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UCRL-AR-136189

Explanation of Significant Differences for the Trailer 5475 Ground Water Remediation, Lawrence Livermore National Laboratory, Livermore Site

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Environmental Protection Department

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1. Introduction

On August 5, 1992, the Record of Decision (ROD) (Department of Energy [DOE], 1992) was signed, documenting the final cleanup plan for the Lawrence Livermore National Laboratory (LLNL) Livermore Site in Livermore, California. Any significant changes to that plan must be publicly noticed through an Explanation of Significant Differences (ESD). As required under Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendment and Reauthorization Act of 1986 (SARA), and pursuant to 40 Code of Federal Regulations (CFR) Section 300.435 (c)(2)(i) (Fed. Reg. Vol. 55, No. 46 [March 8, 1990]), an ESD is required because a significant, but not fundamental change is proposed to the final remedial action plan described in the ROD for the Livermore Site. This ESD has been prepared to describe a change to allow ground water containing volatile organic compounds (VOCs) and tritium above its Maximum Contaminant Level (MCL) to be treated for VOCs at the surface, and then return the tritiated water to the subsurface to decay naturally. This ground water treatment is currently being proposed for the Trailer 5475 area only (Fig. 1).

The lead regulatory agency for this ESD is the U.S. Environmental Protection Agency (EPA). In addition to the EPA, the San Francisco Bay Regional Water Quality Control Board (RWQCB) and the California Department of Toxic Substances Control (DTSC) oversee the LLNL Livermore Site clean up and have commented on this ESD. All three regulatory agencies' comments have been incorporated in this document.

This ESD includes a brief summary of the remedy selected in the ROD, a description of the proposed change, and a description of why DOE/LLNL are making this change to the selected remedy. This ESD was prepared according to EPA guidance (EPA, 1991; 1992).

The changes described in this ESD were presented to EPA's Technical Assistance Grant recipients on November 9, 1999 and the Community Work Group on February 1, 2000. Pursuant to 40 CFR Section 300.435(c)(2)(i), a public comment period is not required for an ESD. A notice was published in local newspapers (*The Independent*, *Tri-Valley Herald*, and *Valley Times*) that briefly summarized this ESD.

The draft ESD was placed in the LLNL repositories for interested members of the public to review. One repository is located at the Livermore Public Library, 1000 South Livermore Avenue. Library hours are Monday through Thursday, 10:00 a.m. to 9:00 p.m.; Friday, 10:00 a.m. to 6:00 p.m., Saturday, 10:00 a.m. to 5:00 p.m.; and Sunday 1:00 to 5:00 p.m. The second repository is at the LLNL Visitors Center on Greenville Road. Visitor Center hours are Monday through Friday, 1:00 to 4:00 p.m. The Administrative Record, which contains all documents that form the basis for the Livermore Site cleanup plan, is also accessed through the Visitor Center.

The site description and history are described in the Livermore Site Remedial Investigation Report (Thorpe et al., 1990), the Feasibility Study (Isherwood et al., 1990), the ROD (DOE, 1992), and the Remedial Action Implementation Plan (Dresen et al., 1993).

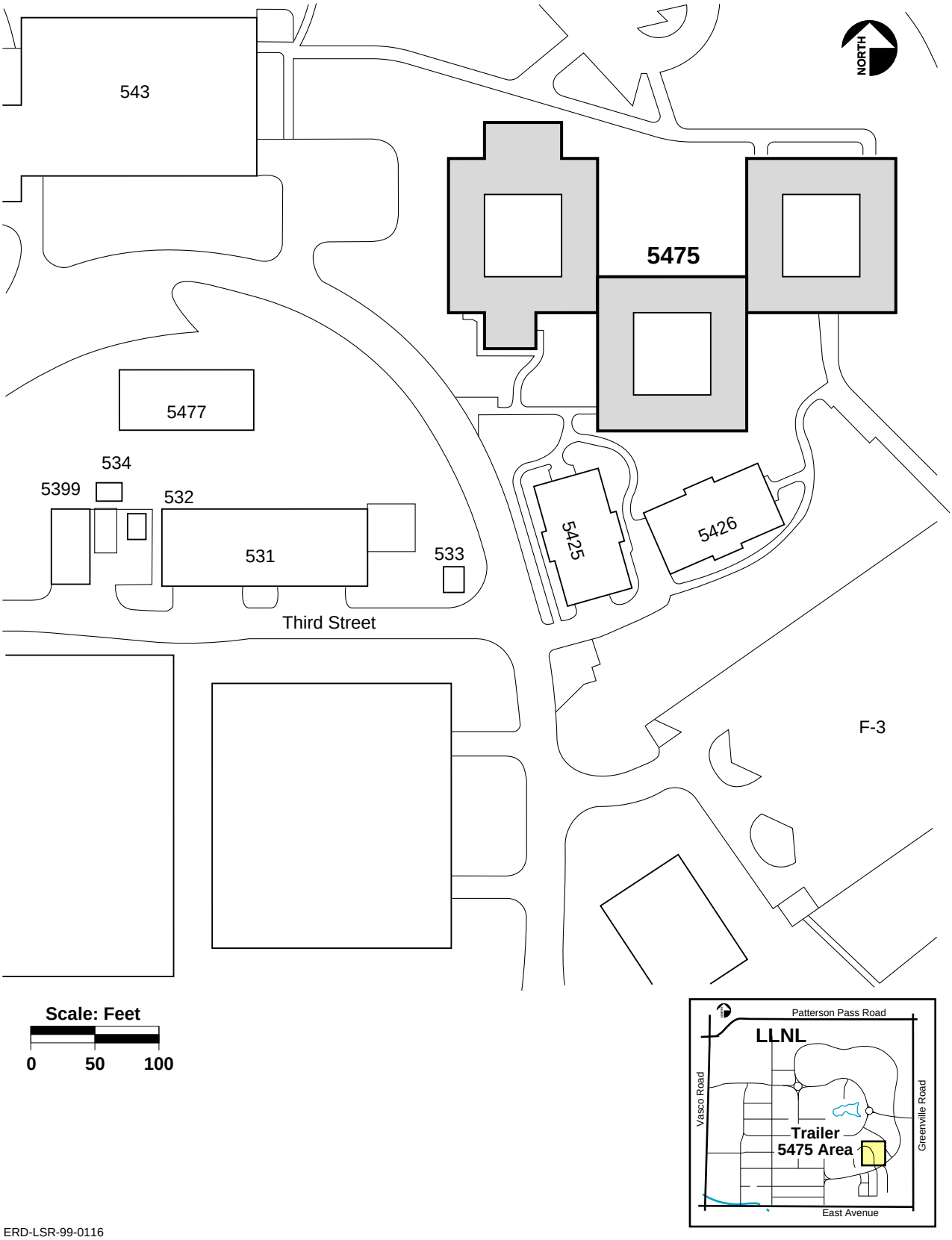

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Figure 1. Location of the Trailer 5475 area at Lawrence Livermore National Laboratory Livermore Site.

2. Remedy Selected in the ROD

The ROD for the Livermore Site specified remedies for treating ground water and soil containing VOCs. At the time of the ROD, there was no technology identified or selected to remediate tritium in ground water. Ground water contains both VOCs and tritium in the Trailer 5475 area of the Livermore Site. In localized areas, tritium concentrations are above its MCL. As stated in the ROD, the approach for tritium is to keep it in the subsurface as much as possible where it will decay naturally and to minimize its migration. The ROD stated that tritium above its MCL would not enter a treatment system or be reinjected back into the subsurface. To be consistent with the ROD, LLNL designed a treatment system to treat the ground water containing VOCs *in situ* in areas where the ground water also contained tritium (Fig. 2). This design was approved by the regulatory agencies in a Remedial Design Report and was implemented in 1998. This ESD discusses a change to allow ground water containing VOCs and tritium to be brought to the surface within a closed-loop system to treat the VOCs, and then reinject the treated ground water containing tritium. Treated water containing tritium above MCLs will be reinjected back into the same hydrostratigraphic unit from which it was extracted.

3. Description of the Significant Differences and the Basis for the Differences

The significant differences between the current remedy and the proposed remedy are described below.

3.1. Description

At the time of the ROD, there was no technology identified to treat the VOCs *in situ* in the presence of tritium. Since the ROD, DOE/LLNL, in conjunction with Stanford University, conducted experiments based on catalytic reductive dehalogenation (CRD) of dissolved VOCs by hydrogen in the presence of a palladium catalyst. After these experiments, LLNL designed a treatment system that was approved by the regulatory agencies in a Remedial Design Report for the Trailer 5475 area (Berg et al., 1998). The design had a treatment column placed down a well with screened intervals in two sand units within a single hydrostratigraphic unit. This downhole treatment method meets the conditions of the ROD, but only captures VOCs in a limited area adjacent to the well, is only effective for very low flow rates (about 1-2 gallons per minute [gpm]), and requires being shutdown overnight to allow the catalyst to regenerate. In addition, recent hydrogeologic analysis suggests that the geological characteristics (two sand bodies within the same hydrostratigraphic unit) needed to deploy a system similar to the original design are not present in all areas requiring VOC remediation in the Trailer 5475 area.

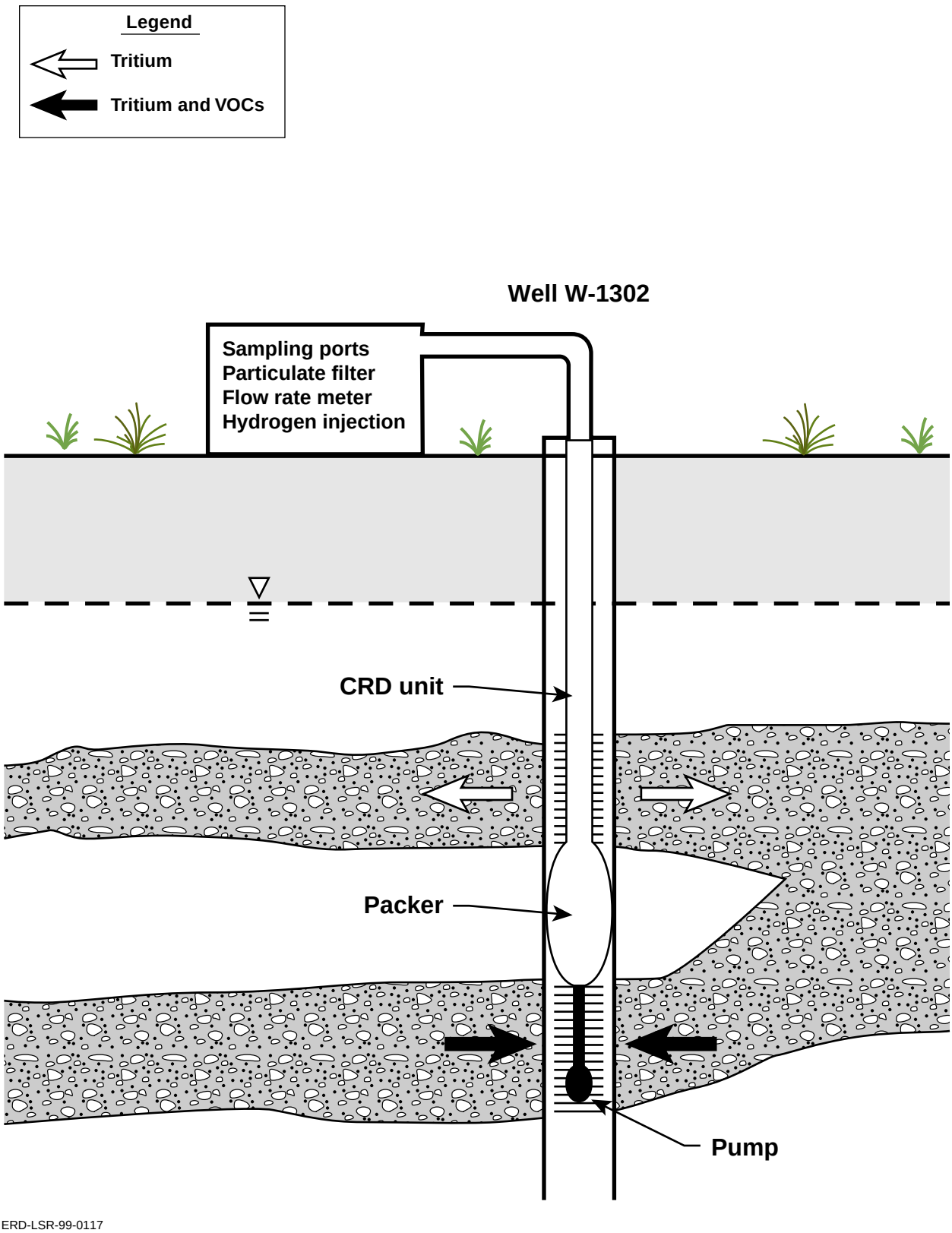

Figure 2. Current treatment method for VOCs in the Trailer 5475 area.

To make this treatment method more effective (e.g., increase flow rates, increase the area of influence, and operate 24 hours per day), DOE/LLNL propose to construct a closed loop system with a CRD treatment unit at the surface. The ground water containing both VOCs and tritium above MCLs will be pumped to the surface where over 90% of the VOCs will be destroyed by CRD, and then the remaining tritiated water will be reinjected back to the subsurface into the same hydrostratigraphic unit from which it was extracted. This change departs from the language in the ROD, yet still follows the primary intent to keep the tritium in the subsurface to decay naturally. The basis for this change is discussed in Section 3.2.

This ESD allows ground water containing tritium and VOCs to be brought to the surface to treat the VOCs. The proposed treatment method is initially planned for one location in the Trailer 5475 area that has ground water containing tritium above its MCL. Aboveground CRD units may also be installed in other areas where the ground water contains both tritium and VOCs.

3.2 Basis

Table 1 describes the significant differences between the current and proposed treatment method (Figs. 2 and 3). Reporting and analysis costs will remain the same from the current remedy to the proposed treatment method. Capital costs will be slightly less than the current treatment method.

Table 1. Significant differences between the current and proposed treatment methods.

Item	Current treatment method	Proposed treatment method
Equipment	**CRD unit down inside a well bore.**	**Safe shutdown equipped CRD unit above ground with piping to extraction and injection wells (closed-loop configuration).**
Hydrogeological area of influence	**Small; between two screened intervals within a single well.**	**Larger; separation between the wells creates a horizontal recirculation cell that remediates a larger area (Fig. 3).**
Ground water flow rate	**Due to space limitations inside a well, the treatment unit can only accommodate about 1-2 gpm.**	**The treatment unit can be sized to accommodate any given gpm. Approximate flow rate is anticipated to range from 3-10 gpm.**
Operating time	**12 hours/day.**	**24 hours/day because larger and multiple catalyst beds can be used.**
Use with other technologies	**None currently.**	**May be used in conjunction with electro-osmosis.**
Tritium remediation	**Tritium above or below its MCL remains in the subsurface to decay naturally.**	**Tritium above or below its MCL returned to the subsurface to decay naturally.**

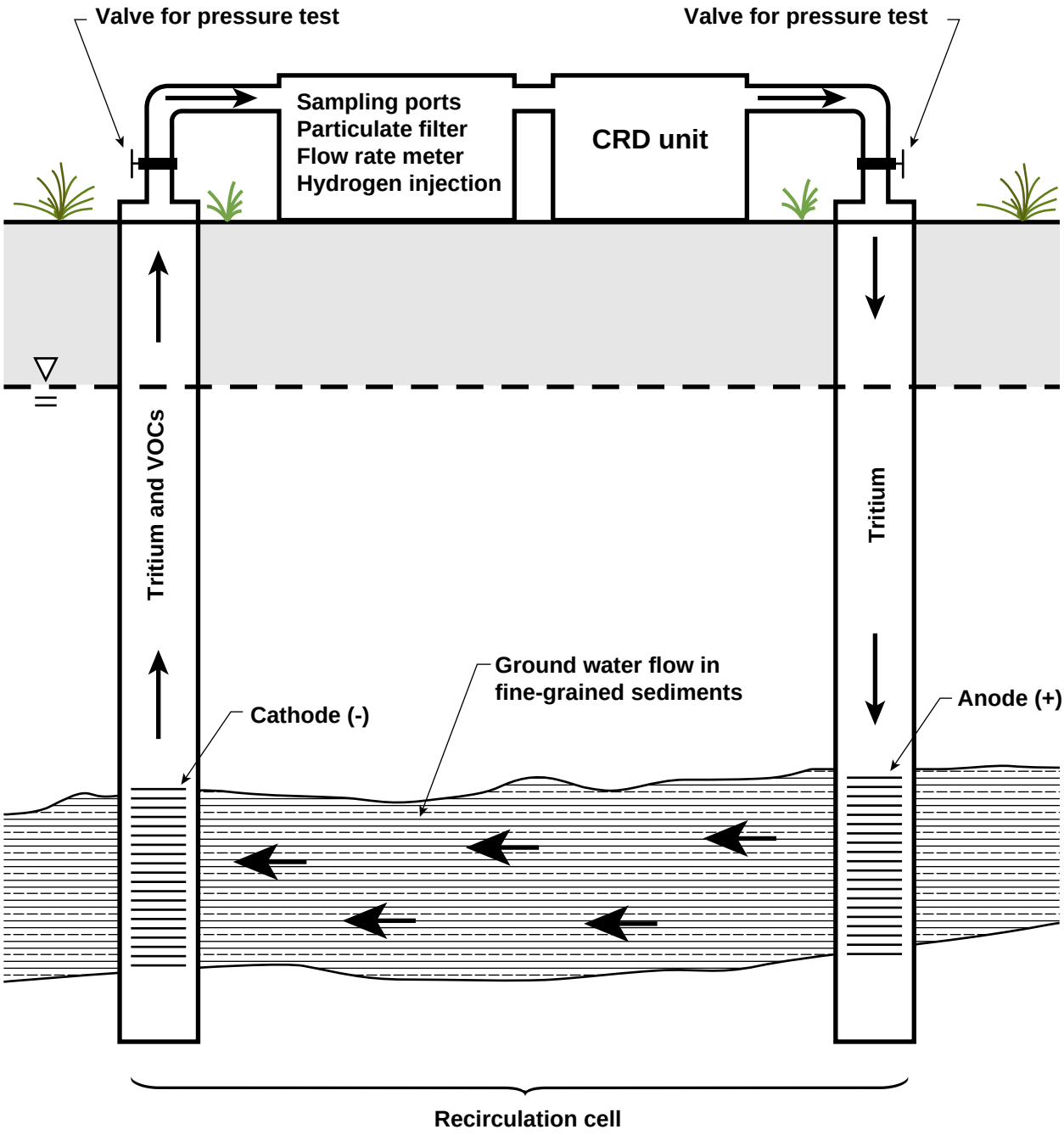

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Figure 3. Proposed treatment method for VOCs in the Trailer 5475 area (shown in conjunction with electro-osmosis).

The benefits of having the treatment unit at the surface include the capability to remediate ground water at higher flow rates, increase the area of influence, and allow for 24 hour per day operation, as discussed below:

- DOE/LLNL plan to use the CRD technology in conjunction with electro-osmosis (EO) (Fig. 3). The EO design will have electrodes in the wells to promote the movement of contaminated pore water in fine-grained sediments under the influence of an electric field. The contaminated pore water will move through the fine-grained sediments to the extraction wells, and will then be treated by CRD to destroy the VOCs. Removing VOCs from the fine-grained sediments is vital to achieving timely cleanup of the Trailer 5475 area. The electrodes in the wells will take up space normally occupied by the CRD unit. An aboveground CRD unit will simplify the design and installation, and can also be sized to simultaneously treat ground water from multiple extraction wells. DOE/LLNL plan to initially operate the system at about 3 gpm, and may eventually operate at about 10 gpm as additional extraction wells are connected.
- There will be a greater area of cleanup in the proposed remedy as the ground water is extracted from one well and injected into another, creating a horizontal recirculation cell (Fig. 3). The recirculation cell created from the current remedy is smaller and more localized because it is only generated between the two screened casing intervals within a single well (Fig. 2).
- Due to deactivation of the CRD catalyst, the current remedy requires the treatment unit to shut down overnight to regenerate the catalyst. The proposed treatment unit at the surface will have at least two CRD units so one can be operating while the other catalyst is regenerating.

These benefits will lead to a more expeditious cleanup of the VOCs in the ground water. In addition, an aboveground CRD unit greatly simplifies the design, fabrication, installation, and maintenance of the system as the unit will not have to be constructed to fit into a well, or removed from the well with a crane for maintenance. The change in maintenance procedures will reduce costs, and reduce worker exposure to the contaminated ground water because of the ability to allow the ground water to thoroughly drain before handling the unit.

Similar to the current treatment method, the proposed treatment method will not adversely affect the distribution of tritium. The extent of tritium in the subsurface is strongly controlled by the distribution of permeable sediments. As discussed in the Remedial Design Report (Berg et al., 1998), remediation in the Trailer 5475 area, and the adjacent Treatment Facility E area, will be optimized to decrease any potential effect on migration of the tritium plume.

To ensure that there is no leakage of the ground water above ground with the proposed treatment method, the system will be installed by a certified pressure system installer, the steel piping between the wells and the treatment unit will be pressure tested to 1.5 times the maximum pressure possible with the extraction pump, and the system will be inspected initially and every

three years by a certified pressure system inspector. The system will also be visually inspected each work day. The system will be equipped with an interlock control system. If a component malfunctions, the entire system, including the well pumps, will automatically shut down. The types of interlocks include controls for excess hydrogen, insufficient hydrogen, high and low ground water flow rate, high or low water levels in the wells, and high water pressure. Bollards will be placed around the system to protect it from accidental damage by vehicles or equipment. The levels of tritium in the treatment system influent are expected to be relatively low (less than twice the MCL). Therefore, incidental exposure of workers performing treatment system maintenance to ground water containing tritium should not pose a health or safety concern. Workers will follow safe working practices and wear appropriate personal protective equipment to minimize their exposure to tritium.

4. Regulatory Agency Comments

Regulatory agency comments were discussed in a teleconference on January 14, 2000 and subsequent editorial comments were submitted on February 2, 2000. All regulatory comments have been incorporated into this document.

5. Affirmation of the Statutory Determinations

Considering the new information and the changes that will be made to the proposed remedy, the EPA believes that the remedy remains protective of human health and the environment, complies with Federal and State requirements identified in the ROD as applicable or relevant or appropriate to this remedial action, and is cost effective. In addition, the revised remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practical for this site.

Daniel A Meer 2/23/00

Dan Meer
Director, Federal Facilities Cleanup Office
EPA Region IX

Date

Daniel N. Nakahara 2/10/00

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Director, Livermore Environmental Programs Division
DOE Oakland Operations Office

Date

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