

NOTICE

All drawings located at the end of the document.

- Delineation of upgradient sources of contamination to SPP (will be accomplished by analysis of 11 samples in the western portion of the Solar Ponds for volatile organic compounds and analysis of a sample from P114389, which is in the North Walnut Creek drainage upgradient of the SPP)
- Characterization of the water quality in SPP groundwater
- Evaluation of fate and transport of uranium and nitrate in SPP, this will include a flowpath analysis and a determination of the mass flux of contaminants to North Walnut Creek (will be accomplished by including the effects of water quality data into the groundwater flow model)
- Evaluation of the effectiveness of the retained alternatives in protecting North Walnut Creek (will be accomplished by simulating the effects of each retained alternative on the SPP and North Walnut Creek using the groundwater model)
- Evaluation of the quantity of uranium added to the SPP by site activities (will be evaluated by sampling and evaluation of uranium isotope analyses of background wells and comparison of uranium isotope ratios between background and SPP wells)

2.2.1 Basis for Selection of SPP Wells for Sampling

Prior to selection of SPP wells to be sampled under this SAP, it was necessary to determine which wells contained sufficient water for sample collection. It was anticipated that many wells might not contain enough water for sample collection because the initial sampling event was planned for the low flow season (late fall/early winter) and some wells are located in or near areas which are typically unsaturated during this time of year.

The RMRS sampling crew visited each well in the SPP area to determine if it still existed and if it contained enough water for collection of nitrate and uranium sample aliquots. Based on this information, 66 wells within the SPP were selected for sampling in the initial sampling event. These 66 wells were distributed across the Solar Ponds, SPP, North Walnut Creek and South Walnut Creek areas and included wells screened in all three stratigraphic units (alluvium, weathered bedrock, and competent bedrock). Some wells near the Solar Ponds were screened across the alluvium and weathered bedrock, these wells were also selected for

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sampling The 65 wells represent all but three of the wells in the SPP which contained sufficient water for sample collection. These three wells were omitted from this sampling program due to their proximity to wells selected for the program and the overlap of their screened intervals. Evaluation of the locations and screened intervals of the dry wells indicated that data from these wells was not necessary for complete characterization of the SPP. For this reason, wells not included in the initial sampling event will not be checked for water and sampled during subsequent water level or sampling events under this SAP.

Although these wells will give a good picture of the water quality in each stratigraphic unit, installation of additional wells is necessary in several areas where wells are not present, contain too little water for full sample collection (due to very small casing/screen diameters), or have been destroyed. Five new monitoring wells were planned to be installed in three areas: southeast of the MSTs (Areas 1) and to the southeast of the Solar Ponds (Areas 2 and 3). The new wells are intended to monitor specific zones within the Upper Hydrostratigraphic Unit (UHSU) (alluvium or weathered bedrock) and will help to identify any stratification of contaminants within the UHSU. The new well in Area 2 will not be installed, as an existing well in this area which contains sufficient water for sampling, P207689, has been identified. See Figures 1 and 2 for locations of existing wells to be sampled and the Areas where the proposed new monitoring wells will be installed.

One well will be installed in the alluvium of Area 1 to provide water quality data near North Walnut Creek downgradient of the ITS system. Two wells were originally proposed for this area, but review of the well distribution in the area indicated that only one additional well would be necessary to fully characterize the area. Three wells will be installed in the weathered bedrock of Area 3 to characterize the water quality. The alluvium is dry in this area and no wells which can be sampled exist in this area. Five wells were originally proposed for this area, however, there are not many suitable drilling sites in this area. The proposed well locations were redistributed such that three wells will provide water quality data for this area.

Wells will be installed at all four proposed locations, even if the target formation does not appear to be saturated during drilling. Site experience has shown that it often takes several days for the wells to fill with water. If a sample cannot be collected during the low flow season, the well will be revisited during the high flow season and a sample collected if sufficient water is present.

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these wells. If a large difference between the dissolved and total uranium activities is observed, both filtered and unfiltered samples may be collected from the six RFCA wells in the SPP during the next SPP sampling event to evaluate this difference.

Evaluation of Site Contribution to Dissolved Uranium in SPP

As discussed in detail in Section 2.3.1, the source (naturally occurring or RFETS activities) can be identified by calculating the ratio of the number of atoms of U^{238} to U^{235} . To provide high quality uranium isotope data comparable to the data to be collected from the SPP wells, 14 background wells and five wells in the North and South Walnut Creek drainages outside of the SPP were selected for sampling during the initial sampling event (shown on Figure 1). The background wells were selected to represent the three stratigraphic units (alluvium, weathered bedrock, competent bedrock) and, because background uranium activities vary greatly across RFETS, a range of uranium isotope activities.

Two wells were selected for sampling in both the North and South Walnut Creek drainages. One well in each drainage is located near the first retention pond and the other is located near the last retention pond, these data points will allow evaluation of changes in uranium activity as the water travels down the drainage. The third well selected for sampling in the North Walnut Creek drainage is P114389 (Figure 1), this well will provide water quality information regarding the water entering the North Walnut Creek drainage from upgradient of the SPP. Please see Section 2.3.1 for a thorough discussion of the planned sampling activities and uranium isotope data evaluation.

2.3 Proposed Sampling Activities

Sixty-six existing wells will be sampled and four new groundwater monitoring wells will be installed and sampled for nitrate/nitrite and uranium isotopes to identify the extent of the SPP. Eleven of the existing wells also will be analyzed for volatile organic compounds (VOCs) to evaluate upgradient sources of VOC contamination. Nineteen existing wells not considered part of the SPP (five in North and South Walnut Creek drainages and 14 background wells) also will be sampled (See section 2.2 for discussion of selection of these wells). Eighteen of these wells will be analyzed for uranium isotopes only, one well (P144389) in the North Walnut Creek drainage upgradient of the SPP area will be analyzed for both uranium isotopes and nitrate/nitrite to evaluate the water quality entering the SPP from upgradient. The wells to be sampled are shown on Figures 1 and 2 and described on Table 1.

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The initial sampling event (all 89 wells) was planned for late fall 1997/early winter 1998, during the low flow season for groundwater at RFETS. In order to complete the sampling event during this season, it was necessary to begin sampling in November 1997. The initial sampling event will be completed in early February 1998.

The new groundwater monitoring wells will be installed and sampled in February 1998. Once the results of this initial sampling event have been reviewed, six to ten wells will be selected for two more sampling events, which will define high flow groundwater conditions at RFETS. The samples will also be analyzed for nitrate/nitrite and uranium isotopes. Water levels from all 66 wells (or 70 wells if the new wells have been installed) will be measured in one event in February 1998, and water levels will be measured at a subset (15 wells) of these wells monthly through June 1998.

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Table 1 lists the wells to be sampled, the unit screened by the wells, and the analyses requested for each well for the initial sampling event. Table 2 presents the analytical methods and sampling requirements for the initial sampling event.

The initial sampling event will include the following parameters:

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- 66 existing wells and the four new wells will be analyzed for nitrate/nitrite and uranium isotopes because these are the primary contaminants of the SPP (70 wells total)
- 19 additional wells (5 in North and South Walnut Creek drainages and 14 background wells) will be sampled. Eighteen will be analyzed for uranium isotopes only, one well, located upgradient of the SPP in the North Walnut Creek drainage, will be analyzed for both uranium isotopes and nitrate/nitrite
- 11 of the existing 66 wells within the SPP will be sampled for volatile organic compounds (VOCs) to evaluate the extent of the VOC plumes which originate outside of the Solar Ponds area

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Table 1. Wells To Be Sampled In November 1997 - February 1998

	Geologic Unit	Well #	Nitrate/Nitrite and Uranium	Uranium Only	VOCs	Comments
1	Alluvium	05293	Y	---	---	
2	Alluvium	2686	Y	---	---	
3	Alluvium	3887	Y	---	---	
4	Alluvium	05193	Y	---	---	
5	Alluvium	P209789	Y	---	---	
6	Alluvium	P218389*	Y	---	---	
7	Alluvium	P207889	Y	---	---	
8	Alluvium	05093	Y	---	---	
9	Alluvium	5687	Y	---	---	
10	Alluvium	2286	Y	---	---	
11	Alluvium	45793	Y	---	Y	
12	Alluvium	41193	Y	---	---	
13	Alluvium	46293	Y	---	---	
14	Alluvium	45093	Y	---	---	
15	Alluvium	45393	Y	---	---	
16	Alluvium	46393	Y	---	---	
17	Alluvium	1386*	Y	---	---	
18	Alluvium	1586	Y	---	---	
19	Alluvium	1786*	Y	---	---	
20	Alluvium	29795	Y	---	---	
21	Alluvium	B208589	Y	---	---	
22	Alluvium	B210489*	Y	---	---	
23	Alluvium	B208789*	Y	---	---	
24	Alluvium	10594	---	Y	---	North Walnut Creek
25	Alluvium	10694	---	Y	---	North Walnut Creek
26	Alluvium	75292	---	Y	---	South Walnut Creek
27	Alluvium	75992 or 3686	---	Y	---	South Walnut Creek
28	Alluvium	P114389	Y	---	---	North Walnut Creek
29	Alluvium	B205589**	---	Y	---	Background
30	Alluvium	B200589	---	Y	---	Background
31	Alluvium	B202589	---	Y	---	Background
32	Alluvium	B102289**	---	Y	---	Background
33	Alluvium	B302789**	---	Y	---	Background
34	Alluvium	10294	---	Y	---	Background
35	Alluvium	5386**	---	Y	---	Background
36	Alluvium	5586	---	Y	---	Background
37	Alluvium	Area 1, W1	Y	---	---	Area 1, New Well
38	Alluvium	P207689	Y	---	---	Area 2

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78	Weathered Bedrock	B201589**	---	Y	---	Background
79	Weathered Bedrock	B203489	---	Y	---	Background
80	Weathered Bedrock	B405489**	---	Y	---	Background
81	Bedrock	B304989	---	Y	---	Background
82	Bedrock	P208889	Y	---	---	
83	Bedrock	3987	Y	---	---	
84	Bedrock	1486	Y	---	---	
85	Bedrock	3286	Y	---	---	
86	Bedrock	2386	Y	---	---	
87	Bedrock	2586	Y	---	---	
88	Bedrock	2786	Y	---	---	
89	Bedrock	1686	Y	---	---	

* RFCA Well

** U by ICP/MS

Table 2. Analytical Sampling Requirements

Analytical Method	Number of Samples	Number of QC Samples	Total Number of Samples	Containers, Preservatives, Holding Times
EPA Method 524.2 Volatile Organic Compounds	11	1 duplicate 1 rinsate 2 trip blanks	15	Three 40 ml teflon-lined VOA vials with septum lids, HCl to pH < 2 and 4° C, 14 days
EPA Method 353.2 Nitrate/Nitrite as Nitrogen	71	4 duplicates 4 rinsates	79	250 ml in polyethylene jar, H ₂ SO ₄ to pH<2, 4° C, 28 days
Alpha Spectroscopy Dissolved Uranium Isotopes	89	5 duplicates 5 rinsates	99	One 1-L glass bottle, 4° C, 6 months
Inductively Coupled Plasma/ Mass Spectroscopy Dissolved Uranium Isotopes	8	1 duplicate 0 rinsate	9	One 1-L glass bottle, 4° C, 6 months
Radiological Screening	89	0 duplicates	99	100 ml in poly jar, delivered to on-site lab next day

The wells to be sampled and the analytes to be requested in the additional sampling events will be determined after review of the results of the initial sampling event

2.3.1 Uranium Isotope Analyses

All wells will be sampled for dissolved uranium isotopes by alpha spectroscopy during the initial sampling event. By sampling all 89 wells (the 66 existing SPP wells, four new SPP wells, five wells in North and South Walnut Creek drainages, and 14 background wells) for uranium isotopes and using the same analytical technique, the data will be comparable with historical data collected from these locations

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Based on the above summary of data, there is no indication of a metals plume in the SPP groundwater which requires additional sampling to characterize. The only metal of potential concern is lithium, and wells in the alluvium along North Walnut Creek downgradient of B208689 are part of the RFCA program and are monitored biannually (1786, B210489, and 1386). If lithium is detected above the Tier II level in these wells, sampling of additional wells for lithium may be required. All of the metals data will be provided to the subcontractor who will be developing the site conceptual hydrogeologic model and the groundwater flow model to ensure that they are considered in all geochemical interpretations. The lithium data, in addition to the nitrate/nitrite and uranium data, will be provided to the subcontractor evaluating the phytoremediation system.

2.3.3 Measurement of Eh in SPP Wells

Downhole Eh measurements will be collected in some SPP wells to evaluate the redox potential in the groundwater of the various stratigraphic units at these locations. The downhole Eh probes at RFETS are relatively large diameter, therefore, only wells with a 4-inch diameter will be considered for these measurements. Alternatively, a flow-through cell and Eh probe may be used for measurement of smaller diameter wells. All of the wells installed within the SPP area in 1989 (well names end in "89") are 4-inch diameter. This includes six wells in the alluvium, 12 wells in the weathered bedrock, and one competent bedrock well. Seventeen wells distributed in the three stratigraphic units across the SPP were selected for monthly water level measurements, six of these (P219589, P218389, P208989, P210089, B210389, and B208589) are 4-inch diameter. Eh measurements will be collected in from these wells during the March and May water level measurement events. This data will provide additional information to be used in evaluation of the retained remedial alternatives.

3.0 WELL INSTALLATION, SAMPLING AND ANALYSES

This SAP has been designed to collect the data necessary to define the SPP and allow selection and implementation of a groundwater control system, if the SPP hydrogeological analysis and groundwater flow model indicate that one is necessary. A thorough definition of the SPP will require installation of four new wells in two areas of the SPP (Areas 1 and 3, as shown on Figure 2). One well is planned to be installed in the alluvium and three in the weathered bedrock, depending upon the saturated thickness in the Areas. Two of the wells will be installed in the Protected Area to the southeast of the Solar Ponds.

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