UNLINED TOXIC AND RADIOACTIVE DUMPS, GROUNDWATER CONTAMINANT PLUMES, AND KEY ISSUES FOR THE SUPERFUND CLEANUP AT THE LAWRENCE LIVERMORE NATIONAL LAB SITE 300 "PIT 7 COMPLEX"

By
Peter Strauss, PM Strauss and Associates
and Marylia Kelley, Tri-Valley CAREs

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Introduction

One of the issues that motivated Tri-Valley CAREs to be actively involved in the "Risk-Based End State (RBES)"policy developed by the Department of Energy (DOE) was the releases of tritium from unlined dumps (called pits) at Site 300. The largest single area full of these pits at the Lawrence Livermore National Laboratory's (LLNL) Site 300 is known as the Pit 7 Complex. The Pit 7 Complex is one of the most controversial cleanup problems at Site 300, and goes directly to the issue of whether DOE will prevent a large plume from spreading beyond its current location.

The RBES Vision for Site 300 was to treat contaminated groundwater not at the source, but rather, when it reached the site boundary and ran into the nearby ranching, residential and recreational lands. This runs counter to state policy and current cleanup policy that measures and treats contaminants at their source. As a general environmental principle, particularly in water-starved California, preservation of potential drinking water sources is imperative. As a result of the existing plume, 5 water supply wells serving Site 300 were sealed and closed. Although models run by LLNL's hydrologists estimated that the main contaminated groundwater plume leaking from the Pit 7 Complex will not be above the maximum contaminant level when it reaches the site boundary, under the RBES vision, migration of the plume would have proceeded unabated (allowing for contamination of a much larger geographic area).

Tri-Valley CAREs (TVC) has been involved in the Pit 7 remediation process from the time it was first identified in the Superfund process in the early 1990s. the group has offered technical and community comments at each step in the process. TVC has made sure that its members were brought up to speed and could participate in the public meetings that were periodically held by LLNL/DOE. Below, we have provided a brief description of these pits and the risk that they pose, and the current status of the pits. These are followed by a series of Attachments, which give a good chronology of TVC's and regulators' comments and concerns over the course of the past several years.

In addition, we want to add that the final version of the RBES Vision for the Livermore Lab's main site and its Site 300, which recommends that RBES approach be rejected by DOE, has not been officially submitted. *(For more information, see TVC's report, "A Major Win for Cleanup at Livermore Lab, October 2005.)*

Instead of a formal decision being made, we understand from interviews with LLNL and the Livermore Site Office DOE staff that DOE headquarters in Washington, DC, knowing the recommendation, does not want to have the final document submitted; instead, they would let the

RBES approach at Livermore "die on the vine." Therefore, however, Tri-Valley CAREs will continue to monitor RBES, with respect to remediation of the Pit 7 Complex as well as the other heavily contaminated areas needing Superfund cleanup at the LLNL main site and Site 300.

Pit 7 Background

Site 300 near Tracy, like the main site in Livermore, is a Superfund cleanup site, meaning that it is one of the most contaminated locations in our nation. Site 300 encompasses approximately 11 square miles of hilly land between the cities of Livermore and Tracy. The Site is surrounded by open space used mainly for recreation and ranching. Since 1955, Site 300 has been used for the processing and testing of high explosives and other materials for nuclear weapons.

In 1990 Site 300 was placed on the National Priorities List (Superfund List), and DOE has since started the Superfund cleanup investigation. An Interim Remedial Action Plan for Site 300 has been approved by the regulators in 2001.

Activities at Site 300 include fabricating high explosive compounds and weapons components, testing of explosives and mock nuclear bomb cores, and decontaminating high explosive equipment. During many of the tests, radioactive hydrogen, called tritium, depleted uranium and other pollutants were released to the surrounding environment. Tritium is used in thermonuclear devices.

Solid wastes from these tests were periodically scooped up and placed in unlined landfills located on-site, known as the Pit 7 Complex. The Pit 7 Complex encompasses over 3,200 acres. Tritium and other contaminants were released from the Pits in the early 1980's due to a rise in the water table that saturated the fill and mobilized the contamination. Tritium readily mixes with water.

The tritium plume in groundwater currently stretches almost two miles but has not reached the site boundaries. The groundwater is area has been re-contaminated during rainy years. Other slower moving contaminants include natural and depleted uranium, and some VOCs (Volatile Organic Compounds).

Contamination has found its way into two springs and ten areas of subsurface soil. Recent studies indicate the entire Pit 7 Complex has surface soil contamination. The main pits contributing to contamination were closed and covered with native soil. Surface water diversions were also installed. However, these diversions did not prevent the recurrence of saturation of the Pits.

It was reported that 22,670 curies of tritium were used at Site 300. Maximum concentrations of tritium at Pit 7 were measured at around 2 million pCi/L of groundwater in 1984; this is 100 times the state and federal maximum contaminant levels. For reference, the Safe Drinking Water Act Maximum Contaminant Level is 20,000 pCi/L.

In December 1996, LLNL reported that a groundwater sample south of Pit 5 contained 1.3 million pCi/L to 1.4 million pCi/L of tritium, a five-fold increase from previous samples in that particular area. The suspected cause was the same phenomena that mobilized the tritium in the early 1980's.

The Pit 7 Complex has been one of the areas that Tri-Valley CAREs has focused on because of large tritium releases to the groundwater. Tritium, if ingested, it will behave like water in the body, essentially permeating every cell. The health risks should not be underestimated, and there is currently a movement to lower the allowable dose from tritiated water.

Because of the controversy surrounding the large tritium plume, and complications in fully characterizing the site, the source of the large tritium plume was excluded from the DOE/LLNL Interim Remedial Action Plan for the Pit 7 Complex. Yet for all the controversy about the Pit 7 Complex, after years of study and debate, nothing has been done to either stop the leaks or to halt

the migration of the contaminated groundwater plume. In April 2006, DOE will finally hold a public hearing and present the public with its Draft Proposed Plan for the Pit 7 Complex.

TVC has consistently advocated controlling the leading edge of the plume through a number of measures: installing surface and subsurface drains around the pits to ensure that groundwater table rises do not disturb what remains of the tritium in the pits; excavating hotspots, if identified; better characterizing the hydrology of the area, specifically addressing the pits, and finally, ensuring that there are adequate hydraulic controls at the "distal" (i.e. leading edge) of the plume.

The Superfund process and remedy selection can be cumbersome and drawn out over many years. This is, unfortunately, the case with the remedy selection for the pits. Basically, the proposed remedy will attempt to keep water from saturating the pits by installing a series of surface water diversions "upstream" from the pits. This may have the effect of hydraulically controlling the tritium plume (as there is less pressure or "head", the rate of groundwater movement slows), thus allowing the tritium time to decay. However, downstream hydraulic control that ensures that the contaminated plume does not migrate and contaminate pristine waters is not presently in the plan.

However, TVC did get one concession from DOE: to include in the Remedial Action Objectives a statement that a goal would be to prevent further migration of the plume. In addition, due to EPA's insistence, DOE is going to treat some parts of the plume that has been contaminated with uranium. This will entail a small pump and treat system, whereby the uranium and tritium contaminated water will be treated and re-injected upstream. Because tritium cannot be treated, it will merely be re-injected – taking pressure off of the leading edge of the plume.

Major issues at the Pit 7 Complex include:

- Will the tritium plume be allowed to expand? Will the steps taken to control the plume expansion be timely and successful?
- What contingencies are there if the tritium plume begins to expand? Currently, there are no plans that would hydraulically control the downstream spread of the plume, if upstream control does not work.
- Will the measures taken to treat the depleted and natural uranium work sufficiently?
- An escalation of nuclear weapons work at LLNL is proposed. Site 300 is expected to be used for more testing. How will the expanded weapons work at Site 300 impact the environment, employee health, and Tracy drinking and irrigation water? Does the increase in allowable tritium open air releases at Site 300 (as authorized in the new Site Wide Environmental Impact Statement) suggest that we may replicate the experience at the Pit 7 complex?
- This year's budget request by DOE states that "Programmatic requirements for test capabilities at Site 300 are being reevaluated to determine the feasibility of initializing closeout in FY 2011." This it supports TVC's continued recommendation that Site 300 be cleaned up to residential standards. Residential development is beginning to take place near the site boundary. We recommend that Site 300 future land use assumptions include mixed residential, recreational, ecological preserve and industrial land uses. Yet as it now stands, DOE assumes that Site 300 will remain under its stewardship in perpetuity, and clean-up assumes only industrial workers. Without full cleanup to standards appropriate for residential use, the residual contamination may restrict the future use of the property.

History of Tri-Valley CAREs Involvement

As soon as Site 300 was listed as a Superfund Site, the large tritium plume was a source of concern for TVC. Originally, based on our discussions with Lab personnel, the plume was going to be allowed to naturally decay without any attempt at slowing it down. Through quarterly

discussions with the regulatory agencies, the DOE and LLNL staff, we have been kept apprised of progress and problems.

After spending considerable effort to develop a Feasibility Study for the Pits, in May 1997, LLNL floated a Draft Engineering Evaluation/Cost Analysis (EE/CA) for the Pit 7 Complex and Building 850 (also a major source of tritium contamination.). The EE/CA was used to justify a non-time critical removal action. This was a short-cut of the normal process and TVC objected to its use for such a critical cleanup remedy.

Our arguments found receptive ears with the regulators. During the preparation of the EE/CA, and after discussions with TVC, LLNL first proposed a subsurface groundwater interceptor and barrier system. LLNL could not, however, assure that it would meet a crucial remedial action objective, which prevented further releases from the pits. The death knell of the EE/CA was that upon evaluating the proposed remedy, there was not enough characterization information.

In fact, due to prolonging this process, hydrogeologists took another look and "discovered" a water bearing lens not previously identified, which carried some groundwater in a different direction than previously thought. This new discovery, together with pressure from the regulators and TVC, brought the EE/CA to a close.

The next step in the process was that LLNL combined all the varying operable units (OUs), into a Site Wide remedy. TVC was a strong advocate of this step, although it wanted something done about the potential for additional tritium releases in the Pits. By 1999, the Draft Site Wide Feasibility was published. Our comments on the first draft included some of the "community acceptance criteria" that we were developing for the Site 300 Community Guide:

> Cleanup levels should be set to the strictest state and federal government levels. We believe that the strictest cleanup levels should be met in cleaning up the site. Federal and state Maximum Contaminant Levels (MCLs) for all groundwater (on-site and off-site) should be the "bottom line below which the cleanup will not fall." In many cases the technology exists (and/or can be developed) that will clean up contamination to "background" levels -- that is to the level that existed at the site before Livermore Lab took over in 1955 and began polluting it. In such cases where "background" cleanup levels that are more protective of human health and the environment can be achieved, they should be achieved. In this regard, Tri-Valley CAREs concurs with a strict interpretation of the California Regional Water Quality Control Board's non-degradation policy for groundwater. It believes that the strictest cleanup levels should be met. MCLs for all groundwater should be the objective, and as soon as possible, migration of contaminants into pristine waters should be halted. At a minimum, the standard of 1 in 1 million excess cancer deaths should be adhered to, as well as meeting a hazard index of less than 1 (non-cancer health effects).
>
> The tritium source and plume should be controlled at the earliest possible time in order to prevent further releases to the environment. The tritium plume, nearly two miles long and growing, cannot be cleaned up in the traditional sense of the word, since it is not feasible to separate the radioactive hydrogen (tritium) component from the water. Therefore, Tri-Valley CAREs recommends the following: a) isolation of the tritium contaminated wastes in the unlined dumps to prevent further and continuing contamination of the groundwater; b) hydraulic control of the plume to prevent further migration; c) aggressive monitoring to ensure no migration while the tritium decays (at a rate of 5.5% per year); and, d) a stringent contingency plan in case these methods fail. As it currently stands, groundwater rises into the waste dumps during heavy rainfall and picks up additional tritium contamination. Isolation of the wastes may be accomplished by means of drains, capturing groundwater upstream from the pits before it is inundated, or removing the

tritium-contaminated debris from the pits and store it above ground in a monitored storage facility.

In many Superfund cleanups, a principal is established that does not permit drawing contaminated groundwater through less contaminated soil or groundwater. This is for obvious reasons: that the remedy should not to enlarge the contaminated area. We recommend that this principal be adopted at Site 300.

Our comments on the second draft (October 1999) were more to the point (see **Attachment 1**).

> "We strongly support EPA's position that monitored natural attenuation (MNA) is not appropriate to consider for Pits 3 and 5 until there is a stable or shrinking plume controlled at the source. Furthermore we do not believe it is appropriate under California regulations to measure the exposure from a hypothetical point at the boundary of the site. In addition, in DOE's response, it notes that preliminary modeling suggests that the contaminant activities will be lower than previously presented to the regulatory agencies. In our view, decisions on the remedy should not rely upon the models. Modeling at the site has relied on assumptions that appear to have been dispelled in the last three recent heavy rain years. There is more tritium locked up in the vadose zone then had been predicted, a greater mass of tritium in the groundwater and Pits, and more ways to move it from the source. Consequently, we do not have very much confidence in the model's conclusion that the contaminants will be below MCLs by the time the plume reaches the site boundary. The better way to deal with this problem is to contain it, and remove the source (areas with high concentrations in the vadose zone and the pits) when practical. MNA should only be considered after the source is controlled or removed."

We also added that hydraulic control of the plume is essential to any solution.

By May of 2000, LLNL prepared its first draft of the Site Wide Proposed Plan. Pertinent comments are in **Attachment 2**. We realized that at this point, due to the controversy surrounding the Pit 7 Complex, it had been removed from the Proposed Plan. We later learned that because of the new characterization data, and requests for further attention to alternatives, that LLNL decided that it would start over again and prepare a separate Feasibility Study for Pit 7. We stated that "for at least two years in conversation at various for with DOE, LLNL staff and regulators, TVC has recommended that something be done to prevent the continued release of tritium from Pits 3 and 5 to the groundwater. With the rainy season just ending, no action was taken to mitigate this problem. While these Pits have been separated from the Proposed Plan to conduct further study, TVC requests that an interim action be done to protect the groundwater and soil near these pits."

Furthermore, we addressed just the issue that the RBES Vision, if implemented, would have engendered:

> "Tri-Valley CAREs strongly believes that that hydraulic control must be part of the remedy. TVC does not believe that the remedy is adequate unless the tritium plume is contained and brought under hydraulic control. As DOE has shifted to the concept of remedy modules that can be used in conjunction with one another, hydraulic control would seem to play a valuable role. This could involve a range of actions including controlling infiltration, controlling the groundwater gradient, removal of the source, and using injection wells to reverse the gradient. Leaving large amounts of tritium to migrate in the groundwater is unacceptable.
>
> Monitored natural attenuation (MNA) is not appropriate to consider for Pits 3 and 5 until there is a stable or shrinking plume controlled at the source. Furthermore we do not believe it is appropriate under California regulations to measure the exposure from a

> hypothetical point at the boundary of the site. In our view, decisions on the remedy should not rely upon the models. Modeling at the site has relied on assumptions that appear to have been dispelled in the last three recent heavy rain years. There is more tritium locked up in the vadose zone then had been predicted, a greater mass of tritium in the groundwater and Pits, and more ways to move it from the source. Consequently, we do not have very much confidence in the model's conclusion that the contaminants will be below MCLs by the time the plume reaches the site boundary. The better way to deal with this problem is to contain it, and remove the source (areas with high concentrations in the vadose zone and the pits) when practical."

Comments on the Draft Feasibility Study for the Pits were completed in May 2004, and a public meeting was held. **Attachment 3** provided information on the pits for TVC members. **Attachment 4** provides our comments. Again, the comments stressed our major concerns about the lack of hydraulic control on the leading edge of the plume.

In August 2004, LLNL completed a Draft -final FS. TVC and the regulators were unhappy with the product, and in January 2005, LLNL produced a second draft-final. TVC's comments are in **Attachment 5**. Here we gave some room for LLNL/DOE to adopt an "adaptive approach" to controlling the plume, recognizing that the subsurface drains may slow the movement of the plume considerably. We stated the following:

> Tri-Valley CAREs strongly believes that hydraulic control must be part of the remedy. Leaving large amounts of tritium to migrate in the groundwater is unacceptable, and violates the letter and spirit of State Water Resources Control Board Resolutions 92-49 and 68-16, both of which indicate that potential drinking water sources should not be contaminated.
>
> Notwithstanding the above statement, Tri-Valley CAREs appreciates the additional analysis that was added to the draft indicating that complete capture of the plume and subsequent re-injection would run the risk of further spreading the plume. However, we think that the goal of hydraulic control does not have to be complete stabilization of the plume, as was the goal of the model. We think that the goal of hydraulic control should be to slow the migration of the tritium plume that would allow more time for the tritium to decay. In other words, <u>it does not have to be all or nothing</u>.
>
> As such, we recommend that the Section on Hydraulic Control be folded into Section 3.2.2.2 (Groundwater Extraction and Ex-Situ Treatment). This remedy proposes establishing an injection well gallery, whereby extracted water containing nitrate, perchlorate, depleted uranium and tritium would be treated and re-injected. (There would be no treatment for the tritium). This could be expanded with a few additional extraction wells that would serve the purpose of slowing down the plume. In or opinion, this would provide LLNL with an adaptable strategy that could be optimized at any of a number of points, as the remedy is staged and data indicates. Optimization could take place in the upstream hydraulic diversion, extraction of source material, ex-situ treatment and re-injection, and partial hydraulic control.

We have discussed this philosophy with the DOE, but it's still uncertain if the final plan for the Pit 7 complex will embody this spirit. A public hearing on the proposed plan is scheduled for April 2006, and TVC is organizing around this event.

Attachment 1: Pertinent Comments on Draft-final Site Wide Feasibility Study (October 1999)

Comments on DOE's Response to Comments on the Draft SWFS

1. DOE's response to CVRWQCB's comment 11 raises several concerns. First, CVRWQCB never suggested in its comment that DOE extract and re-inject contaminated water. Based on previous discussions, TVC recommended extracting clean groundwater upstream of the tritium plume(s). Second, DOE states that it is "abhorrent" to re-inject contaminated water in a pristine area. We agree wholeheartedly with this sentiment. However, allowing the vadose zone to contaminate the groundwater or the plume to be diluted through advection and migrate to pristine waters is sanctioning the same abhorrent effect. This is precisely why we think why State Water Resource Control Board Resolution (SWRCB) 68-16 (i.e., the non-degradation policy) applies to this site.

2. Referring to DOE response to EPA comment 59, we agree with EPA's comment that comparison of alternatives at OU5 (Pits 3&5, B-850) is perhaps the most important area at Site 300 and full comparison of alternatives is very important. As EPA suggests, confining the discussion to boilerplate about groundwater extraction is not very useful.

3. Referring to DOE response to EPA comment 62, we strongly support EPA's position that monitored natural attenuation (MNA) is not appropriate to consider for Pits 3 and 5 until there is a stable or shrinking plume controlled at the source. Furthermore we do not believe it is appropriate under California regulations to measure the exposure from a hypothetical point at the boundary of the site. In addition, in DOE's response, it notes that preliminary modeling suggests that the contaminant activities will be lower than previously presented to the regulatory agencies. In our view, decisions on the remedy should not rely upon the models. Modeling at the site has relied on assumptions that appear to have been dispelled in the last three recent heavy rain years. There is more tritium locked up in the vadose zone then had been predicted, a greater mass of tritium in the groundwater and Pits, and more ways to move it from the source. Consequently, we do not have very much confidence in the model's conclusion that the contaminants will be below MCLs by the time the plume reaches the site boundary. The better way to deal with this problem is to contain it, and remove the source (areas with high concentrations in the vadose zone and the pits) when practical. MNA should only be considered after the source is controlled or removed.

4. Referring to DOE response to Tri-Valley CAREs' comment 24, we do not agree with DOE that newer samples are not called for (i.e., Referring to Table 1-27, spring samples are from 1994. Please indicate more recent data, especially the last two El Nino rain seasons). There have been significant changes in the hydrological regime since 1994. Furthermore, in your response you state that bioassays will be conducted every five years. Since the last bioassay was taken during the summer of 1994, new data should be available.

5. Referring to DOE response to Tri-Valley CAREs' comment 28, we disagree that industrial standards should be used for Site 300. As we suggested in our comment, we recognize that residential standards may not be feasible in a few small places, but on the whole, residential standards should be used. In the future, this would allow DOE to more easily dispose of the property and limit its liability. Also, because the Bay Area is growing so rapidly, and residential growth is beginning to occur in Tracy and near Site 300, it would be unfortunate if the cleanup levels decides in 1999 dictate how this 11 square mile site will be used in the future.

6. Referring to DOE response to Tri-Valley CAREs' comment 44, we strongly disagree that hydraulic control should be screened out as a potential remedy. As DOE has shifted to the concept of remedy modules that can be used in conjunction with one another, hydraulic control would seem to play a valuable role. At Pits 3 and 5, we do not suggest bringing contaminated water to the surface: instead we recommend extracting uncontaminated water upgradient to relieve some of the pressure on the plume.

SPECIFIC COMMENTS ON DRAFT-FINAL SITE WIDE FEASIBILITY STUDY

1. Without source control at Pits 3 and 5, monitored natural attenuation (MNA) should not be considered, as removal or control of the source is a prerequisite for MNA.

2. TVC strongly objects that discussion and detailed evaluation of onsite consolidation and disposal of excavated materials from Pits 3 and 5 has been removed from consideration. It appeared to us that this option, at least for hot spots, was one logical way to remove the source. Using Corrective Action Management Unit (CAMU) allowed by Article 15. 5 of the State's regulations for excavated materials, or placing excavated materials in above ground monitored storage should be analyzed and evaluated. A new landfill at the site could be designed to minimize water infiltration and movement. The reasons for removal from consideration provided in the letter listing major changes to the draft-final document appear to stretch credibility, and are all administrative barriers. First, the NEPA review should not require 2 years, and if it did, this is not a reason to give up on a remedial option. Further, while landfill-permitting requirements are complex, they can be met. CERCLA allows for consolidation and landfilling of extracted waste at Superfund sites. Third, it is our understanding that the current EIS/EIR for LLNL may have to be rewritten.

3. Referring to page 2-2, TVC strongly reiterates that State Water Resource Control Board (SWRCB) Resolution 68-16 (i.e., the non-degradation policy) applies to groundwater at this site, not merely to discharges of treated water. This resolution applies to discharges: either underground or above ground discharges as is commonly understood by the general term discharge. While EPA notes that Resolution 92-49, paragraph III.G may be the more stringent of ARARs for setting in-situ cleanup standards, other Sections of 92-49 are also relevant, including paragraph III. F. Specifically, this paragraph cites that cleanup and abatement activities (emphasis added) shall conform to the provisions of Resolution 68-16. In addition, in response to a comment, DOE states that it is "abhorrent" to re-inject contaminated water in a pristine area. We agree wholeheartedly with this sentiment. However, allowing the vadose zone to contaminate the groundwater or the plume to be diluted through advection and migrate to pristine waters is sanctioning the same abhorrent effect. This is precisely why we think SWRCB Resolution 68-16 applies to this site.

4. Referring to p. 2-5, as Section 2.5, please refer to comment 8 in Comments on DOE's Response to Comments on the Draft SWFS. Please delete the words "for the purpose of developing this Remedial Action Objectives for this SWFS and the interim ROD, it is assumed that".

Attachment 2: Pertinent Comments on the Draft Site-Wide Remedial Plan (May 2000)

General Comments

5. One of the major points that TVC is recommending is that a possible mission change or change in ownership of the site should be considered in remedy selection. If in the future DOE wants to dispose of the property, the remedy that is chosen today should not limit tomorrow's land-use decisions. DOE maintains that it will control then site indefinitely. Cleanup should support multiple uses for the property. Because the Bay Area is growing so rapidly, and residential growth is beginning to occur in Tracy and near Site 300, it would be unfortunate if the cleanup levels decided in 2000 dictate how this 11 square mile site will be used in the future. A possible mission change or change in ownership of the site should be considered in remedy selection. If in the future DOE wants to dispose of the property, the remedy that is chosen today should not limit tomorrow's land-use decisions. Just recently, DOE did make a step in turning over a small portion of the site to the U.S. Fish and Wildlife Service, for the purpose of protecting a rare and endangered plant. We recommend that the remedy by compatible with this use.

6. For at least two years in conversation at various for with DOE, LLNL staff and regulators, TVC has recommended that something be done to prevent the continued release of tritium from Pits 3 and 5 to the groundwater. With the rainy season just ending, no action was taken to mitigate this problem. While these Pits have been separated from the Proposed Plan to conduct further study, TVC requests that an interim action be done to protect the groundwater and soil near these pits.

14. We think that monitored natural attenuation (MNA) is not appropriate to consider for Pits 3 and 5 until there is a stable or shrinking plume controlled at the source. There is more tritium locked up in the vadose zone then had been predicted, a greater mass of tritium in the groundwater and Pits, and more ways to move it from the source The better way to deal with this problem is to contain it, and remove the source (areas with high concentrations in the vadose zone and the pits) when practical. MNA should only be considered after the source is controlled or removed.

15. Referring to Section 6.5.7, Tri-Valley CAREs strongly believes that that hydraulic control must be part of the remedy. TVC does not believe that the remedy is adequate unless the tritium plume is contained and brought under hydraulic control. As DOE has shifted to the concept of remedy modules that can be used in conjunction with one another, hydraulic control would seem to play a valuable role. This could involve a range of actions including controlling infiltration, controlling the groundwater gradient, removal of the source, and using injection wells to reverse the gradient. Leaving large amounts of tritium to migrate in the groundwater is unacceptable.

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greater mass of tritium in the groundwater and Pits, and more ways to move it from the source. Consequently, we do not have very much confidence in the model's conclusion that the contaminants will be below MCLs by the time the plume reaches the site boundary. The better way to deal with this problem is to contain it, and remove the source (areas with high concentrations in the vadose zone and the pits) when practical.

Attachment 3: Some Facts About Pit 7 (for TVC members)

Pit 7 complex was used to dispose of firing table debris from 1958-78. The "pits" were constructed by excavating material to between 15 and 25 feet deep.

"Tritium was used primarily at Site 300 from '63 to 78. Approx. 21,000 curies used. (1,400 Ci per year for these years). From 1978 –'88 only used 13 Ci. Estimated that 99% of tritium debris was used at the B-850 and 851 firing tables, and the majority was disposed of in Pit 7 complex. Metals, including DU were also used and disposed of in these pits.

Pit 3 operated from 1958-67 (volume estimate is 26,000 cubic yds. Pit 4 opened in '68 and closed in 74. Volume was 2,800 cu. Yds. Pit 5 operated from '68 – 79. Volume approx. 30,000 cu. Yds. Pit 7 operated from '78 - 88. Volume approx. 31,000 cu. Yds. Pit 7 received some other material (i.e., not from firing tables 850 and 851) from Builds 801, 802, 812, and 845. Pits were covered with 3 ft. of compacted native soil. In '92, LLNL placed a RCRA compliant cap on Pits 7 and 4 (interceptor trenches, vegetative layer, biotic barrier, and a clay layer. This cover overlaps Pit 3 by approx. 25%. Pits 3 & 5 are where most of the tritium was deposited. Pit 7 is a source of DU.

The hydrology is complicated. During heavy rainfalls, which released most of the tritium in the first place, the groundwater moves in two directions: shallower groundwater in the upper HSU moves to the southeast, and deeper groundwater in the underlying bedrock (lower HSU) moves east-northeast. This latter flow was detected in the past several years. It was estimated through modeling that during heavy rainfall events (El Niño type) 60% of the water infiltrates into the upper HSU and the lower HSU. The remaining 40% flows south.

Contamination-Soil

Most soil samples (277 of 397) contained excess tritium. 10% of the samples contained soil moisture tritium in excess of 10^6 pCi/$L_{sm.}$ The highest reading was approx. 8 x 10^6 pCi/L_{sm} at a depth of 11 ft. That was collected in 1984. 508 samples taken from lysimeters (devices that measure water percolating from soil), obtained similar results, that is 10% over 10^6pCi/L. Samples taken within the pits (3&5) were in the 10^6 range for Pit 3 and 10^5 for Pit 5. It's estimated that 11.7 Ci remain at Pit 3: 2.4 Ci in the Pit and 9.3 Ci beneath the pit.

Pit 3 had max. of 1,180 pCi/g of DU. Pit 5 has max. of 209 pCi/g

Contamination- GW

2^{nd} quarter 2003 max. Concentrations of tritium were 469,000 pCi/L, down from 2,660,000 pCi/L. All downgradient (southeast of Pit 3) tritium sources still exist in the Pits and below the Pits. Tritium is well below its max., but with every El Niño it will continue to move out of the pits and vadose zone. A good example is that in the lower HSU, a single well measured 412 pCi/L in 1997. In October '99 it rose to 770,000pCi/l, 1.5 years after an al Niño event. Now it's 439,000 pCi/L.

The Max uranium in groundwater was 781 pCi/L, collected following the 1998 El Niño. It is now 123 pCi/L. (MCL is 20 pCi/L).A well west o0f Pit 3, near Pit 7 contained 93 pCi/l after the 1998 el Niño.

Tracy is 8 miles from the site. Tracy has doubled in population in the last 11 years, and is expected to keep growing. The Tracy Hills project has a projected population of 28,000, and is planned to begin development in 2006.

EIS states that 194 Ci will be used in future (no action).

Attachment 4: May 2004 Comments on Draft Pit 7 RI/FS

May 2, 2004

Claire Holtzapple
U.S. Department of Energy
Livermore Environmental Programs Division
Lawrence Livermore National Laboratory
P.O. Box 808, L-574
Livermore, California 94551

Subject: Comments on the Draft Remedial Investigation /Feasibility

Dear Claire:

Enclosed are my comments on the Draft Remedial Investigation /Feasibility, on behalf of Tri-Valley CAREs, that address LLNL's Study for the Pit 7 Complex. I serve as Technical Advisor to the Tri-Valley CAREs (TVC), recipient of a Technical Assistance Grant from the U.S. EPA, and these comments are submitted in coordination with TVC.

These comments are divided into three sections:

1) General comments;
2) Specific comments.

Yours very truly,

Peter M. Strauss

GENERAL COMMENTS

1) Tri-Valley CAREs strongly believes that that hydraulic control must be part of the remedy. TVC does not believe that the remedy is adequate unless the tritium plume is contained and brought under hydraulic control. Leaving large

amounts of tritium to migrate in the groundwater is unacceptable. Hence, Tri-Valley CAREs feels strongly that hydraulic control should be retained as a remedial alternative. Because the alternative is discussed but not retained, we believe that the analysis is cursory. Many other sites use a re-circulation process for bio and natural degradation of contaminants, and we believe that this site should undergo a full investigation of this remedy. The description of the rejected remedy also reads (p. 52) that "**if"** modeling indicates the re-injection of limited volumes of water could potentially result in further releases and or the spread of the tritium plume, that this strategy "**may not be viable**." As we read this, it does not seem that the modeling has occurred, and therefore, under any circumstances, it would be premature to exclude this strategy.

Also, we note that LLNL has retained some ex-situ technologies to remove uranium and/or perchlorate. These will not remove tritium, and tritium would have to be re-injected. Yet, the RI/FS excludes hydraulic capture of the plume (leading edge) on just these grounds. This is incongruous to us.

2) We think that monitored natural attenuation (MNA) is not appropriate to consider for Pits 3 and 5 until there is a stable or shrinking plume controlled at the source. There is more tritium locked up in the vadose zone then previously had been predicted, and more ways to move it from the source The better way to deal with this problem is to contain it, and remove the source (areas with high concentrations in the vadose zone and the pits) when practical. MNA should only be considered after the source is controlled or removed.

Furthermore we do not believe it is appropriate under California regulations to measure the exposure from a hypothetical point at the boundary of the site. In our view, decisions on the remedy should not rely upon the models. Modeling at the site has relied on assumptions that appear to have been dispelled in the last three recent heavy rain years. There has been more tritium locked up in the vadose zone then had been predicted, a greater mass of tritium in the groundwater and Pits, and more ways to move it from the source. Consequently, we do not have very much confidence in the model's conclusion that the contaminants will be below MCLs by the time the plume reaches the site boundary.

3) MNA requires that the remedy be done in a "reasonable amount of time". We do not believe that either example given (tritium in 45 years, uranium in 500 years is reasonable. Please clarify how a reasonable timeframe was determined (if addressed at all).

4) We find that MNA for uranium, supposedly stable in areal extent, has little to do with degradation, and is therefore unacceptable to us. There are too many unknown environmental factors (change in water chemistry, earthquakes) in this area to believe that the areal extent of the plume will remain stable. Given that uranium is relatively insoluble to start with, and we do not fully understand how it became soluble to such an extent, there is too much uncertainty to state that it is stable and will go away in 500 years.

5) All U-238 contamination should be addressed in the contingency plan concerning changes in land use. There should be no action taken that would be irreversible, if the uranium needs to removed at a later time.

6) Tri-Valley CAREs' disagrees that industrial standards should be used for Site 300. We recognize that residential standards may not be feasible in a few

small places, but on the whole, residential standards should be used. In the future, this would allow DOE to more easily dispose of the property and limit its liability. Also, because the Bay Area is growing so rapidly, and residential growth is beginning to occur in Tracy and near Site 300, it would be unfortunate if the cleanup performed in 2005 -2006 dictate how this 11 square mile site will be used in the future.

7) In many Superfund cleanups, a principal is established that does not permit drawing contaminated groundwater through less contaminated soil or groundwater. This is for obvious reasons: that the remedy should not enlarge the contaminated area. We recommend that this principal be adopted at Site 300.

8) TVC strongly reiterates that State Water Resource Control Board Resolution (SWRCB) 68-16 (i.e., the non-degradation policy) applies to groundwater at this site, not merely to discharges of treated water. This resolution applies to discharges: either underground or above ground discharges as is commonly understood by the general term discharge. While EPA notes that Resolution 92-49, paragraph III.G may be the more stringent of ARARs for setting in-situ cleanup standards, other Sections of 92-49 are also relevant, including paragraph III. F. Specifically, this paragraph cites that cleanup and abatement activities (emphasis added) shall conform to the provisions of Resolution 68-16.

9) Given that there are ecological receptors of special status and several rare and endangered species at Site 300 that may be affected by remedial action, we find it improper to proceed with a decision before the effects are fully known. Of particular concern are the red-legged frog and the tiger salamander. We recommend that both the United States Fish and Wildlife Service and the California Department of Fish and Game it be provided the opportunity to comment on this document before a decision is final.

SPECIFIC COMMENTS

1) Page 3 states that the pits were constructed by excavating topsoil and alluvium to an average of 12 feet. On p. 15, it states that the depth of the pits ranges from 15 feet to 25 feet below ground surface. Please explain, or correct this discrepancy.

2) As is indicated on p. 40, the location of the two horizontal wells that were installed "may not have been optimum for effective testing." Yet this method is not pursued further. We think that the option of using horizontal wells should be retained and tested using the most effective locations.

3) It is not clear from the text how groundwater behaves when it reaches the Elk Ravine Fault. Please identify where this is addressed, and whether it requires any special action. Also, does this fault limit any of the remedial alternatives?

4) On p. 47, line 33, replace the words "are expected to be" with "will be".

5) Please explain why Section 3.2.2.3 Monitoring is appropriate as a remedial action, as monitoring for this site will be part of the Compliance Monitoring Plan/Contingency Plan. Please identify any extra monitoring that would take place at this site that would not be addressed in the latter document, or the monitored natural attenuation remedy.

6) TVC believes strongly that if MNA is selected, most of the contaminant must be reduced through degradation. On p. 49 it states that attenuation processes for tritium include "decay, volatilization, dilution, and dispersion". Please set forth the approximate amounts of these latter factors take place in the prediction that "tritium activities would decrease to the drinking water standard of 20,000 pCi/L after a maximum of 45 years" (p. 50).

7) Figure 2-17 shows the extent of the tritium plume. However, the monitoring wells that indicate the 20,000 pCi/L contour are very sparse, especially at the leading edge. The figure showing the Qal plume does not show the contours correctly. For example, well NC7-21 indicates 131,000 pCi/L. The next well, approximately 200 feet downgradient (K7-07) indicates 2,740 pCi/L. The next well, approximately 300 feet downgradient is NC7-20. It indicates a level above 20.000 pCi/L. Wells further downgradient also indicate levels higher than K7-07. Please provide an explanation of how this would occur and correct the Figure in question. In addition, we recommend that additional wells be installed to adequately contour the plume. The figure showing the $Tnbs_0$ plume also has the same deficiencies in terms of the amount of wells.

8) Please add companion Figures for Figures E-7 and E-8 that show levels in the Qal HSU.

9) Referring to Page F-15, TVC supports the option of developing a clean area for consolidating the most contaminated portions of the pits. While we are aware that some other communities have had public opposition to this option, we are also aware of communities where this option did not receive opposition.

10) The cost of alternatives 2 and three seems to be driven largely by waste excavation of Pits 3 and 5 (total $53 million direct costs), and then largely by waste disposal costs ($35 million direct costs). Where is the assumed waste going to be disposed? Is it DOE's policy to pay for such large disposal costs at the Nevada Test Site? It would be useful to propose two scenarios for excavation: one for complete excavation and another for hot spots only.

    Additionally, it does not appear that the on-site waste consolidation option was considered in this cost estimate, although it appears that in Appendix F, no definitive statement is made as to whether this strategy is retained.

11) TVC re-iterates EPA comments referring to the history of Waste Disposal **"If there are any de-classified records of how tritium was used during the Building 850/851 firing table experiments that could be used to explain where the other 99.6% of all the tritium used went to, e.g., air monitoring reports after blasts, please discuss them in the RI/FS."**

Attachment 5: January 2005 Comments on Second Draft Final Pit 7 RI/FS

January 10, 2005

Claire Holtzapple
U.S. Department of Energy
Livermore Environmental Programs Division
Lawrence Livermore National Laboratory
P.O. Box 808, L-574
Livermore, California 94551

Subject: Comments on the Second Draft Final Pit 7 Remedial Investigation/Feasibility Study

Dear Claire:

Enclosed are my comments, on behalf of Tri-Valley CAREs, that address LLNL's Final Remedial Investigation /Feasibility Study for the Pit 7 Complex. I serve as Technical Advisor to the Tri-Valley CAREs (TVC), recipient of a Technical Assistance Grant from the U.S. EPA, and these comments are submitted in coordination with TVC.

These comments are divided into two sections:

3) General comments;
4) Specific comments;

Yours very truly,

Peter M. Strauss

GENERAL COMMENTS

1) Tri-Valley CAREs strongly believes that hydraulic control must be part of the remedy. Leaving large amounts of tritium to migrate in the groundwater is unacceptable, and violates the letter and spirit of State Water Resources Control Board Resolutions 92-49 and 68-16, both of which indicate that potential drinking water sources should not be contaminated.

   Notwithstanding the above statement, Tri-Valley CAREs appreciates the additional analysis that was added to the draft indicating that complete capture

of the plume and subsequent re-injection would run the risk of further spreading the plume. However, we think that the goal of hydraulic control does not have to be complete stabilization of the plume, as was the goal of the model. We think that the goal of hydraulic control should be to slow the migration of the tritium plume that would allow more time for the tritium to decay. In other words, it does not have to be all or nothing.

As such, we recommend that the Section on Hydraulic Control be folded into Section 3.2.2.2 (Groundwater Extraction and Ex-Situ Treatment). This remedy proposes establishing an injection well gallery, whereby extracted water containing nitrate, perchlorate, depleted uranium and tritium would be treated and re-injected. (There would be no treatment for the tritium). This could be expanded with a few additional extraction wells that would serve the purpose of slowing down the plume. In or opinion, this would provide LLNL with an adaptable strategy that could be optimized at any of a number of points, as the remedy is staged and data indicates. Optimization could take place in the upstream hydraulic diversion, extraction of source material, ex-situ treatment and re-injection, and partial hydraulic control.

2) We think that monitored natural attenuation (MNA) is not appropriate to consider for Pits 3 and 5 until there is a stable or shrinking plume controlled at the source. There is more tritium locked up in the vadose zone then previously had been predicted, and more ways to move it from the source The better way to deal with this problem is to contain it, and remove the source (areas with high concentrations in the vadose zone and the pits) when practical. MNA should only be considered after the source is controlled or removed.

TVC re-iterates that if MNA is selected, most of the contaminant mass must be reduced through degradation. In DOE's January 8 response to **TVC Specific Comment 1** it estimates that only 50 percent of the reduction in activity is due to radioactive decay. We think that this is inadequate, and further supports the need for hydraulic control. We propose that an objective for any remedy that uses MNA have at least 75 percent of the reduction take place through biological, chemical or radiological degradation.

3) The assumed future use of the land will dictate the clean-up levels, and thereby restrict the allowable future uses of the land. This is a conundrum that we would not like to see. Tri-Valley CAREs' disagrees that industrial standards should be used for Site 300. As we have stated in our Community Acceptance Criteria for Site 300, the strictest clean-up standards should be applied to the site. We recognize that residential standards may not be feasible in a few small places, but on the whole, residential standards should be used. In the future, this would allow DOE to more easily dispose of the property and limit its liability. Also, because the Bay Area is growing so rapidly, and residential growth is beginning to occur in Tracy and near Site 300, it would be unfortunate if the cleanup performed in 2005 -2006 dictate how this 11 square mile site will be used in the future. We recommend that the future land-use assumptions should consider the property multiple-use (residential, industrial, commercial and recreational) with a few areas where hazard controls are necessary due to long-lived contamination.

4) Notwithstanding DOE's response that ARARs that establish clean-up goals not be included in the Interim ROD, TVC strongly reiterates that State Water Resource Control Board Resolution (SWRCB) 68-16 (i.e., the non-degradation policy) and Resolution 92-49 should apply and that the goals of the interim remedies should be set to account for these.

5) Of concern is potential receptors exposed to contaminants from Spring 24 near Pit 7 and intermittent surface waters from Elk and Doall Ravines. It is unclear from the RI/FS how exposure from this source will be controlled.

SPECIFIC COMMENTS

1) Regarding the identification of Chemicals of Concern (p. 42), one of the criterion is that a chemical is screened out if the calculated risk was less than 10^{-6} and a Hazard Index of less than 1. Most of the data in the report uses the 1992 SWRI, which identified cancer slope factors. We recommend that these be reviewed, for many cancer slope factors have been modified in the subsequent 12 years. In particular, since volatization is one of the pathways, we want to point out that EPA Region IX has promulgated a "provisional" PRG for TCE. This is based on new information developed in the early 2000's. The acceptable level in terms of inhalation is considerably more stringent than the previous standard (i.e., 0.017 micrograms per cubic meter for residential exposure and 0.043 micrograms per cubic meter for occupational exposure).

2) At page 44, the fate and transport model indicates that tritium or uranium will not impact a hypothetical well at the eastern boundary of the site. This is not relevant and flies in the face of Resolution 68-16. We believe that the point of compliance is at the point of detection – not the site boundary.

3) On page 47, it states that "groundwater is used at Site 300 for drinking water". Please indicate the location of these drinking water wells.

4) Referring to page 48, SWRCB Resolution 92-49 does not suggest that "background conditions should also be a long-term remediation goal." There is no reference in 92-49 that refers to long-term.