DENOTED BY: ^Δ		C = Composite H = Hot Spot	
SAMPLE ID	INSTR. READING	INSTRUMENT	AREA		
Composite	_____ to _____ cm	_____	_____	m ²	
^Δ _____ C <input type="checkbox"/> H <input type="checkbox"/>	_____ cm	_____	_____	m ²	
^Δ _____ C <input type="checkbox"/> H <input type="checkbox"/>	_____ cm	_____	_____	m ²	
^Δ _____ C <input type="checkbox"/> H <input type="checkbox"/>	_____ cm	_____	_____	m ²	

Exposure Rate Range: _____ to _____ uR/hr

Technician

Chris James / CRP

Reviewed By:

print / sign

Exg: 6000

Revision 5

Location:		SLAPS VP	
Site WBS:	134	Date Entered:	10/9/98
Work Order Number:			
Project Number:			
Environmental Cat:	RI		

Sample ID	Date Collected	Date Analyzed	SDG ID	LAB ID	Vol.	W/D	Sample Type	Analyte	Result	Error	Units	Analytical Method	MDA
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	K-40	12.88	1.73	PCI/G	GAMMASPEC	0.20
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	RA-226	0.68	0.06	PCI/G	GAMMASPEC	0.04
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	RA-228	0.72	0.09	PCI/G	GAMMASPEC	0.05
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	TH-228	0.72	0.09	PCI/G	GAMMASPEC	0.05
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	TH-232	0.72	0.09	PCI/G	GAMMASPEC	0.05
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	U-238	0.72	0.68	PCI/G	GAMMASPEC	3.44
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	CS-137	0.01	0.02	PCI/G	GAMMASPEC	0.03
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	AC-227	0.06	0.07	PCI/G	GAMMASPEC	0.14
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	TH-230	1.52	4.76	PCI/G	GAMMASPEC	7.22
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	PA-231	-0.14	0.41	PCI/G	GAMMASPEC	0.59
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	U-235	0.17	0.15	PCI/G	GAMMASPEC	0.15
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	AM-241	0.05	0.05	PCI/G	GAMMASPEC	0.08
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	K-40	13.26	1.77	PCI/G	GAMMASPEC	0.20
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	RA-226	0.67	0.06	PCI/G	GAMMASPEC	0.04
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	RA-228	0.79	0.09	PCI/G	GAMMASPEC	0.06
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	TH-228	0.79	0.09	PCI/G	GAMMASPEC	0.06
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	TH-232	0.79	0.09	PCI/G	GAMMASPEC	0.06
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	U-238	1.23	0.78	PCI/G	GAMMASPEC	3.56
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	CS-137	0.02	0.02	PCI/G	GAMMASPEC	0.03
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	AC-227	0.09	0.02	PCI/G	GAMMASPEC	0.15
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	TH-230	-1.03	5.03	PCI/G	GAMMASPEC	7.48
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	PA-231	0.42	0.39	PCI/G	GAMMASPEC	0.61
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	U-235	0.05	0.09	PCI/G	GAMMASPEC	0.15
SVP0598	10/05/98	10/08/98	98ML135		831	DRY	REG	AM-241	0.04	0.05	PCI/G	GAMMASPEC	0.08
SVP0599	10/05/98	10/08/98	98ML135		917	DRY	REG	K-40	10.73	1.32	PCI/G	GAMMASPEC	0.27
SVP0599	10/05/98	10/08/98	98ML135		917	DRY	REG	CS-137	0.07	0.03	PCI/G	GAMMASPEC	0.03
SVP0599	10/05/98	10/08/98	98ML135		917	DRY	REG	RA-226	0.79	0.06	PCI/G	GAMMASPEC	0.05
SVP0599	10/05/98	10/08/98	98ML135		917	DRY	REG	RA-228	0.60	0.08	PCI/G	GAMMASPEC	0.08

PRELIMINARY

Approved by:

Date:

Location: SLAPS VP	
Site WBS: 134	Date Entered: 10/9/98
Work Order Number:	
Project Number:	
Environmental Cat: RI	

Sample ID	Date Collected	Date Analyzed	SDG ID	LAB ID	Vol.	W/D	Sample Type	Analyte	Result	Error	Units	Analytical Method	MDA
SVP0599	10/05/98	10/08/98	98ML135		917	DRY	REG	TH-228	0.60	0.08	PCI/G	GAMMASPEC	0.08
SVP0599	10/05/98	10/08/98	98ML135		917	DRY	REG	TH-232	0.60	0.08	PCI/G	GAMMASPEC	0.08
SVP0599	10/05/98	10/08/98	98ML135		917	DRY	REG	U-238	0.70	0.44	PCI/G	GAMMASPEC	4.22
SVP0599	10/05/98	10/08/98	98ML135		917	DRY	REG	AC-227	0.40	0.13	PCI/G	GAMMASPEC	0.20
SVP0599	10/05/98	10/08/98	98ML135		917	DRY	REG	TH-230	-2.58	3.47	PCI/G	GAMMASPEC	4.95
SVP0599	10/05/98	10/08/98	98ML135		917	DRY	REG	PA-231	0.08	0.51	PCI/G	GAMMASPEC	0.72
SVP0599	10/05/98	10/08/98	98ML135		917	DRY	REG	U-235	0.10	0.09	PCI/G	GAMMASPEC	0.16
SVP0599	10/05/98	10/08/98	98ML135		917	DRY	REG	AM-241	0.01	0.03	PCI/G	GAMMASPEC	0.05
SVP0600	10/07/98	10/08/98	98ML135		692	DRY	REG	K-40	15.42	2.07	PCI/G	GAMMASPEC	0.28
SVP0600	10/07/98	10/08/98	98ML135		692	DRY	REG	CS-137	0.06	0.03	PCI/G	GAMMASPEC	0.03
SVP0600	10/07/98	10/08/98	98ML135		692	DRY	REG	RA-226	0.79	0.07	PCI/G	GAMMASPEC	0.04
SVP0600	10/07/98	10/08/98	98ML135		692	DRY	REG	RA-228	0.93	0.11	PCI/G	GAMMASPEC	0.06
SVP0600	10/07/98	10/08/98	98ML135		692	DRY	REG	TH-228	0.93	0.11	PCI/G	GAMMASPEC	0.06
SVP0600	10/07/98	10/08/98	98ML135		692	DRY	REG	TH-232	0.93	0.11	PCI/G	GAMMASPEC	0.06
SVP0600	10/07/98	10/08/98	98ML135		692	DRY	REG	TH-230	8.29	7.54	PCI/G	GAMMASPEC	9.14
SVP0600	10/07/98	10/08/98	98ML135		692	DRY	REG	U-238	0.93	0.82	PCI/G	GAMMASPEC	3.10
SVP0600	10/07/98	10/08/98	98ML135		692	DRY	REG	AC-227	0.09	0.11	PCI/G	GAMMASPEC	0.18
SVP0600	10/07/98	10/08/98	98ML135		692	DRY	REG	PA-231	0.65	0.49	PCI/G	GAMMASPEC	0.78
SVP0600	10/07/98	10/08/98	98ML135		692	DRY	REG	U-235	0.36	0.20	PCI/G	GAMMASPEC	0.19
SVP0600	10/07/98	10/08/98	98ML135		692	DRY	REG	AM-241	0.04	0.07	PCI/G	GAMMASPEC	0.10
SVP0601	10/07/98	10/08/98	98ML135		741	DRY	REG	K-40	15.43	1.82	PCI/G	GAMMASPEC	0.32
SVP0601	10/07/98	10/08/98	98ML135		741	DRY	REG	CS-137	0.07	0.04	PCI/G	GAMMASPEC	0.04
SVP0601	10/07/98	10/08/98	98ML135		741	DRY	REG	RA-226	0.87	0.07	PCI/G	GAMMASPEC	0.06
SVP0601	10/07/98	10/08/98	98ML135		741	DRY	REG	AC-227	0.29	0.12	PCI/G	GAMMASPEC	0.17
SVP0601	10/07/98	10/08/98	98ML135		741	DRY	REG	RA-228	0.97	0.12	PCI/G	GAMMASPEC	0.10
SVP0601	10/07/98	10/08/98	98ML135		741	DRY	REG	TH-228	0.97	0.12	PCI/G	GAMMASPEC	0.10
SVP0601	10/07/98	10/08/98	98ML135		741	DRY	REG	TH-232	0.97	0.12	PCI/G	GAMMASPEC	0.10
SVP0601	10/07/98	10/08/98	98ML135		741	DRY	REG	TH-230	10.74	5.13	PCI/G	GAMMASPEC	6.32

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Location: SLAPS VP	
Site WBS: 134	Date Entered: 10/9/98
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Sample ID	Date Collected	Date Analyzed	SDG ID	LAB ID	Vol.	W/D	Sample Type	Analyte	Result	Error	Units	Analytical Method	MDA
SVP0601	10/07/98	10/08/98	98ML135		741	DRY	REG	U-238	1.61	0.68	PCI/G	GAMMASPEC	4.79
SVP0601	10/07/98	10/08/98	98ML135		741	DRY	REG	PA-231	0.80	0.66	PCI/G	GAMMASPEC	1.00
SVP0601	10/07/98	10/08/98	98ML135		741	DRY	REG	U-235	0.23	0.15	PCI/G	GAMMASPEC	0.20
SVP0601	10/07/98	10/08/98	98ML135		741	DRY	REG	AM-241	0.07	0.04	PCI/G	GAMMASPEC	0.07
SVP0602	10/07/98	10/08/98	98ML135		757	DRY	REG	K-40	14.59	1.94	PCI/G	GAMMASPEC	0.21
SVP0602	10/07/98	10/08/98	98ML135		757	DRY	REG	CS-137	0.06	0.02	PCI/G	GAMMASPEC	0.03
SVP0602	10/07/98	10/08/98	98ML135		757	DRY	REG	RA-226	0.79	0.07	PCI/G	GAMMASPEC	0.04
SVP0602	10/07/98	10/08/98	98ML135		757	DRY	REG	RA-228	0.84	0.10	PCI/G	GAMMASPEC	0.06
SVP0602	10/07/98	10/08/98	98ML135		757	DRY	REG	TH-228	0.84	0.10	PCI/G	GAMMASPEC	0.06
SVP0602	10/07/98	10/08/98	98ML135		757	DRY	REG	TH-232	0.84	0.10	PCI/G	GAMMASPEC	0.06
SVP0602	10/07/98	10/08/98	98ML135		757	DRY	REG	TH-230	6.17	6.34	PCI/G	GAMMASPEC	8.74
SVP0602	10/07/98	10/08/98	98ML135		757	DRY	REG	U-238	1.45	0.93	PCI/G	GAMMASPEC	3.89
SVP0602	10/07/98	10/08/98	98ML135		757	DRY	REG	AC-227	0.09	0.11	PCI/G	GAMMASPEC	0.17
SVP0602	10/07/98	10/08/98	98ML135		757	DRY	REG	PA-231	0.35	0.45	PCI/G	GAMMASPEC	0.70
SVP0602	10/07/98	10/08/98	98ML135		757	DRY	REG	U-235	0.25	0.15	PCI/G	GAMMASPEC	0.18
SVP0602	10/07/98	10/08/98	98ML135		757	DRY	REG	AM-241	0.06	0.06	PCI/G	GAMMASPEC	0.10
SVP0603	10/07/98	10/08/98	98ML135		765	DRY	REG	K-40	12.85	1.53	PCI/G	GAMMASPEC	0.31
SVP0603	10/07/98	10/08/98	98ML135		765	DRY	REG	CS-137	0.12	0.04	PCI/G	GAMMASPEC	0.03
SVP0603	10/07/98	10/08/98	98ML135		765	DRY	REG	RA-226	0.88	0.07	PCI/G	GAMMASPEC	0.06
SVP0603	10/07/98	10/08/98	98ML135		765	DRY	REG	AC-227	0.40	0.12	PCI/G	GAMMASPEC	0.17
SVP0603	10/07/98	10/08/98	98ML135		765	DRY	REG	RA-228	0.81	0.10	PCI/G	GAMMASPEC	0.09
SVP0603	10/07/98	10/08/98	98ML135		765	DRY	REG	TH-228	0.81	0.10	PCI/G	GAMMASPEC	0.09
SVP0603	10/07/98	10/08/98	98ML135		765	DRY	REG	TH-232	0.81	0.10	PCI/G	GAMMASPEC	0.09
SVP0603	10/07/98	10/08/98	98ML135		765	DRY	REG	TH-230	19.12	5.90	PCI/G	GAMMASPEC	6.22
SVP0603	10/07/98	10/08/98	98ML135		765	DRY	REG	U-238	0.94	0.57	PCI/G	GAMMASPEC	4.57
SVP0603	10/07/98	10/08/98	98ML135		765	DRY	REG	PA-231	0.43	0.69	PCI/G	GAMMASPEC	1.01
SVP0603	10/07/98	10/08/98	98ML135		765	DRY	REG	U-235	0.22	0.15	PCI/G	GAMMASPEC	0.20
SVP0603	10/07/98	10/08/98	98ML135		765	DRY	REG	AM-241	0.03	0.04	PCI/G	GAMMASPEC	0.06

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SVP0604	10/04/98	10/08/98	98ML135		769	DRY	REG	K-40	14.27	1.91	PCI/G	GAMMASPEC	0.20
SVP0604	10/04/98	10/08/98	98ML135		769	DRY	REG	CS-137	0.07	0.03	PCI/G	GAMMASPEC	0.02
SVP0604	10/04/98	10/08/98	98ML135		769	DRY	REG	RA-226	0.71	0.07	PCI/G	GAMMASPEC	0.04
SVP0604	10/04/98	10/08/98	98ML135		769	DRY	REG	RA-228	0.86	0.10	PCI/G	GAMMASPEC	0.07
SVP0604	10/04/98	10/08/98	98ML135		769	DRY	REG	TH-228	0.86	0.10	PCI/G	GAMMASPEC	0.07
SVP0604	10/04/98	10/08/98	98ML135		769	DRY	REG	TH-232	0.86	0.10	PCI/G	GAMMASPEC	0.07
SVP0604	10/04/98	10/08/98	98ML135		769	DRY	REG	U-238	0.88	0.69	PCI/G	GAMMASPEC	2.66
SVP0604	10/04/98	10/08/98	98ML135		769	DRY	REG	AC-227	0.04	0.10	PCI/G	GAMMASPEC	0.16
SVP0604	10/04/98	10/08/98	98ML135		769	DRY	REG	TH-230	5.62	5.44	PCI/G	GAMMASPEC	8.82
SVP0604	10/04/98	10/08/98	98ML135		769	DRY	REG	PA-231	0.08	0.47	PCI/G	GAMMASPEC	0.69
SVP0604	10/04/98	10/08/98	98ML135		769	DRY	REG	U-235	0.09	0.12	PCI/G	GAMMASPEC	0.17
SVP0604	10/04/98	10/08/98	98ML135		769	DRY	REG	AM-241	0.06	0.06	PCI/G	GAMMASPEC	0.10
SVP0605	10/07/98	10/08/98	98ML135		715	DRY	REG	K-40	15.56	1.83	PCI/G	GAMMASPEC	0.31
SVP0605	10/07/98	10/08/98	98ML135		715	DRY	REG	CS-137	0.11	0.05	PCI/G	GAMMASPEC	0.04
SVP0605	10/07/98	10/08/98	98ML135		715	DRY	REG	RA-226	0.83	0.07	PCI/G	GAMMASPEC	0.06
SVP0605	10/07/98	10/08/98	98ML135		715	DRY	REG	RA-228	1.01	0.12	PCI/G	GAMMASPEC	0.10
SVP0605	10/07/98	10/08/98	98ML135		715	DRY	REG	TH-228	1.01	0.12	PCI/G	GAMMASPEC	0.10
SVP0605	10/07/98	10/08/98	98ML135		715	DRY	REG	TH-232	1.01	0.12	PCI/G	GAMMASPEC	0.10
SVP0605	10/07/98	10/08/98	98ML135		715	DRY	REG	TH-230	14.76	6.58	PCI/G	GAMMASPEC	6.59
SVP0605	10/07/98	10/08/98	98ML135		715	DRY	REG	U-238	1.41	0.59	PCI/G	GAMMASPEC	5.18
SVP0605	10/07/98	10/08/98	98ML135		715	DRY	REG	AC-227	0.35	0.18	PCI/G	GAMMASPEC	0.27
SVP0605	10/07/98	10/08/98	98ML135		715	DRY	REG	PA-231	0.11	0.68	PCI/G	GAMMASPEC	0.96
SVP0605	10/07/98	10/08/98	98ML135		715	DRY	REG	U-235	0.18	0.15	PCI/G	GAMMASPEC	0.21
SVP0605	10/07/98	10/08/98	98ML135		715	DRY	REG	AM-241	0.04	0.04	PCI/G	GAMMASPEC	0.07
SVP0606	10/07/98	10/08/98	98ML135		687	DRY	REG	K-40	15.83	2.12	PCI/G	GAMMASPEC	0.22
SVP0606	10/07/98	10/08/98	98ML135		687	DRY	REG	CS-137	0.09	0.04	PCI/G	GAMMASPEC	0.03
SVP0606	10/07/98	10/08/98	98ML135		687	DRY	REG	RA-226	0.84	0.08	PCI/G	GAMMASPEC	0.05
SVP0606	10/07/98	10/08/98	98ML135		687	DRY	REG	AC-227	0.28	0.12	PCI/G	GAMMASPEC	0.14

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Sample ID	Date Collected	Date Analyzed	SDG ID	LAB ID	Vol.	N/D	Sample Type	Analyte	Result	Error	Units	Analytical Method	MDA
SVP0606	10/07/98	10/08/98	98ML135		687	DRY	REG	RA-228	0.91	0.10	PCI/G	GAMMASPEC	0.06
SVP0606	10/07/98	10/08/98	98ML135		687	DRY	REG	TH-228	0.91	0.10	PCI/G	GAMMASPEC	0.06
SVP0606	10/07/98	10/08/98	98ML135		687	DRY	REG	TH-232	0.91	0.10	PCI/G	GAMMASPEC	0.06
SVP0606	10/07/98	10/08/98	98ML135		687	DRY	REG	TH-230	21.22	9.68	PCI/G	GAMMASPEC	9.05
SVP0606	10/07/98	10/08/98	98ML135		687	DRY	REG	U-238	1.64	0.89	PCI/G	GAMMASPEC	4.24
SVP0606	10/07/98	10/08/98	98ML135		687	DRY	REG	PA-231	0.28	0.47	PCI/G	GAMMASPEC	0.71
SVP0606	10/07/98	10/08/98	98ML135		687	DRY	REG	U-235	0.17	0.15	PCI/G	GAMMASPEC	0.19
SVP0606	10/07/98	10/08/98	98ML135		687	DRY	REG	AM-241	0.01	0.07	PCI/G	GAMMASPEC	0.10
SVP0607	10/07/98	10/09/98	98ML135		710	DRY	REG	K-40	15.37	1.84	PCI/G	GAMMASPEC	0.31
SVP0607	10/07/98	10/09/98	98ML135		710	DRY	REG	RA-226	0.86	0.08	PCI/G	GAMMASPEC	0.06
SVP0607	10/07/98	10/09/98	98ML135		710	DRY	REG	RA-228	0.93	0.12	PCI/G	GAMMASPEC	0.09
SVP0607	10/07/98	10/09/98	98ML135		710	DRY	REG	TH-228	0.93	0.12	PCI/G	GAMMASPEC	0.09
SVP0607	10/07/98	10/09/98	98ML135		710	DRY	REG	TH-232	0.93	0.12	PCI/G	GAMMASPEC	0.09
SVP0607	10/07/98	10/09/98	98ML135		710	DRY	REG	TH-230	12.75	5.94	PCI/G	GAMMASPEC	6.73
SVP0607	10/07/98	10/09/98	98ML135		710	DRY	REG	U-238	1.60	0.60	PCI/G	GAMMASPEC	4.67
SVP0607	10/07/98	10/09/98	98ML135		710	DRY	REG	CS-137	0.03	0.03	PCI/G	GAMMASPEC	0.05
SVP0607	10/07/98	10/09/98	98ML135		710	DRY	REG	AC-227	0.96	0.19	PCI/G	GAMMASPEC	0.30
SVP0607	10/07/98	10/09/98	98ML135		710	DRY	REG	PA-231	-0.04	0.75	PCI/G	GAMMASPEC	1.04
SVP0607	10/07/98	10/09/98	98ML135		710	DRY	REG	U-235	0.33	0.14	PCI/G	GAMMASPEC	0.22
SVP0607	10/07/98	10/09/98	98ML135		710	DRY	REG	AM-241	0.02	0.05	PCI/G	GAMMASPEC	0.07
SVP0608	10/07/98	10/09/98	98ML135		646	DRY	REG	K-40	16.06	2.15	PCI/G	GAMMASPEC	0.17
SVP0608	10/07/98	10/09/98	98ML135		646	DRY	REG	CS-137	0.05	0.02	PCI/G	GAMMASPEC	0.03
SVP0608	10/07/98	10/09/98	98ML135		646	DRY	REG	RA-226	0.75	0.07	PCI/G	GAMMASPEC	0.04
SVP0608	10/07/98	10/09/98	98ML135		646	DRY	REG	RA-228	0.98	0.11	PCI/G	GAMMASPEC	0.07
SVP0608	10/07/98	10/09/98	98ML135		646	DRY	REG	TH-228	0.98	0.11	PCI/G	GAMMASPEC	0.07
SVP0608	10/07/98	10/09/98	98ML135		646	DRY	REG	TH-232	0.98	0.11	PCI/G	GAMMASPEC	0.07
SVP0608	10/07/98	10/09/98	98ML135		646	DRY	REG	TH-230	10.03	7.41	PCI/G	GAMMASPEC	8.71
SVP0608	10/07/98	10/09/98	98ML135		646	DRY	REG	U-235	0.17	0.13	PCI/G	GAMMASPEC	0.17

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Sample ID	Date Collected	Date Analyzed	SDG ID	LAB ID	Vol.	W/D	Sample Type	Analyte	Result	Error	Units	Analytical Method	MDA
SVP0608	10/07/98	10/09/98	98ML135		646	DRY	REG	U-238	1.22	0.79	PCI/G	GAMMASPEC	4.00
SVP0608	10/07/98	10/09/98	98ML135		646	DRY	REG	AC-227	0.16	0.12	PCI/G	GAMMASPEC	0.17
SVP0608	10/07/98	10/09/98	98ML135		646	DRY	REG	PA-231	0.04	0.50	PCI/G	GAMMASPEC	0.75
SVP0608	10/07/98	10/09/98	98ML135		646	DRY	REG	AM-241	0.03	0.07	PCI/G	GAMMASPEC	0.10
QC SPIKE	04/01/97	10/09/98	98ML135		500	DRY	LCSF	CS-137	87.96	9.51	PCI/G	GAMMASPEC	0.47
QC SPIKE	04/01/97	10/09/98	98ML135		500	DRY	LCSF	AM-241	182.90	29.27	PCI/G	GAMMASPEC	1.15
QC SPIKE	04/01/97	10/09/98	98ML135		500	DRY	LCST	CS-137	85.22	3.84	PCI/G	GAMMASPEC	0.47
QC SPIKE	04/01/97	10/09/98	98ML135		500	DRY	LCST	AM-241	187.31	9.37	PCI/G	GAMMASPEC	1.15
QC BLANK	10/09/98	10/09/98	98ML135		500	DRY	PB	U-238	0.07	0.16	PCI/G	GAMMASPEC	2.72
QC BLANK	10/09/98	10/09/98	98ML135		500	DRY	PB	K-40	-0.07	0.21	PCI/G	GAMMASPEC	0.40
QC BLANK	10/09/98	10/09/98	98ML135		500	DRY	PB	CS-137	0.02	0.01	PCI/G	GAMMASPEC	0.03
QC BLANK	10/09/98	10/09/98	98ML135		500	DRY	PB	RA-226	0.01	0.03	PCI/G	GAMMASPEC	0.05
QC BLANK	10/09/98	10/09/98	98ML135		500	DRY	PB	AC-227	-0.02	0.06	PCI/G	GAMMASPEC	0.10
QC BLANK	10/09/98	10/09/98	98ML135		500	DRY	PB	RA-228	-0.01	0.04	PCI/G	GAMMASPEC	0.07
QC BLANK	10/09/98	10/09/98	98ML135		500	DRY	PB	TH-228	-0.01	0.04	PCI/G	GAMMASPEC	0.07
QC BLANK	10/09/98	10/09/98	98ML135		500	DRY	PB	TH-232	-0.01	0.04	PCI/G	GAMMASPEC	0.07
QC BLANK	10/09/98	10/09/98	98ML135		500	DRY	PB	TH-230	-0.99	1.44	PCI/G	GAMMASPEC	2.07
QC BLANK	10/09/98	10/09/98	98ML135		500	DRY	PB	PA-231	-0.09	0.42	PCI/G	GAMMASPEC	0.57
QC BLANK	10/09/98	10/09/98	98ML135		500	DRY	PB	U-235	0.01	0.07	PCI/G	GAMMASPEC	0.10
QC BLANK	10/09/98	10/09/98	98ML135		500	DRY	PB	AM-241	0.01	0.02	PCI/G	GAMMASPEC	0.02

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Sample ID	Date Collected	Date Analyzed	SDG ID	LAB ID	Vol.	WD	Sample Type	Analyte	Result	Error	Units	Analytical Method	MDA
SVP0609	10/08/98	10/09/98	98ML138		795	DRY	REG	K-40	13.36	1.80	PCI/G	GAMMASPEC	0.23
SVP0609	10/08/98	10/09/98	98ML138		795	DRY	REG	CS-137	0.07	0.02	PCI/G	GAMMASPEC	0.03
SVP0609	10/08/98	10/09/98	98ML138		795	DRY	REG	RA-226	0.80	0.07	PCI/G	GAMMASPEC	0.04
SVP0609	10/08/98	10/09/98	98ML138		795	DRY	REG	AC-227	0.33	0.09	PCI/G	GAMMASPEC	0.13
SVP0609	10/08/98	10/09/98	98ML138		795	DRY	REG	RA-228	0.85	0.10	PCI/G	GAMMASPEC	0.06
SVP0609	10/08/98	10/09/98	98ML138		795	DRY	REG	TH-228	0.85	0.10	PCI/G	GAMMASPEC	0.06
SVP0609	10/08/98	10/09/98	98ML138		795	DRY	REG	TH-232	0.85	0.10	PCI/G	GAMMASPEC	0.06
SVP0609	10/08/98	10/09/98	98ML138		795	DRY	REG	TH-230	16.41	8.16	PCI/G	GAMMASPEC	8.61
SVP0609	10/08/98	10/09/98	98ML138		795	DRY	REG	U-238	0.78	0.83	PCI/G	GAMMASPEC	3.58
SVP0609	10/08/98	10/09/98	98ML138		795	DRY	REG	PA-231	0.28	0.48	PCI/G	GAMMASPEC	0.72
SVP0609	10/08/98	10/09/98	98ML138		795	DRY	REG	U-235	0.35	0.16	PCI/G	GAMMASPEC	0.18
SVP0609	10/08/98	10/09/98	98ML138		795	DRY	REG	AM-241	0.07	0.06	PCI/G	GAMMASPEC	0.10
SVP0610	10/08/98	10/09/98	98ML138		827	DRY	REG	K-40	14.15	1.67	PCI/G	GAMMASPEC	0.24
SVP0610	10/08/98	10/09/98	98ML138		827	DRY	REG	CS-137	0.09	0.03	PCI/G	GAMMASPEC	0.03
SVP0610	10/08/98	10/09/98	98ML138		827	DRY	REG	RA-226	0.70	0.07	PCI/G	GAMMASPEC	0.06
SVP0610	10/08/98	10/09/98	98ML138		827	DRY	REG	RA-228	0.94	0.11	PCI/G	GAMMASPEC	0.09
SVP0610	10/08/98	10/09/98	98ML138		827	DRY	REG	TH-228	0.94	0.11	PCI/G	GAMMASPEC	0.09
SVP0610	10/08/98	10/09/98	98ML138		827	DRY	REG	TH-232	0.94	0.11	PCI/G	GAMMASPEC	0.09
SVP0610	10/08/98	10/09/98	98ML138		827	DRY	REG	TH-230	4.99	4.91	PCI/G	GAMMASPEC	5.77
SVP0610	10/08/98	10/09/98	98ML138		827	DRY	REG	U-235	0.10	0.12	PCI/G	GAMMASPEC	0.17
SVP0610	10/08/98	10/09/98	98ML138		827	DRY	REG	U-238	1.11	0.45	PCI/G	GAMMASPEC	4.63
SVP0610	10/08/98	10/09/98	98ML138		827	DRY	REG	AC-227	0.71	0.15	PCI/G	GAMMASPEC	0.24
SVP0610	10/08/98	10/09/98	98ML138		827	DRY	REG	PA-231	0.19	0.63	PCI/G	GAMMASPEC	0.90
SVP0610	10/08/98	10/09/98	98ML138		827	DRY	REG	AM-241	0.00	0.04	PCI/G	GAMMASPEC	0.06
SVP0611	10/08/98	10/09/98	98ML138		805	DRY	REG	K-40	15.21	2.02	PCI/G	GAMMASPEC	0.18
SVP0611	10/08/98	10/09/98	98ML138		805	DRY	REG	CS-137	0.04	0.03	PCI/G	GAMMASPEC	0.03
SVP0611	10/08/98	10/09/98	98ML138		805	DRY	REG	RA-226	0.64	0.06	PCI/G	GAMMASPEC	0.04
SVP0611	10/08/98	10/09/98	98ML138		805	DRY	REG	RA-228	0.92	0.10	PCI/G	GAMMASPEC	0.06

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Sample ID	Date Collected	Date Analyzed	SDG ID	LAB ID	Vol.	W/D	Sample Type	Analyte	Result	Error	Units	Analytical Method	MDA
SVP0611	10/08/98	10/09/98	98ML138		805	DRY	REG	TH-228	0.92	0.10	PCI/G	GAMMASPEC	0.06
SVP0611	10/08/98	10/09/98	98ML138		805	DRY	REG	TH-232	0.92	0.10	PCI/G	GAMMASPEC	0.06
SVP0611	10/08/98	10/09/98	98ML138		805	DRY	REG	U-235	0.17	0.11	PCI/G	GAMMASPEC	0.15
SVP0611	10/08/98	10/09/98	98ML138		805	DRY	REG	U-238	1.32	0.72	PCI/G	GAMMASPEC	3.01
SVP0611	10/08/98	10/09/98	98ML138		805	DRY	REG	AC-227	0.08	0.10	PCI/G	GAMMASPEC	0.15
SVP0611	10/08/98	10/09/98	98ML138		805	DRY	REG	TH-230	-3.51	4.70	PCI/G	GAMMASPEC	7.61
SVP0611	10/08/98	10/09/98	98ML138		805	DRY	REG	PA-231	0.44	0.57	PCI/G	GAMMASPEC	0.67
SVP0611	10/08/98	10/09/98	98ML138		805	DRY	REG	AM-241	0.05	0.06	PCI/G	GAMMASPEC	0.09
SVP0612	10/08/98	10/09/98	98ML138		663	DRY	REG	K-40	14.53	1.75	PCI/G	GAMMASPEC	0.32
SVP0612	10/08/98	10/09/98	98ML138		663	DRY	REG	CS-137	0.18	0.05	PCI/G	GAMMASPEC	0.04
SVP0612	10/08/98	10/09/98	98ML138		663	DRY	REG	RA-226	0.75	0.07	PCI/G	GAMMASPEC	0.06
SVP0612	10/08/98	10/09/98	98ML138		663	DRY	REG	RA-228	0.86	0.11	PCI/G	GAMMASPEC	0.11
SVP0612	10/08/98	10/09/98	98ML138		663	DRY	REG	TH-228	0.86	0.11	PCI/G	GAMMASPEC	0.11
SVP0612	10/08/98	10/09/98	98ML138		663	DRY	REG	TH-232	0.86	0.11	PCI/G	GAMMASPEC	0.11
SVP0612	10/08/98	10/09/98	98ML138		663	DRY	REG	U-235	0.22	0.14	PCI/G	GAMMASPEC	0.18
SVP0612	10/08/98	10/09/98	98ML138		663	DRY	REG	U-238	0.62	0.49	PCI/G	GAMMASPEC	4.50
SVP0612	10/08/98	10/09/98	98ML138		663	DRY	REG	AC-227	0.58	0.16	PCI/G	GAMMASPEC	0.26
SVP0612	10/08/98	10/09/98	98ML138		663	DRY	REG	TH-230	2.88	3.92	PCI/G	GAMMASPEC	6.27
SVP0612	10/08/98	10/09/98	98ML138		663	DRY	REG	PA-231	0.46	0.51	PCI/G	GAMMASPEC	1.01
SVP0612	10/08/98	10/09/98	98ML138		663	DRY	REG	AM-241	-0.01	0.04	PCI/G	GAMMASPEC	0.06
SVP0613	10/09/98	10/14/98	98ML138		639	DRY	REG	RA-226	0.90	0.08	PCI/G	GAMMASPEC	0.06
SVP0613	10/09/98	10/14/98	98ML138		639	DRY	REG	RA-228	0.86	0.11	PCI/G	GAMMASPEC	0.11
SVP0613	10/09/98	10/14/98	98ML138		639	DRY	REG	TH-228	0.86	0.11	PCI/G	GAMMASPEC	0.11
SVP0613	10/09/98	10/14/98	98ML138		639	DRY	REG	TH-232	0.86	0.11	PCI/G	GAMMASPEC	0.11
SVP0613	10/09/98	10/14/98	98ML138		639	DRY	REG	TH-230	4.77	4.24	PCI/G	GAMMASPEC	6.16
SVP0613	10/09/98	10/14/98	98ML138		639	DRY	REG	U-238	1.64	0.78	PCI/G	GAMMASPEC	5.31
SVP0613	10/09/98	10/14/98	98ML138		639	DRY	REG	K-40	14.77	1.76	PCI/G	GAMMASPEC	2.38
SVP0613	10/09/98	10/14/98	98ML138		639	DRY	REG	CS-137	0.03	0.03	PCI/G	GAMMASPEC	0.05

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Sample ID	Date Collected	Date Analyzed	SDG ID	LAB ID	Vol.	W/D	Sample Type	Analyte	Result	Error	Units	Analytical Method	MDA
SVP0613	10/09/98	10/14/98	98ML138		639	DRY	REG	AC-227	1.26	0.22	PCI/G	GAMMASPEC	0.34
SVP0613	10/09/98	10/14/98	98ML138		639	DRY	REG	PA-231	-0.04	0.71	PCI/G	GAMMASPEC	0.99
SVP0613	10/09/98	10/14/98	98ML138		639	DRY	REG	U-235	0.17	0.14	PCI/G	GAMMASPEC	0.21
SVP0613	10/09/98	10/14/98	98ML138		639	DRY	REG	AM-241	0.03	0.04	PCI/G	GAMMASPEC	0.07
SVP0726	10/13/98	10/14/98	98ML138		685	DRY	REG	CS-137	0.03	0.03	PCI/G	GAMMASPEC	0.04
SVP0726	10/13/98	10/14/98	98ML138		685	DRY	REG	RA-226	0.73	0.07	PCI/G	GAMMASPEC	0.06
SVP0726	10/13/98	10/14/98	98ML138		685	DRY	REG	RA-228	0.66	0.10	PCI/G	GAMMASPEC	0.08
SVP0726	10/13/98	10/14/98	98ML138		685	DRY	REG	TH-228	0.66	0.10	PCI/G	GAMMASPEC	0.08
SVP0726	10/13/98	10/14/98	98ML138		685	DRY	REG	TH-232	0.66	0.10	PCI/G	GAMMASPEC	0.08
SVP0726	10/13/98	10/14/98	98ML138		685	DRY	REG	TH-230	3.36	4.51	PCI/G	GAMMASPEC	5.93
SVP0726	10/13/98	10/14/98	98ML138		685	DRY	REG	U-238	0.90	0.57	PCI/G	GAMMASPEC	5.30
SVP0726	10/13/98	10/14/98	98ML138		685	DRY	REG	K-40	12.61	1.53	PCI/G	GAMMASPEC	2.13
SVP0726	10/13/98	10/14/98	98ML138		685	DRY	REG	AC-227	0.90	0.19	PCI/G	GAMMASPEC	0.29
SVP0726	10/13/98	10/14/98	98ML138		685	DRY	REG	PA-231	-0.08	0.63	PCI/G	GAMMASPEC	0.87
SVP0726	10/13/98	10/14/98	98ML138		685	DRY	REG	U-235	0.15	0.19	PCI/G	GAMMASPEC	0.19
SVP0726	10/13/98	10/14/98	98ML138		685	DRY	REG	AM-241	0.03	0.04	PCI/G	GAMMASPEC	0.06
SVP0727	10/13/98	10/14/98	98ML138		620	DRY	REG	CS-137	0.06	0.05	PCI/G	GAMMASPEC	0.04
SVP0727	10/13/98	10/14/98	98ML138		620	DRY	REG	RA-226	0.74	0.08	PCI/G	GAMMASPEC	0.07
SVP0727	10/13/98	10/14/98	98ML138		620	DRY	REG	RA-228	0.81	0.12	PCI/G	GAMMASPEC	0.10
SVP0727	10/13/98	10/14/98	98ML138		620	DRY	REG	TH-228	0.81	0.12	PCI/G	GAMMASPEC	0.10
SVP0727	10/13/98	10/14/98	98ML138		620	DRY	REG	TH-232	0.81	0.12	PCI/G	GAMMASPEC	0.10
SVP0727	10/13/98	10/14/98	98ML138		620	DRY	REG	U-235	0.28	0.15	PCI/G	GAMMASPEC	0.20
SVP0727	10/13/98	10/14/98	98ML138		620	DRY	REG	U-238	0.95	0.61	PCI/G	GAMMASPEC	6.74
SVP0727	10/13/98	10/14/98	98ML138		620	DRY	REG	K-40	12.51	1.61	PCI/G	GAMMASPEC	2.43
SVP0727	10/13/98	10/14/98	98ML138		620	DRY	REG	AC-227	1.25	0.24	PCI/G	GAMMASPEC	0.38
SVP0727	10/13/98	10/14/98	98ML138		620	DRY	REG	TH-230	1.82	4.80	PCI/G	GAMMASPEC	7.17
SVP0727	10/13/98	10/14/98	98ML138		620	DRY	REG	PA-231	0.16	0.77	PCI/G	GAMMASPEC	1.09
SVP0727	10/13/98	10/14/98	98ML138		620	DRY	REG	AM-241	0.00	0.05	PCI/G	GAMMASPEC	0.07

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SVP0728	10/14/98	10/16/98	98ML138		93	DRY	REG	K-40	13.78	2.75	PCI/G	GAMMASPEC	1.15
SVP0728	10/14/98	10/16/98	98ML138		93	DRY	REG	RA-226	0.71	0.15	PCI/G	GAMMASPEC	0.18
SVP0728	10/14/98	10/16/98	98ML138		93	DRY	REG	RA-228	0.81	0.25	PCI/G	GAMMASPEC	0.33
SVP0728	10/14/98	10/16/98	98ML138		93	DRY	REG	TH-228	0.81	0.25	PCI/G	GAMMASPEC	0.33
SVP0728	10/14/98	10/16/98	98ML138		93	DRY	REG	TH-232	0.81	0.25	PCI/G	GAMMASPEC	0.33
SVP0728	10/14/98	10/16/98	98ML138		93	DRY	REG	U-238	1.13	1.18	PCI/G	GAMMASPEC	14.07
SVP0728	10/14/98	10/16/98	98ML138		93	DRY	REG	CS-137	0.05	0.08	PCI/G	GAMMASPEC	0.14
SVP0728	10/14/98	10/16/98	98ML138		93	DRY	REG	AC-227	0.35	0.35	PCI/G	GAMMASPEC	0.54
SVP0728	10/14/98	10/16/98	98ML138		93	DRY	REG	TH-230	-5.90	8.26	PCI/G	GAMMASPEC	11.47
SVP0728	10/14/98	10/16/98	98ML138		93	DRY	REG	PA-231	0.64	2.06	PCI/G	GAMMASPEC	2.98
SVP0728	10/14/98	10/16/98	98ML138		93	DRY	REG	U-235	-0.02	0.26	PCI/G	GAMMASPEC	0.43
SVP0728	10/14/98	10/16/98	98ML138		93	DRY	REG	AM-241	-0.04	0.09	PCI/G	GAMMASPEC	0.12
SVP0729	10/14/98	10/16/98	98ML138		764	DRY	REG	K-40	11.99	1.48	PCI/G	GAMMASPEC	0.31
SVP0729	10/14/98	10/16/98	98ML138		764	DRY	REG	CS-137	0.04	0.02	PCI/G	GAMMASPEC	0.03
SVP0729	10/14/98	10/16/98	98ML138		764	DRY	REG	RA-226	0.74	0.07	PCI/G	GAMMASPEC	0.05
SVP0729	10/14/98	10/16/98	98ML138		764	DRY	REG	RA-228	0.70	0.10	PCI/G	GAMMASPEC	0.10
SVP0729	10/14/98	10/16/98	98ML138		764	DRY	REG	TH-228	0.70	0.10	PCI/G	GAMMASPEC	0.10
SVP0729	10/14/98	10/16/98	98ML138		764	DRY	REG	TH-232	0.70	0.10	PCI/G	GAMMASPEC	0.10
SVP0729	10/14/98	10/16/98	98ML138		764	DRY	REG	U-238	0.72	0.47	PCI/G	GAMMASPEC	4.92
SVP0729	10/14/98	10/16/98	98ML138		764	DRY	REG	AC-227	0.29	0.14	PCI/G	GAMMASPEC	0.21
SVP0729	10/14/98	10/16/98	98ML138		764	DRY	REG	TH-230	0.34	3.48	PCI/G	GAMMASPEC	5.47
SVP0729	10/14/98	10/16/98	98ML138		764	DRY	REG	PA-231	0.47	0.61	PCI/G	GAMMASPEC	0.90
SVP0729	10/14/98	10/16/98	98ML138		764	DRY	REG	U-235	0.10	0.10	PCI/G	GAMMASPEC	0.17
SVP0729	10/14/98	10/16/98	98ML138		764	DRY	REG	AM-241	0.00	0.04	PCI/G	GAMMASPEC	0.05
SVP0730	10/14/98	10/16/98	98ML138		850	DRY	REG	K-40	11.95	1.46	PCI/G	GAMMASPEC	0.30
SVP0730	10/14/98	10/16/98	98ML138		850	DRY	REG	RA-226	0.75	0.06	PCI/G	GAMMASPEC	0.05
SVP0730	10/14/98	10/16/98	98ML138		850	DRY	REG	RA-228	0.80	0.09	PCI/G	GAMMASPEC	0.08
SVP0730	10/14/98	10/16/98	98ML138		850	DRY	REG	TH-228	0.80	0.09	PCI/G	GAMMASPEC	0.08

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SVP0730	10/14/98	10/16/98	98ML138		850	DRY	REG	TH-232	0.80	0.09	PCI/G	GAMMASPEC	0.08
SVP0730	10/14/98	10/16/98	98ML138		850	DRY	REG	TH-230	1.96	3.98	PCI/G	GAMMASPEC	5.35
SVP0730	10/14/98	10/16/98	98ML138		850	DRY	REG	U-238	0.90	0.55	PCI/G	GAMMASPEC	4.93
SVP0730	10/14/98	10/16/98	98ML138		850	DRY	REG	CS-137	0.02	0.02	PCI/G	GAMMASPEC	0.04
SVP0730	10/14/98	10/16/98	98ML138		850	DRY	REG	AC-227	0.24	0.13	PCI/G	GAMMASPEC	0.20
SVP0730	10/14/98	10/16/98	98ML138		850	DRY	REG	PA-231	-0.03	0.60	PCI/G	GAMMASPEC	0.83
SVP0730	10/14/98	10/16/98	98ML138		850	DRY	REG	U-235	0.05	0.09	PCI/G	GAMMASPEC	0.16
SVP0730	10/14/98	10/16/98	98ML138		850	DRY	REG	AM-241	0.02	0.04	PCI/G	GAMMASPEC	0.05
SVP0731	10/15/98	10/20/98	98ML138		789	DRY	REG	K-40	14.01	1.86	PCI/G	GAMMASPEC	0.17
SVP0731	10/15/98	10/20/98	98ML138		789	DRY	REG	CS-137	0.02	0.02	PCI/G	GAMMASPEC	0.03
SVP0731	10/15/98	10/20/98	98ML138		789	DRY	REG	RA-226	0.81	0.07	PCI/G	GAMMASPEC	0.04
SVP0731	10/15/98	10/20/98	98ML138		789	DRY	REG	RA-228	0.86	0.10	PCI/G	GAMMASPEC	0.07
SVP0731	10/15/98	10/20/98	98ML138		789	DRY	REG	TH-228	0.86	0.10	PCI/G	GAMMASPEC	0.07
SVP0731	10/15/98	10/20/98	98ML138		789	DRY	REG	TH-232	0.86	0.10	PCI/G	GAMMASPEC	0.07
SVP0731	10/15/98	10/20/98	98ML138		789	DRY	REG	U-238	0.69	0.66	PCI/G	GAMMASPEC	3.58
SVP0731	10/15/98	10/20/98	98ML138		789	DRY	REG	AC-227	0.06	0.09	PCI/G	GAMMASPEC	0.15
SVP0731	10/15/98	10/20/98	98ML138		789	DRY	REG	TH-230	-0.20	4.96	PCI/G	GAMMASPEC	7.90
SVP0731	10/15/98	10/20/98	98ML138		789	DRY	REG	PA-231	0.46	0.43	PCI/G	GAMMASPEC	0.68
SVP0731	10/15/98	10/20/98	98ML138		789	DRY	REG	U-235	0.05	0.12	PCI/G	GAMMASPEC	0.16
SVP0731	10/15/98	10/20/98	98ML138		789	DRY	REG	AM-241	-0.01	0.06	PCI/G	GAMMASPEC	0.09
SVP0832	10/21/98	10/22/98	98ML138		663	DRY	REG	K-40	12.40	1.56	PCI/G	GAMMASPEC	0.40
SVP0832	10/21/98	10/22/98	98ML138		663	DRY	REG	CS-137	0.14	0.04	PCI/G	GAMMASPEC	0.03
SVP0832	10/21/98	10/22/98	98ML138		663	DRY	REG	RA-226	1.04	0.09	PCI/G	GAMMASPEC	0.06
SVP0832	10/21/98	10/22/98	98ML138		663	DRY	REG	RA-228	0.81	0.10	PCI/G	GAMMASPEC	0.09
SVP0832	10/21/98	10/22/98	98ML138		663	DRY	REG	TH-228	0.81	0.10	PCI/G	GAMMASPEC	0.09
SVP0832	10/21/98	10/22/98	98ML138		663	DRY	REG	TH-232	0.81	0.10	PCI/G	GAMMASPEC	0.09
SVP0832	10/21/98	10/22/98	98ML138		663	DRY	REG	TH-230	21.41	5.91	PCI/G	GAMMASPEC	6.52
SVP0832	10/21/98	10/22/98	98ML138		663	DRY	REG	U-238	1.52	0.67	PCI/G	GAMMASPEC	5.88

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SVP0832	10/21/98	10/22/98	98ML138		663	DRY	REG	AC-227	0.35	0.17	PCI/G	GAMMASPEC	0.33
SVP0832	10/21/98	10/22/98	98ML138		663	DRY	REG	PA-231	0.46	0.73	PCI/G	GAMMASPEC	1.06
SVP0832	10/21/98	10/22/98	98ML138		663	DRY	REG	U-235	0.33	0.19	PCI/G	GAMMASPEC	0.22
SVP0832	10/21/98	10/22/98	98ML138		663	DRY	REG	AM-241	0.01	0.06	PCI/G	GAMMASPEC	0.07
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REG	K-40	12.46	1.52	PCI/G	GAMMASPEC	0.33
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REG	CS-137	0.07	0.03	PCI/G	GAMMASPEC	0.04
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REG	RA-226	0.84	0.07	PCI/G	GAMMASPEC	0.05
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REG	RA-228	0.85	0.10	PCI/G	GAMMASPEC	0.09
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REG	TH-228	0.85	0.10	PCI/G	GAMMASPEC	0.09
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REG	TH-232	0.85	0.10	PCI/G	GAMMASPEC	0.09
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REG	TH-230	14.12	5.79	PCI/G	GAMMASPEC	5.70
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REG	U-238	1.03	0.57	PCI/G	GAMMASPEC	5.02
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REG	AC-227	0.38	0.14	PCI/G	GAMMASPEC	0.22
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REG	PA-231	0.62	0.61	PCI/G	GAMMASPEC	0.91
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REG	U-235	0.11	0.15	PCI/G	GAMMASPEC	0.18
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REG	AM-241	0.06	0.04	PCI/G	GAMMASPEC	0.06
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REPL	K-40	12.79	1.53	PCI/G	GAMMASPEC	0.29
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REPL	CS-137	0.08	0.04	PCI/G	GAMMASPEC	0.03
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REPL	RA-226	0.87	0.07	PCI/G	GAMMASPEC	0.06
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REPL	RA-228	0.79	0.10	PCI/G	GAMMASPEC	0.09
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REPL	TH-228	0.79	0.10	PCI/G	GAMMASPEC	0.09
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REPL	TH-232	0.79	0.10	PCI/G	GAMMASPEC	0.09
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REPL	TH-230	15.36	6.72	PCI/G	GAMMASPEC	5.55
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REPL	U-238	1.28	0.53	PCI/G	GAMMASPEC	4.66
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REPL	AC-227	0.20	0.14	PCI/G	GAMMASPEC	0.21
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REPL	PA-231	0.22	0.67	PCI/G	GAMMASPEC	0.96
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REPL	U-235	0.14	0.17	PCI/G	GAMMASPEC	0.18
SVP0861	10/22/98	10/23/98	98ML138		799	DRY	REPL	AM-241	0.06	0.04	PCI/G	GAMMASPEC	0.06

PRELIMINARY

Approved by: _____

Date: _____

Location: SLAPS VP	
Site WBS: 134	Date Entered: 10/12/98
Work Order Number:	
Project Number:	
Environmental Cat: RI	

Sample ID	Date Collected	Date Analyzed	SDG ID	LAB ID	Vol.	W/D	Sample Type	Analyte	Result	Error	Units	Analytical Method	MDA
QCBLANK	10/23/98	10/23/98	98ML138		500	DRY	PB	K-40	0.10	0.22	PCI/G	GAMMASPEC	0.22
QCBLANK	10/23/98	10/23/98	98ML138		500	DRY	PB	CS-137	0.01	0.01	PCI/G	GAMMASPEC	0.02
QCBLANK	10/23/98	10/23/98	98ML138		500	DRY	PB	RA-226	0.02	0.02	PCI/G	GAMMASPEC	0.04
QCBLANK	10/23/98	10/23/98	98ML138		500	DRY	PB	AC-227	0.05	0.06	PCI/G	GAMMASPEC	0.10
QCBLANK	10/23/98	10/23/98	98ML138		500	DRY	PB	RA-228	0.00	0.05	PCI/G	GAMMASPEC	0.05
QCBLANK	10/23/98	10/23/98	98ML138		500	DRY	PB	TH-228	0.00	0.05	PCI/G	GAMMASPEC	0.05
QCBLANK	10/23/98	10/23/98	98ML138		500	DRY	PB	TH-232	0.00	0.05	PCI/G	GAMMASPEC	0.05
QCBLANK	10/23/98	10/23/98	98ML138		500	DRY	PB	TH-230	0.72	1.24	PCI/G	GAMMASPEC	2.16
QCBLANK	10/23/98	10/23/98	98ML138		500	DRY	PB	PA-231	0.08	0.59	PCI/G	GAMMASPEC	0.61
QCBLANK	10/23/98	10/23/98	98ML138		500	DRY	PB	U-235	0.06	0.07	PCI/G	GAMMASPEC	0.09
QCBLANK	10/23/98	10/23/98	98ML138		500	DRY	PB	U-238	0.94	1.75	PCI/G	GAMMASPEC	3.23
QCBLANK	10/23/98	10/23/98	98ML138		500	DRY	PB	AM-241	-0.01	0.01	PCI/G	GAMMASPEC	0.02
QC SPIKE	04/01/97	10/23/98	98ML138		500	DRY	LCSF	CS-137	86.51	8.72	PCI/G	GAMMASPEC	0.63
QC SPIKE	04/01/97	10/23/98	98ML138		500	DRY	LCSF	AM-241	186.40	21.56	PCI/G	GAMMASPEC	0.75
QC SPIKE	04/01/97	10/23/98	98ML138		500	DRY	LCST	CS-137	85.22	3.84	PCI/G	GAMMASPEC	0.63
QC SPIKE	04/01/97	10/23/98	98ML138		500	DRY	LCST	AM-241	187.31	9.37	PCI/G	GAMMASPEC	0.75

PRELIMINARY

Approved by: _____

Date: _____

Sample ID : OB26OCT98 - Acquisition date : 26-OCT-1998 13:53:16

VMS Gamma Spectroscopy Report generated 26-OCT-1998 14:53:43

Configuration : DKA200: [GAMMA.SCUSR.ARCHIVE] SMP_OB26OCT98_DET2_500MARSOIL_735

---- Sample Information ----

Sample Title : SVP0862
 Sample ID : OB26OCT98 Sample Quantity : 8.73250E+02 GRAM
 Sample Type : SOIL Sample Geometry :
 Sample Number : 7357 Spctrm Collector : PROCOUNT USER
 Sample Collector : Sample Analyst : PROCOUNT USER

---- Sample Decay/Count Information ----

Sample Date : 23-OCT-1998 00:00:00 Acquisition date : 26-OCT-1998 13:53:16
 Decay time : 3 13:53:16.14 % dead time : 0.2%
 Elapsed live time: 0 01:00:00.00 Elapsed real time: 0 01:00:06.89

---- Detector Parameters ----

Energy cal. time : 23-JUL-1998 07:34:46 Energy cal. oper.: PROCOUNT USER
 Detector name : Det2 Counting geometry: 500MARSOIL
 Effic. cal. time : 8-MAY-1998 06:53:58. Effic. cal. oper.: PROCOUNT USER

---- Processing Parameters ----

Start channel : 50 End channel : 4080
 Sensitivity : 3.00000 Gaussian Sens. : 10.00000
 Critical level? : No Propagate Errors?: Yes
 Empirical Eff? : Yes Library-based eff: Yes
 Energy tolerance : 1.50000 Half life ratio : 8.00000
 Abundance limit : 75.00000 WTM error limit : 3.00000
 MDA Width (FWHM) : 3.00000 MDA Confid Level : 5.00000 %
 Bkg filename : DKA200: [GAMMA.SCUSR.ARCHIVE] BKG_24OCT98_DET2_500MARSOIL_735.

Combined Activity-MDA Report

---- Identified Nuclides ----

Nuclide	Activity (pCi/GRAM)	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
K-40	1.123E+01	1.345E+00	2.867E-01	2.760E-02	39.152
CS-137	4.646E-02	4.044E-02	3.242E-02	3.227E-03	1.433
RA-226	7.751E-01	6.628E-02	5.062E-02	5.738E-03	15.312
AC-228	7.268E-01	9.604E-02	7.469E-02	8.380E-03	9.730
U-238	1.101E+00	5.089E-01	4.631E+00	4.485E-01	0.238

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/GRAM)	K.L. Ided	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
AC-227	2.543E-01		1.299E-01	1.993E-01	1.998E-02	1.276
TH-230	3.614E+00		3.629E+00	5.477E+00	6.171E-01	0.660
PA-231	7.304E-01		6.085E-01	9.111E-01	9.965E-02	0.802
U-235	6.524E-02	+	1.125E-01	1.659E-01	1.601E-02	0.393
AM-241	2.534E-02		3.465E-02	5.247E-02	6.053E-03	0.483

Sample ID : OC26OCT98 Acquisition date : 26-OCT-1998 14:55:13

VMS Gamma Spectroscopy Report generated 26-OCT-1998 15:55:37

Configuration : DKA200:[GAMMA.SCUSR.ARCHIVE]SMP_OC26OCT98_DET2_500MARSOIL_735

---- Sample Information ----

Sample Title : SVP0863
 Sample ID : OC26OCT98 Sample Quantity : 8.94080E+02 GRAM
 Sample Type : SOIL Sample Geometry :
 Sample Number : 7359 Spctrm Collector : PROCOUNT USER
 Sample Collector : Sample Analyst : PROCOUNT USER

---- Sample Decay/Count Information ----

Sample Date : 23-OCT-1998 00:00:00 Acquisition date : 26-OCT-1998 14:55:13
 Decay time : 3 14:55:13.09 % dead time : 0.1%
 Elapsed live time: 0 01:00:00.00 Elapsed real time: 0 01:00:04.51

---- Detector Parameters ----

Energy cal. time : 23-JUL-1998 07:34:46 Energy cal. oper.: PROCOUNT USER
 Detector name : Det2 Counting geometry: 500MARSOIL
 Effic. cal. time : 8-MAY-1998 06:53:58. Effic. cal. oper.: PROCOUNT USER

---- Processing Parameters ----

Start channel : 50 End channel : 4080
 Sensitivity : 3.00000 Gaussian Sens. : 10.00000
 Critical level? : No Propagate Errors?: Yes
 Empirical Eff? : Yes Library-based eff: Yes
 Energy tolerance : 1.50000 Half life ratio : 8.00000
 Abundance limit : 75.00000 WTM error limit : 3.00000
 MDA Width (FWHM) : 3.00000 MDA Confid Level : 5.00000 %
 Bkg filename : DKA200:[GAMMA.SCUSR.ARCHIVE]BKG_24OCT98_DET2_500MARSOIL_735.

Combined Activity-MDA Report

---- Identified Nuclides ----

Nuclide	Activity (pCi/GRAM)	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
K-40	1.254E+01	1.487E+00	2.627E-01	2.529E-02	47.728
CS-137	4.301E-02	3.277E-02	3.640E-02	3.623E-03	1.182
RA-226	8.417E-01	6.569E-02	4.827E-02	5.472E-03	17.437
AC-228	7.394E-01	9.486E-02	8.171E-02	9.168E-03	9.049
TH-230	6.051E+00	4.498E+00	5.146E+00	5.798E-01	1.176
U-238	9.334E-01	5.272E-01	4.659E+00	4.512E-01	0.200

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/GRAM)	K.L. Ided	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
AC-227	4.005E-01		1.313E-01	2.052E-01	2.057E-02	1.952
PA-231	1.395E-01		5.586E-01	7.934E-01	8.677E-02	0.176
U-235	-2.672E-03		9.991E-02	1.683E-01	1.625E-02	-0.016
AM-241	2.159E-02		3.599E-02	5.424E-02	6.257E-03	0.398

Sample ID : be27oct98 Acquisition date : 27-OCT-1998 09:30:01

VMS Gamma Spectroscopy Report generated 27-OCT-1998 10:30:20

Configuration : DKA200:[GAMMA.SCUSR.ARCHIVE] SMP_BE27OCT98_DET1_500MARSOIL_738

---- Sample Information ----

Sample Title : SVP0864
Sample ID : be27oct98 Sample Quantity : 7.80360E+02 GRAM
Sample Type : Sample Geometry :
Sample Number : 7383 Spctrm Collector : PROCOUNT USER
Sample Collector : Sample Analyst : PROCOUNT USER

---- Sample Decay/Count Information ----

Sample Date : 26-OCT-1998 13:15:00 Acquisition date : 27-OCT-1998 09:30:01
Decay time : 0 20:15:01.68 % dead time : 0.0%
Elapsed live time: 0 01:00:00.00 Elapsed real time: 0 01:00:00.98

---- Detector Parameters ----

Energy cal. time : 22-SEP-1998 09:06:09 Energy cal. oper.: PROCOUNT USER
Detector name : Det1 Counting geometry: 500-mar-soil
Effic. cal. time : 8-MAY-1998 14:04:21. Effic. cal. oper.: PROCOUNT USER

---- Processing Parameters ----

Start channel : 50 End channel : 4080
Sensitivity : 3.00000 Gaussian Sens. : 10.00000
Critical level? : No Propagate Errors?: Yes
Empirical Eff? : Yes Library-based eff: Yes
Energy tolerance : 1.50000 Half life ratio : 8.00000
Abundance limit : 75.00000 WTM error limit : 3.00000
MDA Width (FWHM) : 3.00000 MDA Confid Level : 5.00000 %
Bkg filename : DKA200:[GAMMA.SCUSR.ARCHIVE] BKG_24OCT98_DET1_500MARSOIL_7385.

Combined Activity-MDA Report

---- Identified Nuclides ----

Nuclide	Activity (pCi/GRAM)	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
K-40	1.561E+01	2.070E+00	1.887E-01	2.293E-02	82.746
RA-226	6.692E-01	6.369E-02	4.084E-02	6.442E-03	16.383
AC-228	9.491E-01	1.019E-01	5.639E-02	8.154E-03	16.833
U-238	1.176E+00	6.705E-01	3.472E+00	3.715E-01	0.339

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/GRAM)	K.L. Ided	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
CS-137	7.791E-03		1.834E-02	2.795E-02	3.000E-03	0.279
AC-227	6.485E-02		9.276E-02	1.435E-01	1.573E-02	0.452
TH-230	5.497E+00		4.974E+00	8.086E+00	1.388E+00	0.680
PA-231	3.382E-01		4.052E-01	6.302E-01	8.525E-02	0.537
U-235	-1.092E-03		9.799E-02	1.585E-01	1.829E-02	-0.007
AM-241	8.082E-02		5.893E-02	9.203E-02	1.469E-02	0.878

Sample ID : CG28OCT98

Acquisition date : 28-OCT-1998 09:04:09

VMS Gamma Spectroscopy Report generated 28-OCT-1998 10:04:28

Configuration : DKA200:[GAMMA.SCUSR.ARCHIVE]SMP_CG28OCT98_DET1_500MARSOIL_741

---- Sample Information ----

Sample Title : SVP0865
 Sample ID : CG28OCT98
 Sample Type :
 Sample Number : 7414
 Sample Collector :
 Sample Quantity : 6.59000E+02 GRAM
 Sample Geometry :
 Spctrm Collector : PROCOUNT USER
 Sample Analyst : PROCOUNT USER

---- Sample Decay/Count Information ----

Sample Date : 27-OCT-1998 13:25:00 Acquisition date : 28-OCT-1998 09:04:09
 Decay time : 0 19:39:09.80 % dead time : 0.0%
 Elapsed live time: 0 01:00:00.00 Elapsed real time: 0 01:00:00.62

---- Detector Parameters ----

Energy cal. time : 22-SEP-1998 09:06:09 Energy cal. oper.: PROCOUNT USER
 Detector name : Det1 Counting geometry: 500-mar-soil
 Effic. cal. time : 8-MAY-1998 14:04:21. Effic. cal. oper.: PROCOUNT USER

---- Processing Parameters ----

Start channel : 50 End channel : 4080
 Sensitivity : 3.00000 Gaussian Sens. : 10.00000
 Critical level? : No Propagate Errors?: Yes
 Empirical Eff? : Yes Library-based eff: Yes
 Energy tolerance : 1.50000 Half life ratio : 8.00000
 Abundance limit : 75.00000 WTM error limit : 3.00000
 MDA width (FWHM) : 3.00000 MDA Confid Level : 5.00000 %
 Bkg filename : DKA200:[GAMMA.SCUSR.ARCHIVE]BKG_24OCT98_DET1_500MARSOIL_741.5.

Combined Activity-MDA Report

---- Identified Nuclides ----

Nuclide	Activity (pCi/GRAM)	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
K-40	8.191E+00	1.185E+00	1.935E-01	2.352E-02	42.335
CS-137	5.486E-02	1.884E-02	2.517E-02	2.701E-03	2.179
RA-226	5.738E-01	5.532E-02	3.570E-02	5.631E-03	16.072
AC-228	3.904E-01	6.747E-02	6.127E-02	8.861E-03	6.371
U-238	4.444E-01	5.987E-01	3.317E+00	3.549E-01	0.134

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/GRAM)	K.L. Ided	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
AC-227	-1.132E-03		8.583E-02	1.283E-01	1.407E-02	-0.009
TH-230	2.165E+00		4.320E+00	7.024E+00	1.206E+00	0.308
PA-231	7.091E-02		3.611E-01	5.419E-01	7.330E-02	0.131
U-235	4.167E-02		8.608E-02	1.423E-01	1.641E-02	0.293
AM-241	-3.443E-02		5.278E-02	7.601E-02	1.213E-02	-0.453

Sample ID : HK09NOV98 Acquisition date : 9-NOV-1998 19:14:54

VMS Gamma Spectroscopy Report generated 9-NOV-1998 20:15:13

Configuration : DKA200:[GAMMA.SCUSR.ARCHIVE]SMP_HK09NOV98_DET1_500MARSOIL_767

---- Sample Information ----

Sample Title : SVP0933
 Sample ID : HK09NOV98 Sample Quantity : 4.49000E+02 GRAM
 Sample Type : Sample Geometry :
 Sample Number : 7675 Spctrm Collector : PROCOUNT USER
 Sample Collector : Sample Analyst : PROCOUNT USER

---- Sample Decay/Count Information ----

Sample Date : 6-NOV-1998 14:30:00. Acquisition date : 9-NOV-1998 19:14:54.
 Decay time : 3 04:44:54.44 % dead time : 0.1%
 Elapsed live time: 0 01:00:00.00 Elapsed real time: 0 01:00:01.96

---- Detector Parameters ----

Energy cal. time : 22-SEP-1998 09:06:09 Energy cal. oper.: PROCOUNT USER
 Detector name : Det1 Counting geometry: 500-mar-soil
 Effic. cal. time : 8-MAY-1998 14:04:21. Effic. cal. oper.: PROCOUNT USER

---- Processing Parameters ----

Start channel : 50 End channel : 4080
 Sensitivity : 3.00000 Gaussian Sens. : 10.00000
 Critical level? : No Propagate Errors?: Yes
 Empirical Eff? : Yes Library-based eff: Yes
 Energy tolerance : 1.50000 Half life ratio : 8.00000
 Abundance limit : 75.00000 WTM error limit : 3.00000
 MDA Width (FWHM) : 3.00000 MDA Confid Level : 5.00000 %
 Bkg filename : DKA200:[GAMMA.SCUSR.ARCHIVE]BKG_HA08NOV98_DET1_7656.CNF;

Combined Activity-MDA Report

---- Identified Nuclides ----

Nuclide	Activity (pCi/GRAM)	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
K-40	1.338E+01	1.958E+00	5.976E-01	7.263E-02	22.392
CS-137	3.643E-01	6.711E-02	4.850E-02	5.205E-03	7.512
RA-226	4.226E+00	3.022E-01	9.018E-02	1.422E-02	46.865
AC-227	3.719E+00	3.383E-01	3.172E-01	3.476E-02	11.725
AC-228	1.619E+00	1.842E-01	1.445E-01	2.090E-02	11.198
TH-230	3.595E+02	6.714E+01	2.357E+01	4.047E+00	15.251
PA-231	4.020E+00	1.173E+00	1.590E+00	2.151E-01	2.529
U-235	2.264E+00	4.524E-01	3.921E-01	4.523E-02	5.774
U-238	1.049E+01	2.595E+00	6.611E+00	7.073E-01	1.587

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/GRAM)	K.L. Ided	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
AM-241	-1.626E-01		2.272E-01	2.628E-01	4.194E-02	-0.619

Sample ID : HL09NOV98

Acquisition date : 9-NOV-1998 20:15:39

VMS Gamma Spectroscopy Report generated 9-NOV-1998 21:15:59

Configuration : DKA200:[GAMMA.SCUSR.ARCHIVE]SMP_HL09NOV98_DET1_500MARSOIL_767

---- Sample Information ----

Sample Title : SVP0934
 Sample ID : HL09NOV98
 Sample Type :
 Sample Number : 7676
 Sample Collector :
 Sample Quantity : 5.63000E+02 GRAM
 Sample Geometry :
 Spctrm Collector : PROCOUNT USER
 Sample Analyst : PROCOUNT USER

---- Sample Decay/Count Information ----

Sample Date : 6-NOV-1998 14:30:00. Acquisition date : 9-NOV-1998 20:15:39.
 Decay time : 3 05:45:39.41 % dead time : 0.0%
 Elapsed live time: 0 01:00:00.00 Elapsed real time: 0 01:00:01.09

---- Detector Parameters ----

Energy cal. time : 22-SEP-1998 09:06:09 Energy cal. oper.: PROCOUNT USER
 Detector name : Det1 Counting geometry: 500-mar-soil
 Effic. cal. time : 8-MAY-1998 14:04:21. Effic. cal. oper.: PROCOUNT USER

---- Processing Parameters ----

Start channel : 50 End channel : 4080
 Sensitivity : 3.00000 Gaussian Sens. : 10.00000
 Critical level? : No Propagate Errors?: Yes
 Empirical Eff? : Yes Library-based eff: Yes
 Energy tolerance : 1.50000 Half life ratio : 8.00000
 Abundance limit : 75.00000 WTM error limit : 3.00000
 MDA Width (FWHM) : 3.00000 MDA Confid Level : 5.00000 %
 Bkg filename : DKA200:[GAMMA.SCUSR.ARCHIVE]BKG_HA08NOV98_DET1_7656.CNF;

Combined Activity-MDA Report

---- Identified Nuclides ----

Nuclide	Activity (pCi/GRAM)	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
K-40	1.536E+01	2.097E+00	2.850E-01	3.463E-02	53.896
CS-137	1.429E-01	3.881E-02	3.599E-02	3.862E-03	3.972
RA-226	1.640E+00	1.272E-01	5.700E-02	8.990E-03	28.764
AC-227	8.418E-01	1.407E-01	1.855E-01	2.033E-02	4.538
AC-228	9.821E-01	1.271E-01	9.201E-02	1.331E-02	10.674
TH-230	4.758E+01	1.444E+01	1.257E+01	2.159E+00	3.785
U-238	3.419E+00	9.786E-01	4.500E+00	4.815E-01	0.760

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/GRAM)	K.L. Ided	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
PA-231	1.487E+00	+	9.298E-01	1.133E+00	1.533E-01	1.312
U-235	5.186E-01	+	2.491E-01	2.788E-01	3.216E-02	1.860
AM-241	5.154E-02		8.840E-02	1.358E-01	2.168E-02	0.380

Sample ID : JV16NOV98

Acquisition date : 16-NOV-1998 15:22:29

VMS Gamma Spectroscopy Report generated 16-NOV-1998 16:22:50

Configuration : DKA200: [GAMMA.SCUSR.ARCHIVE] SMP_JV16NOV98_DET1_500MARSOIL_780

---- Sample Information ----

Sample Title : SVP0935
 Sample ID : JV16NOV98 Sample Quantity : 7.85080E+02 GRAM
 Sample Type : Sample Geometry :
 Sample Number : 7804 Spctrm Collector : PROCOUNT USER
 Sample Collector : Sample Analyst : PROCOUNT USER

---- Sample Decay/Count Information ----

Sample Date : 12-NOV-1998 16:30:00 Acquisition date : 16-NOV-1998 15:22:29
 Decay time : 3 22:52:29.47 % dead time : 0.0%
 Elapsed live time: 0 01:00:00.00 Elapsed real time: 0 01:00:00.96

---- Detector Parameters ----

Energy cal. time : 22-SEP-1998 09:06:09 Energy cal. oper.: PROCOUNT USER
 Detector name : Det1 Counting geometry: 500-mar-soil
 Effic. cal. time : 8-MAY-1998 14:04:21. Effic. cal. oper.: PROCOUNT USER

---- Processing Parameters ----

Start channel : 50 End channel : 4080
 Sensitivity : 3.00000 Gaussian Sens. : 10.00000
 Critical level? : No Propagate Errors?: Yes
 Empirical Eff? : Yes Library-based eff: Yes
 Energy tolerance : 1.50000 Half life ratio : 8.00000
 Abundance limit : 75.00000 WTM error limit : 3.00000
 MDA Width (FWHM) : 3.00000 MDA Confid Level : 5.00000 %
 Bkg Filename : DKA200: [GAMMA.SCUSR.ARCHIVE] BKG_15NOV98_DET1_7789.CNF;1

Combined Activity-MDA Report

---- Identified Nuclides ----

Nuclide	Activity (pCi/GRAM)	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
K-40	1.340E+01	1.807E+00	2.097E-01	2.548E-02	63.933
RA-226	8.039E-01	7.007E-02	4.305E-02	6.789E-03	18.675
AC-228	8.063E-01	9.403E-02	6.255E-02	9.046E-03	12.890
U-238	9.120E-01	7.589E-01	3.195E+00	3.419E-01	0.285

---- Non-Identified Nuclides ----

Nuclide	Key-Line Activity (pCi/GRAM)	K.L. Ided	Act error	MDA (pCi/GRAM)	MDA error	Act/MDA
CS-137	6.799E-03		1.609E-02	2.779E-02	2.982E-03	0.245
AC-227	1.443E-02		9.583E-02	1.445E-01	1.584E-02	0.100
TH-230	2.802E+00		5.111E+00	8.263E+00	1.419E+00	0.339
PA-231	-2.182E-01		4.468E-01	6.333E-01	8.567E-02	-0.345
U-235	1.610E-02		9.841E-02	1.600E-01	1.845E-02	0.101
AM-241	7.109E-02		5.797E-02	9.044E-02	1.444E-02	0.786

APPENDIX B

ST. DENIS BRIDGE FINAL STATUS SURVEY DATA QUALITY ASSESSMENT

1.0 INTRODUCTION

This report presents the Data Quality Assessment (DQA) for the St. Denis Bridge final status survey. The DQA determines whether the final status survey was an adequate test of the defined remediation goals and whether the data associated with each survey unit satisfies those goals. A final status survey was performed over the 350 m² St. Denis Bridge survey unit and included a gamma walkover survey and the collection of 42 soil samples. The intent of the final status survey was to determine whether the area satisfies dose-based (25 mrem/yr) and concentration-based [15 pCi/g above background for the larger of thorium-230 (Th-230) or radium-226 (Ra-226), 15 pCi/g above background for the larger of Th-232 or Ra-228, and 50 pCi/g above background for uranium-238 (U-238)] criteria as defined in the St. Louis Airport site (SLAPS) Engineering Evaluation/Cost Analysis (EE/CA) (DOE 1997). The final status survey was performed in accordance with the *MARSSIM-Based Final Status Survey Plan for the St. Denis Bridge Area – St. Louis Missouri* (USACE 1998b) and using the guidance provided in the *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)* (DoD 1997). The DQA is based on guidance from Chapter 8 and Appendix I in MARSSIM. The St. Denis Bridge site is identified with other St. Louis site landmarks in Figure B-1.

A DQA is a scientific and statistical evaluation that determines if site data are of the right type, quality, and quantity to support the intended use (DoD 1997). The five steps in the DQA process are as follows:

1. Review the Data Quality Objectives (DQOs) and survey design;
2. Conduct a preliminary data review;
3. Select a statistical test;
4. Verify the assumptions of the statistical test; and
5. Draw conclusions from the data.

Each step is discussed in the following sections. This DQA demonstrates that the St. Denis Bridge survey unit satisfied dose-based and concentration-base criteria and statistical tests as outlined in USACE 1998b and supports releasing the unit for unrestricted use. If the unit did not satisfy the dose-based criterion, concentration-base criterion, or statistical tests, additional material would have been removed and the final status survey repeated. The detailed evaluation of site data is provided in SAIC 1999.

2.0 REVIEW FINAL STATUS SURVEY DESIGN

USACE 1998b outlines the design for the St. Denis Bridge final status survey. The design includes DQOs, the basis for these objectives, the expected radiological conditions at the site, the number and location of sampling points, and the requirements for demonstrating compliance

with derived concentration guideline levels (DCGLs). The following are key components of the St. Denis Bridge survey design:

- The Type I error was set to 0.05 and the Type II error was set to 0.1;
- For planning purposes, the concentration ratio of Th-230, Ra-226 and U-238 were set to 18.5:0.35:1.0, respectively, based on survey data from the ditch adjacent to SLAPS and north McDonnell Boulevard;
- The standard deviations for Th-230, Ra-226 and U-238 were set to 6.15 pCi/g, 0.17 pCi/g and 0.52, respectively, based on data from remediated properties adjacent to Coldwater Creek (vicinity property number 56);
- The evaluation of small areas of elevated activity was based on an assessment reported in ORISE 1998 assuming a 2-inch by 2-inch sodium iodide detector would be used to scan the surface of the excavation; and
- The DCGL_W was set to 1.0 using the sum-of-the-ratios (SOR) approach and cleanup goal of 15 pCi/g above background for the larger of Th-230 or Ra-226, 15 pCi/g above background for the larger of Th-232 or Ra-228, and 50 pCi/g above background for U-238. [Note that the W in DCGL_W stands for Wilcoxon Rank Sum (WRS), the statistical test used to evaluate radionuclides of concern that are present in background.]

Using this information, and considering that the potential site contaminants are present in background, a minimum of 10 survey unit samples would satisfy WRS statistical requirements (USACE 1998b). The evaluation for areas with elevated activity (based on the ORISE dose assessment) (ORISE 1998) required that the number of samples be increased from 10 to 36. The survey design was based on a 400 m² survey unit so each sample would represent approximately 11 m² and a grid spacing of 3.6 meters. Because this sample density was considered unreasonably high, 3-to-1 composites were allowed for contiguous areas limiting the laboratory analyses to 12. Using this approach, each 3-to-1 composite sample analyzed would represent an area of 33 m³.

Since the survey plan was originally developed, data were collected to support current final status survey activities in St. Louis (the ORISE 1998 data were not necessarily collected using the same methods, or using the same remediation goals). This new data includes 50 samples from the reference area located at Aubuchon Park in north St. Louis County and data collected directly from the St. Denis Bridge survey unit. In addition, a site-specific dose assessment was performed that is more appropriate for the St. Denis Bridge project than the generic assessment used in the survey plan. Therefore, this DQA utilizes the updated site data and dose assessment information to evaluate final status survey results.

3.0 PRELIMINARY DATA REVIEW

A preliminary data review identifies patterns and anomalies in the data and may provide an early indication of whether the survey unit will pass or fail statistical tests (i.e., whether additional material should be removed). This review includes three components:

1. A comparison of survey unit data to the concentration-based cleanup goal;

2. A comparison of survey unit data to reference area data and a review of relevant parameters (e.g., mean, median, standard deviation, etc.); and
3. A residual dose assessment for the entire survey unit and small areas of elevated activity.

The preliminary data review is also used to present the data in tabular and graphical form.

3.1 COMPARISON TO CONCENTRATION-BASED CLEANUP GOALS

Data from the St. Denis Bridge survey unit and the St. Louis North County reference area are summarized in Table B-1. The SOR calculations were performed using the results from each survey unit sample. The net SOR value (SOR_N) represents the SOR after background was subtracted as is required by the concentration-based cleanup criterion. The gross SOR value (SOR_G) includes background and is used only for completing the WRS test. The SOR_N and SOR_G formulas are provided below:

$$SOR_G = \frac{(\text{higher of Th - 230}_G \text{ or Ra - 226}_G) + (\text{higher of Th - 232}_G \text{ or Ra - 228}_G) + \frac{U - 238_G}{50 \text{ pCi/g}}}{15 \text{ pCi/g}}$$

$$SOR_N = \frac{(\text{higher of Th - 230}_N \text{ or Ra - 226}_N) + (\text{higher of Th - 232}_N \text{ or Ra - 228}_N) + \frac{U - 238_N}{50 \text{ pCi/g}}}{15 \text{ pCi/g}}$$

Results indicate that no individual sample exceeds the SOR_N cleanup criterion of unity (i.e., 1.0). However, because most of the samples were composites of as many as three samples, this survey unit requires additional evaluation. That is, it may be possible that a composite sample includes a single sample above the criterion that was diluted by the other two samples to a concentration below the cleanup criterion. To account for this possibility, a test was performed to conservatively estimate the maximum possible concentration of an individual sample in each composite.

Of the 17 samples collected from the St. Denis Bridge survey unit, 15 were composites of 2 or 3 adjacent samples as illustrated in Figure B-2. Assuming that two of these samples are present at background concentrations, the reasonable maximum concentration of an individual sample was estimated as follows:

$$\text{Maximum value} = (3 \times \text{result}) - (2 \times \text{background}).$$

Using sample SVP00073 in an example, the maximum possible Th-230 concentration would be:

$$(3 \times 12.33 \text{ pCi/g}) - (2 \times 1.67 \text{ pCi/g}) = 33.7 \text{ pCi/g}.$$

Composites SVP00060, SVP00061 and SVP00069 consist of only two samples each so the maximum value is twice the result minus background. Maximum possible values are listed in Table B-2 (background data are also listed for comparison). Table B-2 demonstrates that the only

significant radionuclides are Th-230 and U-238 with maximum possible concentrations of 33.7 pCi/g for Th-230 and 5.8 pCi/g for U-238. This table also shows that two sample areas (SVP00068 and SVP00073) may have exceeded the SOR cleanup criterion on a single sample basis (recalling that the concentration-based criterion is based on residual concentrations averaged over 100 m² – i.e., the average of 3 composites if each represents 33 m²). The survey unit clearly achieves the concentration-based limit on the bases of an average concentration because all composite SOR_N results are below the limit as listed in Table B-1 and as illustrated in Figure B-3. The potentially elevated areas are evaluated further in Section 3.3 as part of the residual dose assessment.

3.2 COMPARISON TO THE REFERENCE AREA AND EVALUATION OF PARAMETERS

Table B-1 and Table B-2 present summaries of composite sample data, reference area data, etc. The complete data set from the St. Denis Bridge final status survey is presented in Table B-3 including qualifiers, minimum detectable activity (MDA) values, detection errors, and estimated soil concentrations. Table B-4 presents the complete reference area data set.

Although the survey unit appears to satisfy criteria based on SOR_N values alone, an additional evaluation of site data was performed to complete the DQA. Of the radionuclides considered in the St. Denis Bridge survey unit, only Th-230, Ra-226 and Th-232 were identified above the corresponding MDA (see Table B-3). All three radionuclides are present in a lognormal distribution, suggesting anthropogenic disturbance. Additionally, a comparison of the survey unit summary statistics and the Aubuchon Park reference area summary statistics suggests that the reference area data may not represent background for the St. Denis Bridge survey unit. One possible explanation is that the majority of the samples collected in the survey unit are sediments and not soils, and comparison to reference area data is not a fair comparison. However, in the case of Ra-226 and Th-232, the mean, median, standard deviation and upper 95th percent confidence level on the mean (UCL-95) from the survey unit are less than the corresponding reference area values and are well behaved (tight ranges and small standard deviations). From this comparison it is assumed that Ra-226 and Th-232 are not residual site contaminants.

Noting reference area values parenthetically as provided in Table B-1, thorium-230 is clearly elevated above soil background with an average concentration of 4.03 pCi/g (1.67 pCi/g), a median of 3.13 pCi/g (1.60 pCi/g), and UCL-95 of 5.37 pCi/g (1.78 pCi/g). Figure B-4 is a histogram of the Th-230 data from the St. Denis Bridge survey unit. This figure clearly illustrates the skewed (lognormal) distribution and supports selecting Th-230 as a residual site contaminant. Most importantly, though, for evaluating whether the site concentration-based release criterion has been met, the maximum value is below the 15 pCi/g limit for Th-230.

As seen in Table B-3, Uranium-238 was not measured above the MDA of approximately 4 pCi/g. However, the average reported result is 1.29 pCi/g and the average soil background for U-238 is 1.23 pCi/g. Although no uranium was identified above the MDA, it is assumed that uranium is present at the average reported value and is a residual site contaminant. Note that the

uranium MDA achieved better than 10 percent of the 50 pCi/g DCGL as suggested in Section 7.2.2.6 of MARRSIM.

Prior to the collection of systematic final status survey samples, a final gamma walkover survey using a hand-held 2-inch by 2-inch NaI detector was performed over the St. Denis Bridge survey unit. The background while performing the survey was found to be less than 12,000 and 13,000 counts per minute (CPM). During this walkover, the surveyor identified two areas potentially containing elevated levels of radioactive materials. Samples HZT00053 and HZR00054 were collected at these locations. As shown in Table B-1, these soil samples did not contain elevated levels of radionuclides. Results of the walkover survey including detailed surveys around the two potentially elevated areas are presented in Figure B-5.

The comparison to reference area data and evaluation of parameters, while pointing out some limitations in the data, suggests that the St. Denis Bridge survey unit cleanup criteria were satisfied.

3.3 RESIDUAL DOSE ASSESSMENT

A site-specific dose assessment was performed assuming that a construction worker could spend approximately two months working in the survey unit area renovating the St. Denis Bridge (bridge renovation work is currently scheduled). The construction worker was considered to be the most likely future occupant. It was assumed that the worker ingests 480 mg of sediment/soil per day, breathes air at a rate of 1.3 m³ per hour, and is present for approximately 333 total hours (2/12th of a 2,000-hour working year). RESRAD Version 5.82 (Yu et al. 1993) was used to model the worker's exposure to the concentrations listed in Table B-1. The source term was developed by subtracting average background concentrations from the survey unit UCL-95 concentrations providing estimates of reasonable maximum exposure (RME) concentrations. If the UCL-95 concentration is less than the average background, the concentration was set to zero to avoid negative RME concentrations. Results indicate that the dose to the construction worker would be less than 1 mrem.

The potentially elevated concentrations in Table B-2 were also evaluated to determine if, under a worst case scenario, the construction worker could receive an unacceptable dose while exposed to small areas of elevated activity. These estimates assumed the surface area of approximately 10 m² (rounding up 7.7 m²). Using the maximum possible concentrations from samples SVP00068 and SVP00073, the maximum potential dose at both locations would be less than 1 mrem. Elevated measurement dose estimates and dose estimates averaged over the survey unit demonstrate that dose-based criteria have been satisfied by the remedial action at St. Denis Bridge.

4.0 SELECT A STATISTICAL TEST

Because the radionuclide contaminants of concern are present in background, the WRS test is selected. The WRS test shifts reference area data by the DCGL_w. If the survey unit data

are significantly above the shifted reference area data, the unit fails the test and additional material must be removed. As stated in Table 8.2 in MARSSIM, if the difference between the largest survey unit measurement and the smallest reference area (background) measurement is less than the $DCGL_w$, the survey unit meets the criterion. At St. Denis Bridge, the maximum gross composite result is $SOR_G = 0.88$ and the smallest reference area result is $SOR_B = 0.16$. Because the difference is less than the $DCGL_w = 1.0$, the survey unit meets the release criterion without performing the WRS statistical test.

5.0 VERIFY THE ASSUMPTIONS OF THE STATISTICAL TEST

As described in Section 2.0, the survey design used data from a site in the vicinity of the St. Denis Bridge to calculate the number of samples necessary to satisfy statistical tests. Once site data were available, these calculations were repeated to confirm that enough samples were collected. Using the mean concentrations and standard deviations for Th-230, Ra-226 and U-238 from the survey unit data summary in Table B-1 and repeating the steps outlined in the survey plan, the calculations to obtain the number of samples required for the WRS test is presented below:

The relative shift (Δ/σ) was calculated given values for the DCGL, LBGR, and σ . The DCGL was set to 1.0, so the $LBGR = DCGL/2 = 0.5$. The value for Δ was, therefore, $DCGL - LBGR = (1.0) - (0.5) = 0.5$. The specific values of σ are: Th-230, 2.73 pCi/g; Ra-226, 0.21 pCi/g; and U-238, 0.63. Using these values, the weighted standard deviation for the St. Denis Bridge survey unit was calculated as follows:

$$\sigma = \sqrt{\left(\frac{\sigma_{Ra}}{DCGL_{Ra}}\right)^2 + \left(\frac{\sigma_U}{DCGL_U}\right)^2 + \left(\frac{\sigma_{Th}}{DCGL_{Th}}\right)^2} = \sqrt{\left(\frac{0.21}{15}\right)^2 + \left(\frac{0.63}{50}\right)^2 + \left(\frac{2.73}{15}\right)^2} = 0.18$$

Using this value and a Δ of 0.5, the relative shift (Δ/σ) for the survey unit was calculated to be 2.73. This value falls within the MARSSIM recommended range of 1 to 3 for Δ/σ . From Table 5.3 in MARSSIM and given 0.05 for Type I errors and 0.1 for Type II errors, the number of samples for the survey unit was estimated to be 6. The original survey plan called for 10 samples to be taken and 17 were actually collected (including 15 composites and 2 biased samples). Therefore, more than enough samples were collected to satisfy the WRS statistical test.

This DQA has shown that more than a sufficient number of samples were collected to satisfy statistical requirements (calculations shown below), that DQO were originally followed and then adjusted in this report to account for additional site data and information, and that ample reference area samples were collected. Based on this information, it appears that the methods used to assess the St. Denis Bridge survey unit are sufficient and that the site release criteria have been met.

This DQA has also demonstrated some limitations in the data including a reference area data set that may overestimate background on the St. Denis Bridge site. It has also been determined that the U-238 MDA was high compared to background, thus increasing the

uncertainty in SOR calculations. In addition, two composite samples may demonstrate that a sub-area (7.7 m²) may contain Th-230 concentrations above the DCGL_w limit. However, none of these limitations should result in the removal of additional soil because:

- A review of the data shows that Ra-226, Th-232, Ra-228, Pa-231, and Ac-227 concentrations are less than soil background, although true background is likely a different background than the selected reference area;
- The MDA values listed in Table B-3 are less than 10 percent of the 50 pCi/g uranium limit and the reported values are lower still; and
- The maximum possible Th-230 concentration at the site, while potentially exceeding the 15 pCi/g limit, represents an area less than 10 m² and would result in a dose of less than 1 mrem/yr to the most likely future occupant.

In addition, these soils will likely be covered with a combination of clean soil, large rocks and concrete to assure the stability of the bridge and, therefore, creating a lower potential risk of exposure to individuals that may occupy the area.

6.0 CONCLUSIONS

The residual radioactivity in soil/sediment under the St. Denis Bridge meets the requirements as specified in the survey design, the DQOs, and the DQA. The concentration-based criteria for Th-230, Ra-226, Th-232, Ra-226 and U-238 have been satisfied noting that no SOR_N value exceeds the limit of 1.0. The dose-based limit has been satisfied noting that the maximum potential exposure estimate is less than 1 mrem. The survey unit also satisfies the statistical requirements with no composite sample exceeding the DCGL_w. Given that the concentration-based criterion, the dose-based criterion, and the statistical tests have been satisfied, the St. Denis Bridge survey unit should be released for unrestricted use.

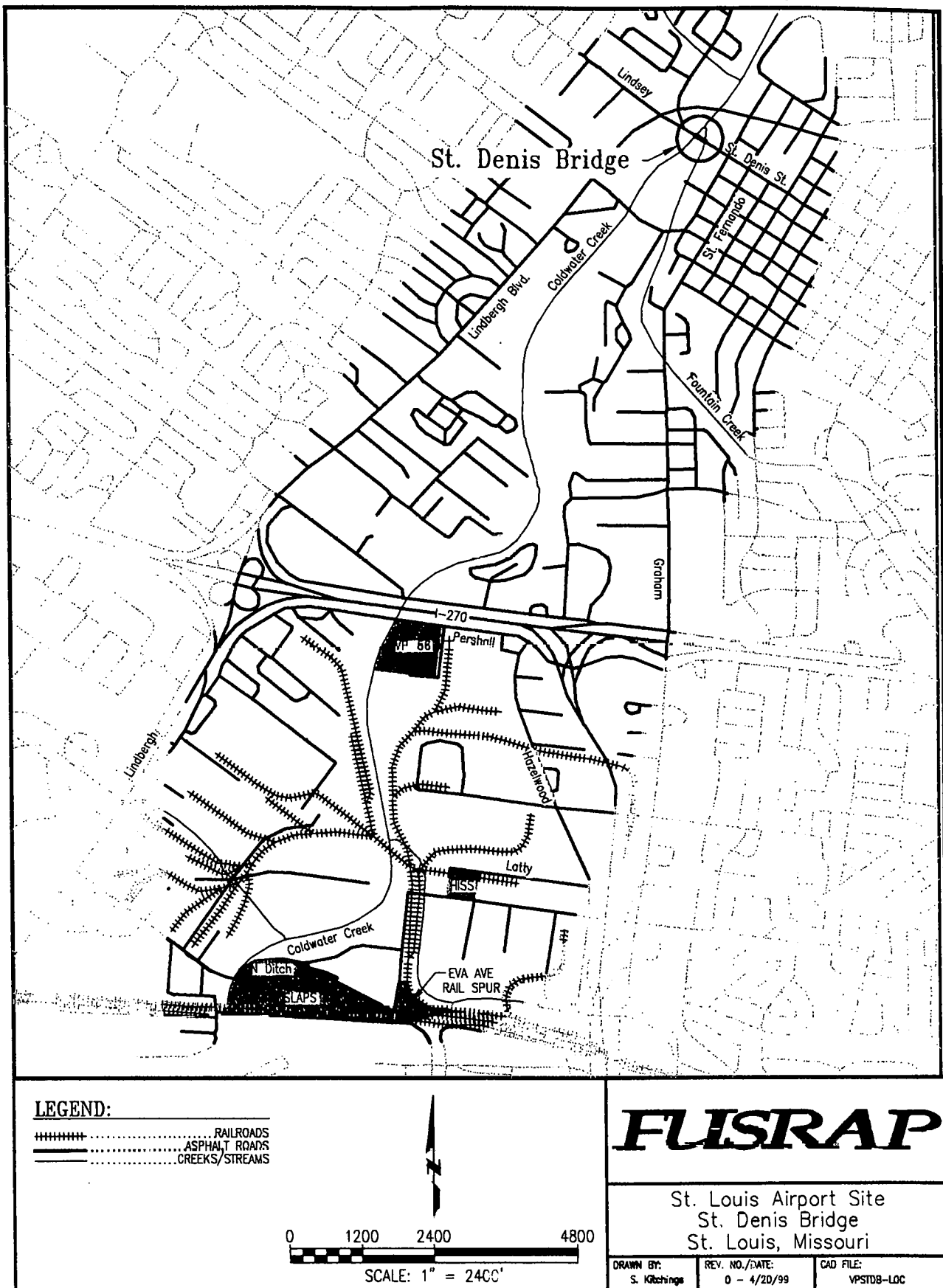


Figure B-1. St. Denis Bridge at Florissant, Missouri

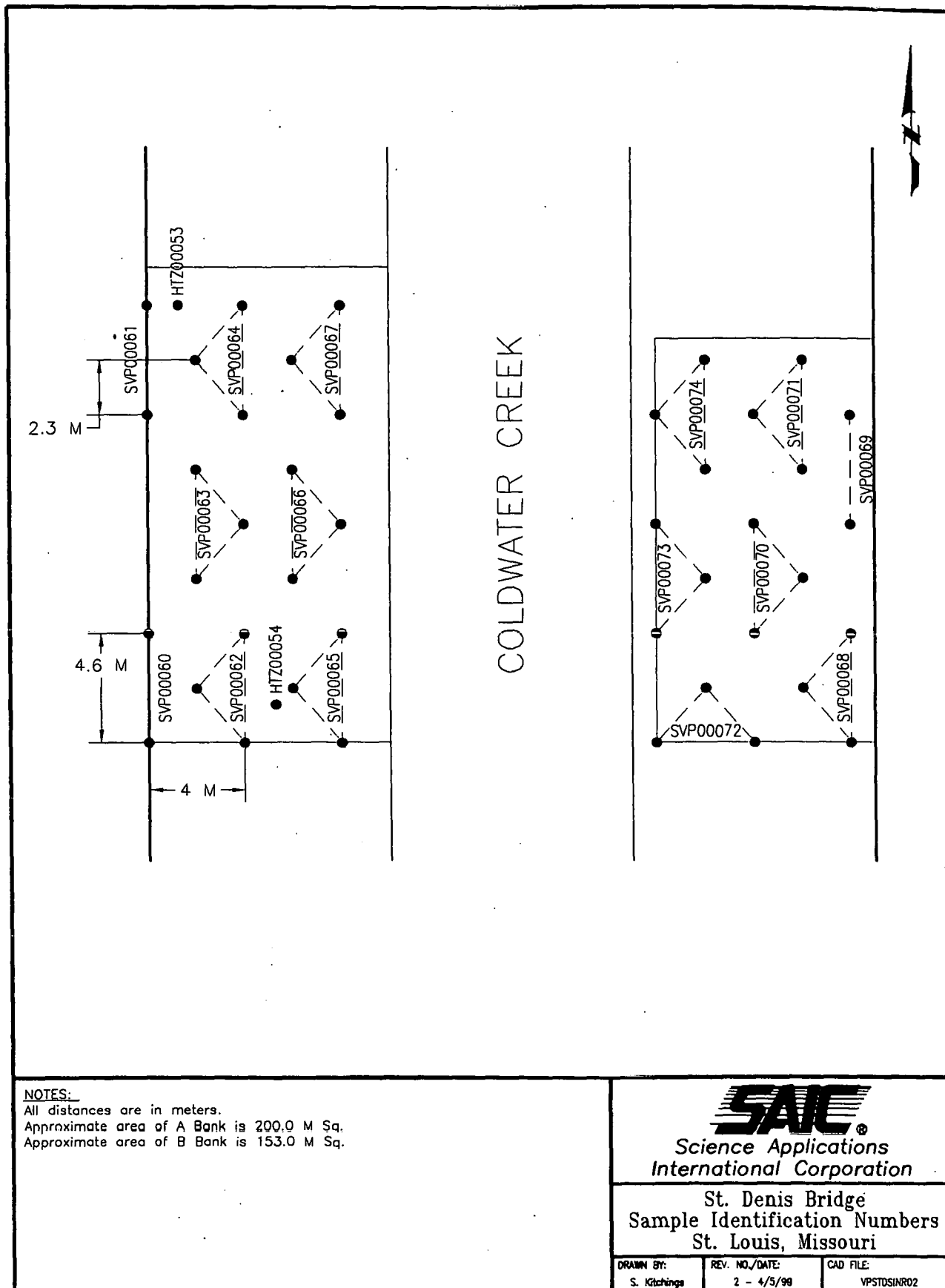


Figure B-2. St. Denis Bridge Sample Identification Numbers

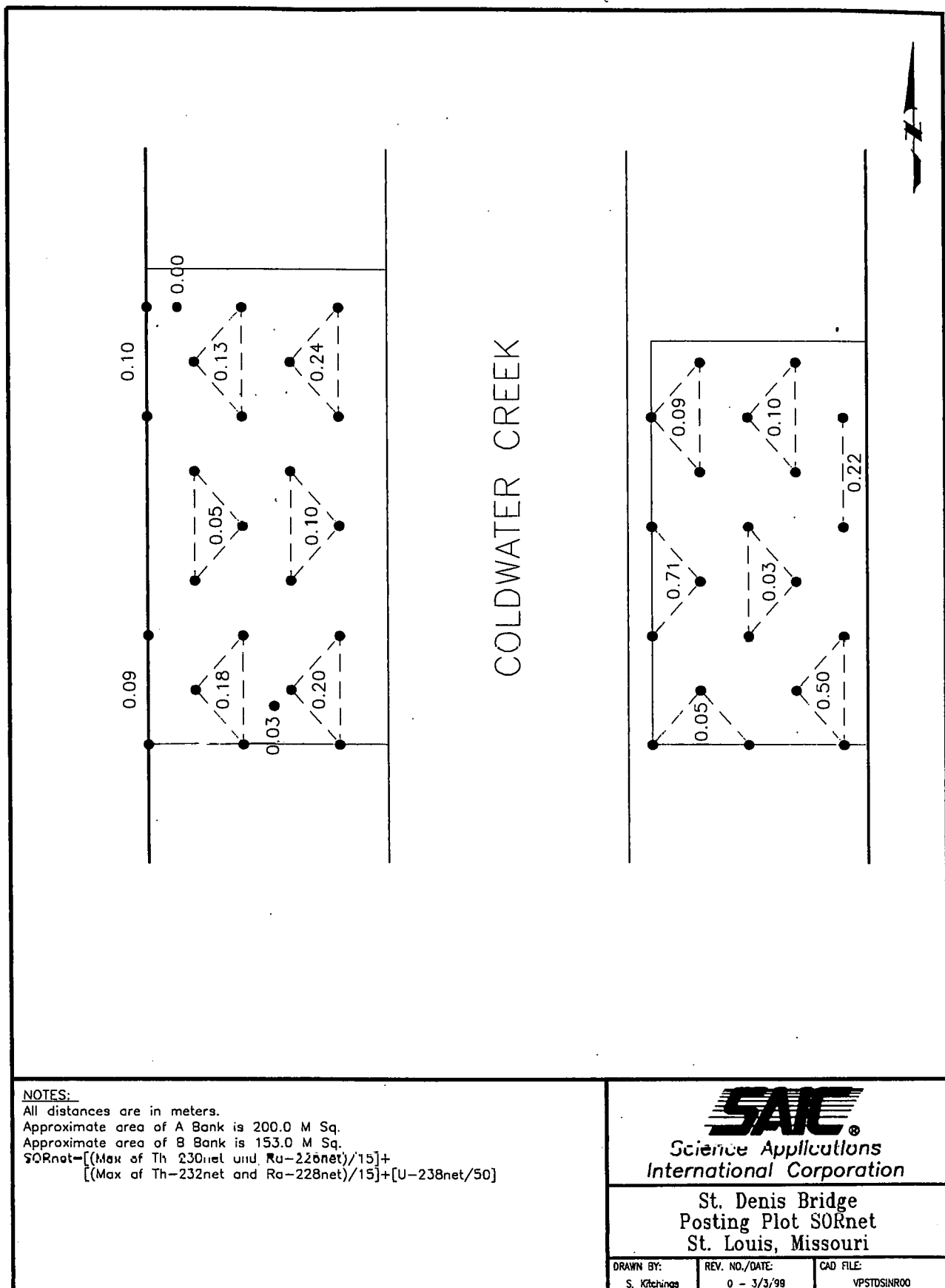


Figure B-3. St. Denis Bridge Posting Plot SORnet

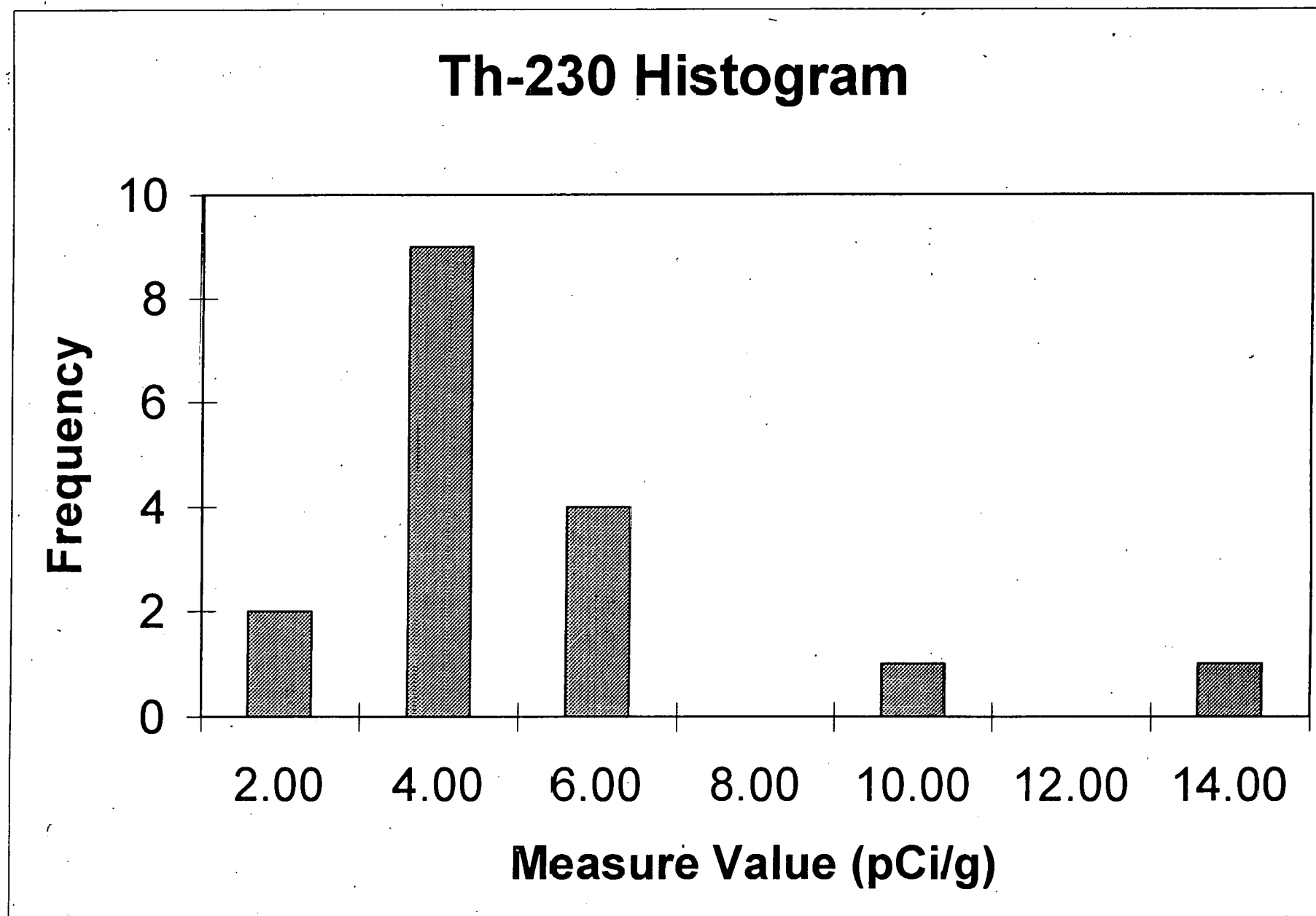


Figure B-4. Th-230 Histogram

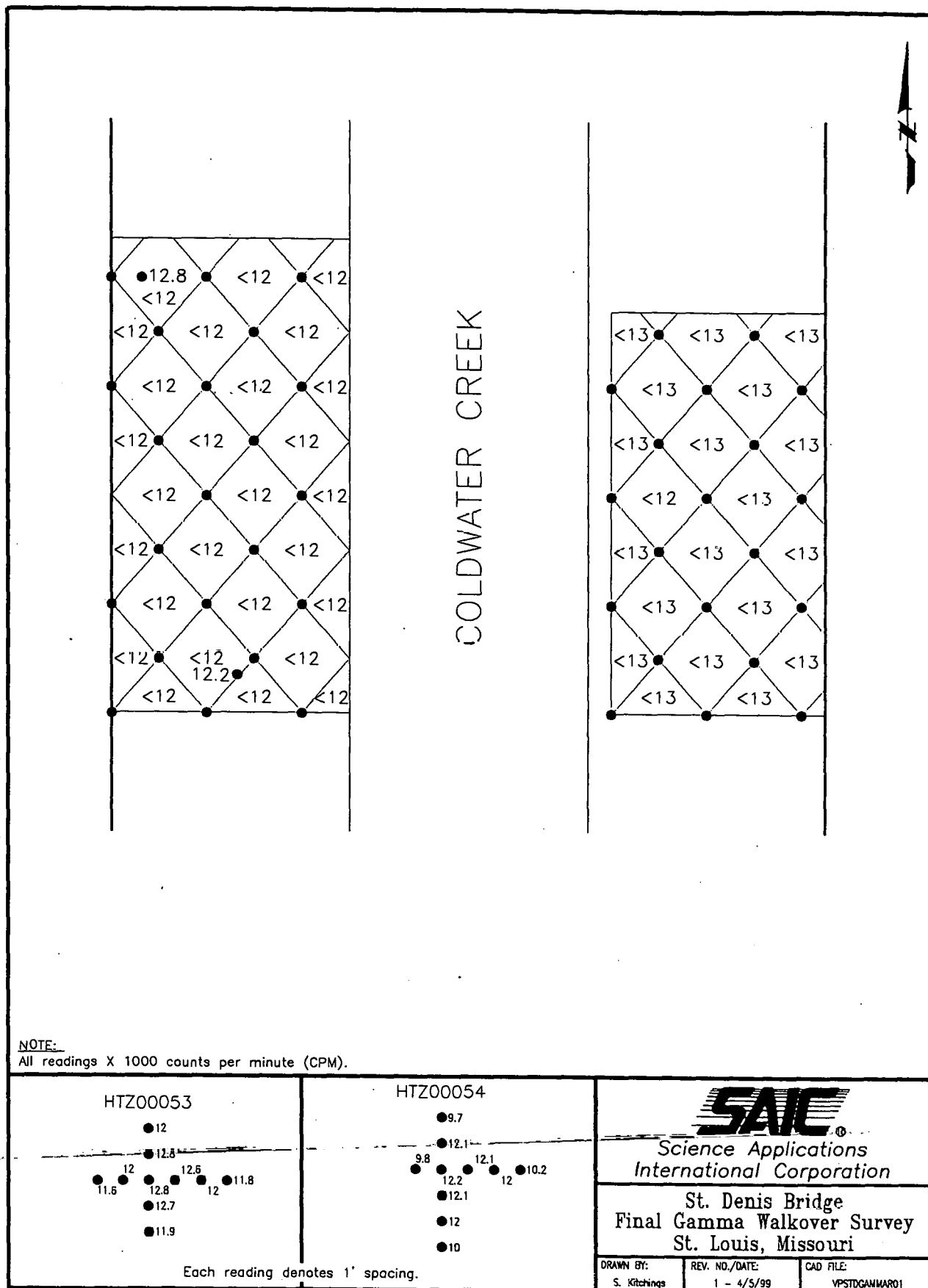


Figure B-5. St. Denis Bridge Final Gamma Walkover Survey

Table B-1. St. Denis Bridge Summary of Final Status Survey Data

MARSSIM Background Data Summary										
Statistic	Area (m ²)	Th-230 (pCi/g)	Ra-226 (pCi/g)	Th-232 (pCi/g)	Ra-228 (pCi/g)	U-238 (pCi/g)	Ac-227 (pCi/g)	Pa-231 (pCi/g)	SOR _B (5/5/50)	SOR _B (15/15/50)
Mean	—	1.67	1.21	1.18	1.02	1.23	0.12	0.16	—	0.221
Median	—	1.60	1.17	1.18	1.02	1.19	0.08	0.16	—	0.211
UCL-95	—	1.78	1.25	1.27	1.05	1.32	0.15	0.27	—	—
St. Dev	—	0.44	0.17	0.36	0.12	0.31	0.15	0.44	—	0.042
Range	—	1.76	0.63	1.41	0.45	1.39	0.78	2.66	—	0.184
No. Samples (m)	—	50	50	50	50	50	50	50	—	50
Survey Unit Data Summary										
Statistic/Sample	Area (m ²)	Th-230 (pCi/g)	Ra-226 (pCi/g)	Th-232 (pCi/g)	Ra-228 (pCi/g)	U-238 ^a (pCi/g)	Ac-227 ^a (pCi/g)	Pa-231 ^a (pCi/g)	SOR _G (15/15/50)	SOR _N (15/15/50)
Mean	—	4.03	0.85	0.95	0.76	1.29	0.11	0.18	0.359	0.163
Median	—	3.13	0.75	0.99	0.76	1.34	0.09	0.20	0.299	0.101
UCL-95	—	5.37	0.95	1.11	0.82	1.41	0.15	0.25	—	—
St. Dev	—	2.73	0.21	0.30	0.15	0.63	0.08	0.17	0.177	0.184
Range	—	10.92	0.67	1.13	0.49	2.69	0.27	0.56	0.695	0.711
Maximum	—	12.33	1.24	1.68	0.99	2.77	0.28	0.47	0.882	0.711
No. Samples (n)	—	17	17	17	17	17	17	17	17	17
SVP00060	18.2	2.92	0.96	0.72	0.88	1.34	0.14	0.31	0.280	0.086
SVP00061	18.2	3.02	0.80	1.02	0.50	1.75	0.04	0.10	0.304	0.100
SVP00062	27.3	4.39	1.03	1.10	0.85	1.39	0.09	-0.06	0.394	0.185
SVP00063	27.3	2.48	0.89	0.86	0.57	0.88	0.07	-0.09	0.240	0.054
SVP00064	27.3	3.69	1.07	0.65	0.73	0.08	0.14	0.23	0.296	0.135
SVP00065	27.3	4.53	1.23	0.76	0.86	1.65	0.28	-0.06	0.392	0.199
SVP00066	27.3	3.13	1.09	1.12	0.88	1.46	0.11	0.16	0.313	0.102
SVP00067	27.3	4.92	1.24	0.99	0.99	2.21	0.27	0.18	0.438	0.236
SVP00068	23.1	8.68	0.69	0.69	0.76	2.77	0.14	-0.02	0.685	0.498
SVP00069	15.4	4.94	0.72	0.71	0.68	0.99	0.03	0.21	0.396	0.218
SVP00070	23.1	2.17	0.68	1.03	0.58	1.12	0.02	0.47	0.236	0.033
SVP00071	23.1	3.19	0.75	1.04	0.95	0.85	0.01	0.20	0.299	0.101
SVP00072	23.1	2.40	0.57	0.55	0.62	1.35	0.04	0.20	0.228	0.051
SVP00073	23.1	12.33	0.74	0.66	0.60	0.80	0.17	0.20	0.882	0.711
SVP00074	23.1	2.48	0.66	1.68	0.81	0.48	0.08	0.20	0.287	0.054
HTZ00053	2.8	1.41	0.69	1.05	0.91	1.17	0.19	0.42	0.187	0.000
HTZ00054	1.1	1.76	0.63	1.50	0.67	1.60	0.07	0.43	0.249	0.013

^a All measurements below minimum detectable activities (MDAs).

Table B-2. Estimate of the Maximum Individual Sample Result

MARSSIM Background Data Summary										
Statistic	Area (m ²)	Th-230 (pCi/g)	Ra-226 (pCi/g)	Th-232 (pCi/g)	Ra-228 (pCi/g)	U-238 (pCi/g)	Ac-227 (pCi/g)	Pa-231 (pCi/g)	SOR _G (15/15/50)	SOR _N (15/15/50)
Mean	—	1.67	1.21	1.18	1.02	1.23	0.12	0.16	0.221	—
Median	—	1.60	1.17	1.18	1.02	1.19	0.08	0.16	0.211	—
UCL-95	—	1.78	1.25	1.27	1.05	1.32	0.15	0.27	—	—
St. Dev	—	0.44	0.17	0.36	0.12	0.31	0.15	0.44	0.042	—
Range	—	1.76	0.63	1.41	0.45	1.39	0.78	2.66	0.184	—
No. Samples (m)	—	50	50	50	50	50	50	50	50	—

Reasonable Maximum Result for 1 of 3 Composited Samples ^a										
Sample	Area (m ²)	Th-230 (pCi/g)	Ra-226 (pCi/g)	Th-232 (pCi/g)	Ra-228 (pCi/g)	U-238 (pCi/g)	Ac-227 (pCi/g)	Pa-231 (pCi/g)	SOR _G (15/15/50)	SOR _N (15/15/50)
SVP00060 ^b	9.1	4.2	0.7	0.3	0.7	1.4	0.2	0.5	0.355	0.172
SVP00061 ^b	9.1	4.4	0.4	0.9	0	2.3	0	0	0.399	0.203
SVP00062	9.1	9.8	0.7	0.9	0.5	1.7	0	-0.5	0.747	0.551
SVP00063	9.1	4.1	0.3	0.2	-0.3	0.2	0	-0.6	0.291	0.162
SVP00064	9.1	7.7	0.8	-0.4	0.1	-2.2	0.2	0.4	0.520	0.402
SVP00065	9.1	10.3	1.3	-0.1	0.5	2.5	0.6	-0.5	0.770	0.601
SVP00066	9.1	6.1	0.9	1.0	0.6	1.9	0.1	0.2	0.511	0.309
SVP00067	9.1	11.4	1.3	0.6	0.9	4.2	0.6	0.2	0.904	0.708
SVP00068	7.7	22.7	-0.3	-0.3	0.2	5.8	0.2	-0.4	1.643	1.493
SVP00069 ^b	7.7	8.2	0.2	0.2	0.3	0.7	-0.1	0.3	0.581	0.435
SVP00070	7.7	3.2	-0.4	0.7	-0.3	0.9	-0.2	1.1	0.278	0.102
SVP00071	7.7	6.2	-0.2	0.8	0.8	0.1	-0.2	0.3	0.469	0.302
SVP00072	7.7	3.9	-0.7	0.7	-0.2	1.6	-0.1	0.3	0.292	0.156
SVP00073	7.7	33.7	-0.2	-0.4	-0.2	-0.1	0.3	0.3	2.247	2.135
SVP00074	7.7	4.1	-0.4	2.7	0.4	-1	0.0	0.3	0.453	0.162

^a Reasonable maximum means the highest concentration that one of the samples making up the composite could have to produce the results shown in Table 1. Negative results show that the composite result is below average background for that radionuclide.

^b Composite contains only two samples.

Shaded cells indicate results with SOR_G or SOR_N > 1.0.

Table B-3. St. Denis Bridge Final Status Survey Data (pCi/g)

Sample ID	Radium-226				Radium-228				Thorium-230				Thorium-232				Uranium-238				Actinium-227				Protactinium-231			
	Qual.	Result	Error	MDA	Qual.	Result	Error	MDA	Qual.	Result	Error	MDA	Qual.	Result	Error	MDA	Qual.	Result	Error	MDA	Qual.	Result	Error	MDA	Qual.	Result	Error	MDA
SVP00060		0.96	0.09	0.06		0.88	0.11	0.09		2.92	0.97	0.34		0.96	0.50	0.15	<	1.34	2.64	4.48	<	0.14	0.14	0.21	<	0.31	0.65	0.96
SVP00061		0.80	0.08	0.06		0.50	0.10	0.07		3.02	1.06	0.38		1.02	0.54	0.17	<	1.75	1.42	3.66	<	0.04	0.13	0.19	<	0.10	0.63	0.90
SVP00062		1.03	0.09	0.06		0.85	0.12	0.10		4.39	1.23	0.26		1.10	0.52	0.14	<	1.39	1.48	4.27	<	0.09	0.14	0.21	<	-0.06	0.67	0.93
SVP00063		0.89	0.08	0.05		0.57	0.10	0.08		2.48	0.79	0.12		0.86	0.42	0.23	<	0.88	1.49	4.14	<	0.07	0.13	0.19	<	-0.09	0.60	0.83
SVP00064		1.07	0.09	0.06		0.73	0.11	0.10		3.69	1.12	0.33		0.65	0.40	0.15	<	0.08	1.26	4.65	<	0.14	0.14	0.22	<	0.23	0.60	0.88
SVP00065		1.23	0.11	0.06		0.86	0.13	0.10		4.53	1.22	0.32		0.76	0.41	0.24	<	1.65	1.68	4.47	<	0.28	0.17	0.25	<	-0.06	0.70	0.98
SVP00066		1.09	0.10	0.06		0.88	0.12	0.09		3.13	0.92	0.27		1.12	0.49	0.12	<	1.46	1.63	4.65	<	0.11	0.15	0.23	<	0.16	0.64	0.93
SVP00067		1.24	0.11	0.06		0.99	0.12	0.10		4.92	1.27	0.28		0.99	0.46	0.13	<	2.21	1.79	5.48	<	0.27	0.16	0.25	<	0.18	0.66	0.95
SVP00068		0.69	0.07	0.05		0.76	0.11	0.08		8.68	1.84	0.28		0.69	0.35	0.11	<	1.17	2.77	4.73	<	0.14	0.08	0.17	<	-0.02	0.55	0.80
SVP00069		0.72	0.07	0.04		0.68	0.09	0.07		4.94	1.20	0.21		0.71	0.36	0.11	<	0.99	0.85	3.70	<	0.03	0.09	0.14	<	0.21	0.47	0.71
SVP00070		0.68	0.06	0.04		0.58	0.08	0.06		2.17	0.71	0.22		1.05	0.45	0.12	<	1.12	0.64	3.22	<	0.02	0.09	0.14	<	0.47	0.41	0.66
SVP00071		0.75	0.07	0.05		0.95	0.11	0.08		3.19	0.89	0.28		1.04	0.45	0.11	<	0.85	0.88	3.97	<	0.01	0.11	0.17	<	0.20	0.50	0.76
SVP00072		0.57	0.06	0.04		0.62	0.09	0.07		2.40	0.75	0.31		0.55	0.31	0.11	<	1.35	0.73	3.63	<	0.04	0.10	0.15	<	0.20	0.39	0.67
SVP00073		0.74	0.07	0.05		0.60	0.08	0.08		12.33	2.53	0.12		0.66	0.37	0.27	<	0.80	0.95	4.71	<	0.17	0.09	0.17	<	0.20	0.51	0.77
SVP00074		0.66	0.07	0.05		0.81	0.11	0.09		2.48	0.79	0.27		1.68	0.62	0.12	<	0.48	0.70	3.93	<	0.08	0.11	0.17	<	0.20	0.56	0.84
HTZ00053		0.69	0.07	0.05		0.91	0.11	0.03		1.41	0.56	0.29		1.05	0.46	0.12	<	1.17	0.67	3.64	<	0.19	0.10	0.17	<	0.42	0.55	0.86
HTZ00054		0.63	0.06	0.05		0.67	0.10	0.07		1.76	0.64	0.23		1.50	0.58	0.12	<	1.60	0.84	4.43	<	0.07	0.10	0.16	<	0.43	0.50	0.78

Table B-4. St. Louis North County Reference Area Data

Sample ID	Sample Depth		Qual.	Thorium-230			Qual.	Radium-226			Qual.	Radium-228			Qual.	Thorium-232		
	SSMP	DEP		Result	Error	MDA		Result	Error	MDA		Result	Error	MDA		Result	Error	MDA
SLA04300	0	0.5		1.33	0.53	0.29		1.27	0.11	0.07		1.08	0.14	0.11		0.81	0.39	0.12
SLA04301	2	3		1.29	0.49	0.19		1.25	0.11	0.06		1.09	0.12	0.09		0.99	0.42	0.10
SLA04302	0	0.5		1.41	0.54	0.22		1.11	0.09	0.06		0.96	0.13	0.10		0.64	0.35	0.12
SLA04303	2	3		1.81	0.73	0.38		1.39	0.11	0.06		1.18	0.15	0.09		1.28	0.59	0.28
SLA04304	0	0.5		1.80	0.66	0.32		1.15	0.10	0.07		1.01	0.13	0.09		1.18	0.51	0.13
SLA04305	2	3		2.07	0.72	0.24		1.51	0.11	0.05		1.15	0.13	0.09		1.32	0.55	0.13
SLA04306	0	0.5		1.18	0.50	0.22		1.01	0.10	0.06		0.93	0.13	0.11		0.57	0.33	0.12
SLA04307	2	3		1.75	0.69	0.35		1.45	0.11	0.07		1.04	0.13	0.10		1.47	0.61	0.14
SLA04308	0	0.5		1.21	0.52	0.33		1.16	0.10	0.07		1.01	0.14	0.10		1.12	0.49	0.12
SLA04309	2	3		1.59	0.58	0.11		1.29	0.11	0.07		1.10	0.15	0.10		1.02	0.45	0.25
SLA04310	0	0.5		1.40	0.60	0.31		1.12	0.11	0.07		0.91	0.14	0.11		1.58	0.63	0.14
SLA04311	2	3		1.23	0.52	0.31		1.55	0.13	0.07		1.24	0.15	0.11		0.81	0.41	0.12
SLA04312	0	0.5		1.20	0.59	0.31		1.07	0.09	0.06		0.87	0.11	0.09		0.83	0.48	0.30
SLA04313	2	3		1.60	0.65	0.36		1.40	0.11	0.06		1.10	0.14	0.09		1.25	0.56	0.27
SLA04314	0	0.5		2.01	0.73	0.30		1.17	0.11	0.07		0.87	0.13	0.10		1.37	0.58	0.14
SLA04315	2	3		2.00	0.78	0.35		1.50	0.11	0.07		1.09	0.14	0.11		1.50	0.65	0.16
SLA04316	0	0.5		1.28	0.54	0.24		1.09	0.09	0.06		0.84	0.13	0.10		1.00	0.47	0.13
SLA04317	2	3		2.70	0.86	0.13		1.40	0.12	0.06		1.14	0.13	0.09		1.51	0.60	0.25
SLA04318	0	0.5		1.74	0.71	0.29		1.08	0.10	0.06		0.91	0.12	0.09		1.34	0.61	0.28
SLA04319	2	3		2.32	0.83	0.36		1.42	0.13	0.06		1.21	0.14	0.10		1.86	0.72	0.27
SLA04320	0	0.5		1.74	0.72	0.35		1.10	0.10	0.06		0.99	0.12	0.10		1.00	0.52	0.16
SLA04321	2	3		1.45	0.60	0.30		1.32	0.11	0.06		1.11	0.14	0.09		1.67	0.65	0.14
SLA04322	0	0.5		1.68	0.66	0.26		1.08	0.10	0.06		0.94	0.13	0.09		1.08	0.51	0.14
SLA04323	2	3		2.73	0.88	0.14		1.31	0.11	0.06		1.17	0.13	0.09		0.64	0.38	0.25
SLA04324	0	0.5		1.47	0.60	0.30		1.12	0.09	0.06		0.96	0.12	0.09		1.34	0.56	0.13
SLA04325	2	3		1.27	0.48	0.22		1.38	0.11	0.06		1.19	0.15	0.11		1.18	0.46	0.10
SLA04326	0	0.5		1.93	0.67	0.12		1.07	0.09	0.06		0.89	0.12	0.10		0.57	0.34	0.23
SLA04327	2	3		1.42	0.54	0.21		1.33	0.10	0.06		1.13	0.14	0.09		1.22	0.49	0.21
SLA04328	0	0.5		1.14	0.47	0.27		1.11	0.09	0.07		0.92	0.13	0.09		1.16	0.47	0.20
SLA04329	2	3		2.18	0.75	0.13		1.22	0.10	0.06		1.03	0.13	0.09		1.42	0.58	0.25
SLA04330	0	0.5		1.30	0.50	0.20		0.98	0.08	0.06		0.85	0.12	0.09		0.55	0.31	0.20
SLA04331	2	3		1.33	0.48	0.23		1.29	0.10	0.07		1.20	0.14	0.10		1.45	0.50	0.17
SLA04332	0	0.5		1.19	0.48	0.20		1.04	0.08	0.06		0.97	0.12	0.08		1.24	0.49	0.11
SLA04333	2	3		1.49	0.52	0.22		1.44	0.11	0.07		1.12	0.16	0.10		1.15	0.44	0.10
SLA04334	0	0.5		1.01	0.41	0.18		1.16	0.09	0.06		0.91	0.12	0.10		1.02	0.41	0.10
SLA04335	2	3		1.50	0.53	0.10		1.44	0.11	0.07		1.16	0.13	0.11		0.74	0.35	0.19
SLA04336	0	0.5		1.16	0.41	0.18		1.03	0.09	0.06		0.89	0.12	0.09		0.76	0.32	0.08
SLA04337	2	3		1.89	0.75	0.42		1.12	0.10	0.06		1.12	0.13	0.10		0.90	0.49	0.29
SLA04338	0	0.5		1.48	0.68	0.38		0.92	0.09	0.05		0.85	0.11	0.09		1.07	0.56	0.17
SLA04339	2	3		1.73	0.74	0.17		1.21	0.10	0.05		1.09	0.13	0.10		1.64	0.72	0.32

Table B-4. St. Louis North County Reference Area Data (continued)

Sample ID	Sample Depth		Qual.	Thorium-230			Qual.	Radium-226			Qual.	Radium-228			Qual.	Thorium-232		
	SSMP_DEP	ESMP_DEP		Result	Error	MDA		Result	Error	MDA		Result	Error	MDA		Result	Error	MDA
SLA04340	0	0.5		1.95	0.83	0.19		0.92	0.08	0.06		0.99	0.12	0.08		1.95	0.83	0.19
SLA04341	2	3		2.24	0.93	0.20		1.30	0.10	0.06		1.06	0.13	0.09		1.02	0.60	0.37
SLA04342	0	0.5		1.62	0.71	0.32		0.94	0.09	0.05		0.86	0.11	0.07		0.86	0.50	0.32
SLA04343	2	3		1.48	0.67	0.41		1.29	0.11	0.06		1.09	0.14	0.10		0.84	0.48	0.31
SLA04344	0	0.5		1.75	0.80	0.43		1.10	0.10	0.06		0.97	0.12	0.09		1.50	0.72	0.19
SLA04345	2	3		2.65	1.09	0.49		1.30	0.11	0.06		1.08	0.13	0.08		1.96	0.90	0.22
SLA04346	0	0.5		1.81	0.83	0.38		0.97	0.09	0.06		0.88	0.11	0.08		1.59	0.77	0.21
SLA04347	2	3		2.77	1.09	0.21		1.30	0.12	0.06		1.21	0.14	0.09		1.37	0.71	0.39
SLA04348	0	0.5		1.34	0.71	0.46		1.04	0.09	0.06		0.79	0.12	0.09		1.53	0.75	0.21
SLA04349	2	3		1.86	0.69	0.30		1.17	0.09	0.05		0.98	0.12	0.07		1.19	0.53	0.13

Sample ID	Sample Depth		Qual.	Uranium-238			Qual.	Protactinium-231			Qual.	Actinium-227		
	SSMP_DEP	ESMP_DEP		Result	Error	MDA		Result	Error	MDA		Result	Error	MDA
SLA04300	0	0.5												
SLA04301	2	3		0.76	0.48	0.30	<	0.25	0.76	1.10	<	0.05	0.16	0.23
SLA04302	0	0.5		2.04	0.88	0.18	<	0.71	0.62	0.93	<	-0.11	0.13	0.18
SLA04303	2	3		1.38	0.70	0.19	<	0.09	0.67	0.95	<	0.21	0.17	0.27
SLA04304	0	0.5		1.40	0.64	0.15	<	-0.05	0.67	0.94	<	0.32	0.15	0.24
SLA04305	2	3		1.51	0.63	0.13	<	-0.49	0.75	0.99	<	0.06	0.15	0.22
SLA04306	0	0.5		1.10	0.53	0.25	<	0.34	0.63	0.92	<	-0.01	0.14	0.20
SLA04307	2	3		1.33	0.67	0.32	<	-0.14	0.75	1.04	<	0.08	0.15	0.23
SLA04308	0	0.5		1.66	0.70	0.15	<	0.75	0.57	1.01	<	0.05	0.15	0.22
SLA04309	2	3		1.21	0.59	0.16	<	-0.25	0.77	1.06	<	0.09	0.09	0.23
SLA04310	0	0.5		1.86	0.91	0.22	<	0.27	0.75	1.09	<	0.05	0.16	0.23
SLA04311	2	3		1.11	0.53	0.25	<	2.17	1.19	1.15	<	-0.02	0.16	0.23
SLA04312	0	0.5		1.37	0.62	0.15	<	0.38	0.81	1.17	<	-0.03	0.17	0.23
SLA04313	2	3		1.47	0.61	0.13	<	-0.06	0.66	0.92	<	-0.02	0.14	0.20
SLA04314	0	0.5		1.12	0.52	0.13	<	-0.43	0.69	0.92	<	0.24	0.15	0.23
SLA04315	2	3		1.16	0.54	0.14	<	0.20	0.72	1.03	<	0.56	0.18	0.27
SLA04316	0	0.5		0.97	0.46	0.12	<	0.31	0.70	1.02	<	0.62	0.18	0.27
SLA04317	2	3		0.79	0.40	0.21	<	0.38	0.64	0.94	<	0.05	0.14	0.20
SLA04318	0	0.5		1.08	0.47	0.11	<	0.39	0.69	1.00	<	0.00	0.15	0.21
SLA04319	2	3		0.94	0.44	0.12	<	0.68	0.66	1.00	<	0.01	0.14	0.20
SLA04320	0	0.5		1.47	0.66	0.15	<	0.19	0.72	1.03	<	0.14	0.15	0.22
SLA04321	2	3		0.88	0.45	0.13	<	-0.37	0.70	0.94	<	0.12	0.14	0.20
SLA04322	0	0.5		1.58	0.64	0.13	<	-0.45	0.67	0.90	<	0.00	0.14	0.20
SLA04323	2	3		1.06	0.53	0.14	<	0.60	0.68	1.01	<	-0.05	0.14	0.20
SLA04324	0	0.5		1.04	0.49	0.23	<	-0.16	0.66	0.92	<	0.14	0.07	0.19
SLA04325	2	3		1.05	0.48	0.22	<	-0.10	0.62	0.86	<	0.10	0.13	0.20
SLA04326	0	0.5		1.72	0.68	0.13	<	0.46	0.69	1.02	<	0.17	0.15	0.22

Table B-4. St. Louis North County Reference Area Data (continued)

Sample ID	Sample Depth		Qual.	Uranium-238			Qual.	Protactinium-231			Qual.	Actinium-227			
	SSMP	DEP		ESMP	DEP	Result		Error	MDA	Result		Error	MDA	Result	Error
SLA04327	2		3		0.92	0.50	0.16	<	0.47	0.70	0.99	<	0.01	0.14	0.20
SLA04328	0		0.5		1.32	0.83	0.28	<	-0.11	0.69	0.96	<	0.23	0.15	0.23
SLA04329	2		3		1.16	0.86	0.35	<	0.05	0.69	0.98	<	0.06	0.15	0.22
SLA04330	0		0.5		1.26	0.43	0.07	<	-0.24	0.70	0.96	<	0.35	0.15	0.24
SLA04331	2		3		0.85	0.36	0.09	<	0.09	0.62	0.88	<	0.03	0.13	0.19
SLA04332	0		0.5		1.25	0.48	0.10	<	0.25	0.72	1.04	<	0.03	0.16	0.23
SLA04333	2		3		1.02	0.44	0.10	<	0.10	0.61	0.88	<	-0.02	0.14	0.19
SLA04334	0		0.5		1.29	0.45	0.08	<	0.51	0.77	1.14	<	0.01	0.16	0.23
SLA04335	2		3		1.15	0.49	0.11	<	0.30	0.69	1.00	<	0.20	0.12	0.21
SLA04336	0		0.5		1.28	0.43	0.16	<	-0.40	0.75	1.00	<	-0.16	0.21	0.22
SLA04337	2		3		1.06	0.39	0.17	<	0.54	0.52	0.91	<	0.06	0.17	0.20
SLA04338	0		0.5		1.75	0.70	0.14	<	-0.19	0.67	0.92	<	0.20	0.15	0.22
SLA04339	2		3		0.90	0.48	0.14	<	-0.32	0.64	0.86	<	0.07	0.13	0.20
SLA04340	0		0.5		1.05	0.51	0.14	<	0.23	0.65	0.93	<	0.25	0.15	0.23
SLA04341	2		3		1.38	0.57	0.22	<	0.49	0.71	0.91	<	0.32	0.14	0.22
SLA04342	0		0.5		1.66	0.76	0.17	<	-0.21	0.67	0.92	<	0.09	0.14	0.21
SLA04343	2		3		0.94	0.54	0.17	<	-0.39	0.60	0.80	<	0.08	0.13	0.20
SLA04344	0		0.5		1.50	0.83	0.24	<	0.06	0.75	1.06	<	0.10	0.08	0.22
SLA04345	2		3		0.65	0.42	0.16	<	0.15	0.78	0.88	<	0.44	0.15	0.24
SLA04346	0		0.5		1.72	0.92	0.25	<	0.16	0.69	0.99	<	0.27	0.16	0.25
SLA04347	2		3		1.45	0.76	0.21	<	0.46	0.59	0.87	<	0.06	0.14	0.20
SLA04348	0		0.5		1.28	0.65	0.33	<	0.12	0.71	1.00	<	0.19	0.15	0.23
SLA04349	2		3		0.74	0.49	0.35	<	-0.18	0.65	0.90	<	0.08	0.14	0.21
					1.01	0.51	0.14	<	0.49	0.50	0.78	<	0.07	0.12	0.17

FUS258P/071399

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7.0 REFERENCES

DoD 1997, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, NUREG-1575, EPA 402-R-97-016, December.

DOE 1997, *St. Louis Airport Site (SLAPS) Interim Action Engineering Evaluation/Cost Analysis (EE/CA)*, DOE/OR/21950-1026, draft prepared by Science Application International Corporation, September.

ORISE 1998, *Proposed Final Status Survey Plan Using MARSSIM Survey Methodology at the St. Louis, Missouri FUSRAP Sites*, Oak Ridge Institute for Science and Education, May.

SAIC 1999, *Calculation Package: St. Denis Bridge Data Quality Assessment*, accession number 1331.19990412.002, March.

USACE 1998a, *Engineering Evaluation/Cost Analysis (EE/CA) and responsiveness Summary for the St. Louis Airport Site (SLAPS)*, St. Louis, Missouri, St. Louis District Office, May.

USACE 1998b, *MARSSIM-Based Final Status Survey Plan for the St. Denis Bridge Area - St. Louis Missouri*, draft prepared by Science Application International Corporation, November.

Yu, C., A.J. Zielen, L. Cheng, Y. Yuan, L. Jones, D. LePoinre, et al. 1993, *Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0* (working draft), ANL/EAP/D-2, ANL-Environmental Assessment Division, Argonne, Illinois, September.

Cataloging Form

{Technical/Project Managers fill in C through G, K through Q. RM completes other fields}

A. Document ID Number: Assigned by database

717

B. Further Information Required? ☐

C. Operable Unit (Choose One):

- USACE ☐
- St. Louis Sites ☐
- Downtown ☐
- North County ☒
- Madison Sites ☐
- Inaccessible Areas ☐
- PRP ☐
- Oversight Committee ☐

D. Site (Optional):

- SLDS VPs ☐
- Mallinckrodt ☐
- SLAPS ☐
- SLAPS VPs ☐
- CWC ☒
- HISS ☐
- Madison ☐

E. Area (Optional):

St. Denis Bridge

F. Primary Document Type (Choose One):

- Site Management Records ☐
- Removal Response ☒
- Remedial Investigation ☐
- Feasibility Study ☐
- Record of Decision ☐
- Remedial Design ☐

- Remedial Action ☐
- Public Affairs/Community Relations ☐
- Congressional Relations ☐
- Freedom of Information Act ☐
- Real Estate ☐
- Project Management ☐

G. Secondary Document Type (see back of form): Sampling/Analysis Data and Plans

H. Bechtel Number:

I. SAIC Number:

J. MARKS Number(Choose One): FN: 1110-1-8100e ☐

FN: 1110-1-8100f ☐

FN: 1110-1-8100g ☐

K. Subject/Title:

Final PRAR for the St. Denis Bridge w/ Responses to Comments

L. Author:

M. Author's Company:

SAIC

N. Recipient(s):

O. Recipient(s) Company:

USACE

P. Version (Choose One): Draft ☐

Final ☒

Q. Date:

7/99

R. Include in the ARF? ☒

S. Include in the AR? ☐

T. Filed as Confidential/Privileged? ☐

U. Document Format (Choose one):

- Paper ☒
- Electronic ☐

- Photographic ☐
- Audio-visual ☐

- Cartographic/Oversize ☐
- Microform ☐

V. Filed in AR Volume Number: 2.01

W. Physical Location (Choose One):

- Central Files ☒
- Records Holding Area ☐

- Microfilm Vendor ☐
- Department of Energy ☐

- In ARF ☐
- In AR ☐

X. Associated with Document(s):

Secondary Document Types

☐ Amendments to Record of Decision (ROD)
☐ Anomaly Review Board Documents (Management Plan, Correspondence, Standard Operating Procedures, Findings)
☐ Applicable or Relevant and Appropriate Requirements (ARAR) Determinations
☐ Archives Search Reports (ASR)
☐ Briefing Papers
☐ Chain of Custody Forms
☐ Community Relations Plan
☐ Correspondence
☐ Daily Operations Summary/Situation Reports
☐ Engineering Evaluation and Cost Analysis (EE/CA) Action Memo
☐ Engineering Evaluation and Cost Analysis (EE/CA) Approval Memorandum
☐ Engineering Evaluation and Cost Analysis (EE/CA)
☐ Explanation of Significant Differences
☐ Fact Sheets/Newsletters
☐ Feasibility Study (FS) Reports
☐ Federal, State, Local Tech. Records
☐ Final Approved Findings and Determinations
☐ Final Remedial Design Documents
☐ Freedom of Information (FOIA) Requests
☐ Freedom of Information (FOIA) Responses
☐ Health and Endangerment Assessments
☐ Interagency Agreements/Memoranda
☐ Interim Deliverables
☐ Inventory Project Report (INPR) Risk Assessment Code (RAC)
☐ Invoices/Contractor Payments/Cost Reports
☐ Land Grants/Deeds
☐ Mailing Lists
☐ News Clippings and Press Releases
☐ No Further Action Docs (NOFA)
☐ On-Scene Coordinator Reports
☐ Proposed Plans for Remedial Action
☐ Public Meeting Minutes/Transcripts
☐ Public Notices
☐ Public notices, Comments Received, Responses to the Comments
☐ Published Hearings
☐ Record of Decision (ROD)
☐ Reference Documents
☐ Remedial Action Documents
☐ Remedial Investigation (RI) Reports
☐ Removal Response Reports (Emergency Evacuation Orders)
☐ Rights of Entry Documents
☐ Sampling/Analysis Data and Plans
☐ Scopes of Work/Contractual Documents
☐ Site Descriptions and Chronologies
☐ Site Inspection Documents
☐ Site Photographs and Maps
☐ Testimonies
☐ Title Search Documents
☐ Work Logs
☐ Work Plans and Progress Reports
☐ Work Plans/Site Safety and Health Plans and Progress Reports
☐ Work Register and Logs