Downsizing Remediation Systems

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ABSTRACT

Envirocare of Utah, LLC, currently operates several radioactive disposal facilities at its South Clive facility, located in the western desert of Utah. These cells are licensed by several regulatory agencies to receive and dispose of low-level radioactive waste from throughout the United States. The location of Envirocare's South Clive Facility is ideal for the disposal of these wastes due in part to the extremely poor groundwater (greater than 50,000 mg/L TDS) found in a low-yielding aquifer beneath the site. Although high TDS waters are found in this area, Envirocare is committed to protect the groundwater as if it were a source of drinking water.

Envirocare's current groundwater monitoring network consists of 90 shallow monitoring wells, which are sampled on a semi-annual basis for major cations and anions, metals, volatile and semi-volatile organic compounds, and radiologics. Semi-annual analytical results are compared to baselines levels established prior to disposal activities to demonstrate compliance. Shortly after developing baseline levels for monitoring well P3-95 SWC, increases were observed in general chemistries (TDS, calcium, and magnesium), nitrate, uranium (U-234, U-235, and U-238). After verifying these increases, Envirocare notified regulatory agencies and prepared and implemented a Corrective Action Plan to mitigate any further problems. Monitoring well P3-95 SWC is located immediately upgradient of the evaporation pond built in 1995.

The Corrective Action plan included: 1) investigating the nature and extent of the problem using Geoprobe soil and water sampling equipment, 2) collecting and analyzing soil along a suspect drain line using excavation equipment, 3) repairing the drain line and over excavating soil, 4) pressure testing the pond liner system, 5) installing a pump and treat system to remove contaminants from the groundwater.

By implementing the Corrective Action on a timely basis, Envirocare successfully mitigated an environmental problem effectively and efficiently. Contaminants of concern have all been reduced to below initial groundwater protection levels. Operation of the extraction system has not interfered with disposal operations and the system will be shut-down approximately one and a half years after starting.

INTRODUCTION

Envirocare of Utah, LLC (Envirocare) operates four waste disposal facilities near Clive, Utah; two Low Activity Class A Radioactive Waste units (Class A and Class A North), an 11e.(2) unit, and a Mixed Waste Unit. This report addresses an investigation and remediation of groundwater near one of the four evaporation ponds that operate at the facility. These ponds are licensed and permitted to operate under the following laws and rules:

- A materials license to receive, acquire, possess, and transfer byproduct, source, and special nuclear material pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 33, 34, 35, 39, 40, and 70. This constitutes Envirocare's 11e.(2) License; License number SMC-1559, which is administered by the State of Utah, Division of Radiation Control (DRC).

- A category 4-A license to receive, store and possess, and use specific radioactive materials pursuant to Section 19-3-104 of the Utah Code annotated 1953 and the Utah Department of Environmental Quality Rules for the control of ionizing radiation.

- A Groundwater Quality Discharge Permit (GWQDP) for a Low-Activity Radioactive Waste (LARW) and 11e.(2) waste disposal facility, effective April 5, 1996, pursuant to the Utah Water Quality Act, Title 19, Chapter 5, Utah Code annotated 1953 as amended. Envirocare's GWQDP License number is UGW450005 and is administered by the Utah Division of Radiation Control.

- A State-issued Part B Permit to treat, store, and dispose of Mixed Waste pursuant to the Utah Solid and Hazardous Waste Act, (The At), 26-14-1 et.seq., Utah Code Annotated 1953 and the Utah Administrative Code (UAC) (R450-1 through R450-13 and R450-50) as authorized by the U.S. Environmental Protection Agency (U.S. EPA) under Section 3006 (b) of the Resource Conservation and Recovery Act (RCRA)

LOCATION

The Envirocare facility is located in Section 32, T1S, R11W near Clive, Utah, approximately 80 miles west of Salt Lake City, Utah. The Department of Energy (DOE) and the Utah Department of Environmental Quality (UDEQ) selected the area in 1984 for the disposal of the VITRO tailings from Salt Lake City, UT. These tailings occupy approximately 85 acres in the north-central portion of Section 32. The DOE and UDEQ selected this facility because it exhibited the most suitable hydrogeological, ecological, and economical characteristics for waste disposal.

One of the primary hydrogeological attributes of the facility is poor groundwater quality and quantity. Based on the Utah Administrative Code (UAC R317-6-3.7), groundwater beneath the facility has been classified as a Class IV aquifer because the water has a total dissolved solids (TDS) concentration of greater than 10,000 milligrams per liter (mg/L). Monitoring wells at the facility have TDS concentrations ranging from 35,000 to greater than 75,000 mg/L. Despite its

poor beneath the facility, Envirocare is committed to protect the groundwater as if it were a source of potable water.

GROUNDWATER MONITORING PROGRAM

Envirocare's GWQDP requires compliance monitoring of the shallow, unconfined groundwater. Envirocare conducts pre-operational monitoring to establish Groundwater Protection Levels (GWPL). Table 1 provides a list of monitoring and compliance parameters required by the GWQDP. Baselines and GWPLs were established for each parameter at each well based on the following criteria: for detected parameters – the mean plus two standard deviations; for undetected parameters – the laboratory detection method.

Groundwater samples are collected on a semi-annual basis at approximately 90 monitoring wells that surround each of the disposal embankments and evaporation ponds. Analytical results are compared to baselines and/or GWPLs to determine if any exceedances have occurred. Should exceedances be observed, Envirocare is required to notify the respective regulatory agency and begin out-of-compliance monitoring.

EVAPORATION PONDS

Four evaporation ponds are currently operating at Envirocare's facility. The 1995, 1997, 2000, and Mixed Waste ponds receive water from various site operations, such as decontamination of shipping containers (rail cars, intermodals, etc.), run-off from waste management areas (container storage pads, truck unloading facility, etc.), and contact water removed from disposal areas. These ponds are designed with two high density polyethylene (HDPE) liners with a leak detection system. The leak detection system consists of a collection sump below the top liner with a pump and transducer to keep the hydraulic head on the lower liner below one foot. Water collected in the leak detection system is pumped back into the pond and the volume of water collected is monitored for compliance purposes. In addition, up- and down-gradient monitoring wells are installed to determine if the ponds are impacting the shallow, unconfined aquifer.

Table I. Groundwater Monitoring and Compliance Parameters

Analyte	GWQDP	
	Required Parameter	Compliance Parameter
Major Cations and Anions		
Bicarbonate	✓	
Calcium	✓	
Carbonate	✓	
Chloride	✓	
Fluoride	✓	✓
Magnesium	✓	
Nitrate	✓	✓
Nitrate-Nitrite	✓	✓
Potassium	✓	
Sodium	✓	
Sulfate	✓	
Metals		
Arsenic	✓	
Barium	✓	✓
Beryllium	✓	✓
Cadmium	✓	✓
Chromium	✓	✓
Copper	✓	✓
Lead	✓	✓
Mercury	✓	✓
Molybdenum	✓	
Nickel	✓	✓
Selenium	✓	✓
Silver	✓	✓
Zinc	✓	✓
Other Analytes		
Cyanide	✓	✓
TOX	✓	✓
TOC	✓	✓
Total Dissolved Solids	✓	✓
Radiologics		
Carbon-14	✓	✓
Gross Alpha	✓	
Gross Beta	✓	✓
Iodine-129	✓	✓
Neptunium-237	✓	✓
Potassium-40	✓	
Radium-226	✓	✓
Radium-228	✓	✓
Strontium-90	✓	✓
Technetium-99	✓	✓
Thorium-230	✓	✓
Thorium-232	✓	✓
Tritium	✓	✓
Total Uranium	✓	✓
Uranium 233/234	✓	✓
Uranium 235/236	✓	✓
Uranium 238	✓	✓
Organics		
Volatiles (Short List)	✓	✓
Semi-Volatiles (Short List)	✓	✓

During routine semi-annual monitoring, an increase in general water quality parameters were observed at monitoring well P3-95 SWC. Specifically, increases were observed in total dissolved solids, specific conductance, calcium, and magnesium. Increases were also observed

in the compliance parameters of fluoride, nitrate, gross alpha, radium, isotopes of uranium (U-234 and U-238), and total uranium.

CORRECTIVE ACTION

In accordance with Envirocare's GWQDP, Envirocare began immediate corrective action after confirming the increases in GWPLs. Envirocare submitted a Source and Contamination Study Plan (Plan) to conduct a subsurface investigation of the soils around P3-95 SWC. This plan provided the steps Envirocare would take to determine the nature and extent of contamination causing the monitoring well to be out of compliance.

The investigation consisted of excavating a trench along drain pipe running from the LARW Container and Bulk unloading area into the 1995 evaporation pond. A loose coupling was discovered on the drain pipe. Soil samples were collected from the excavation as shown in Figure A-1. In addition, 10 Geoprobe© ground water wells were installed and sampled at the locations shown in Figure A-2. Analytical results from these soil and ground water samples were an order of magnitude lower than contaminant concentrations detected at P3-95 SWC, suggesting a relatively localized area of contamination.

The DRC reviewed the results of the investigation and determined that the source and extent of contamination associated with monitoring well P3-95-SWC was inconclusive. Therefore, Envirocare assumed that the source of the contamination was the pipeline, not the pond, and pursued remediation.

Envirocare repaired the suspected leaking joint in a wastewater drainpipe located adjacent to P3-95 SWC in April 2001. In addition, Envirocare replaced a large portion of the drainpipe and over excavated soils to remove potential source areas in the spring of 2004.

In June 2004, Envirocare installed a check valve pump to remove contaminated ground water from the well and discharge it into the 1995 evaporation pond. Envirocare also prepared and submitted a Corrective Action Plan (CAP) to the DRC describing the long-term operation and maintenance of the pump.

Corrective Action Plan

The proposed remediation technique is to pump contaminated ground water from P3-95 SWC and treat it by disposal into an existing on-site wastewater evaporation pond. Since groundwater below the facility is in a high TDS, low-yield aquifer, a check-valve pump was selected as these pumps area ideally suited for these conditions. Monitoring well P3-

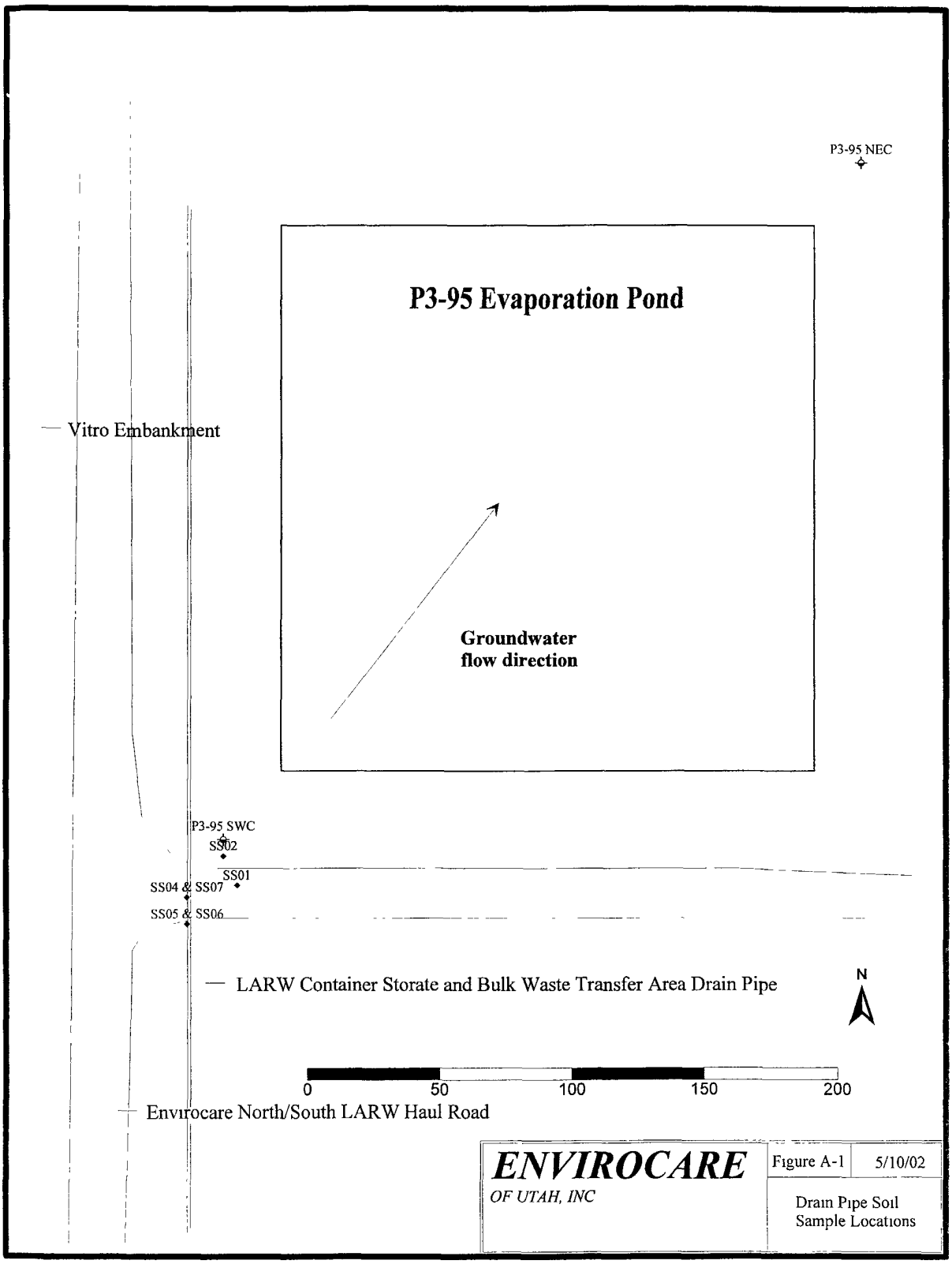

Fig. 1. Soil sample locations

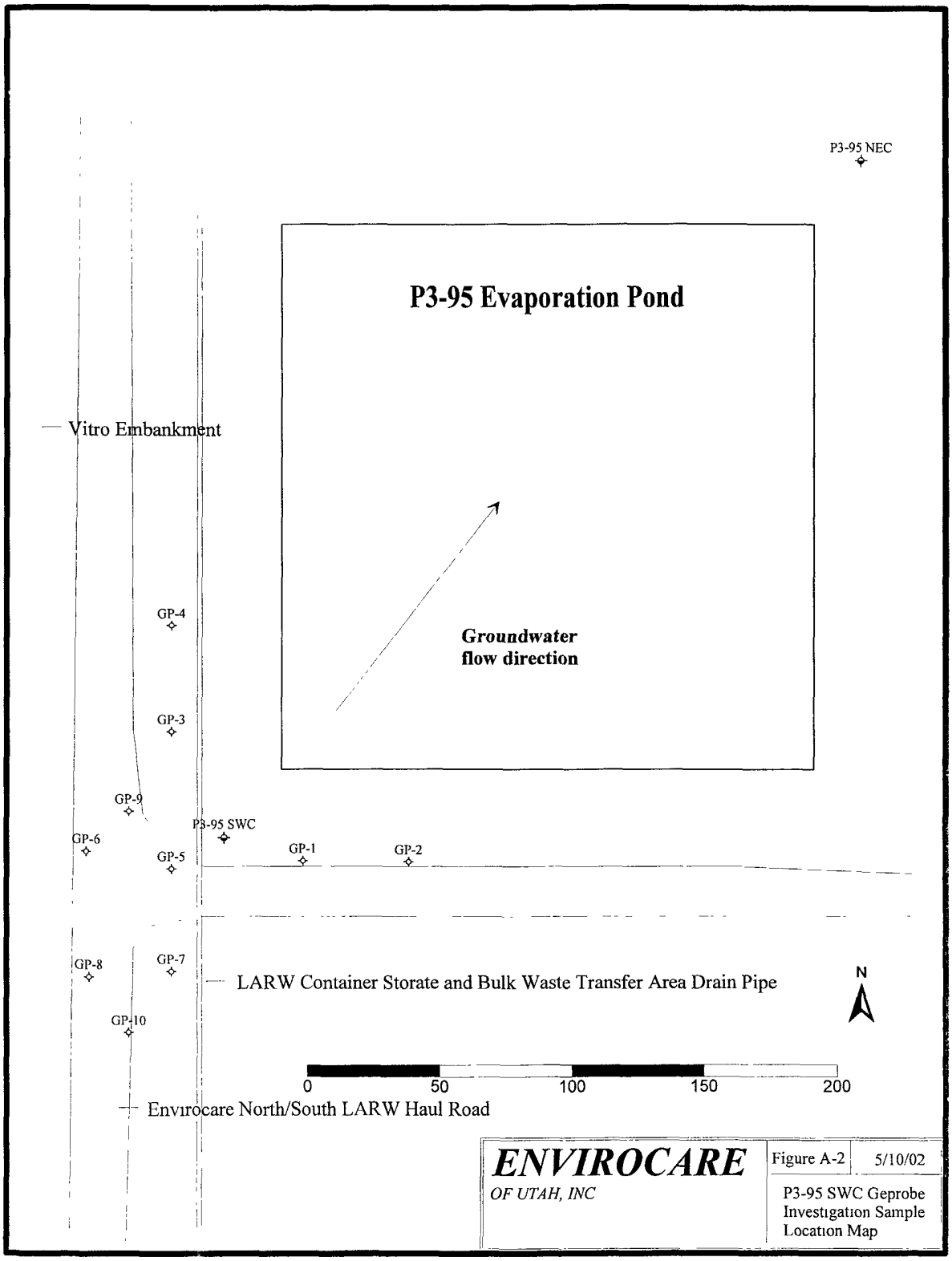

Fig. 2. Geoprobe sampling locations

95 SWC pumps down relatively quickly, but does sustain flow throughout the day. Envirocare set a goal to remove 100 gallons per week.

DRC regulators were concerned that contaminants would rebound after shutting down the extraction system. Envirocare proposed in the CAP that after removing 7,000 gallons of water, which was an estimate of eight purge volumes from the aquifer, the pump would be turned off, and 4 weekly samples collected to evaluate rebound. After these four samples are collected, the system will again be started until 8,500 gallons are removed. At this time, the system will again be shut down and samples collected on a monthly basis for three months. If GWPLs are no longer exceeded at the end of this process, the monitoring well will return to semi-annual monitoring. Should analytical results suggest that the aquifer has rebounded; the CAP specifies an ongoing pumping and monitoring plan that will be followed.

RESULTS

Positive results were observed at monitoring well P3-95 SWC immediately after starting the pumping system. Monthly samples were collected and analyzed for key parameters while the regulatory agency reviewed and approved the CAP. Analytical results from samples collected after starting the pumping system were all below GWPLs as shown in Figures 3, 4, 5, and 6. Envirocare continued operating the system in accordance with the CAP. At the end of August 2005, 7,000 gallons had been removed and the system went through the first shut down. Samples were collected immediately after shutting the system down, and every week for three weeks. Results of these sampling events indicate that there has not been a rebound in contaminants. This is not unexpected, as the monitoring well is allowed to fully recover each day, thereby "flushing" residual contamination from the shallow aquifer.

CONCLUSION

The successful operation of a groundwater compliance monitoring system depends on the ability of the system to detect releases from the disposal facility or waste management area. Envirocare's current monitoring system provided an early detection and allowed for a much smaller remediation system. It is important to have a functioning monitoring system and review the data on a timely fashion. It is also important to start remediation systems as soon as possible, and to not wait for all of the paperwork to finish. If problems are detected in early stages, they are much easier to resolve. It is also good to use site resources and infrastructure to resolve problems.

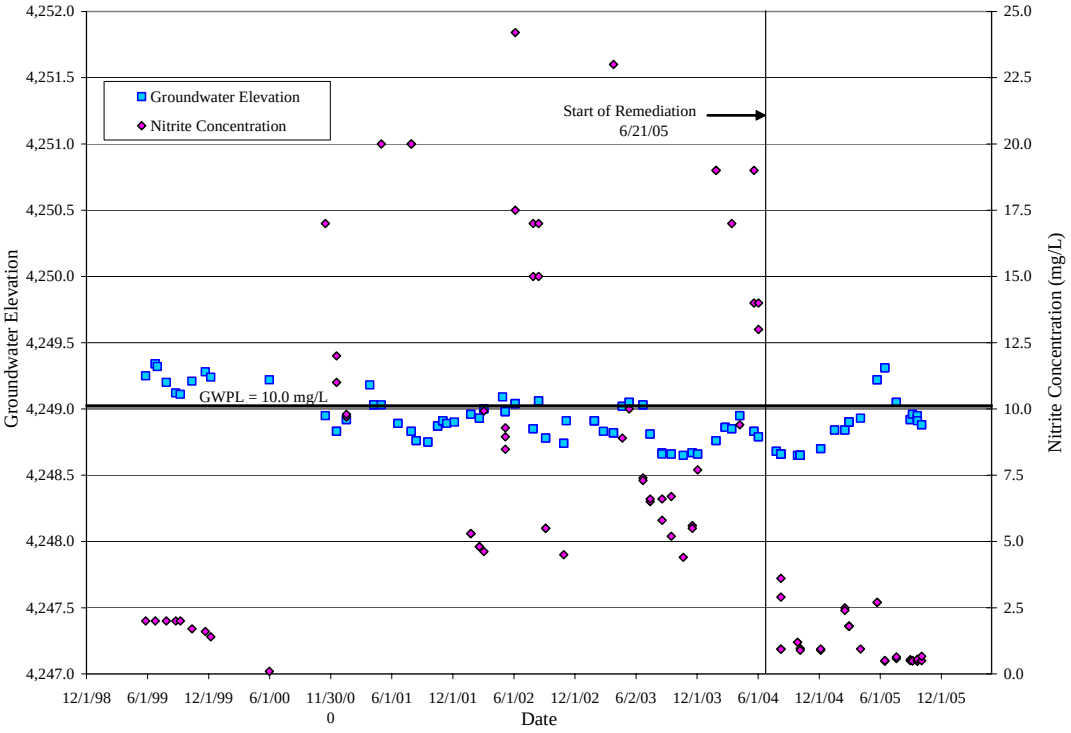

Fig. 3. Envirocare of Utah, LLC monitoring well P3-95 SWC groundwater elevation and nitrate concentration

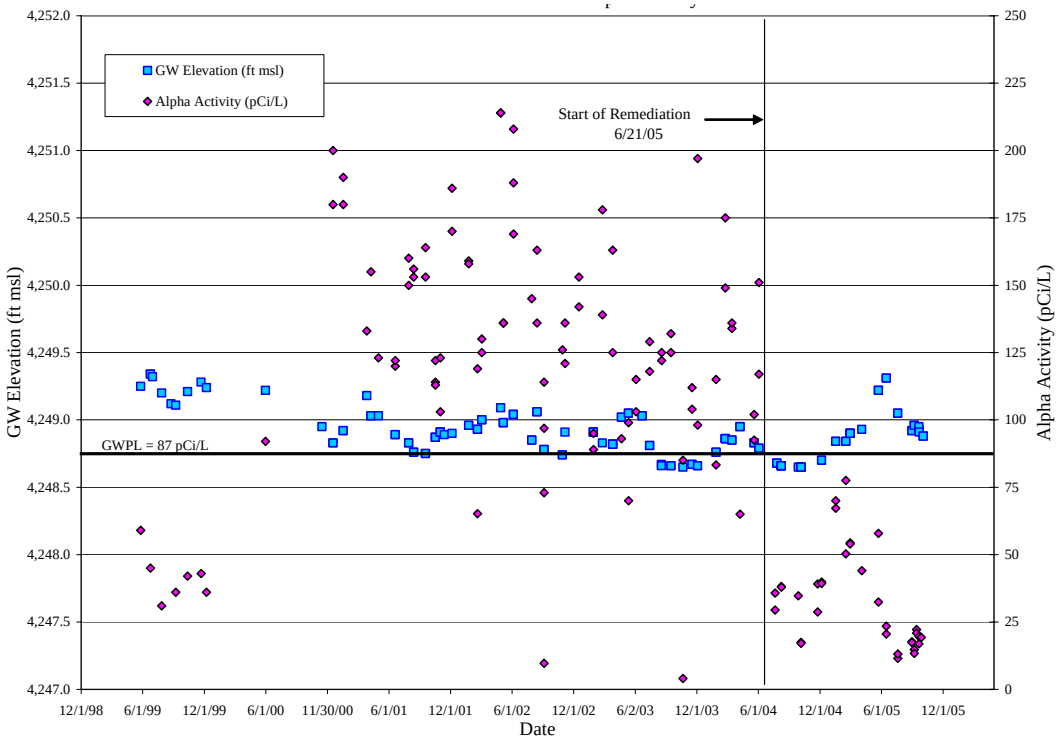

Fig. 4. Envirocare of Utah, LLC monitoring well P3-95 groundwater elevation and alpha activity

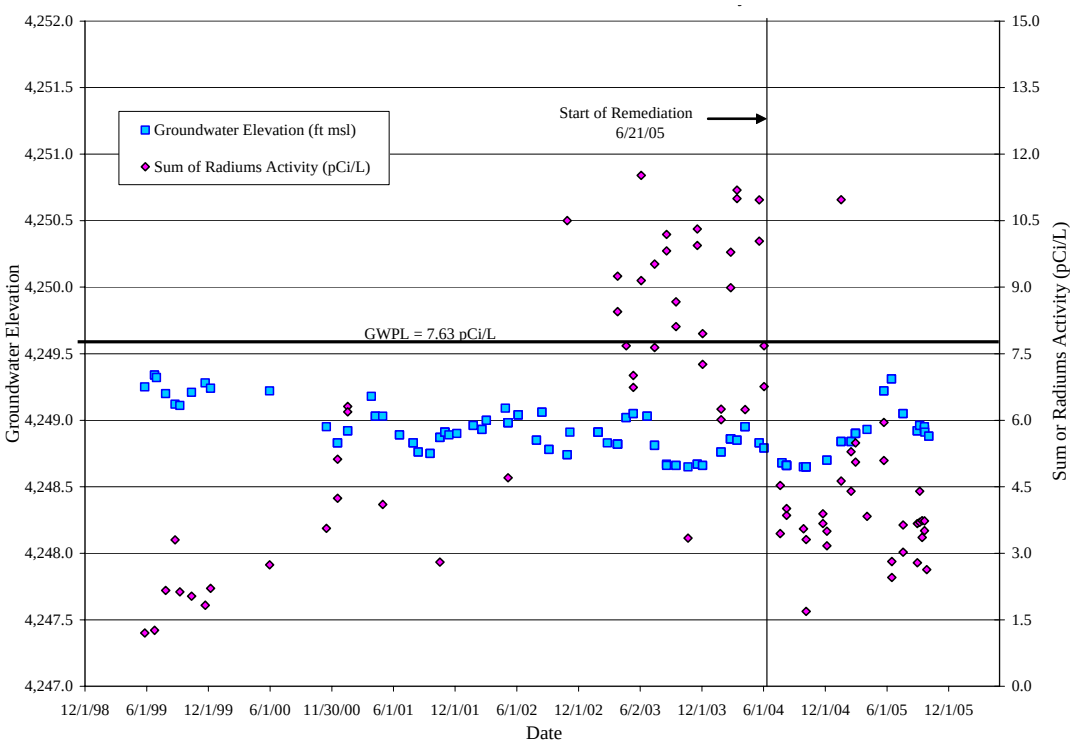

Fig. 5. Envirocare of Utah, LLC monitoring well P3-95 SWC groundwater elevation and sum of radiums activity

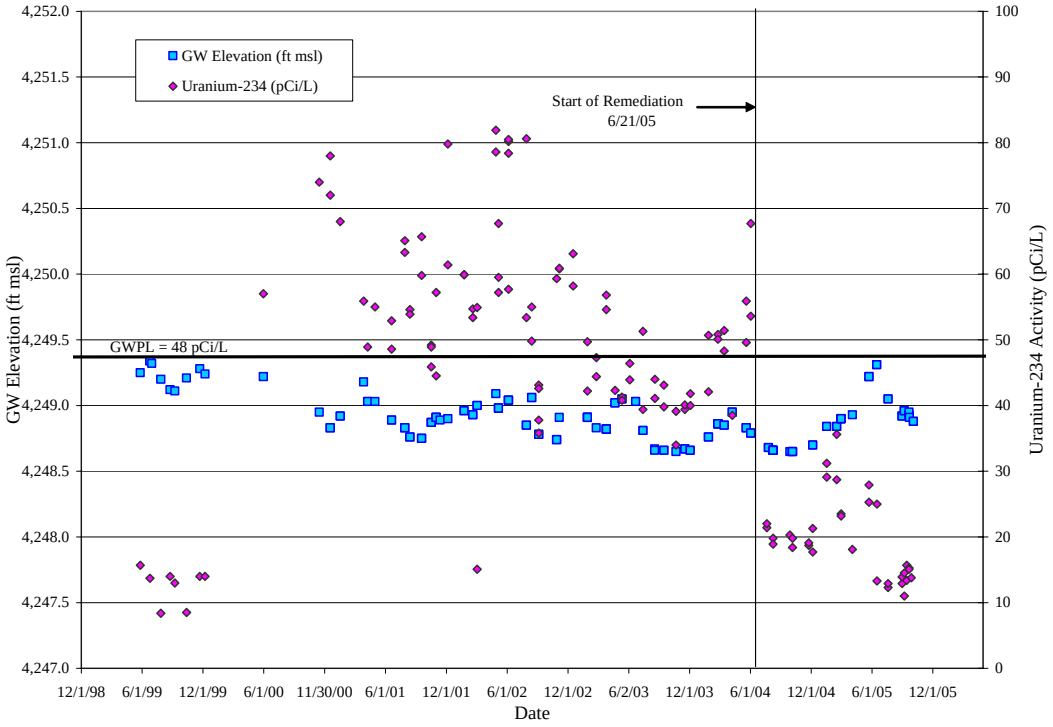

Fig. 6. Envirocare of Utah, LLC monitoring well P3-95 SWC groundwater elevation and Uranium-234

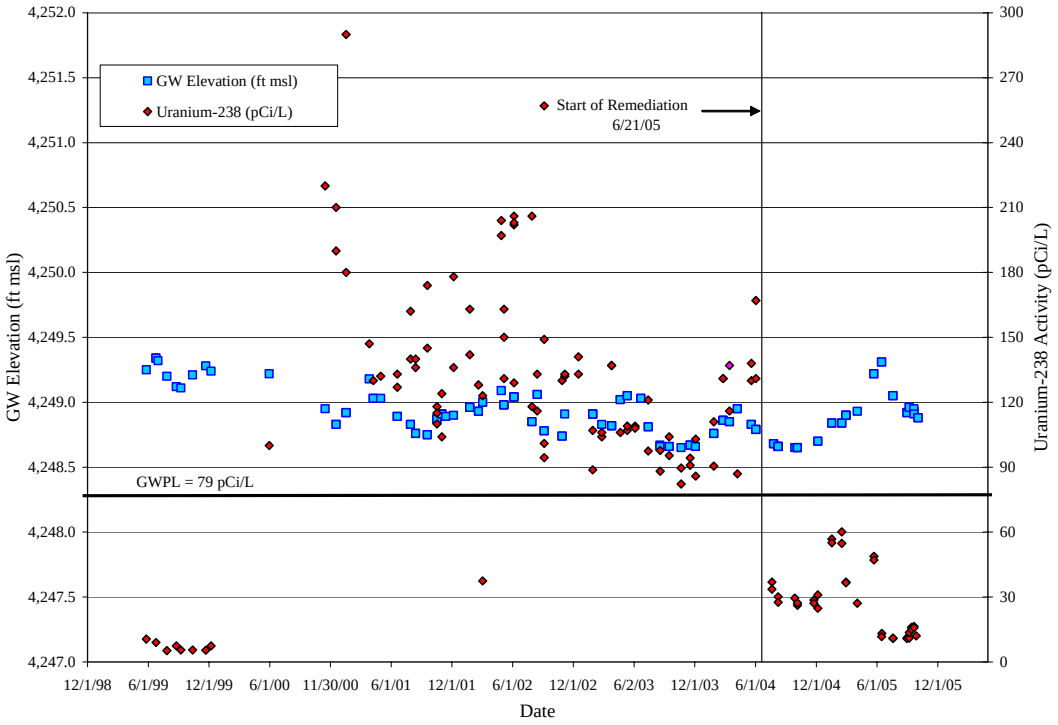

Fig. 7. Envirocare of Utah, LLC monitoring well P3-95 SWC groundwater elevation and Uranium 238

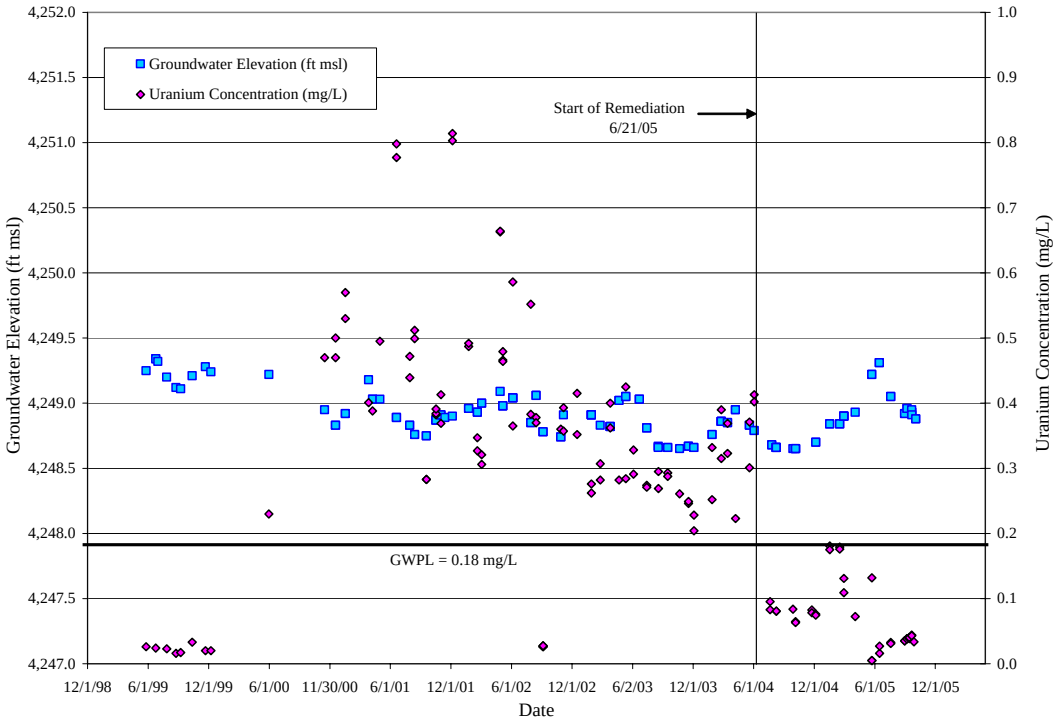

Fig. 8. Envirocare of Utah, LLC monitoring well P3-95 SWC groundwater elevation and total Uranium concentration