5.0 VOC VADOSE ZONE

The following sections provide background information on the vadose zone contamination along with a description of the interim removal actions that have been conducted to date. Recent concerns regarding radon are also described and evaluated in this section.

The Five-Year Review evaluation in Section 5.5 discusses the protectiveness of the interim removal actions conducted to satisfy the RAOs detailed in the Basewide Engineering Evaluation/Cost Analysis (EE/CA) (McClellan, 1993). Section 5.5 also includes an examination of mass removal, evaluates the protectiveness of the cleanup levels, and reviews new information that has come to light in the last five years.

It should be noted that the acronym 'IC' in this section refers to investigation clusters and is used to designate SVE sites. As explained in the acronym list located within the Table of Contents, the acronym 'ICs' is used in other sections (particularly Section 12.0) to designate 'Institutional Controls'.

5.1 DESCRIPTION AND BACKGROUND OF VADOSE ZONE

In 1993, the Air Force and regulatory agencies approved SVE as the presumptive remedy for VOC cleanup in soil at McClellan. The interim removal actions were considered to be part of a basewide process to achieve early risk reduction and prevent future VOC migration to groundwater by removing significant quantities of VOCs in the vadose zone. In March 1993, SVE operations began at McClellan with a pilot system/treatability study at OU D. The next set of SVE systems was installed in 1995 at IC 1, IC 7, and OU C1. Between 1996 and 2001, ten additional SVE systems were installed (Mitretek, 2000a, p. 6). Table 5-1, located in the Tables section, presents information on the SVE systems currently operating at McClellan.

Currently, the SVE program at McClellan is composed of 13 treatment systems (IC 34/35/37 and IC 41/42/43 have two co-located systems) treating 23 removal action areas which affect an

estimated 91 IRP Sites (Figure 5-1, located in the Figures section). The treatment systems include (URS, 2003m, p. ES-1):

- 3 Catalytic Oxidation (CatOx) systems
- 3 Flameless Thermal Oxidation (FTO) systems
- 7 Vapor-Phase Granular Activated Carbon (VGAC) systems

The locations of the SVE systems are shown in Figure 5-1 and the system operational data are summarized in Tables 5-1 and 5-2.

Since implementation, all SVE systems have been in long-term operation and monitoring (LTO/LTM), which is documented in a Quarterly Vadose Zone Monitoring Report and Monthly Operations/Status Report (URS, 2003m, 2003n, 2003r).

All of the original 23 removal action sites have had halogenated VOC contamination present. Six of the 23 sites (i.e., IC 1; IC 7; IC 23; IC 25; IC 27; and IC 41) have very little residual contamination left and have had a formal closure evaluation (i.e., STOP evaluations, see Section 5.3) performed recently (Table 5-1). Sites IC 29 and PRL S-13 have been recommended to have STOP evaluations performed on them (URS, 2003r); however, the STOP evaluation process is currently being re-evaluated to consider human health risk from potential indoor air inhalation of VOCs present in shallow soil gas. The "START-STOP" process was first developed for the former Castle AFB and later adopted by McClellan to evaluate criteria for SVE system startup and shut down, as further explained in Section 5.3.

During the Second Quarter 2003, 11 of the 13 SVE systems operated; no SVE occurred at sites IC 5, IC 7, IC 25, IC 27, and PRL S-13 to assess VOC rebound (URS, 2003r). During the Second Quarter 2003, approximately 1,478 pounds of VOC contaminants were removed from the vadose zone (Table 5-2).

The specific RAOs for soil at McClellan are (CH2M Hill, 1999, p. ES-7):

- Protect human health from exposure through ingestion, inhalation, and direct contact with soil that presents an unacceptable risk.
- Remove or isolate vadose zone contaminants in source areas to reduce cost and time of groundwater cleanup.
- Remove contaminants from the vadose zone to the extent technically and economically feasible to protect groundwater.

The most significant issues that have developed with the SVE systems since implementation include 1) accumulation of radon gas in VGAC systems and 2) reassessment of shallow soil gas distribution from ground surface to 15 feet bgs (URS, 2003c, 2003m, 2003r). Both issues are further described in Section 5.5.

5.2 PREVIOUS INVESTIGATIONS OF VADOSE ZONE

Previous RIs performed at the 23 removal action sites indicate that VOCs constitute the most widespread and the most common subsurface contaminant at McClellan. Compounds with significant concentrations in decreasing order of frequency of detection in soil gas are: TCE; PCE; 1,1-DCE; 1,1,1-trichloroethane (TCA); and freon-113. In addition, the following compounds are commonly identified in soil gas, but at lower concentrations: cis-1,2-DCE; 1,1-DCA; trichlorofloromethane; dichlorodifloromethane; trans-1,2-DCE; 1,2-DCA; vinyl chloride; carbon tetrachloride; chloroform; chlorobenzene; toluene; xylenes; and benzene. Of these compounds, TCE and PCE contribute the bulk of the contaminant mass in some areas, but 1,1,1-TCA and 1,1-DCE are as significant in other areas. Table 5-2 presents the primary VOCs present at each of the removal action sites, where applicable. Most of these compounds have also been detected in groundwater at various locations beneath the base. All cited compounds are amenable to recovery by SVE from soils (McClellan AFB, 1993, p. 15).

The previous investigations focused mostly on soil contamination from 20 feet bgs to first encounter with the groundwater at approximately 110 feet bgs. Most shallow soils were field screened during drilling operations but samples were not sent in for laboratory analysis.

Currently, the regulatory agencies are requesting soil gas analytical data from the shallow subsurface between 0-15 feet bgs to support the conclusion that these soils are not contaminated. In preparation for future closure of the removal action sites, several shallow subsurface sampling efforts are underway. For more detail on the site-specific previous investigations, refer to the Basewide VOC FS Report (CH2M Hill, 1999).

Radiation monitoring has confirmed that all of the operating VGAC SVE systems are concentrating radon gas from subsurface soils in the VGAC. While the FTO and CatOx systems do not pose a radiation exposure risk to the general public, McClellan personnel, or McClellan subcontractors, the VGAC systems tend to concentrate the radon gas in the carbon vessels at concentrations that could potentially expose the public to unacceptable levels under very conservative conditions. In response to this potential risk, AFRPA elected to construct cement-filled block walls around the VGAC vessels to reduce the exposure levels at the SVE system perimeter fence and monitor the exposure to ensure the potential risks have been eliminated. The construction of the cement-filled block walls around the VGAC vessels was completed in March 2003. Radiation monitoring to confirm the effectiveness of these cement-filled block walls is currently being conducted.

5.3 INTERIM REMOVAL ACTIONS FOR VADOSE ZONE

The decision to take action to remove VOCs from the vadose zone was made by the Air Force in the EE/CA for SVE General Evaluation Document in late 1993 (McClellan AFB, 1993, p. 1). Presumptive remedies and approaches were implemented under this document, which allowed McClellan to select technologies that were proven to be effective under similar site conditions and rapidly identify sites on the base which were suitable for these technologies.

The BCT members have adopted the “START-STOP” process, which was developed for and successfully applied to Castle Airport, (i.e., former Castle AFB) to evaluate criteria for SVE system startup and shutdown at McClellan. As part of the STOP criteria, the soil gas VOC concentrations were modeled for several of the SVE sites using an appropriate vadose zone model in order to predict whether concentrations in leachate at the capillary fringe would exceed

the groundwater cleanup standard. If the leachate at the capillary fringe meets the groundwater standard, then the cleanup goal for the vadose zone is met. If the leachate at the capillary fringe exceeds the groundwater standard, the feasibility of implementing or continuing operation of an SVE system is reevaluated. Table 5-3 shows screening levels used to evaluate rebounded soil gas concentrations and their potential impact on groundwater. When evaluating the feasibility of operating an SVE system, operational costs are compared to those of operating a groundwater pump-and-treat system (URS, 2003c, p. 9).

The Air Force identified 23 removal action areas suitable for SVE VOC removal and installed several extraction and soil vapor monitoring wells (Table 5-1). Originally, a total of 14 SVE systems were installed with most addressing multiple removal action areas. More than half of the SVE systems removed more than 80% of the VOC contaminants during the first year of SVE operation. A few of the systems have been shut down for an extended period of time (IC 5/7, IC 25/27, and PRL S-13) due to very low VOC removal rates and continuing rebound studies indicate that the concentrations are remaining at low levels. The current extraction rates and contaminant concentrations are presented in Table 5-4. Some of the deeper extraction wells, just above groundwater, contain soil gas concentrations above the MCL equivalent levels; however, contaminated groundwater beneath the extraction wells may be off-gassing. As a result, the STOP process has begun at several of the removal action sites. Once a VOC ROD is finalized and cleanup goals are defined, several of the removal action sites may be ready for closure under the STOP process. It should be noted that the STOP evaluation process has been suspended and confirmation borings delayed until the completion of the site-specific shallow soil gas evaluations.

5.4 PROGRESS SINCE 1999 FIVE-YEAR REVIEW FOR VADOSE ZONE

This Five-Year Review will be the first evaluation of the SVE program at McClellan.

5.5 FIVE-YEAR REVIEW PROCESS FOR VADOSE ZONE

The Five-Year review process for the Vadose Zone removal actions consists of document review, data review, a site inspection, interviews, and technical assessment. Each of these areas is discussed in detail in the following sections.

5.5.1 Document Review for Vadose Zone

This Five-Year Review consisted of a review of the following documents to obtain background information and technical details on the SVE systems in order to conduct the technical evaluation:

- Quarterly Vadose Zone Monitoring Report, First Quarter 2002, Former McClellan Air Force Base, URS, May 2002 (2002d).
- Quarterly Vadose Zone Monitoring Report, Second Quarter 2002, Former McClellan Air Force Base, URS, August 2002 (2002c).
- Quarterly Vadose Zone Monitoring Report, Third Quarter 2002, Former McClellan Air Force Base, URS, November 2002 (2002b).
- Quarterly Vadose Zone Monitoring Report, Fourth Quarter 2002, Former McClellan Air Force Base, URS, February 2003 (2003c).
- Quarterly Vadose Zone Monitoring Report, First Quarter 2003, Former McClellan Air Force Base, URS, May 2003 (2003m).
- Quarterly Vadose Zone Monitoring Report, Second Quarter 2003, Former McClellan Air Force Base, URS, August, August 2003 (2003r).
- Soil Vapor Extraction Operations and Maintenance Monthly Operations/Status Report for March 2003, Former McClellan Air Force Base, URS, April 2003 (2003d).
- Soil Vapor Extraction Operations and Maintenance Monthly Operations/Status Report for June 2003, Former McClellan Air Force Base, URS, July 2003 (2003n).
- Technical Memorandum: Soil Vapor Extraction Strategy for McClellan Air Force Base (Subsurface), Former McClellan Air Force Base, Mitretek Systems, February 2000 (2000a).
- Basewide Engineering Evaluation/Cost Analysis for Soil Vapor Extraction, Former McClellan Air Force Base, McClellan AFB, November 1993.

- Basewide Removal Action Workplan for Soil Vapor Extraction Former McClellan Air Force Base, URS, October 2001 (2001a).
- Basewide Volatile Organic Compound Feasibility Study Report, Former McClellan Air Force Base, CH2M Hill, December 1999.
- Performance and Protectiveness Review Scoping Visit, Former McClellan Air Force Base, AFBCA, July 29 through August 8 2002 (2002d).

5.5.2 Data Review for Vadose Zone

The most recent site-specific data evaluated for this report were gathered from both the Quarterly Vadose Zone Monitoring Report, April - June 2003 (URS, 2003r) and the Monthly Operations/Status Report for June 2003 (URS, 2003n).

5.5.3 Site Inspection for Vadose Zone

The site inspection was conducted on 13 May 2003 by MWH. The purpose of the inspection was to assess the site conditions, access, security, and general protectiveness to the public. All of the SVE systems are well secured with chain-link fencing and security lighting and have adequate signage to indicate potential hazards and contact numbers. All of the SVE system locations are well maintained for weed control and general appearance. The cement-filled block walls, installed to reduce radiation exposure, were constructed around the VGAC vessels within the security fencing on every operating SVE VGAC system. A site inspection checklist is included in Appendix A.

5.5.4 Interviews for Vadose Zone

Interviews regarding the SVE sites basewide were conducted with Mr. P. Graff and Mr. S. Freeman, URS, and Mr. D. Self, AFRPA, on 13 May 2003. Summaries of the interviews are included in Appendix B. The topics that were discussed with the interviewees included: operational histories, incidents or accidents, preventative system inspections, emergency measures, notice of violations, and noise and other potential nuisance issues. Other than one accidental injury during the construction of the cement-filled walls around the VGAC vessels,

there have been no significant incidents. A more comprehensive discussion of LUC/ICs is presented in Section 12.

5.5.5 Technical Assessment for Vadose Zone

In accordance with the Comprehensive Five-Year Review Guidance (USEPA, 2001b), the technical assessment includes the evaluation of the following three questions.

Question A: Is the remedy functioning as intended by the decision documents?

The current remedy is removing VOCs that could potentially migrate to groundwater and is functioning as intended by the EE/CA.

It is important to note that the decision documents, first the EE/CA (McClellan AFB, 1993) followed by the VOC FS (CH2M Hill, 1999), were only generated to describe a general proactive approach to begin the cleanup of VOC contamination in the vadose zone during the interim until a ROD is finalized.

The intent of the remedy is defined by the RAOs from the EE/CA, which are stated in Section 5.1. The SVE program has removed over one million pounds of total volatile hydrocarbon (TVH) mass since 1995 (Figure 5-2). The removal of this large mass has eliminated a significant source of contaminants from potentially contaminating groundwater. The majority of the contaminant mass removed has been from a select number of sites (i.e. OU D, OU C1, and IC-19). The contamination levels at most of the removal action areas currently under SVE remediation are at or just above the preliminary cleanup goals and continuing vapor extraction is achieving only very slow reduction of the levels.

The AFRPA has instituted its own program of oversight and review of SVE system performance. The last Performance and Protectiveness Review (P&PR) was conducted between July 29 through August 8, 2002 (Air Force Base Conversion Agency [AFBCA], 2002d). As discussed in

this P&PR report, the SVE program team has already performed several optimization efforts. These optimizations include:

- Reduced sampling frequency of soil vapor monitoring (SVM) and SVE wells with low concentrations;
- Only utilizing extraction wells on the SVE system that are removing VOCs that may impact groundwater above MCLs;
- Converting SVE from FTO to VGAC at site PRL T-44; and
- Shutting down systems for long-term rebound studies when they are no longer practical to operate.

While the P&PR review found no issues with safety or protectiveness of the SVE systems, they did raise issues of cost and efficiency of some of the systems. In brief, their recommendations included converting to VGAC at lower trigger concentrations to reduce O&M cost and shut down SVE systems when the soil vapors near the water table are less than the off-gassing concentrations from the contaminated groundwater (AFBCA, 2002d, p. 24).

The USEPA has requested that the Air Force restart the IC 7 SVE system because considerable mass remains at this site despite many years of operation and there appears to be some uncertainty regarding the protection of all hypothetical future receptors. Optimization may be required at IC 7 to assure long-term protectiveness.

For the purpose of the Five-Year Review Guidance (USEPA, 2001b), annual operational and maintenance costs for the Vadose Zone Removal Actions are reported in the monthly Operations and Status Reports.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

During the last five years there have been changes in 1) the methodology recommended for assessment of soil gas vapor migration to indoor air, 2) default input parameters to the model and 3) toxicity values for a number of chemicals assessed. Since the development of the preliminary

RAOs for soil gas analysis of the original model, parameters for the newer models, guidelines, and criteria indicate that the generic preliminary proposed residential and industrial RAOs for six shallow soil gas VOCs no longer explicitly meet the protectiveness goal of HIs less than 1.0, as further detailed in the discussion below.

Two potential issues were evaluated to determine the protectiveness of the soil gas RAOs: 1) discharge from the SVE systems to the atmosphere (SVE system stack emissions) and 2) vapor intrusion from shallow soil gas into indoor air. Additionally, the impact of VOCs in the vadose zone on groundwater quality was also evaluated.

SVE System Stack Emissions

Protectiveness of SVE system emissions was evaluated by examining the human health risk downwind from concentrations of COPCs emitted from the SVE system. Emission data of VOCs from OU C1 and OU D SVE systems, and dioxin/furan data from six SVE systems (IC 29/30/31/32 CatOx, IC 34/35/37 FTO, IC 41/42/43 FTO, SSA 2 FTO, OU C1/PRL 66B CatOx, and OUD/IC19 CatOx) were assessed to determine whether the concentrations of COPCs emitted from the SVE systems might present a health risk to downwind human receptors. The VOC emissions for the OU C1 and OU D SVE systems were used as a conservative estimate because emission from the other systems emit substantially lower concentrations of COPCs.

The most recent emission data were combined with simple dilution modeling, default exposure parameters and the most recent toxicity criteria from USEPA and Cal/EPA (See Appendix C Tables C-1 and C-2).

The estimated risks and hazards associated with the SVE VOC emissions were approximately 10^{-6} utilizing current Cal/EPA and currently adopted USEPA toxicity criteria, and 10^{-5} utilizing the draft revised USEPA TCE criteria (i.e., within the acceptable cancer risk range of 10^{-6} to 10^{-4}) and less than a non-cancer HI of 1.0. Furthermore, based upon these conservative modeling assumptions, the dioxin/furan emissions are well within or below the acceptable risk range of 10^{-6} to 10^{-4}. Therefore, based on this conservative screening approach, the emissions associated with the SVE systems are acceptable and protective of human health.

Vapor Intrusion of Shallow Soil Gas into Indoor Air

The preliminary soil gas RAOs that are currently proposed were developed using indoor air exposure scenarios (residential and industrial), as well as equilibrium soil gas concentrations equivalent to MCLs for the protection of groundwater quality (URS, 2003c, p. 9, 2003m, p. 6). It should be noted that final RAOs will be developed for the ROD.

Currently, in areas where SVE systems are operating and where capture zones encompass residual soil vapor contamination, the pathway from subsurface sources to indoor air is considered to be mitigated because soil vapor is actively captured and treated and the current remedy is still considered to be protective of public health. If data are insufficient to determine capture zones are effectively containing soil vapor plumes, there is uncertainty whether the remedy is preventing potential exposures of receptors to constituents in soil gas. Phase 1 of a remedial investigation has taken place to address both exposure to shallow soil gas via the indoor air pathway as well as close data gaps for the fuel sites. Due to a change in funding, future sampling efforts will be associated with the individual parcel RODs. The strategy for the shallow soil gas is to close any data gaps necessary to determine the areas where indoor air inhalation risk of 10^{-6} or greater or a hazard quotient of 1.0 or greater exists due to VOCs. The potential risks include infiltration of VOCs from shallow soil gas into buildings and/or confined spaces which could pose both a short-term and long-term human health risk through the inhalation pathway.

As part of the initial Phase 1 investigation, shallow soil gas data was collected at IC 7 (which is shut down for rebound) and SSA 2 (the new system from PRL S-13 has not been started up). IC 7 and SSA 2 were the only two locations which were not influenced by recent SVE system operation. This data will be used to evaluate whether the SVE systems are mitigating the potential pathway from shallow subsurface sources to indoor air.

It should be noted, however, that since the completion of the proposed soil gas RAOs, a change has occurred in the methodology currently recommended for assessment of soil gas vapor migration to indoor air. New draft guidance (USEPA, 2002a) prescribes a tiered assessment process that may lead to modeling of soil vapor intrusion into indoor air utilizing the Johnson

and Ettinger model which has changed since the preliminary RAOs were developed (USEPA, 2002a). The new draft guidance also provides several new default model parameters, most notably for this assessment, a change of vapor flow rate into building from a calculated value to a recommended value of 5 liters per minute (L/min). Furthermore, toxicity values have changed for a number of the chemicals assessed since the development of the preliminary RAOs for soil gas.

To assess the protectiveness of the current proposed RAOs, screening of COCs was conducted as part of this Five-Year Review evaluation using the site-specific model parameters outlined in CH2M Hill (1999), the new vapor flow rate into buildings recommended by USEPA (5 L/min), the most recent Johnson and Ettinger model (USEPA, 2001c), default exposure parameters, and most recent USEPA and Cal/EPA toxicity criteria.

The results of this screening indicate that several of the generic preliminary proposed residential and industrial RAOs for shallow soil gas (less than 15 feet bgs) no longer explicitly meet the protectiveness metrics (1×10^{-6} and HI of 1.0) originally used to derive them. All non-carcinogenic chemicals except acetone, chlorobenzene, chloroform, toluene, cis-1,2-DCE and trans-1,2-DCE are below the target HI of 1.0 with the generic (non-site specific) modeling conditions established in Appendix H in the Basewide VOC FS Report (CH2M Hill, 1999). It should be noted that use of CH2M Hill's generic value for depth to contamination is conservative and may contribute to this conclusion for these non-carcinogenic compounds. All of the carcinogenic chemicals have chemical-specific risk estimates that are within the acceptable risk range of 10^{-6} to 10^{-4} utilizing current Cal/EPA or current (excluding the draft TCE revision) USEPA toxicity criteria (Table 5-5).

According to Mitretek (Mr. B. Walser, 2003 interview, Appendix B), final site-specific RAOs for shallow soil gas (0-15 feet bgs) will be based on protection of residential indoor air utilizing site-specific modeling and risk assessment. Given the uncertainties and the generic nature of the preliminary RAO calculations, and the sensitivity of the model to site-specific information, final site-specific RAO development is warranted. Because modeling of this type is sensitive to site-specific information, it is recommended that defensible site-specific final RAOs be calculated

utilizing a risk-based decision making process that implements site-specific information including soil parameters, consideration of intended final land use (or potential LUCs) rather than generic scenarios, and tiered risk assessment in order to optimize the process while remaining health protective.

Impacts to Groundwater

Preliminary RAOs protective of groundwater were developed based on simple partitioning using Henry's Law constants to derive equilibrium soil gas concentrations equivalent to MCLs (developed based on the Basewide VOC FS Report, CH2M Hill 1999 and Basewide Groundwater OU IROD, CH2M Hill 1995, and using Henry's Law constants from the RI General Framework Document, URS, 2002f). The values derived with this simple partitioning procedure should conservatively protect groundwater quality as defined by the California MCLs, as no evaluation of dilution or attenuation is incorporated into this partitioning calculation. These preliminary RAOs should continue to be considered protective of groundwater in the future under the conditions that the MCLs continue to be considered protective of human health and the environment. A discussion of MCL protectiveness is provided in Section 4.5 and Appendix C.

Furthermore, final site-specific RAOs for soil gas will be based on protection of groundwater quality (defined as MCLs) as determined by site-specific modeling (Mr. B. Walser, 2003 interview, Appendix B). For determining potential impacts to groundwater, AFRPA plans to use VLEACH or the most current soil to groundwater model mandated by regulatory guidance. Because the most current methods will be utilized, this procedure is considered to be adequate to ensure that the RAOs are technically sound and protective of human health and the environment under the conditions that the MCLs continue to be considered protective of human health and the environment.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

New information has come to light regarding 1) the buildup of radon in the vapor-phase carbon vessels of the treatment systems, 2) ecological assessments from SVE emissions and 3) the potential impact of rising groundwater levels. Further evaluation will be based on additional monitoring data. These issues are discussed below.

Radon

Radon gas is a naturally occurring radioactive substance resulting from the decay of certain elements found in subsurface rocks and soils. Radon decays relatively quickly and is not considered hazardous outdoors or in well-ventilated areas. Radon may present a health problem to those exposed for a long time to high concentrations, typically in an enclosed indoor space like a basement. Because SVE concentrates vapors from a relatively large subsurface volume, radon gas can also concentrate in certain types of treatment systems. In April 2002, radon emissions and radioactivity from SVE systems were monitored at McClellan and it was noted that VGAC vessels tended to have relatively high radioactivity levels. This was attributed to radon adsorbing to the carbon. On April 30, 2002, five SVE systems, IC 1 VGAC, IC 5/7 VGAC, IC 23 Dual Phase Extraction, IC 41/42/43 VGAC and PRL T-44 VGAC, were shut down at the direction of the AFRPA because of elevated radiation levels (determined to be from radon gas accumulating in the carbon vessels) exceeding public allowable dosage (assuming continued exposure over 24 hours per day, 365 days per year) at the system fencelines. These systems remained shut down during May 2002. Although these radon levels would not normally present a significant health risk unless a person is continuously exposed for a long time, mitigation measures were undertaken by McClellan (URS, 2003c, p. 14).

Radiation barrier walls of cement-filled blocks were constructed around the carbon vessels on SVE systems IC 1, IC 5/7, IC 23, IC 27, IC 34/35/37, IC 41/42/43, and PRL T-44 during the fourth quarter 2002 and the first quarter 2003 to provide shielding from excess radiation. In addition, the vessels are allowed to stand idle for approximately two weeks before used carbon is replaced to allow for natural radioactive decay to occur prior to carbon changeout, thus reducing or eliminating exposure to workers. Radon concerns, monitoring results, and mitigation measures are described in the *Evaluation of Radiation Controls at Soil Vapor Extraction Units Technical Memorandum, August 1, 2002*, which is included as part of the *Second Quarter 2002*

Quarterly Vadose Zone Monitoring Report and Closure Considerations, April-June 2002 (URS, 2002c) and in *Soil Vapor Extraction Unit Effluent Dose at the Former McClellan AFB, November 2002*, which is included in *the Quarterly Vadose Zone Monitoring Report, July-September 2002* (URS, 2003b, p. 14).

Ecological Evaluation

An inhalation pathway for burrowing receptors has not been analyzed in ecological risk assessments prepared for McClellan. Based on a preliminary review of the available shallow soil gas data for McClellan, sites with significant VOC concentrations (i.e., at least one VOC exceeds its preliminary cleanup goal) are generally restricted to the developed portions of the base. VOCs have been detected in shallow soil gas in a few areas of low-quality grassland habitat - primarily in the OU D cap area and in the vicinity of the former base landfills in OU C. Although it appears there is limited potential for exposure of sensitive wildlife to significant concentrations of VOCs in shallow soil gas, the inhalation pathway for burrowing wildlife will be considered and discussed with regulatory agencies if significant levels of volatile compounds are detected in soil gas samples at depths where wildlife species of concern may occur (Personal Communication, Ms. M. Enloe, 05 August 2003). For a more detailed discussion of ecological issues, please refer to Section 13.

Rising Groundwater Levels

As noted in Section 4.1, from 1982 to 1995, groundwater elevations beneath the base were decreasing at a rate of approximately one-foot per year. However, from 1996 to present, the decline of groundwater elevation appears to have halted, and in some cases may actually be rising (URS, 2003g, p. 2-25). If these rising elevations continue and become a trend, it will be necessary for the Air Force to develop a strategy for enhancing the SVE systems to address the smear zone before residual contamination is remobilized by the rising water table.

Technical Assessment Summary

According to the documents and data reviewed, site inspections, and interviews, the remedy is functioning as intended by the Basewide EE/CA. The cleanup levels are protective of human health and the environment. There are several new issues that are being examined to determine

the future protectiveness of the RAOs and the following section presents these issues. Section 15 presents the recommendations and follow-on actions.

5.6 ISSUES FOR VADOSE ZONE

The pending actions and recommendations for the vadose zone are summarized below:

Pending Actions	Impact	Plan in Place to Address Issue? (Y/N)	Is Plan Protective Short-Term? (Y/N)	Is Plan Protective Long-Term? (Y/N)	Possible Issue that Could Affect Future Protectiveness? (Y/N)
Continue to monitor dioxins/furans, VOCs, and radon gas accumulations in VGAC (See Section 5.5.5).	Potential exposure to public and site workers.	Y	Y	Y	N
Consider changes in toxicity criteria, and methodology for assessment of soil gas vapor migration to indoor air (See Section 5.5.5).	RAOs for six COPCs have HIs greater than 1.0.	Y	Y	Y	N
Conduct site-specific modeling for RAOs (See Section 5.5.5).	Develop more protective and realistic RAOs.	Y	Y	Y	N

6.0 OPERABLE UNIT B1 CAP AND DRAINAGE DITCHES

The following sections provide background information on the OU B1 Cap and Drainage Ditches contamination along with a description of the interim remedial actions that have been conducted. Recent concerns regarding ecological issues at Magpie Creek are also described.

The Five-Year Review evaluation discusses the protectiveness of the interim remedial actions conducted to satisfy the RAOs detailed in the IROD (Radian Corporation, 1993a). Section 6.3 includes an examination of the interim remedial actions and Section 6.5 includes an evaluation of the protectiveness of the cleanup levels and a review of the new information that has come to light in the last five years.

6.1 DESCRIPTION AND BACKGROUND FOR OU B1 CAP AND DRAINAGE DITCHES

OU B1 is located in the southwestern portion of McClellan and consists of four previously identified sites and the areas between them: PRL 29, SA 12A, SA 12B, and SA 13 (Figure 6-1, located in the Figures section). OU B1 is approximately 18 acres in size and consists of 1) an open storage lot (SA 12A,B) formerly operated by the Defense Reutilization and Marketing Office (DRMO), 2) a former transformer storage, loading, and unloading area (PRL 29), and 3) the Civil Engineering (CE) Storage Yard (SA 013). The on-base areas surrounding OU B1 are industrial, warehouse, and aircraft operations areas. Approximately 500 feet away, off base, nearby land is zoned residential and light industrial (Radian, 1999a, p. 9). OU B1 also includes the drainage ditches that received runoff from the DRMO storage yard (Figure 6-1). Two of the three ditches at the site drain the northern portion of OU B1 and the third ditch drains the southern portion (Roy F. Weston, 2001a, p. ii).

The area designated as OU B1 was open farmland and residences until about 1957. Building 700, which borders OU B1 on the south and west, was built in approximately 1962 and the area northeast of the building has been used as an open storage lot by the DRMO since the early 1960s (Radian, 1993a, p. II-5).

Past activities at OU B1 have resulted in soil contamination from primarily PCBs, and secondarily dioxins and metals. The source of these contaminants consisted of spills from transformers or other equipment with oil containing PCBs, and waste oil that was applied to OU B1 soils in the 1960s to suppress dust. Spills are the sources for high levels of PCB contamination detected in site soils, while waste oil application is considered the source of widespread low levels of contamination. Waste oil was collected from various facilities on base, and may have included hydraulic oils, degreasing solvents, transformer oils, and automotive oils and fluids. Transformers were stored at the DRMO lot at various times from the 1960s through 1987. Transformers containing oil with PCBs were loaded and unloaded from railroad cars along railroad tracks at the northern end of the OU, and were also reportedly stored at the CE storage yard at some time between 1960 and 1987. Spills associated with these activities probably contributed to the contamination at OU B1 (Radian, 1999a, p. 9). Table 6-1, located in the Tables section, presents information on the history and current use of the site.

6.2 PREVIOUS INVESTIGATIONS FOR OU B1 CAP AND DRAINAGE DITCHES

Previous investigations at OU B1 include: 1) a 1985 investigation to determine the presence of buried waste at PRL 029, 2) a 1987 investigation to verify cleanup of an oil spill, 3) a 1990 shallow soil gas investigation, and 4) the 1991-1992 RI (Radian, 1993b). The objectives of the RI were to determine the presence or absence of PCBs and other contaminants, to define possible contaminant source areas, and to collect sufficient data to conduct a human health risk assessment and an engineering evaluation of remedial alternatives (Radian, 1993a, p. II-5).

PCB contamination was reported in the surface soil in the DRMO yard during the OU B1 RI. A fence was constructed around the soil area containing concentrations greater than 100 milligrams per kilogram (mg/kg) of PCBs to restrict access, and solid metal planking was placed over the area to reduce fugitive dust emissions. In 1993, a 45-mil high density polyethylene (HDPE) liner was placed over the area as part of a TCRA to control dust and to prevent runoff to the OU B1 Drainage Ditches (Radian, 1993b, p. II-5). The COPCs identified during the RI are summarized

in Table 6-2. The highest concentrations encountered during the RI for each of the COCs are shown in Table 6-2.

In the 1994 implementation of the interim remedial action, the upper 18 inches of soils were excavated from portions of PRL 29, SA 13, and the southern portion of SA 12A, where PCB concentrations exceeded 10 mg/kg. The excavated soils were consolidated in the northwestern portion of OU B1, in SA 12A. A surface water drainage system was installed, the excavated areas were backfilled with roadbase material, a sediment trap was installed in the drainage channel, and Site 12A was covered with an 8-acre asphalt cap.

Currently, SA 12A and SA 13 are paved lots and PRL 29 is gravel covered and surrounded by paved areas. PCB-contaminated soils are not exposed at the site and therefore cannot contribute to contamination of the ditches through erosion/runoff. Three sediment traps are in place to monitor the effectiveness of the cap.

6.3 INTERIM REMEDIAL ACTIONS FOR OU B1 CAP AND DRAINAGE DITCHES

In 1993, an IROD was signed by USEPA that addressed an area of known PCB contamination in surface soils and the drainage ditches in OU B1 (Radian, 1993a). In 1994, contaminated soils were consolidated and a temporary eight-acre asphalt cap was installed over sites SA 012A, SA 13, and portions of PRL 029 to prevent exposure or migration of the contamination until a final remedy could be selected. Additionally, two sediment traps were installed in the drainage ditches as an additional measure to prevent contaminated sediment from migrating off-site via stormwater runoff.

In 2002, approximately two feet of soil was removed from the unlined portions of the drainage ditches and sediments and debris were removed from the surface of the gunite-lined portion. Confirmation samples were collected in the unlined ditches to demonstrate that all the cleanup goals were achieved. In the absence of final cleanup goals, non-detect values were selected for PCBs (0.025 mg/kg) and PAHs (0.00056 mg/kg); benthic invertebrate toxicity equivalent

concentration levels were selected for dioxins and furans (0.86×10^{-6} mg/kg for Total TCDD/Furans, Canadian Council of Ministers of the Environment, 2001); and background levels were selected for metals (General Framework, URS, 2002f). A total of 2,054 cubic yards of soil contaminated with PCBs were excavated from the unlined ditches and disposed at the Forward Landfill near Manteca, California (Weston Solutions, 2003, p. 28).

During the remedial action of the drainage ditches, it was determined that very minor contamination exists beneath the gunite liner and that it is not technically and economically feasible to remove the small amount of contaminated soil from beneath the gunite-lined ditches. As a result, the ditches with the gunite lining were not excavated and measures to prevent future exposures were implemented as part of the O&M Manual, OU B-1 Cap (International Technology Corporation [IT Corp.], 1994). The operations and maintenance requirements for the gunite-lined ditches consist of the following: 1) sampling of the sediment traps, 2) repairs of the gunite liner if it deteriorates, and 3) quarterly inspections. Sediments are removed and the sediment traps are sampled during the first and fourth quarter, i.e., in March and December of every year. The site will also have a deed restriction on any excavation activities in the area of the ditches with the gunite lining. The Strategic Sites ROD will specify the necessary restrictions and long-term monitoring that will be applied to the lined ditches (Weston Solutions, 2003, p. 34).

The First Quarter 2003 inspection of the drainage ditches found residual PCB contamination (0.520 mg/kg) at the sediment trap located between the western-most section of the gunite-lined ditch and the unlined section of ditch south of Magpie Creek (Figure 6-1). This concentration appears to be a result of silt remaining in the lined section of ditch following completion of the remedial action. In accordance with the O&M Plan, which specifies that analysis for the other COCs are performed only if the total concentration of PCBs exceeds 0.025 mg/kg, sediments from this sediment trap were also analyzed for the other COCs, including PAHs, dioxins and furans, and metals. No PAHs or dioxins/furans were detected, and no metals were reported above background levels. Sediments accumulated in the sediment traps will continue to be removed during routine maintenance activities and monitored for COCs per this protocol (Mr. S. Mayer, 2003 interviews, Appendix B).

During the First Quarter 2003 inspection, concentrations of PCBs (1.1 mg/kg) were also detected in a sample collected from the section of unlined ditch adjacent to the southeast corner of the OU B1 Cap (Figure 6-1). In accordance with the protocol, a complete suite of analyses was conducted for the other COCs. No PAHs or dioxins/furans were detected, and no metals were reported above background levels. Additional samples were collected to determine the extent of residual PCB contamination and an additional six inches of soil were excavated in July 2003 from this 1000-feet long section of the ditch on the south-side of the OU B1 Cap (near Building 700). Confirmation samples indicated that the remaining soils were below the cleanup levels.

No COCs were detected in other sections of the unlined ditch during the First Quarter 2003 inspection. All of the unlined sections were backfilled with clean soil in October 2003, and a new sediment trap was installed in November 2003 between the OU B1 Cap and the unlined section of the ditch immediately south of the cap. This sediment trap was installed to allow future monitoring of sediment runoff from the southeast portion of the OU B1 Cap and to protect the downstream section of unlined ditch from receiving contaminated sediments. In the future, this sediment trap will be sampled at the same time the two previously existing OU B1 sediment traps are sampled.

6.4 PROGRESS SINCE 1999 FIVE-YEAR REVIEW FOR OU B1 CAP AND DRAINAGE DITCHES

The asphaltic concrete cover was installed over OU B1 and the sediments in the ditches immediately adjacent to the OU B1 storage yard were removed and placed under the cap prior to the 1999 Five-Year Review. However, during the previous review, it was determined that the confirmation sampling of soils in the drainage ditches was not properly documented and there was some question as to whether PCB contamination remained in the drainage ditches connected to OU B1. An RI data gap investigation of the unlined drainage ditches was conducted in November 1998 and December 1999 which identified elevated PCB contamination in several locations along the unlined drainage ditches leading from the OU B1 Cap to the outfall at Magpie Creek. This contaminated soil and sediment was removed from the unlined drainage ditches in 2002 and 2003 (Weston Solutions, 2003). Since then, quarterly inspections and

maintenance have been conducted and accumulated sediments have been periodically removed from the sediment traps. Table 6-3 presents the RAOs developed in the IROD and the progress toward meeting those objectives.

6.5 FIVE-YEAR REVIEW PROCESS FOR OU B1 CAP AND DRAINAGE DITCHES

The Five-Year Review process for the OU B1 Cap and Drainage Ditches interim remedial action consists of document review, data review, a site inspection, interviews, and technical assessment. Each of these areas is described in detail in the following sections.

6.5.1 Document Review for OU B1 Cap and Drainage Ditches

This Five-Year Review consisted of a review of the following documents:

- Installation Restoration Program, Part 2B1 – Operable Unit B1 Remedial Investigation Feasibility Study and Addendum, URS, June 2001 (2001e).
- Workplan for Remedial Action at Operable Unit B1 Drainage Ditch, Roy F. Weston, October 2001 (2001a).
- Installation Restoration Program, Operable Unit B1, Interim Record of Decision, Radian Corporation, July 1993 (1993a).
- Quarterly Inspection Program of Operable Unit B1 Cap, OU B1 Cap Inspection Fourth Quarter 2001 Report and Annual Inspection Report, URSG-OHM, January 2002.
- Five Year Review Report, McClellan Air Force Base, Radian International, October 1999 (1999a).
- Draft Remedial Action Closeout Report for the Operable Unit B1 Drainage Ditch, Weston Solutions, March 2003.
- Basewide Ecological Risk Assessment Scoping Summary Status Report, JEG, December 1995.
- Annual Landfill Cap Inspection and Maintenance Report, Operable Unit B1, Cape Environmental, May 2003 (2003b).
- Interim Basewide Remedial Investigation Report, Part 2C – Site Characterization Summary/Field Sampling Plan and Remedial Investigation Characterization Summaries, Radian Corporation, August 1997 (1997a).

- Interim Basewide Remedial Investigation Report, Operable Unit C, Volume 14, URS, September 2000 (2000b).
- Draft Basewide Remedial Investigation Report, Part 1 General Framework, Revision 2, URS, December 2002 (2002f).
- Delineation of Wetlands and Other Jurisdictional Waters of the United States at McClellan Air Force Base, California, RMI, June 2001.
- Final Ecological Risk Assessment for the Initial Parcel, CH2M Hill, August 2003 (2003c).
- Quarterly Inspection Report, Operable Unit (OU) B1 Cap, Geo-Marine Incorporated (GMI), June 2003.

6.5.2 Data Review for OU B1 Cap and Drainage Ditches

Confirmation samples collected as part of the removal of the contaminated soil and sediment in the drainage ditches in 2002 and 2003 indicated that all soils contaminated with PCBs or other COCs above the cleanup levels were removed from the unlined sections ditch. Analytical data and maintenance records published in documents were reviewed.

The annual reports for 2001, 2002, and the First Quarter 2003 Inspection Report were reviewed to determine if the cap is being properly maintained.

6.5.3 Site Inspection for OU B1 Cap and Drainage Ditches

The site inspection was conducted on 6 May 2003 by MWH. The purpose of the inspection was to assess the protectiveness of the remedy and the integrity of the cap and drainage ditches. Site inspection checklists and photographs are included in Appendix A.

The cap appears to be in good condition and, according to the field team and maintenance logs, it appears that maintenance and repairs are being made in a timely manner. The drains at OU B1 along with the sediment traps and gunite-lined sections of ditch are inspected and maintained on a quarterly basis. The sediment traps are sampled semi-annually to verify the protectiveness of the installed cap. Any accumulated sediment is removed from the sediment traps on an annual

basis. In addition, although not required, the AFCEE Field Team conducts weekly drive-by inspections at the drainage channels and cap to verify that the site is secure.

Operations and maintenance requirements were evaluated by reviewing the inspection reports and interviewing maintenance personnel. Currently the cap is used for storage of pallets of wood, equipment, supplies, and parking. The tenant, Hampton Door Company (HDC), is aware of the restrictions associated with the asphalt cap (Mr. P. Bernheisel, 2003 interview, Appendix B). There was a breach of the cap in 2002 when McClellan Park installed a fence for the tenant, which is discussed in Section 6.5.5 and in Section 12.

6.5.4 Interviews for OU B1 Cap and Drainage Ditches

Interviews were conducted with Mr. S. Mayer, AFRPA representative, and Mr. P. Bernheisel and Mr. S. Burkhard, AFCEE Field Team, on 6 May 2003. The interview records are included in Appendix B. Information from these interviews is included in the technical assessment in Section 6.5.5.

6.5.5 Technical Assessment for OU B1 Cap and Drainage Ditches

In accordance with the Comprehensive Five-Year Review Guidance (USEPA, 2001b), the technical assessment includes the evaluation of the following three questions.

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicated that the remedy is functioning as intended by the IROD and Workplan. The RAOs from the IROD are summarized in Table 6-3. The cap, constructed in 1994, has reduced the human health risk posed by the PCBs in the soil and has reduced or eliminated the potential for exposure to site workers and visitors. Based on the site interviews, inspections, and review of the maintenance logs, the operation and maintenance of the cap has been effective. The most common problems found during the quarterly inspections are small cracks, softening of the

asphalt from fuel or oil spills by the tenant, settlement, and gouges by equipment. Site interviews indicate that the prompt repairs of the cap are ensuring that the cap is operating properly and is protective.

LUCs on the cap include access limitations and deed restrictions. According to the AFCEE field team and AFRPA, the current tenant, HDC, is aware of these restrictions. An issue was discovered when McClellan Park installed a fence across the cap. The drawings submitted for the digging permit were not clear and the permit was approved to install the fence. Following the discovery of the cap breach, the soil removed during the fence post installation was sampled and sent for off-site disposal, and the concrete footings were sealed around the asphalt cap. Submitted digging permit applications at the base now require more detailed drawings be submitted prior to approval of the permit. Section 12 describes the current process for digging permits and contains a more comprehensive discussion of LUC/ICs.

Following the removal of two feet of sediment from the unlined ditches in 2002, the confirmation samples indicated that concentrations of COCs were below cleanup levels. However, during the First Quarter 2003 inspection, PCBs were detected in two sediment samples collected as part of the routine quarterly cap inspection. These detections are thought to be the result of residual sediment remaining on top of the gunite lining after completion of the remedial action (Mr. S. Mayer, 2003 interview, Appendix B). The sediment traps will continue to be sampled on a semi-annual basis to ensure that there is no ongoing source of PCBs. Operations and maintenance requirements were implemented for the lined ditches and include annual monitoring and maintenance along with deed restrictions on any excavation activities in the vicinity of the ditches.

For the purpose of the Five-Year Review Guidance (USEPA, 2001b), current annual maintenance costs for the OU B1 Cap and Drainage Ditch are approximately $50,000 and are expected to increase due to anticipated future repairs at the cap as the cap continues through its 30 year design life.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Cap

The interim remedial action under the current industrial conditions is protective. A risk-based approach was not utilized to develop cleanup levels. Soils to a depth of three feet containing PCBs at a concentration exceeding 10 mg/kg were consolidated and placed under a cap as an interim remedial measure, therefore mitigating potential exposures. The site is currently occupied by HDC and is access controlled. Exposures to soils containing PCBs at a concentration of less than 10 mg/kg in an industrial setting utilizing USEPA or Cal/EPA toxicity criteria results in an estimated cancer risk that falls within the acceptable risk range of 10^{-6} to 10^{-4}. Therefore, the interim remedial measure under industrial conditions is protective of current land use. Exposure pathways to soils greater than three feet bgs for industrial receptors are not considered complete. Therefore, the interim measures for PCBs greater than 3 feet bgs are considered protective as long as current land use and access to the site continues to be restricted to industrial receptors, and the cap over the consolidation area is maintained. The final RAO should address risks to receptors associated with any potential future land use.

For dioxin and furan compounds, soils containing 1 µg/kg tetrachlorodibenzodioxin (TCDD) equivalent concentrations were consolidated and placed under the cap as an interim remedial measure. Under current controlled industrial land conditions, soils containing TCDD equivalent concentrations of 1 µg/kg or less utilizing USEPA or Cal/EPA toxicity criteria result in a cancer risk that falls within the acceptable risk range of 10^{-6} to 10^{-4}. Therefore, the interim measures for dioxins and furans are considered protective as long as current land use is maintained and access to the site continues to be restricted to industrial receptors, and the cap over the consolidation area is maintained. The final RAOs should address risks to receptors associated with any potential future land use.

Low levels of VOCs have been sporadically detected in soils across the site. Higher concentrations of VOCs (e.g., TCE, PCE) of limited extent have been identified in the northern portion of OU B1. No structures appear to be located in these areas of the site. Furthermore, the

presence of the asphalt cap, which is maintained on a regular basis, further impedes volatilization of VOCs through the vadose zone and into ambient air. Therefore, volatilization into ambient air does not appear to be a pathway of significance under the current land use scenario. The current cap appears to be an effective barrier to reduce or eliminate the potential exposure pathways associated with the limited extent of VOCs at the site as long as the cap is actively maintained.

Unlined ditches

The interim remedial action at the unlined drainage ditches remains protective of human health. For PCBs and PAHs, a risk-based approach was not utilized to determine the cleanup goals. Rather, any sediment above the detection limit for either of these constituents was removed, disposed of off-site, and confirmation samples were collected to ensure the cleanup goals were met. The detection limit cleanup levels (for PAHs and PCBs) were:

- PCBs - 0.025 mg/kg.
- PAHs - 0.00056 mg/kg.

These detection limits are below concentrations that would result in a 1×10^{-6} cancer risk for residential receptors utilizing either USEPA or Cal/EPA current toxicity criteria.

For inorganics, the background levels established in the General Framework Document (URS, 2002f) were used as the interim removal goal. Because the initial assessment assumed removal of only the upper six inches (i.e., sediments), background levels of inorganics in sediments were selected as the basis for removal goals. During the drainage ditch remedial action, however, two feet of soils were removed, resulting in an excavation bottom in the native soils, which in this case are predominantly silts and clays. Therefore, established background levels of inorganics in silt and clays were considered more appropriate removal goals.

For dioxins and furans, benthic invertebrate toxicity equivalent concentration levels (0.86×10^{-6} mg/kg for Total TCDD/Furans, Canadian Council of Ministers of the Environment, 2001) were used as the cleanup objective.

No changes to toxicity criteria or exposure assessment protocols have occurred that would change this conclusion. Therefore, the interim remedy for the unlined drainage ditches remains protective of human health.

Gunite ditches

As long as the lining is maintained, the interim action remains protective of human health. A risk-based approach was not utilized to develop cleanup goals for the gunite-lined ditches. Accumulated sediment and debris were removed from the top of the gunite lining. Low level contamination in the soil under the lining was left in place in order to preserve the gunite lining of the ditches. The lining currently eliminates exposures to receptors by providing a physical barrier between impacted sediments and potential receptors. Operations and maintenance requirements have been implemented to maintain the gunite lining.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Subsequent to preparation of the OU B1 IROD, the section of unlined drainage ditch immediately south of Magpie Creek was identified as an ecological area of concern because it flows into Magpie Creek in the West Nature Area of McClellan. This section of Magpie Creek is considered a sensitive biological resource area because it provides habitat for a variety of wetland and riparian-associated species, including the federally threatened giant garter snake.

The OU B1 remedial action work plan established cleanup levels to be protective of ecological as well as human receptors. Due to the non-detect clean-up levels achieved during the drainage ditch remedial action, an ecological assessment was not performed as part of the OU B1 closure report.

Currently, sediment traps are monitored on a semi-annual basis during the first and fourth quarter for constituents of concern (Cape Environmental 2003a; Mr. S. Mayer, 2003 interview, Appendix B). During the First Quarter 2003 inspection, a PCB concentration of 0.52 mg/kg was detected in sediment from the trap located between the western-most section of lined ditch and

the unlined section south of Magpie Creek (GMI, 2003). The source of this detection is believed to be silt and sediment remaining on top of the gunite lining after completion of the remedial action and subsequently washed down into the sediment trap. This concentration exceeds the cleanup level of 0.025 mg/kg and may not be protective of ecological receptors if sediments were allowed to reach the unlined section of ditch upstream of Magpie Creek, or Magpie Creek itself.

This concentration also exceeds freshwater sediment quality guidelines for "threshold effects concentration" (TEC) (TECPCB = 0.0598 mg/kg, MacDonald et al., 2000 - see Regulatory Guidance and Supporting Information below), which was "intended to identify contaminant concentrations below which harmful effects on sediment-dwelling organisms were not expected." However, the detected concentration is less than the "probable effects concentration" (PEC) (PECPCB = 0.676 mg/kg, MacDonald et al., 2000), which was "intended to identify contaminant concentrations above which harmful effects on sediment-dwelling organisms were expected to occur frequently." According to MacDonald et al. (2000), samples with contaminant concentrations between the TEC and PEC are "neither predicted to be toxic nor nontoxic."

The purpose for the installation of sediment traps within the OU B1 drainage ditches as part of the consolidation and capping activities was to intercept PCB containing materials that may enter the drainage before they reach the sensitive Magpie Creek habitat. Current maintenance and monitoring of the sediment traps is conducted in an effort to monitor the effectiveness of the cap and detect and intercept any PCB containing materials prior to reaching Magpie Creek that may escape the cap. Based on the review of available information, the remedy appears to be functioning as intended and is protective.

The Air Force is using the interim cleanup levels established in the work plan (0.025 mg/kg PCB) to monitor future detections in the sediment traps. However, no formal decision criteria are currently in place to address detections of PCBs in the traps. Furthermore, no formal decision criteria are currently in place to determine suitability/appropriateness of monitoring program reductions should future monitoring demonstrate a consistent trend of non-detections (personal communication, S. Mayer, 05 August 2003).

It is therefore recommended that ongoing monitoring of sediment traps continues to determine whether detected PCB concentrations in sediment traps are transitory (residual sediments remaining in the lined section of ditch following the remedial action) or are originating from under the OU B1 Cap. As part of this monitoring program it is also recommended that systematic decision criteria be developed. The decision criteria should contain a set of risk-based triggers (that are related to levels that pose a potential risk to potentially exposed receptors) or evaluation criteria for either acting upon future detected concentrations of PCBs in the sediment trap system, or for identifying a specific monitoring period after which reductions in the monitoring program might be appropriate.

With regards to the lined portions of the OU B1 Drainage Ditch, sampling was conducted beneath the gunite-lined sections to ascertain nature and extent of any contamination which was present prior to installation of the gunite lining. Results showed only sporadic detections of PCBs with no vertical extent (Weston, 2003). With the existing competency of the gunite lining, and the minimal contamination isolated beneath it, the decision was made to forego the removal of the gunite lining. Therefore, the remedial action, within the gunite-lined sections, was limited to the removal of accumulated sediment and debris from the surface of the gunite lining. The gunite lining currently precludes exposures to biotic receptors by providing a physical barrier between impacted sediments and potential biotic receptors. Necessary restrictions have also been implemented to maintain the gunite lining. On condition that the gunite lining is maintained, contact with any impacted sediments are prevented and the interim action is considered to be protective of ecological receptors. A more detailed discussion of the ecological evaluation is included in Section 13.

Technical Assessment Summary

According to the documents and data reviewed, site inspection, and interviews, the remedy is functioning as intended by the IROD. The drainage ditch sediment traps are in place to prevent PCB contaminated sediment from reaching Magpie Creek. A summary of the progress toward meeting the RAOs for OU B1 is presented in Table 6-3. The cleanup levels are protective of human health and the environment. Due to the First Quarter 2003 detection of PCBs in one sediment trap, continued sampling is recommended. Formal decision criteria that include risk-

based trigger points for acting upon detected PCB concentrations or for reducing the monitoring program is also recommended. It is anticipated that the establishment of a formal systematic decision process (incorporating risk-based triggers) and the analysis of pending additional sediment sampling data will provide the information necessary to determine the long-term protectiveness of the remedy. The following section presents the issues from the Five-Year Review evaluation.

6.6 ISSUES FOR OU B1 CAP AND DRAINAGE DITCHES

The pending actions and recommendations for the OU B1 Cap and Drainage Ditches are summarized below:

Pending Actions	Impact	Plan in Place to Address Issue? (Y/N)	Is Plan Protective Short-Term? (Y/N)	Is Plan Protective Long-Term? (Y/N)	Possible Issues that Could Affect Future Protectiveness? (Y/N)
Continue to monitor PCB detections in drainage ditch sediment traps (See Section 6.5.5).	Potential migration of contaminated sediment to Magpie Creek.	Y	Y	Y	N
Develop decision criteria for acting upon PCB concentrations or for reducing the monitoring program for the drainage ditch sediment traps (See Section 6.5.5).	Expedite decision making as new monitoring data becomes available.	N	NA	NA	N

7.0 OPERABLE UNIT D CAP

The following sections provide background information on the OU D Cap along with a description of the interim remedial actions that have been conducted. Recent concerns regarding ecological issues at the OU D Cap are also described.

The Five-Year Review evaluation discusses the protectiveness of the interim remedial actions conducted to satisfy the RAOs detailed in the RI (CH2M Hill, 1994). Section 7.3 includes an examination of the interim remedial action and Section 7.5.5 includes an evaluation of the protectiveness of the cleanup levels and a review of the new information that has come to light in the last five years.

7.1 DESCRIPTION AND BACKGROUND FOR OU D CAP

The OU D Cap covers sites CS 1, 2, 3, 4, 5, A, S, and T; and parts of CS 6 and CS 26. CS 1, 2, 3, 4, 5, A, S, and T are clustered in the central western portion of OU D, and CS 6 and CS 26 are located in the northwestern portion of OU D, east of the other eight disposal pits. Site locations are presented on Figure 7-1, located in the Figures section.

CS 1, 2, 3, 4, 5, A, S, and T were used primarily for the disposal of waste solvents, fuels, and oils from aircraft maintenance processes and sludge from the McClellan IWTP. The first disposal of material into CS 1 took place in 1959, and disposal activities stopped at all sites in 1984. Because the IWTP treated wastewaters coming from a variety of industrial processes, some of which involved radioactive materials (such as radium paint), some of the waste sludges may have contained radioactive materials. The waste pits are unlined and have no collection sumps (URS, 2000a, p. 4-5*)*. An engineered cap was placed over these eight disposal pits in 1985. The cap at OU D was installed as a temporary measure to prevent infiltration from precipitation and to control off-gas emissions. The final remedy will be developed as part of the Strategic Sites FS and ROD which will determine whether the cap represents the final remedy for this site. The cap consists of five layers, which include granular fill, six inches of sand and gravel, 18 inches of compacted clay, a 40-mil plastic membrane, and two to three feet of imported top soil. The cap

is covered with grasses and bare soil. The cap is surrounded by a chain link fence and is closed to public access.

CS 26 was also a sludge disposal pit used from 1972 to 1977. This landfill, which also received sludge from the IWTP, is unlined and has no gas or leachate collection systems. CS 6 was a burn area for skimmed oil collected from the main sludge disposal pits and the tank cleaning operations conducted at McClellan. As an interim measure, contaminated soils from CS 6 and CS 26 were excavated and consolidated in areas CS 1, 2, 3, 4, S, A, and T, which is covered by the engineered cap. Currently, CS 26 is covered by eight feet of clean fill (URS, 2000a, p. 2*)*. The site is flat and covered partially by an access road, asphalt parking lot, and unpaved soil. CS 6 is partially covered by the asphalt parking lot of Building 1093. The engineered cap that covers the other eight disposal pits also covers the southwestern corners of CS 26 and CS 6 (URS, 2000a, p. 18*)*. Site history information for these sites is presented in Table 6-1, located in the Tables section.

7.2 PREVIOUS INVESTIGATIONS FOR OU D CAP

The first investigation at OU D was conducted in 1981 by McClellan personnel to identify all disposal sites. Groundwater monitoring wells were installed in 1983 to determine the extent of groundwater contamination and migration (CH2M Hill, 1994, p. 1-8). In 1984, a Site Characterization Study was conducted and a shallow exploration program investigated the waste in the pits to assess the lateral and vertical extent of contamination. The highest total VOC, semivolatile organic compound (SVOC), and metals concentrations were found in CS 2 and CS 5, indicating that the highest VOC, SVOC, and metals concentrations are in the middle of the site. The vertical extent of the contamination appears to decrease in concentration with increased depth (URS, 2000a, p. 11).

In 1993, soil, soil gas, and groundwater samples were collected and analyzed from the OU D landfills as part of an RI. The results showed that the soil and soil gas contamination in the landfills had migrated to the groundwater beneath the sites. The contaminants reported during the RI included VOCs, SVOCs, pesticides, PCBs, and inorganic species (URS, 2000a, p. 6*)*. A

supplemental RI was conducted in 1998 to investigate potential radiological contamination at the landfill sites. Results from this investigation concluded that surface soil radiation levels were consistent with background levels established at the time of the investigation. (URS, 2000a, p. 1*)*. Table 6-2 presents information on previous investigations and contaminants detected at the site.

Groundwater wells at OU D have been sampled/monitored since 1986. Four of the wells have shown decreasing trends in TCE concentrations; however, the remaining wells are showing an increase in TCE concentrations.

7.3 INTERIM REMEDIAL ACTIONS FOR OU D CAP

Several interim remedial actions have been initiated at OU D. These include: 1) excavation and capping of the landfills, 2) placing local residents on city water, 3) establishing a groundwater extraction system, and 4) installing an SVE system. By 1985, CS 6, 26, and 4 had been excavated, the material was consolidated into the remaining landfills, and the area was backfilled with clean soil. The OU D Cap was placed over eight (CS 1, 2, 3, 4, 5, S, A, and T) landfill sites in 1985 (Figure 7-1). The cap was constructed to prevent infiltration from precipitation and to control off-gas emissions (CH2M Hill, 1994, p 1-11*)*. The cap consists of five layers, which include granular fill, six inches of sand and gravel, 18 inches of compacted clay, a 40-mil plastic membrane, and two to three feet of imported top soil (URS, 2000a, p. 5*)*.

In 1986 and 1987, 500 off-base residences adjacent to OU D were connected to the municipal water supply system. The switch to municipal water was initiated when the contaminated groundwater plume under OU D was found to have migrated off base (CH2M Hill, 1994, p. 1-11).

A groundwater extraction system was established in 1987. Six extraction wells pump contaminated groundwater from OU D to the treatment system south of the OU D Cap (CH2M Hill, 1994, p. 1-11).

The SVE system was constructed in 1992 and began operation in 1993. The SVE system was installed on top of CS 4, 5, A, S, and T as part of a VOC removal action (URS, 2000a, p. 5). A discussion of the SVE systems is included in Section 5.

7.4 PROGRESS SINCE 1999 FIVE-YEAR REVIEW FOR OU D CAP

This is the first Five-Year Review for this site.

7.5 FIVE-YEAR REVIEW PROCESS FOR OU D CAP

The Five-Year Review process for the OU D Cap interim remedial action consists of document review, data review, a site inspection, interviews, and technical assessment. Each of these areas is described in detail in the following sections.

7.5.1 Document Review for OU D Cap

This Five-Year Review consisted of a review of the following documents:

- Operable Unit D Remedial Investigation Report, CH2M Hill, June 1994.
- Operable Unit D Report and RI Addenda, Radian International, April 2000 (2000c).
- Interim Basewide RI Report, Part 2D – OU D Remedial Investigation Addenda, URS, April 2000 (2000a).
- Operable Unit D 2001 Annual Cap Inspection Report, Cape Environmental, January 2002.
- OU D 2002 Annual Cap Inspection Report, Cape Environmental, May 2003 (2003b).
- Basewide Ecological Risk Assessment (ERA) Scoping Summary Status Report, JEG, December 1995.
- Special Status Species Monitoring Report: McClellan Air Force Base and Davis Communications Facilities, Jacobs Engineering Group and Resource Management International, November 1995.

- Interim Basewide Remedial Investigation Report, Part 2C – Site Characterization Summary/Field Sampling Plan and Remedial Investigation Characterization Summaries, Radian International, August 1997 (1997a).
- Interim Basewide Remedial Investigation Report, Operable Unit C, Volume 14, URS, September 2000 (2000b).
- Draft Basewide Remedial Investigation Report, Part 1 General Framework, URS, December 2002 (2002f).
- Delineation of Wetlands and Other Jurisdictional Waters of the United States at McClellan Air Force Base, California, RMI, June 2001.
- Final Ecological Risk Assessment for the Initial Parcel CH2M Hill, August 2003 (2003c).

7.5.2 Data Review for OU D Cap

The 2001 and 2002 Annual Inspection reports were reviewed to determine if the cap is being maintained and LUCs are adequate.

7.5.3 Site Inspection for OU D Cap

The site inspection was conducted on 6 May 2003 by MWH. The purpose of the inspections was to assess the protectiveness of the remedy and the integrity of the cap. The cap appears to be in good condition and maintenance records indicate that repairs are made in a timely manner. The fence around the site, the roads, and the cap appear to be well maintained and secure. The inspection form is included in Appendix A.

7.5.4 Interviews for OU D Cap

Interviews were conducted with Mr. S. Mayer, AFRPA representative, and Mr. P. Bernheisel and Mr. S. Burkhard, AFCEE Field Team, on 6 May 2003. No significant problems regarding the site were identified during the interviews. A more comprehensive discussion of LUC/ICs is presented in Section 12. The interview records are included in Appendix B.

7.5.5 Technical Assessment for OU D Cap

In accordance with the Comprehensive Five-Year Review Guidance (USEPA, 2001b), the technical assessment includes the evaluation of the following three questions.

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, risk assumptions, and the results of the site inspections indicate that the remedy is functioning as intended by the RI. The cap has reduced the human health risk posed by the contaminants in the soil and has reduced or eliminated the potential for exposure to site workers and visitors. O&M of the cap has been effective. The most common problems found during the quarterly inspections are vegetation buildup in the drainage ditches, minor cracks in the surface soil on the cap, and well monument damage. According to the site interviews and maintenance records, prompt repairs of the cap ensure that the cap is operating properly and is protective. The cap is fenced and closed to the public. In addition, bollards are located on either side of the access road to prevent driving on the cap (photos in Appendix A). A summary of the progress toward meeting the RAOs for the OU D Cap is presented in Table 7-1.

For the purpose of the Five-Year Review Guidance (USEPA, 2001b), current annual maintenance and monitoring costs for the OU D Cap are approximately $40,000.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

The engineered cap with the liner combined with the SVE and groundwater extraction systems effectively minimize or eliminate the potential for exposure to site contaminants. As an interim measure, soils in CS 4, 6, and 26 were excavated and back-filled with clean soil. Furthermore, excavated materials from CS 4, 6, and 26 were consolidated in areas CS 1, 2, 3, 4, S, A, and T, and these areas were covered with an engineered cap consisting of engineered fill and a geosynthetic membrane to prevent infiltration. An SVE system and groundwater extraction system have also been installed at the property.

There are currently no structures or buildings on the cap. The presence of the engineered cap effectively eliminates direct contact with potentially impacted soils. Therefore, the only potentially complete exposure pathway to COCs at the site is vapor emissions from soil and groundwater into ambient air. Discussion of the SVE system emissions is included in the Vadose Zone Interim Removal Action for VOCs discussion in Section 5.0. Since the site is not currently occupied and access is strictly controlled, the cap is considered to be protective of human health. The final RAO remedy should be established utilizing the most current risk assessment practices and toxicity information.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

An ecological evaluation has not been conducted for the OU D Cap and therefore, the ecological assessment is considered new information that could call into question the protectiveness of the remedy. This evaluation is included below.

Ecological Evaluation

The risk for burrowing animals to be exposed to contamination at the OU D Cap is considered minimal. The cap consists of five layers, which include granular fill, six inches of sand and gravel, 18 inches of compacted clay, a 40-mil plastic membrane, and two to three feet of imported top soil. The cap is also covered with grasses and bare soil. Furthermore, the Air Force is conducting quarterly inspections of the cap that include an evaluation for burrowing animals. These regular inspections also mitigate any potential exposure.

The OU D Cap is considered protective as long as 1) significant habitat or biota of concern cannot contact consolidated soils, 2) the engineered cap over the consolidation area is maintained, 3) man-made structures, pavement, and bare soil continue to dominate the area, and 4) land use continues to be restricted, and appropriate restrictions are in place to prevent exposure. This is consistent with State and Federal guidance, which consider the residual concentrations of constituents, such as those left in OU D soils, as protective providing that 1) significant habitat or biota of concern do not contact soils, 2) contact (exposures) are considered

to be negligible (e.g., biota of concern spend a negligible portion of their time at OU D), and 3) land use continues to be restricted, and appropriate restrictions are in place to prevent exposure.

The OU D cap is located just north of the West Nature Area of McClellan, which contains sensitive habitats and biotic receptors, including seasonal wetlands and vernal pools and swales. The 1995 Basewide Ecological Risk Assessment (ERA) Scoping Report recommended no further ecological investigation for the OU D sites because most of the sites are covered by the OU D Cap, and because the grassland areas not covered by the cap were considered to be only marginal ecological habitat. The scoping report identified the wetlands in the West Nature Area as an "important ecological habitat potentially affected by surface runoff from DP-178 before the emplacement of the OU D environmental cap" (Jacobs Engineering Group [JEG], December 1995).

In 2001, the basewide wetland delineation for McClellan was updated, and several new areas of seasonal wetlands and vernal pools were identified. In 2002, a basewide vernal pool scoping assessment was conducted, using the updated wetland delineation, to identify IRP sites that could be a potential source of contamination to sensitive habitats (seasonal wetlands or vernal pools) via surface water runoff. The assessment concluded that sensitive habitats in the northeast corner of the West Nature Area, as well as two wetlands located north of the cap, could have been affected by surface runoff from IRP sites now covered by the OU D Cap (Personal Communication, Ms. M. Enloe, 25 July 2003).

As part of the basewide vernal pool scoping assessment, the OU D RI report was reviewed to identify which sites in the OU D cap area could have impacted sensitive habitats via surface water runoff. CS 6 and CS 26 are identified in the RI report as the only sites in the cap area that may have had a surface water pathway (the remainder of the OU D sites contain only subsurface contamination). CS 6 and CS 26 have since been excavated and backfilled with clean soil. DP-178 (CS 1) was not identified as having a surface water pathway, and was likely reported as a potential source in the 1995 Basewide ERA Scoping Report due to its proximity to the West Nature Area (Personal Communication, Ms. M. Enloe, 25 July 2003).

The Air Force is currently in the process of conducting a detailed Screening-level/ Tier 1 ecological risk assessment to document the results of the basewide vernal pool scoping assessment and to identify potential ecological risks associated with contaminant concentrations at IRP sites with surface water pathways to sensitive habitats. This ERA, which is described in further detail in Section 13, will include an evaluation of potential ecological risks to vernal pools that may have received runoff from CS 6 and CS 26 prior to the excavation and backfill of these sites. If an ecological risk is identified and remediation of the adjacent sensitive habitat areas is required, the appropriate remedy will be determined in the Ecological Sites ROD. Because there are no remaining surface pathways to ecological receptors from the OU D Cap, the remedy is considered protective.

Technical Assessment Summary

The review of documents, ARARs, results of the site inspections, and the site interviews indicates that the remedy is functioning as intended. No physical conditions have changed at the site that affect the protectiveness of the remedy. In general, the engineered cap is effective at meeting the RAOs developed for OU D.

7.6 ISSUES FOR OU D CAP

There are currently no issues or recommendations for the OU D Cap.

8.0 POTENTIAL RELEASE LOCATION S-033

The following sections provide background information on the PRL S-033 contamination along with a description of the interim removal actions that have been conducted at the site.

The Five-Year Review evaluation discusses the protectiveness of the interim removal actions conducted to satisfy the RAOs detailed in the EE/CA (CH2M Hill, 2000a). Section 8.3 includes an examination of the interim removal actions and Section 8.5 includes an evaluation of the protectiveness of the cleanup levels and a review of the new information that has come to light in the last five years.

8.1 DESCRIPTION AND BACKGROUND FOR PRL S-033

PRL S-033 consists of one bay (Bay "A") which is part of a large warehouse building (Building 786), and the property immediately adjacent to the building on the east, west, and south sides (Figure 8-1, located in the Figures section). The site is located in the northwestern portion of OU B (Figure 8-1). The entire site is approximately 2.5 acres, but the portion of the site where contamination was detected consists of a loading dock on the exterior of the west side of Building 786A and the concrete driveway that leads to an asphalt access road (Roy F. Weston, 2002a, p. 6).

Several drainage depressions and connecting culverts beneath roadways are located west of the loading dock at Building 786A. The building loading docks are in a low area and consist of rectangular-shaped sections of concrete. The concrete seams are not sealed to prevent liquid infiltration (Roy F. Weston, 2002a, p. 6).

Prior to the construction of Building 786 in 1955, the site was undeveloped land west of the existing base boundary. Since its opening, Building 786A has been utilized for a variety of warehousing functions, from 1955 to 1980 the building was used as a chemical and chemical waste storage facility. The building was a collection point for chemical wastes and was used for receiving and distributing chemicals. Materials handled included acids and bases, fuels and oils,

paints, SVOCs, and solvents (Radian, 1995, PRL S-33 p. 1). No reports of spills within the building are available. Currently, Building 786A houses a tenant, Beutler Heating and Air Conditioning (Roy F. Weston, 2002a, p. 6).

The site is highly developed and consists primarily of a loading dock and driveway with unpaved areas on each side. The driveway leads from the building loading dock to an asphalt access road. There is a small grass covered area with picnic tables to the south of the site. Information on the history of the site and on the site conditions is summarized in Table 6-1, located in the Tables section.

8.2 PREVIOUS INVESTIGATIONS FOR PRL S-033

In 1991, Radian Corporation performed a preliminary assessment of sites and PRLs at OU B. This assessment compiled historical information about operations and investigations at PRL S-033, but did not collect soil or soil gas samples. The Preliminary Assessment/Site Investigation identified the site as a PRL because of the shipment of materials to and from the building and the potential for surface spills. Based on a review of these records, the site history, and the inspection of the building floors, there is no reason to suspect the soil beneath the building has been contaminated (Radian, 1991).

PRL S-033 was further investigated during the OU B RI in 1992 and 1993. Soil samples were collected from locations adjacent to the existing loading docks on the east, west, and south sides of the building to determine if soils had been contaminated with metals, total petroleum hydrocarbons (TPH), and SVOCs, including PAHs. The only COCs identified during the RI were PAHs, specifically benzo(a)pyrene, in the surface soil adjacent to the loading dock on the west side of the building. Therefore, PAHs are considered the only COCs (CH2M Hill, 2000a, p. 3-3).

The specific source of the PAHs is not known, but the potential sources include diesel exhaust, a surface spill, or decomposing asphalt. The maximum depth of contamination was estimated to be approximately two feet bgs. Benzo(a)pyrene was the most consistently detected PAH. The

maximum concentration of benzo(a)pyrene detected during the RI was 3.4 mg/kg in surface soil (<1 foot bgs). Other PAHs such as benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-c,d)pyrene were also detected above the 1999 USEPA Region 9 industrial and residential PRGs (CH2M Hill, 2000a, p. 3-3). Table 6-2 presents a summary of the COCs and investigations at PRL S-033.

Preliminary cleanup goals in surface and shallow soils were developed for worker and residential exposure scenarios, assuming direct contact exposure pathways. The exposure pathways to workers and residents considered in developing these goals were soil ingestion, dermal contact with soil, and inhalation of windblown dust or vapor emissions. The PRGs address these exposure pathways and were used as health-based levels to develop preliminary cleanup goals for the protection of human health. Because the PRGs do not include the exposure pathway for homegrown produce and the cumulative risk of multiple COCs, they were used only as guides to determine the initial volume of contaminated soil that had to be removed. Once the removal action was complete, confirmation soil samples were collected. Upon verification that residential PRGs were achieved through sampling and analysis of residual soil, the cumulative residual risk from PAHs was calculated using this analytical data (Roy F. Weston, 2002a, p. 15).

The benzo(a)pyrene Toxicity Equivalency Factor (TEF) approach was used to calculate a single PRG for PRL S-033. This method calculates the carcinogenicity of a mixture of PAHs relative to the carcinogenicity of benzo(a)pyrene using Relative Potency Factors (RPFs) found in the U.S. EPA *Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons* (USEPA, 1993). Benzo(a)pyrene is used because it is the best studied PAH. For the purpose of the removal action at PRL S-033, a single PRG benzo(a)pyrene [B(a)P] equivalent concentration of 0.062 mg/kg was calculated.

Furthermore, modeling results indicated that the contaminants at the site will not pose a threat to groundwater or surface water. PRL S-033 contains marginal quality habitat and was recommended for no further ERA (CH2M Hill, 2000a, p. 2-2).

8.3 INTERIM REMOVAL ACTION FOR PRL S-033

In 2001, approximately 608 cubic yards of contaminated soil with PAH levels above the benzo(a)pyrene equivalent concentration of 0.062 mg/kg were excavated and removed from PRL S-033. Confirmation sampling was conducted which verified that all soils with PAH levels above the 1999 residential PRG were removed. A final human health risk assessment was performed which verified that the cumulative residual cancer risk from PAHs is less than $1x10^{-6}$ and that the non-cancer HI is less than 1. Therefore, the site has been cleared for unrestricted land use (Roy F. Weston, 2002a, p. 22*)*.

8.4 PROGRESS SINCE 1999 FIVE-YEAR REVIEW FOR PRL S-033

This is the first Five-Year Review for the site.

8.5 FIVE-YEAR REVIEW PROCESS FOR PRL S-033

The Five-Year review process for the PRL S-033 removal action consists of document review, data review, interviews, and technical assessment. Each of these areas is described in detail in the following sections.

8.5.1 Document Review for PRL S-033

This Five-Year Review consisted of a review of the following documents:

- Non-VOC EE/CA Document and Work Plan for PRL S-033, CH2M Hill, June 2000 (2000a).
- Interim Basewide RI Part 2B: Operable Unit B, Remedial Investigation Characterization Summaries, Radian Corporation, December 1995.
- Final Workplan for Removal Action at PRL S-033, Roy F Weston, Inc, February 2001 (2001b).
- Final Removal Action Report for Site PRL S-033, Roy F Weston, Inc, April, 2002 (2002a).

- Basewide Ecological Risk Assessment Scoping Summary Status Report, JEG, December 1995.
- Interim Basewide Remedial Investigation Report, Part 2C – Site Characterization Summary/Field Sampling Plan and Remedial Investigation Characterization Summaries, Radian Corporation, August 1997 (1997a).
- Interim Basewide Remedial Investigation Report, Operable Unit C, Volume 14 URS, September 2000 (2000b).
- Draft Basewide Remedial Investigation Report, Part 1 General Framework URS, Revision 2, December 2002 (2002f).
- Delineation of Wetlands and Other Jurisdictional Waters of the United States at McClellan Air Force Base, California, RMI, June 2001.
- Final Initial Parcel Feasibility Study 1 (7 Sites), Volume 1, CH2M Hill, August 2003 (2003b).

8.5.2 Data Review for PRL S-033

The confirmation sample results in the Removal Action Report indicate that all contaminated soil was removed and the site is cleared for unrestricted access.

8.5.3 Site Inspection for PRL S-033

Since the site has been cleared for unrestricted land use and no ongoing controls are in place, no site inspection was conducted.

8.5.4 Interviews for PRL S-033

Interviews were conducted with various parties connected to the site. Mr. S. Mayer, AFRPA representative, and Mr. P. Bernheisel and Mr. S. Burkhard, AFCEE Field Team, were interviewed on 6 May 2003. No significant problems regarding the site were identified during the interviews. Completed interview forms are included in Appendix B.

8.5.5 Technical Assessment for PRL S-033

In accordance with the Comprehensive Five-Year Review Guidance (USEPA, 2001b), the technical assessment includes the evaluation of the following three questions.

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, and risk assumptions indicates that the remedy is functioning as intended by the EE/CA. The PAH contaminated soil was removed from the site, and the site was cleared for unrestricted land use. Closure activities removed contaminated soil to the RAOs outlined in the EE/CA. PRL S-033 is currently recommended for unrestricted use because the reported concentrations of metals are less than screening levels or are believed to be representative of background, and PAH contamination was excavated and removed from the site (CH2M Hill, 2003b). A summary of the interim removal action progress toward meeting the RAOs developed for PRL S-033 is presented in Table 8-1.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

The exposure assessment considered current and future potential receptors including on-site commercial workers and hypothetical future residents. No changes have occurred that affect the protectiveness of the remedy at PRL S-033.

There have been no substantial changes to the USEPA toxicity criteria since the initial assessment of risk at the property. The only change of note has been the use of oral cancer slope factors as inhalation cancer slope factors. This has resulted in a two-fold increase in the applied cancer slope factor. However, because the inhalation risk presents less than 1% of the total risk across all pathways, as noted in Table 5-7 of the original PRL S-033 Removal Action Report (Roy F. Weston, 2002a), the change in cancer slope factor has no effect. Consequently, no changes have occurred that affect the protectiveness of the RAOs for PRL S-033.

A post remediation risk assessment demonstrated that residual risks from PAHs were less than 1×10^{-6} and residual hazards were less than 1.0. The minor changes that have occurred in the PAH toxicity criteria discussed above will not significantly affect this conclusion.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new information has come to light that would question the protectiveness of the remedy.

An ecological risk assessment was not conducted for PRL S-033 because it was determined that the site contained minimal habitat. PRL S-033 is located within a drainage area that conveys storm water runoff to the OU B1 drainage ditches. Soil contamination at PRL S-033 was removed in 2001, and the site was backfilled with clean soil to a depth of three feet bgs. Given the fact that soil contamination at site PRL S-033 has been removed to three feet bgs, there is no longer a potential source or pathway for contamination to the OU B-1 Drainage Ditches. All contaminated sediments were removed from the OU B1 Ditch as part of the 2002/2003 removal action for that site. No new sensitive habitats were identified in the vicinity of PRL S-033 as a result of the 2002 basewide delineation update (Personal Communication, M. Enloe, 25 July 2003). Therefore, no additional ecological investigation or risk assessments are recommended for the site. A more detailed discussion of the ecological issues at McClellan is included in Section 13.

Technical Assessment Summary

The review of documents, ARARs, and the confirmation sample results indicate that the remedy was successful. There have been no changes in the site conditions (exposure pathways) or in exposure parameters that would affect the overall conclusions of the risk assessment or the derivation of the soil RAOs (USEPA Region 9 PRGs). There have been no changes in risk assessment procedures that would affect the protectiveness of the remedy.

8.6 ISSUES FOR PRL S-033

There are no issues or recommendations for PRL S-033.

9.0 POTENTIAL RELEASE LOCATION 32

The following sections provide background information on the PRL 32 contamination along with a description of the interim removal actions that have been conducted. The Five-Year Review evaluation discusses the protectiveness of the interim removal action conducted to satisfy the RAOs detailed in the EE/CA (Radian, 1999b). Section 9.5.5 includes an examination of the success of the interim removal action, an evaluation of the protectiveness of the cleanup levels, and a review of the new information that has come to light in the last five years.

9.1 DESCRIPTION AND BACKGROUND FOR PRL 32

PRL 32 is located in OU C, within IC 11, which is in the western portion of McClellan (Figure 9-1, located in the Figures section). PRL 32 is an open field, approximately a half acre, bordered on the north by the clean soils holding area including PRL 55 and the former gas station, on the southeast by surface storage area PRL 56, and on the west by Patrol Road and Magpie Creek (Radian, 1999b, p. 1-2). The anticipated future land use is expected to be commercial or industrial.

The site consists of a former hazardous waste and low-level radioactive waste storage area used between 1956 and 1978. Wastewater used in decontaminating aircraft was stored at the site until samples were analyzed for radioactivity. The water was then discharged at a rate based on the level of radioactivity detected in the water; the point of discharge is unknown. A concrete slab (approximately 50 feet by 50 feet) once covered a portion of the southwestern area of the site. This slab has since been covered with approximately three to six inches of soil. It is assumed that containers storing waste were stored on this concrete pad. In addition, in the 1970s, a station wagon containing an unknown quantity of mercury reportedly was stored at the site for two years (URS, 2002g, PRL 32, p. 6). Table 6-1, located in the Tables section, presents a summary of the site conditions and background.

9.2 PREVIOUS INVESTIGATIONS FOR PRL 32

In 1985, an investigation of potential contamination at PRL 32 was performed, which included a total of 18 borings. Although identifiable wastes or fill materials were not encountered, the maximum concentration of any contaminants in soil were VOCs [550 micrograms per kilogram (µg/kg)], SVOCs (940 µg/kg), and oil and grease (440 mg/kg). In 1993, a preliminary assessment of sites and locations in OU C was conducted which included records review, site visits, and interviews with base personnel. It was determined that PRL 32 was not a significant source of soil or groundwater contamination (Radian, 1999b, p. 1-6).

An RI was conducted at PRL 32 in two phases: Phase 1 was conducted from August 1994 through January 1995; and Phase 2 was conducted between September and November 1997. The investigation consisted of drilling 23 hand augers and one shallow boring, collecting four downhole soil gas samples, and surface scanning for gamma radiation. Analyses of the data collected during the RI indicate that there is no mercury contamination, but that soil is contaminated with radium 226 and its daughter products (Ra 226+D). Other chemicals were detected at low levels in soil and soil gas, but were determined to be below thresholds for further action, or, in the case of soil gas, have migrated through the vadose zone from another site (URS, 2002g, p. 24-25). Total petroleum hydrocarbons (gasoline range) (TPH-g) and TCE were detected in soil gas in the central portion of PRL 32 (URS, 2002g, p. 1). COPCs included radium 226 in soil, TCE in soil gas, TPH-g in soil gas, and copper in soil. Radium 226 was the only identified COC. Table 6-2 presents a summary of the previous investigation and the COCs for PRL 32.

Results of the RI indicated radium 226 contamination at PRL 32 extending from the surface soil to a depth of approximately five feet bgs. Radium 226 concentrations were defined laterally but not vertically at six sample locations, though data show decreasing radium 226 concentrations with depth. RI results indicated that the contamination was the result of a surface release (URS, 2002g, p. 23).

9.3 INTERIM REMOVAL ACTIONS FOR PRL 32

The chosen removal action for PRL 32 was an interim action consisting of excavation and off-site disposal of radium 226 contaminated soils exceeding 2.0 picoCuries per gram (pCi/g). As of spring 2002, the soil excavation had been completed. However, following the discovery of plutonium at CS 10 (see Section 10), the soil waste bins at PRL 32 were sampled and a small detection of plutonium (<1 pCi/g) was discovered in the bins (Personal Communication, Mr. D. Green, 31 July 2003). The presence of plutonium was not expected for this site. Currently a sampling plan is being prepared to sample the open excavation at PRL 32 for plutonium.

Following the final status survey of the site for radium and plutonium, a final determination of excess cancer risks will be performed using the radium 226 and plutonium concentrations from the post action verification samples. The final cleanup action will be addressed in the forthcoming Non-VOC FS and ROD (Radian, 1999b, p. ES-7).

The issues of concern at PRL 32 are human health risks associated with exposure to radiation from radium 226, plutonium 238/239 and its daughter products. The radium 226 cancer risk (commercial scenario) at PRL 32 prior to excavation was 2.5 X 10^{-4} (Radian 1999b, p. 1-37). Ecological risk was not considered during the RI because the site was determined to lack sufficient ecological habitat. Additionally, the section of Magpie Creek adjacent to the site was not identified as sensitive habitat because it is entirely lined with concrete. The potential for radium 226 contamination of groundwater beneath the site is low due to both the depth to existing groundwater at McClellan and the chemical properties of Ra 226+D (Radian, 1999b, p. 1-33).

9.4 PROGRESS SINCE 1999 FIVE-YEAR REVIEW FOR PRL 32

This is the first Five-Year Review for this site.

9.5 FIVE-YEAR REVIEW PROCESS FOR PRL 32

The Five-Year review process for the PRL 32 interim removal action consists of document review, data review, a site inspection, interviews, and technical assessment. Each of these areas is described in detail in the following sections.

9.5.1 Document Review for PRL 32

This Five-Year Review consisted of a review of the following documents:

- Interim Basewide RI Report, OU C – RI Characterization Summaries and Addenda, URS, May 2002 (2002g).
- CS 10 and PRL 32 Engineering Evaluation/Cost Analysis, Radian International, September 1999 (1999b).
- CS 10 and PRL 32 Removal Action Memorandum for Soil Removal, Radian International, May 2000 (2000b).
- CS 10 and PRL 32 Removal Action Workplan, Radian International, July 2000 (2000a).
- Basewide Ecological Risk Assessment (ERA) Scoping Summary Status Report, JEG, December 1995.
- Interim Basewide Remedial Investigation Report, Part 2C – Site Characterization Summary/Field Sampling Plan and Remedial Investigation Characterization Summaries, Radian Corporation, August 1997 (1997a).
- Draft Basewide Remedial Investigation (RI) Report, Part 1 General Framework URS, December 2002 (2002f).
- Delineation of Wetlands and Other Jurisdictional Waters of the United States at McClellan Air Force Base, California, RMI, June 2001.

9.5.2 Data Review for PRL 32

Analytical data collected during the RI were evaluated to determine the remaining risk if all concentrations above 2 pCi/g were removed from the site. Results of data collected following the radium excavation activities were not available. A final closure report will be submitted following completion of the final status survey.

9.5.3 Site Inspection for PRL 32

The site inspection was conducted on 6 May 2003 by MWH. The purpose of the inspection was to assess the current site conditions. The open excavation is covered with plastic sheeting to eliminate the potential for surface water contact with the soil. The plastic is secured to prevent wind from moving the plastic and water was observed ponding on the plastic sheeting. The area is surrounded by a locked fence and signs indicating the potential for radioactive material. The site inspection form is included in Appendix A.

9.5.4 Interviews for PRL 32

Interviews were conducted with Mr. D. Green, AFRPA representative, and Mr. C. Gray, URS Site Manager, on 6 May 2003. No significant problems regarding the site were identified during the interviews. The completed interview forms are included in Appendix B. A more comprehensive discussion of LUC/ICs is presented in Section 12.

9.5.5 Technical Assessment for PRL 32

In accordance with the Comprehensive Five-Year Review Guidance (USEPA, 2001b), the technical assessment includes the evaluation of the following three questions.

Question A: Is the remedy functioning as intended by the decision documents?

The purpose of the remedy was to excavate soil contaminated with radium 226 above 2 pCi/g. However, the final status survey has not been conducted to verify that all radium 226 contaminated soil has been removed. This question will be answered following confirmation sampling conducted as part of the final status survey. Confirmation sampling will also be conducted for plutonium, and a final determination of excess cancer risks will be performed using the radium 226 and plutonium concentrations from the post action verification samples. Until the final status survey can be completed and the excavation backfilled, the site is secured

by a locked fence and covered with plastic sheeting. A summary of the progress of the interim removal action at meeting the RAOs is presented in Table 9-1.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

The site is not currently used and there are no human health receptors at the site; therefore, there is no information that calls into question the protectiveness of the interim remedy for human health.

The exposure assessment conducted during the 2002 RI considered exposure to radium 226 of current and future potential receptors including on-site commercial workers and hypothetical future residents (URS, 2002g*)*. There have been no changes in the exposure pathways that would affect the overall conclusions of the risk assessment. However, a change has occurred in the methodology of assessing risks from radionuclides, which reduces the conservatism of the external dose calculations (see Appendix C). Furthermore, additional assessment pathways have been added to the radionuclide assessment methodology, which includes assessment of radionuclides in agricultural soils. Future site use does not include agriculture, so this change of risk assessment procedure does not appear significant for this site. There have also been several changes to the toxicity criteria since the initial assessment of risk at the property (Appendix C). Overall, the CSFs have become more conservative, although the increase is considered moderate.

USEPA recently released radionuclide PRGs (USEPA, 2003a) with the changes in the toxicity and exposure assumptions discussed above. Based upon these PRGs, the changes in toxicity criteria and risk assessment methods should have no effect on the overall protectiveness of the interim remedy for radionuclides given the current land use, as well as the future potential industrial land use. The outdoor worker soil PRG for radium 226 and associated decay chain (daughter products; Ra 226+D) is 0.0255 pCi/g at a 10^{-6} cancer risk level. Indoor worker PRG for Ra226+D is 0.0573 pCi/g at 10^{-6}. At a 10^{-4} risk level, these values are 2.55 pCi/g and 5.73 pCi/g, respectively. Based upon these PRGs and for the current industrial land use, the cancer risks associated with 2 pCi/g of radium 226 for outdoor workers and indoor workers are 8×10^{-5}

and 3 x 10^{-5}, respectively. Therefore, the current remedy is considered protective for the current industrial land use.

In terms of future potential residential land uses, the residential PRG for Ra226 +D has increased 100% from 0.0062 pCi/g to 0.0124 at a 10^{-6} cancer risk levels, and to 1.24 pCi/g at a 10^{-4} cancer risk level, respectively. Based upon this PRG, the estimated incremental upper-bound lifetime cancer risk associated with a future potential resident is 2 x 10^{-4} for a proposed cleanup level of 2 pCi/g. Appropriateness of final RAOs should be ensured following the final status survey to demonstrate that the site average of radium 226 concentrations do not exceed the interim action level. Such information will assist in the determination that the total risk to the intended site-reuse receptors (commercial) is within the acceptable risk range.

It should also be noted that plutonium was recently discovered in the PRL 32 area. Evidence obtained via the site reconnaissance and interviews (Appendix B) indicates that the current levels of plutonium discovered are less than 1.0 pCi/g. The outdoor worker, indoor worker, and residential PRGs for plutonium 238 are 16.4, 29.7, and 2.97 pCi/g, respectively, at a 10^{-6} cancer risk level (USEPA, 2003a). The outdoor worker, indoor worker, and residential PRGs for plutonium 239 are 14.3, 25.9, and 2.59 pCi/g, respectively, at a 10^{-6} cancer risk level (USEPA, 2003a). Therefore, estimated upper-bound lifetime incremental cancer risks associated with potential exposures to 1 pCi/g concentration of plutonium 238 or plutonium 239 would be below the risk range of 10^{-6} to 10^{-4} under current industrial or future potential residential conditions. Exposures associated with concentrations less than 1 pCi/g of plutonium 238 or plutonium 239 should not pose an unacceptable cancer risk. It should be noted that this evaluation should be verified once site plutonium levels have been determined. Plutonium was detected at low concentrations in the heavily worked soil waste pile which may not be indicative of site plutonium levels.

Although VOC and TPH-g contamination at PRL 32 was determined in prior risk assessments to be below thresholds for further action, current methodologies and criteria were evaluated during this Five-Year Review evaluation. A change has also occurred in the methodology currently recommended for VOC assessment of soil, soil gas and groundwater vapor migration to indoor

air (USEPA, 2002a; Appendix C). The methodologies utilized in the 1993 risk assessment are not consistent with currently advocated methods (USEPA, 2002a) and are likely to be less conservative than the methods currently recommended.

There is a newly proposed CSF for TCE of 0.04, whereas the previous CSF in 1999 was 0.006. Based on results of indoor air modeling (see Appendix C) using the maximum measured concentration of TCE, the total theoretical upper-bound incremental lifetime cancer risk estimates were within the acceptable cancer risk range of 10^{-6} to 10^{-4} and below an HI of 1.0. Therefore, the implementation of a new CSF for TCE will not change conclusions of the interim RAO for TCE (i.e., TCE is not a COC for the interim RAO). Furthermore, although TPH-g was detected in soil gas, the most toxic components of this TPH class (benzene, toluene, ethylbenzene, and xylenes) do not appear to have been detected. Therefore, any changes to the risk assessment methodology are unlikely to change the conclusions that TPH-g in soil gas is not a COC.

Because the site is not currently used and there are no human health receptors at the site, there is no information that calls into question the protectiveness of the interim remedy for human health. This conclusion should be re-evaluated based upon the final land use selected for the property when the final remedy for the site is chosen.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new information has come to light that might call into question the protectiveness of the remedy.

Ecological Evaluation

An ERA was not conducted for PRL 32 because the 1995 Basewide ERA Scoping Report determined that the site contained only marginal habitat. In 2001, the wetland delineation for McClellan was updated, and two new vernal pools were identified in the open field south of PRL 32. A basewide vernal pool scoping assessment was conducted in 2002, using the new wetland

delineation mapping, to identify IRP sites that could be a potential source of contamination to sensitive habitats (seasonal wetlands or vernal pools) via surface water runoff. The assessment concluded that the two vernal pools south of PRL 32 could have been affected by surface runoff from the site (Personal Communication, Ms. M. Enloe, 25 July 2003).

The Air Force is currently preparing a detailed Screening-level/ Tier 1 ecological risk assessment to document the results of the basewide vernal pool scoping assessment and to identify potential ecological risks associated with contaminant concentrations at IRP sites with surface water pathways to sensitive habitats. This ERA, which is described in further detail in Section 13, will include an evaluation of potential ecological risks to vernal pools that could have been impacted by surface water runoff from PRL 032. If an ecological risk is identified and remediation of the vernal pools is required, the appropriate remedy will be determined in the Ecological Sites ROD. The final RAOs developed for PRL 032 should ensure that surface contamination is not left in place at levels that could impact adjacent sensitive habitats.

In addition to the two vernal pools south of PRL 32, Magpie Creek runs along the western border of PRL 32. This portion of Magpie Creek is heavily engineered and the bottom of the creek is lined with concrete. However, downstream portions of Magpie Creek (in the West Nature Area) are not heavily engineered and support natural freshwater aquatic habitat and biota. Remedial actions or other ground-disturbing activities have the potential to release sediment-bound constituents to the creek, which could then be transported to the West Nature Area and impact sensitive habitats and receptors. To address this possibility, surface water modeling was conducted and is reported in the Interim Basewide Remedial Investigation Report (URS, 2000b). The surface water modeling of radium 226 at PRL 32 indicated that the surface water criteria for protection of Freshwater Aquatic Organisms would not be exceeded in the annual runoff reaching the boundary of the site.

Technical Assessment Summary

The review of documents, ARARs, and the results of the site inspection indicate that the remedy is functioning as intended by the Workplan (Radian, 2000a*)*. The excavation was successful at meeting the RAOs, based on preliminary sampling for radium 226. There have been no changes

in the site conditions (exposure pathways) that would affect the overall conclusions of the risk assessment and there are no changes in toxicology or methodology that call into question the protectiveness of the interim remedy. It is recommended that the final confirmation sampling and evaluation of plutonium be carried out as soon as practical to expedite backfilling of the excavation.

9.6 ISSUES FOR PRL 32

The pending actions and recommendations for PRL 32 are summarized below:

Pending Action	Impact	Plan in Place to Address Issue? (Y/N)	Is Plan Protective Short-Term? (Y/N)	Is Plan Protective Long-Term? (Y/N)	Possible Issue that Could Affect Future Protectiveness (Y/N)
Complete the sampling and evaluation to determine if the remaining soil contains concentrations of plutonium, complete final status survey, and restore the site (See Section 9.5.5).	Potential exposure to public and environment.	Y	Y	Y	N

10.0 TIME CRITICAL REMOVAL ACTION AT CONFIRMED SITE 10

The following sections provide background information on the CS 10 contamination along with a description of the interim removal actions that have been conducted. The Five-Year Review evaluation discusses the protectiveness of the interim removal actions conducted to satisfy the RAOs detailed in the TCRA Workplan (URS, 2001d). Section 10.3 includes an examination of the interim removal actions and Section 10.5.5 includes an evaluation of the protectiveness of the cleanup levels and a review of the new information that has come to light in the last five years.

10.1 DESCRIPTION AND BACKGROUND FOR CS 10

CS 10 is one of five inactive disposal pits located in the northern portion of OU C (Figure 10-1, located in the Figures section). The CS 10 disposal pit was used from approximately 1949 to the mid-1960s for the disposal of industrial waste and ash, and burn residues from waste incinerated elsewhere at McClellan (URS, 2002g, p. 2-5).

CS 10 is approximately 2 acres and the former disposal pit varies in depth from approximately 10 to 25 feet bgs. The site consists of a flat, mostly unpaved area with minimal vegetative cover. Groundwater at the site is located approximately 105 feet bgs. CS 10 drains to a seasonal creek that connects to Don Julio Creek (AFBCA, 2000, p. 1).

There are no residences within a one-mile radius of CS 10. However, the Air Force has an industrial complex within a half-mile radius. These facilities are being turned over to the County of Sacramento LRA through the reuse process. Table 6-1, located in the Tables section, presents a summary of the site conditions and history for CS 10 (combined with other McClellan interim removal/remedial actions).

10.2 PREVIOUS INVESTIGATIONS FOR CS 10

The 1993 preliminary assessment of sites at OU C recommended that CS 10 be further investigated. In 1994, a chain-link fence was installed around the area to limit access because

radiological contamination was discovered during previous investigations. An RI was conducted in 1998 and the results indicated the waste pit contained buried metal, including buried drums (some with radiation warning placards). Contaminants of Concern (COCs) were identified as radium 226, VOCs, SVOCs, PAHs, dioxins/furans, PCBs, pesticides, TPH-D, and metals. A data gap investigation was conducted in 1998 to establish the lateral extent of the disposal pit boundaries (URS, 2001d, p. 2-4 to 2-8). Table 6-2 presents a summary of the investigations and COCs at CS 10.

10.3 INTERIM REMOVAL ACTIONS FOR CS 10

A non-TCRA began in August 2000 and continued until September 2000. These removal activities included:

- Removal of 480 cubic yards of soil.
- Excavation of 109 55-gallon drums containing glass and plastic laboratory items, laboratory equipment, and radium commodities.
- Excavation of one 20-gallon drum containing vials and bottles labeled plutonium (Pu).

The interim removal action was halted on 6 September 2000, when a 20-gallon drum was discovered containing bottles and vials marked with the chemical symbol for Pu. Following this discovery, the Air Force, USEPA, and the State of California concurred that the entire CS 10 site should be removed, and the removal action was changed to time critical (URS, 2001c, p. 4 through 9).

The TCRA began in December 2000. The removal action objectives for the TCRA at CS 10 include (URS, 2001d):

- Reduce the final site radionuclides, non-VOC, and inorganic species to concentration levels that are protective of human health and the environment, as developed in the Final Status Survey Field Sampling Plan and agreed to by stakeholder regulatory agencies. The Final Status Survey Field Sampling Plan (to be developed at a later date) will include a determination of background concentrations of radionuclides not addressed in the Background Survey for Radionuclides Report (Radian, 2000d). The CS 10 Final Status Survey Field

Sampling Plan will be developed in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (USEPA, 2000a).

- Removal of disposal pit debris.
- Removal of drums potentially contaminated with radiological waste.
- Off-site disposal of all materials removed.
- Removal of all waste material in the CS 10 disposal pit so that the site can be designated No Further Action (NFA) and exempted from the reuse restrictions normally associated with landfills (URS, 2001d, p. 1-2).

A weatherization tent covering the entire CS 10 was completed in November 2001 as part of the mobilization activities for the TCRA. This tent was constructed to prevent rain and rainwater run-on from entering the disposal pit. The tent is 204-feet wide, 630-feet long and 66-feet high. The tent allows for year-round operations in a dry environment sheltered from the wind and rain. A drainage system was also constructed around the tent to convey rainwater away from the site and to prevent a storm surge from impacting the adjacent seasonal creek (URS, 2002e, p. 3).

A chain link perimeter fence topped with barbed wire restricts access to the site. All access gates are locked and only site personnel with badges are allowed to enter the site unescorted. Given the radiological material at the site, security at the site during off-hours, 7 days a week, is provided by the Sacramento County Sheriff's Department (URS, 2002e, p. 7).

The status of the removal action at CS 10 through 31 July 2003 is summarized below (Personal Communication, Mr. D. Green, 14 August 2003).

- 501 drums were excavated and were generally found to be in poor condition.
- Radiological air samples inside and outside the containment area were all within regulatory compliance levels.
- 28,575 cubic yards of soil have been excavated and sent to off-site disposal.
- Several practice bombs and one practice land mine were found in the excavation. None of these item contained explosives.
- 22,953 cubic yards of soil have been stockpiled inside the tent since November 2002.

Because of funding shortfalls, the Air Force revised the TCRA to include excavation and stockpiling of the soil and debris rather than transport and disposal. Disposal of removed drums will continue; however, the soil will be stockpiled inside the tent until funding becomes available. The stockpiling began in November 2002 (AFRPA, 2002f).

10.4 PROGRESS SINCE 1999 FIVE-YEAR REVIEW FOR CS 10

This is the first Five-Year Review for this site.

10.5 FIVE-YEAR REVIEW PROCESS FOR CS 10

The Five-Year review process for the CS 10 interim removal action consists of document review, data review, a site inspection, interviews, and technical assessment. Each of these areas is described in detail in the following sections.

10.5.1 Document Review for CS 10

This Five-Year Review consisted of a review of the following documents:

- Interim Basewide RI Report, Part 2C (Northern) – RI Characterization Summaries for Investigation Clusters IC 17, IC 19, and IC 21, Radian Corporation, January 1998.
- CS 10 and PRL 32 Engineering Evaluation/Cost Analysis, Radian Corporation, September 1999 (1999b).
- CS 10 and PRL 32 Removal Action Memorandum for Soil Removal, Radian Corporation, May 2000 (2000b).
- CS 10 and PRL 32 Removal Action Workplan, Radian Corporation, July 2000 (2000a).
- Action Memorandum for Confirmed Site 10, AFBCA, November 2000.
- Removal Action Work Plan for CS 10 TCRA, URS, July 2001 (2001d).
- Non-Time Critical Removal Action Completion Report for CS 10, URS, September 2001 (2001c).

- Removal Action Work Plan Addendum for CS 10 Time Critical Removal Action, URS, December 2001 (2001b).
- Interim Basewide Remedial Investigation Report, OU C – Remedial Investigation Characterization Summaries and Addenda, URS, May 2002 (2002g).
- Removal Action Work Plan for CS 10 Time Critical Removal Action, Addendum No. 2, URS, November 2002 (2002e).
- Restoration Advisory Board Meeting Cleanup Update, 12 December 2002, AFRPA, 2002 (2002f).
- CS 10 TCRA, Quarterly Status Report, Third Quarter 2002 (July through September), URS, January 2003 (2003i).
- Basewide Ecological Risk Assessment (ERA) Scoping Summary Status Report, JEG, December 1995.
- Interim Basewide Remedial Investigation Report, Part 2C – Site Characterization Summary/ Field Sampling Plan and Remedial Investigation Characterization Summaries, Radian Corporation, August 1997 (1997a).
- Draft Basewide Remedial Investigation Report, Part 1 General Framework URS, December 2002 (2002f).
- Delineation of Wetlands and Other Jurisdictional Waters of the United States at McClellan Air Force Base, California, RMI, June 2001.

10.5.2 Data Review for CS 10

The air sampling data collected during the excavation was reviewed for environmental and site worker protectiveness. To verify that there is no airborne radioactivity, four 24-hour air monitoring stations have been located around the perimeter of the site. Air samples are collected once weekly and are analyzed for beta-gamma and alpha radiation levels using a Ludlum model 2929 with a Ludlum Model 43-10-1 alpha and beta scintillation detector. The samples are held for 24 hours to permit the decay of naturally occurring radioactive material prior to analysis. Ongoing monitoring has shown no radiological migration, exposure, or airborne radioactivity that would affect worker or public safety. All site workers have current hazardous waste operator (40 hour Hazardous Waste Operation and Emergency Response [HAZWOPER]) training and radiation safety training. Prior to entering the exclusion zone, all personnel are issued thermoluminescent dosimeters (TLD) to monitor external exposure to ionizing radiation. Additionally, surface water in the drainage ditches is also sampled for metals and radiation.

Monitoring reports were reviewed to determine that there have been no exceedences or exposures to the public or the environment.

10.5.3 Site Inspection for CS 10

The site inspection was conducted on 6 May 2003 by MWH. The purpose of the inspections was to assess the current site conditions. The excavation is covered with a weatherization tent to eliminate the potential for surface water contact with the soil, and the area is surrounded by a locked fence and signs indicating the potential for radioactive material. A summary of the site inspection is included in the checklist in Appendix A.

10.5.4 Interviews for CS 10

Interviews were conducted with Mr. D. Green, AFRPA representative, Mr. R. Lidstrom, URS Project Manager, and Mr. C. Gray, URS Site Manager, on 6 May 2003. No significant problems regarding the site were identified during the interviews. Interview records are contained in Appendix B. A more comprehensive discussion of LUC/ICs is presented in Section 12.

10.5.5 Technical Assessment for CS 10

In accordance with the Comprehensive Five-Year Review Guidance (USEPA, 2001b), the technical assessment includes the evaluation of the following three questions.

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, risk assumptions, and the results of the site inspections indicate that the remedy is functioning as intended by the TCRA Workplan (URS, 2001d). The current remedy includes the excavation of disposal pit debris until the site is visually clean. Interim cleanup levels were established in the Work Plan and will be updated in the Final Status Survey Field Sampling Plan. Final cleanup goals will be established in the ROD. The ongoing excavation beneath the weatherization tent with the security measures and ongoing air

monitoring are functioning as intended in the TCRA Workplan and addenda. A summary of the progress of the interim removal action at meeting the RAOs is presented in Table 10-1.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

The exposure assessment is considered current and still valid for future potential receptors including on-site commercial workers and hypothetical future residents. There have been no changes in the site conditions (exposure pathways) that would affect the overall conclusions of the risk assessment. Some changes have occurred in radionuclide exposure assessment and toxicity values; however, no compound-specific RAOs are currently being implemented for non-radionuclides or radionuclide compounds.

The current interim removal action is based on excavation of radionuclide, non-VOC, and inorganic species contaminated soil to concentrations that will be determined in the Final Status Survey Field Sampling Plan. Until the final cleanup levels are determined, interim removal activities should be protective of current potential on- and off-site receptors because control measures are currently in place at the site. These control measures are evaluated below. According to an interview with Mitretek (Mr. B. Walser, 2003 interview, Appendix B), final RAOs for soils will be based on site-specific risk assessments including the most recent risk assessment methods, models, and toxicity criteria.

During implementation of the interim RAOs for CS 10, a number of control measures are being implemented to protect public and worker health. These control measures include:

- Monitoring emissions from the site to determine whether emissions from the weatherization tent exceed background. If emissions exceed background, mitigation measures will be employed. Based upon the site visit and interviews (Appendices A and B), no exceedances of background have occurred.
- All workers are required to wear level C protective equipment during excavation activities. Utilization of level C protective equipment should reduce or remove direct contact exposures, and eliminate dust exposures (workers wear a combination of organics/high efficiency particulate air [HEPA] filters on their

respirators), thereby mitigating or removing exposures to non-VOC compounds (dioxins, pesticides, metals, SVOCs, etc). However, during the handling of the drums workers will upgrade to Level B.

- All workers undergo routine medical and personal airspace monitoring to identify potentially unacceptable exposures. Based upon the site visit and interviews (Appendices A and B), no unacceptable exposures have been reported.
- Volatile constituents in soil gas appear to be below levels of concern for indoor air, based on screening level Johnson and Ettinger modeling which uses a residential scenario. Based upon a site-specific soil type (sandy loam), and default model values for other soil parameters, the total theoretical upper-bound incremental lifetime cancer risk estimates associated with the maximum detected soil gas value was well within the acceptable cancer risk range of 10^{-6} to 10^{-4}. Therefore, it is concluded that potential exposures to workers are less conservative than the residential exposures estimated using the Johnson and Ettinger model and are also within the acceptable risk range.
- The exposure time of all workers is monitored and limited to prevent unacceptable exposures to radionuclides.
- The site is secured and no non-essential personnel or trespassers may access the site.

These measures appear to be reasonable for the protection of human health and the environment pending completion of the interim removal action.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new information has come to light that might question the protectiveness of the remedy.

Ecological Evaluation

An ecological evaluation was not conducted for CS 10 because the 1994 Basewide ERA Scoping Report determined that the site contained only marginal habitat. In 2001, the wetland delineation for McClellan was updated, and several new areas of seasonal wetlands and vernal pools were identified. A basewide vernal pool scoping assessment was conducted in 2002 (Personal Communication, Ms. M. Enloe, 25 July 2003) using the new wetland delineation mapping, to identify IRP sites that could be a potential source of contamination to sensitive habitats (seasonal wetlands or vernal pools) via surface water runoff. The assessment concluded that there were no

vernal pools or seasonal wetlands that could have been affected by surface runoff from CS 10 (Personal Communication, Ms. M. Enloe, 25 July 2003).

A seasonal creek that drains to Don Julio Creek is located along the southern side of the CS 10 site. This seasonal creek contains limited wetland habitat; however, the downstream section of Don Julio Creek in the West Nature Area is considered a sensitive biological resource area because it provides habitat for a variety of wetland and riparian-associated species, including the federally threatened giant garter snake. Because contaminants at CS 10 occur at depths from approximately 10 to 25 feet bgs, there is no surface water pathway of exposure from subsurface contaminants to the adjacent drainage. However, removal activities could result in the exposure of CS 10 contaminants to surface water if the excavation area and stockpiled materials are not properly protected and contained.

As discussed above, a weatherization tent covers the entire CS 10 site to prevent rain and rainwater run-on from entering the disposal pit. A drainage system was constructed around the tent to convey rainwater away from the site and to prevent a storm surge from impacting the adjacent seasonal creek. Contaminated soils excavated from the site are being containerized and stored inside the tent until funding is available for transport and disposal. Ongoing site monitoring includes sampling in the adjacent drainage ditches for metals and radionuclides. Based on the site visit and interviews, no exceedances of background have occurred. These measures appear to be reasonable for the protection of sensitive habitats and biotic receptors of concern pending completion of the TCRA. A more detailed discussion of the ecological issues at McClellan is included in Section 13.

Technical Assessment Summary

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the TCRA Workplan. In general, the ongoing excavation and security measures are successful at meeting the interim RAOs.

In conducting assessments for final RAO determination, it is recommended that a risk-based decision making process be utilized that implements site-specific information, consideration of

intended final land use rather than generic scenarios, and tiered risk assessment in order to optimize the process while remaining health protective.

10.6 ISSUES FOR CS 10

Pending actions and recommendations are summarized below:

Pending Action	Impact	Plan in Place to Address Issue? (Y/N)	Is Plan Protective Short-Term? (Y/N)	Is Plan Protective Long-Term? (Y/N)	Possible Issue that Could Affect Future Protectiveness? (Y/N)
Use site-specific risk-based decision making to develop RAO cleanup levels to verify completion of excavation (See Section 10.5.5).	Site closure will be delayed until the cleanup levels are developed.	Y	Y	Y	N
Resume off-site disposal of contaminated soil currently stored in the tent (See Section 10.5.5).	On-site storage will delay cleanup efforts.	Y	Y	Y	N

11.0 CERCLA SITES WITH FUEL COMPONENTS

The fuels program at McClellan has evolved from tank closures to encompassing fuel-contaminated sites basewide. The current list of petroleum, oil, and lubricant (POL) sites includes sites where fuel contamination is commingled with other CERCLA contaminants. In defining commingling sites, generally, two types are recognized: 1) commingling at the source and 2) commingling in the subsurface. Sites where CERCLA contaminants are commingled with fuels and fuels-related constituents or products will, in the future, be addressed under the CERCLA program. These sites are the focus of this section. Sites contaminated only with fuels and fuels-related constituents are non-CERCLA sites and will be addressed under the fuels program for McClellan and regulated by the California RWQCB. This includes fuels-only sites within an IRP Site boundary.

To determine which sites are commingled, all sites in the fuels program are currently undergoing a screening process so that the appropriate closeout program can be applied. In some cases, additional data is necessary to make this determination. The Air Force has already conducted some sampling to determine whether or not sites are commingled as part of the initial shallow soil gas sampling effort. The Air Force is currently preparing a Remedial Investigation Characterization Summary (RICS) Addendum to formalize this data. If additional data is required to determine whether or not a site is commingled, that data will be collected as part of the preparation of the individual parcel RODs. The Air Force will prepare a Field Sampling Plan (FSP) that will propose sampling locations and analytical methods to characterize the site adequately. Based on the data from the sampling effort, the sites can be categorized and closed out appropriately under either the Fuels Program or the CERCLA Program.

As of December 2003, a total of 113 fuels and fuels-related sites within IRP sites have been identified. Of these, 15 sites have been confirmed to be commingled with CERCLA constituents. A total of eight sites are not commingled. The remaining 90 sites are assumed to be commingled for investigation and programming purposes. As mentioned above, sampling as part of the preparation of the individual parcel RODs will validate the commingling status of these 90 sites. As an added note, approximately 20 fuels-only sites exist outside of IRP sites.

These are in the process of being investigated and closed out under the fuels program. If any of these sites are found to be commingled through the fuels closeout process, they will be integrated into the CERCLA program.

Until a determination is made whether remedial actions are warranted at these sites, LUCs currently in place provide adequate protection. These LUCs include lease restrictions, the encroachment permit process and digging restrictions, implementation of a Soils Management Manual, and other physical and administrative controls discussed in Section 12.0.

Technical Assessment

In accordance with the Comprehensive Five-Year Review Guidance (USEPA, 2001b), the technical assessment includes evaluation of the following three questions:

Question A: Is the remedy functioning a intended by the decision documents?

The determination of which sites will be associated with CERCLA remedial actions is still being addressed through sampling associated with the individual parcel RODs. Therefore, no remedy has been designated for these sites.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Final action levels for TPH at commingled sites are still being developed. Recently, DTSC has requested the California RWQCB ensure cleanup levels for TPH and other petroleum constituents at fuel sites be protective of human health and not just water quality. Up to this point, the California RWQCB has cleared TPH contaminated sites based on threat to groundwater and surface water. The final action levels will consider surface risk, including indoor air exposure.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

There are outstanding issues such as the uncertainty over which sites are commingled; the development of final action levels for TPH at commingled sites, and the verification that all TPH sites have been adequately identified and/or characterized. Future sampling associated with the preparation of the individual parcel RODs will provide the necessary additional information to determine whether sites will be remediated under CERCLA and identify site-specific RAOs. The California RWQCB is working with DTSC to develop final cleanup levels for TPH and verify that all fuel-related sites have been adequately defined and characterized. A complete evaluation of fuel sites is recommended for the next Five-Year Review (2009).

11.1 ISSUES FOR CERCLA SITES WITH FUEL COMPONENTS

As a result, there are no definitive issues with CERCLA Sites with Fuel Components at this time. However, due to residual shallow fuel contamination, there may be potential indoor air health concerns that are identified in the future. Determination of cleanup levels and closure requirements will be based on future risk based screening criteria being developed by the State. The pending actions and recommendations for the CERCLA sites with fuel components are summarized below:

Pending Actions	Impact	Plan in Place to Address Issue? (Y/N)	Is Plan Protective Short-Term? (Y/N)	Is Plan Protective Long-Term? (Y/N)	Possible Issues that Could Affect Future Protectiveness? (Y/N)
Complete sampling to determine which sites are commingled.	Sites won't be adequately addressed.	Y	Y	Y	Y
Apply final cleanup levels for TPH, once they have been determined.	Sites that were deemed protective may no longer be protective based on new findings.	Y	Y	Y	Y

12.0 LAND USE CONTROLS

When sites remain contaminated at levels that prevent unrestricted use at the time of transfer, LUCs are necessary to prevent exposure to hazardous substances above permissible limits. Although some level of residual contamination remains, the site can be acceptable for industrial, commercial, or other limited property uses through the effective use of controls.

According to the DoD Guidance titled *Policy on Land Use Controls Associated with Environmental Restoration Activities* (Office of the Secretary of Defense, 2001, p. 1-2), LUCs include any type of physical, legal, or administrative mechanism that restricts the use of, or limits access to, real property to prevent or reduce risks to human health and the environment. These mechanisms include:

- **Physical** mechanisms encompass a variety of engineered remedies to contain or reduce contamination and/or physical barriers to limit access to property, such as fences or signs. The physical controls can be broken down into the main remedy (e.g., a cap or covering) and site controls (e.g., fences, signs, alarm systems).
- **Institutional** mechanisms (i.e., institutional controls) are primarily legal controls imposed to ensure continued effectiveness of land use restrictions imposed as part of a remedial decision. Legal mechanisms include restrictive covenants and deed notices.
- **Administrative** mechanisms include notices, adopted local land use plans and ordinances, construction permitting, and other existing land use management systems that may be used to ensure compliance with use restrictions.

Although the Groundwater OU IROD (CH2M Hill, 1995) did not outline any specific requirements for LUCs at McClellan, the 1999 Five-Year Review Report (Radian, 1999a) did recognize these needs to ensure protectiveness of public health and the environment. The prior Five-Year Review Report assumed that checklists and monitoring programs would be established as appropriate to ensure effective implementation (Radian, 1999a, p. 47).

Since then, McClellan has developed a number of controls and procedures that address various issues relevant to LUC/ICs for 1) land under Air Force control and 2) land that has been transferred. Since the McClellan RODs are not final, these controls and procedures represent

interim measures, but they are appropriate for this stage of the remedial program. These interim LUC/IC controls and procedures are described in greater detail in Section 12.2. More recently, the AFRPA has initiated the LUC/IC Management Program which will be implemented whenever the use of property is restricted based on its environmental condition (AFBCA, 2002c, p. 1-3). This program is described in more detail in Section 12.2. McClellan's current LUC/IC program is evolving and becoming consistent with the requirements of the AFRPA LUC/IC Management Program.

The following sections provide background information on LUC/ICs and discuss the current and future planned mechanisms. Section 12.4 evaluates the protectiveness of the LUC/ICs and Section 12.5 provides a summary of the approach to LUC/ICs . By definition, the Five-Year Review does not evaluate the protectiveness of those sites or areas of concern for which decision documents are not in place. However, many of these sites have on-going investigations and other actions planned for the future that address potential impacts on human health or the environment. Section 12.6 describes the use of LUC/ICs to ensure protectiveness for these sites and areas of concern. Issues that could potentially impact short-term and long-term protectiveness are described in Section 12.7.

It should be noted that in this report, the term 'LUC/IC' is used for simplicity when referencing the current controls and measures that are in place at McClellan. It is not intended to refer to either LUCs as defined by State law and regulations or to ICs under CERCLA and the NCP.

12.1 PROPERTY TRANSFER STATUS AT McCLELLAN

Following closure of McClellan on July 13, 2001, the Air Force's remaining objective was to facilitate property transfer and efficiently complete the environmental cleanup to ensure the protection of human health and the environment. The primary goal is to complete property transfer as quickly as possible while minimizing the level of LUC/ICs required to ensure that the protectiveness goal is met.

Property at McClellan can be transferred by lease or by deed. To transfer property by lease, a Finding of Suitability to Lease (FOSL) must be in place; and to transfer property by deed, a Finding of Suitability to Transfer (FOST) or a Finding of Suitability for Early Transfer (FOSET) must be in place. At present, the AFRPA can transfer property directly to 1) federal agencies, utility companies and other tenants; and 2) to the County of Sacramento LRA for reuse at McClellan. In turn, the LRA can lease directly with 1) its own agencies (i.e., County tenants, airfield, and public works); and with 2) McClellan Park, a commercial real estate developer, who supports the LRA's reuse interests at McClellan and can lease with its own list of tenants. Figure 12-1, located in the Figures section, shows the current relationships and responsibilities at McClellan for property transfer and reuse.

Of the 3,452 acres available for reuse at McClellan, 2,702 acres are currently in reuse. The remaining 750 acres remain in custody of the Air Force. The table below shows the current status of reuse acreage at McClellan:

Use	**Acres**
Acreage in long-term lease	1,354
Acreage conveyed by deed	275
Acreage licensed for airfield	1,073
Total:	**2,702**

Table 12-1, located in the Tables section, shows the intended reuse selection for McClellan based on the LUC/IC Management Program projections (AFRPA, 2003b, p. 2). Although not fully implemented, the intended reuse encompasses a full spectrum of residential applications (i.e., housing, daycare, hospitals, schools, clinics, and miscellaneous), commercial (i.e., office and industrial facilities), recreation, airport, and municipal facilities. The one reuse alternative that is not being considered at this point is agricultural.

12.2 LAND USE CONTROLS/INSTITUTIONAL CONTROLS AT McCLELLAN

Currently, there are four general LUC/IC mechanisms being used at McClellan to ensure that protection of human health and the environment is maintained, namely: 1) administrative, 2) legal, 3) physical (primarily site controls), and 4) other mechanisms. Figure 12-2 shows these four mechanisms further divided into various supporting actions. Many of these supporting actions are currently used at McClellan; others are planned for future implementation as part of the AFRPA LUC/IC Management Program. Although the AFRPA LUC/IC Management Program for full implementation of LUC/ICs at McClellan is still in development, the basic framework that will comprise the LUC/IC program is in place and is currently being utilized. However, for those areas that are not deeded or that do not have RODs in place, LUC/ICs will be in place but those LUC/ICs associated with deed transfer will not be implemented. For example, lease restrictions are in place instead of deed covenants under an Air Force lease with the County of Sacramento. These lease restrictions are monitored and enforced by the Air Force since the Air Force still owns the property. Deed covenants, on the other hand, are instituted upon deed transfer and run with the land.

12.2.1 LUC/IC Mechanisms

The LUC/IC mechanisms and supporting actions currently in place at McClellan are as follows:

Legal

Lease Restrictions. Standard restrictive language is included in all leases between the Air Force and McClellan tenants or agents to ensure that activities are not performed that will endanger human health or the environment and to ensure that leased property is used in a manner that is consistent with government regulations. An environmental questionnaire is completed by prospective tenants prior to occupancy to identify any activities that may require prior approval by the Air Force. McClellan Park (the property developer), Sacramento County (the LRA), and the AFRPA have programs in which site visits are conducted to ensure that activities being conducted on the leased premises are consistent with any restrictions stated in the lease.

AFRPA includes restrictive language in all lease documents that notifies the leaseholder of the environmental conditions relevant to their site. The leases include or reference: 1) a copy of the McClellan Environmental Baseline Survey (EBS), the Supplemental EBS, the Federal Facilities Agreement (FFA), and a listing of Areas of Special Notice; 2) an acknowledgement that McClellan is a NPL site under CERCLA, as amended; 3) special restrictions, that flow down to subleases, regarding installation of any new drinking water wells, digging, or other activities that might disturb the ground surface in Areas of Special Notice; 4) special restrictions on any filling or discharge to wetlands or floodplains; and 5) special restrictions on any use of existing USTs, aboveground storage tanks (ASTs), and oil water separators (OWSs) (Department of the Air Force, 1998).

Administrative

Encroachment Permit Process. An encroachment permit is required at McClellan for any activities that will disturb soils or for work carried out within or near biologically sensitive habitats. The detailed process is outlined in *McClellan's Soils Management Manual* (AFRPA, 2003c, p. 9-12), and the objective of the process is to ensure that activities being performed are done so in a manner that is protective of human health and the environment.

The encroachment permit process is quite extensive, consisting of: 1) screening of site locations in reference to base maps showing IRP sites and natural resource areas; 2) review by all appropriate Air Force Remedial program managers; and 3) final evaluation with a summary of recommendations for approval or disapproval of the application. AFRPA manages the encroachment permit process through a single point of contact, the Environmental Screening IRP Manager. Depending on the nature and location of the permit, this manager can draw on other on-base resources from the Air Force, Sacramento County, McClellan Park, and Boeing Services (Airport Manager). The process focuses on intrusive activities that could expose workers or the public to contaminated areas, jeopardize the integrity and safety of in-place remedial systems, or cause disruption to environmentally sensitive areas/habitats. The process may require one to eight weeks for approval depending on the site location(s), contaminants present, and the nature of the activities to be performed. In some cases, AFRPA may disapprove an encroachment

permit if the excavation is in an area that is highly contaminated, could damage a treatment system, or could encroach upon a nature resource, such as a vernal pool.

Site Controls

Fencing/Barriers. Fences and/or barriers are installed and maintained throughout the base property around treatment systems or sites in order to prevent the public from accessing restricted areas. The main objective of installing fences and barriers is to protect human health and the environment by impeding access to areas that would result in exposure to contaminants. The AFCEE Field Team is responsible for verifying that fences and barriers are maintained.

Security. The Air Force has contracted with the Sacramento County Sheriff's Department to provide overnight security of the special radiological excavations at the CS 10 site, as well as other sites and treatment systems on McClellan

Signage. Signs are installed and maintained throughout the base property to 1) notify the public of known contaminated or environmentally sensitive areas, 2) to discourage trespassing or other unauthorized entry, and 3) to provide points of contact or other information useful during emergencies. The main objective of posted signs is to protect human health and the environment. The AFRPA Field Team is responsible for verifying that signs are maintained.

Periodic Inspections

The Air Force and others stakeholders have been monitoring the implementation of LUC/ICs at the sites through visual site inspections. As part of this program, the AFCEE Field Team conducts frequent inspections at key remedial systems. Additionally, the Sheriff's patrol, as a result of the activities at CS 10, conducts daily evening, week-end, and holiday patrols of the key remedial systems. These inspections are in addition to those conducted in conjunction with routine operation and maintenance activities at existing remedial systems, as well as the quarterly OU B1 and OU D Cap inspections.

Maintenance and Monitoring

All active remediation systems at McClellan receive maintenance and undergo monitoring according to their individual O&M Plans. These O&M plans are designed to keep the remediation systems running efficiently, in accordance with the selected remedy, and in compliance with applicable regulations and standards to ensure protectiveness to public health and the environment. Results of the O&M activities are evaluated and reported quarterly in documents that are reviewed by regulatory project managers and that are available to the public. The same general process is incorporated into the maintenance and monitoring for the groundwater monitoring program which is carried out in accordance with the *Final Groundwater Monitoring Plan* (Radian, 1997b) and the *Addendum to the Groundwater Monitoring Program Field Sampling Plan for 1,4-Dioxane, Hexavalent Chromium, and Total Metals in Groundwater Monitoring and Extraction Wells* (URS, 2002a) and is reported in quarterly documents that are reviewed by the regulatory project managers and that are available to the public.

Other

Soils Management Program. AFRPA has established a program for the management of excavated soil that is protective of human health and the environment, facilitates McClellan's remediation effort, and minimizes the transport and storage of soil on McClellan property (AFRPA, 2003c, p. 4). The Soils Management Manual (AFRPA, 2003c) describes 1) the roles and responsibilities of the Air Force and its contractors, 2) the procedures for planning and approving projects that will generate soils, 3) the various processes for handling soils from construction projects, investigation derived wastes, and unexpected contamination or potential hazards encountered during excavation; and 4) procedures for sampling, on-site storage, containment, transportation and disposal.

Health and Safety Plans. Each contractor at McClellan is required to prepare a Health and Safety Plan for any work at IRP or other managed sites and for any work carried out under the Encroachment Permit Process where soil contaminants have been identified. The focus of the Health and Safety Plans is primarily on worker safety associated with the particular activities and site conditions.

McClellan Tenant and Utilities Communications Plan. A Communications Plan exists to keep McClellan tenants and utilities informed of activities that may potentially impact their work sites (AFRPA, 2003e). For the purpose of the plan, McClellan tenants are divided into four groups: McClellan Park tenants, federal tenants, County tenants, and other tenants. The plan describes the steps to be taken in notifying affected tenants of both non-emergency and emergency activities. This plan also applies to utility companies who own or operate systems at McClellan.

Public Notices and Community Outreach. McClellan maintains an active community relations and public outreach program that is guided by a CRP (URS, 2003k). The primary purposes of the community relations program are to 1) inform the public of environmental issues; 2) report progress on remediation goals; and 3) solicit comments and concerns from the public. The community relations program holds public meetings and prepares fact sheets and articles to more clearly describe complex environmental issues and their potential effect on the health and safety of the surrounding community. The program also interviews representative members of the public at large to determine underlying issues that may be creating concerns with the community and tenants. The community relations program also interacts closely with the news media to promptly distribute information relevant to environmental issues of immediate public interest. Direct access to remedial investigation studies and reports is available through the Administrative Record.

The extensive community relations program at McClellan encourages communication on the cleanup program between the Air Force and the LRA, McClellan Park, and on-site tenants. The LRA and McClellan Park are members of the RAB where cleanup information is shared. An active outreach program aims to keep tenants informed of the on-going cleanup program through presentations, fact sheets, and newsletters.

12.2.2 LUC/IC Management Program

As briefly described in Section 12.0, the future development of LUC/ICs at McClellan will follow the guidance of the LUC/IC Management Program (AFBCA, 2002a). A layering

approach is used by the Air Force when implementing LUC/ICs. The LUC/IC Management Program is a layering strategy that will be implemented whenever the use of property is restricted based on its environmental condition. The LUC/IC Management Program for each BRAC base consists of four modules: 1) the Layering Strategy Worksheet module, 2) the Institutional Controls Communication Plan module, 3) the Management Plan module, and 4) the Institutional Control Tracking Module.

The layering strategy worksheet is used to identify "layers" of reinforcing mechanisms that both individually and jointly help to ensure the effectiveness of the LUC/ICs. The communication plan for each base describes the use restrictions, identifies layering mechanisms and stakeholders, and specifies the information to be communicated to the specific stakeholders. The management plan describes how the LUC/ICs are identified, implemented, monitored and enforced. The IC tracking module consists of a web accessible database available to the general public and contains a description of the LUC/ICs and the affected property, information on maintenance of the LUC/ICs, and points of contact for the associated grantees, regulators, and other stakeholders (AFBCA, 2002c, p. 1-3). All four modules of the Management Program were completed by the end of calendar year 2003.

12.2.3 Incidents

Based on interviews and records researched during this Five-Year Review, there have been a number of incidents during the last five years resulting from unauthorized access, breached barriers/containment systems, or violations of lease restrictions. Fortunately, none of these incidents have been severe or have resulted in any significant increased risk to human health or long-term impact to the environment. Because of these incidents and the review process for corrective action at McClellan, many of the LUC/IC mechanisms have been revised and strengthened. The table on the following page provides some examples of incidents and improvements that were made to the LUC/ICs over the last five years.

Incident	Corrective Action
Mowing of vernal pools or other biologically sensitive habitats.	Encroachment permit process was improved requiring more detailed maps to be provided indicating areas to be mowed. Additional signs were posted and meetings with contractors were conducted.
Incursions into biologically sensitive habitats.	Additional signs were posted restricting access and activities in biologically sensitive habitats. Training with contractors was conducted.
Contractor drilled through the OU B1 Cap.	Encroachment permit process was improved requiring more detailed maps to be provided indicating specific areas to be drilled or excavated.
Drums of unknown contents were left on the side of an on-base road in the vicinity of IRP Site 91. Presence of the drums did not present an imminent threat to the environment.	Coordination with McClellan Park and the LRA resulted in the drums being removed.
SVE unit was broken into.	Existing fencing was topped with concertina wire.
Empty paint cans and asbestos piping were stored on a tenant's property.	AFRPA conducts lease monitoring and site inspections for violations of lease restrictions.
Leaks in above-ground conveyance piping of groundwater treatment system.	More frequent integrity checks on a weekly basis by AFCEE Field Team. Weekly checks are summarized in site checklists and in biweekly reports.

12.3 PROGRESS SINCE 1999 FIVE-YEAR REVIEW FOR LUC/ICs

This is the first Five-Year Review to formally evaluate LUC/ICs. The previous Five-Year Review Report referenced the Air Force encroachment permit process and the County well permit application process. It also stated that upon base closure and for transfer of properties, any controls established in the ROD would be detailed in the transfer document and would be recorded with the County.

However, the 1999 Five-Year Review Report did identify institutional controls as an issue that would require evaluation in the 2004 Five-Year Review. That earlier report concluded:

> "Institutional controls must be addressed to ensure that they are enforced and maintained to ensure that they remain protective of human health and the environment. Prior to base closure, checklists and monitoring programs will be established as appropriate to ensure effective implementation of these controls. Also prior to base closure, the party(ies) responsible for monitoring the controls and completing and maintaining records should be identified to ensure uninterrupted implementation of the current and any future controls established in the RODs" (Radian, 1999a).

As described in Section 12.1, considerable progress has been made in the last five years in developing a framework of legal, administrative, and physical mechanisms to initiate the LUC/IC process. The mechanisms and supporting actions that have been developed to date, while incomplete, are consistent with the broader layering strategy that is being implemented through the LUC/IC Management Plan. It is anticipated that each of the scheduled RODs for McClellan will involve considerable discussion and refinement of the layering strategy before final determination of appropriate LUC/ICs.

12.4 FIVE-YEAR REVIEW PROCESS FOR LUC/ICs

The Five-Year Review process for the LUC/ICs consists of document review, data review, a site inspection, interviews, and technical assessment.

12.4.1 Document Review for LUC/ICs

This Five-Year Review consisted of a review of the following documents:

- McClellan Soils Management Manual, AFRPA, February 2003 (2003c).
- Draft LUC/IC Layering Strategy Worksheet, Former McClellan AFB, AFRPA, February 2003 (2003b).
- Land Use Control/Institutional Controls Management Guidance Memorandum, AFBCA, July 2002 (2002c).
- AFBCA Guidance on the Management of LUC/ICs, AFBCA, July 2002 (2002a).
- Fact Sheet: Land Use Controls, FS LUC #2, AFBCA, July 2002 (2002b).

- Policy on Land Use Controls Associated with Environmental Restoration Activities, Office of the Under Secretary of Defense, January 2001.
- McClellan Environmental Overview (RAB Presentation), AFRPA, April 2003 (2003a).
- McClellan Tenant and Utilities Communication Plan, AFRPA, January 2003 (2003e).
- Protecting the Health and Safety of Tenants and the Environment (RAB Presentation), AFRPA, May 2002 (2002e).
- Air Force Policy and Guidance on Remedy Selection Documentation in RODs, Department of the Air Force, January 2002.
- Interim Guidance on Environmental Restoration Records of Decision, Office of the Under Secretary of Defense, June 2002.
- Lease of Property on Former McClellan Air Force Base, California, Department of the Air Force, 1998.

12.4.2 Data Review for LUC/ICs

Limited data, mostly in the form of files, were reviewed as part of the evaluation consisting of 1) incident reports, 2) lease language and compliance, and 3) bi-weekly field reports.

12.4.3 Site Inspections for LUC/ICs

On 6 May 2003, an inspection of remedial systems and environmentally sensitive areas on McClellan was conducted with Mr. P. Bernheisel and Mr. S. Burkhard, AFCEE Field Team. The inspection focused on the existence and effectiveness of site controls such as fencing, signage, barriers, and other security measures that are designed to warn the public and prevent unauthorized entry. No significant issues were identified. Site inspection forms are documented within the individual site visits.

12.4.4 Interviews for LUC/ICs

Interviews were conducted with several individuals involved with different aspects of the LUC/IC process, including Ms. J. Musil from the LRA; Mr. A. Hersh and Ms. D. Clark from McClellan Park; as well as Mr. J. McCain, Mr. R. Solander, Ms. L. Geissinger, Mr. P. Bernheisel

and Mr. S. Burkhard from the AFRPA (2003 Interviews, Appendix B). Additionally, one phone interview was conducted with Mr. J. Healy, USEPA, to obtain information on the various perspectives of the LUC/IC process. MWH and the Air Force conducted interviews of four tenants of the former base, two of which are tenants of McClellan Park, while the other two are Federal tenants of the Air Force. The interviews were intended to gauge the tenants' knowledge and understanding of the contamination at the base, lease restrictions on their property as well as the Air Force's encroachment permit process.

Tenant representatives that were interviewed were aware that there is contamination at the base, and that this is the reason there are lease restrictions on the property they occupy. The tenants were all aware that they needed to get Air Force approval prior to moving any soil. Three of the tenants routinely apply for, and obtain encroachment permits. The other tenant has not had a need to dig to date, but was aware they needed to contact the Air Force before planning any subsurface activities.

Through the interviews it was evident that the company or entities that were the tenants understand the lease restrictions and encroachment permit process. However, there were individuals that did not know the details of the process, but did know the person in their organization to contact for guidance. The Air Force took the interview as an opportunity to further explain in detail the encroachment permit process, and in some cases, the contamination issues at the base. Copies of interview records are included in Appendix B.

12.4.5 Technical Assessment for LUC/ICs

In accordance with the Comprehensive Five-Year Review Guidance (USEPA, 2001b), the technical assessment includes the evaluation of the following three questions.

Question A: Is the remedy functioning as intended by the decision documents?

Currently, the implementation of LUC/ICs at McClellan is not governed by any decision document. The RODs are still being prepared and the two IRODs for McClellan, the

Groundwater OU and the OU B1 Cap, do not contain specifics regarding the requirements for LUC/ICs.

For the most part, McClellan has adopted a practical interim approach, which has addressed the most immediate LUC/IC needs. This interim approach includes implementation of a relatively thorough set of site controls to 1) prevent unauthorized access by the public to contaminated sites and environmentally sensitive areas; 2) prevent accidental encroachment or vandalism to existing remedial systems; 3) ensure maintenance and monitoring of key remedial activities and systems; 4) ensure procedures and plans for managing contaminated soils; and 5) ensure health and safety plans for every phase of the cleanup activities. In regards to site controls, the interim LUC/IC program at McClellan is functioning as intended and is generally protective of public health and the environment.

In terms of legal, administrative, and other mechanisms, McClellan's interim approach has incorporated environmental language into its leases that generally notifies tenants of the environmental status of the property and places certain responsibilities on the tenant for compliance with environmental practices and regulations that are enforced at McClellan. The Air Force follows up with occasional inspections on the tenants to determine compliance. However, there is no formal system in place for tracking LUC/ICs. It is likely that these tracking and notification systems will be implemented when the Air Force LUC/IC Management Plan is completed. Also, a system to track breaches to LUC/ICs would be beneficial to recognize patterns, prevent future breaches, and implement appropriate changes to the current system.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

The response to Question B can not be determined at this time because final RODs have not been completed and the two interim RODs did not include LUC/ICs or criteria for determining when and where to apply LUC/ICs. Final RODs at McClellan are expected to address these concerns. During the interim, lease restrictions apply everywhere and appear to be conservative until RODs specify unrestricted use standards for individual LUC/ICs.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

New environmental information is being developed constantly from the ongoing investigations and interim remedial actions being carried out at McClellan. As a result, new COPCs and/or pathways are being identified that may affect the number of sites that will have residual contamination above levels that allow unrestricted use, and therefore may require LUC/ICs. It is important to note that this constantly increasing list affects sites that have been transferred as well as those that remain to be remediated and closed.

As described in other sections of this Five-Year Review Report, examples of new COPCs that have been found within the last five years include hexavalent chromium, 1,4-dioxane, radon gas, radium 226, and buried low level radioactive waste. The California RWQCB has recently issued a list of "emergent" contaminants that have been associated with base closures. This list includes hexavalent chromium, 1,4-dioxane, NDMA, perchlorate, PBDE, and 1,2,3-TCP. There is every reason to believe that these types of associated contaminants will be better understood in the future and that closed bases will be required to broaden their lists of COPCs.

Other LUC/IC-Related Issues

Prior Third Party Reviews of the 1999 McClellan Five-Year Review Report. A third-party review of the 1999 Five-Year Review Report was conducted by PMSA in 1999 (PMSA, 1999). As described in Section 1.3, the contractor concluded that the Five-Year Review Report presented a good snapshot of the cleanup status and provided adequate detail on how the remedial strategy evolved; however, a number of recommendations were made. Recommendations outlined in this report specific to LUCs stated that

> "if institutional controls are to be used, they should be accompanied by stepped up long-term enforcement of the controls, and to the degree possible, use institutional controls in areas that have physical attributes consistent with the remedy. The Air Force should assume responsibility for monitoring the effectiveness of any institutional controls it relies upon."

These recommendations were reviewed as part of this second Five-Year Review and are being addressed through the layering strategy and the LUC/IC Management Program.

Technical Assessment Summary

In regards to site controls, the interim LUC/IC program at McClellan is functioning as intended and is generally protective of public health and the environment.

12.5 APPROACH TO LUC/ICs

The Air Force, the State of California, and the USEPA agree that LUC/ICs are critical to the protection of human health and the environment. All parties agree that state land use covenants (SLUCs), which give the state a direct enforcement role in LUC/ICs, will be an important component of the overlapping mechanisms to protect the public from unsafe exposures to residual contamination that is left in place upon closure of a contaminated site.

Before transfer of title to the property including one or more of the sites at which ICs are selected, the Air Force will execute a SLUC that includes legal descriptions of affected areas. The SLUC will be recorded before the recording of the federal deed. The State will enter into the SLUC pursuant to State law and regulations, including the CCR, Title 22, Section 67391.1. The SLUC will be based on the Model Covenant to Restrict Use of Property developed by DTSC. Modifications or termination of the SLUC must be undertaken in accordance with State law, CERCLA, the NCP, and the IRP.

The LUC/IC program that is currently in place at McClellan is protective on a short-term basis because the Air Force assumes responsibility for enforcement of LUC/ICs primarily by lease restrictions and encroachment permit process.

12.6 LUC/ICs AS PROTECTIVE MEASURES AT OTHER IRP SITES AND AREAS OF CONCERN WHERE REMEDIAL ACTIONS ARE STILL TO BE DETERMINED

The previous sections in this document discuss and evaluate the protectiveness of those sites where interim remedial actions have been taken and decision documents are in place. There are a number of other sites and areas of concern where a determination has to be made if remedial actions are necessary, and some of these sites are currently under investigation. In the interim until such a determination is made whether remedial actions are warranted at these sites, LUC/ICs currently in place provide adequate protection. These LUC/ICs consist of physical, institutional, and administrative controls discussed in previous sections, including lease restrictions, the encroachment permit process and digging restrictions, implementation of a Soils Management Manual (AFRPA, 2003c). Some examples of these protective measures are described below.

Radiological Sites

Further investigations are currently on-going for radiological areas of concern that were not previously discussed (PRL 32 and CS 10), including the airfield, sanitary sewer system, buildings that are pending clearance for radiological contamination, Dudley site, and burial/disposal sites. To ensure protection of public health, these areas of radiological investigation have not been turned over for reuse and remain under strict control of the Air Force. Fencing and warning signs are in place, and many of the areas are inspected daily to ensure the protective measures are in place and functioning.

A radiation health and safety survey of the disposal pits was conducted in 2002 to evaluate whether there is an unacceptable risk due to radiological contamination to persons on or nearby the surface of these disposal pits. As a result of the survey, a recommendation was made at two of the sites (CS 52 and CS 57) to maintain fencing and post warning signs to reduce exposure at the current site conditions and use level.

Other IRP Sites

As part of basewide LUC/IC measures, all tenants, and even Air Force personnel, are required to obtain an encroachment permit for any soil disturbing activities or encroachment onto Air Force property. AFRPA Program Managers review and evaluate the proposed activities to ensure an exposure risk does not exist or that sensitive habitats would not be affected. The encroachment permit to is approved and issued only if there is no risk to human health or the environment, or if health risks can be mitigated through use of personal protective measures and monitoring. A Health and Safety Plan is required in many cases. AFRPA personnel monitor the permitted activities to ensure that the conditions and/or restrictions of the encroachment permit are followed. For all digging activities, the Air Force Soils Management Manual must be followed (AFRPA, 2003c). This manual describes how excess soils are to be handled, stored, transported, and disposed of.

12.7 ISSUES FOR LUC/ICs

The pending actions and recommendations for the LUC/ICs are summarized below:

Pending Actions	Impact	Plan in Place to Address Issue? (Y/N)	Is Plan Protective Short-Term? (Y/N)	Is Plan Protective Long-Term? (Y/N)	Possible Issues that Could Affect Future Protectiveness? (Y/N)
Develop central repository or database to capture all of the incidents or breaches of LUC/ICs and develop formal tracking method for LUC/ICs (See Section 12.4).	Difficult to recognize a pattern of breaches and prevent future breaches.	Y	Y	Y	Y
Reevaluate parcels following discovery and confirmation of any new COPCs (See Section 12.4).	Sites that were deemed protective may no longer be protective based on new findings.	Y	Y	Y	Y

13.0 ECOLOGICAL EVALUATION

The purpose of a Five-Year Review is to evaluate the implementation and performance of a remedy to determine if the remedy is or will be protective of human health and the environment. For the previous sections of this Five-Year Review, the technical assessment includes an evaluation of three questions that are listed in the technical guidance document (USEPA, 2001b):

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

However, for this ecological evaluation, these three questions are not applicable. In terms of an ecological evaluation, the Five-Year Review should consider ecological risks that have not been adequately addressed at a site, and for which there is not a plan to address them through a future action (USEPA, 2001b, p. 4-9).

Previously presented Sections 4 through 10 address site-specific ecological issues related to the interim remedial actions evaluated in each of these sections. The following sections provide a general evaluation of the protectiveness of on-going investigations and action plans for sites that may pose an ecological risk at McClellan, but for which a remedy is not in place or has not yet been decided upon. These on-going investigations, assessments, and/or action plans are being implemented to ensure the protectiveness of the cleanup program at McClellan for ecological sites and receptors and are further described in Sections 13.2 and 13.3 below.

Sections 13.4 and 13.5 provide an evaluation of the protectiveness of on-going ecological risk assessments and interim remedial actions, respectively. Section 13.6 evaluates the use of ecological ARARs and guidelines that have been updated since 1998. Conclusions of this ecological evaluation are provided in Section 13.7. Sensitive habitats at McClellan are shown in Figure 13-1, located in the Figures section.

The following documents were reviewed in preparation of this ecological evaluation:

- Basewide Ecological Risk Assessment (ERA) Scoping Summary Status Report, JEG, December 1995.
- Special Status Species Monitoring Report: McClellan Air Force Base and Davis Communications Facilities, JEG and RMI, November 1995.
- Site Characterization Summary/Field Sampling Plan for Magpie Creek, located as an appendix to the Interim Basewide Remedial Investigation Report, Part 2C, Radian, August 1997 (1997a).
- Interim Basewide Remedial Investigation Report, Operable Unit C, Remedial Investigation Characterization Summaries and Addenda, Volume 14, Radian, September 2000 (2000e).
- Draft Basewide Remedial Investigation (RI) Report, Part 1 General Framework, URS, December 2002 (2002f).
- Delineation of Wetlands and Other Jurisdictional Waters of the United States at McClellan Air Force Base, RMI, June 2001.
- Final Ecological Risk Assessment for the Initial Parcel, CH2M Hill, August 2003 (2003c).

In addition, discussions with and text provided by Ms. M. Enloe were instrumental in the preparation of Section 13 (Personal Communication, Ms. M. Enloe, 05-08 August 2003).

13.1 DESCRIPTION AND BACKGROUND

Approximately 250 acres of McClellan are undeveloped and designated as natural areas. Two natural areas, the North Runway Area and the West Nature Area, are the primary areas of concern with respect to sensitive habitats and biotic receptors. Sensitive resources in the North Runway Area include Robla Creek, a small portion of Rio Linda Creek, vernal pools, and seasonal wetlands. Sensitive resources in the West Nature Area include Don Julio Creek, Magpie Creek, vernal pools, freshwater emergent wetlands, and seasonal wetlands. Outside of the North Runway Area and the West Nature Area, sensitive habitats consist of vernal pools and seasonal wetlands scattered throughout the remaining undeveloped areas of McClellan. All of

these aquatic features are subject to the jurisdiction of the United States Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (URS, 2002f).
Recent discussions with regulatory agencies have resulted in an agreement to evaluate potential ecological impacts to two resource categories:

- Seasonal wetlands and vernal pools
- Creeks and floodplains

Accordingly, Sections 13.2 and 13.3 describe on-going investigations and action plans for the above two resource categories, respectively.

13.2 SEASONAL WETLANDS AND VERNAL POOLS

In 2001, a basewide update of jurisdictional resources at McClellan was conducted, and several new areas of seasonal wetlands and vernal pools were identified. The Air Force subsequently conducted a basewide scoping assessment to identify IRP sites with residual surface contamination that are located within or adjacent to a vernal pool or seasonal wetland, or which could have contributed sediment-bound constituents to a vernal pool or wetland via surface water runoff. The identification of these sites has been reviewed and accepted by the regulatory agencies (Personal Communication, Ms. M. Enloe, 05 August 2003). Currently, the Air Force is in the process of conducting a detailed Screening-level/Tier 1 ERA to determine the potential impact of IRP site contaminants on ecological receptors in the adjacent habitat areas for these sites (Personal Communication, Ms. M. Enloe, 05 August 2003). The strategy for conducting this assessment is to use maximum contaminant concentrations from potential source sites and to compare these concentrations with available toxicity benchmarks for plants, aquatic invertebrates, and birds. If maximum concentrations exceed toxicity benchmarks, a potential risk is identified and a subsequent Tier 2 ERA using site-specific soil samples will be conducted (Personal Communication, Ms. M. Enloe, 05 August 2003).

Assessment of surface water impacts was not proposed as part of the Tier 1 ERA due to the lack of appropriate surrogate data and because the chemical constituents in the vernal pools/seasonal

wetlands are expected to be strongly bound to the underlying sediments and not highly water soluble. The findings of sediment assessments (comparing sediment concentrations to available toxicity reference values) will be used to infer potential risks to aquatic invertebrates that swim and forage in the water column, and which spend only a portion of the life cycle in direct contact with the underlying soils (i.e., vernal pool fairy shrimp). The use of this approach is anticipated to provide a sufficiently conservative estimate of potential risk and ensure the protectiveness of sensitive habitats and biotic receptors of concern (Personal Communication, Ms. M. Enloe, 05 August 2003).

13.3 CREEKS AND FLOODPLAINS

The creeks and associated habitats in the West Nature Area (Magpie and Don Julio creeks) have been subject to an extensive ERA, including bioaccumulation studies, toxicity testing, and risk calculations for six different biotic receptors of concern. Based on the results of the Tier 2 ERA, Technical Memorandum for the West Nature Area at McClellan, located as an appendix in the Interim Basewide Remedial Investigation Report, Operable Unit C (Radian, 2000e), it was determined that the creeks in the West Nature Area pose an unacceptable level of risk to biotic receptors of concern, and that an evaluation of cleanup alternatives is warranted. In addition, DTSC Human and Ecological Risk Division (HERD) performed preliminary calculations based on sediment results, demonstrating potential risk to human health from fish consumption.

13.3.1 Conceptual Site Model and Data Gap Assessment/Field Sampling Plan

In 2002, the Air Force completed a basewide Creeks and Floodplains Conceptual Site Model (CSM) (AFBCA, 2002h). The purpose and scope of the Creeks and Floodplains CSM was to 1) identify current and historical sources of contaminants that could have entered one or more of the creeks that receive storm runoff from McClellan, 2) describe (at a conceptual level of detail) the possible mechanisms for transport of contaminants into and through the creek system, and 3) identify ecological and human receptors that could be exposed to contaminants carried by the creeks. Historically, CSMs for the creeks at McClellan had been prepared using an OU approach (i.e., previous models looked at specific creek segments located within the OU that was being

studied at the time). By looking at the creek system as a whole and reconsidering the range of possible sources and fate and transport scenarios, the basewide Creeks and Floodplains CSM was intended to help identify sources, pathways, or receptors that might have been overlooked using the earlier OU approach.

To support this evaluation, the Air Force is currently preparing a basewide Creeks Data Gap Assessment and FSP. The objective of this effort is to 1) further screen potential source sites (i.e., sites that may represent a source of historic or ongoing releases of contaminants to the creeks, as identified in the Creeks and Floodplains CSM [AFBCA, 2002h]), 2) identify the COPCs associated with potential source sites, and 3) provide recommendations for additional sediment sampling needed to characterize the nature and extent of those COPCs in the creeks. The data collected under this FSP will be used to update the human health and ecological risk assessments for the creeks and to support decisions regarding the cleanup of contaminated creek sediments. This FSP will also include sampling of aquatic biota and co-located sediment from the creeks in the West Nature Area. This sampling will support a site-specific analysis of the potential risks to aquatic biota, species that feed on aquatic biota (e.g., green heron), and human receptors that may catch and consume aquatic biota from the creeks.

The potential downstream effects of residual constituent concentrations and proposed remedial activities at the upland source sites will be evaluated in the Ecological Sites FS prepared for those sites to ensure that the selected remedies are protective of sensitive habitats and biotic receptors of concern (i.e., the sites do not continue to pose a potential source of contamination to the creeks in the future).

13.3.2 Tailings Piles

Tailings piles were created along the upper banks of Don Julio and Magpie creeks by the discharge of sediments dredged from the creeks in 1997. The tailings piles were studied as a discrete exposure area in the Tier 2 ERA Technical Memorandum for the West Nature Area at McClellan AFB (Radian, 2000e). The results of this study indicate that benthic invertebrates would have hazard quotients (HQs) greater than 1 (indicating a potential risk) from exposure to

inorganics, pesticides, and PCBs in the tailings piles. Exposure would occur if soil from the tailings piles was washed into the creeks. Mean HQs for green heron, which would be exposed primarily through the aquatic food chain, were greater than 1 for inorganics, pesticides, dioxins, furans, and total PCBs. Mean- and upper-bound HQs for terrestrial invertebrates were all less than 1; however, regulators with the US F&WS and the California DFG have stated that the risks to terrestrial invertebrates and vertebrates were potentially underestimated due to the assumptions regarding percent exposure to tailing soils and the lack of established benchmarks for many chemicals.

A interim removal action for the creek tailings was recommended in letters from the USEPA, California DFG, and US F&WS based on the following rationale: 1) contaminant levels in the tailings piles represent an existing, ongoing threat to the terrestrial receptors, 2) contaminants in the tailings piles could migrate to surface waters in Magpie and Don Julio creeks, resulting in risk to sensitive aquatic receptors, and 3) removal of the tailings piles can be conducted with relatively little impact to adjacent sensitive habitats.

RAOs would not be established for this removal. The piles would be excavated to a depth of six to 12 inches below grade and backfilled with clean soil. It is not anticipated that this removal would be codified as a final action, because tailings piles that overlap threatened or endangered species habitats would not be removed, and because remediation of the contaminated sediments in Magpie and Don Julio Creeks would not be accomplished. Final action levels and cleanup requirements for the West Nature Area, including Don Julio and Magpie Creeks and the tailings piles, will be established in the Ecological Sites ROD.

13.4 ONGOING ECOLOGICAL RISK ASSESSMENT EFFORTS

McClellan has developed and is currently implementing a basewide approach to investigating ecological exposures and assessing potential impacts to sensitive habitats and biotic receptors of concern. Risk assessments are planned to be conducted in two distinct efforts: the basewide vernal pool ERA and the creeks and floodplains risk assessment (Personal Communication, Ms. M. Enloe, 05 August 2003). Based on discussions with Ms. Enloe and the approach described in

the Draft Final ERA for the Initial Parcel (CH2M Hill, 2003c), McClellan is using a consensus-based ERA approach and recently developed bioaccumulation models and toxicity values to ensure a protective and defensible ERA. The ERA approach includes proactive discussions with and approval by regulatory agency representatives with regard to the ERA's approach, scope, models and values used to assess exposure and effects, and interpretation of ERA results. McClellan is using bioaccumulation models (Bechtel et al. 1998a and b; Sample et al. 1998a and b), consensus-based freshwater sediment quality guidelines (MacDonald et al. 2000), and U.S. DOE's approach for evaluating radiation doses to aquatic and terrestrial biota (U.S. DOE, 2002) developed within the last five years.

The results of these risk assessments will be considered when evaluating remedial alternatives in the Ecological Sites FS and, if necessary, will provide the basis for the development of risk-based cleanup goals that are protective of biota of concern (e.g., local communities, local populations, threatened and endangered species).

13.5 ONGOING INTERIM ACTIONS

Potential exposures are being monitored and evaluated for sediments accumulating in the OU B1 Drainage Ditches and for discharges from the GWTP at McClellan. It is recommended that the monitoring program for the OU B1 sediments establish decision criteria for the initiation of appropriate response actions that may include (but not limited to) removal action, increased monitoring efforts, reduced monitoring efforts, and termination of monitoring efforts. Monitoring and control of discharges from the GWTP is regulated under the Clean Water Act and the Porter-Cologne Act through its National Pollutant Discharge Elimination System (NPDES) permit.

Interim actions being taken to control existing exposure pathways include placement of "no trespassing" and "no fishing" signs in the West Nature Area; implementation of the creek tailings removal action; and identification/control of continuing sources of contamination via the encroachment permit process. No interim removal actions are proposed for other ecological sites where risks have been identified (e.g., Don Julio and Magpie Creek). Identification of final

remedial alternatives and remedial action areas for these sites will occur in the future as part of the Ecological Sites Feasibility Study and Record of Decision.

A full evaluation of available remedial alternatives will be conducted in the Ecological Sites FS to ensure that the selected remedy achieves a balance between the risks, costs, and benefits.

13.6 ECOLOGICAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The NCP states that ARARs shall be considered in determining remediation goals (USEPA, 1990). ARARs related to ERAs for McClellan include:

- Endangered Species Act
- Migratory Bird Treaty Act
- Clean Water Act and Porter-Cologne Act

Currently, there are no federal ARARs for soils or sediments.

Biota of concern (also considering California Species of Special Concern) at McClellan have been recently discussed with natural resource trustees and regulatory agency representatives and include species protected under both state and federal Endangered Species Acts and the Migratory Bird Treaty Act (Personal Communication, Ms. M. Enloe, 05 August 2003). A consensus-based list of aquatic, riparian, and terrestrial receptors of concern has been developed and approved by regulatory agency representatives. This consensus-based ERA approach ensures that other receptors have been considered and, if appropriate, included in the ERA.

Although there are no federal or State sediment ARARs for the protection of ecological receptors, McClellan is using recently developed consensus-based sediment guidelines for the freshwater ecosystems (MacDonald et al., 2000) to evaluate potential risks (CH2M Hill, 2003c).

Based on available information, McClellan efforts are using the most recent ARARs to evaluate and monitor existing exposure pathways to ecological resources.

13.7 CONCLUSIONS

To date, no final Basewide Scoping Assessment, final Tier 1 ERAs, or final interim RODs are available for 1) seasonal wetlands and vernal pools and 2) creeks and floodplains. However, a list of IRP sites that may impact vernal pools or seasonal wetlands has been reviewed and accepted by the regulatory agencies (Personal Communication, Ms. M. Enloe, 05 August 2003). In addition, McClellan is using a consensus-based approach and recently developed bioaccumulation models and toxicity values to ensure a protective evaluation and defensible ERAs. Furthermore, ongoing efforts are in place to monitor potential sources (e.g., discharge from the GWTP, surface soils transported via OU B1 Drainage Ditches) to sensitive resources (e.g., creeks, vernal pools). Water quality ARARs included in the GWTP discharge requirements ensure protectiveness of aquatic biota in receiving waters. Finally, interim actions are being taken to control existing exposure pathways.

Based on available information, sites that may pose an ecological risk at McClellan have on-going investigations, assessments, and/or future action plans. Further, it is anticipated that results from these efforts will provide information needed to 1) determine and justify whether ecological risks exists, 2) select protective cost-effective remedies, and 3) prepare RODs for sites that may pose an ecological risk at McClellan.

14.0 NO ACTION ROD SITES

Following further investigation, some soil sites have been listed as no further action and do not require further risk analysis or data collection to complete site closeout. Six sites are specifically included in the No Action ROD which was finalized by AFRPA on 16 January 2003 (AFRPA, 2003d). The following sections include the Five-Year Review evaluation for the six sites included in the No Action ROD.

14.1 DESCRIPTION AND BACKGROUND OF NO ACTION ROD SITES

The protectiveness of the No Action remedy at the sites included in the No Action ROD was evaluated during the Five-Year Review. These sites include PRL B-004, SA 064, SA 039, SA 050, PRL 035, and SA 017, encompassing approximately 3 acres. Except for SA 017 and SA 039, a quantitative risk-based approach was not utilized to recommend No Action at these soil sites. Based on historical uses and previous data for these sites, no evidence of contamination was found or activities at the sites were reported to comply with applicable RCRA and Occupational Safety and Health Administration (OSHA) regulations. For Site 017, no evidence of contamination in soils at the site was found and no contaminants were detected in soils. For Site 039, impacted soils were removed and confirmation samples demonstrated no detected residual impacts. The excavated area was back-filled with clean soils (AFRPA, 2003d).

14.2 FIVE-YEAR REVIEW PROCESS FOR NO ACTION ROD SITES

The detailed Five-Year Review process that was conducted for the other remedial/removal action areas (Sections 4 through 10) was not directly applicable to the No Action ROD sites. The protectiveness evaluation was conducted for these sites by reviewing whether new information has come to light that could call into question the protectiveness of the remedy.

14.2.1 Technical Assessment for No Action ROD Sites

In accordance with the Comprehensive Five-Year Review Guidance (USEPA, 2001b), the technical assessment typically includes the evaluation of the following three questions.

Question A: Is the remedy functioning as intended by the decision documents?

There is no remedy in place at these sites and therefore, this question does not apply.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

There is no remedy in place at these sites and therefore, this question does not apply.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

There is no new information that has come to light that could call into question the protectiveness of the remedy for the six No Action ROD sites. The No Action ROD does not address possible groundwater or sewer line contamination at the six sites. These two topics will be addressed under subsequent RODs. If applicable, groundwater and sewer line restrictions (i.e., LUCs) will be implemented to prevent exposure to contaminated groundwater and prevent interference with groundwater and sewer line remedial actions (AFRPA, 2003d, p. vi).

In their review of the No Action ROD, the DHS noted that SA 039 was in close proximity to a site identified as a former Technical Operations Division radiochemistry laboratory and that recent interviews with past McClellan AFB employees indicated that radioactive waste from this facility may have been buried in the vicinity of the laboratory. However, it was not known where the burial pit was located and whether it existed since no investigation had be done (DHS, 2002). The Air Force considered SA 039 as a potential radiation site based on the storage of chemical agent detection kits in Building 29; however, this building was later cleared for

unrestricted use by DHS. Since SA 039 was close to Building 334, a radiological laboratory operated by Technical Operation Division in site SA 058, the building and Site 058 will be investigated as part of the Existing Sites Radiological RI. The investigation will not be limited to the administrative boundaries of SA 58. Rather it will be based on potential release points and migration paths. Therefore, the Air Force believes that if any radioactive contamination from Building 334 was released in the areas currently covered by SA 039, the existing sites radiological RI will characterize it and it should be considered part of the SA 058 contamination (DHS, 2002).

The Air Force, USEPA, and State regulators have developed a new basewide McClellan radiological conceptual model and numerous radiological investigations are underway and planned for McClellan. The results from these investigations will be finalize in future RODs. The Air Force has the responsibility to take cleanup action at any of the six No Action ROD sites should any new evidence be found that activities at these sites caused contamination requiring cleanup action, even if the land is transferred by deed to another party (AFRPA, 2003d, p. A6-5).

In 2001, the wetland delineation for McClellan was updated, and several new areas of seasonal wetlands and vernal pools were identified. A basewide vernal pool scoping assessment was conducted in 2002, using the new wetland delineation mapping, to identify IRP sites that could be a potential source of contamination to sensitive habitats (seasonal wetlands or vernal pools) via surface water runoff. None of the sites in the No Action ROD were identified as sites with potential surface water pathways to sensitive habitat areas (Personal Communication, Ms. M. Enloe, 25 July 2003). The regulatory agreement of the lack of contamination at these sites, and the lack of a surface pathway to sensitive habitat areas or biota of concern, suggest that the recommendation of No Action is valid.

Technical Assessment Summary

According to the documents reviewed, the No Action remedy is protective.

14.3 ISSUES FOR NO ACTION ROD SITES

There are currently no issues or recommendations for the No Action ROD sites.

15.0 RECOMMENDATIONS

The actions taken to date at McClellan have eliminated the immediate threat of exposure to contamination and are protective of human health and the environment. However, long-term risks from potential exposure still exist. The actions recommended from this review are intended to ensure that these specific goals will be met as planned to achieve long-term and permanent solutions to remediate/eliminate the identified contamination. The recommendations follow for each of the remedial investigations/areas of concern evaluated as part of this Five-Year Review.

15.1 GROUNDWATER OU

The following constitute the recommendations for the groundwater OU interim remedial action:

- Complete the Phase III Data Gaps investigation to adequately define all VOC plumes exceeding the MCL and complete the development of a groundwater model, design and installation of the Phase III expansion to prevent VOC MCL contamination from migrating.
- Continue implementing groundwater monitoring programs for radiological constituents, 1,4-dioxane, and hexavalent chromium to identify and better define non-VOC and inorganic contamination at McClellan.
- Continue to evaluate the potential affect of non-VOC (including 1,4-dioxane) and inorganic contamination in the GWTP effluent on protectiveness to human health and the environment.
- Install additional extraction wells, and continue to install monitoring wells, and piezometers recommended in the GWMP Quarterly Monitoring reports, and address additional areas of contamination identified during the remedial investigations (carried forward and modified from the 1999 Five-Year Review Protectiveness Determination).
- Continue the well abandonment program as needed to destroy wells and piezometers that are no longer functional or are not needed for groundwater monitoring or extraction; these wells could become conduits for contaminant migration (carried forward from the 1999 Five-Year Review Protectiveness Determination).
- Ensure that any ICs established in the ROD are monitored. A checklist and monitoring program should be established, and responsibility delegated to an appropriate party upon property transfer (carried forward and modified from the 1999 Five-Year Review Protectiveness Determination).

- Prove out the ion exchange system for treatment of hexavalent chromium concentrations in the GWTP influent.
- Prepare a FS to evaluate and prove out treatment options for 1,4-dioxane in groundwater.
- Implement Department of Defense (DoD) policy regarding "emergent chemicals" once DoD policy is established.
- Issue a letter to the County Health Department to request that they conduct an outreach program to identify those homeowners within the area of off-base contamination who still have groundwater wells and are using those wells for domestic purposes.

15.2 VOC VADOSE ZONE

The following constitute the recommendations for the vadose zone removal actions (VOCs only):

- Continue to monitor and evaluate the stack emissions from the vadose zone treatment systems for dioxins/furans and VOCs, as well as the radon gas concentrations in the carbon vessels at the points of potential exposure.
- Incorporate site-specific shallow soil gas and soil properties data from ongoing investigations and evaluate changes in toxicity criteria for soil gas in the most recent indoor air model to develop site-specific RAOs.

15.3 OU B1 CAP AND DRAINAGE DITCHES

The following constitute the recommendations for the OU B1 Cap and Drainage Ditches:

- Continue sampling and evaluating the analytical results of the sediment traps to determine if contaminants are present and if so, determine if they are originating from under the OU B1 Cap, represent residual contamination from the lined section of the OU B1 Drainage Ditch, or are the result of some new source.
- Develop decision criteria to evaluate the monitoring results and make and implement recommendations for actions or changes to the monitoring program until the final ROD can be implemented.
- Ensure that any ICs established in the ROD are monitored and responsibility is delegated to an appropriate party upon property transfer (carried forward and modified from the 1999 Five-Year Review Protectiveness Determination).

15.4 OU D CAP

There are no recommendations for the OU D Cap.

15.5 PRL S-033

There are no recommendations for PRL S-033.

15.6 PRL 32

The following constitute the recommendations for PRL 32:

- Complete the sampling and evaluation of radiological contaminants at PRL 32 as soon as practical in order to expedite site restoration.

15.7 CS 10

The following constitute the recommendations for CS 10:

- A site-specific risk-based decision process should be used to develop RAO cleanup levels to verify completion of the excavation.
- Resume off-site disposal of contaminated soils currently stored in the tent as soon as funding becomes available.

15.8 CERLCA SITES WITH FUEL COMPONENTS

The following constitute the recommendations for the CERLCA sites with fuel components:

- Complete sampling to determine which sites are commingled.
- Apply final cleanup levels for TPH once they have been determined.

15.9 LAND USE CONTROLS

The following constitute the recommendations for the LUCs:

- Develop a central repository or database to capture all incidents or breaches of LUC/ICs and develop a formal tracking method for LUC/ICs.
- Reevaluate the parcels following discovery and confirmation of any new COPCs.
- Ensure that any ICs established in the site-specific RODs are monitored and responsibility is delegated to an appropriate party upon property transfer (carried forward and modified from the 1999 Five-Year Review Protectiveness Determination).

15.10 NO ACTION ROD SITES

- There are no recommendations for the No Action ROD Sites.

15.11 ECOLOGICAL SITES

The following constitute the recommendations for the ecological sites:

- Complete ongoing ecological investigations, assessments, and/or future action plans that will determine whether ecological risks exist in sensitive habitats at McClellan, and help identify and select protective and cost-effective remedies for cleanup of sensitive habitat areas in the Ecological Sites ROD. Cleanup of those sites that could pose an ongoing risk to ecological receptors if contaminants are left in place at levels that exceed ecological thresholds will be determined in the applicable RODs for those sites.
- Prepare an EE/CA for the creek tailings removal action, and implement the removal of contaminated tailings according to the accepted plan.

All of the above-listed recommendations should be implemented prior to the next Five-Year Review (2009) with the oversight authority by the State and Federal Remedial Program Managers.

16.0 PROTECTIVENESS STATEMENT

A Protectiveness Determination is located at the front of the report, preceding the Executive Summary.