Section 6
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

This section details remedial alternatives for IR Site 27 and evaluates them against regulatory criteria. Alternatives have been developed (Section 5) based on technology screening results (Section 4). Section 6.1 summarizes the criteria for assessing remedial alternatives as specified in the NCP. Sections 6.2 through 6.7 describe and analyze remedial alternatives for IR Site 27, emphasizing how technologies and process options would be applied. Each alternative is evaluated against the NCP criteria.

Under the BGMP, the Navy is currently collecting analytical data for natural attenuation parameters for IR Site 27, as discussed in Section 4.3.4.1. Based on the interpretation of these results, natural attenuation processes have reduced VOC concentrations at the site, and continued reduction is expected to occur. No other remedial actions have taken place for VOCs in groundwater at IR Site 27.

Data gaps were identified in the RI Report (BEI 2005) related to a washdown area (including two OWS units) and stained soil that appears to be associated with a transformer. These data gaps will be addressed in the remedial design phase. No costs for these activities are included in the FS alternatives.

The alternatives evaluated in this section are intended to give decision makers a range of remedial alternatives to address VOC impacts to groundwater at IR Site 27. The following six alternatives are evaluated in this section:

- Alternative 1 – no action
- Alternative 3 – MNA and ICs
- Alternative 4A – ISB source area treatment, MNA, and ICs
- Alternative 6A – ISCO source area treatment, MNA, and ICs
- Alternative 6B – sitewide ISCO and groundwater confirmation sampling
- Alternative 7 – dynamic circulation source area treatment, MNA, and ICs

6.1 REVIEW OF CRITERIA

The following nine criteria are stipulated in the NCP at 40 C.F.R. § 300.430(e)(9)(iii) for the evaluation of remedial alternatives under CERCLA:

1) overall protection of human health and the environment
2) compliance with ARARs
3) long-term effectiveness and permanence
4) reduction of toxicity, mobility, or volume through treatment
5) short-term effectiveness
6) implementability
7) cost

8) state acceptance

9) community acceptance

The NCP divides these criteria into three categories: threshold, primary balancing, and modifying criteria. The first two criteria are considered threshold criteria. CERCLA Section 121(d) and the NCP at 40 C.F.R. § 300.430(f)(1)(ii) require that a cleanup remedy protect human health and the environment and comply with ARARs unless justification to waive a specific ARAR is provided in the ROD. In other words, both threshold criteria must be satisfied for a remedial alternative to be eligible for selection unless an ARARs waiver applies. Criteria 3 through 7 from the list above are considered primary balancing criteria. The remedial alternatives do not have to meet all five balancing criteria, although it is preferred. The last two criteria from the list above are considered modifying criteria. Evaluation against modifying criteria is the final test in determining whether the state and the community find the alternative acceptable.

These NCP criteria are further defined by subcriteria and other factors (U.S. EPA 1988b). The following subsections explain the nine NCP criteria and summarize relevant subcriteria and other factors.

6.1.1 Overall Protection of Human Health and the Environment

This criterion assesses the extent to which an alternative protects human health and the environment, considering site characteristics and expected risk reduction. Evaluation of the overall protection of human health and the environment afforded by each alternative draws on assessments made under several other NCP criteria, especially short-term effectiveness, long-term effectiveness and permanence, and compliance with ARARs.

The following issues are addressed for each alternative under this criterion:

- reduction in risk to human health and the environment
- ability to document that remediation goals for groundwater at IR Site 27 are met and that any remaining concentrations are stable and not migrating at a rate that would adversely impact downgradient surface water

6.1.2 Compliance With ARARs

This criterion examines whether an alternative would comply with all federal and state ARARs, as defined by CERCLA Section 121 and identified for IR Site 27 in Appendix A. When an ARAR is not met, the basis for justifying one of the six waivers allowed under CERCLA should be discussed.

6.1.3 Long-Term Effectiveness and Permanence

This criterion examines the impact of a remedial alternative in the long term, defined in U.S. EPA guidance as the time after RAOs are met (U.S. EPA 1988b). The risk to human and environmental receptors from remaining COC-impacted groundwater at the completion

of remedial activities is determined. Evaluation of a remedial alternative relative to its long-term effectiveness and permanence is made considering the following factors:

- magnitude of the residual risk to human and environmental receptors from remaining COC-impacted groundwater at the completion of remedial activities
- type, degree, and adequacy of long-term management (including ECs, monitoring, and O&M) required for COC-impacted groundwater remaining at the site
- long-term reliability of engineering controls and/or ICs to provide continued protection from COC-impacted groundwater
- the potential need to replace components of the remedy and the continuing need for repairs or maintenance

6.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

According to CERCLA, preferred cleanup alternatives use technologies that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances (compared to baseline levels, i.e., the no action alternative). For the groundwater plume at IR Site 27, this would mean using technologies that:

- destroy VOCs in groundwater,
- reduce the total mass of VOCs in the subsurface,
- reduce the volume of VOC-impacted groundwater, or
- irreversibly reduce VOC mobility.

Alternatives that do not use treatment technologies to achieve these goals, such as extraction and off-site disposal of COC-impacted groundwater, do not reduce the toxicity, mobility, or volume of contaminants.

Evaluation of alternatives for reduction of toxicity, mobility, or volume includes the following considerations:

- treatment processes used
- amount of hazardous materials to be treated and how the principal threats at the site would be addressed
- degree of expected reduction in toxicity, mobility, or volume measured as a percentage of baseline levels
- irreversibility of the treatment
- type and quantity of treatment residuals

6.1.5 Short-Term Effectiveness

This criterion considers how an alternative affects human health and the environment during cleanup (i.e., the short term). "Short term" is defined as the time required to plan, design,

construct, and operate a system of cleanup until RAOs are achieved (U.S. EPA 1988b). The following factors are considered:

- short-term risks that might be imposed on the community, such as dust from excavation of header trenches for remediation systems
- potential impacts on workers during construction and O&M, as well as the effectiveness and reliability of the protective measures that would be taken
- potential environmental impacts of the remedial action and the effectiveness and reliability of mitigation measures that would be taken during implementation
- amount of time required before protection is achieved (i.e., the duration of the short term)

6.1.6 Implementability

This criterion evaluates the technical and administrative feasibility of an alternative. The availability of required equipment, materials, and services is also considered. When assessing implementability, the following factors are considered:

- technical feasibility, which refers to the relative ease of implementing or completing an action based on site-specific constraints, including the use of established technologies. The following issues are considered:
  - constructability of components necessary for the alternative
  - operational reliability, or the likelihood that a technology would meet specified efficiency levels or performance goals
  - ability of the owner to undertake future remedial actions that may be required and difficulty of implementing such actions
  - ability of the owner to monitor the effectiveness of the remedy
- administrative feasibility, which includes the ability (as well as the time) to obtain approvals from governmental bodies
- availability of services and materials required to implement the alternative, including the following:
  - capacity and location of off-site treatment, storage, and disposal services
  - equipment (such as heavy construction equipment) and specialists needed
  - time needed to develop new or innovative technologies under consideration, including the time required for bench-scale and pilot-scale tests
  - potential for competitive construction bids, a factor that may be particularly important for innovative technologies such as ISCO and Dynamic Subsurface Circulation

6.1.7 Cost

Procedures outlined in U.S. EPA guidance (U.S. EPA 1987, 1988b, 2000) have been followed in developing cost estimates for each remedial alternative. These cost estimates are based on the conceptual engineering designs presented in this section. All estimates include capital costs and O&M costs and are expressed as present value in terms of January 2005 dollars (Appendix C). The details of the alternatives (e.g., number of injection points, frequency of groundwater sampling, analysis parameters, and amendment type and volume) would be determined in the remedial design phase. Assumptions used in estimating costs in this FS Report are described in the following sections.

6.1.8 State Acceptance

This criterion evaluates the remedial alternatives with respect to the concerns of state regulatory agencies. Comments from the state of California on the draft FS Report, as well as responses to these comments, are presented in Appendix D. State comments will also be considered in finalizing the Proposed Plan and ROD.

6.1.9 Community Acceptance

This criterion assesses issues of concern to the community for each remedial alternative. No comments on the draft FS Report were received from RAB members or the public during the review period. Although community acceptance will be evaluated after the public comment period for the Proposed Plan, this criterion is briefly assessed in Section 7.

6.2 ALTERNATIVE 1 – NO ACTION

Alternative 1 is the no action alternative. Per the NCP (40 C.F.R. § 300.430[e][6]), this alternative must be evaluated in the same manner as the other remedial response actions considered in this FS Report.

6.2.1 Description of Alternative

The no action alternative provides a baseline against which other potential remedial action alternatives can be compared. Alternative 1 involves no engineered remediation measures, administrative controls, or monitoring of contaminated groundwater at IR Site 27 and vicinity. This alternative would not include any activities to monitor natural attenuation processes or to implement ICs to prevent exposure to VOC-affected groundwater. If implemented, this action would be considered a final remedy for IR Site 27. Groundwater monitoring would be discontinued and no periodic reviews would be conducted to verify the protectiveness of this alternative.

6.2.2 Evaluation by Criteria

Evaluation of Alternative 1 for IR Site 27 by threshold and balancing criteria follows.

6.2.2.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

While Alternative 1 would leave VOC-contaminated groundwater uncontrolled, natural attenuation processes would be expected to continue to reduce chemical concentrations. However, no sampling would be performed to verify these reductions. Human-health risk associated with possible domestic use of groundwater would not be mitigated.

6.2.2.2 COMPLIANCE WITH ARARs

According to the NCP, the no action alternative must be evaluated in the same manner as other proposed remedial action alternatives. There are no ARARs that would apply under the no action alternative; per CERCLA Section 121, the requirement to meet ARARs applies only when a response action is taken. This alternative does not involve any steps to prevent access to, reduce, remove, or treat the VOCs (other than by natural attenuation processes already occurring at the site). This alternative would provide no additional protection to human health or the environment should exposure routes develop.

6.2.2.3 BALANCING CRITERIA

Alternative 1 does not meet the threshold criterion of overall protection of human health and the environment. Therefore, an evaluation against the balancing criteria is not necessary and was not performed.

6.3 ALTERNATIVE 3 – MNA AND ICs

Alternative 3 relies on natural processes to continue to reduce contaminant levels in the plume at IR Site 27. A long-term groundwater monitoring program, including periodic reviews, would be implemented to track reductions in contaminant concentrations. ICs would prohibit groundwater extraction for domestic purposes at the site. ICs would also prohibit taking actions that would interfere with MNA activities. Once groundwater sampling results indicate that RAOs have been reached or that ICs are no longer warranted, ICs and the MNA program would be discontinued.

6.3.1 Description of Alternative

This alternative assumes that natural attenuation processes (biodegradation, adsorption, dilution, etc.) will reduce concentrations of chlorinated VOCs in groundwater to achieve RAOs. This alternative is included based on the following assumptions.

- Historical concentration trends indicate that reductive dechlorination is occurring in the subsurface at IR Site 27. These processes are likely to continue to reduce contaminant concentrations and thus further reduce potential risk.
- Vertical migration of chlorinated VOCs is limited to an estimated depth of 20 feet bgs (BEI 2005).
- Contamination in shallow groundwater would not threaten the deeper water-bearing zone due to the presence of a saltwater interface (BEI 2005).

- Contaminant concentrations in the shallow aquifer would continue to be tracked as part of the MNA program.

Groundwater modeling was performed to assist in evaluating the effectiveness of Alternative 3 and to estimate the duration for MNA and ICs. The analytical model BIOCHLOR was used to predict the time to achieve RAOs in IR Site 27 groundwater. BIOCHLOR is a U.S. EPA-accepted software package that provides an analytical solution to modeling natural attenuation of dissolved-phase organic compounds. A model description and model simulation results are contained in Appendix B.

BIOCHLOR model simulations (Appendix B) performed for this alternative indicate that the VOC plume appears to be stable and declining with time, with limited downgradient migration potential, and that VOC concentrations should attenuate to RAOs within 70 years. This model is conservative because it is based on the highest VOC concentrations observed at IR Site 27. The assumed end point (i.e., MCLs) may be achieved sooner, in which case the ICs would be discontinued.

This alternative includes the following components:

- monitoring program design, groundwater sampling and analysis
- ICs to prohibit groundwater extraction for domestic purposes
- periodic reviews

Based on the model simulations, the duration of MNA and ICs under Alternative 3 is assumed to be 70 years. Recent groundwater monitoring results indicate that VOCs in shoreline groundwater have attenuated to concentrations below RAOs. Therefore, no further action is proposed for shoreline groundwater. Sitewide groundwater monitoring (including selected shoreline wells as appropriate) would be conducted to monitor the performance of the selected remedy for inland groundwater.

6.3.1.1 MONITORING PROGRAM DESIGN FOR MNA

Activities associated with MNA include collecting and analyzing groundwater samples from wells within and along the downgradient migration pathways of the plume, and data evaluation. For FS cost estimating purposes, the monitoring program is assumed to utilize existing groundwater monitoring wells. Details regarding the Ferry Point Road plume and the Building 168 plume can be found in Section 2.5.3.3. The approximate locations of these plumes are shown on Figure 6-2. Based on the BIOCHLOR model simulations for Alternative 3, and for FS purposes, the Ferry Point Road plume is projected to reach RAOs in approximately 30 years, and the Building 168 plume is projected to reach RAOs in approximately 70 years. The number of monitoring wells included in the monitoring program was assumed to be reduced after 30 years due to the closure of the Ferry Point Road plume.

The frequency and number of groundwater sampling events would be higher at the beginning of the MNA program, and reduce with time. It is assumed that groundwater from eight wells would be sampled quarterly for years 1 through 3, groundwater from six

wells would be sampled semiannually for years 4 through 6, groundwater from six wells would be sampled annually for years 7 through 30, and groundwater from four wells would be sampled annually for the remainder of the MNA program.

For FS cost estimating purposes, it is assumed that all groundwater samples collected under this alternative would be analyzed for VOCs and MNA parameters. Monitoring for natural attenuation parameters is included to aid in understanding natural attenuation progress and VOC concentration trends. Ferrous iron, conductivity, temperature, pH, oxidation-reduction potential (ORP), and dissolved oxygen would be measured with hand-held equipment. An off-site laboratory would conduct analyses for VOCs and the following MNA parameters: dissolved gases, alkalinity, major anions, major cations, total organic carbon (TOC), and TDS. Annual monitoring reports would be prepared and submitted to the regulatory agencies for review.

6.3.1.2 INSTITUTIONAL CONTROLS

Under Alternative 3, the actual ICs to be employed would be established in the ROD and subsequent remedial design/remedial action documentation. The Navy would use its policy entitled Principles and Procedures for Specifying, Monitoring and Enforcement of LUCs and Other Post-ROD Actions (Attachment B) for specifying and implementing ICs for this alternative.

ICs would be put in place at IR Site 27 to prohibit extraction of groundwater for domestic purposes. Figure 6-1 depicts the portion of IR Site 27 assumed to be subject to ICs.

Alternative 3 does not include active source area treatment or any further groundwater sampling. Quarterly groundwater sampling has been conducted at the site since 2002. Analytical results have shown that chlorinated VOC concentrations in groundwater are stable and declining with time. Natural attenuation processes would be expected to continue reducing contaminant concentrations at the site.

A key component of the ICs for this alternative would be proprietary land-use restrictions incorporated into a quitclaim deed(s) and Covenant to Restrict Use of Property agreement(s) with DTSC. The Navy would employ a dual approach to include land-use restrictions in both Navy deeds of conveyance and in Covenant to Restrict Use of Property agreements with DTSC, entered into pursuant to the March 2000 MOA between the Navy and DTSC (Attachment A). The installation and construction of groundwater extraction wells would be prohibited unless approved by the Navy, U.S. EPA, DTSC, and San Francisco Bay RWQCB. In addition, a deed notice would be recorded to notify the public of the existence of the groundwater contamination. The ICs might be released if the transferee demonstrates to the concurrence of the Navy, U.S. EPA, DTSC, and San Francisco Bay RWQCB that the risk associated with exposure to groundwater at IR Site 27 no longer warrants ICs. This alternative has an assumed duration of 70 years for cost estimating purposes.

6.3.1.3 PERIODIC REVIEWS

For FS cost estimating purposes, it is assumed that groundwater sampling reports would be submitted to the agencies annually and that periodic reviews would be performed every 5 years over the 70-year MNA period to assess natural attenuation progress and plume stability. Reviews would be documented in a summary report issued to appropriate regulatory agencies. These reports might suggest modifications to the cleanup program as needed.

6.3.2 Evaluation by Criteria

Evaluation of Alternative 3 by the threshold criteria and balancing criteria follows.

6.3.2.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 3 is considered protective of the environment. Natural attenuation processes occurring at the site reduce chlorinated VOC concentrations, evidenced by the presence of daughter products (cis-1,2-DCE and vinyl chloride) and historical data trends. ICs would limit human exposure to shallow groundwater at the site. Groundwater monitoring and periodic reviews would provide information to support future remedial action decisions.

6.3.2.2 COMPLIANCE WITH ARARs

Alternative 3 is expected to meet potential chemical-specific, location-specific, and action-specific ARARs. Purgewater and other wastes generated during groundwater monitoring for Alternative 3 would be subject to the substantive provisions of potential RCRA ARARs to determine whether such wastes should be classified as hazardous. This determination would be made at the time the waste is generated. The substantive provisions of potential waste management ARARs for storing, labeling, manifesting, and transporting this material for final treatment or disposal would be followed if the wastes were found to be RCRA or non-RCRA hazardous waste.

6.3.2.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Groundwater monitoring and administrative controls such as ICs have been routinely implemented at hazardous-waste release sites in the United States. These activities are expected to be reliable in minimizing future health risks associated with the VOC plume at IR Site 27.

ICs would limit human exposure to shallow groundwater at the site. The long-term effectiveness of these measures would depend on their continued adherence. Local agencies would be responsible for administering these controls (e.g., prohibiting the installation of wells) upon any future transfer in property ownership. The Navy would use its policy entitled Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions (Attachment B) for

specifying and implementing ICs for this alternative. Monitoring and periodic reviews would be conducted to evaluate lines of evidence and progress of MNA.

6.3.2.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

The mobility and toxicity of VOCs would be reduced with time through natural attenuation; however, there is no active treatment provided by this alternative. The plume at IR Site 27 is stable and VOC concentrations are declining (particularly at the shoreline), so the volume of contaminated groundwater is not expected to increase. This alternative would not affect the rate at which natural attenuation processes are acting to decrease contaminant concentrations in the subsurface.

6.3.2.5 SHORT-TERM EFFECTIVENESS

Alternative 3 would be effective in the short term, because no construction activities are required for implementation. ICs could be put in place quickly to prohibit extraction of groundwater for domestic purposes at the site. Groundwater sampling activities are already being conducted at IR Site 27 as part of the BGMP. Implementation of Alternative 3 is not expected to have adverse effects on site workers, the surrounding community, or the environment.

6.3.2.6 IMPLEMENTABILITY

MNA and ICs have been routinely implemented at CERCLA sites in the United States. No new monitoring wells are proposed for this alternative. Periodic sampling of the existing monitoring wells should not be incompatible with the potential reuse options; however, access to monitoring wells would need to be maintained to allow for sampling. New construction of buildings over the IR Site 27 plume could limit access to portions of the site and therefore could limit future monitoring activities.

6.3.2.7 COST

The comparative present value cost for Alternative 3 is approximately $1,407,000 (Table 6-1). Major cost components for this alternative are associated with long-term groundwater monitoring. Cost estimates are solely for comparing alternatives in this FS Report; they should not be used for budgetary or planning purposes because actual costs may change based on the final design and the duration of the MNA program.

6.4 ALTERNATIVE 4A – ISB SOURCE AREA TREATMENT, MNA, AND ICs

Alternative 4A is included to evaluate the opportunity to accelerate contaminant concentration reduction using ISB remediation technology in the two areas of higher VOC concentrations in groundwater at IR Site 27.

6.4.1 Description of Alternative

Alternative 4A is similar to Alternative 3 but would additionally employ anaerobic ISB technology to accelerate VOC contaminant degradation in the IR Site 27 plume. It is assumed that the proprietary HRC technology would be used to accelerate biodegradation (reductive dechlorination) of VOCs. HRC would be injected into the subsurface at the two areas of higher VOC concentrations in groundwater shown on Figure 6-2. HRC would be injected by direct-push methods. Groundwater sampling and data evaluation would be performed as part of an MNA program to document the reduction in contaminant concentrations after treatment and demonstrate that contaminant levels are reduced over time through naturally occurring processes during the IC period. ICs would prohibit extraction of groundwater and single-family residential land use at the site. ICs would also prohibit actions that would interfere with activities associated with this alternative.

BIOCHLOR model simulations (Appendix B) performed for this alternative indicate that VOC concentrations should attenuate to RAOs within 60 years after source area treatment. This model is conservative because it is based on the highest VOC concentrations observed at IR Site 27. However, the BIOCHLOR modeling result of 60 years is adequate for comparison purposes. The assumed end point (i.e., MCLs) may be achieved sooner, in which case the ICs would be discontinued.

Major components of this alternative include ISB, MNA, and ICs. The assumed duration of Alternative 4A is 60 years. Recent groundwater monitoring results indicate that VOCs in shoreline groundwater have attenuated to concentrations below RAOs. Therefore, no further action is proposed for shoreline groundwater. Sitewide groundwater monitoring (including selected shoreline wells as appropriate) would be conducted to monitor the performance of the selected remedy for inland groundwater.

6.4.1.1 *IN SITU* BIOREMEDIATION

Enhanced anaerobic ISB for this alternative would consist of a single application of an electron donor compound in the two areas of higher VOC concentrations, followed by MNA. The total treatment area is approximately 43,000 square feet. For FS cost estimating purposes, it is assumed that a single injection event of HRC at 128 direct-push borings would enhance natural attenuation processes in the two treatment areas. The assumed dose rate for HRC is 120 pounds per injection point. The injections would be located on 20-foot centers, based on an estimated radius of influence of 10 feet. Details of this alternative (e.g., the number of borings and dose rates per boring for HRC) would be determined in the remedial design phase. The two treatment areas and an assumed array of injection points are shown on Figure 6-3.

The enhanced anaerobic ISB process should provide active treatment for VOC-impacted groundwater. No pilot-scale testing is assumed.

6.4.1.2 MONITORING PROGRAM DESIGN FOR MNA

MNA for Alternative 4A would be similar to Alternative 3 except that the duration is assumed to be 60 years, based on BIOCHLOR model simulations (Appendix B) and the

sampling event frequency would vary as described below. For FS cost estimating purposes, the monitoring program is assumed to utilize existing groundwater monitoring wells. Details regarding the Ferry Point Road plume and the Building 168 plume can be found in Section 2.5.3.3. The approximate locations of these plumes are shown in Figure 6-2. Based on the BIOCHLOR model simulations for Alternative 4A, and for FS purposes, the Ferry Point Road plume is projected to reach RAOs in approximately 25 years, and the Building 168 plume is projected to reach RAOs in approximately 60 years. The number of monitoring wells included in the monitoring program is assumed to be reduced after 25 years due to the closure of the Ferry Point Road plume.

Monthly groundwater sampling and analysis would be performed prior to and following the HRC injection to evaluate remediation progress for a total of 12 months. Both laboratory and field analyses would be conducted to establish baseline groundwater conditions. Ferrous iron, conductivity, temperature, pH, ORP, and dissolved oxygen would be measured using hand-held equipment.

For cost estimating purposes, it is assumed that an off-site laboratory would conduct analysis for VOCs and the same MNA parameters as under Alternative 3. Additionally, organic acid analyses would be performed using gas chromatography/flame ionization detection to assess the dissolution of HRC in the aquifer. DNA [deoxyribonucleic acid] testing (using quantitative polymerase chain reaction and terminal restriction fragment length polymorphism) and metabolic acids testing would be performed to confirm the presence of dechlorinating bacteria within the probable source areas.

The frequency of groundwater sampling events would be higher at the beginning of the MNA program, and were assumed to reduce with time. It is assumed that groundwater from existing wells would be sampled on the following schedule.

- Year 1 would include monthly monitoring of eight wells for VOCs, DNA, and metabolic acids, and quarterly monitoring for all MNA parameters.
- Years 2 through 3 would include quarterly monitoring of eight wells for VOCs and all MNA parameters.
- Years 4 through 5 would include semiannual monitoring of eight wells for VOCs and annual monitoring for all MNA parameters.
- Years 6 through 25 would include annual monitoring of six wells for VOCs and all MNA parameters.
- Years 26 through 60 would include annual monitoring of four wells for VOCs and all MNA parameters.

For FS cost estimating purposes, the groundwater sampling techniques, field and laboratory analyses, and annual reporting are assumed to be the same as for Alternative 3.

6.4.1.3 INSTITUTIONAL CONTROLS

ICs under Alternative 4A would be similar in scope to ICs for Alternative 3, with an assumed duration of 60 years for FS cost estimating purposes.

6.4.1.4 PERIODIC REVIEWS

Periodic reviews for Alternative 4A would be performed similarly to those described under Alternative 3. Reviews would occur every 5 years over the 60-year period.

6.4.2 Evaluation by Criteria

Evaluation of Alternative 4A by threshold and balancing criteria follows.

6.4.2.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 4A would protect human health and the environment and should accelerate reduction of contaminant mass within the probable source areas of the plume to a greater extent than passive methods. Treatment of the source area groundwater *in situ* would reduce the VOC contaminant mass. Although Alternative 4A was not designed to treat all contamination in the subsurface, it does address the areas of highest VOC concentrations in the plume. The primary uncertainty associated with this alternative concerns the extent to which ISB treatment accelerates reductive dechlorination occurring at the site compared to natural (unassisted) dechlorination processes. MNA would document the reductions in VOC concentrations and natural attenuation parameters over time at IR Site 27. ICs would prohibit groundwater extraction for domestic purposes at the site.

6.4.2.2 COMPLIANCE WITH ARARs

Alternative 4A is expected to meet potential chemical-specific, location-specific, and action-specific ARARs. The time to reduce VOC concentrations in groundwater is expected to be shorter than for passive cleanup alternatives.

Potential ARARs associated with ICs are the same as those described for Alternative 3 in Section 6.3.2.2. Investigation-derived waste (IDW) generated during the direct-push HRC injection and MNA program would be subject to the substantive provisions of potential RCRA ARARs to determine whether such wastes should be classified as hazardous. This determination would be made at the time the waste is generated. The substantive provisions of potential waste management ARARs for storing, manifesting, and transporting this material for final disposal would be followed if the wastes were found to be RCRA or non-RCRA hazardous waste.

6.4.2.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 4A would be an effective means to reduce contaminant concentrations within the plume at IR Site 27. ISB, MNA, and ICs have been routinely implemented at hazardous waste release sites in the United States. These activities are expected to be reliable in minimizing future health risks associated with the contaminated plume.

ISB is expected to be effective and permanent in the long term. It would permanently treat VOC-affected groundwater in the two treatment areas. No O&M would be required after the ISB treatment. Risk to human and environmental receptors is expected to be reduced following the ISB treatment, and VOC concentrations in groundwater would be

monitored during the MNA sampling events. MNA would be used to verify plume stability and track VOC concentrations until ICs are no longer needed.

6.4.2.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternative 4A is expected to reduce the toxicity of groundwater by biodegrading VOCs through the ISB and MNA processes. Alternative 4A includes HRC injections in two treatment areas, which would provide an active treatment process to accelerate the biodegradation of chlorinated VOC concentrations in the subsurface. After ISB treatment, MNA processes would continue to reduce VOC concentrations.

6.4.2.5 SHORT-TERM EFFECTIVENESS

HRC addition in the two treatment areas should reduce VOC mass in the groundwater in the first year of implementation. Short-term risks during implementation include potential risk to workers during invasive work and injection of HRC product, and exposure to contaminated groundwater during HRC injection. Potential formation of undesirable by-products during ISB is discussed in Section 4.3.8.2, which presents potential concerns about short-term risks. The field activities related to the treatment event are anticipated to take approximately 3 weeks to complete. The injection would utilize direct-push installation to minimize invasiveness and generation of soil cuttings.

These potential risks would be mitigated through proper design and implementation of a site-specific safety and health plan and remedial action work plan. These plans would include provisions for personnel protection, air sampling, and contingency actions needed to protect workers and the nearby community. ICs would prohibit extraction of groundwater for domestic purposes at IR Site 27.

6.4.2.6 IMPLEMENTABILITY

Alternative 4A would be readily implemented with no anticipated difficulties regarding technical feasibility, reliability, or scheduling. ISB injection would be completed using conventional direct-push drilling equipment. ICs and MNA have been routinely implemented at CERCLA sites in the United States. The injection points in the two treatment areas are largely located in paved areas that would require coring through concrete or asphalt. Additional injection points are located in the vicinity of railroad tracks and existing Buildings 168 and 449. Limited-access drilling equipment is available, if required. Periodic sampling of the existing monitoring wells should not be incompatible with the potential reuse options; however, access to monitoring wells would need to be maintained to allow for sampling. Construction of buildings over the IR Site 27 plume could limit access to portions of the site and, therefore, could limit future monitoring activities. This alternative would necessitate coordination with state and local agencies to administer ICs.

6.4.2.7 COST

The comparative present value cost for Alternative 4A is approximately $1,962,000 (Table 6-2). Major cost components are associated with the MNA program and HRC injection. It is assumed that HRC treatment could be completed in 1 year. Following source area treatment, MNA and ICs would be conducted for a period of approximately 60 years. Appendix C provides cost backup and supporting details.

Cost estimates are solely for comparing alternatives in this FS Report; they should not be used for budgetary or planning purposes because actual costs may change based on the final design and the duration of the MNA program.

6.5 ALTERNATIVE 6A – ISCO SOURCE AREA TREATMENT, MNA, AND ICs

Alternative 6A is included to evaluate the opportunity to accelerate contaminant concentration reduction in the two treatment areas (Figure 6-2) using ISCO technology.

6.5.1 Description of Alternative

For Alternative 6A, ISCO would be used in a focused manner to oxidize VOCs in groundwater in two treatment areas in the IR Site 27 plume. The ISOTEC chemical oxidation process would be employed to chemically destroy contaminants in groundwater in the two treatment areas. For FS cost estimating purposes, the two treatment areas shown on Figure 6-2 are assumed to be treated using one treatment event across both treatment areas plus one additional hot spot injection event assumed to be limited to one-half of the original treatment area. MNA would document the reduction in contaminant concentrations after treatment and demonstrate that residual contaminant levels are reduced over time through naturally occurring processes during the IC period. ICs would prohibit groundwater extraction for domestic purposes at IR Site 27 and preclude actions that would interfere with activities associated with this alternative.

BIOCHLOR model simulations (Appendix B) performed for this alternative indicate that VOCs at IR Site 27 should attenuate to RAO concentrations across the VOC plume within 45 years after source area treatment. This model is conservative because it is based on the highest VOC concentrations observed at IR Site 27. However, the BIOCHLOR modeling result of 45 years is adequate for comparison purposes. The assumed end point (i.e., MCLs) may be achieved sooner, in which case the ICs would be discontinued.

Major components of this alternative include ISCO, MNA, and ICs. The assumed duration of Alternative 6A is approximately 45 years. Recent groundwater monitoring results indicate that VOCs in shoreline groundwater have attenuated to concentrations below RAOs. Therefore, no further action is proposed for shoreline groundwater. Sitewide groundwater monitoring (including selected shoreline wells as appropriate) would be conducted to monitor the performance of the selected remedy for inland groundwater.

6.5.1.1 *IN SITU* CHEMICAL OXIDATION

For FS cost estimating purposes, it is assumed that treatment would occur over two areas with an approximate total area of 43,000 square feet. A 15-foot radius of influence at each application well is assumed for FS cost estimating purposes. Alternative 6A would employ an estimated 43 injection points in the western treatment area and 57 injection points in the eastern treatment area, for a total of 100 injection points. The assumed dose rate for ISCO is 300 gallons per injection point. Measures to minimize possible plume migration during injection would be developed in the remedial design stage. The injections would be performed using direct-push drilling technology, and applied via gravity through temporary injection screens. For FS cost estimating purposes, it is assumed that the injections would focus on a 10-foot-thick treatment zone for ISCO. Performance of the process would be evaluated through groundwater sampling and analysis.

Although the ISCO process should provide active treatment, no pilot-scale testing is assumed to be necessary. The ISOTEC process was recently performed successfully at IR Site 9 near IR Site 27. IR Site 9 has similar geology, contaminants and VOC concentrations as IR Site 27. Pilot-scale testing is not considered necessary because of this local experience.

Sampling for the first 6 months after implementing ISCO injection would be conducted during three sampling events using eight existing groundwater monitoring wells. Both laboratory and field analyses would be conducted. Ferrous iron, conductivity, temperature, pH, ORP, and dissolved oxygen would be measured using hand-held equipment. For cost estimating purposes, it is assumed that an off-site laboratory would analyze groundwater samples for VOCs and MNA parameters (dissolved gases, alkalinity, major anions, major cations, TOC, and TDS).

6.5.1.2 MONITORING PROGRAM DESIGN FOR MNA

After ISCO treatment, groundwater monitoring conducted as part of an MNA program would be the same as that described for Alternative 3 except that the duration is assumed to be 45 years, based on BIOCHLOR model simulations (Appendix B), and the sampling event frequency would vary as described below. For FS cost estimating purposes, the monitoring program is assumed to utilize existing groundwater monitoring wells. Details regarding the Ferry Point Road plume and the Building 168 plume can be found in Section 2.5.3.3. The approximate locations of these plumes are shown in Figure 6-2. Based on the BIOCHLOR model simulations for Alternative 6A and for FS purposes, the Ferry Point Road plume is projected to reach RAOs in approximately 15 years, and the Building 168 plume is projected to reach RAOs in approximately 45 years. The number of monitoring wells included in the monitoring program is assumed to be reduced after 15 years due to the closure of the Ferry Point Road plume.

The frequency of groundwater sampling events would be higher at the beginning of the MNA program and reduce with time. It is assumed that groundwater from existing wells would be sampled on the following schedule.

- Three monitoring events for eight wells would occur in the first 6 months after ISCO treatment as described above in the ISCO description.
- Monitoring from month 6 through year 2 would include quarterly monitoring for eight wells for VOCs and all MNA parameters.
- Monitoring from year 3 through year 15 would include annual monitoring for six wells for VOCs and all MNA parameters.
- Monitoring from year 16 through year 45 would include annual monitoring for four wells for VOCs and all MNA parameters.

For FS cost estimating purposes, the groundwater sampling techniques, field and laboratory analyses, and annual reporting are assumed to be the same as for Alternative 3.

6.5.1.3 INSTITUTIONAL CONTROLS

ICs under Alternative 6A would be similar in scope to ICs described for Alternative 3, with an assumed duration of 45 years for FS cost estimating purposes.

6.5.1.4 PERIODIC REVIEWS

Periodic reviews would be performed every 5 years as described for Alternative 3. The reviews would occur over a 45-year period.

6.5.2 Evaluation by Criteria

Evaluation of Alternative 6A by threshold and balancing criteria follows.

6.5.2.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 6A would protect human health and the environment and should accelerate reduction of contaminant mass within the two treatment areas of the plume to a greater extent than passive methods. This alternative would reduce the potential for off-site plume migration. MNA and periodic reviews would track the overall performance of the remedy. Although Alternative 6A is not designed to treat all contamination in the subsurface, it would address the areas of highest VOC concentrations in the plume. MNA and data evaluation would verify plume stability following ISCO treatment in the IR Site 27 area. ICs would prohibit groundwater extraction at IR Site 27 until the Navy and regulatory agencies agree that risks associated with impacted groundwater are acceptable.

6.5.2.2 COMPLIANCE WITH ARARs

Alternative 6A is expected to meet the potential chemical-specific, location-specific, and action-specific ARARs. The time to reduce VOC concentrations in groundwater is expected to be shorter than for strictly passive cleanup alternatives.

Potential ARARs associated with ICs are the same as those described for Alternative 3 in Section 6.3.2.2. IDW generated during the installation of chemical injection points and

the MNA program would be subject to the substantive provisions of potential RCRA ARARs to determine whether such wastes should be classified as hazardous. This would be determined at the time the waste is generated. The substantive provisions of potential waste management ARARs for storing, manifesting, and transporting this material for final disposal would be followed if the wastes were found to be either RCRA or non-RCRA hazardous waste.

While considered unlikely, off-gas through monitoring wells or injection points resulting from the ISCO process may require treatment to comply with the substantive provisions of potential air emissions ARARs of the Bay Area Air Quality Management District (BAAQMD). Monitoring of wellheads and injection points with a photoionization detector (PID) and/or flame ionization detector would be conducted to verify that vapor emissions meet the substantive provisions of potential BAAQMD ARARs.

6.5.2.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 6A would be an effective means to reduce contaminant concentrations within the plume at IR Site 27. It would permanently treat VOC-affected groundwater within the two treatment areas. Most of the contamination in the two treatment areas would be removed during the *in situ* chemical treatment. After treatment, the aquifer would be expected to reestablish reducing conditions within 1 to 2 months (Eilber, pers. com. 2005a). The progress of MNA would then be used to track VOC concentrations until ICs are no longer needed. Risk to human and environmental receptors from remaining VOC-impacted groundwater at the completion of this alternative should not be significant.

6.5.2.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternative 6A would reduce the toxicity of the groundwater contaminants through chemical treatment. Chemical reactions occurring within the aquifer would destroy VOCs in groundwater. MNA would further reduce any residual contaminants at IR Site 27.

6.5.2.5 SHORT-TERM EFFECTIVENESS

Most of the VOC mass in the groundwater would be destroyed within the first year of implementation. Short-term risks during implementation associated with ISCO could potentially include the following:

- human contact with process chemicals, which include bulk quantities of 12 percent hydrogen peroxide (approximately one shipment per day of treatment)
- environmental contamination by process chemicals

These potential risks would be mitigated through proper design and implementation of a site-specific safety and health plan and remedial action work plan. These plans would include provisions for personnel protection, air monitoring, and contingency actions needed to protect workers and the nearby community. ICs would prohibit groundwater extraction for domestic purposes at IR Site 27.

6.5.2.6 IMPLEMENTABILITY

ISCO is implementable at Alameda Point. Implementability concerns and technology limitations associated with ISCO were described in Sections 4.3.8.4 and 6.5.2.5. However, the ISOTEC chemical oxidation process has been implemented successfully at Alameda Point at IR Sites 9, 11/21, and 16 (IT 2003; Eilber, pers. com. 2005a). Therefore, the operational reliability of the ISCO process is considered medium to high. Although the ISOTEC process generally induces less vigorous reactions than competing versions of ISCO, there are safety considerations regarding implementation (e.g., handling and storage of process chemicals) that would need to be planned for during remedial design.

The injection points in the treatment areas are largely located in paved areas that would require coring through concrete or asphalt. Additional injection points are located in the vicinity of railroad tracks and existing Buildings 168 and 449. Limited-access drilling equipment is available, if required.

Installation of ISCO injection points and the injection of reagents would not have a significant adverse impact on existing tenants. Periodic sampling should not be incompatible with the potential reuse options; however, access to monitoring wells would need to be maintained. New construction of buildings over the IR Site 27 area could limit access to portions of the site. This alternative would necessitate coordination with state and local agencies to administer ICs.

6.5.2.7 COST

The comparative present value cost for Alternative 6A is approximately $1,532,000 (Table 6-3). Major cost components for this alternative include installation of the chemical injection points, injection of process chemicals, and the monitoring program. For FS cost estimating purposes, up to 6 months of ISCO is assumed. Following source area treatment, MNA and ICs would be conducted for a period of approximately 45 years. Appendix C provides cost backup and supporting details.

This cost estimate is solely for comparing alternatives in this FS Report and should not be used for budgetary or planning purposes because actual costs may change based on the final design and the duration of the MNA program.

6.6 ALTERNATIVE 6B – SITEWIDE ISCO TREATMENT AND GROUNDWATER CONFIRMATION SAMPLING

Alternative 6B is included to evaluate the opportunity to accelerate contaminant concentration reduction by using sitewide ISCO technology for inland groundwater in association with groundwater confirmation sampling.

6.6.1 Description of Alternative

For Alternative 6B, ISCO would be used to aggressively treat the entire IR Site 27 inland groundwater plume to reduce VOC concentrations to achieve RAOs. The ISOTEC chemical oxidation process assumed for Alternative 6A would be employed under

Alternative 6B to treat the entire inland area of the approximately 11-acre plume. For FS cost estimating purposes, the initial full-scale injection event would be completed in the area shown on Figure 6-1. If needed, a subsequent hot spot injection event would be performed at up to one-half the number of the full-scale injection points. Groundwater sampling would document the reduction in contaminant concentrations after sitewide ISCO treatment for inland groundwater.

Recent groundwater monitoring results indicate that VOCs in shoreline groundwater have attenuated to concentrations below RAOs. Therefore, no further action is proposed for shoreline groundwater. Sitewide groundwater monitoring (including selected shoreline wells as appropriate) would be conducted to monitor the performance of the selected remedy for inland groundwater.

6.6.1.1 *IN SITU* CHEMICAL OXIDATION

For FS cost estimating purposes, it is assumed that treatment would occur over the entire inland groundwater plume area. A 15-foot radius of influence at each application well is assumed for FS cost estimating purposes; therefore, Alternative 6B would employ an estimated 570 injection points. The assumed dose rate for ISCO is 300 gallons per injection point. Measures to minimize possible plume migration during injection would be developed in the remedial design stage. The injection would take an estimated 50 days to complete, based on recent experience at IR Site 9 (Eilber, pers. com. 2005b). The injections would be performed using direct-push drilling technology, and applied via gravity through temporary injection screens. For FS cost estimating purposes, it is assumed that the injections would focus on a 10-foot-thick treatment zone for ISCO. Performance of the process would be evaluated through groundwater sampling and analysis, and data evaluation. The initial injection would be followed by an additional hot spot injection event, as necessary, at up to one-half of the full-scale injection points, or up to 285 injection points over an estimated 25 days.

As with Alternative 6A, no pilot-scale testing is assumed to be necessary because the ISCO technology has been implemented successfully at nearby IR Site 9 which has similar geology, COCs, and VOC concentrations.

After ISCO treatment, groundwater confirmation sampling would be conducted every 2 months for 6 months using eight existing groundwater monitoring wells. Both laboratory and field analyses would be conducted. Ferrous iron, conductivity, temperature, pH, ORP, and dissolved oxygen would be measured using hand-held equipment. For cost estimating purposes, it is assumed that an off-site laboratory would analyze groundwater samples for VOCs and MNA parameters (dissolved gases, alkalinity, major anions, major cations, TOC, and TDS).

6.6.1.2 GROUNDWATER CONFIRMATION SAMPLING PROGRAM

Groundwater sampling under this alternative is assumed to be conducted for 3 years. The 3-year monitoring period is assumed to be sufficient to document post-treatment VOC

concentrations in groundwater. For FS cost estimating purposes, the monitoring program is assumed to utilize existing groundwater monitoring wells.

It is assumed that groundwater from existing wells would be sampled on the following schedule.

- The first 6 months of monitoring are described above in the ISCO description.
- Monitoring from month 7 through year 2 would include quarterly monitoring events for eight wells for VOCs and all MNA parameters (same MNA parameters as Alternative 3).
- Monitoring in year 3 would consist of one annual monitoring event at the end of year 3.

For FS cost estimating purposes, the groundwater sampling techniques, field and laboratory analyses, and annual reporting are assumed to be the same as for Alternative 3.

6.6.1.3 CLOSEOUT REPORT

Because ISCO treatment is assumed to reduce VOC concentrations to levels below RAOs within 6 months, and Alternative 6B has a duration of only 3 years, periodic reviews would not need to be performed every 5 years. At the end of year 3, a project closeout report would be prepared.

6.6.2 Evaluation by Criteria

Evaluation of Alternative 6B by threshold and balancing criteria follows.

6.6.2.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 6B would protect human health and the environment and chemically destroy VOCs across the entire area of the plume. This alternative would reduce the potential for off-site plume migration. Groundwater confirmation sampling would verify treatment effectiveness. One follow-up ISCO treatment would be included. Alternative 6B is designed to treat the entire inland groundwater plume, and would therefore be expected to achieve RAOs within 6 months.

6.6.2.2 COMPLIANCE WITH ARARs

Alternative 6B is expected to meet the potential chemical-specific, location-specific, and action-specific ARARs. Potential ARARs associated with this alternative are the same as those described for Alternative 6A in Section 6.5.2.2.

6.6.2.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 6B would be an effective means to actively reduce contaminant concentrations at IR Site 27. It would permanently treat VOC-affected groundwater within the entire inland area of the plume. It is assumed that VOCs in groundwater would be destroyed and that RAO concentrations would be attained within 6 months of ISCO treatment. Groundwater sampling during and after ISCO treatment would be used to assess treatment

effectiveness. Risk to human and environmental receptors from remaining VOC-impacted groundwater at the completion of this alternative should not be significant.

6.6.2.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternative 6B would reduce the toxicity, mobility, or volume of the groundwater contaminants through chemical treatment. Chemical reactions within the aquifer would destroy VOCs such as DCE and vinyl chloride.

6.6.2.5 SHORT-TERM EFFECTIVENESS

Alternative 6B would be effective in the short term because RAOs would be met within 6 months after beginning treatment. Most of the VOC mass in the groundwater would be chemically destroyed following the first chemical treatment. Short-term risks during implementation associated with ISCO are the same as Alternative 6A and could be mitigated through proper design and implementation of a site-specific safety and health plan and a remedial action work plan. These plans would include provisions for personnel protection, air monitoring, and contingency actions needed to protect workers and the nearby community.

6.6.2.6 IMPLEMENTABILITY

This ISCO alternative could be challenging to implement due to the large number of injection points required. Potential risks associated with ISCO are described in Section 6.5.2.6. Other implementability factors associated with Alternative 6B are the same as those described for Alternative 6A (Section 6.5.2.6).

6.6.2.7 COST

The comparative present value cost for Alternative 6B is approximately $2,050,000 (Table 6-4). Major cost components for this alternative include installation of the chemical injection points, injection of process chemicals, and groundwater sampling costs. For FS cost estimating purposes, 6 months of ISCO is assumed. Groundwater sampling would be conducted for a total of 3 years. Appendix C provides cost backup and supporting details.

This cost estimate is solely for comparing alternatives in this FS Report and should not be used for budgetary or planning purposes because actual costs may change based on the final design and duration of groundwater confirmation sampling.

6.7 ALTERNATIVE 7 – DYNAMIC CIRCULATION SOURCE AREA TREATMENT, MNA, AND ICs

Alternative 7 is included to evaluate an innovative source area treatment technology for comparison to other source area treatment options (Alternatives 4A and 6A) at IR Site 27.

6.7.1 Description of Alternative

Alternative 7 uses a proprietary Dynamic Subsurface Circulation well technology in association with MNA and ICs. The ART circulation well design utilizes SVE, in-well air stripping, and in-well air sparging (Figure 6-4). This combination of technologies creates circulation of treated groundwater outward from the treatment well through capillary fringe soil and returning into the well for treatment. The reported radius of influence for this technology is up to 70 feet (Odah, pers. com. 2005). For the purposes of this FS, it is assumed that a separate pilot-scale study would not be performed, since the area of a pilot-scale study would be similar in size to the targeted treatment areas for Alternative 7.

BIOCHLOR model simulations (Appendix B) performed for this alternative indicate that VOC concentrations should attenuate to RAOs within 55 years after source area treatment. This model is conservative because it is based on the highest VOC concentrations observed at IR Site 27. However, the BIOCHLOR modeling result of 55 years is adequate for comparison purposes. The assumed end point (i.e., MCLs) may be achieved sooner, in which case the ICs would be discontinued.

The principal components of this alternative include remediation system construction, O&M, MNA, and ICs. The assumed duration of ICs for Alternative 7 is 55 years. Recent groundwater monitoring results indicate that VOCs in shoreline groundwater have attenuated to concentrations below RAOs. Therefore, no further action is proposed for shoreline groundwater. Sitewide groundwater monitoring (including selected shoreline wells as appropriate) would be conducted to monitor the performance of the selected remedy for inland groundwater.

6.7.1.1 REMEDIATION SYSTEM CONSTRUCTION

In order to implement Alternative 7 at IR Site 27, it is assumed that ten 6-inch-diameter remediation wells would be installed. Two remediation systems would be installed as part of this alternative, one just east of Ferry Point Road and one outside the western edge of Building 168. SVE piping, compressed air for in-well sparging, and electrical supply for the recirculation pumps would be run in trenches from the remediation systems to each remediation well. An estimated 600 linear feet of trenching would be required. Locations of the two remediation equipment compounds, ten remediation wells, and trenches are shown on Figure 6-5.

Each remediation system would consist of an electrical panel, air compressor, SVE system, and two 1,000-pound vapor-phase granular activated carbon vessels for treatment of extracted soil vapor (Figure 6-6). Concrete-filled bollards would be installed to protect equipment from traffic damage. Each system would be surrounded by chain-link fencing with appropriate signage.

6.7.1.2 STARTUP, OPERATION AND MAINTENANCE

After construction is completed, a 1-month period of startup and equipment shakedown would be conducted. During the startup period, daily flow rates and PID readings of soil

vapor influent, intermediate (between carbon vessels) and effluent sampling locations of both remediation systems would be recorded. Equipment adjustments also would be made to balance system operation. Dissolved oxygen and ORP readings would be conducted daily for the first week, and weekly for the remainder of the 1-month startup period.

O&M activities are assumed to extend for 1 year. During that period, the systems would be inspected at least weekly to measure vapor flow rates, and to perform PID measurements. A total of 32 soil vapor samples are assumed to be collected for VOC analysis by U.S. EPA Method TO-15.

Vapor-phase carbon would be changed out based on PID readings. For FS cost estimating purposes, it is assumed that both vessels from each remediation system would be changed out after 4 months and 8 months of operation.

During the O&M period, groundwater sampling also would be performed, as described in Section 6.7.1.3.

6.7.1.3 MONITORING PROGRAM DESIGN FOR MNA

MNA for Alternative 7 would be similar to the program under Alternative 6A except that the duration is assumed to be 55 years. For FS cost estimating purposes, the monitoring program is assumed to utilize existing groundwater monitoring wells. Details regarding the Ferry Point Road plume and the Building 168 plume can be found in Section 2.5.3.3. The approximate locations of these plumes are shown on Figure 6-2. Based on the BIOCHLOR model simulations for Alternative 7, and for FS purposes, the Ferry Point Road plume is projected to reach RAOs in approximately 20 years, and the Building 168 plume is projected to reach RAOs in approximately 55 years. The number of monitoring wells included in the monitoring program is assumed to be reduced after 20 years due to the closure of the Ferry Point Road plume.

Monthly groundwater sampling and analysis would be performed prior to and following the startup of the remediation systems to evaluate the remediation process for a total of 6 months. Quarterly sampling would then be conducted through year 2. Both laboratory and field analyses would be conducted to establish baseline groundwater conditions. The monthly and quarterly groundwater samples would be analyzed for MNA parameters (as described under Alternative 3). Ferrous iron, conductivity, temperature, pH, ORP, and dissolved oxygen would be measured using hand-held equipment.

The frequency of groundwater sampling events is assumed to be higher at the beginning of the MNA program, and reduce with time. It is assumed that groundwater from existing wells would be sampled on the following schedule.

- Years 1 and 2 would include monthly/quarterly monitoring of eight wells for VOCs and MNA parameters as described above.
- Years 3 through 20 would include annual monitoring of six wells for VOCs and all MNA parameters.

- Years 21 through 55 would include annual monitoring of four wells for VOCs and all MNA parameters.

For FS cost estimating purposes, the groundwater sampling techniques, field and laboratory analyses, and annual reporting are assumed to be the same as for Alternative 3.

6.7.1.4 INSTITUTIONAL CONTROLS

ICs under Alternative 7 would be similar in scope to ICs for Alternative 3, with an assumed duration of 55 years for FS cost estimating purposes. The area subject to ICs is shown on Figure 6-1.

6.7.1.5 PERIODIC REVIEWS

Periodic reviews for Alternative 7 would be performed similarly to those described for Alternative 3. The reviews would occur every 5 years over a 55-year period.

6.7.2 Evaluation by Criteria

Evaluation of Alternative 7 by threshold and balancing criteria follows.

6.7.2.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 7 would protect human health and the environment and should accelerate reduction of contaminant mass within the two treatment areas of the plume to a greater extent than passive methods. Treatment of the source area groundwater *in situ* would reduce the VOC contaminant mass in 1 year. Although Alternative 7 is not designed to treat all contamination in the subsurface, it does address the areas of highest VOC concentrations in the plume. MNA would document the reductions in VOC concentrations and natural attenuation parameters over time at IR Site 27. ICs would prohibit groundwater extraction at the site.

6.7.2.2 COMPLIANCE WITH ARARs

Alternative 7 is expected to meet potential chemical-specific, location-specific, and action-specific ARARs. The time to reduce VOC concentrations in groundwater is expected to be shorter than for passive cleanup alternatives.

Potential ARARs associated with ICs are the same as those described for Alternative 3 in Section 6.3.2.2. IDW generated during the remediation system construction, operation, and the MNA program would be subject to substantive provisions of potential RCRA ARARs to determine whether such wastes should be classified as hazardous. This determination would be made at the time the waste is generated. The substantive provisions of potential waste management ARARs for storing, manifesting, and transporting this material for final disposal would be followed if the wastes were found to be RCRA or non-RCRA hazardous waste.

6.7.2.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 7 would reduce contaminant concentrations within the plume at IR Site 27. Dynamic Subsurface Circulation has been implemented at several dozen sites in the United States, but this technology is relatively new. This technology has been selected for at least one Superfund site (U.S. EPA 2004). Remediation activities are expected to be reliable in minimizing future health risks associated with the contaminated plume.

This groundwater circulation technology is limited by heterogeneous soils, particularly stratification in capillary fringe and saturated soils. This technology is also not effective in low-permeability soils. Soil types in the two treatment areas are primarily very fine and fine sands across both treatment areas. Although fill materials are stratified, this technology is expected to be effective at IR Site 27.

Alternative 7 is expected to be effective and permanent in the long term. It would permanently remove VOCs from groundwater in the two treatment areas. A 1-year O&M period is assumed. Risk to human and environmental receptors is expected to be reduced following groundwater remediation, and post-remediation VOC concentrations in groundwater would be monitored during the MNA sampling events. MNA would be used to track VOC concentrations until ICs were no longer needed.

6.7.2.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternative 7 is expected to reduce the toxicity of groundwater by removing VOCs through the SVE system. VOCs would be adsorbed onto granular activated carbon and shipped off-site to a carbon regeneration facility for recycle. At the regeneration facility, VOCs are removed and destroyed using thermal treatment processes. Alternative 7 includes groundwater remediation in the same two areas as Alternatives 4A and 6A. Alternative 7 would provide an active treatment process to accelerate the reduction of chlorinated VOC concentrations in the groundwater. After remediation, MNA processes would continue to reduce VOC concentrations.

6.7.2.5 SHORT-TERM EFFECTIVENESS

Most of the VOCs in groundwater are assumed to be removed under Alternative 7 within the first year of implementation. Short-term risks during implementation associated with this alternative could potentially include the following:

- human contact with groundwater and excavated soil during well installation, trenching, and construction of remediation systems
- inhalation of VOCs from air emissions emitted by remediation systems
- human contact with VOCs and granular activated carbon during carbon vessel changeouts, waste transportation, and carbon regeneration

These potential risks would be mitigated through proper design and implementation of a site-specific safety and health plan and remedial action work plan. These plans would include provisions for personnel protection, air monitoring, and contingency actions

needed to protect workers and the nearby community. ICs would prohibit groundwater extraction for domestic purposes at IR Site 27.

6.7.2.6 IMPLEMENTABILITY

The technologies required to construct remediation systems for Alternative 7 (trenching, excavation, concrete forming, etc.) are readily available and technically feasible. The proprietary well design is only available from ART, who would install the well components. The ten remediation wells may need to extend 1 to 2 feet above grade because of shallow groundwater conditions. Otherwise, this alternative is considered implementable.

6.7.2.7 COST

The comparative present value cost for Alternative 7 is approximately $2,082,000 (Table 6-5). Major cost components are associated with the MNA program and remediation system construction. It is assumed that active groundwater remediation could be completed in 1 year. Following source area treatment, MNA and ICs would be conducted for a period of approximately 55 years. Appendix C provides cost backup and supporting details.

Cost estimates are solely for comparing alternatives in this FS Report; they should not be used for budgetary or planning purposes because actual costs may change based on the final design.

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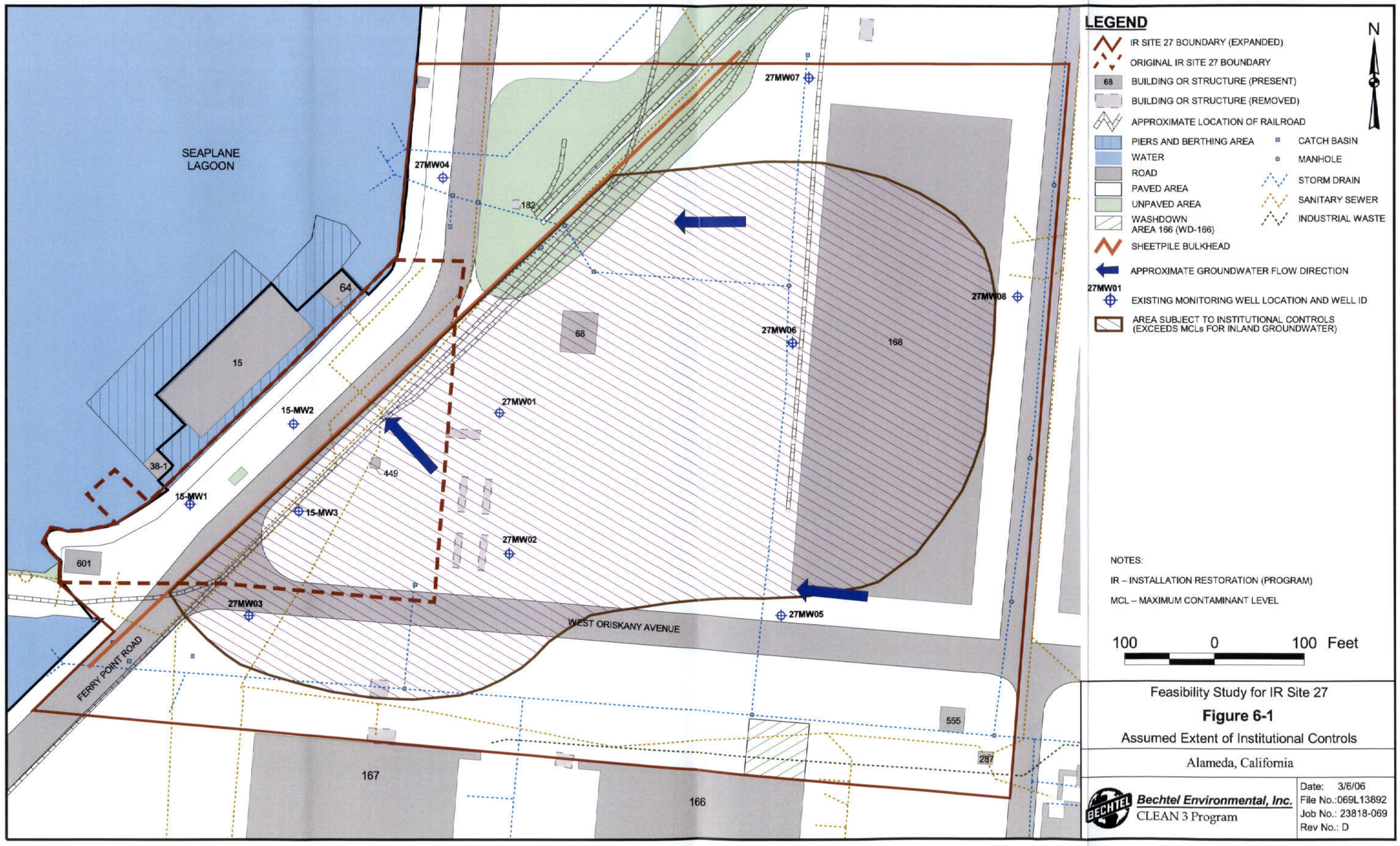
FIGURES

FINAL FEASIBILITY STUDY REPORT FOR IR SITE 27, DOCK ZONE

DATED 01 APRIL 2006



LEGEND

- IR SITE 27 BOUNDARY (EXPANDED)
- ORIGINAL IR SITE 27 BOUNDARY
- 68 BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- APPROXIMATE LOCATION OF RAILROAD
- PIERS AND BERTHING AREA
- WATER
- ROAD
- PAVED AREA
- UNPAVED AREA
- WASHDOWN AREA 166 (WD-166)
- SHEETPILE BULKHEAD
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- SANITARY SEWER
- INDUSTRIAL WASTE
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- 27MW01 EXISTING MONITORING WELL LOCATION AND WELL ID
- AREA SUBJECT TO INSTITUTIONAL CONTROLS (EXCEEDS MCLs FOR INLAND GROUNDWATER)

N

NOTES:

IR – INSTALLATION RESTORATION (PROGRAM)

MCL – MAXIMUM CONTAMINANT LEVEL

100 0 100 Feet

Feasibility Study for IR Site 27

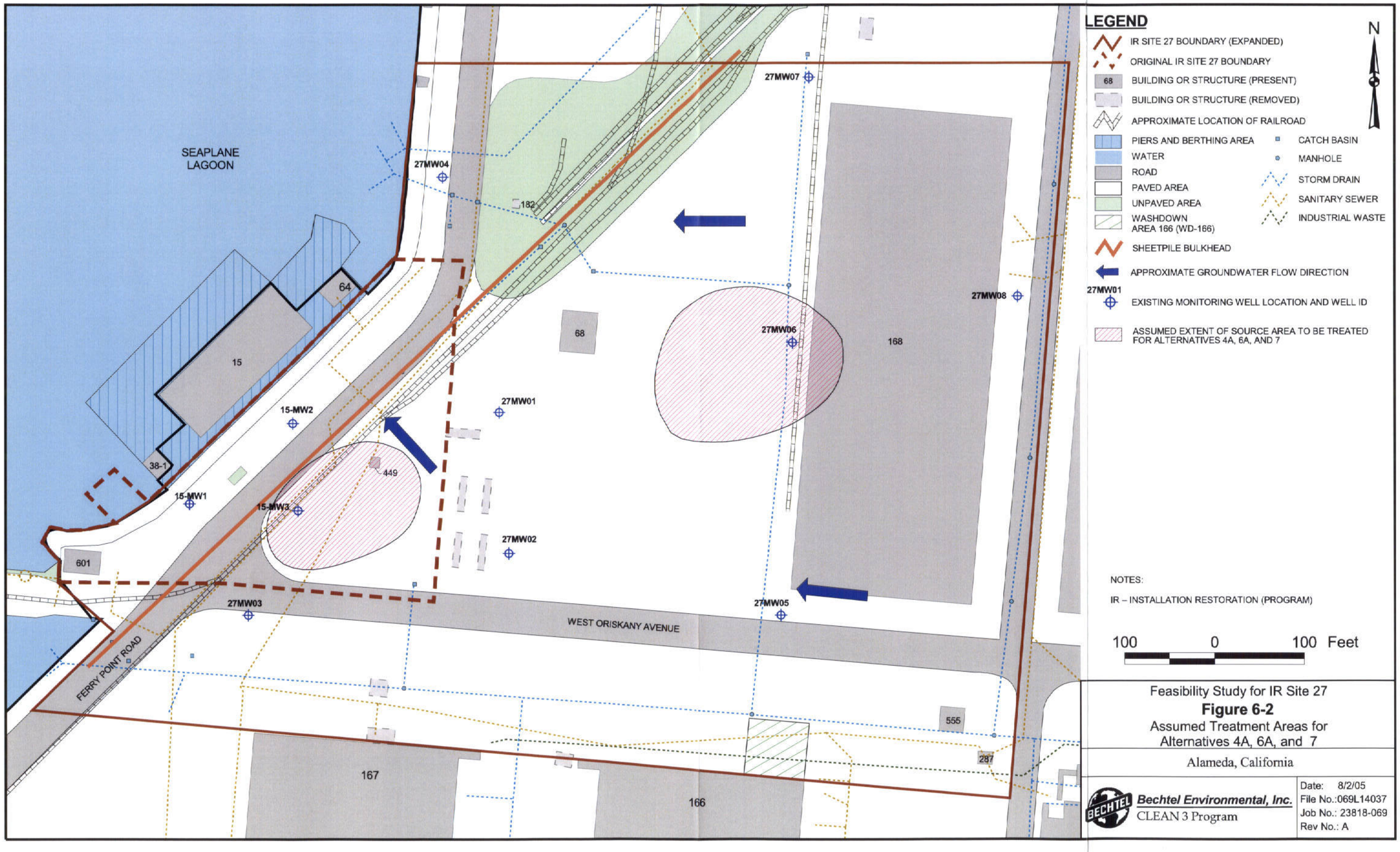
Figure 6-1

Assumed Extent of Institutional Controls

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/6/06
File No.:069L13892
Job No.: 23818-069
Rev No.: D



Feasibility Study for IR Site 27

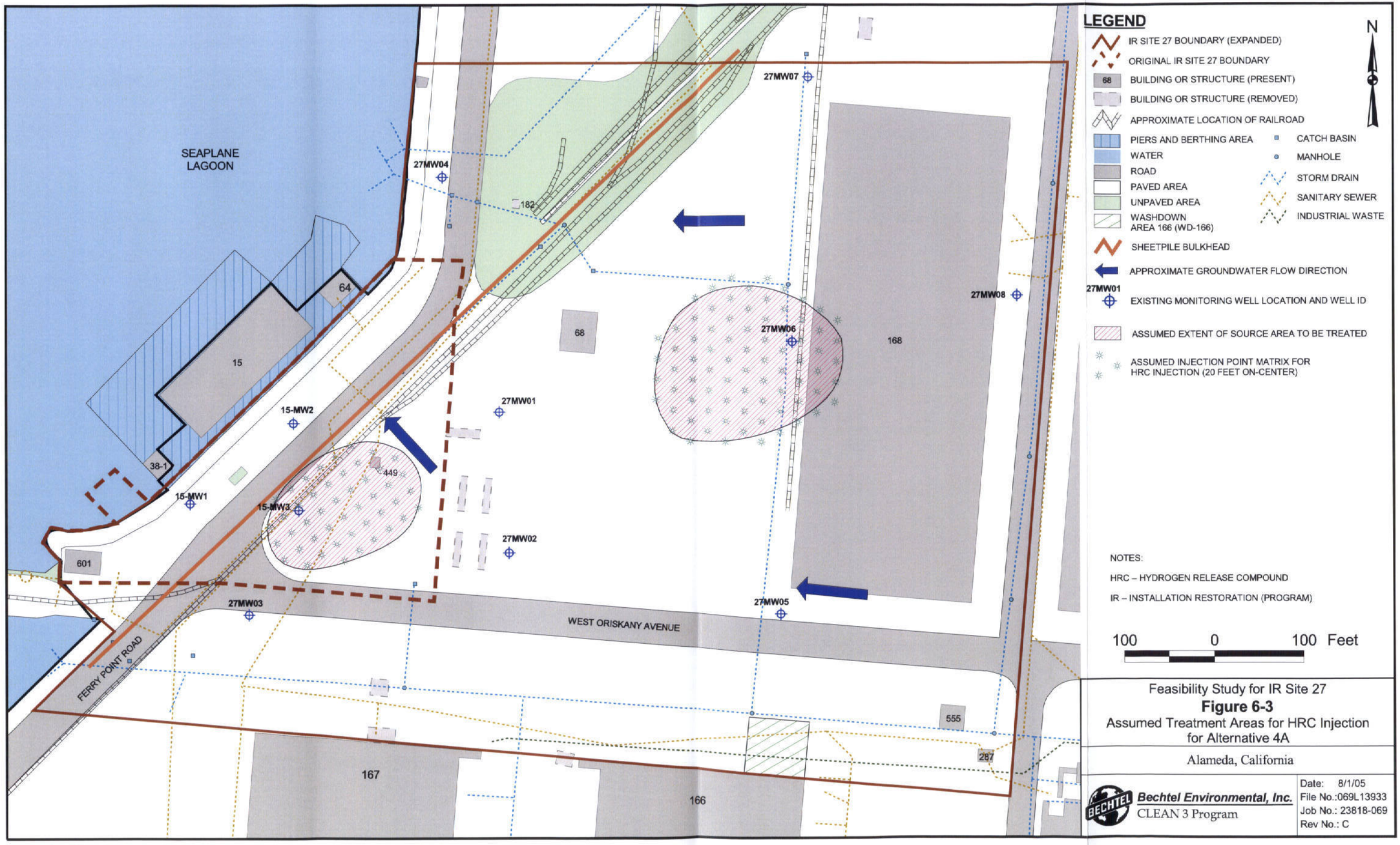
Figure 6-2

Assumed Treatment Areas for Alternatives 4A, 6A, and 7

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 8/2/05
File No.:069L14037
Job No.: 23818-069
Rev No.: A



Feasibility Study for IR Site 27

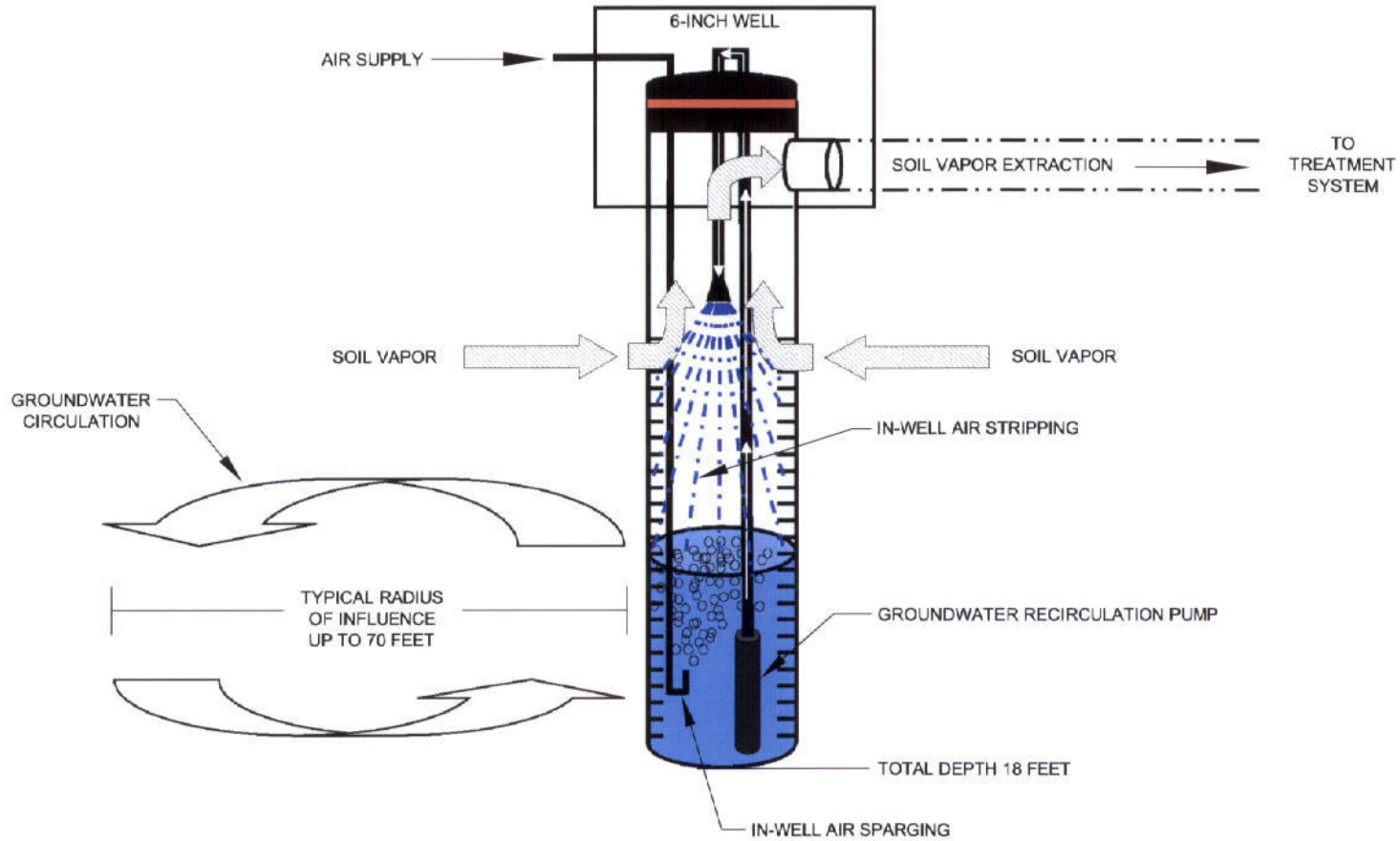
Figure 6-3

Assumed Treatment Areas for HRC Injection for Alternative 4A

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 8/1/05
File No.:069L13933
Job No.: 23818-069
Rev No.: C



NOTES:

NOT TO SCALE

Feasibility Study for IR Site 27

Figure 6-4

Schematic of Dynamic Circulation Well for Alternative 7

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 8/2/05
File No: 069C13880
Job No: 23818-069
Rev No: C

SEAPLANE LAGOON

27MW04

27MW07

182

64

15

68

168

27MW08

27MW06

27MW01

15-MW2

38-1

449

15-MW1

15-MW3

27MW02

601

27MW03

27MW05

WEST ORISKANY AVENUE

FERRY POINT ROAD

555

287

167

166

LEGEND

- IR SITE 27 BOUNDARY (EXPANDED)
- ORIGINAL IR SITE 27 BOUNDARY
- 68 BUILDING OR STRUCTURE (PRESENT)
- BUILDING OR STRUCTURE (REMOVED)
- APPROXIMATE LOCATION OF RAILROAD
- PIERS AND BERTHING AREA
- WATER
- ROAD
- PAVED AREA
- UNPAVED AREA
- WASHDOWN AREA 166 (WD-166)
- SHEETPILE BULKHEAD
- CATCH BASIN
- MANHOLE
- STORM DRAIN
- SANITARY SEWER
- INDUSTRIAL WASTE
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- 27MW01 EXISTING MONITORING WELL LOCATION AND WELL ID
- ASSUMED EXTENT OF SOURCE AREA TO BE TREATED
- REMEDIATION EQUIPMENT COMPOUND
- LOCATION OF TRENCH FOR REMEDIATION PIPING AND ELECTRICAL CONDUIT
- LOCATION OF NEW REMEDIATION WELL FOR ALTERNATIVE 7

N

NOTES:

IR – INSTALLATION RESTORATION (PROGRAM)

100 0 100 Feet

Feasibility Study for IR Site 27

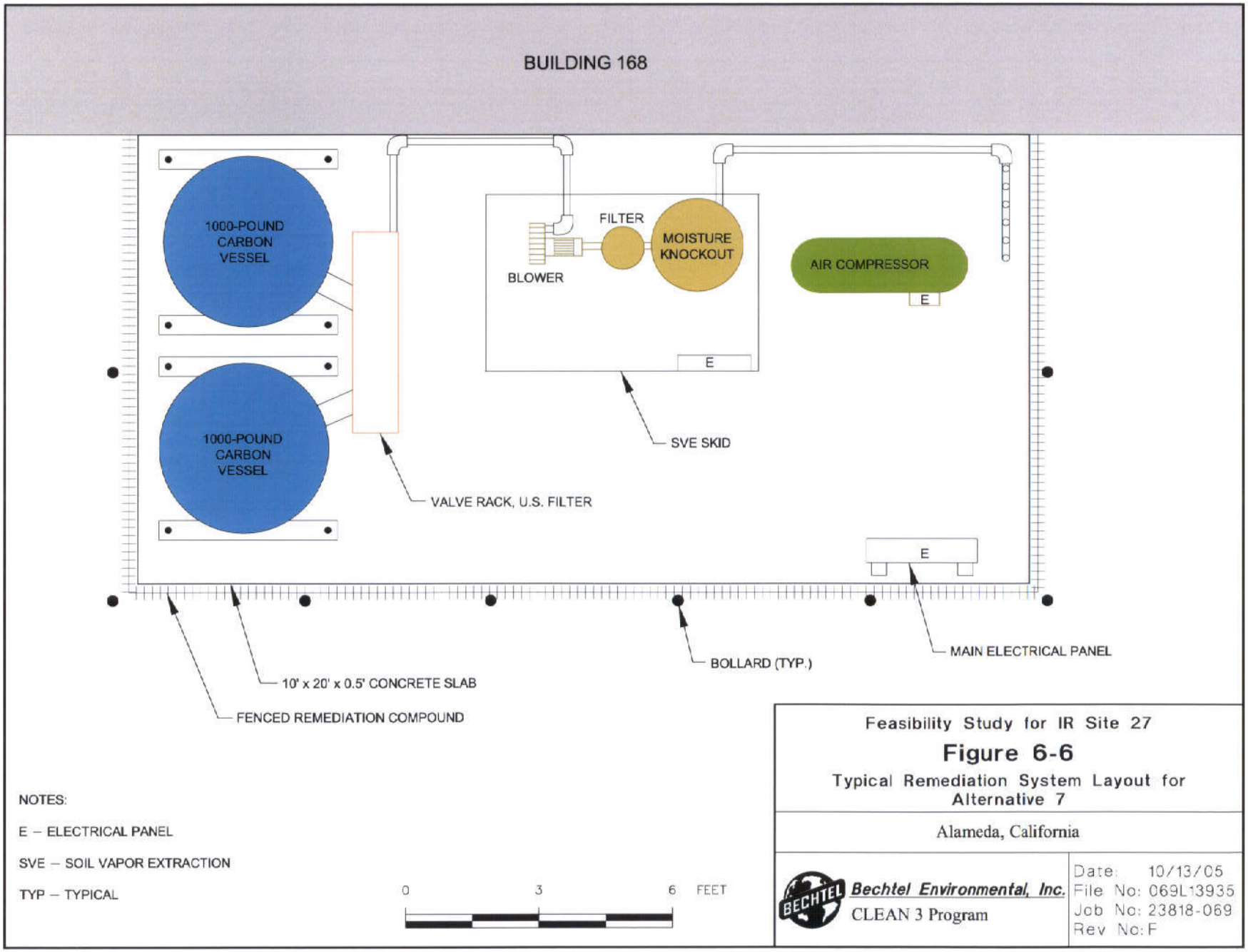
Figure 6-5

Dynamic Circulation Treatment Area and Layout for Alternative 7

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 9/29/05
File No.: 069L13934
Job No.: 23818-069
Rev No.: C


BUILDING 168
1000-POUND CARBON VESSEL
1000-POUND CARBON VESSEL
FILTER
MOISTURE KNOCKOUT
BLOWER
AIR COMPRESSOR
E
E
E
SVE SKID
VALVE RACK, U.S. FILTER
BOLLARD (TYP.)
MAIN ELECTRICAL PANEL
10' x 20' x 0.5' CONCRETE SLAB
FENCED REMEDIATION COMPOUND
NOTES:
E – ELECTRICAL PANEL
SVE – SOIL VAPOR EXTRACTION
TYP – TYPICAL
0
3
6
FEET
Feasibility Study for IR Site 27
Figure 6-6
Typical Remediation System Layout for Alternative 7
Alameda, California
Bechtel Environmental, Inc.
CLEAN 3 Program
Date: 10/13/05
File No: 069L13935
Job No: 23818-069
Rev No: F

TABLES

FINAL FEASIBILITY STUDY REPORT FOR IR SITE 27, DOCK ZONE

DATED 01 APRIL 2006

Table 6-1
Cost Estimate Summary for
Alternative 3 – MNA and ICs

Description	Cost (dollars)
Remedial design costs[a]	
Remedial design	80,000
IC implementation plan	72,000
Total remedial design costs (based on 2005 dollars)	**152,000**
O&M costs[a]	
ICs (70 years)	700,000
Long-term monitoring (70 years)	1,164,000
5-year reviews	280,000
Total O&M costs (based on 2005 dollars)	**2,144,000**
Contingency (20 percent)	**459,000**
TOTAL COST	**2,755,000**
COMPARATIVE PRESENT VALUE COST (based on 2005 dollars)[b]	**1,407,000**

Note:
[a] includes indirect costs (overhead, profit)
[b] discount rate of 3.1 percent per year was used to calculate present value

Acronyms/Abbreviations:
IC – institutional control
MNA – monitored natural attenuation
O&M – operation and maintenance

Table 6-2
Cost Estimate Summary for
Alternative 4A – ISB Source Area Treatment, MNA, and ICs

Description	Cost (dollars)
Remedial design costs[a]	
Remedial design	100,000
IC implementation plan	72,000
Total remedial design costs (based on 2005 dollars)	**172,000**
Capital costs[a]	
ISB aquifer amendments (HRC)	210,000
Total capital costs (based on 2005 dollars)	**210,000**
O&M costs[a]	
ICs (60 years)	600,000
Long-term monitoring (60 years)	1,300,000
5-year reviews	240,000
Total O&M (based on 2005 dollars)	**2,140,000**
Contingency (20 percent)	**504,000**
TOTAL COST	**3,026,000**
COMPARATIVE PRESENT VALUE COST (based on 2005 dollars)[b]	**1,962,000**

Note:
[a] includes indirect costs (overhead, profit)
[b] discount rate of 3.1 percent per year was used to calculate present value

Acronyms/Abbreviations:
HRC – Hydrogen Release Compound
IC – institutional control
ISB – *in situ* bioremediation
MNA – monitored natural attenuation
O&M – operation and maintenance

Table 6-3
Cost Estimate Summary for
Alternative 6A – ISCO Source Area Treatment, MNA, and ICs

Description	Cost (dollars)
Remedial design costs[a]	
Remedial design	100,000
IC implementation plan	72,000
Total remedial design costs (based on 2005 dollars)	**172,000**
Capital costs[a]	
ISCO treatment	289,000
Total capital costs (based on 2005 dollars)	**289,000**
O&M costs[a]	
ICs (45 years)	450,000
Long-term monitoring (45 years)	760,000
5-year review	180,000
Total O&M costs (based on 2005 dollars)	**1,390,000**
Contingency (20 percent)	**370,000**
TOTAL COST	**2,221,000**
COMPARATIVE PRESENT VALUE COST (based on 2005 dollars)[b]	**1,532,000**

Note:
[a] includes indirect costs (overhead, profit)
[b] discount rate of 3.1 percent per year was used to calculate present value

Acronyms/Abbreviations:
IC – institutional control
ISCO – *in situ* chemical oxidation
MNA – monitored natural attenuation
O&M – operation and maintenance

Table 6-4
Cost Estimate Summary for
Alternative 6B – Sitewide ISCO Treatment and Groundwater Confirmation Sampling

Description	Cost (dollars)
Remedial design costs[a]	
Remedial design	200,000
Total remedial design costs (based on 2005 dollars)	**200,000**
Capital costs[a]	
ISCO treatment	1,247,000
Total capital costs (based on 2005 dollars)	**1,247,000**
O&M costs[a]	
Groundwater confirmation sampling (3 years)	234,000
Annual report	10,000
Closeout report	50,000
Total O&M costs (based on 2005 dollars)	**294,000**
Contingency (20 percent)	**348,000**
TOTAL COST	**2,089,000**
COMPARATIVE PRESENT VALUE COST (based on 2005 dollars)[b]	**2,050,000**

Note:
[a] includes indirect costs (overhead, profit)
[b] discount rate of 3.1 percent per year was used to calculate present value

Acronyms/Abbreviations:
ISCO – *in situ* chemical oxidation
O&M – operation and maintenance

Table 6-5
Cost Estimate Summary for
Alternative 7 – Dynamic Circulation Source Area Treatment, MNA, and ICs

Description	Cost (dollars)
Remedial design costs[a]	
Remedial design	200,000
IC implementation plan	72,000
Total remedial design costs (based on 2005 dollars)	**272,000**
Capital costs[a]	
Dynamic Subsurface Circulation system (east)	166,000
Dynamic Subsurface Circulation system (west)	111,000
Trenching for system piping	19,000
Remediation wells	21,000
Electrical power	39,000
Total capital costs (based on 2005 dollars)	**356,000**
O&M costs[a]	
Dynamic Subsurface Circulation system	133,000
ICs (55 years)	550,000
Long-term monitoring (55 years)	999,000
5-year reviews	220,000
Total O&M costs (based on 2005 dollars)	**1,902,000**
Contingency (20 percent)	**506,000**
TOTAL COST	**3,036,000**
COMPARATIVE PRESENT VALUE COST (based on 2005 dollars)[b]	**2,082,000**

Note:
[a] includes indirect costs (overhead, profit)
[b] discount rate of 3.1 percent per year was used to calculate present value

Acronyms/Abbreviations:
IC – institutional control
MNA – monitored natural attenuation
O&M – operation and maintenance

Section 7
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

The alternatives evaluated in Section 6 provide a range of options for remediation of the VOC-contaminated groundwater at IR Site 27. These alternatives were developed after consideration of the requirements of the NCP and U.S. EPA technical guidance (U.S. EPA 1988b), the statutory preferences listed in CERCLA Section 121(b), and RAOs (Section 3).

Six alternatives have been evaluated in detail in Section 6.

- **Alternative 1 – no action.** No further action of any type would be taken.
- **Alternative 3 – MNA and ICs.** MNA monitoring would be performed in association with ICs for an assumed duration of 70 years.
- **Alternative 4A – ISB source area treatment, MNA, and ICs.** HRC treatment of two source areas of the IR Site 27 VOC plume would be performed, followed by MNA and ICs. The assumed duration of this alternative is 60 years.
- **Alternative 6A – ISCO source area treatment, MNA, and ICs.** ISCO treatment of two source areas of the IR Site 27 plume would be performed, followed by MNA and ICs. The assumed duration of this alternative is 45 years.
- **Alternative 6B – sitewide ISCO treatment and groundwater confirmation sampling.** ISCO treatment of the entire IR Site 27 VOC plume would be performed in conjunction with 3 years of groundwater confirmation sampling.
- **Alternative 7 – dynamic circulation source area treatment, MNA, and ICs.** Dynamic circulation treatment would be performed in the two source areas using specially designed remediation wells. MNA and ICs would be implemented following treatment. The assumed duration of this alternative is 55 years.

This section compares the relative performance of the remedial alternatives considered in this FS Report to the NCP evaluation criteria (Section 6.1). This comparative analysis distinguishes the advantages and disadvantages of each alternative and identifies key trade-offs the Navy must consider when selecting a cleanup remedy. When selecting a final remedy under CERCLA, the NCP criteria are evaluated according to the following hierarchy, in accordance with 40 C.F.R. § 300.430(f):

- threshold criteria
  - overall protection of human health and the environment
  - compliance with ARARs
- primary balancing criteria
  - long-term effectiveness and permanence
  - reduction of toxicity, mobility, or volume through treatment
  - short-term effectiveness
  - implementability
  - cost

- modifying criteria
  - state acceptance
  - community acceptance

CERCLA Section 121(d) and the NCP at 40 C.F.R. § 300.430(f)(1)(ii) require that a cleanup remedy must protect human health and the environment and comply with ARARs, unless justification to waive a specific ARAR is provided in the final FS Report. Both threshold criteria must be satisfied for a remedial alternative to be eligible for selection unless an ARAR waiver applies. Therefore, the selection of eligible remedial alternatives will generally be based on a comparison of the five balancing criteria and the two modifying criteria.

The first two sections below discuss the NCP threshold criteria. Sections 7.3 through 7.7 describe the five balancing criteria. To facilitate the discussion, these five criteria are evaluated and compared in the same order as in the detailed analysis of alternatives for IR Site 27 presented in Sections 6.2 through 6.7 (Table 7-1).

The two modifying criteria (state acceptance and community acceptance) are also briefly identified in this section. The Navy's evaluation of these modifying criteria will be documented in the Proposed Plan and ROD once formal comments have been received on this FS Report and a final remedy selection decision has been being made.

7.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

CERCLA and the NCP require that a cleanup remedy protect human health and the environment unless justification to waive a specific ARAR is provided in the ROD.

Alternative 1 would not be fully protective of human health and the environment because plume stability would not be verified; therefore, Alternative 1 will not be evaluated under the additional criteria. Alternatives 3, 4A, 6A, 6B, and 7 meet the threshold criterion of overall protection of human health and the environment and provide a broad range of alternatives for consideration.

7.2 COMPLIANCE WITH ARARS

CERCLA and the NCP require that a cleanup remedy must comply with ARARs, unless justification to waive a specific ARAR is provided in the ROD.

Alternatives 3, 4A, 6A, 6B, and 7 meet the threshold criterion of compliance with ARARs.

7.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Long-term effectiveness and permanence refers to the impact of a remedial alternative in the long term, defined as the time after remedial construction activities are completed. Long-term effectiveness and permanence are affected by the following:

- magnitude of residual risk at the completion of remedial activities (after RAOs are achieved)
- type, degree, and adequacy of long-term management of contaminants remaining on-site
- long-term reliability of ECs/ICs
- potential need to replace components
- continuing need for repair/maintenance

Alternative 3 received a rating of medium because the assumed 70-year duration would require implementation of ICs for a longer time period than durations assumed for Alternatives 4A, 6A, and 7. The assumed duration for Alternative 3 is also considerably longer than that assumed for Alternative 6B. In addition, the long-term effectiveness of ICs would depend on continued adherence. Alternative 7 also received a rating of medium. Although this source area treatment would be expected to reduce VOC concentrations in the source area within 1 year of implementation, it is a relatively less proven technology than Alternatives 4A, 6A, and 6B. In addition, the treatment system associated with Alternative 7 would require a significant amount of O&M, which is not required for Alternatives 4A, 6A, and 6B.

Alternatives 4A, 6A, and 6B all rated high in long-term effectiveness and permanence. These alternatives all could potentially shorten the IC time frame significantly and would result in permanent and long-term reductions in VOC concentrations. The ISB treatment of Alternative 4A is expected to take longer to reduce concentrations than the ISCO treatment of Alternatives 6A and 6B. Most of the contamination in the ISCO treatment areas would be removed during the *in situ* chemical treatment within 6 months.

7.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

CERCLA has a preference for technologies that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances. These reductions are affected by the following:

- treatment processes used
- amount of hazardous material to be treated
- degree of expected reduction in toxicity, mobility, or volume
- degree to which treatment is irreversible
- type and quantity of treatment residuals

Alternative 6B rated highest in the reduction of toxicity, mobility, or volume through sitewide active treatment. Chemical reactions within the aquifer would permanently remove VOCs from groundwater within weeks, and VOCs such as DCE and vinyl

chloride would be chemically destroyed. This alternative is also the only active treatment alternative that would treat the entire plume and not just the source areas.

Alternatives 4A, 6A, and 7 received medium rankings in reduction of toxicity, mobility, or volume. These alternatives provide active treatment; however, they target a smaller mass of contaminants and a smaller treatment area. The processes by which VOC concentrations are reduced differ among the three alternatives. Alternative 4A should permanently degrade a significant mass of VOCs within the first 2 years under favorable conditions. The ISCO process of Alternative 6A is expected to permanently destroy a significant mass of VOCs within weeks in the treatment area. Alternative 7 is expected to accomplish VOC reductions similar to Alternative 4A; however, Alternative 7 treatment would result residual spent granular activated carbon that would need to be replaced and treated at an off-site carbon regeneration facility.

Alternative 3 rated lowest in reduction of toxicity, mobility, or volume through treatment. Although MNA provides a monitoring program for the natural attenuation under Alternative 3, no active treatment is provided.

7.5 SHORT-TERM EFFECTIVENESS

Short-term effectiveness refers to how an alternative affects human health and the environment from the planning stage until just before the RAOs are achieved. Short-term effectiveness is evaluated for the following:

- short-term risks to the community during implementation
- potential impacts on workers during construction and O&M
- potential environmental impacts of the action during implementation
- amount of time required before protection is achieved (i.e., the duration of the short term)

Alternative 3 received a rating of high in short-term effectiveness because it would have no short-term risks to the community and low impacts to workers, and because protection provided by ICs can be implemented readily. Alternatives 4A, 6A, and 6B received a rating of medium in short-term effectiveness. Alternative 4A has a slight risk to the community and workers due to the invasive work and injection of HRC product, and has a moderate time frame of approximately 2 years until concentrations are reduced significantly. Alternatives 6A and 6B (ISCO alternatives) have a very short reaction time and therefore concentrations would be reduced within a very short time frame. However, the risks to the community and workers from the process chemicals, while manageable, are higher than short-term risks associated with Alternative 4A. Transporting the process chemicals used for ISCO to the site would pose some short-term risks to the community, and the use of the chemicals in the ISCO process would pose some hazards to workers during implementation.

Alternative 7 received a rating of low in short-term effectiveness. Installation of the ten ART wells and two associated treatment compounds would require the most invasive

work of any alternative. Approximately 600 linear feet of trenching across paved areas of the site would be required. Air emissions associated with operation of the two remediation systems could pose some short-term risks to the community and hazards to site workers.

7.6 IMPLEMENTABILITY

Implementability includes the technical and administrative feasibility of completing an alternative. Each alternative should be evaluated for implementability by considering the following:

- ease of constructability
- operational reliability
- ability to take alternative remedial actions in the future
- ability to monitor effectiveness
- ability to obtain governmental approvals
- availability of services and materials, including time needed to develop new or innovative technologies

The best alternatives from an implementability perspective are Alternatives 3, 4A, and 6A, which all scored high in implementability. Alternative 3 is easy to implement and has a means by which to monitor the effectiveness of natural attenuation processes. Alternatives 4A and 6A are both readily implemented with no anticipated difficulties regarding technical feasibility, reliability, or scheduling. Both the ISB and ISCO injection processes would be completed using conventional direct-push drilling equipment. ISCO was recently implemented successfully at IR Site 9. In addition, Alternatives 4A and 6A focus on the two source areas of the IR Site 27 VOC plume; therefore, they would be implemented on a smaller scale than Alternative 6B.

Alternative 7 rated medium in implementability. It would require extensive invasive work during installation of the ten ART wells and two treatment system compounds. However, the technologies required to construct the remediation systems for Alternative 7 (trenching, excavation, concrete forming, etc.) are readily available and technically feasible. The remediation wells may need to extend above grade, potentially causing traffic and well security concerns.

Alternative 6B rated low in implementability. This alternative involves full-scale ISCO injection in 570 points throughout the IR Site 27 plume for sitewide treatment and would be difficult to implement.

7.7 COST

The present value of money is used to compare remedial alternative costs that occur over different time periods by discounting all future costs to a common base year. When comparing alternatives, consideration is given to relative capital costs (including both

direct and indirect costs) and O&M costs. For the cost criterion, a high ranking signifies lower comparative costs, and a low ranking signifies higher comparative costs.

The estimated costs for the five retained active remedial alternatives are summarized in Table 7-2. Alternatives 3 and 6A rated medium in cost. Alternatives 4A, 6B and 7 rated low in cost.

7.8 STATE ACCEPTANCE

This criterion evaluates the remedial alternatives with respect to the concerns of state agencies. Agency comments on the draft FS Report have been addressed and included in this FS Report (Appendix D).

7.9 COMMUNITY ACCEPTANCE

This criterion assesses issues of concern to the community for each remedial alternative. No comments were received from the RAB on this FS Report. Comments made during public and regulatory agency review of this document will be evaluated during the remedy selection process. As required by the NCP and U.S. EPA guidance, comments will also be addressed in the Proposed Plan as well as in the ROD.

7.10 CONCLUSIONS

Alternative 1 fails to meet the threshold criterion of overall protectiveness and is, therefore, not considered for selection as a final remedy. Alternative 6A (ISCO source-area treatment, MNA and ICs) scored highest using the balancing criteria. Alternatives 3 and 4A scored second highest using the balancing criteria. Alternative 6B scored next highest using the balancing criteria. Alternative 7 scored lowest using the balancing criteria.

TABLES

FINAL FEASIBILITY STUDY REPORT FOR IR SITE 27, DOCK ZONE

DATED 01 APRIL 2006

Table 7-1
Comparative Analysis of Remedial Alternatives Using Balancing Criteria

Alternative	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost*
	Parameters considered: • residual risk at completion • long-term management of remaining contaminants • reliability of ECs/ ICs • need to replace components • continuing repair/maintenance needs	Parameters considered: • treatment processes • amount of hazardous material • degree of reduction in toxicity, mobility, or volume • degree of irreversibility • treatment residuals	Parameters considered: • short-term risks to community • impacts on workers • environmental impacts • time until protection is achieved	Parameters considered: • technical feasibility • operational reliability • future alternative remedial options • ability to monitor effectiveness • ability to obtain governmental approvals • availability of services and materials	Parameters considered: • net present value • relative capital costs • O&M costs
Alternative 3 – MNA and ICs	**Medium** The assumed duration for ICs and the MNA program for this alternative (70 years) is longer than that assumed for Alternatives 4A, 6A, and 7, and would require a longer period of well maintenance/repair and management of ICs. The long-term effectiveness of ICs would depend on continued adherence.	**Low** Contaminant levels are reduced via natural attenuation processes. No active treatment is conducted under this alternative.	**High** There are no short-term risks associated with this alternative. The time to achieve protection is low because ICs can be implemented readily. Risks to the community should be minimal. Risks to workers during groundwater sampling would be mitigated with adherence to a health and safety plan.	**High** ICs are easy to implement. Groundwater sampling technology is proven. Monitoring results would track progress of MNA.	**Medium** Comparative present value costs associated with this alternative are lower than Alternatives 4A, 6A, 6B, and 7.
Alternative 4A – ISB source area treatment, MNA and ICs	**High** ISB treatment is expected to reduce source area concentrations faster than passive alternatives. The assumed duration for ICs for this alternative (approximately 60 years) is longer than that assumed for Alternative 6A, and would require a longer period of well maintenance/repair and management of ICs.	**Medium** The HRC process should permanently destroy a significant mass of VOCs within the first 2 years under favorable conditions, resulting in innocuous end products. However, the plume is treated less aggressively than for Alternatives 6A and 6B.	**Medium** The HRC product would need to be transported to the site. However, implementation of this alternative is not likely to have adverse impacts on site workers, the surrounding community, or the environment. Source area treatment under this alternative would reduce VOC concentrations within approximately two years.	**High** HRC injection is easy to implement at Alameda Point. Equipment for HRC injection is readily available. This alternative is more complex to implement than Alternative 3 due to design of an *in situ* treatment process, but soil types are fairly uniform (fine sands) in the treatment areas so no difficulties are anticipated with implementation of this alternative.	**Low** Comparative present value costs associated with this alternative are comparable to sitewide Alternative 6B. High present value cost compared to Alternatives 3, 6A, and 7.
Alternative 6A – ISCO source area treatment, MNA and ICs	**High** ISCO treatment is expected to reduce source area concentrations faster than Alternatives 3 and 4A. The assumed duration for ICs for this alternative (approximately 45 years) is shorter than that assumed for Alternatives 3 and 4A.	**Medium** The chemical oxidation process should permanently destroy a significant mass of VOCs within weeks in the treatment area, resulting in innocuous end products. However, less of the plume is aggressively treated than for Alternative 6B.	**Medium** ISCO would destroy the VOCs in the source areas more quickly with this alternative than Alternatives 3, 4A, or 7. However, the ISCO process poses some risks to site workers and the community. Approximately one truck per day of hydrogen peroxide would need to be delivered to the site during treatment.	**High** ISCO was recently implemented successfully at IR Site 9 (near IR Site 27). No difficulties are anticipated with implementation of this alternative. This alternative is judged to be similar in implementability to Alternative 4A.	**Medium** High comparative present value cost compared to Alternative 3; however, comparative cost is lower than Alternatives 4A, 6B, and 7.

Table 7-1 (continued)

Alternative	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost*
Alternative 6B – sitewide ISCO treatment and groundwater confirmation sampling	**High** Most or all of the contamination would be eliminated within 6 months; therefore, only a limited time frame would be necessary for groundwater confirmation sampling to confirm that MCL-equivalent concentrations have been reached.	**High** This sitewide chemical oxidation alternative should permanently destroy virtually all of the VOCs in groundwater within weeks, resulting in innocuous by-products.	**Medium** ISCO would destroy the VOCs to MCL-equivalent concentrations across the entire plume within an estimated time of 6 months. However, the ISCO process poses some risks to site workers and the community. Approximately one truck per day of hydrogen peroxide would need to be delivered to the site during treatment.	**Low** This alternative is considered the least implementable due to the number of injection points (570) required for sitewide ISCO treatment.	**Low** High present value cost compared to Alternatives 3 and 6A. Cost is comparable to Alternative 4A. Cost is lower than Alternatives 4A and 7.
Alternative 7 – dynamic circulation source area treatment, MNA, and ICs	**Medium** This source area treatment alternative would be expected to reduce VOC concentrations in the source area within a year after implementation, but is relatively less proven than ISB and ISCO treatments. The assumed duration for ICs for this alternative (approximately 55 years) is shorter than that that assumed for Alternatives 3 and 4A and would require a shorter period of well maintenance/repair and management of ICs.	**Medium** This alternative would accomplish VOC reductions similar to Alternative 4A. VOCs would be removed by SVE and carbon adsorption and destroyed at a carbon regeneration facility.	**Low** This alternative requires installation of ten new remediation wells, two treatment compounds, and approximately 600 lineal feet of trenching across paved areas of the site. Air emissions associated with operation of remediation systems could pose some risk to the community.	**Medium** Technologies required to implement this alternative (well installation, trenching, and remediation system construction) are readily available. Remediation wells may need to extend above grade, potentially causing traffic and well security concerns. The proprietary well design is available only from ART.	**Low** High comparative present value cost compared to other source area treatment alternatives

Note:
* a low ranking under the cost criterion means present value costs are comparatively higher, and a high ranking means present value costs are comparatively lower

Acronyms/Abbreviations:
ART – Accelerated Remediation Technologies, LLC
EC – engineering control
HRC – Hydrogen Release Compound
IC – institutional control
IR – Installation Restoration (Program)
ISB – *in situ* bioremediation
ISCO – *in situ* chemical oxidation
MCL – maximum contaminant level
MNA – monitored natural attenuation
SVE – soil vapor extraction
VOC – volatile organic compound

Table 7-2
Summary of Cost Estimates for IR Site 27 Remedial Alternatives

Alternative	Duration of Alternative	Remedial Design Cost	Capital Cost	O&M Cost	Total Cost	Net Present Value*
Alternative 3 – MNA and ICs	70 years	$152,000	$0	$2,144,000	$2,755,000	$1,407,000
Alternative 4A – ISB source area treatment, MNA, and ICs	60 years	$172,000	$210,000	$2,140,000	$3,026,000	$1,962,000
Alternative 6A – ISCO source area treatment, MNA, and ICs	45 years	$172,000	$289,000	$1,390,000	$2,221,000	$1,532,000
Alternative 6B – sitewide ISCO treatment and groundwater confirmation sampling	3 years	$200,000	$1,247,000	$294,000	$2,089,000	$2,050,000
Alternative 7 – dynamic circulation source area treatment, MNA, and ICs	55 years	$272,000	$356,000	$1,902,000	$3,036,000	$2,082,000

Note:
* discount rate of 3.1 percent per year was used to calculate net present value

Acronyms/Abbreviations:
IC – institutional control
ISB – *in situ* bioremediation
ISCO – *in situ* chemical oxidation
MNA – monitored natural attenuation
O&M – operation and maintenance

Section 8
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APPENDIX A

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

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TABLES

ATTACHMENTS

ACRONYMS/ABBREVIATIONS

ACL	alternative concentration limit
ARAR	applicable or relevant and appropriate requirement
BAAQMD	Bay Area Air Quality Management District
Basin Plan	Water Quality Control Plan for the San Francisco Bay Basin
bgs	below ground surface
BSU	Bay Sediment Unit
Cal. Code Regs.	*California Code of Regulations*
Cal/EPA	California Environmental Protection Agency
Cal. Fish & Game Code	*California Fish and Game Code*
Cal. Pub. Res. Code	*California Public Resources Code*
Cal. Water Code	*California Water Code*
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	*Code of Federal Regulations*
ch.	chapter
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	chemical of concern
CTR	California Toxics Rule
CZMA	Coastal Zone Management Act
DCA	dichloroethane
DCE	dichloroethene
div.	division
DOI	Department of the Interior
DTSC	(California Environmental Protection Agency) Department of Toxic Substances Control
EP	extraction procedure
ESA	Endangered Species Act
Exec. Order No.	Executive Order Number
Fed. Reg.	*Federal Register*
FEMA	Federal Emergency Management Agency
FS	feasibility study
FWBZ	first water-bearing zone
HRC	Hydrogen Release Compound
IC	institutional control
IR	Installation Restoration (Program)
ISCO	*in situ* chemical oxidation

LDR	land-disposal restriction
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
mg/L	milligrams per liter
MOU	memorandum of understanding
MUN	municipal or domestic water supply
NAAQS	National Ambient Air Quality Standards
National Register	National Register of Historic Places
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NRWQC	National Recommended Water Quality Criteria
NTR	National Toxics Rule
OSWER	Office of Solid Waste and Emergency Response
PCE	tetrachloroethene
POC	point of compliance
Porter-Cologne Act	Porter-Cologne Water Quality Control Act
pt.	part
RCRA	Resource Conservation and Recovery Act
Res.	Resolution
RI	remedial investigation
ROD	record of decision
RWQCB	(California) Regional Water Quality Control Board
§	section
SDWA	Safe Drinking Water Act
SIP	State Implementation Plan
STLC	solubility threshold limit concentration
subdiv.	subdivision
SWRCB	(California) State Water Resources Control Board
TBC	to be considered
TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
tit.	title
Toxics Standards SIP	Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California
TTLC	total threshold limit concentration

U.S.C.	*United States Code*
U.S. EPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound
WQO	water quality objective

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Section A1
INTRODUCTION

This appendix identifies and evaluates potential federal and state of California applicable or relevant and appropriate requirements (ARARs) from the universe of regulations, requirements, and guidance. This appendix sets forth the Navy determinations regarding those potential ARARs for each response action alternative retained for detailed analysis in this Feasibility Study (FS) Report for Installation Restoration (IR) Program Site 27, Alameda Point, Alameda, California. Tables for this appendix are located behind a tab following the text.

This evaluation includes an initial determination of whether the potential ARARs actually qualify as ARARs and a comparison for stringency between the federal and state regulations to identify the controlling ARARs. The identification of ARARs is an iterative process. The final determination of ARARs will be made by the Navy in the Record of Decision (ROD) after public review, as part of the response action selection process.

A1.1 SUMMARY OF CERCLA AND NCP REQUIREMENTS

Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (Title 42 *United States Code* [U.S.C.] Section [§] 9621[d]), as amended, states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to the conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than the federal ARAR.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site (U.S. EPA 1988a). A requirement must be determined to be both relevant and appropriate in order to be considered an ARAR.

The criteria for determining relevance and appropriateness are listed in Title 40 *Code of Federal Regulations* (C.F.R.) § 300.400(g)(2) and include the following:

- the purpose of the requirement and the purpose of the CERCLA action
- the medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site

- the substances regulated by the requirement and the substances found at the CERCLA site
- the actions or activities regulated by the requirement and the response action contemplated at the CERCLA site
- any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site
- the type of place regulated and the type of place affected by the release or CERCLA action
- the type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action
- any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resources at the CERCLA site

According to CERCLA ARARs guidance (U.S. EPA 1988a), a requirement may be "applicable" or "relevant and appropriate," but not both. Identification of ARARs must be done on a site-specific basis and involve a two-part analysis: first, a determination of whether a given requirement is applicable; then, if it is not applicable, a determination of whether it is nevertheless both relevant and appropriate. It is important to explain that some regulations may be applicable or, if not applicable, may still be relevant and appropriate. When the analysis determines that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable (U.S. EPA 1988a).

Tables included at the end of this appendix present each potential ARAR with an initial determination of ARAR status (i.e., applicable, relevant and appropriate, or not an ARAR). For the determination of relevance and appropriateness, the pertinent criteria are examined to determine whether the requirements address problems or situations sufficiently similar to the circumstances of the release or response action contemplated, and whether the requirement is well suited to the site. A negative determination of relevance and appropriateness indicates that the requirement does not meet the pertinent criteria. Negative determinations are documented in the tables of this appendix but are discussed in the text only for specific cases.

To qualify as a state ARAR under CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a state requirement must be:

- a state law or regulation,
- an environmental or facility siting law or regulation,
- promulgated (of general applicability and legally enforceable),
- substantive (not procedural or administrative),
- more stringent than federal requirements,

- identified in a timely manner, and
- consistently applied.

To constitute an ARAR, a requirement must be substantive. Therefore, only the substantive provisions of requirements identified as ARARs in this analysis are considered to be ARARs. Permits are considered to be procedural or administrative requirements. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or nonenvironmental, including permit requirements, are not considered to be ARARs. CERCLA Section 121(e)(1), 42 U.S.C. § 9621(e)(1), states that "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." The term "on-site" is defined for purposes of this ARARs discussion as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (40 C.F.R. § 300.5).

Nonpromulgated advisories or guidance issued by federal or state governments is not legally binding and does not have the status of ARARs. Such advisories or guidance may, however, be useful and are "to be considered" (TBC). TBC requirements (40 C.F.R. § 300.400[g][3]) complement ARARs but do not override them. They are useful for guiding decisions regarding cleanup levels or methodologies when regulatory standards are not available.

Pursuant to United States Environmental Protection Agency (U.S. EPA) guidance (U.S. EPA 1988a), ARARs are generally divided into three categories: chemical-specific, location-specific, and action-specific requirements. This classification was developed to aid in the identification of ARARs; some ARARs do not fall precisely into one group or another. ARARs are identified on a site-specific basis for remedial actions where CERCLA authority is the basis for cleanup.

As the lead federal agency, the Navy has primary responsibility for identifying federal ARARs at Alameda Point. Potential federal ARARs that have been identified for the IR Site 27 FS Report are discussed in Section A1.2.2. Pursuant to the definition of the term "on-site" in 40 C.F.R. § 300.5, the contaminated soil and groundwater and adjacent areas necessary for implementing the selected remedial actions at IR Site 27 are considered to be the on-site boundaries for purposes of this ARARs analysis. Regulatory requirements that apply to off-site actions are not ARARs. Off-site actions (e.g., off-site disposal) are required to comply with applicable requirements only and are not required to comply with relevant and appropriate requirements identified as ARARs for on-site actions.

Identification of potential state ARARs was initiated through Navy requests that the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) identify potential state ARARs, an action described in more detail in Section A1.2.3. Potential state ARARs that have been identified for IR Site 27 are discussed below.

A1.2 METHODOLOGY DESCRIPTION

As the lead federal agency, the Navy has primary responsibility for identification of potential ARARs for IR Site 27. In preparing this ARARs analysis, the Navy undertook the following measures, consistent with CERCLA and the NCP:

- identified federal ARARs for each response action alternative addressed in the FS Report, taking into account site-specific information for IR Site 27
- reviewed potential state ARARs identified by the state to determine whether they satisfy CERCLA and NCP criteria that must be met in order to constitute state ARARs
- evaluated and compared federal ARARs and their state counterparts to determine whether state ARARs are more stringent than the federal ARARs or are in addition to the federally required actions
- reached a conclusion as to which federal and state ARARs are the most stringent and/or are "controlling" ARARs for each alternative

A1.2.1 Identifying and Evaluating Federal ARARs

As the lead federal agency under CERCLA and the NCP, the Navy is responsible for identifying federal ARARs. The final determination of federal ARARs will be made when the Navy issues the ROD. The federal government implements a number of federal environmental statutes that are the source of potential federal ARARs, either in the form of the statutes or regulations promulgated thereunder. Examples include the Resource Conservation and Recovery Act (RCRA), the Clean Water Act, the Safe Drinking Water Act (SDWA), the Toxic Substances Control Act, and their implementing regulations, to name a few. See the NCP preamble in 55 *Federal Register* (Fed. Reg.) 8764–8765 (1990) for a more complete listing.

The proposed response action and alternatives were reviewed against all potential federal ARARs, including but not limited to those set forth in 55 Fed. Reg. 8764–8765 (1990), to determine if they were applicable or relevant and appropriate, utilizing the CERCLA and NCP criteria and the procedures for ARARs identification issued by lead federal agencies.

A1.2.2 Identifying and Evaluating State ARARs

The process of identifying and evaluating potential state ARARs by the state and the Navy is described in this subsection.

A1.2.2.1 SOLICITATION OF STATE ARARs UNDER NCP

U.S. EPA guidance (U.S. EPA 1988b) recommends that the lead federal agency consult with the state when identifying state ARARs for remedial actions. In essence, the CERCLA/NCP requirements at 40 C.F.R. § 300.515 for remedial actions provide that the lead federal agency request that the state identify chemical- and location-specific state ARARs upon completion of site characterization. The requirements also provide that the

lead federal agency request identification of all categories of state ARARs (chemical-, location-, and action-specific) upon completion of identification of remedial alternatives for detailed analysis. The state must respond within 30 days of receipt of the lead federal agency requests. The remainder of this subsection documents the Navy's efforts to date to identify and evaluate state ARARs.

The Navy followed the procedures of the process set forth in 40 C.F.R. § 300.515 and Section 7.6 of the Federal Facilities Agreement for remedial actions in seeking state assistance in identifying state ARARs.

A1.2.2.2 CHRONOLOGY OF EFFORTS TO IDENTIFY STATE ARARs

The following chronology summarizes the Navy efforts to obtain state assistance in identifying state ARARs for the response action at IR Site 27. Key correspondence between the Navy and the state agencies related to this effort has been included in the Administrative Record for this FS Report.

In a letter dated September 12, 1996, the Navy requested potential state ARARs for the remedial investigation (RI) and FS effort at Naval Air Station Alameda. The state of California responded in a Cal/EPA DTSC letter to the Navy dated November 13, 1996. The response from the DTSC is included as Attachment A1. The list of requirements included solid waste disposal site closure and post-closure maintenance and a long list of potential requirements that could be pertinent to IR Site 27. Since IR Site 27 was not used as a landfill or disposal site, the disposal site closure and post-closure maintenance requirements were determined not to be pertinent. Other requirements on the list were included where determined to be pertinent.

The Navy requested chemical-, location-, and action-specific ARARs for IR Site 27 from DTSC in a letter dated July 7, 2005 (Attachment A2). No response had been received as of the issue date of this FS Report.

A1.3 REQUIREMENTS OF THE FEDERAL RESOURCE CONSERVATION AND RECOVERY ACT

RCRA is a federal statute passed in 1976 to meet four goals: 1) the protection of human health and the environment, 2) the reduction of waste, 3) the conservation of energy and natural resources, and 4) the elimination of the generation of hazardous waste as expeditiously as possible. The Hazardous and Solid Waste Amendments of 1984 significantly expanded the scope of RCRA by adding new corrective action requirements, land disposal restrictions, and technical requirements. RCRA, as amended, contains several provisions that are potential ARARs for CERCLA sites.

Substantive RCRA requirements are applicable to response actions on CERCLA sites if the waste is a RCRA hazardous waste, and either:

- the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement; or
- the activity at the CERCLA site constitutes treatment, storage, or disposal, as defined by RCRA (U.S. EPA 1988a).

The preamble to the NCP indicates that state regulations that are components of a federally authorized or delegated state program are generally considered federal requirements and potential federal ARARs for the purposes of ARARs analysis (55 Fed. Reg. 8666, 8742 [1990]). The state of California received approval for its base RCRA hazardous waste management program on July 23, 1992 (57 Fed. Reg. 32,726 [1992]). The state of California standards document entitled Environmental Health Standards for the Management of Hazardous Waste, set forth in Title (tit.) 22 *California Code of Regulations* (Cal. Code Regs.) Division (div.) 4.5 was approved by the U.S. EPA as a component of the federally authorized state of California RCRA program. On September 26, 2001, California received final authorization of its revised State Hazardous Waste Management Program by the U.S. EPA (63 Fed. Reg. 49,118 [2001]).

The regulations of Cal. Code Regs. tit. 22, div. 4.5 are therefore a source of potential federal ARARs for CERCLA response actions. The exception is when a state regulation is "broader in scope" than the corresponding federal RCRA regulations. In that case, such regulations are not considered part of the federally authorized program or potential federal ARARs. Instead, they are purely state law requirements and potential state ARARs.

The U.S. EPA notice of July 23, 1992, approving the state of California RCRA program (57 Fed. Reg. 32,726 [1992]), specifically indicated that the state regulations addressed certain non-RCRA, state-regulated hazardous wastes that fell outside the scope of federal RCRA requirements. Cal. Code Regs. tit. 22, div. 4.5 requirements would be potential state ARARs for such non-RCRA, state-regulated wastes.

A key threshold question for the ARARs analysis is whether or not the contaminants at IR Site 27 constitute federal hazardous waste, as defined under RCRA and the state's authorized program, or qualify as non-RCRA, state-regulated hazardous waste. A discussion of waste characterization is presented in Section A1.4.

A1.4 WASTE CHARACTERIZATION

Selection of ARARs for IR Site 27 involves the characterization of wastes as RCRA hazardous, California-regulatory non-RCRA hazardous, and other California waste classifications.

A1.4.1 RCRA Hazardous Waste Determination

Federal RCRA hazardous waste determination is necessary to determine whether a waste is subject to RCRA requirements at Cal. Code Regs. tit. 22, div. 4.5 and other state requirements at Cal. Code Regs. tit. 23, div. 3, Chapter (ch.) 15. The first step in the RCRA hazardous waste characterization process is to evaluate contaminated media at the site(s) and determine whether the contaminant constitutes a "listed" RCRA waste. The preamble to the NCP states that "it is often necessary to know the origin of the waste to determine whether it is a listed waste and that, if such documentation is lacking, the lead agency may assume it is not a listed waste" (55 Fed. Reg. 8666, 8758 [1990]).

This approach is confirmed in U.S. EPA guidance for CERCLA compliance with other laws (U.S. EPA 1988a), as follows:

> To determine whether a waste is a listed waste under RCRA, it is often necessary to know the source. However, at many Superfund sites, no information exists on the source of wastes. The lead agency should use available site information, manifests, storage records, and vouchers in an effort to ascertain the nature of these contaminants. When this documentation is not available, the lead agency may assume that the wastes are not listed RCRA hazardous wastes, unless further analysis or information becomes available that allows the lead agency to determine that the wastes are listed RCRA hazardous wastes.

RCRA hazardous wastes that have been assigned U.S. EPA hazardous waste numbers (or codes) are listed in Cal. Code Regs. tit. 22, § 66261.30–66261.33. The lists include hazardous waste codes beginning with the letters "F," "K," "P," and "U."

Knowledge of the exact source of a waste is required for source-specific listed wastes (K waste code). Some knowledge of the nature or source of the waste is required, even for listed wastes from nonspecific sources such as spent solvents (F waste code) or commercial chemical products (P and U waste codes). These listed RCRA hazardous wastes are restricted to commercially pure chemicals used in particular processes such as degreasing.

P and U wastes cover only unused and unmixed commercial chemical products, particularly spilled or off-spec products (U.S. EPA 1991a). Not every waste containing a P or U chemical is a hazardous waste. To determine whether a CERCLA investigation-derived waste contains a P or U waste, there must be direct evidence of product use. In particular, all the following criteria must be met. The chemicals must be:

- discarded (as described in 40 C.F.R. § 261.2[a][2]),
- either off-spec commercial products or a commercially sold grade,
- not used (soil contaminated with spilled unused wastes is a P or U waste), and
- the sole active ingredient in a formulation.

No documentation of past waste disposal practices was found that would serve to classify the sources of groundwater contamination at IR Site 27 with respect to the RCRA waste listings. Therefore, the Navy has made the determination that the mere presence of chemicals of concern (COCs) in the soil and groundwater should not classify IR Site 27 contaminated soil or groundwater as RCRA-listed hazardous wastes. By extension of this reasoning, any residuals generated during treatment of IR Site 27 groundwater will also not be classified as RCRA-listed hazardous wastes.

The second step in the RCRA hazardous waste characterization process is to evaluate potential hazardous characteristics of the waste. The evaluation of characteristic waste is described in U.S. EPA guidance as follows (U.S. EPA 1988a):

> Under certain circumstances, although no historical information exists about the waste, it may be possible to identify the waste as RCRA characteristic waste. This is important in the event that (1) remedial alternatives under consideration at the site involve on-site treatment, storage, or disposal, in which case RCRA may be triggered as discussed in this section; or (2) a remedial alternative involves off-site shipment. Since the generator (in this case, the agency or responsible

> party conducting the Superfund action) is responsible for determining whether the wastes exhibit any of these characteristics (defined in 40 C.F.R. § 261.21–261.24), testing may be required. The lead agency must use best professional judgment to determine, on a site-specific basis, if testing for hazardous characteristics is necessary.
>
> In determining whether to test for the toxicity characteristic using the extraction procedures (EP) toxicity test, it may be possible to assume that certain low concentrations of waste are not toxic. For example, if the total waste concentration in soil is 20 times or less the EP toxicity concentration, the waste cannot be characteristic hazardous waste. In such a case, RCRA requirements would not be applicable. In other instances, where it appears that the substances may be characteristic hazardous waste (ignitable, corrosive, reactive, or EP toxic), testing should be performed.

Hazardous waste characteristics, as defined in 40 C.F.R. § 261.21–261.24, are commonly referred to as ignitability, corrosivity, reactivity, and toxicity. California environmental health standards for the management of hazardous waste set forth in Cal. Code Regs. tit. 22, div. 4.5, were approved by the U.S. EPA as a component of the federally authorized California RCRA program. Therefore, the characterization of RCRA waste is based on the state requirements.

The characteristics of ignitability, corrosivity, reactivity, and toxicity are defined in Cal. Code Regs. tit. 22, § 66261.21–66261.24. According to Cal. Code Regs. tit. 22, § 66261.24(a)(1)(A), "A waste that exhibits the characteristic of toxicity pursuant to subsection (a)(1) of this section has the EPA Hazardous Waste Number specified in Table I of this section which corresponds to the toxic contaminant causing it to be hazardous." Table I assigns hazardous waste codes beginning with the letter "D" to wastes that exhibit the characteristic of toxicity; D waste codes are limited to "characteristic" hazardous wastes.

According to Cal. Code Regs. tit. 22, § 66261.10, waste characteristics can be measured by an available standardized test method or be reasonably classified by generators of waste based on their knowledge of the waste, provided that the waste has already been reliably tested or that there is documentation of chemicals used. Contaminants at IR Site 27 are not likely to be ignitable, corrosive, or reactive, as defined in Cal. Code Regs. tit. 22, § 66261.21–66261.23. This determination was based on knowledge of the nature and concentrations of contaminants at IR Site 27.

The requirements at Cal. Code Regs. tit. 22, § 66261.24 list the toxic contaminant concentrations that determine the characteristic of toxicity. The concentration limits are in milligrams per liter (mg/L). These units are directly comparable to total concentrations in waste groundwater and surface water. For waste soils, these concentrations apply to the extract or leachate produced by the toxicity characteristic leaching procedure (TCLP).

A waste is considered hazardous if the contaminants in the wastewater or in the soil TCLP extract equal or exceed the TCLP limits. TCLP testing is required only if total contaminant concentrations in soil equal or exceed 20 times the TCLP limits because TCLP uses a 20-to-1 dilution for the extract (U.S. EPA 1988a).

The analytical data reported for groundwater samples were evaluated to determine whether there is a potential for classification of groundwater at IR Site 27 as a characteristic hazardous waste. None of the chemical compounds reported in the samples had maximum concentrations above the TCLP limits. Therefore, groundwater at the site does not appear to meet the standard for classification as a characteristic hazardous waste.

A1.4.2 California-Regulated Non-RCRA Hazardous Waste

A waste determined not to exhibit the RCRA toxicity characteristic may still be considered a state-regulated non-RCRA hazardous waste. The state is broader in scope in its RCRA program in determining hazardous waste. Cal. Code Regs. tit. 22, § 66261.24(a)(2) lists the total threshold limit concentrations (TTLCs). An aqueous waste is considered hazardous if total concentrations exceed the TTLCs. None of the chemical compounds reported in the samples had maximum concentrations above the TTLC limits. Therefore, groundwater at the site does not appear to meet the standard for classification as a characteristic hazardous waste.

Since groundwater at IR Site 27 does not meet the standard for classification as a RCRA hazardous waste, the analytical data reported for groundwater samples were evaluated to determine whether there is a potential for classification of groundwater as a state-regulated non-RCRA hazardous waste. The state has identified soluble threshold limit concentrations (STLCs) for classification as a state-regulated nonhazardous waste. None of the chemical compounds reported in the samples had maximum concentrations above the STLC limits. Therefore, groundwater at the site does not meet the standard for classification as a state-regulated nonhazardous waste.

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Section A2
POTENTIAL CHEMICAL-SPECIFIC ARARs

Chemical-specific ARARs are generally health- or risk-based numerical values or methodologies applied to site-specific conditions that result in the establishment of a cleanup level. Many potential ARARs associated with particular response alternatives (such as closure or discharge) can be characterized as action-specific, but include numerical values or methodologies to establish them; therefore, they fit into both categories (chemical- and action-specific). To simplify the comparison of numerical values, most action-specific requirements that include numerical values are included in this chemical-specific section and, if repeated in the action-specific section, the discussion refers back to this section.

This section presents a detailed discussion and a summary of conclusions regarding chemical-specific ARARs by medium. Potential numeric groundwater ARARs are compared in Table A2-1. Potential federal and state chemical-specific ARARs are summarized in Tables A2-2 and A2-3, respectively.

A2.1 SUMMARY OF ARARs CONCLUSIONS BY MEDIUM

Groundwater, surface water, soil, and air are the environmental media potentially affected by the envisioned remedial actions. The conclusions for ARARs pertaining to these media are presented in the following sections.

A2.1.1 Groundwater ARARs Conclusions

As part of the RI, groundwater samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds, and metals. Based on RI results, selected VOCs are COCs in groundwater at IR Site 27 (BEI 2005b). The potential federal and state chemical-specific ARARs for remediation of IR Site 27 groundwater are as follows:

- federal maximum contaminant levels (MCLs) for tetrachloroethene (PCE), trichloroethene (TCE), and arsenic in drinking water, as promulgated by U.S. EPA under the SDWA at 40 C.F.R. § 141.61(a)
- federal MCLGs for cis- and trans-1,2-dichloroethene (DCE) at 40 C.F.R. § 141.50(a)
- state primary MCLs for cis-1,2-DCE, trans-1,2-DCE, vinyl chloride, and 1,1-dichloroethane (DCA) at Cal. Code Regs. tit. 22, § 64444
- RCRA standards in Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), 66261.100
- RCRA standards in Cal. Code Regs. tit. 22, § 66264.94(a)(1) and (3), (c), (d) and (e)
- Porter-Cologne Water Quality Control Act (Porter-Cologne Act), California Water Code (Cal. Water Code) §§ 13241, 13243, 13263(a), 13269, and 13360
- Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan), Chapters 2 and 3, Beneficial Uses and Water Quality Objectives (WQOs)
- State Water Resources Control Board (SWRCB) Resolution (Res.) 88-63

MCLs are only potentially relevant and appropriate for inland groundwater at IR Site 27, based on groundwater characteristics. Please refer to Section A2.2.1.1 for further information about the characteristics of shoreline groundwater and inland groundwater.

A2.1.2 Surface Water ARARs Conclusions

There are no natural streams, rivers, ponds, lakes, and other surface water bodies in IR Site 27. Even though IR Site 27 is adjacent to the Seaplane Lagoon, surface water is not a medium of concern for the site because the area offshore from IR Site 27 is being investigated as part of IR Site 17. However, the discharge of contaminants from the flow of groundwater (traveling directly to Seaplane Lagoon and/or through the storm drain network) is a potential concern at the site. Furthermore, discharges resulting from remedial activities at IR Site 27 to surface water may be a concern if a remedial action is selected that treats the groundwater and discharges treated water to Seaplane Lagoon. Therefore, surface water requirements were identified to assist in developing cleanup goals for IR Site 27.

The substantive provisions of the following federal and state regulations are potential chemical-specific ARARs:

- CERCLA alternative concentration limits in CERCLA Section 121(d)(2)(B)(ii) (42 U.S.C. § 9621[d][2][B][ii])
- Water quality standards in the National Toxics Rule (NTR) and California Toxics Rule (CTR) standards at 40 C.F.R. § 131.36 and 131.38
- Porter-Cologne Act (Cal. Water Code §§ 13241, 13243, 13263[a], 13269, and 13360)
- Basin Plan, Chapters 2 and 3, Beneficial Uses and WQOs
- Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Toxics Standards SIP), Sections 1.3 and 1.4

A2.1.3 Soil ARARs Conclusions

Soil is not a medium of concern at IR Site 27. However, soil saturated with contaminated groundwater could be excavated during drilling or remediation activities. Therefore, the substantive provisions of the following requirements were identified as potential chemical-specific ARARs for characterization of soil at the site:

- RCRA protection standards in Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100

A2.1.4 Air ARARs Conclusions

The COCs in groundwater include VOCs that might be a concern if they were emitted to the atmosphere. Proposed soil-moving operations might also emit particulates to the air. Since the potential for release to air may occur during groundwater remediation or other actions, these requirements are addressed in Section A4, Action-Specific ARARs.

A2.2 DETAILED DISCUSSION OF ARARs BY MEDIUM

The following subsections provide a detailed discussion of federal and state ARARs by medium.

A2.2.1 Potential Groundwater ARARs

During the RI field activities for IR Site 27, the average depth to water measured in IR Site 27 monitoring wells was 6.9 feet below ground surface (bgs). Groundwater in the southeastern portion of Alameda Point, which includes IR Site 27, generally flows to the west towards Seaplane Lagoon or to the southwest towards San Francisco Bay.

IR Site 27 includes four hydrogeologic units:

- upper first water-bearing zone (FWBZ) – artificial fill material and the sandy member of the Bay Sediment Unit (BSU)
- semiconfining unit – clayey member of the BSU
- lower FWBZ – Merritt Sand Formation and the Upper San Antonio Formation
- regional aquitard – Lower San Antonio Formation, including Yerba Buena Mud

The clayey member of the BSU (the Young Bay Mud) is absent in many areas of IR Site 27. It is likely that the three lithologic units (artificial fill layer, sandy member of BSU, and Merritt Sand Formation) encountered to depths of 17 feet bgs in borings at IR Site 27 represent a single unconfined FWBZ.

A2.2.1.1 POTENTIAL FEDERAL ARARs

One of the significant issues in identifying ARARs for groundwater under the SDWA and RCRA is whether the groundwater at the site can be classified as a source of drinking water. The U.S. EPA groundwater policy is set forth in the preamble to the NCP (55 Fed. Reg. 8666, 8752–8756 [1990]). This policy uses the groundwater classification system set forth in the draft U.S. EPA Guidelines for Groundwater Classification Under the U.S. EPA Groundwater Protection Strategy (U.S. EPA 1986). Under this policy, groundwater is classified in one of three categories (Class I, II, or III) based on ecological importance, replaceability, and vulnerability considerations. Irreplaceable groundwater that is currently used by a substantial population, or groundwater that supports a vital habitat, is considered to be Class I groundwater. Class II groundwater is groundwater that is currently being used or that might be used as a source of drinking water in the future. Groundwater that cannot be used for drinking water due to insufficient quality (e.g., high salinity or widespread, naturally occurring contamination) or quantity is considered to be Class III groundwater. The U.S. EPA guidelines define Class III groundwater as groundwater with total dissolved solids (TDS) concentrations above 10,000 mg/L and a yield of less than 150 gallons per day (U.S. EPA 1986). Class III groundwater can also be classified based on economic or technological treatability tests, as well as on quality or quantity (one set of criteria or the other must be satisfied, but not both).

The U.S. EPA clarified further considerations for whether an aquifer should be considered a potential source of drinking water in a letter from Tom Huetteman, U.S. EPA, to Henry Gee, Navy (U.S. EPA 1998). These considerations include:

- the thickness of the aquifer,
- the actual groundwater yield,
- the proximity to salt water and the potential for saltwater intrusion,
- the quality of underlying water-bearing units and whether these units are current or potential drinking water sources,
- the existence of institutional controls (ICs) on well construction or aquifer use,
- information on current or historical use of the aquifer, and
- the cost of cleanup to MCLs.

In the southeastern portion of Alameda Point, which includes IR Site 27, the FWBZ is connected to a Class II groundwater aquifer (Merritt Sand Formation) that is a potential drinking-water source for off-site wells. Sixty wells located upgradient of the southeastern portion of Alameda Point are screened in the Merritt Sand in an area east (up to 1 mile) of Alameda Point (i.e., east of Main Street), and an additional 113 upgradient wells screened in the Merritt Sand are located between 1 and 2 miles east-southeast of Alameda Point (TtEMI 2000b). Most of these wells were installed on residential properties during the 1970s to provide a supplemental source of irrigation water for homeowners; some of these wells are still in use. No restrictions currently exist on the use to which water from these wells may be put (domestic supply, industrial supply, or irrigation).

The "Determination of the Beneficial Uses of Groundwater" report for Alameda Point (TtEMI 2000b) indicates that the U.S. EPA Well Head Protection Area model was used to determine whether an off-site well could capture a groundwater contaminant plume from the southeastern portion of Alameda Point. The model indicated that plume capture was possible at a pumping rate of 3 gallons per minute. The existence of upgradient wells and the classification of the aquifer as Class II makes groundwater in the southeastern portion of Alameda Point a potential drinking water source.

The U.S. EPA determined that the groundwater underlying the southeastern region of Alameda Point should be considered a drinking water source in a letter from A.M. Cook, dated January 3, 2000 (U.S. EPA 2000). In this letter, the U.S. EPA stated:

> In the southeastern portion of the base, the groundwater meets the TDS and yield criteria and is classified as a Class II aquifer. It appears that .... existing domestic supply wells are located immediately adjacent to this portion of the base. The existence of these wells, in addition to the classification of the aquifer, make the groundwater in this area a potential and possibly current drinking water source. This determination means that contaminated groundwater beneath and migrating from Sites 3, 4, 9, 11, 13, 16, 19, 21, 22, and 23 must be remediated to levels that meet MCLs.

Although IR Site 27 was not designated or delineated at the time of the beneficial use study, it is located in the southeastern area of the base. However, site-specific information indicates that not all of the groundwater on-site would classify as Class II. Comparison of TDS and major anion and cation concentrations and ratios indicate that the six wells installed west of Ferry Point Road, along the shoreline with Seaplane Lagoon, are subject to saltwater intrusion. For four of the six wells (15MJ-MW1, 37-MJ-MW-9, 37-MJ-MW-10, and 27MW04), average TDS values range from 15,100 to 27,900 mg/L, which is consistent with levels in seawater (34,400 mg/L) diluted by influx of freshwater in the San Francisco Bay. The other two shoreline wells (15-MW1 and 15-MW2) have lower average TDS values (2,380 and 4,780 mg/L), which suggests that these two wells are less impacted by water from Seaplane Lagoon. The concentrations and proportions of chloride, sodium, magnesium, and calcium in the shoreline wells, shown in Table 4-5 of the RI Report (BEI 2005b), are consistent with those of diluted seawater; this area would therefore not be considered a Class II aquifer. Water from the eight inland wells at IR Site 27 has average TDS values (322 to 783 mg/L) and common ion concentrations consistent with freshwater and is considered a Class II aquifer and a potential source of drinking water.

Based on the above discussion, the shoreline groundwater is not considered a potential source of drinking water under the U.S. EPA guidance. However, the inland groundwater is considered a potential source of drinking water.

Safe Drinking Water Act

Federal MCLs and maximum contaminant level goals (MCLGs) developed by the U.S. EPA under the SDWA are generally considered potentially relevant and appropriate requirements for aquifers with Class I and Class II characteristics, and therefore as potential federal ARARs. The point of contact for MCLs and MCLGs under the SDWA is at the tap. Therefore, the MCLs and MCLGs are not applicable ARARs for Navy sites. However, MCLs and MCLGs are generally considered relevant and appropriate as remediation goals for current or potential drinking water sources. The VOC-impacted inland groundwater at IR Site 27 exhibits Class II characteristics and, therefore, for FS purposes, MCLs and MCLGs are potential ARARs for inland groundwater. MCLGs for cis- and trans-1,2-DCE promulgated at 40 C.F.R. §141.50(a) are potential federal relevant and appropriate requirements for the inland groundwater. Since there are no nonzero MCLGs for the other groundwater COCs, MCLs for vinyl chloride, TCE, and PCE at 40 C.F.R. § 141.61(a) are potential federal relevant and appropriate requirements for the inland groundwater at IR Site 27.

However, because shoreline groundwater at IR Site 27 is saline and subject to saltwater intrusion, this groundwater is not considered a current or potential drinking water source. Therefore MCLs and MCLGs are not potential ARARs for shoreline groundwater.

RCRA Hazardous Waste

The federal RCRA requirements at 40 C.F.R. Part (pt.) 261 do not apply in California because the state RCRA program is authorized. The authorized state RCRA

requirements are therefore considered potential federal ARARs (Section A1.3). The applicability of RCRA requirements depends on whether the waste is a RCRA hazardous waste, whether the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement, and whether the activity at the site constitutes treatment, storage, or disposal as defined by RCRA. However, RCRA requirements may be relevant and appropriate even if they are not applicable. Examples include activities that are similar to the definition of RCRA treatment, storage, or disposal for waste that is similar to RCRA hazardous waste.

The determination of whether a waste is a RCRA hazardous waste can be made by comparing the site waste to the definition of RCRA hazardous waste. The substantive provisions of RCRA requirements at Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are potential ARARs because they define RCRA hazardous waste. A waste can meet the definition of hazardous waste if it has the toxicity characteristic of hazardous waste. This determination is made by using the TCLP. The maximum concentrations allowable for the TCLP listed at Cal. Code Regs. tit. 22, in § 66261.24(a)(1)(B) are potential federal ARARs for determining whether the site has hazardous waste. If the site waste has concentrations exceeding these values, it is determined to be a characteristic RCRA hazardous waste (Section A1.4.1).

RCRA Groundwater Protection Standards

Groundwater concentration limits for RCRA-regulated units are promulgated at Cal. Code Regs. tit. 22, § 66264.94. For corrective action programs, Subsection(a)(1) and (3) states that for each COC, the owner or operator shall propose, for each medium (groundwater, surface water, and the unsaturated zone) monitored, a concentration limit not to exceed the background value or a concentration limit greater than background established for a corrective action program.

Subsection (c) states that a concentration limit that is greater than the background value can only be used if it is technologically or economically infeasible to achieve the background value and if the COC will not pose a substantial present or potential hazard to human health or the environment.

Subsection (e) states that in no event shall a concentration limit greater than background exceed other criteria set by applicable statutes or regulations (e.g., an MCL), or the lowest concentration demonstrated to be technologically and economically achievable. For the inland groundwater, the MCL has been determined to be the lowest concentration technologically and economically achievable.

Since the uppermost aquifer at IR Site 27 along the shoreline is not a potential source of drinking water, MCLs have been determined not to be potential ARARs for shoreline groundwater. The lowest concentration demonstrated to be technologically and economically achievable is a potential ARAR for the uppermost aquifer at the IR Site 27 shoreline. In general, economic feasibility is an objective balancing of the incremental benefit of attaining further reductions in the concentrations of COCs with the incremental cost of achieving those reductions. Since the shoreline groundwater at IR Site 27 is not a drinking water source, there is no benefit from attaining further reduction than required to

mitigate threats from other exposure pathways. Therefore, for the shoreline groundwater, the lowest feasible concentration limits are based on the site risk.

These standards are not "applicable" because IR Site 27 does not contain a RCRA waste management unit. However, the Navy has determined that the substantive provisions of Cal. Code Regs. tit. 22, § 66264.94(a)(1) and (3), (c), (d) and (e) are potentially relevant and appropriate requirements for this response action because the wastes at the site are similar or identical to RCRA hazardous waste constituents.

CERCLA Alternative Concentration Limits

Under CERCLA Section 121(d)(2)(B)(ii) (42 U.S.C. § 9621[d][2][B][ii]), an alternative concentration limit (ACL) using a point of exposure (similar to a point of compliance [POC]) beyond the facility boundary can be used where:

- there are known and projected points of entry of such groundwater into surface water,
- there will be no statistically significant increase of hazardous constituents from groundwater in surface water at the point of entry or at any point where there is reason to believe accumulation of constituents may occur downstream, and
- there are enforceable ICs to prevent human exposure at any point between the facility boundary and the point of entry into surface water.

Shoreline groundwater already meets RAOs (CTR surface water criteria). Therefore, for remedial action at IR Site 27, ACLs are not needed to demonstrate that contaminants in shoreline groundwater will not cause an exceedance of surface water criteria in Seaplane Lagoon.

National Recommended Water Quality Criteria

Section 304(a)(1) of the Clean Water Act (33 U.S.C. § 1314[a][1]) directs the U.S. EPA to publish and periodically update the National Recommended Water Quality Criteria (NRWQC). These standards are intended to protect humans and aquatic life organisms from contaminants in surface water. The current NRWQC standards were published in a report dated November 2002. These criteria, updated periodically in the *Federal Register*, reflect the latest scientific knowledge on the identifiable effects of pollutants on public health and welfare (related to the use of shoreline for recreational purposes) and the health of aquatic life populations. These criteria serve as guidance to states in adopting water quality standards under Section 303(c) of the Clean Water Act (33 U.S.C. § 1313[c]) that protect aquatic life organisms from acute and chronic effects of pollutants.

The applicability of surface water criteria to groundwater is discussed in CERCLA Section 121(d)(2)(B)(i) (42 U.S.C. § 9621[d][2][B][i]), 40 C.F.R. § 300.430(e), and the NCP preamble (55 Fed. Reg. 8666, 8754–8755 [1990]). Although the NRWQC provide nonenforceable guidelines, they may be potentially relevant and appropriate for groundwater where MCLs are not available. In such cases, the NRWQC may be adjusted

to reflect only drinking water use and may be used as cleanup goals for the response actions. Although the inland groundwater at IR Site 27 is a potential drinking water source, the NRWQC are not potential ARARs for inland groundwater because MCLs are available for the COCs in inland groundwater.

A2.2.1.2 POTENTIAL STATE ARARs

The following requirements were identified by the state of California and were evaluated for groundwater cleanup at the site:

- Porter-Cologne Act, Cal. Water Code §§ 13241, 13243, 13263(a), 13269, and 13360
- Basin Plan
- Cal. Code Regs. tit. 22, § 64444, in which primary state MCLs are set forth (MCLs – organic chemicals)
- SWRCB Res. 68-16, Res. 88-63, and Res. 92-49
- Cal. Code Regs. tit. 23, div. 3, ch. 15, § 2550(a), 2550.4(d), (e), and (f), and 2550.5
- Toxics Standards SIP

Primary State Maximum Contaminant Levels

The inland groundwater at IR Site 27 exhibits Class II characteristics and, therefore, for FS purposes, MCLs are potential ARARs for inland groundwater. The state MCLs at Cal. Code Regs. tit. 22, § 64444 for cis- and trans-1,2-DCE; vinyl chloride; and 1,1-DCA are potential state ARARs for inland groundwater because they are more stringent than the federal MCLs. However, because shoreline groundwater at IR Site 27 is saline and subject to saltwater intrusion, this groundwater is not considered a current or potential drinking water source, and therefore MCLs are not potential ARARs for shoreline groundwater.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Act became Division 7 of the Cal. Water Code in 1969. The Porter-Cologne Act requires each Regional Board to formulate and adopt Basin Plans for all areas within the region (Cal. Water Code § 13240). It also requires each Regional Board to establish WQOs that will protect the beneficial uses of the water basin (Cal. Water Code § 13241) and to prescribe waste discharge requirements that would implement the Basin Plan for any discharge of waste to the waters of the state (Cal. Water Code § 13263[a]).

Other sections of the Porter-Cologne Act include Cal. Water Code § 13243, which allows regional boards to specify conditions or areas where waste discharge is not permitted. Cal. Water Code § 13269 provides the Board's authority for waivers for reports or compliance with requirements as long as it is not against the public interest. Cal. Water Code § 13360 specifies circumstances under which Regional Boards may order compliance in a specific manner.

The Navy accepts the substantive provisions of Cal. Water Code §§ 13241, 13243, 13263(a), 13269, and 13360 of the Porter-Cologne Act as enabling legislation (as implemented through the beneficial uses, WQOs, waste discharge requirements, and promulgated policies of the Basin Plan) as potential state ARARs. The Navy does not consider the sections of the state Water Code to be ARARs, because they are authorizing provisions for the Water Boards and do not impose requirements that would be applicable or relevant and appropriate to the Navy's CERCLA action. Where waste discharge requirements are specified in general permits, the substantive requirements in the permits, but not the permits themselves, are potential ARARs.

Cal. Water Code § 13304 sets forth enforcement authority and an enforcement process (orders issued by the state) and is procedural in nature. It does not constitute an ARAR because it does not itself establish or contain substantive environmental "standards, requirements, criteria, or limitations" (CERCLA Section 121 [42 U.S.C. § 9621]) and is not in itself directive in intent. Through its enforcement authority and procedures, substantive state environmental standards set forth in other statutes, regulations, plans, and orders are enforced. In addition, Cal. Water Code § 13304 is not more stringent than the substantive requirements of the potential state ARARs identified in the above paragraphs or the potential federal ARARs for groundwater.

Comprehensive Water Quality Control Plan for San Francisco Bay Basin (Basin Plan)

The Navy accepts the substantive provisions in the Basin Plan (RWQCB 1995), including beneficial uses and WQOs, as potential ARARs.

The Basin Plan was prepared and implemented by the San Francisco Bay Regional Water Quality Control Board (RWQCB) to protect and enhance the quality of the waters in the basin. The Basin Plan establishes location-specific beneficial uses and WQOs for the surface water and groundwater of the region and is the basis of the RWQCB San Francisco Bay Basin regulatory programs. The Basin Plan includes both numeric and narrative WQOs for specific groundwater subbasins. The WQOs are intended to protect the beneficial uses of the waters of the region and to prevent nuisance conditions.

Beneficial use and reuse of water are key aspects of the Basin Plan for the San Francisco Bay Basin. IR Site 27 is located in the East Bay Plain groundwater subbasin. This subbasin has the following beneficial use designations (RWQCB 1995):

- municipal and domestic supply (MUN)
- agricultural supply
- industrial service supply
- industrial process supply

The Basin Plan allows for exceptions from MUN designation (see Section 2 of the Basin Plan, "Beneficial Uses, Present and Potential Beneficial Uses, Groundwater," beginning at the end of page 2-5). The Navy considers the substantive provisions of this section to be an ARAR, and therefore the criterion for excepting a MUN designation is the occurrence of either of the following conditions.

- TDS exceeds 3,000 mg/L (electrical conductivity 5,000 micromhos per centimeter), and it is not reasonably expected by the RWQCB that the groundwater could supply a public water supply system.
- The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day.

Shoreline groundwater beneath IR Site 27 has little potential as a source of drinking water because of 1) existing saltwater intrusion into some of the shoreline wells, and 2) the likelihood of saltwater intrusion into the remaining shoreline wells shortly after beginning groundwater pumping, causing elevated TDS levels in a short period of time. Because it has been determined that the shoreline groundwater in the uppermost aquifer at IR Site 27 is not a potential source of drinking water, the MUN beneficial use is not considered a potential ARAR for shoreline groundwater. For the same reasons, the shoreline groundwater is also not a potential water source for the agricultural and industrial uses, and those beneficial uses are also not considered potential ARARs for the shoreline groundwater.

Since the inland groundwater is a potential source of drinking water, the substantive provisions of beneficial uses are considered potentially applicable state ARARs for the inland groundwater.

State Water Resources Control Board Res. 92-49 and 68-16

SWRCB Res. 92-49, as amended on April 21, 1994, and October 2, 1996, is entitled "Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Cal. Water Code § 13304." It contains policies and procedures for the Regional Boards that apply to all investigations and cleanup and abatement activities for all types of discharges subject to Cal. Water Code § 13304.

SWRCB Res. 68-16, Statement of Policy With Respect to Maintaining High Quality of Waters in California, establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the state." It provides that whenever the existing quality of water is better than the required applicable water quality policies, such existing high-quality water will be maintained until it has been demonstrated to the state that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to discharge to existing high-quality waters will be required to meet waste discharge requirements that will result in the best practicable treatment or control of the discharge necessary to assure that 1) pollution or a nuisance will not occur and 2) the highest water quality consistent with maximum benefit to the people of the state will be maintained (SWRCB 1968).

Cleanup to below background water quality conditions is not required by the SWRCB under the Porter-Cologne Act. SWRCB Res. 92-49 II.F.1 (SWRCB 1992) provides that

regional boards may require cleanup and abatement to "conform to the provisions of the Resolution No. 68-16 of the State Water Board, and the Water Quality Control Plans of the State and Regional Water Quality Control Boards, provided that under no circumstances shall these provisions be interpreted to require cleanup and abatement which achieves water quality conditions that are better than background conditions."

The Navy Position Regarding SWRCB Res. 92-49 and 68-16

The Navy recognizes that the key substantive requirements of Cal. Code Regs. tit. 22, § 66264.94 (and the identical requirements of Cal. Code Regs tit. 23, § 2550.4 and Section III.G of SWRCB Res. 92-49) require cleanup of COCs to background levels unless such restoration proves to be technologically or economically infeasible and an alternative cleanup level for COCs will not pose a substantial present or potential hazard to human health or the environment. In addition, the Navy recognizes that these provisions are more stringent than corresponding provisions of 40 C.F.R. § 264.94, and although they are federally enforceable through the RCRA program authorization, they are also independently based on state law to the extent that they are more stringent than the federal regulations.

The Navy also determined that SWRCB Res. 68-16 is not a chemical-specific ARAR for determining response action goals. The Navy determined that further migration of already contaminated groundwater is not a discharge governed by the language in SWRCB Res. 68-16. More specifically, the language of SWRCB Res. 68-16 indicates that it is prospective in intent, applying to new discharges in order to maintain existing high-quality waters. It is not intended to apply to restoration of waters that are already degraded.

The Navy's position is that SWRCB Res. 68-16 and 92-49 and Cal. Code Regs. tit. 23, § 2550.4 do not constitute chemical-specific ARARs for this response action because they are state requirements and are not more stringent than federal ARAR provisions of Cal. Code Regs. tit. 22, § 66264.94. The NCP at 40 C.F.R. § 300.400(g)(4) provides that only state standards more stringent than federal standards may be ARARs (see also CERCLA Section 121, 42 U.S.C. § 9621[d][2][A][ii]). Furthermore, the RWQCB has clarified that Res. 92-49 was not intended to address cleanup of polluted groundwater where the groundwater is discharging into surface water, as is the case for this response action (BEI 2005a).

The substantive technical standard in the equivalent state requirements (i.e., Cal. Code Regs. tit. 23, div. 3, ch. 15, and SWRCB Res. 92-49 and 68-16) is identical to the substantive technical standard in Cal. Code Regs. tit. 22, § 66264.94. This section of Cal. Code Regs. tit. 22 will likely be applied in a manner consistent with equivalent provisions of other regulations, including SWRCB Res. 92-49 and 68-16.

State Water Resources Control Board Res. 88-63

SWRCB Res. 88-63, Adoption of Policy Entitled "Sources of Drinking Water," establishes criteria to help the RWQCB identify potential sources of drinking water (SWRCB 1988). According to this resolution, all groundwater in California is considered

suitable or potentially suitable for domestic or municipal freshwater supply except in cases where any one of the following water quality and production criteria cannot be met.

- TDS exceeds 3,000 mg/L (or electrical conductivity is greater than 5,000 micromhos per centimeter) and the RWQCB does not reasonably expect the groundwater to supply a public water supply system.
- Groundwater is contaminated, either by natural processes or by human activity unrelated to a specific pollution incident, and cannot reasonably be treated for domestic use either by best management practices or best economically available treatment practices.
- The groundwater does not provide sufficient water to supply a single well capable of producing an average sustained yield of 200 gallons per day.

SWRCB Res. 88-63 has been incorporated by reference into the Basin Plan (RWQCB 1995). The Navy has documented herein that shoreline groundwater at IR Site 27 is not a current or potential source of drinking water supply (Section 2.4.6 of the FS Report).

Cal. Code Regs. tit. 23, div. 3, ch. 15, § 2550(a), 2550.4(d), (e), and (f), and 2550.5

The Cal. Code Regs. tit. 23, div. 3, ch. 15 regulations address hazardous waste discharges to land. Other waste classifications are addressed under Cal. Code Regs. tit. 27, div. 2, subdivision (subdiv.) 1. Cal. Code Regs. tit. 23, § 2550(a) addresses the general applicability of other technical standards in Chapter 15 and does not contain standards itself. Therefore, Cal. Code Regs. tit. 23, § 2550(a) is not an ARAR. Cal. Code Regs. tit. 23, § 2550.4(d), (e), and (f) address concentration limits for monitoring and cleanup programs at hazardous waste management units. Because the site was not a hazardous waste management unit, these requirements are not potentially applicable. The POC requirements at Cal. Code Regs. tit. 23, § 2550.5 are not potentially relevant since there is no downgradient edge of a waste management unit. The Navy has also determined that the requirements contained in these sections are identical to those found in Cal. Code Regs. tit. 22, § 66264.94(d)(1), (2), and (4), and (e)(1) and (2). Since they are not more stringent than the corresponding federal ARARs, these regulations are therefore not ARARs for IR Site 27.

RCRA Requirements

Substantive state RCRA requirements included in the U.S. EPA-authorized RCRA program for California are considered to be potential federal ARARs and are discussed above. When state regulations are either broader in scope or more stringent than their federal counterparts, they are considered potential state ARARs. Substantive state requirements such as the non-RCRA, state-regulated hazardous waste requirements may be potential state ARARs because they are not within the scope of the federal ARARs (57 Fed. Reg. 60,848). The Cal. Code Regs. tit. 22, div. 4.5 requirements that are part of the state-approved RCRA program would be potential state ARARs for non-RCRA, state-regulated hazardous wastes.

A2.2.2 Potential Surface Water ARARs

Surface water is not a medium being addressed by this FS Report. No surface water body is located within the boundaries of IR Site 27. Seaplane Lagoon is located along the western border of the site. The discharge of contaminants from the flow of groundwater (traveling directly to Seaplane Lagoon and San Francisco Bay and/or through the storm drain network) is a potential concern at IR Site 27. Therefore, potential federal and state ARARs for surface water are detailed in the following subsections.

A2.2.2.1 POTENTIAL FEDERAL ARARs

Safe Drinking Water Act

Federal MCLs and MCLGs developed by the U.S. EPA under the SDWA are generally considered relevant and appropriate as remediation goals for current or potential drinking water sources, including surface water bodies (see Section A2.2.1.1). Since Seaplane Lagoon and San Francisco Bay are not existing or potential sources of drinking water, the MCLs and MCLGs are not potential ARARs.

Water Quality Standards

On December 22, 1992, the U.S. EPA promulgated federal water quality standards under the authority of the federal Clean Water Act Section 303(c)(2)(B), 33 U.S.C. ch. 26, § 1313(c)(2)(B), in order to establish water quality standards required by the Clean Water Act where the state of California and other states had failed to do so (57 Fed. Reg. 60,848 [1992]). These standards have been amended over the years in the *Federal Register*, including amendments of the NTR (60 Fed. Reg. 22,228 [1995]). These water quality standards, as amended, are codified at 40 C.F.R. § 131.36.

The U.S. EPA promulgated a rule on May 18, 2000, to fill a gap in California water quality standards that was created in 1994 when a state court overturned the state's water quality control plans that contained water quality criteria for priority toxic pollutants. The rule, commonly called the CTR, is codified at 40 C.F.R. § 131.38. These federal criteria are legally applicable in the state of California for inland surface waters and enclosed bays and estuaries for all purposes and programs under the Clean Water Act.

The substantive water quality standards contained in 40 C.F.R. § 131.36 and 131.38 are potential applicable federal ARARs for groundwater cleanup remedial actions for IR Site 27 that discharge to surface water (Seaplane Lagoon and/or San Francisco Bay).

The Navy's position on the POC for submarine discharge of groundwater to surface water is that the POC is within the ambient receiving water itself, following initial dilution. The Navy believes this precedent to be well established under Clean Water Act case law and in state plans, policies, and operating practices.

National Recommended Water Quality Criteria

Please see discussions in Section A2.2.1.1. The NRWQC may be potentially relevant and appropriate for surface water in the absence of promulgated state standards. However, as discussed in the CERCLA Compliance With Other Laws Manual (U.S. EPA 1988a), "If the state has promulgated a numerical water quality standard for a given chemical and use, the state standard would generally be relevant and appropriate rather than a water quality criterion, because it essentially represents a site-specific adaptation of a water quality criterion." Since water quality standards have been promulgated in the CTR, the substantive CTR standards, not the NRWQC, would be considered potential chemical-specific ARARs for this site.

CERCLA Alternative Concentration Limits

Please see discussions in Section A2.2.1.1.

RCRA Hazardous Waste and Groundwater Protection Standards

Please see discussions in Section A2.2.1.1.

A2.2.2.2 POTENTIAL STATE ARARs

Comprehensive Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan)

Please see discussion in Section A2.2.1.2. The substantive provisions of the Basin Plan for beneficial uses (Chapter 2), WQOs (Chapter 3), and waste discharge requirements (Chapter 4) are potential state ARARs for discharges from migrating groundwater to surface water.

The substantive provisions of beneficial uses for the surface water potentially affected by migrating groundwater are potential ARARs. This surface water is at the upper end of the lower San Francisco Bay and the beneficial uses are as follows:

- ocean, commercial, and sport fishing
- estuarine habitat
- industrial service supply
- fish migration
- navigation
- preservation of rare and endangered species
- water contact recreation
- noncontact water recreation
- shellfish harvesting
- wildlife habitat

Chapter 3 of the Basin Plan lists several narrative WQOs. The toxicity narrative WQO requires in substantive part that all waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic

organisms. It further states that there shall be no acute toxicity or chronic toxicity in ambient waters. Based on the COCs in the groundwater, the substantive provisions of the toxicity WQO is a potentially applicable ARAR for IR Site 27 groundwater discharge to surface water.

Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California

The Toxics Standards SIP (SWRCB 2000) was effective on April 28, 2000, with respect to the priority pollutant criteria promulgated for California by the U.S. EPA through the NTR (40 C.F.R. § 131.36) and to the priority pollutant objectives established by the RWQCB in their Water Quality Control Plans (Basin Plans). The Toxics Standards SIP was effective on May 18, 2000, with respect to the priority pollutant criteria promulgated by the U.S. EPA through the CTR (40 C.F.R. § 131.38). The Toxics Standards SIP implements the federal numeric water quality criteria (40 C.F.R. § 131.36 and 131.38) by requiring that they serve as the basis for determining water-quality-based effluent limitations for point sources that protect beneficial uses. The determination of whether an effluent limitation is required is based on whether the point-source discharge may cause, have a reasonable potential to cause, or contribute to an excursion above any applicable priority pollutant criterion or WQO. If an effluent limitation is required, it can be calculated using the appropriate dilution credit and ambient background concentration for the site, or it could be based on the total maximum daily load if one is in effect.

The substantive requirements for determining whether an effluent limitation is required and the methodology for calculating the effluent limitation found in Sections 1.3 and 1.4 of the Toxics Standards SIP are potentially applicable state ARARs for discharges that cause, have a reasonable potential to cause, or contribute to an excursion above any applicable priority pollutant criterion or objective into inland surface waters, enclosed bays, and estuaries (nonocean surface waters). Other sections of the Toxics Standards SIP are not ARARs because they are not more stringent than the federal ARARs discussed in Section A2.2.2.1.

State Water Resources Control Board Res. 92-49 and 68-16

Please see discussion in Section A2.2.1.2, including the positions of the Navy and the state of California on these resolutions.

State Water Resources Control Board Res. 88-63

Please see discussion in Section A2.2.1.2. SWRCB Res. 88-63 states that water sources that contain TDS exceeding 3,000 mg/L (or having an electrical conductivity of greater than 5,000 micromhos per centimeter) or a yield from a single well of less than 200 gallons per day are not reasonably expected by the RWQCB to supply a public water supply system (SWRCB 1988). Since Seaplane Lagoon and San Francisco Bay are not existing or potential sources of drinking water due to the presence of TDS exceeding 3,000 mg/L, SWRCB Res. 88-63 is not a potential state ARAR.

NPDES Permit Requirements

The SWRCB or RWQCB can issue National Pollutant Discharge Elimination System (NPDES) permits for discharges to water from operations such as construction dewatering or groundwater cleanup. These permits can be general in order to cover similar discharges statewide or within a region. The permits can also be site-specific. CERCLA response actions are not subject to permit requirements as provided under CERCLA Section 121(e) (42 U.S.C. § 9621[e]). Therefore, the NPDES permit requirements are not potential ARARs.

Although NPDES permits are not potential ARARs for CERCLA actions, if a permit is issued for the remedial actions at IR Site 27, then it may be considered as guidance on how to comply with the federal Clean Water Act ARARs and other state water quality ARARs identified for direct discharges to the Seaplane Lagoon or San Francisco Bay.

A2.2.3 Potential Soil ARARs

Soil is not a medium of concern for the remedial action at IR Site 27. However, soil saturated with contaminated groundwater could be excavated or otherwise generated (e.g., drill cuttings) as part of the remedial action for groundwater. The key threshold question for soil ARARs is whether or not the wastes located at IR Site 27 would be classified as hazardous waste. The soil may be classified as a federal hazardous waste as defined by RCRA and the state-authorized program, or as non-RCRA, state-regulated hazardous waste. If the soil is determined to be hazardous waste, the RCRA requirements may be applicable. If the soil has concentrations below hazardous waste criteria but are similar to hazardous waste, the RCRA requirements may be relevant and appropriate.

A2.2.3.1 POTENTIAL FEDERAL ARARs

RCRA Hazardous Waste and Groundwater Protection Standards

The federal RCRA requirements at 40 C.F.R. pt. 261 do not apply in California because the state RCRA program is authorized. The substantive authorized state RCRA requirements are therefore considered potential federal ARARs (see Section A1.3). The applicability of RCRA requirements depends on whether the waste is a RCRA hazardous waste; whether the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement; and whether the activity at the site constitutes treatment, storage, or disposal as defined by RCRA. However, RCRA requirements may be relevant and appropriate even if they are not applicable. Examples include activities that are similar to the definition of RCRA treatment, storage, or disposal for waste that is similar to RCRA hazardous waste.

The determination of whether a waste is a RCRA hazardous waste can be made by comparing the site waste to the definition of RCRA hazardous waste. The substantive RCRA requirements at Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are potential ARARs because they define RCRA hazardous waste. A waste can meet the definition of hazardous waste if it has the

toxicity characteristic of hazardous waste. This determination is made by using the TCLP. The concentrations in a TCLP extract at which a waste becomes hazardous, listed in Cal. Code Regs. tit. 22, § 66261.24(a)(1)(B), are potential federal ARARs for determining whether the site contains hazardous waste. If the site waste has concentrations exceeding these values, it is determined to be a characteristic RCRA hazardous waste (see Section A1.4.1).

The substantive requirements at Cal. Code Regs. tit. 22, § 66264.94(a)(1), (a)(3), (c), (d), and (e) are potential federal ARARs for contamination in the vadose zone (i.e., the unsaturated zone). These sections set concentration limits for the unsaturated zone as well as for groundwater and surface water. These requirements are considered to be potential federal ARARs because they are part of the approved state RCRA program.

Substantive RCRA land-disposal restrictions (LDRs) at Cal. Code Regs. tit. 22, § 66268.1(f) are potential federal ARARs for discharging waste to land. This section prohibits the disposal of hazardous waste to land unless 1) it is treated in accordance with the treatment standards of Cal. Code Regs. tit. 22, § 66268.40 and the underlying hazardous constituents meet the Universal Treatment Standards at Cal. Code Regs. tit. 22, § 66268.48; 2) it is treated to meet the alternative soil treatment standards of Cal. Code Regs. tit. 22, § 66268.49; or 3) a treatability variance is obtained under Cal. Code Regs. tit. 22, § 66268.44. These are potentially applicable requirements for proposed on-site treatment and disposal only (Alternative S7). Off-site treatment and disposal must comply with all applicable laws and regulations that are both substantive and procedural requirements.

A2.2.3.2 POTENTIAL STATE ARARs

RCRA Requirements

Substantive state RCRA requirements included in the U.S. EPA-authorized RCRA program for California are considered to be potential federal ARARs. When substantive state regulations are either broader in scope or more stringent than their federal counterparts, they are considered potential state ARARs. Substantive state requirements such as the non-RCRA, state-regulated hazardous waste requirements may be potential state ARARs because they are not within the scope of the federal ARARs (57 Fed. Reg. 60,848). The substantive Cal. Code Regs. tit. 22, div. 4.5 requirements that are part of the state-approved RCRA program would be potential state ARARs for non-RCRA, state-regulated hazardous wastes.

The site waste characteristics need to be compared to the definition of non-RCRA, state-regulated hazardous waste. The substantive non-RCRA, state-regulated waste definition requirements at Cal. Code Regs. tit. 22, § 66261.24(a)(2) are potential state ARARs for determining whether other RCRA requirements are potential state ARARs. This section lists the TTLCs and STLCs. The site waste may be compared to these thresholds to determine whether it meets the characteristics for a non-RCRA, state-regulated hazardous waste.

Cal. Code Regs. tit. 23, div. 3, ch. 15

The requirements at this section define a hazardous waste that is covered by the Chapter 15 requirements. These are not more stringent than federal or state RCRA ARARs for identifying hazardous waste.

A2.2.4 Potential Air ARARs

For this FS, the COCs in soil and groundwater include chemicals that may be a concern if they are emitted to the atmosphere. Soil movement may result in particulate emissions. However, since these requirements are associated with actions, they are included under action-specific requirements, which are presented after the remedial alternatives have been identified in Section A4.

A2.2.4.1 POTENTIAL FEDERAL ARARs

The Clean Air Act and RCRA air emission requirements are discussed below.

Clean Air Act

The Clean Air Act establishes the National Ambient Air Quality Standards (NAAQS) in 40 C.F.R. § 50.4–50.12. NAAQS are not enforceable in and of themselves; they are translated into source-specific emissions limitations by the state (U.S. EPA 1990). Substantive requirements of the Bay Area Air Quality Management District (BAAQMD) rules that have been approved by the U.S. EPA as part of the State Implementation Plan (SIP) under the Clean Air Act are potential federal ARARs for air emissions (Clean Air Act Section 110). The SIP includes rules for emissions restrictions for particulates, organic compounds, and hazardous air pollutants, as well as standards of performance for new sources.

BAAQMD Rule 1-301, under *California Health and Safety Code* § 41700, is considered a federal requirement because it has been approved into the SIP. Rule 1-301 prohibits the discharge to the atmosphere of air contaminants that may cause injury, detriment, nuisance, or annoyance to the public. The Navy is troubled by the vague, subjective nature of the nuisance rule and the lack of objective standards, as well as the inclusion of subjective nonenvironmental criteria such as "annoyance, repose, and comfort." The requirements of 40 C.F.R. § 300.5 specify that an ARAR must be an environmental or facility siting requirement or limitation. Rule 1-301 does not fall within the definition of those terms and is therefore not an ARAR. The nature, quantity, and location of identified contaminants at IR Site 27 should not be of concern. The Navy has determined that BAAQMD Rule 1-301 is not an ARAR.

A2.2.4.2 POTENTIAL STATE ARARs

RCRA requirements for non-RCRA, state-regulated hazardous wastes and BAAQMD rules are described below.

BAAQMD Regulations

Substantive BAAQMD regulations that are not included in the SIP may be potentially applicable state ARARs. For example, BAAQMD Regulation 8, Rule 40 limits emissions of VOCs from soil during excavation and removal operations. More specific information will be provided in the discussion of action-specific ARARs (Section A4).

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Section A3
POTENTIAL LOCATION-SPECIFIC ARARs

Potential location-specific ARARs are identified and discussed in this section. The discussions are presented based on various attributes of the site location, such as whether it is within a floodplain. Additional surveys will be performed in connection with the remedial actions to confirm location-specific ARARs where inadequate siting information currently exists, or in the event of changes to planned facility locations.

A3.1 POTENTIAL LOCATION-SPECIFIC ARARs CONCLUSIONS

Cultural resources, wetlands protection, floodplain management, hydrologic resources, biological resources, coastal resources, and geologic characteristics as appropriate for the site are the resource categories relating to location-specific requirements potentially affected by the IR Site 27 remedial actions. The conclusions for ARARs pertaining to these resources are presented in the following sections.

A3.1.1 Cultural Resources ARARs Conclusions

No archaeological or historic data have been identified at IR Site 27. Therefore, no potential cultural resources ARARs were identified.

A3.1.2 Wetlands Protection and Floodplain Management ARARs Conclusions

IR Site 27 is not located in a wetland or floodplain. Although wetland areas exist to the west of IR Site 27, remedial actions at the site would not affect the wetland area. With regard to floodplains, there are no naturally occurring streams or ponds at Alameda Point. Therefore, no potential wetlands protection or floodplain management ARARs were identified.

A3.1.3 Hydrologic Resources ARARs Conclusions

IR Site 27 contains no designated hydrologic resources, nor would the IR Site 27 remedial actions affect any such resource. Therefore, no potential hydrologic resources ARARs were identified.

A3.1.4 Biological Resources ARARs Conclusions

No native or natural habitat occurs or is expected to occur at IR Site 27. The barren habitat (bare soil and paved parking area) at the site generally offers little value to wildlife; it may serve as a corridor between other habitats or as a place of brief resting, but it is not a significant place of shelter. The proposed Alameda National Wildlife Refuge is located west of IR Site 27. Remedial actions at the site would not impact this refuge.

Estuarine habitat occurs at locations around the San Francisco Bay, such as Seaplane Lagoon to the west of IR Site 27. The estuarine habitat exists in the intertidal and

subtidal zones along the shoreline of the site. This estuarine habitat supports submerged aquatic vegetation, numerous invertebrates, fish, birds, and marine mammals.

The Migratory Bird Treaty Act of 1972 (16 U.S.C. §§ 703–712) is the only potential biological resource ARAR for the remedial actions at IR Site 27.

A3.1.5 Coastal Resources ARARs Conclusions

IR Site 27 is adjacent to Seaplane Lagoon. The substantive provisions of the Coastal Zone Management Act (CZMA) (16 U.S.C. §§ 1451–1464, 15 C.F.R. § 930) is a potential ARAR.

A3.1.6 Geologic Characteristics ARARs Conclusions

There are no known faults directly at or in the vicinity of IR Site 27. The nearest active fault is the Hayward Fault, which is approximately 6.5 miles (10.5 kilometers) east of Alameda Point (Foster Wheeler 2002). Therefore, no potential geologic characteristics ARARs were identified.

A3.2 DETAILED DISCUSSION OF POTENTIAL ARARs

The following subsections provide a detailed discussion of potential federal and state ARARs by location-specific resources. Pertinent and substantive provisions of the potential ARARs listed and described below have been reviewed to determine whether they are potential federal or state ARARs for the IR Site 27 groundwater FS.

Requirements that are determined to be potential ARARs or TBCs are identified in Table A3-1 (federal) and Table A3-2 (state). Potential ARARs determinations are presented in the ARAR Determination column. Determinations of status for potential location-specific ARARs are generally based on consultation of maps or lists included in the regulation or prepared by the administering agency. References to the document or agency consulted are provided in the Comments column and may be provided in footnotes to the table. Specific issues concerning some of the requirements are discussed in the following sections.

A3.2.1 Potential Cultural Resources ARARs

No archaeological or historic data have been identified at IR Site 27. The following cultural resource regulations were evaluated:

- National Historic Preservation Act (NHPA) of 1966, as amended (16 U.S.C. § 470–470x-6, 36 C.F.R. pt. 800, 40 C.F.R. § 6.301[b])
- Archaeological and Historic Preservation Act (16 U.S.C. § 469–469c-1, 40 C.F.R. § 6.301[c])
- Historic Sites, Buildings, and Antiquities Act of 1935 (16 U.S.C. §§ 461–467, 40 C.F.R. § 6.301[a])
- Archaeological Resources Protection Act of 1979, as amended (Public Law Number 96-95, 16 U.S.C. § 470aa–470mm)

A3.2.1.1 NATIONAL HISTORIC PRESERVATION ACT OF 1966, AS AMENDED

Pursuant to Sections 106 and 110(f) of the NHPA (16 U.S.C. § 470–470x-6, and its implementing regulations [36 C.F.R. pt. 800]), as amended, CERCLA remedial actions are required to take into account the effects of remedial activities on any historic properties included on or eligible for inclusion on the National Register of Historic Places (National Register). The National Register is a list of districts, sites, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and culture. Section 110(f) of the NHPA, as amended, requires that before approval of any federal undertaking that may directly and adversely affect any National Historic Landmark, the head of the responsible federal agency will, to the maximum extent possible, undertake such planning and actions as may be necessary to minimize harm to the landmark, and will afford the Advisory Council a reasonable opportunity to comment on the undertaking.

The NHPA requires federally funded projects to identify and mitigate impacts of project activities on properties included in or eligible for the National Register. No historic properties, sites, buildings, or landmarks are present at the site. Therefore, the NHPA is not a potential ARAR.

A3.2.1.2 ARCHAEOLOGICAL AND HISTORIC PRESERVATION ACT

The Archaeological and Historic Preservation Act, 16 U.S.C. § 469–469c-1, provides for the preservation of historical and archaeological data that might otherwise be lost as a result of dam construction or alterations of the terrain. If activities in connection with any federal construction project or federally approved project may cause irreparable loss to significant scientific, prehistoric, or archaeological data, the act requires the agency undertaking that project to preserve the data or request the Department of the Interior (DOI) to do so. This act differs from the NHPA in that it encompasses a broader range of resources than those listed on the National Register and mandates only the preservation of the data (including analysis and publication).

The Archaeological and Historic Preservation Act requires that for federally approved projects that may cause irreparable loss to significant scientific, prehistoric, historic, or archaeological data, the data must be preserved by the agency undertaking the project or the agency undertaking the project may request the DOI to do so. No scientific, prehistoric, historic, or archaeological sites were identified in existing data for the Alameda Point area that potentially could be impacted by the remedial actions at IR Site 27. Therefore, the Archaeological and Historic Preservation Act is not a potential ARAR.

A3.2.1.3 HISTORIC SITES, BUILDINGS, AND ANTIQUITIES ACT OF 1935

The purpose of the Historic Sites, Buildings, and Antiquities Act (16 U.S.C. §§ 461–467) and its implementing regulations (40 C.F.R. § 6.301[a]) is to encourage the long-term preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States, including historic landmarks (36 C.F.R. § 65) and natural landmarks (36 C.F.R. § 62). Properties designated as National Historic Landmarks in California are listed in the National Register. Natural landmarks are

nationally significant examples of a full range of ecological and geological features that constitute the nation's natural heritage. In conducting an environmental review of a proposed action, the responsible official shall consider the existence and location of natural landmarks using information provided by the National Park Service pursuant to 36 C.F.R. § 62.6(d) to avoid undesirable impacts on such landmarks. These requirements are not substantive and are not potential ARARs. However, if it is determined that areas to be disturbed during the remedial actions are potentially eligible for the National Natural Historic Landmark Program, the State Historic Preservation Officer should be contacted.

A3.2.1.4 ARCHAEOLOGICAL RESOURCES PROTECTION ACT OF 1979, AS AMENDED

Public Law Number 96-95 (16 U.S.C. § 470aa–470mm) was enacted in 1979 and amended in 1988 and applies to all lands to which the fee title is held by the United States Government. The purpose of this statute is to provide for the protection of archaeological resources on federal and Indian lands. The act prohibits unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources located on public lands unless such activity is pursuant to a permit issued under Section 470cc.

Alameda Point is not known to contain archaeological resources. The area was submerged prior to filling and dredging activities. No archaeological resources have been discovered at IR Site 27. Therefore, the Archaeological Resources Protection Act is not an ARAR.

A3.2.2 Potential Wetlands Protection and Floodplains Management ARARs

IR Site 27 is not located in a wetland or floodplain. Although a wetland area exists to the west of IR Site 27, it is located approximately 3,100 feet from the site, and remedial actions at the site would not affect the wetland area. With regard to floodplains, there are no naturally occurring streams or ponds at Alameda Point. The following wetlands protection and floodplain management regulations were evaluated:

- Protection of Wetlands (Executive Order Number [Exec. Order No.] 11990, 40 C.F.R. § 6.302[a])
- Floodplain Management (Exec. Order No. 11988, 40 C.F.R. § 6.302[b])
- Clean Water Act of 1977 (33 U.S.C. § 1344)
- RCRA (42 U.S.C. §§ 6901–6991[i])

A3.2.2.1 POTENTIAL FEDERAL ARARs

Protection of Wetlands, Executive Order Number 11990

Exec. Order No. 11990 requires that federal agencies minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial value of wetlands; and avoid support of new construction in wetlands if a practicable alternative exists.

There are no wetlands located within IR Site 27. Remedial actions at IR Site 27 would not impact wetlands areas. Therefore, Exec. Order No. 11990 is not an ARAR.

Floodplain Management, Executive Order Number 11988

Under 40 C.F.R. § 6.302(b), federal agencies are required to evaluate the potential effects of action they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.

The Federal Emergency Management Agency (FEMA) map service was consulted via the Internet at http://www.hazardmaps.gov. The IR Site 27 area is not located in a floodplain. There are no naturally occurring streams or ponds at Alameda Point. Therefore, 40 C.F.R. § 6.302(b) is not an ARAR.

Clean Water Act of 1977 (33 U.S.C. § 1344)

Section 404 of the Clean Water Act of 1977 governs the discharge of dredged and fill material into waters of the United States, including adjacent wetlands. Wetlands are areas that are inundated by water frequently enough to support vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mudflats, natural ponds, and similar areas. Both the U.S. EPA and the U.S. Army Corps of Engineers have jurisdiction over wetlands. U.S. EPA's Section 404 guidelines are promulgated in 40 C.F.R. § 230, and the U.S. Army Corps of Engineers' guidelines are promulgated in 33 C.F.R. § 320.

Discharge of dredged or fill material to a wetland is not planned as part of the remedial actions at IR Site 27. Therefore, 33 U.S.C. § 1344, 40 C.F.R. § 230, and 33 C.F.R. § 320 are not ARARs.

Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])

Under Cal. Code Regs. tit. 22, § 66264.18(b), any hazardous waste facility located in a 100-year floodplain or within the maximum high tide must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood or maximum high tide, unless the owner or operator can demonstrate that procedures are in effect that will cause the waste to be removed safely before flood or tidewater can reach the facility.

The FEMA map service was consulted via the Internet at http://www.hazardmaps.gov. The IR Site 27 area is not located in a floodplain. There are no naturally occurring streams or ponds at Alameda Point. Therefore, 42 U.S.C. §§ 6901–6991(i) is not an ARAR.

A3.2.2.2 POTENTIAL STATE ARARs

The state RCRA requirements for floodplains have been evaluated in Section A3.2.2.1.

A3.2.3 Potential Hydrologic Resources ARARs

IR Site 27 contains no designated hydrologic resources, nor would the IR Site 27 remedial actions affect any such resource. The following hydrologic resource regulations were evaluated:

- Wild and Scenic Rivers Act (16 U.S.C. §§ 1271–1287)
- Fish and Wildlife Coordination Act (16 U.S.C. §§ 661–666c)
- Rivers and Harbors Act of 1899 (33 U.S.C. §§ 401–413, 33 C.F.R. § 322)

A3.2.3.1 WILD AND SCENIC RIVERS ACT

The Wild and Scenic Rivers Act (16 U.S.C. §§ 1271–1287) establishes requirements applicable to water resource projects affecting wild, scenic, or recreational rivers within the National Wild and Scenic Rivers System, as well as rivers designated on the National Rivers Inventory to be studied for inclusion on the national system. In accordance with Section 7 of the act, a federal agency may not assist, through grant, loan, license, or otherwise, the construction of a water resources project that would have a direct and adverse effect on the free-flowing, scenic, and natural values for which a river on the national system or a study river on the National Rivers Inventory was established. The act also covers indirect effects from construction of water resources projects below or above rivers or their tributaries that are in the national system or under study on the National Rivers Inventory, such as a dam on a tributary and construction or development on adjacent shorelines. Adverse impacts must be mitigated, and coordination may be required with the National Park Service and Department of Agriculture.

IR Site 27 is not situated near a wild, scenic, or recreational river. Therefore, 16 U.S.C. §§ 1271–1287 is not a potential ARAR.

A3.2.3.2 FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act (16 U.S.C. §§ 661–666c) was enacted to protect fish and wildlife when federal actions result in the control or structural modification of a natural stream or body of water. The statute requires federal agencies to take into consideration the effect a water-related project would have on fish and wildlife and take action to prevent loss or damage to these resources.

The IR Site 27 remedial actions would not result in the control or structural modification of a natural stream or body of water. Therefore, 16 U.S.C. §§ 661–666c is not a potential ARAR.

A3.2.3.3 RIVERS AND HARBORS ACT OF 1899

Section 10 of the Rivers and Harbors Act of 1899 prohibits the creation of any obstruction not authorized by Congress to the navigable capacity of any waters of the United States (33 U.S.C. §§ 401–413). It prohibits construction of wharves, piers, booms, weirs, breakwaters, bulkheads, jetties, or other structures in a port unless the construction is approved by the U.S. Army Corps of Engineers. In addition, excavation

or filling of any port, harbor, channel, lake, or any navigable water is prohibited without authorization. Section 10 permits are required for these activities. Section 10 permits cover construction, excavation, or deposition of materials in, over, or under navigable waters, or any work that would affect the course, location, condition, or capacity of those waters.

The IR Site 27 remedial actions would not result in the creation of any obstruction to the navigable capacity of any waters of the United States. Therefore, 33 U.S.C. §§ 401–413 is not a potential ARAR.

A3.2.4 Potential Biological Resources ARARs

No native or natural habitat occurs or is expected to occur at IR Site 27. The barren habitat (bare soil and paved parking area) at the site generally offers little value to wildlife; it may serve as a corridor between other habitats or as a place of brief resting, but it is not a significant place of shelter.

The proposed Alameda National Wildlife Refuge is located approximately 3,100 feet west of IR Site 27. This area is home to a variety of sensitive avian species, including the American peregrine falcon, brown pelican, and a nesting colony of California least terns. These species are listed by either federal or state agencies as endangered. In addition, the western snowy plover, a federally listed threatened species, is known to often share nesting sites with the California least tern. Due to its distance from IR Site 27, the Alameda National Wildlife Refuge would not be affected by the remedial actions at the site.

Estuarine habitat occurs at Seaplane Lagoon, which is located to the west of IR Site 27 and is connected to the San Francisco Bay. The estuarine habitat exists in the intertidal and subtidal zones along the shoreline of the site. This estuarine habitat supports submerged aquatic vegetation such as eelgrass, numerous invertebrates such as worms and small crustaceans, fish, birds, and marine mammals.

The following biological resource regulations were evaluated:

- Endangered Species Act of 1973 (16 U.S.C. §§ 1531–1543)
- Migratory Bird Treaty Act of 1972 (16 U.S.C. §§ 703–712)
- Marine Mammal Protection Act (16 U.S.C. §§ 1361–1421h)
- Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended (16 U.S.C. §§ 1801–1882)
- National Wildlife Refuge System Administration Act of 1996 (16 U.S.C. § 668dd–668ee, substantive provisions of 50 C.F.R. § 27.11–27.97)
- Wilderness Act (16 U.S.C. §§ 1131–1136, 50 C.F.R. § 35.1–35.14)
- California Endangered Species Act (*California Fish and Game Code* [Cal. Fish & Game Code], ch. 1.5, §§ 2050–2116)

A3.2.4.1 POTENTIAL FEDERAL ARARs

Endangered Species Act of 1973

The Endangered Species Act (ESA) of 1973 (16 U.S.C. §§ 1531–1543) provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction. The ESA defines an endangered species and provides for the designation of critical habitats. Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. Under Section 7(a) of the ESA, federal agencies must carry out conservation programs for listed species. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented. Consultation regulations at 50 C.F.R. § 402 are administrative in nature and are therefore not ARARs. However, the Navy may consult with the U.S. Fish and Wildlife Service (USFWS) to assist with compliance with the substantive provisions of the ESA.

There are no known critical habitats for threatened or endangered species present at IR Site 27. The proposed Alameda National Wildlife Refuge is located approximately 3,100 feet west of IR Site 27, and it would not be affected by the remedial actions at the site. The ESA is not a potential ARAR.

Migratory Bird Treaty Act of 1972

The Migratory Bird Treaty Act (16 U.S.C. §§ 703–712) prohibits at any time, using any means or manner, the pursuit, hunting, capturing, and killing or attempting to take, capture, or kill any migratory bird. This act also prohibits the possession, sale, export, and import of any migratory bird or any part of a migratory bird, as well as nests and eggs. A list of migratory birds for which this requirement applies is found at 50 C.F.R. § 10.13. It is the Navy's position that this act is not legally applicable to Navy actions; however, Exec. Order No. 13186 (dated January 10, 2001) requires each federal agency taking actions that have or are likely to have a measurable effect on migratory bird populations to develop and implement, within 2 years, a memorandum of understanding (MOU) with the USFWS to promote the conservation of such populations. The Department of Defense and the USFWS are in the process of negotiating this MOU. In the meantime, the Migratory Bird Treaty Act will continue to be evaluated as a potentially relevant and appropriate requirement for Navy CERCLA response actions.

There are no known habitats for migratory birds present within IR Site 27. The barren habitat (bare soil and paved parking area) at the site generally offers little value to wildlife. However, it may serve as a corridor between other habitats or as a place of brief resting for migratory birds. The Migratory Bird Treaty Act is potentially relevant and appropriate for remedial actions at IR Site 27.

Marine Mammal Protection Act

The Marine Mammal Protection Act (16 U.S.C. §§ 1361–1421h) prohibits the taking of a marine mammal on the high seas or in a harbor or other place under the jurisdiction of the

United States. It prohibits the possession, transport, and sale of a mammal or marine mammal product unless authorized under law. The prohibitions that are potentially pertinent to CERCLA actions are at 16 U.S.C. § 1372(a)(2).

Even though IR Site 27 is adjacent to the Seaplane Lagoon, remedial activities at the site would not involve the capture, possession, transport, or sale of any marine mammals or marine mammal products. Therefore, 16 U.S.C. §§ 1361–1421h is not a potential ARAR.

Magnuson-Stevens Fishery Conservation and Management Act of 1976, as Amended

The purpose of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801–1882) is to conserve and manage the fishery resources found off the coasts of the United States, the anadromous species, and the continental shelf fishery resources of the United States. It establishes a fishery conservation zone within which the United States has exclusive fishery management prerogatives.

Even though IR Site 27 is adjacent to Seaplane Lagoon, remedial activities at the site would not impact any managed fishery resources. Therefore, 16 U.S.C. §§ 1801–1882 is not a potential ARAR.

National Wildlife Refuge System Administration Act of 1966

The National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee) and its implementing regulations at 50 C.F.R. §§ 25–37 establish wildlife refuges that are maintained for the primary purpose of developing a national program of wildlife and ecological conservation and rehabilitation. These refuges are established for the restoration, preservation, development, and management of wildlife and wild land habitats; protection and preservation of endangered or threatened species and their habitats; and management of wildlife and wild lands to obtain the maximum benefit from these resources.

The National Wildlife Refuge System Administration Act contains the following substantive requirements that may be potential ARARs. The act prohibits any person from disturbing, injuring, cutting, burning, removing, destroying, or possessing any property within any area of a wildlife refuge. The act also prohibits the taking or possessing of any fish, bird, mammal, or other wild vertebrate or invertebrate animals, or nest or eggs, within any refuge area or otherwise occupying any such area unless such activities are done with a permit or permitted by express provision of law. The act also regulates the use of audio equipment as well as motorized vehicles, aircraft, and boats in wildlife refuges. It prohibits construction activities, disposal of waste, and the introduction of plants and animals into any wildlife refuge. The prohibitions under the act are codified at 50 C.F.R. § 27.

There is no wildlife refuge present within IR Site 27. The proposed Alameda National Wildlife Refuge is located approximately 3,100 feet west of IR Site 27 and would not be affected by the remedial actions at the site. Therefore, 16 U.S.C. § 668dd–668ee is not a potential ARAR.

Wilderness Act

The Wilderness Act (16 U.S.C. § 1131) and its accompanying implementing regulations (50 C.F.R. § 35.1–35.14) create the National Wilderness Preservation System. The intent of the law is to administer and manage units of this system (i.e., wilderness areas) in order to preserve their wilderness character and to leave them unimpaired for future use as wilderness.

Neither Alameda Point nor IR Site 27 is a federally owned wilderness area. Therefore, 16 U.S.C. § 1131 and its accompanying implementing regulations (50 C.F.R. § 35.1–35.14) are not potential ARARs.

A3.2.4.2 POTENTIAL STATE ARARs

California Endangered Species Act

The California ESA is codified in the Cal. Fish & Game Code §§ 2050–2116. It is the Navy's position that the requisite federal sovereign immunity waiver does not exist to authorize applicability of the California Endangered Species Act. Nevertheless, this act will be evaluated as a potentially relevant and appropriate requirement for the Navy's CERCLA response actions. Cal. Fish & Game Code § 2080 prohibits the taking of endangered species.

There are no known critical habitats for threatened or endangered species present in IR Site 27. The remedial actions at the site would not affect the Alameda National Wildlife Refuge and any areas that support special-status species or habitat. Therefore, substantive requirements of Cal. Fish & Game Code § 2080 are not potential ARARs.

A3.2.5 Potential Coastal Resources ARARs

IR Site 27 is adjacent to Seaplane Lagoon. The following coastal resource regulations were evaluated:

- CZMA (16 U.S.C. §§ 1451–1464, 15 C.F.R. § 930)
- California Coastal Act of 1976 (California Public Resources Code [Cal. Pub. Res. Code] §§ 30000–30900, Cal. Code Regs. tit. 14, §§ 13001–13666.4)

A3.2.5.1 POTENTIAL FEDERAL ARARs

Coastal Zone Management Act

The CZMA (16 U.S.C. §§ 1451–1464) specifically excludes federal lands from the coastal zone (16 U.S.C. § 1453[1]). Therefore, the CZMA is not potentially applicable to IR Site 27. The CZMA will be evaluated as a potentially relevant and appropriate requirement. Section 1456(a)(1)(A) requires each federal agency activity within or outside the coastal zone that affects any land or water use or natural resource to conduct its activities in a manner that is consistent to the maximum extent practicable with enforceable policies of approved state management policies. A state coastal zone management program is developed under state law guided by the CZMA and its

accompanying implementing regulations at 15 C.F.R. § 930. A state program sets forth objectives, policies, and standards to guide public and private uses of lands and water in the coastal zone. See Section A3.2.5.2 for a discussion of the state coastal zone management program.

A3.2.5.2 POTENTIAL STATE ARARs

California Coastal Act of 1976

The California Coastal Act is codified at Cal. Pub. Res. Code §§ 30000–30900 and Cal. Code Regs. tit. 14, §§ 13001–13666.4. These sections regulate activities associated with development to control direct significant impacts on coastal waters and to protect state and national interests in California coastal resources. Since federal lands are specifically excluded from the definition of coastal zone, the California Coastal Act is not potentially applicable to IR Site 27, but is evaluated further as a potentially relevant and appropriate requirement. The California Coastal Act policies set forth in the act constitute the standards used by the California Coastal Commission in its coastal development permit decisions and for the review of local coastal programs. These policies contain the following substantive requirements:

- protection and expansion of public access to the shoreline and recreation opportunities (Cal. Pub. Res. Code §§ 30210–30224)
- protection, enhancement, and restoration of environmentally sensitive habitats including intertidal and nearshore waters, wetlands, bays and estuaries, riparian habitat, grasslands, streams, lakes, and habitat for rare or endangered plants or animals (Cal. Pub. Res. Code §§ 30230–30240)
- protection of productive agricultural lands, commercial fisheries, and archaeological resources (Cal. Pub. Res. Code §§ 30234, 30241–30244)
- protection of the scenic beauty of coastal landscapes (Cal. Pub. Res. Code § 30251)
- provisions for expansion in an environmentally sound manner of existing industrial ports and electricity-generating power plants (Cal. Pub. Res. Code § 30264)

Because IR Site 27 is not located in a designated coastal zone, Cal. Pub. Res. Code §§ 30000–30900 and Cal. Code Regs. tit. 14, §§ 13001–13666.4 are not potential ARARs.

A3.2.6 Potential Geologic Characteristics ARARs

There are no known faults directly at or in the vicinity of IR Site 27. The nearest active fault is the Hayward Fault, which is approximately 6.5 miles (10.5 kilometers) east of Alameda Point. Another nearby active fault is the San Andreas Fault in the hills on the west side of San Francisco Bay at a distance of approximately 12 miles (19 kilometers) (Foster Wheeler 2002).

The following geologic regulations were evaluated: 42 U.S.C. §§ 6901–6991(i); Cal. Code Regs. tit. 22, § 66264.18(a); and Cal. Code Regs. tit. 22, § 66264.18(c).

A3.2.6.1 POTENTIAL FEDERAL ARARs

Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])

Hazardous waste facilities must be sited in accordance with the following requirements:

- Seismic considerations (Cal. Code Regs. tit. 22, § 66264.18[a]). Portions of new facilities or facilities undergoing substantial modification where transfer, treatment, storage, or disposal of hazardous waste will be conducted shall not be located within 61 meters (200 feet) of a fault that has had displacement in Holocene time.
- Salt dome formations, salt bed formations, underground mines, and caves (Cal. Code Regs. tit. 22, § 66264.18[c]). The placement of any noncontainerized or bulk liquid hazardous waste in any salt dome formation, salt bed formation, or underground mine or cave is prohibited.

IR Site 27 is not located within 61 meters of a Holocene fault. No discharge is proposed to a salt dome formation, a salt bed formation, underground mines, or caves as part of the remedial actions at the site. Therefore, the requirements in Cal. Code Regs. tit. 22, § 66264.18(a) and (c) are not potential ARARs.

A3.2.6.2 POTENTIAL STATE ARARs

The state location-specific RCRA requirements for geologic characteristics are evaluated above in Section A3.2.6.

Section A4
POTENTIAL ACTION-SPECIFIC ARARs

This FS Report evaluates groundwater remedial action alternatives for IR Site 27. This ARARs analysis is based on the following remedial alternatives:

- 1 – no action
- 3 – MNA and ICs
- 4A – ISB source area treatment, MNA, and ICs
- 6A – *in situ* chemical oxidation (ISCO) source area treatment, MNA, and ICs
- 6B – sitewide ISCO treatment and groundwater confirmation sampling
- 7 – dynamic circulation source area treatment, MNA, and ICs

Detailed descriptions of these remedial alternatives are provided in the main text of this FS Report.

Table A4-1 presents an evaluation of potential federal potential action-specific ARARs for IR Site 27. Potential state action-specific ARARs with chemical-specific requirements are presented in Table A2-3. No other potential state action-specific ARARs have been identified.

A discussion of the requirements determined to be pertinent to each alternative being evaluated for IR Site 27 is presented in this section. A discussion of how the alternative complies with each identified potential ARAR is also provided.

A4.1 ALTERNATIVE 1 – NO ACTION

There is no need to identify ARARs for the no action alternative because ARARs apply to "any removal or remedial action conducted entirely on-site" and the no action alternative is not a removal or remedial action (CERCLA Section 121[e], 42 U.S.C. § 9621[e]). CERCLA Section 121 (42 U.S.C. § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the no action alternative (U.S. EPA 1991b). Therefore, a discussion of compliance with action-specific ARARs is not appropriate for this alternative.

A4.2 ALTERNATIVE 3 – MNA AND ICs

For Alternative 3, MNA would be performed in association with ICs. Groundwater monitoring would demonstrate that contaminant levels in groundwater at IR Site 27 are being reduced over time through naturally occurring processes. A long-term groundwater monitoring program, including periodic reviews, would be implemented to track plume migration and cleanup progress. ICs would be implemented to prohibit domestic use of groundwater and any actions that would interfere with MNA until the Navy and regulatory agencies agree that risks associated with impacted groundwater are acceptable.

A4.2.1 MNA

MNA would involve collecting and analyzing groundwater samples from existing on-site monitoring wells within the source areas and the downgradient migration pathways of the

plume. Groundwater levels would be measured in the wells to confirm groundwater flow patterns and gradients. The extent of the VOC plume was defined in the RI, so no additional monitoring wells or groundwater investigations are included under this alternative. The objective of future monitoring efforts would be to verify that natural attenuation is continuing.

A4.2.1.1 POTENTIAL GROUNDWATER MONITORING ARARs

For CERCLA sites where it has already been determined that a remediation decision on contaminated groundwater must be made, the guidance is clear that only the substantive requirements of the corrective action program under RCRA are potential ARARs and not the detection or evaluation monitoring requirements (U.S. EPA 1988a). Cal. Code Regs. tit. 22, § 66264.100(d) requires that a water quality monitoring program be established to demonstrate the effectiveness of a corrective action program. The groundwater is not a potentially hazardous waste (see Section A1.4). However, the groundwater contaminants have been determined to be similar enough to hazardous waste constituents that the substantive RCRA corrective action groundwater monitoring provisions have been evaluated as potentially relevant and appropriate ARARs. Therefore, the substantive provisions of Cal. Code Regs. tit. 22, § 66264.100(d) have been determined to be potentially relevant and appropriate ARARs for IR Site 27. The substantive provisions of the general monitoring system requirements at Cal. Code Regs. tit. 22, § 66264.97(b)(1)(A) and (D), (2), (4), (5), (6) and (7), and (e) have also been identified as potentially relevant and appropriate requirements for the monitoring at IR Site 27. The concentration limits for groundwater monitoring are identified as chemical-specific ARARs in Section A2.2.1.1.

Cal. Code Regs. tit. 22, § 66264.90(c)(1) and (c)(2) state that after closure of the regulated unit, the monitoring regulations apply during the post-closure care period under § 66264.117 unless: 1) the regulated unit has been in compliance with the water quality protection standard for a period of 3 consecutive years, and 2) all waste, waste residues, contaminated containment system components, contaminated subsoils and all other contaminated geologic materials are removed or decontaminated at closure. Cal. Code Regs. tit. 22, § 66261.10 defines "decontaminate" as "to make free of wastes that are hazardous."

Once all RCRA hazardous waste is removed or decontaminated at closure ("clean closure"), the groundwater monitoring needs only to show compliance for 3 years.

Once corrective action monitoring is completed, if waste still remains in soil at IR Site 27, the substantive post-closure monitoring requirements at Cal. Code Regs. tit. 22, § 66264.117(b)(1)(A) and (b)(2)(A) may be potential ARARs. These provisions require that for closed facilities with hazardous waste left in place, groundwater monitoring must continue for a period of time sufficient to protect human health and the environment. For facilities with waste left in place, these requirements may be relevant and appropriate when determined not to be applicable.

A4.2.1.2 IDENTIFICATION AND MANAGEMENT OF SOLID AND HAZARDOUS WASTES

Substantive RCRA requirements for identification and management of solid and hazardous wastes are potential federal action-specific ARARs identified for MNA. Water generated in the course of monitoring groundwater would be subject to RCRA requirements at Cal. Code Regs. tit. 22, § 66262.10(a) and 66262.11 to determine whether such wastes should be classified as hazardous.

The Navy has determined that groundwater at IR Site 27 would not be classified as RCRA-listed hazardous wastes. However, testing would still be required to classify these materials with respect to the RCRA hazardous-waste characteristics. This determination would be made at the time the waste is generated. The appropriate requirements for storing and handling the waste until it is characterized would be followed. The waste would be disposed off-site and would comply with all applicable requirements. Since the disposal would be off-site, it is not addressed by ARARs. A further description of disposal requirements is included in the main text of this FS Report.

The substantive provisions of Cal. Code Regs. tit. 22, § 66262.34 regulations for waste accumulation are potential action-specific ARARs if waste is found to be hazardous. Substantive provisions of Cal. Code Regs. tit. 22, § 66264.171–178 regulations for temporary storage of wastes in containers are potentially applicable if the wastes are classified as hazardous.

The container storage units for which requirements are discussed above may be defined as temporary units under Cal. Code Regs. tit. 22, § 66264.553. A temporary unit is allowed to operate for up to 1 year (Cal. Code Regs. tit. 22, § 66264.553[d]). A 1-year extension may be allowed if continued operation of the unit is necessary to ensure timely and efficient implementation of corrective actions at the facility and if the unit will continue to be protective of human health and the environment (Cal. Code Regs. tit. 22, § 66264.553[e]). For temporary tanks and container storage areas used for treatment or storage of hazardous remediation wastes during corrective action activities, a design, operating, or closure standard applicable to such units may be replaced by alternative requirements that are protective of human health or the environment (Cal. Code Regs. tit. 22, § 66264.553[a]). The unit must be located within the facility boundary and used only for treatment or storage of remediation waste (Cal. Code Regs. tit. 22, § 66264.553[b]). When alternative standards are being established, the following must be considered (Cal. Code Regs. tit. 22, § 66264.553[c]):

- length of operating time
- type of unit
- volume of waste
- physical and chemical characteristics of the waste
- potential for releases from the unit
- hydrogeological and other relevant environmental conditions at the facility that may influence the migration of potential releases

- potential for exposure of humans and environmental receptors if releases were to occur from the unit

The substantive provisions of Cal. Code Regs. tit. 22, § 66264.553(a), (b), (c), (d), and (e) regulations are potentially applicable ARARs for setting alternative requirements for the temporary container storage areas.

The wastewater generated will be contained and handled in accordance with substantive provisions of Cal. Code Regs. tit. 22, §§ 66262.34, 66264.171–178, and/or 66264.553(a), (b), (c), (d), and (e) regulations as potential ARARs until test results indicate that the waste is not hazardous.

A4.2.2 ICs

The objective of ICs for Alternative 3 would be to prohibit domestic use of groundwater and any actions that would interfere with MNA. The actual ICs to be employed would be established in the ROD and subsequent remedial design/remedial action documentation. The Navy would use its policy entitled Principles and Procedures for Specifying, Monitoring and Enforcement of Land-Use Controls and Other Post-ROD Actions for specifying and implementing ICs for this alternative. ICs would be included in both Navy deeds of conveyance and in Covenant to Restrict Use of Property agreements with DTSC entered into pursuant to the March 2000 Memorandum of Agreement between the Navy and DTSC.

A4.3 ALTERNATIVE 4A – ISB SOURCE AREA TREATMENT, MNA, AND ICs

Alternative 4A would employ anaerobic *in situ* bioremediation (ISB) technology to accelerate VOC contaminant mass removal in the two areas of highest VOC concentrations in the IR Site 27 plume. Hydrogen Release Compound (HRC) would be injected into the source area aquifer zone by direct-push methods to accelerate reductive dechlorination.

Groundwater confirmation sampling would be performed to document the reduction in contaminant concentrations and assess the progress of MNA after HRC injection. ICs would be implemented in the same manner as for Alternative 3 in Section A4.2.2.

A4.3.1 ISB Source Area Treatment

The direct-push technology for injecting the HRC is expected to generate some waste soil and decontamination water. As with Alternative 3 (Section A4.2), these wastes would be handled in accordance with substantive provisions of Cal. Code Regs. tit. 22, §§ 66262.34, 66264.171–178, and/or 66264.553(a), (b), (c), (d), and (e) regulations as potential ARARs until test results indicate that the waste is not hazardous.

A4.3.2 MNA and ICs

Potential ARARs for MNA and ICs for Alternative 4A would be the same as those identified for Alternative 3 in Section A4.2.

A4.4 ALTERNATIVE 6A – ISCO SOURCE AREA TREATMENT, MNA, AND ICs

Alternative 6A is included to evaluate the opportunity to accelerate the reduction of contaminant concentrations in the two source areas by using *in situ* chemical remediation technology that would be performed in association with MNA and ICs. With Alternative 6A, ISCO would be used as a technology for contaminant mass reduction in the two source areas. Using this process, dilute 12-percent stabilized hydrogen peroxide would be injected into the two source areas. The peroxide is followed by the injection of a chelated iron catalyst. It is expected that the reagent and catalyst would be injected using a similar direct-push method to that described for Alternative 4A in Section A4.3.

Groundwater confirmation sampling would be performed to document contaminant reductions and assess the progress of MNA after ISCO.

A4.4.1 ISCO Source Area Treatment

The direct-push injection of the chemicals is expected to generate some decontamination water and debris. As with Alternative 3 (Section A4.2), these wastes will be handled in accordance with substantive provisions of Cal. Code Regs. tit. 22, §§ 66262.34, 66264.171–178, and/or 66264.553(a), (b), (c), (d), and (e) regulations as potential ARARs until test results indicate that the waste is not hazardous.

A4.4.2 MNA and ICs

Potential ARARs for MNA and ICs for Alternative 6A would be similar to those identified for Alternative 3 in Section A4.2.

A4.5 ALTERNATIVE 6B – SITEWIDE ISCO TREATMENT AND GROUNDWATER CONFIRMATION SAMPLING

For Alternative 6B, ISCO would be used to aggressively treat the entire IR Site 27 plume to reduce VOC concentrations to MCL-equivalent levels, allowing for unrestricted use. The *In-Situ* Oxidative Technologies, Inc., chemical oxidation process assumed for Alternative 6A would be employed under Alternative 6B to treat the entire 11-acre plume. Groundwater sampling would be conducted for 2 years to document the reduction in contaminant concentrations after sitewide ISCO treatment.

Potential ARARs associated with ISCO treatment and groundwater sampling under Alternative 6B are the same as the potential ARARs identified for Alternative 6A in Section A4.4.

A4.6 ALTERNATIVE 7 – DYNAMIC CIRCULATION SOURCE AREA TREATMENT, MNA, AND ICs

Alternative 7 is included to evaluate an innovative source area treatment technology to reduce contaminant concentrations using a proprietary well technology (Dynamic Subsurface Circulation) in association with MNA and ICs. The circulation well design utilizes soil vapor extraction, in-well air stripping using a circulation pump and spray system, and in-well air sparging. This combination of technologies creates circulation of treated groundwater outward from the treatment well through capillary fringe soil and returning into the well for treatment. This alternative combines in-well air sparging, in-well air stripping, soil vapor extraction, and dynamic groundwater circulation to remove VOCs from soil, soil gas, and groundwater. This alternative includes trenching to run underground pipes for the treatment technology.

Groundwater confirmation sampling would be performed to document the reduction in contaminant concentrations during and after treatment and to assess the progress of MNA after source area treatment. The same ICs described for Alternative 4 would be applied to this alternative until the Navy and regulatory agencies agree that risks associated with impacted groundwater are acceptable.

A4.6.1 Dynamic Circulation Source Area Treatment

This alternative includes well installation and trenching that could produce soil and groundwater waste. As with Alternative 3 (Section A4.2), these wastes would be handled in accordance with substantive provisions of Cal. Code Regs. tit. 22, §§ 66262.34, 66264.171–178, and/or 66264.553(a), (b), (c), (d), and (e) regulations as potential ARARs until test results indicate that the waste is not hazardous. Larger amounts of soil may be stockpiled in staging piles in accordance with substantive provisions of 40 C.F.R. § 264.554 regulations as potential ARARs. Since the Navy has determined that the soil and groundwater are not potentially hazardous, these requirements are not potential ARARs. However, these requirements have been determined to be potentially relevant and appropriate for on-site handling until the results of characterization indicate no hazardous waste.

The staging pile requirements at 40 C.F.R. § 264.554 are potentially applicable for the area where soils may exceed hazardous waste limits. For other soil wastes that might be generated, these requirements may be relevant and appropriate. These requirements allow temporary storage and treatment of remediation wastes without triggering LDRs. The staging pile regulations consist of the performance and technical standards for staging piles (40 C.F.R. § 264.554[d][1][i–ii] and [d][2]); staging pile requirements for reactive, ignitable, and incompatible wastes (40 C.F.R. § 264.554[e–f]); and closure requirements for staging piles (40 C.F.R. § 264.554[j]–[k]). A staging pile may be designated for temporary (up to 2 years or more, based on the necessity to assure timely and efficient implementation of remedial actions [40 C.F.R. § 264.554{i}{2}]) treatment or storage of solid, nonflowing remediation wastes. The RCRA LDRs, the landfill minimum technology requirements, and the waste pile permitting requirements are not applicable to staging piles for RCRA hazardous wastes.

The staging pile regulations also require that the unit facilitate a remedy that is reliable, effective, and protective (40 C.F.R. § 264.554[d][1][I]) and be designed using appropriate measures (e.g., liners, covers, run-on/runoff controls, groundwater monitoring systems) to prevent or minimize releases and cross-media transfers of hazardous wastes and constituents (40 C.F.R. § 264.554[d][1][ii]). For units located in a previously contaminated area of the facility, all remediation wastes, contaminated containment system components, structures, and equipment that are contaminated with wastes or leachate must be removed or decontaminated within 180 days after the operating term of the staging pile expires (40 C.F.R. § 264.554[j]). In addition, contaminated subsurface soils must be decontaminated. For units located on uncontaminated areas of the facility, within 180 days following expiration of the operating term, the staging pile must be closed in accordance with waste pile closure requirements at Cal. Code Regs. tit. 22, § 66264.258(a) or § 66265.258(a) and the closure performance standards at Cal. Code Regs. tit. 22, § 66264.111 or § 66265.111 for permitted and interim status facilities, respectively (40 C.F.R. § 264.554[k]). In summary, substantive provisions of 40 C.F.R. § 264.554(d)(1)(i–ii) and (d)(2), (e), (f), (h), (i), (j), and (k) requirements are potentially relevant and appropriate even if they are determined not to be applicable.

The substantive site-closure requirements at Cal. Code Regs. tit. 22, § 66264.111(a) and (b) are potentially relevant and appropriate requirements for the staging piles. In addition, the substantive closure requirements at Cal. Code Regs. tit. 22, § 66264.114 and § 66264.258(a) pertaining to disposal and decontamination of equipment are potentially relevant and appropriate for closure of the staging piles.

Because there may be fugitive emissions during excavation activities, substantive provisions of the following BAAQMD requirements were identified as potential ARARs: Regulation 6, Sections 6-301, 6-302 and 6-305. The remedial action will include engineering controls to minimize dust levels.

Further air requirements for air stripping and soil vapor extraction are at BAAQMD Regulation 8, Rule 47. The substantive provisions of Section 8-47-301 requirements are potentially applicable state ARARs for emissions from the Alternative 7 treatment operations because TCE in groundwater is one of the regulated parameters. The substantive provisions of this requirement are to reduce emissions by 90 percent for air stripping and soil vapor extraction operations. Other sections of the rule were determined not to be ARARs.

A4.6.2 MNA and ICs

Potential ARARs for MNA and ICs would be the same as those identified for Alternative 3 in Section A4.2.

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Section A5
SUMMARY

Controlling potential ARARs have been identified for IR Site 27 in this appendix for each medium, location, and proposed remedial action alternative.

A5.1 POTENTIAL CHEMICAL-SPECIFIC ARARs

The potential chemical-specific ARARs are summarized by medium in Section A2.1. The substantive provisions of the following requirements were identified as potential chemical-specific ARARs for the site:

- RCRA hazardous waste characterization at Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), 66261.100 for characterizing waste water and debris generated during remedial actions
- Non-RCRA hazardous waste characterization at Cal. Code Regs. tit. 22, § 66261.22(a)(3) and (4), 66261.24(a)(2)–(a)(8), 66261.101, and 66261.3(a)(2)(C) or 66261.3(a)(2)(F)
- RCRA groundwater protection standards at Cal. Code Regs. tit. 22, §66264.94(a)(1), (a)(3), (c), (d), and (e); the lowest achievable concentrations determined to be technologically and economically feasible are the MCLs for the inland groundwater and risk-based concentrations for the shoreline groundwater
- alternative concentration limits in CERCLA Section 121(d)(2)(B)(ii) (42 U.S.C. § 9621[d][2][B][ii]) (for surface water)
- water quality standards in the NTR and CTR (40 C.F.R. § 131.36 and 131.38)
- Porter-Cologne Act (Cal. Water Code §§ 13241, 13243, 13263[a], 13269, and 13360)
- Basin Plan, Chapters 2 and 3 (Beneficial Uses and WQOs), except that the beneficial uses for the shoreline groundwater are not potential ARARs
- SWRCB Res. 88-63
- Toxics Standards SIP, Sections 1.3 and 1.4
- federal MCLGs for cis- and trans-1,2-DCE at 40 C.F.R. §141.50(a); federal MCLs for PCE, TCE, and arsenic at 40 C.F.R. § 141.61(a); and state MCLs for cis- and trans-1,2-DCE, 1,1-DCA, and vinyl chloride at Cal. Code Regs. tit. 22, §64444 (MCLs and MCLGs are potential ARARs for inland groundwater only)

A5.2 POTENTIAL LOCATION-SPECIFIC ARARs

The potential location-specific ARARs are summarized in Section A3.1. No archaeological or historic data have been identified at IR Site 27. The site is not located within a wetland or floodplain. Furthermore, IR Site 27 does not contain any designated hydrologic resources. Therefore, no potential cultural, wetlands protection, floodplain management, or hydrologic resources ARARs were identified.

No native or natural habitat occurs or is expected to occur at IR Site 27. The barren habitat (bare soil and paved parking area) at the site generally offers little value to wildlife; it may serve as a corridor between other habitats or as a place of brief resting, but it is not a significant place of shelter. The proposed Alameda National Wildlife Refuge is located approximately 3,100 feet west of IR Site 27. Remedial actions at the site would not impact this refuge. The substantive provisions of the Migratory Bird Treaty Act of 1972 (16 U.S.C. §§ 703–712) regulations are the only potential biological resource ARARs for the remedial actions at IR Site 27.

Since IR Site 27 is adjacent to the Seaplane Lagoon, the substantive provisions of the CZMA (16 U.S.C. §§ 1451–1464, 15 C.F.R. § 930) regulations are potential coastal resource ARARs for the site.

There are no known faults at or in the vicinity of IR Site 27. The nearest active fault is the Hayward Fault, which is about 6.5 miles east of Alameda Point. No potential geologic characteristics ARARs were identified.

A5.3 POTENTIAL ACTION-SPECIFIC ARARs

The following seven groundwater remedial alternatives were evaluated for IR Site 27 in this FS Report:

- 1 – no action
- 3 – MNA and ICs
- 4A – ISB Source area treatment, MNA, and ICs
- 6A – ISCO source area treatment, MNA, and ICs
- 6B – sitewide ISCO treatment and groundwater confirmation sampling
- 7 – dynamic circulation source area treatment, MNA, and ICs

No ARARs were identified for the no action alternative.

No ARARs have been identified for the use of ICs at IR Site 27. However, the Navy will use its policy entitled Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions (Attachment B to the FS Report) for specifying and implementing ICs. ICs would be included in both Navy deeds of conveyance and in Covenant to Restrict Use of Property agreements with DTSC entered into pursuant to the March 2000 Memorandum of Agreement between the Navy and DTSC (Attachment A to the FS Report).

For MNA, the substantive monitoring requirements at Cal. Code Regs. tit. 22, § 66264.100(d) and 66264.97(b)(1)(A) and (D), (e)(6), (12)(A) and (12)(B), (13), and (15) are potentially relevant and appropriate requirements for monitoring the natural attenuation and other active groundwater treatment at IR Site 27. The monitoring will continue until the remedial action goals have been maintained for 3 years in accordance with Cal. Code Regs. tit. 22, § 66264.90(c)(1) and (c)(2).

Alternatives 3, 4A, 6A, 6B and 7 involve generation of purgewater and other treatment-related wastes. Alternative 7 involves generation of soil cuttings from well installation and stockpiled soil from trenching activities. All of these wastes would require characterization and disposal. RCRA requirements in Cal. Code Regs. tit. 22, §§ 66262.10(a), 66262.11, and 66264.13(a) and (b) for whether wastes should be classified as hazardous are potentially applicable. The substantive provisions of § 66262.34 regulations for waste accumulation are potential action-specific federal ARARs. Substantive provisions of Cal. Code Regs. tit. 22, § 66264.171–178 for temporary storage of wastes in containers are potentially applicable if the wastes are classified as hazardous. For temporary container storage areas used for treatment or storage of hazardous remediation wastes during corrective action activities, the substantive provisions of Cal. Code Regs. tit. 22, § 66264.553(a), (b), (c), (d), and (e) regulations are potentially applicable federal ARARs for setting alternative requirements for the temporary container storage areas.

Because there may be fugitive emissions during excavation activities, the substantive provisions of the following BAAQMD requirements were identified as potential federal ARARs: Regulation 6, Sections 6-301, 6-302, and 6-305. The excavation activities will include engineering controls to minimize dust levels. In addition, the requirements at BAAQMD Section 8-47-301 are potentially applicable for emissions under the Alternative 7, which involves treatment using soil vapor extraction and air stripping.

For Alternative 7, in which trenching and well installation spoils may require stockpiling, substantive staging pile provisions of 40 C.F.R. § 264.554 regulations are potentially applicable for the area where soils may exceed hazardous waste limits. For other soil wastes to be generated, substantive provisions of these requirements may be relevant and appropriate. The substantive site-closure provisions of Cal. Code Regs. tit. 22, § 66264.111(a) and (b) regulations are potentially relevant and appropriate requirements for the staging piles. In addition, the substantive closure provisions of Cal. Code Regs. tit. 22, § 66264.114 and 66264.258(a) regulations pertaining to disposal and decontamination of equipment are potentially relevant and appropriate for closure of the staging piles.

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Section A6
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TABLES

FINAL FEASIBILITY STUDY REPORT FOR IR SITE 27, DOCK ZONE

DATED 01 APRIL 2006

Table A2-1
Potential ARAR-Based Numerical Criteria for Groundwater COCs
(micrograms per liter)

Analyte	SHORELINE GROUNDWATER	INLAND GROUNDWATER		
	CTR[a] Human Health Consumption of Organisms	Federal MCL[b]	Federal Nonzero MCLG[c]	California MCL[d]
1,1-dichloroethane	—	—[e]	—	**5**[f]
cis-1,2-dichloroethene	—	70[g]	70	**6**[f]
trans-1,2-dichloroethene	140,000	100[g]	100	**10**[f]
tetrachloroethene	8.85	**5**[f]	—	5[h]
trichloroethene	81	**5**[f]	—	5[h]
vinyl chloride	525	2	—	**0.5**[f]
arsenic	—	**10**[f]	—	50[h]

Notes:
[a] 40 C.F.R. § 131.38
[b] 40 C.F.R. 141.61(a)
[c] 40 C.F.R. 141.50
[d] Cal. Code Regs. tit. 22, §64444
[e] dash indicates that a criterion has not been developed for the analyte
[f] numbers in bold type are the controlling potential ARARs for groundwater
[g] not potential ARARs because there are nonzero MCLGs for these chemicals
[h] not potential ARARs because these are not exceeded at the site

Acronyms/Abbreviations:
ARAR – applicable or relevant and appropriate requirement
Cal. Code Regs. – *California Code of Regulations*
C.F.R. – *Code of Federal Regulations*
COC – chemical of concern
CTR – *California Toxics Rule*
MCL – maximum contaminant level
MCLG – maximum contaminant level goal
§ – section

Table A2-2
Potential Federal Chemical-Specific[a] ARARs by Medium

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
GROUNDWATER				
Safe Drinking Water Act (42 U.S.C., ch. 6A, § 300[f]–300[j]-26)[c]				
National primary drinking water standards are health-based standards for public water systems (MCLs).	Public water system.	40 C.F.R. § 141.61(a)	Relevant and appropriate	Not an ARAR for shoreline groundwater that is not a potential drinking water source. Substantive provisions are potentially relevant and appropriate for inland groundwater.
MCLGs pertain to known or anticipated adverse health effects (also known as recommended MCLs).	Public water system.	40 C.F.R. § 141.50(a)	Relevant and appropriate	Not an ARAR for shoreline groundwater that is not a potential drinking water source. Substantive provisions are potentially relevant and appropriate for inland groundwater.
National secondary drinking water regulations are standards for the aesthetic qualities of public water systems (SMCLs).	Public water system.	40 C.F.R. § 143.3	Not an ARAR	SMCLs are federal contaminant levels intended as guidelines for the states. Because they are not enforceable, federal SMCLs are not ARARs.
Resource Conservation and Recovery Act (42 U.S.C., ch. 82, §§ 6901–6991[i])[c]				
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste.	Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Substantive provisions are potentially applicable for determining whether waste is hazardous.

Table A2-2 (continued)

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
GROUNDWATER (continued)				
Groundwater protection standards: Owners/operators of RCRA treatment, storage, or disposal facilities must comply with conditions in this section that are designed to ensure that hazardous constituents entering the groundwater from a regulated unit do not exceed the concentration limits for contaminants of concern set forth under Cal. Code Regs. tit. 22, § 66264.94 in the uppermost aquifer underlying the waste management area of concern at the POC.	A regulated unit that receives or has received hazardous waste before July 26, 1982, or regulated units that ceased receiving hazardous waste prior to July 26, 1982, where constituents in or derived from the waste may pose a threat to human health or the environment.	Cal. Code Regs. tit. 22, § 66264.94, except 66264.94(a)(1) and (3), (c), (d), and (e)	Relevant and appropriate	These standards are not "applicable" because IR Site 27 does not contain a RCRA waste management unit. However, substantive provisions of Cal. Code Regs. tit. 22, § 66264.94(a)(1), (a)(3), (c), (d), and (e) are potentially relevant and appropriate federal ARARs for groundwater at IR Site 27. The lowest achievable technologically and economically feasible concentration criteria are MCLs for inland groundwater and risk-based concentrations for shoreline groundwater.
Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C., ch. 103, §§ 9601–9675)[c]				
ACLs using a point of exposure beyond the facility boundary.	Known or projected points of entry from groundwater to surface water.	CERCLA Section 121(d)(2)(B)(ii) 42 U.S.C., ch. 103, § 9621	Not an ARAR	Shoreline groundwater already meets RAOs (CTR surface water criteria). Therefore, for remedial action at IR Site 27, ACLs are not needed to demonstrate that contaminants in shoreline groundwater will not cause an exceedance of surface water criteria in Seaplane Lagoon.

Table A2-2 (continued)

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
GROUNDWATER (continued)				
Clean Water Act of 1977, as Amended (33 U.S.C., ch. 26, §§ 1251–1387)[c]				
National Recommended Water Quality Criteria (NRWQC).		33 U.S.C. § 1314(a) and 42 U.S.C. § 9621(d)(2) 64 Fed. Reg. 19,781 (April 22, 1999)	Not an ARAR	NRWQC are only potential ARARs for groundwater if MCLs are not available. MCLs are available for the chemicals of concern in inland groundwater, and shoreline groundwater is not a potential drinking water source. Therefore the NRWQC are not potential ARARs.
SURFACE WATER				
Safe Drinking Water Act (42 U.S.C., ch. 6A, § 300[f]–300[j]-26)[c]				
National primary drinking water standards are health-based standards for public water systems (MCLs).	Public water system.	40 C.F.R. § 141.11, excluding § 141.11(d)(3), 141.61(a) and (c), and 141.62(b)	Not an ARAR	Since Seaplane Lagoon and San Francisco Bay are not existing or potential sources of drinking water, the MCLs are not potential ARARs.
Ensure safety of public water systems; remedial actions must meet cleanup standards; MCLGs pertain to known or anticipated health effects (also known as recommended MCLs).	Public water system; remedial activities impacting surface water; surface water that is a potential source of drinking water.	40 C.F.R. § 141.50–141.51	Not an ARAR	Since Seaplane Lagoon and San Francisco Bay are not existing or potential sources of drinking water, the MCLGs are not potential ARARs.
National secondary drinking water regulations are standards for the aesthetic qualities of public water systems (SMCLs).	Public water system.	40 C.F.R. § 143.3	Not an ARAR	SMCLs are federal contaminant levels intended as guidelines for the states. Because they are not enforceable, federal SMCLs are not ARARs.

Table A2-2 (continued)

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
SURFACE WATER (continued)				
Clean Water Act of 1977, as Amended (33 U.S.C., ch. 26, §§ 1251–1387)[c]				
Water quality standards. National Toxics Rule and California Toxics Rule.	Discharges to waters of the United States.	40 C.F.R. § 131.36(b) and 131.38	Applicable	Substantive provisions are potentially applicable for potential discharges to Seaplane Lagoon or the San Francisco Bay.
Effluent limitations that meet technology-based requirements, including BCPCT and BAT to the extent economically achievable.	Discharges to groundwater and to waters of the United States.	33 U.S.C., ch. 26, § 1311(b)(2) (CWA § 301[b])	Applicable	Substantive provisions are potentially applicable for potential discharges to the Oakland Inner Harbor or the San Francisco Bay.
NRWQC.		33 U.S.C. § 1314(a) and 42 U.S.C. § 9621(d)(2) 64 Fed. Reg. 19,781 (April 22, 1999)	Not an ARAR	Since California has water quality standards that are the same as the standards of the NRWQC for the chemicals of concern, there is no reason to use the NRWQC. Therefore, the NRWQC are not potential ARARs.
SOIL				
Resource Conservation and Recovery Act (42 U.S.C., ch. 82, §§ 6901–6991[i])[c]				
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste.	Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Substantive provisions are potentially applicable for determining whether waste is hazardous.

Table A2-2 (continued)

Notes:

[a] many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables

[b] only the substantive provisions of the requirements cited in this table are potential ARARs

[c] statutes and policies and their citations are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the statutes or policies in their entirety as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs

Acronyms/Abbreviations:

ACL – alternative concentration limit
ARAR – applicable or relevant and appropriate requirement
BAT – best available technology
BCPCT – best conventional pollution control technology
Cal. Code Regs. – *California Code of Regulations*
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R. – *Code of Federal Regulations*
ch. – chapter
CWA – Clean Water Act
DON – Department of the Navy
Fed. Reg. – *Federal Register*
IR – Installation Restoration (Program)
MCL – maximum contaminant level
MCLG – maximum contaminant level goal
NRWQC – National Recommended Water Quality Criteria
NAAQS – National Ambient Air Quality Standards (primary and secondary)
PCB – polychlorinated biphenyl
POC – point of compliance
ppm – parts per million
RCRA – Resource Conservation and Recovery Act
§ – section
SMCL – secondary maximum contaminant level
TCLP – toxicity characteristic leaching procedure
tit. – title
U.S.C. – *United States Code*

Table A2-3
Potential State Chemical-Specific ARARs[a] by Medium

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
GROUNDWATER and SURFACE WATER				
Cal/EPA Department of Toxic Substances Control[c]				
Definition of non-RCRA hazardous waste.	Waste.	Cal. Code Regs. tit. 22, § 66261.22(a)(3) and (4), § 66261.24(a)(2)–(a)(8), § 66261.101, § 66261.3(a)(2)(C), or § 66261.3(a)(2)(F)	Applicable	Substantive provisions are potentially applicable for determining whether a waste is a non-RCRA hazardous waste.
Primary drinking water standards for public water systems (state MCLs).	Public water system.	Cal. Code Regs. tit. 22, § 64444	Relevant and appropriate	Inland groundwater is a potential source of drinking water and for cis- and trans-1,2-DCE, 1,1-DCA, and vinyl chloride; the state MCLs are potentially relevant and appropriate because they are more stringent than federal MCLs. Not an ARAR for shoreline groundwater, which is not considered a current or potential future source of drinking water.
State Water Resources Control Board and San Francisco Bay Regional Water Quality Control Board[c]				
Authorizes the SWRCB and RWQCB to establish water quality control plans for beneficial uses and numerical and narrative standards to protect both surface water and groundwater quality. Authorizes regional water boards to issue permits for discharges to land or surface or groundwater that could affect water quality, including NPDES permits, and to take enforcement action to protect water quality.		Cal. Water Code, div. 7, §§ 13241, 13243, 13263(a), 13269, and 13360 (Porter-Cologne Water Quality Control Act)	Applicable	The Navy accepts the substantive provisions of §§ 13241, 13243, 13263(a), 13269, and 13360 of the Cal. Water Code (the Porter-Cologne Act enabling legislation), as implemented through the beneficial uses, WQOs, waste discharge requirements, and promulgated policies of the Basin Plan for the San Francisco Bay Basin, as potential ARARs. The U.S. EPA does not agree that the Cal. Water Code sections are ARARs because they are not requirements in themselves. See Section A2.2.1.2 for further discussion.

Table A2-3 (continued)

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
GROUNDWATER AND SURFACE WATER (continued)				
		Cal. Water Code, div. 7, § 13304	Not an ARAR	Section 13304 does not constitute an ARAR because it does not itself establish or contain substantive environmental "standards, requirements, criteria or limitations" (CERCLA Section 121) and is not in itself directive in intent. In addition, § 13304 is not more stringent than the substantive requirements of the potential federal ARARs identified in Table A2-1.
Describes the San Francisco Bay Basin, establishes beneficial uses of groundwater and surface water, establishes WQOs, including narrative and numeric standards, establishes implementation plans to meet WQOs and protect beneficial uses, and incorporates statewide water quality control plans and policies.		Comprehensive Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) (Cal. Water Code § 13240)	Applicable	Substantive requirements pertaining to beneficial uses and WQOs are potential state ARARs for the surface water and groundwater components of this response action. The beneficial uses for groundwater are not potential ARARs for the shoreline groundwater. See Section A2.2.2 for discussion.
Establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the State." It provides that whenever the existing quality of water is better than that required by applicable water quality policies, such existing high-quality water will be maintained until it has been demonstrated to the state that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste and that		Statement of Policy With Respect to Maintaining High Quality of Waters in California, SWRCB Res. 68-16	Not an ARAR	The Navy's position is that SWRCB Res. 68-16 and 92-49 do not constitute chemical-specific ARARs because they are state requirements and are not more stringent than federal ARAR provisions of Cal. Code Regs. tit. 22, § 66264.94.

Table A2-3 (continued)

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
GROUNDWATER AND SURFACE WATER (continued)				
discharges or proposes to discharge to existing high-quality waters will be required to meet waste-discharge requirements that will result in the best practicable treatment or control of the discharge.				
Describes requirements for RWQCB oversight of investigation and cleanup and abatement activities resulting from discharges of hazardous substances. RWQCB may decide on cleanup and abatement goals and objectives for the protection of water quality and beneficial uses of water within each region. Establishes criteria for "containment zones" where cleanup to established water quality goals is not economically or technically practicable.		Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Cal. Water Code § 13304, SWRCB Res. 92-49	Not an ARAR	The Navy's position is that SWRCB Res. 68-16 and 92-49 do not constitute chemical-specific ARARs because they are state requirements and are not more stringent than federal ARAR provisions of Cal. Code Regs. tit. 22, § 66264.94.
Incorporated into all regional board basin plans. Designates all groundwater and surface waters of the state as drinking water except where the TDS is greater than 3,000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal resource or in a water conveyance facility, or the water cannot reasonably be treated for domestic use using either best management practices or best economically achievable treatment practices.		SWRCB Res. 88-63 (Sources of Drinking Water Policy)	Applicable	Substantive provisions are potentially applicable for determining drinking water sources. Shoreline groundwater at IR Site 27 is not a current or potential future drinking water source. The inland groundwater is a potential source of drinking water.
Requires analysis for each priority pollutant to determine if water-quality-based effluent limitation is required. Provides effluent limitation development methodology.	Discharges of toxic priority pollutants into inland surface waters, bays, or estuaries.	Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Toxics Standards SIP) (SWRCB 2000), § 1.3 and 1.4	Applicable	Substantive provisions are potentially applicable for discharges into Seaplane Lagoon or the San Francisco Bay.

Table A2-3 (continued)

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
SOIL				
Cal/EPA Department of Toxic Substances Control[c]				
Definition of non-RCRA hazardous waste.	Waste.	Cal. Code Regs. tit. 22, § 66261.22(a)(3) and (4), 66261.24(a)(2)–(a)(8), 66261.101, 66261.3(a)(2)(C),or 66261.3(a)(2)(F)	Applicable	Substantive provisions are potentially applicable for determining whether a waste is a non-RCRA hazardous waste.
Establishes concentration limits for cleanup actions, including groundwater, surface water, and the unsaturated zones for hazardous waste at background. Allows a higher cleanup limit (but not to exceed MCLs) if background is not technically or economically achievable.		Cal. Code Regs. tit. 23, §§ 2550(a); 2550.4(d), (e), and (f)	Not an ARAR	Cal. Code Regs. tit. 23, § 2550(a) addresses the general applicability of other standards in Chapter 15 and does not contain standards itself. Cal. Code Regs. tit. 23, § 2550.4(d), (e), and (f), and § 2550.5 are not more stringent than federal ARARs at Cal. Code Regs. tit. 22, § 66264.94.
Definitions of designated waste, nonhazardous waste, and inert waste.		Cal. Code Regs. tit. 27, §§ 20210, 20220, and 20230	Applicable	Substantive provisions are potentially applicable for classifying waste and determining ARAR status of other requirements.

Notes:

[a] many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables

[b] only the substantive provisions of the requirements cited in this table are potential ARARs

[c] statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the statutes or policies in their entirety as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of specific citations are considered potential ARARs

Table A2-3 (continued)

Acronyms/Abbreviations:
ARAR – applicable or relevant and appropriate requirement
BAAQMD – Bay Area Quality Management District
Cal. Code Regs. – *California Code of Regulations*
Cal/EPA – California Environmental Protection Agency
Cal. Water Code – *California Water Code*
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
div. – division
DON – Department of the Navy
gpd – gallons per day
IR – Installation Restoration (Program)
MCL – maximum contaminant level
NPDES – National Pollutant Discharge Elimination System
ppm – parts per million
RCRA – Resource Conservation and Recovery Act
Res. – Resolution
RWQCB – (California) Regional Water Quality Control Board
§ – section
SWRCB – (California) State Water Resources Control Board
TDS – total dissolved solids
tit. – title
Toxics Standards SIP – Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California
VOC – volatile organic compound
WQO – water quality objective

Table A3-1
Potential Federal Location-Specific ARARs

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
National Historic Preservation Act of 1966, as Amended (16 U.S.C. § 470–470x-6)[b]					
Historic project owned or controlled by federal agency	Action to preserve historic properties; planning of action to minimize harm to properties listed on or eligible for listing on the National Register of Historic Places.	Property included in or eligible for the National Register of Historic Places.	16 U.S.C. § 470–470x-6 36 C.F.R. pt. 800 40 C.F.R. § 6.301(b)	Not an ARAR	No historic properties, sites, buildings, or landmarks are located within IR Site 27.
Archaeological and Historic Preservation Act (16 U.S.C. § 469–469c-1)[b]					
Within area where action may cause irreparable harm, loss, or destruction of significant artifacts	Construction on previously undisturbed land would require an archaeological survey of the area. Data recovery and preservation would be required if significant archaeological or historical data were found on-site. The responsible official or Secretary of the Interior is authorized to undertake data recovery and preservation.	Regulated alteration of terrain caused as a result of a federal construction project or federally licensed activity or program where action may cause irreparable harm, loss, or destruction of significant artifacts.	16 U.S.C. § 469–469c-1 40 C.F.R. § 6.301(c)	Not an ARAR	No archaeological or historic data have been identified at IR Site 27.

Table A3-1 (continued)

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Historic Sites, Buildings, and Antiquities Act of 1935 (16 U.S.C. §§ 461–467)[b]					
Historic sites	Avoid undesirable impacts on landmarks.	Areas designated as historic sites.	16 U.S.C. §§ 461–467 40 C.F.R. § 6.301(c)	Not an ARAR	No historic properties, sites, buildings, or landmarks are located within IR Site 27.
Archaeological Resources Protection Act of 1979, as Amended (16 U.S.C. § 470aa–470mm)[b]					
Archaeological resources on federal land	Prohibits unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources located on public lands unless such action is conducted pursuant to a permit.	Archaeological resources on federal land.	Pub. L. No. 96-95 16 U.S.C. § 470aa–470mm	Not an ARAR	No archaeological or historic data have been identified at IR Site 27.
Exec. Order No. 11990, Protection of Wetlands[b]					
Wetland	Action to minimize the destruction, loss, or degradation of wetlands.	Wetland as defined by Exec. Order No. 11990 § 7.	40 C.F.R. § 6.302(a)	Not an ARAR	IR Site 27 is not located within a wetland area. The nearest wetland area (runway wetland area) is located to the northeast of the site. Remedial actions at IR Site 27 would not impact any wetland areas.
Exec. Order No. 11988, Floodplain Management[b]					
Within floodplain	Actions taken should avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values.	Action that will occur in a floodplain (i.e., lowlands) and relatively flat areas adjoining inland and coastal waters and other flood-prone areas.	40 C.F.R. § 6.302(b)	Not an ARAR	IR Site 27 is not located within a floodplain.

Table A3-1 (continued)

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Clean Water Act of 1977, as Amended, Section 404 (33 U.S.C. § 1344)[b]					
Wetland	Action to prohibit discharge of dredged or fill material into wetland without permit.	Wetland as defined by Exec. Order No. 11990 § 7.	33 U.S.C. § 1344	Not an ARAR	Discharge of dredged or fill material to a wetland is not planned as part of the remedial actions at IR Site 27.
Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])[b]					
Within 100-year floodplain	Facility must be designed, constructed, operated, and maintained to avoid washout.	RCRA hazardous waste; treatment, storage, or disposal of hazardous waste.	Cal. Code Regs. tit 22, § 66264.18(b)	Not an ARAR	IR Site 27 is not located within a floodplain.
Wild and Scenic Rivers Act (16 U.S.C. §§ 1271–1287)[b]					
Within area affecting national wild, scenic, or recreational river	Avoid taking or assisting in action that will have direct adverse effect on scenic river.	Activities that affect or may affect any of the rivers specified in 16 U.S.C. §1276(a).	16 U.S.C. §§ 1271–1287	Not an ARAR	No wild, scenic, or recreational rivers are at or in the vicinity of IR Site 27.
Fish and Wildlife Coordination Act (16 U.S.C. §§ 661–666c)[b]					
Area affecting stream or other water body	Action taken should protect fish or wildlife.	Diversion, channeling, or other activity that modifies a stream or other water body and affects fish or wildlife.	16 U.S.C. § 662	Not an ARAR	Remedial actions at IR Site 27 are not anticipated to control or modify a stream or other water body.
Rivers and Harbors Act of 1899 (33 U.S.C. §§ 401–413)[b]					
Navigable waters	Permits required for structures or work in or affecting navigable waters.	Activities affecting navigable waters.	33 U.S.C. § 403 33 C.F.R. § 322	Not an ARAR	The IR Site 27 remedial actions would not result in the creation of any obstruction to the navigable capacity of any of the waters of the United States.

Table A3-1 (continued)

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Endangered Species Act of 1973 (16 U.S.C. §§ 1531–1543)[b]					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented.	Determination of effect upon endangered or threatened species or its habitat. Critical habitat upon which endangered species or threatened species depend.	16 U.S.C. § 1536(a), (h)(1)(B)	Not an ARAR	There are no known critical habitats for threatened or endangered species present within IR Site 27. The future site of the Alameda National Wildlife Refuge is located west-northwest of IR Site 27, and it would not be affected by the remedial actions at the site.
Migratory Bird Treaty Act of 1972 (16 U.S.C. §§ 703–712)[b]					
Migratory bird area	Protects almost all species of native migratory birds in the U.S. from unregulated "take," which can include poisoning at hazardous waste sites.	Presence of migratory birds.	16 U.S.C. § 703	Relevant and appropriate	Substantive provisions are potentially relevant and appropriate. There are no known habitats for migratory birds present within IR Site 27. The barren habitat (bare soil and paved parking area) at the site generally offers little value to wildlife. However, it may serve as a corridor between other habitats or as a place of brief resting for migratory birds.

Table A3-1 (continued)

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Marine Mammal Protection Act (16 U.S.C. §§ 1361–1421h)[b]					
Marine mammal area	Protects any marine mammal in the U.S., except as provided by international treaties, from unregulated "take."	Presence of marine mammals.	16 U.S.C. § 1372(a)(2)	Not an ARAR	Although IR Site 27 is adjacent to Seaplane Lagoon, remedial activities at the site would not involve the capture, possession, transport, or sale of any marine mammals or marine mammal products.
Magnuson-Stevens Fishery Conservation and Management Act of 1976, as Amended (16 U.S.C. §§ 1801–1882)[b]					
Fishery under management	Provides for conservation and management of specified fisheries within specified fishery conservation zones.	Presence of managed fisheries.	16 U.S.C. §§ 1801–1882	Not an ARAR	Although IR Site 27 is adjacent to Seaplane Lagoon, remedial activities at the site would not impact any managed fishery resources.
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee)[b]					
Wildlife refuge	No person shall take any animal or plant from any national wildlife refuge, except as authorized under 50 C.F.R. § 27.51. The disposing or dumping of wastes is prohibited.	Area designated as part of National Wildlife Refuge System.	16 U.S.C § 668dd–668ee Substantive provisions of 50 C.F.R. § 27.11–27.97	Not an ARAR	There is no wildlife refuge present in IR Site 27. The future site of the Alameda National Wildlife Refuge is located west-northwest of IR Site 27 and would not be affected by the remedial actions at the site.
Wilderness Act (16 U.S.C. §§ 1131–1136)[b]					
Wilderness area	Area must be administered in such a manner as will leave it unimpaired as wilderness and preserve its wilderness character.	Federally owned area designated as wilderness area.	16 U.S.C. §§ 1131–1136 50 C.F.R. § 35.1–35.14	Not an ARAR	Neither Alameda Point nor IR Site 27 is a federally owned wilderness area.

Table A3-1 (continued)

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Coastal Zone Management Act (16 U.S.C. §§ 1451–1464)[b]					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone including lands thereunder and adjacent shore land.	16 U.S.C. § 1456(c) 15 C.F.R. § 930	Relevant and appropriate	The CZMA specifically excludes federal lands from the coastal zone (16 U.S.C. § 1453[1]). Therefore, the CZMA is not potentially applicable to IR Site 27. Substantive provisions of the CZMA will be evaluated as potentially relevant and appropriate requirements because a state coastal zone management program is developed under state law guided by the CZMA and its accompanying implementing regulations in 15 C.F.R. § 930. See Table A3-2 summarizing potential state location-specific ARARs.
Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])[b]					
Within 61 meters (200 feet) of a fault displaced in Holocene time	New treatment, storage, or disposal of hazardous waste prohibited.	RCRA hazardous waste; treatment, storage, or disposal of hazardous waste.	Cal. Code Regs. tit. 22, § 66264.18(a)	Not an ARAR	IR Site 27 is not located within 61 meters of a Holocene fault.
Within salt dome formation, underground mine, or cave	Placement of noncontainerized or bulk liquid hazardous waste prohibited.	RCRA hazardous waste; placement.	Cal. Code Regs. tit. 22, § 66264.18(c)	Not an ARAR	No discharge is proposed to a salt dome formation, a salt bed formation, underground mines, or caves as part of the remedial actions at IR Site 27.

Table A3-1 (continued)

Notes:

[a] only the substantive provisions of the requirements cited in this table are potential ARARs

[b] statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs

Acronyms/Abbreviations:

ARAR – applicable or relevant and appropriate requirement
Cal. Code Regs. – *California Code of Regulations*
C.F.R. – *Code of Federal Regulations*
CZMA – Coastal Zone Management Act
DON – Department of the Navy
Exec. Order No. – Executive Order Number
FEMA – Federal Emergency Management Agency
IR – Installation Restoration (Program)
pt. – part
Pub. L. No. – Public Law Number
RCRA – Resource Conservation and Recovery Act
§ – section
tit. – title
U.S. – United States
U.S.C. – *United States Code*

Table A3-2
Potential State Location-Specific ARARs

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
California Endangered Species Act (Cal. Fish & Game Code §§ 2050–2116)[b]					
Endangered species habitat	No person shall import, export, take, possess, or sell any endangered or threatened species or part or product thereof.	Threatened or endangered species determination on or before January 1, 1985, or a candidate species with proper notification.	Cal. Fish & Game Code § 2080	Not an ARAR	There are no known critical habitats for threatened or endangered species present within IR Site 27. The future site for the Alameda National Wildlife Refuge is located west-northwest of IR Site 27, and it would not be affected by the remedial actions at the site.
California Coastal Act of 1976[b]					
Coast	Regulates activities associated with development to control direct significant impacts on coastal waters and to protect state and national interests in California coastal resources.	Any activity that could impact coastal waters and resources.	Cal. Pub. Res. Code §§ 30000–30900; Cal. Code Regs. tit. 14, §§ 13001–13666.4	Not an ARAR	Policies of the California Coastal Act are not potentially affected by the proposed actions.

Notes:
[a] only the substantive provisions of the requirements cited in this table are potential ARARs
[b] statutes and policies and their citations are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire body of statutes or policies as potential ARARs; specific potential ARARs follow each general heading; only substantive requirements of the specific citations are considered potential ARARs

Acronyms/Abbreviations:
ARAR – applicable or relevant and appropriate requirement
Cal. Code Regs. – *California Code of Regulations*
Cal. Fish & Game Code – *California Fish and Game Code*
Cal. Pub. Res. Code – *California Public Resources Code*
DON – Department of the Navy
IR – Installation Restoration (Program)
§ – section
tit. – title

Table A4-1
Potential Federal Action-Specific ARARs

1 – no action
3 – MNA and ICs
4A – ISB source area treatment, MNA, and ICs
6A – ISCO source area treatment, MNA, and ICs
6B – sitewide ISCO treatment and groundwater confirmation sampling
7 – dynamic circulation source area treatment, MNA, and ICs

Action	Requirement	Prerequisite	Citation	ARAR Determination A	RA	TBC	Comments
Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])*							
On-site waste generation	Person who generates waste shall determine if that waste is a hazardous waste.	Generator of waste.	Cal. Code Regs. tit. 22, § 66262.10(a), 66262.11	3, 4A, 6A, 6B, 7			Substantive provisions are potentially applicable for any excavated soils, soil cuttings, or wastewater that is generated.
	Requirements for analyzing waste for determining whether waste is hazardous.	Generator of waste.	Cal. Code Regs. tit. 22, § 66264.13(a) and (b)	3, 4A, 6A, 6B, 7			Substantive provisions are potentially applicable for any excavated soils, soil cuttings, or wastewater that is generated.
Hazardous waste accumulation	On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers in accordance with § 66262.171–178 or in tanks, on drip pads, inside buildings, and is labeled and dated.	Accumulate hazardous waste.	Cal. Code Regs. tit. 22, § 66262.34		3, 4A, 6A, 6B, 7		Substantive provisions are potentially relevant and appropriate for temporary storage of excavated soils, soil cuttings, or wastewater.
Site closure	Minimize the need for further maintenance controls and minimize or eliminate, to the extent necessary to protect human health and the environment, postclosure escape of hazardous waste, hazardous constituents, leachate, contaminated rainfall or runoff, or waste decomposition products to groundwater or surface water or to the atmosphere.	Hazardous waste management facility.	Cal. Code Regs. tit. 22, § 66264.111(a) and (b)		7		Substantive provisions are potentially relevant and appropriate for closure of staging piles used for temporary storage of excavated soils for trenching.

Table A4-1 (continued)

1 – no action
3 – MNA and ICs
4A – ISB source area treatment, MNA, and ICs
6A – ISCO source area treatment, MNA, and ICs
6B – sitewide ISCO treatment and groundwater confirmation sampling
7 – dynamic circulation source area treatment, MNA, and ICs

Action	Requirement	Prerequisite	Citation	ARAR Determination A	ARAR Determination RA	ARAR Determination TBC	Comments
Clean closure	During the partial and final closure periods, all contaminated equipment, structures, and soils shall be properly disposed or decontaminated by removing all hazardous wastes and residues.	Hazardous waste management facility.	Cal. Code Regs. tit. 22, § 66264.114		7		Substantive provisions are potentially relevant and appropriate for closure of staging piles used for temporary storage of excavated soils for trenching.
Container storage	Containers of RCRA hazardous waste must be: • maintained in good condition, • compatible with hazardous waste to be stored, and • closed during storage except to add or remove waste.	Storage of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere, in a container.	Cal. Code Regs. tit. 22, § 66264.171–173		3, 4A, 6A, 6B, 7		Substantive provisions are potentially relevant and appropriate for any excavated soils, soil cuttings, or wastewater that is generated.
	Inspect container storage areas weekly for deterioration.		Cal. Code Regs. tit. 22, § 66264.174		3, 4A, 6A, 6B, 7		Substantive provisions are potentially relevant and appropriate for any excavated soils, soil cuttings, or wastewater that is generated.
	Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide containment system with a capacity of 10 percent of the volume of containers of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system.	Storage in a container of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere.	Cal. Code Regs. tit. 22, § 66264.175(a) and (b)		3, 4A, 6A, 6B, 7		Substantive provisions are potentially relevant and appropriate for any excavated soils, soil cuttings, or wastewater that is generated.

Table A4-1 (continued)

1 – no action
3 – MNA and ICs
4A – ISB source area treatment, MNA, and ICs
6A – ISCO source area treatment, MNA, and ICs
6B – sitewide ISCO treatment and groundwater confirmation sampling
7 – dynamic circulation source area treatment, MNA, and ICs

Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Container storage (continued)	Keep incompatible materials separate. Separate incompatible materials stored near each other by a dike or other barrier.		Cal. Code Regs. tit. 22, § 66264.177		3, 4A, 6A, 6B, 7		Substantive provisions are potentially relevant and appropriate for any excavated soils, soil cuttings, or wastewater that is generated.
	At closure, remove all hazardous waste and residues from the containment system, and decontaminate or remove all containers and liners.		Cal. Code Regs. tit. 22, § 66264.178		3, 4A, 6A, 6B, 7		Substantive provisions are potentially relevant and appropriate for any excavated soils, soil cuttings, or wastewater that is generated.
	Alternative requirements that are protective of human health or the environment may replace design, operating, or closure standards for temporary tanks and container storage areas.		Cal. Code Regs. tit. 22, § 66264.553(b), (d), (e), and (f)		7		Substantive provisions are potentially relevant and appropriate for any excavated soils, soil cuttings, or wastewater that is generated.
Staging piles	Allows generators to accumulate solid remediation wastes during remedial operations in a U.S. EPA-designated pile for storage only, up to 2 years, without triggering LDRs.	Hazardous remediation waste temporarily stored in piles.	40 C.F.R. § 264.554(d)(1) (i–ii) and (d)(2), (e), (f), (h), (i), (j), and (k)		7		Substantive provisions are potentially relevant and appropriate for excavated soils.

Table A4-1 (continued)

1 – no action
3 – MNA and ICs
4A – ISB source area treatment, MNA, and ICs
6A – ISCO source area treatment, MNA, and ICs
6B – sitewide ISCO treatment and groundwater confirmation sampling
7 – dynamic circulation source area treatment, MNA, and ICs

Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Closure of waste pile	At closure, owner shall remove or decontaminate all waste residues, contaminated containment system components, contaminated subsurface soils, and structures and equipment contaminated with wastes and leachate, and manage them as hazardous wastes. If wastes are left on-site, perform postclosure care in accordance with the closure and postclosure care requirements that apply to landfills.	Waste pile used to store hazardous wastes.	Cal. Code Regs. tit. 22, § 66264.258(a) and (b) except references to procedural requirements		7		Substantive provisions are potentially relevant and appropriate for closure of the temporary storage of staging piles.
Monitoring	Requires monitoring groundwater to determine effectiveness of corrective action.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.100(d)		3, 4A, 6A, 6B, and 7		Not applicable because the site is not a hazardous waste management unit and the waste is not expected to be hazardous. Substantive provisions are potentially relevant and appropriate for monitoring the corrective action and natural attenuation because groundwater constituents are similar to hazardous waste constituents.

Table A4-1 (continued)

1 – no action
3 – MNA and ICs
4A – ISB source area treatment, MNA, and ICs
6A – ISCO source area treatment, MNA, and ICs
6B – sitewide ISCO treatment and groundwater confirmation sampling
7 – dynamic circulation source area treatment, MNA, and ICs

Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Monitoring (continued)	Requirements for monitoring groundwater, surface water, and the vadose zone.	Hazardous waste treatment, storage, or disposal facility.	Cal. Code Regs. tit. 22, § 66264.97(b)(1)(A) and (D), (e)(6), (12)(A) and (12)(B), (13), and (15)		3, 4A, 6A, 6B, and 7		Not applicable because the site is not a hazardous waste management unit and the waste is not expected to be hazardous. Substantive provisions are potentially relevant and appropriate for monitoring the corrective action and natural attenuation because groundwater constituents are similar to hazardous waste constituents.

Table A4-1 (continued)

1 – no action
3 – MNA and ICs
4A – ISB source area treatment, MNA, and ICs
6A – ISCO source area treatment, MNA, and ICs
6B – sitewide ISCO treatment and groundwater confirmation sampling
7 – dynamic circulation source area treatment, MNA, and ICs

Action	Requirement	Prerequisite	Citation	ARAR Determination			Comments
				A	RA	TBC	
Postclosure care monitoring	For closed facilities with hazardous waste left in place, groundwater monitoring must continue for a period of time sufficient to protect human health and the environment.	Hazardous waste management unit where waste is left in place.	Cal. Code Regs. tit. 22, § 66264.117 [b][1][A] and [b][2][A]				Substantive provisions are potentially relevant and appropriate for monitoring if waste is left in place above groundwater at IR Site 27. Since there is no hazardous waste at IR Site 27, this is not a potential ARAR. However, the cleanup levels established for the site are protective of human health and the environment.
Monitoring	After closure of the regulated unit, the monitoring regulations apply during the postclosure care period under § 66264.117 unless: 1) the regulated unit has been in compliance with the water quality protection standard for a period of 3 consecutive years, and 2) all waste, waste residues, contaminated containment system components, contaminated subsoils and all other contaminated geologic materials are removed or decontaminated at closure.	Hazardous waste management unit	Cal. Code Regs. tit. 22, § 66264.90(c)(1) and (c)(2)		3, 4A, 6A, and 7		Substantive provisions are potentially relevant and appropriate for monitoring if waste is removed. IR Site 27 meets the waste removal requirement because there is no hazardous waste at the site. The monitoring will continue until the cleanup levels have been maintained for 3 years.

Table A4-1 (continued)

1 – no action
3 – MNA and ICs
4A – ISB source area treatment, MNA, and ICs
6A – ISCO source area treatment, MNA, and ICs
6B – sitewide ISCO treatment and groundwater confirmation sampling
7 – dynamic circulation source area treatment, MNA, and ICs

Action	Requirement	Prerequisite	Citation	ARAR Determination A	RA	TBC	Comments
Clean Air Act (42 U.S.C. §§ 7401–7671)*							
Discharge to air	Provisions of SIP approved by the U.S. EPA under Section 110 of CAA.	Major sources of air pollutants.	40 U.S.C. § 7410; portions of 40 C.F.R. § 52.220	7			Substantive provisions are potentially applicable but implemented through SIP requirements listed below.
	NAAQS – primary and secondary standards for ambient air quality to protect public health and welfare (including standards for particulate matter and lead).	Contamination of air affecting public health and welfare.	40 C.F.R. § 50.4–50.12				Not an ARAR. Federal NAAQS are nonenforceable standards.
	A person shall not emit from any source for a period or periods aggregating more than 3 minutes in any hour a visible emission which is as dark as or darker than No. 1 on the Ringelmann chart or of such opacity as to obscure an observer's view to an equivalent or greater degree.		BAAQMD Regulation 6, Section 6-301	7			Substantive provisions are potentially applicable for the soil excavation activities.
	A person shall not emit for a period or periods aggregating more than 3 minutes in any hour, an emission equal to greater than 20 percent opacity.		BAAQMD Regulation 6, Section 6-302	7			Substantive provisions are potentially applicable for the soil excavation activities.
	A person shall not emit particles from any operation in sufficient quantity to cause annoyance to another person.	Particles fall on real property other than of the emitter.	BAAQMD Regulation 6, Section 6-305	7			Substantive provisions are potentially applicable for the soil excavation activities.

Table A4-1 (continued)

1 – no action
3 – MNA and ICs
4A – ISB source area treatment, MNA, and ICs
6A – ISCO source area treatment, MNA, and ICs
6B – sitewide ISCO treatment and groundwater confirmation sampling
7 – dynamic circulation source area treatment, MNA, and ICs

Action	Requirement	Prerequisite	Citation	ARAR Determination A	RA	TBC	Comments
Air stripping or soil vapor extraction	Any air stripping and soil vapor extraction operations that emit benzene, vinyl chloride, perchloroethylene, methylene chloride, and/or trichloroethylene shall be vented to a control device that reduces emissions to the atmosphere by at least 90 percent by weight.		BAAQMD Regulation 8, Section 8-47-301	7			Substantive provisions are potentially applicable for the treatment proposed.
	Any air stripping and soil vapor extraction operations with a total organic compound emission greater than 15 pounds per day shall be vented to a control device that reduces the total organic compound emission to the atmosphere by at least 90 percent by weight.		BAAQMD Regulation 8, Section 8-47-302				Not an ARAR. The proposed treatment is not expected to emit more than 15 pounds per day.

Table A4-1 (continued)

Note:

* statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the statutes or policies in their entirety as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of specific citations are considered potential ARARs

Acronyms/Abbreviations:

A – applicable
ARAR – applicable or relevant and appropriate requirement
BAAQMD – Bay Area Air Quality Management District
BDAT – best demonstrated available technology
CAA – Clean Air Act
Cal. Code Regs. – *California Code of Regulations*
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R. – *Code of Federal Regulations*
DON – Department of the Navy
IC – institutional control
MRC™ – Metals Remediation Compound
LDR – land-disposal restriction
NAAQS – National Ambient Air Quality Standards (primary and secondary)
NCP – National Oil and Hazardous Substances Pollution Contingency Plan
POC – point of compliance
RA – relevant and appropriate
RAO – remedial action objective
RCRA – Resource Conservation and Recovery Act
§ – section
SIP – State Implementation Plan
TBC – to be considered
tit. – title
U.S.C. – *United States Code*
U.S. EPA – United States Environmental Protection Agency
VOC – volatile organic compound

ATTACHMENT A1

NOVEMBER 13, 1996, LETTER FROM CAL/EPA DTSC TO NAVY

NAS ALAMEDA
SSIC No. 5090.3

Cal/EPA

November 13, 1996

Department of
Toxic Substances
Control

700 Heinz Avenue
Suite 200
Berkeley, CA
94710-2737

Commander
Engineering Field Activity, West
Naval Facilities Engineering Command
Attn: Camille Garibaldi
900 Commodore Drive
San Bruno, California 94066-2402

Pete Wilson
Governor

James M. Strock
Secretary for
Environmental
Protection

Dear Ms. Garibaldi:

APPLICABLE RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE NAVAL AIR STATION, ALAMEDA

The California Department of Toxic Substances Control (DTSC), is in receipt of the Navy's September 12, 1996 letter requesting Applicable or Relevant and Appropriate Requirements (ARARs) from the State of California for the Remedial Investigation and Feasibility Study of the Naval Air Station, Alameda. Enclosed in this document are State laws and regulations that California State Agencies believe may apply to the environmental remediation of Naval Air Station (NAS) Alameda.

As lead regulatory agency and a partner with the Navy and the United States Environmental Protection Agency (EPA) in conducting the remediation of NAS Alameda, we propose that a workshop be scheduled with all responsible State and Federal agencies to establish the ARARs for the NAS Alameda remediation. We also encourage the participation of the Restoration Advisory Board in the workshop. The invitation to participate in the workshop shall include a new solicitation for ARARs from the invited agencies.

We hope you are in agreement with us on this proposal. We anticipate the process to establish ARARs to be a consensual process based on our mutual goals and our partnership as lead agencies responsible for the protection of human health and the environment at NAS Alameda.

N00236.002255
ALAMEDA POINT
SSIC NO. 5090.3

CONFIDENTIAL RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED CONFIDENTIAL AND ARE NOT FOR PUBLIC VIEWING

PRIVATE CITIZEN'S HOME ADDRESS HAS BEEN REDACTED IN ACCORDANCE WITH THE PRIVACY ACT

QUESTIONS MAY BE DIRECTED TO:

DIANE C. SILVA
RECORDS MANAGEMENT SPECIALIST
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 532-3676

If you wish to discuss this letter, the enclosures, or the proposal, please call me at (510) 540-3809.

Sincerely,

Thomas P. Lanphar
Project Manager
Base Closure Branch

Enclosures

cc's: Ms. Gina Kathuria
Regional Water Quality Control Board
2101 Webster Street, Suite 500
Oakland, California 94612

Mr. Steve Edde
Base Environmental Coordinator
Alameda Naval Air Station
Building 1, Code 52
Alameda, California 94501

Mr. James Ricks
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

Mr. George Kikugawa
Engineering Field Activity, West
Naval Facilities Engineering Command
900 Commodore Drive
San Bruno, California 94066-2402

Ms. Ardella Dailey
Community Co-Chair

California Laws, Regulations and Policies
for Potential Application at the
Naval Air Station, Alameda
November 12, 1996

I. Generation, Storage and Treatment of Hazardous Waste

A. California Code of Regulations (CCR), Title 22, Chapter 11, Identification and listing of hazardous wastes. Chapter identifies those waste that are subject to regulations hazardous waste and are subject to the notification requirements of Health and Safety Code section 25153.6.

1. Article 1: General; purpose and scope, definition of waste and hazardous waste, exclusions, requirements for recyclable materials and contaminated containers. (66261.1 - 66261.7)

2. Article 2: Criteria for identifying Characteristics of Hazardous Waste. (66261.10)

3. Article 3: Characteristics of Hazardous Waste. (66261.20 - 66261.35)

4. Article 4: List RCRA Hazardous Waste. (66261.30 - 66261.35)

5. Article 5: Categories of Hazardous Waste. (66261.100 - 66261.126)

B. CCR, Title 22, Chapter 12, Standards Applicable to generator of hazardous waste

1. Article 1: Applicability. A generator of a waste must determine if waste is hazardous, and if so obtain an identification number. (66262.10 - 66262.12)

2. Article 2: A generator who transports, or offers for transportation, hazardous waste for off-site transfer, treatment, storage or disposal shall prepare a Manifest. (66262.20 - 66262.23)

3. Article 3: Pre-transport Requirements include packaging, labeling, marking, and placarding. Article also identifies maximum accumulation time for hazardous waste prior to transport to permitted hazardous waste facility.

4. Article 4: Record keeping and Reporting. Establishes requirements for the generator to keep records of manifests and other hazardous waste generation activities.

5. Article 5: Export of Hazardous Waste. This article establishes requirements applicable to exports of hazardous waste to a foreign country from the State. Except to the extent 40 CFR section 262.58 provides otherwise, a primary exporter of hazardous waste shall comply with the requirements of this article.

C. CCR, Title 22, Chapter 14, Standards for Owners and operators of hazardous wastes transfer, treatment, storage and disposal facilities.

1. Article 2: Requirements apply to the owners and operators of hazardous waste facilities. These requirements are for inspection, Personal Training, General Requirements, Location Standards, Construction Quality Assurance Program, Seismic and precipitation design standards. (66264.13 - 66264.25)

2. Article 3: Preparedness and prevention apply to of hazardous waste facility. These are related to design and operation, required equipment, testing and maintenance of equipment, access to communication or alarm system, required aisle space and informing the local authorities. 66264.30 - 66264.37

3. Article 4: Contingency and emergency procedures apply to the owners and operators of hazardous waste facilities. The owners and operators shall have contingency plan for the facility. 66264.52 - 66264.56

4. Article 5: Manifest System, Recordkeeping, and Reporting. The regulations in this article apply to owners and operators of both on-site and off-site facilities. 66264.71 - 66264.77

5. Article 6: Water Quality Monitoring and Response Programs for Permitted Facilities.

6. Article 7: Closure and Post-Closure. Requirements apply to the owners and operators of hazardous waste management facilities. 66264.111 through 66264.120

7. Article 9: Use and management of containers.

8. Article 10: Requirements that apply to the owners and operators of facilities that use Tank Systems[66264.190 - 66264.199]

9. Article 11: Regulations in this article apply to owners and operators of facilities that use surface impoundment to treat, store or dispose of hazardous waste. 66264.221 through 66264.231

10. Article 12: Regulations in this article apply to owners and operators of facilities that store or treat hazardous waste in piles unless exempt. 66264.251 through 66264.259.

11. Article 13: Land Treatment. Applies to treatment or disposal of hazardous waste in land treatment units. Requires demonstration of treatment of waste prior to application. 66264.270 - 66264.283

12. Article 14: This article applies to disposal of hazardous waste in Landfills. 66264.300 - 66264.318

13. Article 15.5: The regulations in this article apply to the construction of Corrective Action Management Units for the management of remediation waste. The DTSC may designate one or more CAMUs. Placement of remediation waste does not constitute land disposal. Temporary units may also be designated for the storage or treatment of remediation waste. 66264.500 - 66264.553

14. Article 27: Regulations in this article apply to owners and operators of facilities that treat, store or dispose of RCRA hazardous waste by process vents associated with distillation, fraction, thin-film evaporation, solvent extraction, or air steam stripping. 66264.1030 through 1035

15. Article 28: Regulations in this article apply to owners and operators of facilities that treat, store or dispose of RCRA hazardous waste, unless exempt. 66264.1052 through 66264.1065

D. CCR, Title 22, Chapter 16, Recyclable Materials (Recyclable hazardous waste)

1. Article 1: Identifies recyclable hazardous waste types including: solvents, petroleum products, pickling liquor, unspent acids, unspent alkalis, unrinsed empty containers. 66266.1 - 66266.2

2. Article 2. This article applies to the generation,

transportation, and facility operation requirements. A generator of a recyclable hazardous material shall comply with all of the hazardous waste requirements except for the Extremely Hazardous Waste Disposal Permit requirements. 66266.3 - 66266.5

E. CCR, Title 22, Chapter 18, Land Disposal Restrictions

1. Article 1: Identifies hazardous waste that are restricted from land disposal. 66268.1 - 66268.9

2. Article 2: Contains schedule for land disposal prohibition and establishment of treatment standards. 66268.10 - 66268.29

3. Article 3: Contains prohibitions on Land Disposal. 66268.30 - 66268.38

4. Article 4: This article identifies treatment standards. 66268.40 - 66268.48

5. Article 5: Identifies prohibitions on storage of waste restricted from land disposal. 66268.50

6. Article 10: Identifies land disposal prohibitions of non-RCRA hazardous waste. 66268.100

7. Article 11: Contains treatment standards for non-RCRA waste categories. 66268.105 - 66268.114

II. Investigation and Remediation of Hazardous Substance Release Sites

A. California Health and Safety Code, Chapter 6.5. Hazardous Substance Account

1. Section 25187: Authorizes the Department to issue corrective action orders.

a. Remedial Action Order, Issued 1988 by the DTSC to the Naval Air Station, Alameda

B. California Health and Safety Code, Chapter 6.8. Hazardous Substance Account

1. Article 2: Definitions

a. 25319.5 "Preliminary Endangerment Assessment". Activity which is performed to determine whether current or past waste management practices have resulted in the release or threatened release of hazardous

substances which pose a threat to public health or the environment. 8-3-89

b. 25323.1 "Removal Action Workplan" A workplan approved by the DTSC or RWQCB to carry out a removal action. Includes: detailed engineering plan, description of onsite contamination, goals, and alternatives removal options that were considered and rejected and the basis for that rejection.

2. Article 5, Section 25355: Authorizes the Department to take over remedial actions at a hazardous substance release site if the Responsible Parties are not in compliance.

3. Article 5, Section 25355.5(a)(1)(B): Identifies requirements

4. Article 5, Section 25356.1, Remedial Action Plans and Removal Action Workplans

   a. Section 25356.1(d): All RAPs must be based upon Section 25350, Subpart F of the NCP and upon factors identified in this subsection.

   b. Section 25356.1(e): Identifies community involvement requirements as they relate to a RAP.

   c. Section 25356.1(f): Authorizes the DTSC to issue the final RAP.

   d. Section 25356.1(h): Exemptions to the RAP requirements.

      (1) Section 25356.1(h)(1): Authorizes the DTSC to prepare a Removal Action Workplan if the estimated cost of the removal action is less than $1,000,000. Identifies community involvement requirements for a RAW.

      (2) Section 25356.1(h)(2): A RAP is not required if the site listed on the National Priority List by the EPA.

      (3) Section 25356.1(h)(3): Authorizes DTSC to waive the RAP requirements in subdivision (d) if certain conditions apply, including estimated costs for remedial action below $2,000,000.

5. Article 5, Section 25358.1: Rights of the DTSC to

take actions at known or suspected hazardous substance release sites.

a. Section 25358.1(b)(1): The DTSC may require any potentially responsible party to furnish information on materials generated, stored, treated or disposed of at a hazardous substance release site

b. Section 25358.1(b)(2) The DTSC may require any potentially responsible party to furnish information on the nature or extent of a release or a threatened release of a hazardous substance at a hazardous substance release site.

6. Article 5, Section 25358.3(a): Authorizes the DTSC to take action in situations posing an imminent and substantial endangerment.

7. Article 5, Section 25358.3(b),(c): Authorizes the DTSC to undertake investigations whenever there has been a release or threat of a release of hazardous substances to the environment.

8. Article 5, Section 25358.4: Requires that all analysis of material to determine if it is hazardous must be done by a state certified and accredited laboratory.

9. Article 5, Section 25358.7: Identifies the right of any interested party who may be affected by remedial actions at a site to become involved in the DTSC decision making process.

10. Article 5, Section 25358.9: Authorizes the DTSC, to the extent consistent with RCRA, to exclude any portion of a response action conducted entirely onsite from the hazardous waste facility permit requirements of Section 25201 if both the following apply:

    a. The removal or remedial action is carried out pursuant to a removal action workplan or a remedial action plan approved by the DTSC.

    b. The RAW or RAP complies with all substantive requirements.

11. Article 5, Section 25359: Authorizes the DTSC to access punitive damages on Responsible Parties who fail to comply with clean-up and remediation orders.

12. Article 5, Section 25359.5: Authorizes the DTSC to issue 'Fence and Post' Orders and establishes their requirements.

13. Article 5, Section 25359.7: Requires a property owner to inform buyers of unmitigated hazardous substance releases on that property.

14. Article 6, Section 25367: Establishes penalties for the making of false claims and misrepresentations related to the release of hazardous substances to the environment.

C. California Health and Safety Code, Chapter 6.6: Safe Drinking Water and Toxic enforcement Act of 1986 (Prop. 65).

1. Section 25249.5: Prohibits the release, to drinking water, of hazardous substances which cause cancer or which have reproductive toxicity.

D. Preliminary Endangerment Assessment Guidelines, January 1995

III. Protection of Air Quality

A. Bay Area Air Quality Management District(BAQMD), Regulation 8, Rule 40, "Aeration of Contaminated Soil and Removal of Underground Storage Tanks:

B. BAAQMD, Regulation 8, Rule 47 "Air Stripping and Soil Vapor Extraction Operations"

IV. Soil Storage

A. Assembly Bill 1060, Richter (Chapter 627, Statutes of 1995): allow generators to hold contaminated soil from site cleanup projects in waste pile for up to one year or 18 months for purposes of offsite transportation, subject to certain conditions.

V. Sediment and Wetland Remediation

A. Endangered and Rare Species Protection

1. California Endangered Species Act of 1973

a. Fish and Game Code Section 2050; 2065

2. Requirements for endangered or rare species: Fish and Game Code Section 1900 et seq.; 2050 et seq. to 2068; 2070; 2080; 2090 et seq. to 2096;

3. Federal Endangered Species Act of 1973

B. Protection of fish and wildlife resources and their habitats

1. Designation of the Department of Fish and Game as trustee for State fish and wildlife resources: fish and Game Code Section 711.7;

2. Possession permit for scientific purposes, etc.: Fish and Game code Section 1002

3. Requirements for releasing substances deleterious to fish and wildlife: fish and Game Code Section 5650 (a)(b),(f): 5651; and 12016;

4. Illegal take of birds and mammals: Fish and Game Code Section 3003;

5. Relevant policies for the general protection and conservation of fish and wildlife resources: fish and Game Code Section 1600; 1700; 1750; 1801; and 2014; Water Code Section 1243

C. Federal Coastal Zone Management Act (16 USC 1456(c)(3)(A)): federal actions or federally funded or approved actions that affect the coastal zone must be consistent with the policies of the San Francisco Bay Conservation and Development Commission's federally approved coastal management program.

1. Elements of the BCDC's coastal management program:

a. McAteer-Petris Act

b. BCDC regulations

c. SF Bay Plan

d. SF Bay Area Seaport Plan: NAS Alameda designated as port priority

2. SFBCDC policies:

a. Fish and Wildlife: to the greatest extent feasible, remaining marshes and mudflats around the Bay, the remaining water volume and surface area of the Bay, and adequate freshwater inflow to the Bay should be maintained. Specific habitats that are needed to prevent the extinction of any species, or to maintain or increase any species that would provide substantial public benefits should be protected, whether in the

Bay or on the shoreline.

b. Water Quality: follow State Water Resources Control Board and the San Francisco Bay Regional Water Quality Control Board. Bay marshes, mudflats, and water surface area and volume should be maintained and, wherever possible, increased.

c. Marshes and Mudflats: Marshes and mudflats are integral part of the Bay tidal system and, therefore, should be protected in the same manner as open water area. Filling and diking should only be allowed for purposes providing substantial public benefits and only if there is no reasonable alternative.

d. Mitigation: Mitigation should consist of measures to compensate for the adverse impacts of Bay fill to the natural resources of the Bay, such as to water surface area, volume, or circulation, and to fish and wildlife habitat or marshes or mudflats. Mitigation is no a substitute for meeting the other requirements of the McAteer-Petris Act concerning fill.

VI. Protection and Remediation of Groundwater

A. CCR, Title 23, Division 3, Chapter 15

1. Governs the discharge of waste to land for treatment, storage, and disposal and establish siting, containment, monitoring, and closure requirements

B. State Water Resources Control Board Resolution Number 68-16 (Statement of Policy with Respect to Maintaining High Quality of Waters in California), October 28, 1968

1. Requires the continued maintenance of high quality waters of the state even where that quality is better than needed to protect beneficial uses, unless specific findings are made.

2. Chemical-specific and action-specific

3. Beneficial uses of groundwater must be defined for NAS Alameda

C. State Water Resources Control Board Resolution 88-63 (Adoption of Policy Entitled "Sources of Drinking

Water"), May 19, 1988

1. The Resolution states that, with few specific exceptions, all surface and groundwaters of the state are to be considered existing drinking water sources except where the TDS is greater than 3000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal

D. State Water Resources Control Board Resolution 92-49 (As Amended on April 21, 1994), (Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304), July 8, 1994

E. Water Quality Control Plan, San Francisco Bay Basin Region, December 1986; and September 29, 1992 Basin Plan Amendments

F. California Code of Regulations, Title 22, Chapter 15, Domestic Water Quality Criteria and Monitoring

1. Article 4: Primary Standard - Inorganic Chemicals. Identifies Maximum Contaminant Levels in drinking water supplies. 64431.0 - - 64437.0

2. Article 4.5: Primary Standard - Organic Chemicals. Identifies Maximum Contaminant Levels in drinking water supplies. 64444.0 - - 64445.2

G. Title 3, Food and Agriculture; Division 6, Pesticides and Pest Control Operations; Chapter 4, Environmental Protection; Subchapter 1, Groundwater; Article 1, Pesticide Contamination Prevention.

1. Lists of pesticides labeled for agricultural, outdoor institutional or outdoor industrial use that contain chemicals designated as having the potential to pollute groundwater.

State ARARs for Solid Waste Disposal Site Closure and Postclosure Maintenance

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description	Comment	Associated Site
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17368 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Emergency Response Plan (ERP): potential emergency conditions that may exceed the design of the site and could endanger the public health or environment must be anticipated. Response procedures for these conditions must be addressed in the SDMSA plans.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17360.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17367 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Security at Closed Sites: all points of access to the site must be restricted, except permitted entry points. All monitoring, control, and recovery systems shall be protected from unauthorized access.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17360.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17775 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Cover: the design and construction of the final cover must meet specific prescriptive standards of 23 CCR 2581(c). These include minimum thickness and quality of the construction material. If the prescriptive standard is not feasible then an engineered alternative that meets the performance goals (i.e. limiting infiltration, controlling gas emissions, compatibility with reuse) can be proposed.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17360	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17774 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Construction Quality Assurance (CQA): a CQA program must be designed and implemented. It must include specific parameters (and for some components specific testing methods) for each component of the final cover.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17360.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17776 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Grades: the final grades for the covered landfill must meet grading standards provided in 23 CCR 2581, they must be appropriate to control runoff and erosion.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17360.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17777 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Site Face: the design of the final site face must provide for the integrity of the final cover both under static and dynamic conditions	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17360.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17778 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Drainage: the design of the final cover must control runon and runoff produced by a 100 year 24 hour storm event and must be prepared according to CQA requirements.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17360.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17779 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Slope Protection and Erosion Control: the design and construction of the slopes must protect the integrity of the final cover and minimize soil erosion.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17360.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17781 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Leachate Control During Closure and Post Closure: leachate must be monitored, collected, treated, and discarded appropriately.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17360. The state does not intend that subsurface leachate monitoring and collecting systems need to be added to existing landfills unless leachate production and/or accumulation is evident.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17783 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Gas Monitoring and Control During Closure and Post Closure: landfill gases must be collected and analyzed; the concentration of combustible gas at the landfill boundary must be 5% or less, trace gases must not be at levels that cause adverse health or environmental impacts.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17360.	For closing sites

State ARARs for Solid Waste Disposal Site Closure and Postclosure Maintenance

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description	Comment	Associated Site
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17784 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Post Closure Maintenance: the landfill must be maintained and monitored for no less than 30 years following closure.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8, Scope and Applicability pursuant to 14 CCR 17780.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17796 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Post Closure Land Use: Site Closure Design shall show one or more proposed uses of the closed site or show development that is compatible with open space. Changes in postclosure land use must be approved by the appropriate State agency prior to implementation.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8, Scope and Applicability pursuant to 14 CCR 17780.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	14 CCR 18261.3 Chapter 3, Article 3.4 Closure and Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements for closure plans for solid waste disposal sites.	Applies to solid waste disposal sites that received waste after January 1, 1988. Relevant and appropriate for closing sites that did not receive waste after January 1, 1988.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	14 CCR 18265.3 Chapter 3, Article 3.4 Closure and Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements for postclosure maintenance plans for solid waste disposal sites.	Applies to solid waste disposal sites that received waste after January 1, 1988. Relevant and appropriate for closing sites that did not receive waste after January 1, 1988.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	14 CCR 18278 Chapter 3, Article 3.4 Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements to obtain certification that the solid waste disposal site has closed pursuant to state standards.	Applies to solid waste disposal sites that received waste after January 1, 1988. Relevant and appropriate for closing sites that did not receive waste after January 1, 1988.	For closing sites

14 CCR - California Code of Regulations, Title 14 ARAR - applicable or relevant and appropriate requirement ROD - Record of Decision RD/RA - remedial design/remedial action

ATTACHMENT A2

JULY 7, 2005, LETTER FROM NAVY TO CAL/EPA DTSC CONCERNING IDENTIFICATION OF STATE ARARS

DEPARTMENT OF THE NAVY
BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
1230 COLUMBIA STREET, SUITE 1100
SAN DIEGO, CA 92101-8571

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Ser BPMOW.JAS\093
July 7, 2005

Ms. Marcia Liao
Project Manager
State of California Environmental Protection Agency
Department of Toxic Substances Control
700 Heinz Avenue, Suite 200
Berkeley, CA 94710

Dear Ms. Liao:

Subj: IDENTIFICATION OF STATE "APPLICABLE" OR "RELEVANT AND APPROPRIATE" REQUIREMENTS (ARARS) FOR INSTALLATION RESTORATION SITE 27 AT ALAMEDA POINT, ALAMEDA, CALIFORNIA

Pursuant to previous discussions and to accomplish the goals of Alameda Point, Installation Restoration (IR) program, the Department of the Navy (DoN) is hereby requesting that the Department of Toxic Substances Control (DTSC) identify potential State chemical-specific, action specific, and location specific ARARs for IR Site 27. Information on this site can be found in the draft *Remedial Investigation Report, IR Site 27, Dock Zone, Alameda Point, Alameda, March 2005.*

In addition, the DoN is requesting that the State of California (State) identify any other criteria, advisories, guidance, and proposed standards that the State requests be considered (TBCs) for the above identified site. Please coordinate responses from all California state agencies.

Timely identification of potential State ARARs is required under Section 121(d)(2)(A) of CERCLA and under the National Contingency Plan (NCP), 40 CFR 300.400(g) and 300.515(d) & (h). Experience to date around the country has shown that a failure to identify ARARs with sufficient precision, early in the process, can cause severe disruptions in *timely implementation* of remedial action.

To ensure timely and complete ARARs identification, please include the following information:

1. A specific citation to the statutory or regulatory provision(s) for the potential State ARAR and the date of enactment or promulgation.

2. A brief description of why the State ARAR is applicable or relevant and appropriate to the particular IR Site.

3. A description of how the potential State ARAR would apply to potential remedial action including: specific numeric discharge, effluent, or emission limitations; hazardous substance/constituent action or clean up levels; etc., if the State intends to take the position that the potential State ARAR includes such limitations, levels, etc.

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July 7, 2005

4. If the State believes its proposed ARAR is more stringent than the corresponding Federal ARAR, please provide the rationale and technical justification for this position.

5. If the State determines that there is not enough information to fully respond to our request, please identify any additional information that would be required to support identification of State ARARs and their application.

Consistent with 40 CFR 300.515(h)(2), the Navy is requesting that your response be sent via first class mail addressed to Ms. Jennifer Stewart, the Navy Remedial Project Manager, and postmarked within 30 calendar days of receipt of this request.

If you have any technical questions concerning this request, please contact Ms. Jennifer Stewart at jennifer.stewart@navy.mil. For any legal questions, please call Mr. Rex Callaway, Environmental Counsel at (619) 532-0988.

Sincerely,

for/ THOMAS L. MACCHIARELLA
BRAC Environmental Coordinator
By direction of the Director

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July 7, 2005

Blind copy to:
O5GIH.DS (Alameda NAS, Site 27) (3 copies)
Jennifer Stewart
Greg Lorton
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Read File
Serial File

Writer: J. Stewart, Code BPMOW.JAS, Jennifer.stewart@navy.mil
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APPENDIX B

BIOCHLOR MODELING

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FIGURES

TABLES

ACRONYMS/ABBREVIATIONS

BEI	Bechtel Environmental, Inc.
BIOCHLOR	BIOCHLOR Natural Attenuation Decision Support System
cm/sec	centimeters per second
DCE	dichloroethene
IC	institutional control
IR	Installation Restoration (Program)
ISB	*in situ* bioremediation
ISCO	*in situ* chemical oxidation
MCL	maximum contaminant level
MNA	monitored natural attenuation
PCE	tetrachloroethene
RI	remedial investigation
TCE	trichloroethene
U.S. EPA	United States Environmental Protection Agency
VC	vinyl chloride
VOC	volatile organic compound

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Appendix B
BIOCHLOR MODELING

This appendix describes the BIOCHLOR Natural Attenuation Decision Support System (BIOCHLOR) groundwater modeling calculations performed in support of Alternatives 3, 4A, 6A, and 7 for Installation Restoration (IR) Program Site 27. Modeling was not conducted for Alternative 6B because it was assumed that almost all the groundwater contamination would be remediated and that minimal residual contamination remaining would be reduced through natural attenuation within 1 or 2 years. Modeling was not conducted for Alternatives 1 and 2 because these alternatives do not include monitored natural attenuation (MNA) as a component.

B1 MODEL SETUP

BIOCHLOR is a screening model that simulates remediation by natural attenuation of dissolved solvents at sites with chlorinated volatile organic compound (VOC) releases. The reported concentrations of VOC degradation products in the IR Site 27 plume (i.e., dichloroethene [DCE] and vinyl chloride) indicate that reducing conditions conducive to anaerobic biodegradation of these solvents has occurred in the plume.

B1.1 Site Description

IR Site 27 is a 15.8-acre site covered with buildings, roadways, and concrete or asphalt pavement, except for an unpaved area east of Ferry Point Road in the northwestern portion of the site (Figure B-1). Precipitation generally drains into the storm drain system that discharges to Seaplane Lagoon, which forms the western border of IR Site 27.

Prior to 1941, the location that is now IR Site 27 was under water. The western margin of IR Site 27 is the seawall constructed to form the eastern margin of Seaplane Lagoon. An 18-foot-deep steel sheetpile bulkhead was also installed and is located beneath what is now Ferry Point Road (Figure B-1). Most of the IR Site 27 land consists of fill material that was emplaced east of the sheetpile bulkhead between 1941 and 1945. The material fill has a thickness of 4 to 8 feet beneath most of IR Site 27, and is predominantly poorly graded sand.

The artificial fill material is underlain by the Bay Sediment Unit (BSU), which has a thickness of 7 to 8 feet. The BSU extends to 12 to 16 feet below ground surface (bgs) and is predominantly poorly graded sand (a sandy member of the BSU) with clay lenses or a discontinuous layer of clay (Young Bay Mud member) present in some borings. The BSU is underlain by the Merritt Sand Formation, which consists of yellow-brown, poorly sorted sand. The top of the Merritt Sand Formation was encountered at 12 to 16 feet bgs.

The water-bearing zone consists of artificial fill material, BSU, Merritt Sand Formation, and the Upper San Antonio Formation that underlies the Merritt Sand Formation. Investigations at IR Site 27 indicated that the water-bearing zone at the shoreline adjacent to Seaplane Lagoon is subject to significant tidal fluctuation (tidal efficiency of 49 to 50 percent). Groundwater flow direction at IR Site 27 is generally to the west towards Seaplane Lagoon.

The water-bearing zone is in direct contact with the brackish waters of Seaplane Lagoon and the San Francisco Bay. There is saltwater intrusion at the shoreline and extending inland. The depth to the contact between freshwater and salt water increases with distance from the lagoon and the bay. At IR Site 27, the shoreline wells (west of the sheetpile bulkhead and screened at depths between 1.5 and 18.5 feet bgs) have total dissolved solids and common ion concentrations consistent with brackish water, and the inland wells (east of the sheetpile bulkhead and screened at depth of 6 to 16 feet bgs) have total dissolved solids (TDS) and common ion concentrations consistent with freshwater. The depth to the contact between freshwater and salt water in the eastern portion of IR Site 27 is approximately 16 to 20 feet bgs.

The remedial investigation identified a chlorinated VOC plume in groundwater encompassing approximately 11 acres within the boundaries of IR Site 27 (Figure B-1). Chlorinated VOCs reported at concentrations exceeding regulatory screening criteria at IR Site 27 include the following, in order of decreasing abundance:

- cis-1,2-DCE
- vinyl chloride
- trans-1,2-DCE
- trichloroethene (TCE)
- tetrachloroethene (PCE)
- 1,1-dichloroethane (DCA)

This list indicates that the most abundant chlorinated VOCs are the three reductive dechlorination products of PCE and TCE: cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride. Chlorinated VOCs are distributed in groundwater across IR Site 27 from beneath Building 168 to monitoring wells 15-MW1 and 15-MW2 at the shoreline. Two areas of higher concentrations of chlorinated VOCs are notable: 1) the Building 168 plume at the western margin of Building 168, and 2) the Ferry Point Road plume in the vicinity of monitoring well 15 MW3.

The depth of the chlorinated VOC plume appears to be limited by the salt water/freshwater interface at depths of 16 to 20 feet bgs. The thickness of the saturated zone impacted by chlorinated VOC concentrations exceeding regulatory criteria is approximately 10 feet (in general, located between 6 to 16 feet bgs).

Monitoring of the Ferry Point Road plume between 1995 and 2004 has shown a decrease in concentrations of TCE and PCE with a corresponding early increase in reductive dechlorination products. VOC concentrations west of the sheetpile bulkhead (shoreline wells) appear to have decreased rapidly between 2000 and 2004, which may be the result of different water quality (TDS) and geochemical conditions (presence of the iron of the sheetpile bulkhead).

B1.2 BIOCHLOR Description

BIOCHLOR is screening model developed for the U.S. Air Force Center for Environmental Excellence Technology Transfer Division at Brooks Air Force Base by Groundwater Services, Inc., Houston, Texas, in collaboration with the United States Environmental Protection Agency (U.S. EPA) (Subsurface Protection and Remediation Division, National Risk Management Research Laboratory, Robert S. Kerr Environmental Research Center, Ada, Oklahoma). The BIOCHLOR software and its user manual have undergone external and internal peer review by U.S. EPA and the U.S. Air Force. Programmed to run under Microsoft Excel software, BIOCHLOR is based on the Domenico analytical solute transport model (U.S. EPA 2000).

BIOCHLOR can simulate one-dimensional advection, three-dimensional dispersion, linear adsorption, and biotransformation via reductive dechlorination (the dominant biotransformation process at most solvent sites). Reductive dechlorination is assumed to occur under anaerobic conditions, and degradation of dissolved solvents is assumed to follow a sequential first-order decay process. BIOCHLOR includes three model types:

- solute transport without decay
- solute transport with biotransformation modeled as a sequential first-order decay process
- solute transport with biotransformation modeled as a sequential first-order decay process with two different reaction zones (i.e., each zone has a different set of rate coefficient values)

BIOCHLOR was designed to assess how far a dissolved chlorinated VOC plume would extend if no engineered controls or source area reduction measures were implemented. BIOCHLOR uses an analytical solute transport model with sequential first-order decay for simulating *in situ* biotransformation. The model predicts the maximum extent of dissolved-phase plume migration, which may then be compared to the distance to potential points of exposure (e.g., drinking water wells, groundwater discharge areas, or property boundaries). Analytical models of groundwater transport have seen wide application for these purposes, and experience has shown that such models can produce reliable results when site conditions in the plume study area are relatively uniform (U.S. EPA 2000).

Version 2.2 of BIOCHLOR, dated March 2002, was used for the model simulations. Details of the model are provided in the BIOCHLOR User's Manual (U.S. EPA 2000) and the User's Manual Addendum (Aziz et al. 2002). Features of Version 2.2 include rate constant decision support, source decay, and animation.

B1.3 Advection

Groundwater velocities used with this BIOCHLOR modeling were based on site-specific data. Groundwater velocity is calculated using horizontal hydraulic conductivity, effective porosity, and hydraulic gradient.

Horizontal hydraulic conductivity was measured by performing slug tests at wells 27MW01, 27MW02 and 27MW03 (Figure B-1). The geometric mean of these hydraulic conductivities is 1×10^{-3} centimeters per second (cm/s), and values ranged from 7×10^{-4} to 1.5×10^{-3} cm/s (Table B-1).

The hydraulic gradient across IR Site 27 was estimated from groundwater contours for spring and June 2004 provided in the Remedial Investigation (RI) Report (BEI 2005, Figures 2-9 and 2-11). A gradient of 0.005 was estimated across the center of the site for Spring 2004 (2 ft/440 ft), and a gradient of 0.006 was estimated across the northern and southern portions of the site for June 2004 (3 ft/465 ft and 3 ft/525 ft, respectively).

Effective porosity is typically estimated as less than total porosity. Total porosity was measured in nine samples from IR Site 27, collected at depths between 1.5 and 20 feet (Table B-2). The average total porosity was 0.37. An effective porosity of 0.30 is assumed for the BIOCHLOR modeling.

Using a geometric mean horizontal hydraulic conductivity of 1×10^{-3} cm/s, a hydraulic gradient of 0.006, and an effective porosity of 0.30, BIOCHLOR calculated a groundwater seepage velocity of 20.7 feet per year (Figures B-2 and B-3).

B1.4 Dispersion

Dispersion describes the mechanical mixing and spreading of a contaminant as it moves through the aquifer. BIOCHLOR allows input of parameters that describe mixing along the direction of groundwater flow (longitudinal dispersivity), mixing perpendicular to groundwater flow (transverse dispersivity), and mixing downward (vertical dispersivity).

The longitudinal dispersivity was calculated using BIOCHLOR Option 3, which applies an empirical correlation developed by Xu and Eckstein based on travel distance (U.S. EPA 2000). For a travel distance of 460 feet from Building 168 to the lagoon, the longitudinal dispersivity calculated by BIOCHLOR is 17.4 feet (Figure B-2). For a travel distance of 150 feet from the vicinity of well 15-MW3 within the Ferry Point Road plume to the lagoon, the calculated longitudinal dispersivity is 9.3 feet (Figure B-3).

The transverse dispersivity was set at 10 percent of the longitudinal dispersivity. This is a common estimate of transverse dispersivity, and is the default value in BIOCHLOR. Vertical dispersivity was set at 1×10^{-99}, as suggested in the BIOCHLOR manual to yield a conservative estimate of vertical dispersion, and because the plume, as indicated by the investigation at IR Site 27, shows very limited downward migration (plume thickness of only about 10 feet).

B1.5 Adsorption

The retardation factor affects the rate that organic chemicals migrate in groundwater. The retardation factor can be estimated using soil bulk density, effective porosity, organic carbon-water partition coefficient, and fraction organic carbon in soil.

Soil bulk density was measured for nine samples collected from IR Site 27 at depths between 1.5 and 20 feet (Table B-2). The average soil density is 1.72 grams per cubic centimeter. This is similar to the "typical" value of 1.7 grams per cubic centimeter cited in the BIOCHLOR manual.

Fraction of organic carbon in soil was measured for eight samples from IR Site 27 at depths between 3.0 and 20 feet (Table B-2). The average fraction of organic carbon in soil is 0.21 percent. The value used in the BIOCHLOR modeling was rounded to 0.2 percent.

BIOCHLOR default values were used for organic carbon-water partition coefficients for each VOC, as listed on Figures B-2 and B-3.

Using measured soil density, measured fraction organic carbon, and BIOCHLOR default values for partition coefficients, a median ("common") retardation factor of 2.49 was calculated by BIOCHLOR (Figures B-2 and B-3).

B1.6 Biotransformation

The biotransformation decay coefficients for the plume describe first-order anaerobic reductive dehalogenation of one chemical into another (e.g., biotransformation of TCE into DCE).

Decay coefficients were estimated by separately calibrating the BIOCHLOR models for the Building 168 plume and the Ferry Point Road plume to match concentrations in groundwater reported in the RI Report for IR Site 27 (BEI 2005). The concentration data used for model calibration are discussed in Section B1.8.

A trial-and-error procedure was applied to determine a best-fit decay coefficient for each VOC. The biotransformation decay coefficients estimated by this procedure are shown on Figures B-2 and B-3. These site-specific estimates of decay coefficients are between the minimum and median values cited in the BIOCHLOR manual and as listed in Table B-3.

The PCE decay coefficient is estimated as 0.77 per year for the Ferry Point Road plume, and matches the minimum value of 0.8 per year given in the BIOCHLOR manual.

The TCE decay coefficients of 0.46 and 0.63 per year for the Building 168 plume and Ferry Point Road plume, respectively, are similar to the 25th percentile value of 0.5 per year given in the BIOCHLOR manual.

The cis-1,2-DCE decay coefficients of 0.23 and 0.87 per year for the Building 168 plume and Ferry Point Road plume, respectively, are slightly more than the minimum value of 0.1 per year, and similar to the 25th percentile value of 0.7 per year given in the BIOCHLOR manual. The decay coefficient for cis-1,2-DCE is estimated to be significantly larger for the Ferry Point Road plume than the Building 168 plume.

The vinyl chloride decay coefficient of 0.99 per year estimate for both plumes is larger than the 25th percentile value of 0.6 per year given in the BIOCHLOR manual, and is close to the median value of 1.7 per year.

B1.7 Source Assumptions

The source area for the main portion of the plume at IR Site 27 is assumed to be along the west wall of Building 168, just outside the large doors. A secondary source area is interpreted to be located near 15-MW3, east of the railroad tracks that run parallel to Ferry Point Road. A source width of 200 feet was assumed for the Building 168 plume, and a source width of 100 feet was assumed for the secondary Ferry Point Road plume.

Initial source releases were assumed to have occurred at approximately 40 years ago, in order to correspond approximately with a probable period of release at Building 168 between the early 1950s and early 1970s. A secondary release near Ferry Point Road is assumed to have occurred at a similar time.

Concentrations are assumed to decrease over time at the source areas, i.e., sources of constant concentrations are not present. The presence of nonaqueous-phase liquids in the subsurface would be indicative of a continuing source; however, subsurface investigations at IR Site 27 have not found indications of the presence of nonaqueous-phase liquids.

Initial source concentrations for each VOC and the source decay rate constant were adjusted by a trial-and-error procedure to obtain an approximate match between simulated concentrations and reported concentrations after 40 years.

Initial source concentrations estimated by the trial-and-error calibration are hypothetical values that would have been present 40 years ago. Simulation periods of 30 years and 50 years were also analyzed, but a 40-year simulation provided a better match to recent reported concentrations for samples collected.

Initial concentrations for various combinations of only PCE and TCE were attempted (assuming no DCE or vinyl chloride initially), but those trials failed to provide a reasonable calibration to reported concentrations in groundwater. Only an initial combination of PCE, TCE, DCE, and vinyl chloride, presumed present 40 years ago, was able to provide an approximate match to reported concentrations from sampling between 2000 and 2004.

The trial-and-error estimate of concentrations at the Building 168 plume source area 40 years ago are 4,000 micrograms per liter (µg/L) for TCE, 6,000 µg/L for cis-1,2-DCE, and 20,000 µg/L for vinyl chloride (Figure B-2).

The trial-and-error estimates of concentrations at the Ferry Point Road plume source area 40 years ago are 4,000 µg/L for PCE and TCE, 40,000 µg/L for cis-1,2-DCE, and 3,000 µg/L for vinyl chloride (Figure B-3).

Source decay rate constants of 0.099 per year and 0.15 per year were estimated for the Building 168 plume and Ferry Point Road plume, respectively, based on the trial-and-error procedure of matching simulated concentrations with reported concentrations in groundwater (Figures B-2 and B-3).

B1.8 Concentration Data

Samples collected in 2002 by HydroPunch and from monitoring wells, and subsequent samples in 2003 and 2004 from monitoring wells, were analyzed for chlorinated VOCs. In addition, monitoring wells at the Ferry Point Road plume were previously analyzed in 1995 and 2000. The maximum annual concentrations reported for monitoring well samples and HydroPunch samples are summarized in Table B-4. Sampling locations are listed in this table in order of approximate distance downgradient from the assumed areas of initial sources at Building 168 and at well 15-MW3 near Ferry Point Road.

Reported results for PCE have not exceeded its maximum contaminant level (MCL), except for results from the initial sample at well 15-MW2 in 1995, which had a concentration of 40 µg/L. Concentrations of TCE exceeded its MCL in samples from only three locations, 27B19, 15-MW2 and 15-MW3, with a maximum concentration of 26 µg/L.

Cis-1,2-DCE and vinyl chloride concentrations exceed MCLs at nearly all other sampling locations listed in Table B-4. Maximum concentrations for these two VOCs are 230 µg/L for cis-1,2-DCE and 200 µg/L for vinyl chloride. Concentrations of trans-1,2-DCE are approximately an order of magnitude less than concentrations for cis-1,2-DCE, and therefore trans-1,2-DCE is not included in the BIOCHLOR modeling for this site. Other sampling locations with reported VOCs are not included in Table B-4 if those locations were on the side fringes of the plume (and below MCLs), upgradient of the plume, or adjacent to locations having higher concentrations.

B2 MODEL CALIBRATION

The concentration data presented in Table B-4 were used in the trial-and-error calibration of the BIOCHLOR model to estimate biotransformation decay coefficients, source concentrations, and source decay rate constants. Because the greatest numbers of groundwater samples were analyzed in 2003, the maximum concentrations reported in that year at each sampling location were selected as calibration targets. That set of targets was supplemented with monitoring well results obtained in 2002, if those values were higher than reported in 2003 at the same well, or if a well was not sampled in 2003.

B2.1 Building 168 Plume

Simulated concentrations were compared to the reported concentrations listed in Table B-4 using an iterative process to estimate the biotransformation decay coefficients, source concentrations, and source decay rate constants for the Building 168 plume. The model input for the Building 168 plume calibration is shown in Figure B-2, and is discussed in Section B1.

Figures B-4 and B-5 show the simulated concentrations and reported concentrations for cis-1,2-DCE and vinyl chloride, respectively. Simulated concentrations along the centerline of the plume were compared to the maximum reported concentrations downgradient of the assumed source area. A reasonable match to reported concentrations

of cis-1,2-DCE is shown for sampling locations 27B59 and 27B29 near the source area, 27B22 and 27B23 at 150 feet downgradient of the source area, and 37-MJ-MW-10 near Seaplane Lagoon. A reasonable match to reported concentrations of vinyl chloride is shown for sampling location 27B29 near the source area, 27B22, 27B14 and 27MW01 between 150 feet and 350 feet downgradient, and 37-MJ-MW-10 near Seaplane Lagoon. Matching the maximum concentrations reported within the plume is expected to provide a conservative estimate of parameters with the highest uncertainty, i.e., biotransformation decay coefficients and source parameters.

B2.2 Ferry Point Road Plume

Simulated concentrations were compared to the reported concentrations listed in Table B-4 using an iterative process to estimate the biotransformation decay coefficients, source concentrations, and source decay rate constant for the Ferry Point Road plume. The model input for the Ferry Point Road plume calibration is shown on Figure B-3, and is discussed in Section B1.

Figures B-6 and B-7 show the simulated concentrations and reported concentrations for cis-1,2-DCE and vinyl chloride, respectively. Simulated concentrations along the centerline of the plume were compared to the maximum reported concentrations downgradient of the assumed source area. A reasonable match to maximum reported 2002–2004 concentrations of cis-1,2-DCE is shown for well 15-MW3 near the source area and for well 15-MW2 at approximately 70 feet downgradient of the source area; however, the model overpredicts the concentration at 15-MW1 at approximately 90 feet downgradient. A reasonable match to reported concentrations of vinyl chloride is shown for 15-MW3 near the source area and at well 15-MW1, but not at well 15-MW2.

Matching the maximum concentrations reported within the plume is expected to provide a conservative estimate of parameters with the highest uncertainty, i.e., biotransformation decay coefficients and source parameters. However, calibration results for this plume may be less reliable than the results for the Building 168 plume because of fewer sampling locations, the apparent fluctuation in concentrations between 1995 and 2004 (generally decreased from 1995 to 2000, increased from 2000 to 2002, and decreased again from 2002 to 2004), uncertain release location, and possible differences in decay coefficients near the seawall.

B3 SIMULATION OF ALTERNATIVES

The 40-year calibration simulations described in Section B2 were extended in time until VOC concentrations decreased to MCLs within the Building 168 plume and the Ferry Point Road plume. Model simulation times discussed below are rounded upward to the nearest 5-year increment. Table B-5 provides a summary of the model results for comparison of alternatives with unremediated and remediated sources.

B3.1 Alternative 3 – MNA and ICs

Alternative 3 includes MNA to verify that existing conditions within the plume are effective at reducing VOC concentrations; MNA is accompanied by institutional controls (ICs).

The BIOCHLOR modeling results indicate that VOCs present at concentrations above at least one MCL would persist approximately 70 years into the future for the Building 168 plume and 30 years into the future for the Ferry Point Road plume. The target concentrations (MCLs) for MNA for the modeled VOCs are: 5 µg/L for TCE, 6 µg/L for cis-1,2-DCE, and 0.5 µg/L for vinyl chloride.

B3.2 Alternative 4A – ISB Source Area Treatment, MNA, and ICs

For Alternative 4A, *in situ* bioremediation (ISB) would be followed by MNA and ICs.

ISB is assumed to reduce the concentration of chlorinated VOCs by approximately 50 percent, and in the predictive simulations with BIOCHLOR, the source concentrations were reduced by 50 percent from those used in Alternative 3.

The BIOCHLOR modeling results indicate that MNA would require approximately 60 years after ISB source area treatment for chlorinated VOC concentrations to attenuate to MCLs at the Building 168 plume and would require 25 years at the Ferry Point Road plume.

B3.3 Alternative 6A – ISCO Source Area Treatment, MNA, and ICs

For Alternative 6A, *in situ* chemical oxidation (ISCO) would be followed by MNA and ICs.

ISCO is assumed to reduce the concentration of chlorinated VOCs by approximately 90 percent, and in the predictive simulations with BIOCHLOR, the source concentrations were reduced by 90 percent from those used in Alternative 3.

ISCO could change the reducing conditions in the source area. It is assumed that the affected area would return to pretreatment reducing conditions, that the microbial community would reestablish within 3 months after injection of ISCO, and that the same decay coefficients used for Alternative 3 would apply after 3 months.

The BIOCHLOR modeling results indicate that MNA would continue to reduce chlorinated VOC concentrations to MCLs for approximately 45 years after ISCO source area treatment for the Building 168 plume, and for approximately 15 years for the Ferry Point Road plume.

B3.4 Alternative 7 – Dynamic Circulation Source Area Treatment, MNA, and ICs

For Alternative 7, dynamic circulation source area treatment would be followed by MNA and ICs.

Dynamic circulation is assumed to reduce the concentration of chlorinated VOCs by approximately 80 percent, and in the predictive simulations with BIOCHLOR, the source concentrations were reduced by 80 percent from those used in Alternative 3.

Dynamic circulation would temporarily change the reducing conditions in the source area. It was assumed that the affected area would return to pretreatment reducing conditions within 1 to 3 months and that the same decay coefficients would apply as for Alternative 3.

The BIOCHLOR modeling results indicate that MNA would continue to reduce chlorinated VOC concentrations to MCLs for approximately 55 years after dynamic circulation treatment at the Building 168 plume, and for 20 years for the Ferry Point Road plume.

B4 MODEL UNCERTAINTY AND SENSITIVITY

Each input parameter for the BIOCHLOR modeling effort has uncertainties that result from difficulties in making accurate and representative measurements. Uncertainties may cause simulated concentrations to be overestimated or underestimated, and resulting times required to achieve MCLs may be overestimated or underestimated.

Parameters that contribute to uncertainty in the BIOCHLOR modeling are described in the following sections. Sensitivity analyses were performed based on adjusting values of these parameters by factors of one-half and twice the values applied for the "base case" with Alternative 3 and the Building 168 plume. Table B-6 provides a summary of the sensitivity analyses.

B4.1 Advection

Although consistent measurements of hydraulic conductivity at IR Site 27 were obtained, and a consistent hydraulic gradient was measured at different times and locations across IR Site 27 in 2004, uncertainty in effective porosity and uncertainty of the hydraulic gradient in previous and future decades could affect the accuracy of the simulations for future conditions. Conditions affecting the hydraulic gradient are not expected to have been much different in previous years, and are expected to be similar for future years.

However, to evaluate the effect of groundwater velocity on the modeling results, sensitivity simulations were performed using approximately one-half (10 feet per year) and twice (40 feet per year) the estimated velocity of 20.7 feet per year that was used in the modeling to compare alternatives.

The lower groundwater velocity results in a large increase in the time required to achieve MCLs (almost three times longer, but part of the change results from a decreased source decay rate imposed by BIOCHLOR to prevent an unstable solution). With a higher groundwater velocity, the time to achieve MCLs is not noticeably changed.

B4.2 Dispersion

Trace concentrations of VOCs were reported in recent monitoring events at locations adjacent to Seaplane Lagoon. Because the contaminants have already reached the seawall, a calibrated estimate of longitudinal dispersivity is not possible. Also, because of uncertainty in the exact width of the source release, a calibrated estimate of transverse dispersivity is also not possible.

However, to evaluate the sensitivity of the model to dispersion, sensitivity simulations were performed using one-half (8.7 feet) and twice (35 feet) the longitudinal dispersivity of 17.4 feet that was selected for comparison of alternatives for the Building 168 plume. Transverse dispersivity was proportionally changed to remain equal to 0.1 of the longitudinal dispersivity.

The lower dispersivity has minimal effect on the modeling results, but the higher dispersivity results in a large increase in time required to achieve MCLs (almost three times longer, but part of the change results from a decreased source decay rate imposed by BIOCHLOR to prevent an unstable solution).

B4.3 Adsorption

The median ("common") retardation factor calculated by BIOCHLOR is similar to the calculated retardation factor for cis-1,2-DCE, but overestimates the retardation factor for vinyl chloride.

To evaluate the sensitivity of the model to the retardation coefficient, sensitivity simulations were performed using one-half (retardation coefficient of 1.25) and twice (retardation coefficient of 3.75) the common retardation coefficient of 2.49 applied in the comparison of alternatives.

Decreasing the retardation factor has minimal effect on the modeling results for the time required to achieve MCLs, but increasing the retardation factor significantly increases the time required (time is approximately doubled).

B4.4 Biotransformation

Decay coefficients for plumes may vary spatially and temporally, although available data and interpretations for IR Site 27 do not suggest that such variations have occurred (except perhaps associated with iron rusting from the sheet piles installed at the seawall).

To evaluate the sensitivity of the model to the decay coefficient, sensitivity simulations were performed using one-half and twice the decay coefficients for individual VOCs: 0.23 and 0.92 per year for TCE, 0.12 and 0.46 per year for cis-1,2-DCE, and 0.50 and 1.98 per year for vinyl chloride, compared to 0.46, 0.23, and 0.99 per year, respectively, for the base case with Alternative 3 and Building 168 plume.

The lower decay coefficients result in an increase in the time required to achieve MCLs, but they have less of an effect than decreased groundwater velocity, increased

dispersivity, or increased retardation factor. With higher decay coefficients, the time to achieve MCLs is only slightly reduced.

B4.5 Source Concentrations

The major assumptions required for the source in BIOCHLOR modeling are the initial concentrations and the source decay rate constant.

The simulated plume concentrations are linearly related to the initial source concentrations, i.e., doubling the initial source concentrations will double the predicted concentrations throughout the plume for a given time of simulation. To evaluate the sensitivity of the model to the initial source concentrations, sensitivity simulations were performed using one-half and twice the initial concentrations of 4,000 µg/L for TCE, 6,000 µg/L for cis-1,2-DCE, and 20,000 µg/L for vinyl chloride, which were assumed for the comparison of alternatives.

Decreasing the initial source concentrations slightly reduces the time required to achieve MCLs, and increasing the initial source concentrations slightly increases the time required to achieve MCLs.

B4.6 Source Decay

To evaluate the sensitivity of the model to the source decay, sensitivity simulations were performed using one-half (0.05 per year) and twice (0.198 per year) the decay rate of 0.099 per year applied in the comparison of alternatives for the Building 168 plume.

A decrease in the source decay rate constant has a large effect on the estimated time required to achieve MCLs (approximately 2.5 times longer). The source decay rate appears to have a greater effect on the time required than any other parameter in this model, and like the initial source concentrations, has a high uncertainty.

An increase in the source decay rate could not be simulated because BIOCHLOR limits the rate to prevent an unstable solution.

B4.7 Plume Concentrations

Reported VOC concentrations affect the estimation of biotransformation decay coefficients and assumptions for source concentrations and source decay rate constants.

The large number of HydroPunch samples collected in 2003, supplemented with samples from monitoring wells in 2002, 2003 and 2004, are interpreted to provide a one-time "snapshot" for plume characterization. However, without measurements of the initial source release or a second snapshot for plume concentrations in a different decade, the calibrated model is subject to considerable uncertainty for decay coefficients and source assumptions. Insufficient data were collected in 1995 to provide a snapshot for IR Site 27 for that period, and reported results suggest differences in sampling and analysis methodologies for different years (generally a large decrease in reported concentrations between 1995 and 2000, but then a significant increase in reported concentrations

between 2000 and 2002). With these limitations, the primary application of the BIOCHLOR modeling simulations is a comparison of alternatives based on a consistent set of values for flow, transport, and degradation parameters.

B5 SUMMARY OF RESULTS

The unremediated source scenario modeling (Alternative 3) indicates that approximately 70 years are required for MNA to lower chlorinated VOC concentrations to MCLs at the Building 168 plume, and that approximately 30 years are required for the Ferry Point Road plume.

The remediated-source scenario modeling indicates that for a reduction in VOC concentrations of 50 percent by Alternative 4A, approximately 60 years following completion of ISB are required for MNA to lower chlorinated VOC concentrations to MCLs at the Building 168 plume, and approximately 25 years are required at the Ferry Point Road plume.

The time required for MNA to lower chlorinated VOC concentrations is less for Alternatives 6A and 7, assuming a reduction in chlorinated VOC concentrations of 90 percent and 80 percent, respectively, after the aquifer returns to reducing conditions and the microbial community reestablished. It is assumed that 1 to 3 months may be required for the aquifer to return to pretreatment conditions for Alternatives 6A and 7. The additional time required for MNA to lower chlorinated VOCs to MCLs at the Building 168 plume is 45 years for Alternative 6A and 55 years for Alternative 7. At the Ferry Point Road plume, 15 years and 20 years are required for MNA to lower chlorinated VOCs to MCLs for Alternatives 6A and 7, respectively.

B6 REFERENCES

Aziz, C., C.J. Newell, and J.R. Gonzales. 2002. BIOCHLOR Natural Attenuation Decision Support System, Version 2.2 – User's Manual Addendum. March.

Bechtel Environmental, Inc. 2005. Draft Final Remedial Investigation Report – IR Site 27, Dock Zone, Alameda Point, Alameda, California, July.

BEI. *See* Bechtel Environmental, Inc.

United States Environmental Protection Agency. 2000. BIOCHLOR Natural Attenuation Decision Support System – User's Manual, Version 1.0. EPA/600/R-00/008. January.

U.S. EPA. *See* United States Environmental Protection Agency.

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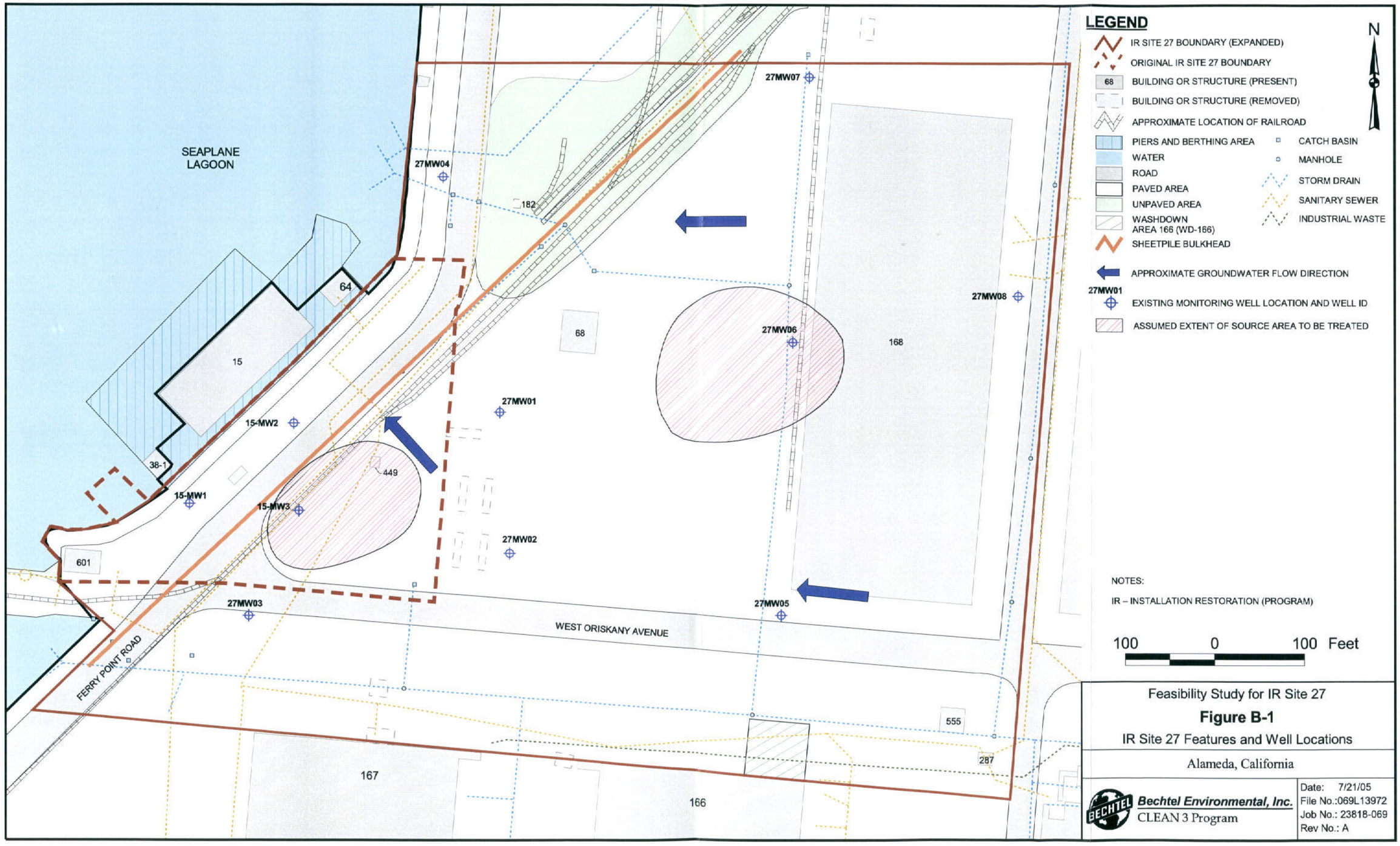
FIGURES

FINAL FEASIBILITY STUDY REPORT FOR IR SITE 27, DOCK ZONE

DATED 01 APRIL 2006



Feasibility Study for IR Site 27

Figure B-1

IR Site 27 Features and Well Locations

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 7/21/05
File No.:069L13972
Job No.: 23818-069
Rev No.: A

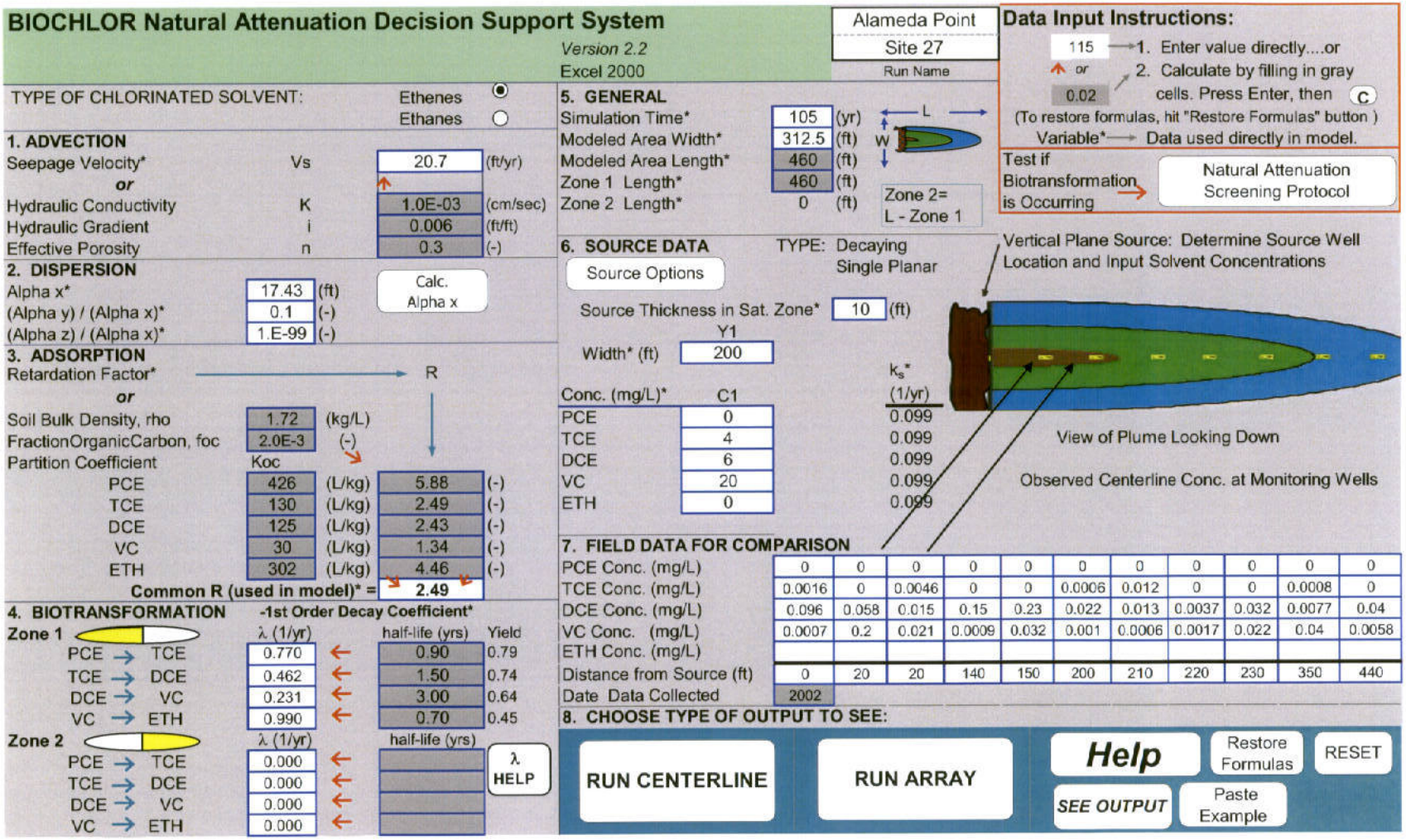


Figure B-2
BIOCHLOR Model Input – Building 168 Plume

Figure B-2 (continued)

Notes:

Calc. – calculate
cm/sec – centimeters per second
conc. – concentration
DCE – dichloroethene
ETH – ethene
ft – feet
ft/ft – foot per foot
ft/yr – feet per year
i – hydraulic gradient
K – hydraulic conductivity
K_{oc} – organic carbon partition coefficient
k_s – source decay constant
kg/L – kilograms per liter
λ – biotransformation rate constant
L – length
L/kg – liters per kilogram
mg/L – milligrams per liter
n – effective porosity
PCE – tetrachloroethene
R – retardation factor
Sat. – saturated
TCE – trichloroethene
VC – vinyl chloride
W – width
yr – year

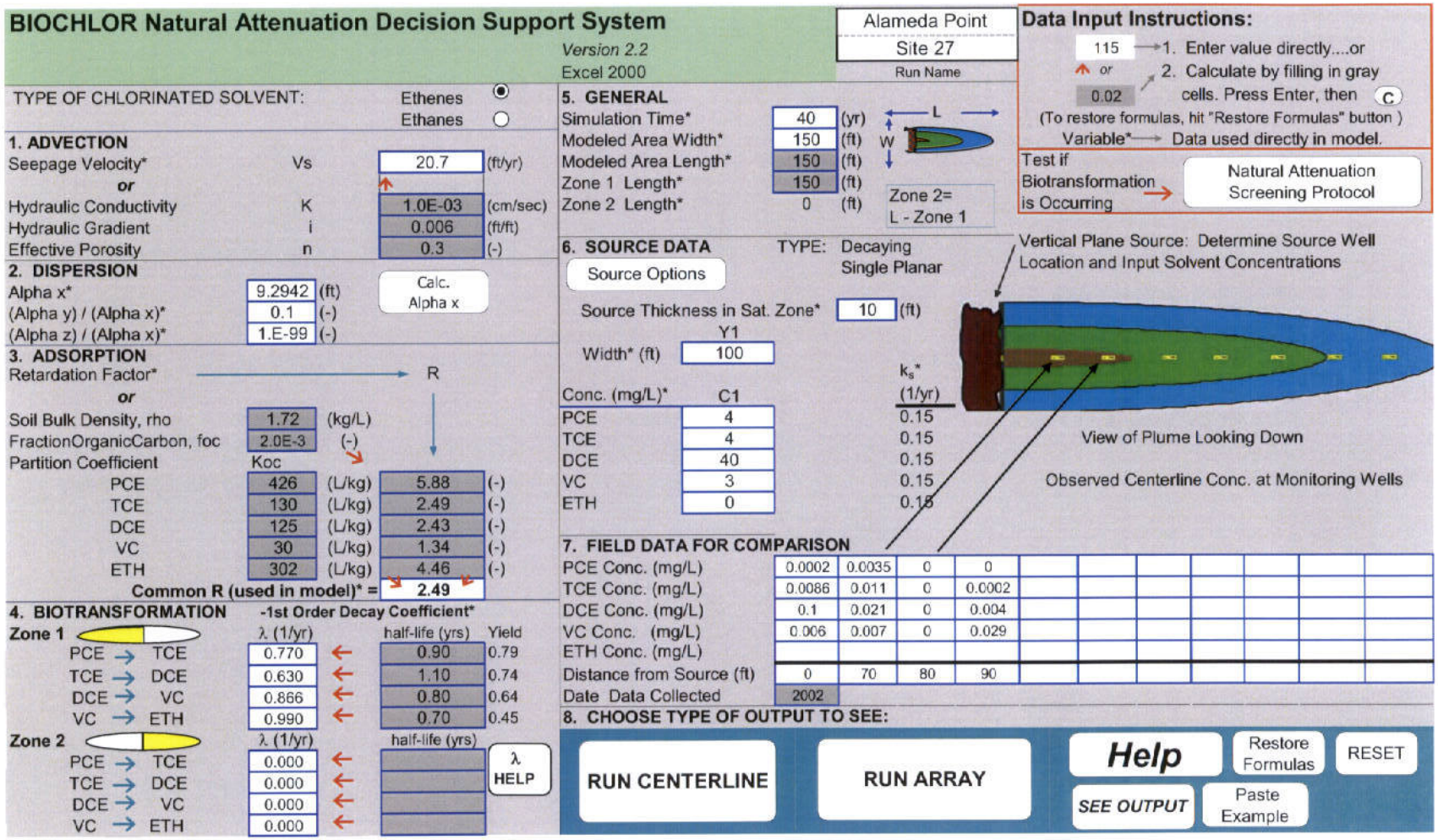


Figure B-3
BIOCHLOR Model Input – Ferry Point Road Plume

Figure B-3 (continued)

Notes:

Calc. – calculate
cm/sec – centimeters per second
conc. – concentration
DCE – dichloroethene
ETH – ethene
ft – feet
ft/ft – foot per foot
ft/yr – feet per year
i – hydraulic gradient
K – hydraulic conductivity
K_{oc} – organic carbon partition coefficient
k_s – source decay constant
kg/L – kilograms per liter
λ – biotransformation rate constant
L – length
L/kg – liters per kilogram
mg/L – milligrams per liter
n – effective porosity
PCE – tetrachloroethene
R – retardation factor
Sat. – saturated
TCE – trichloroethene
VC – vinyl chloride
W – width
yr – year

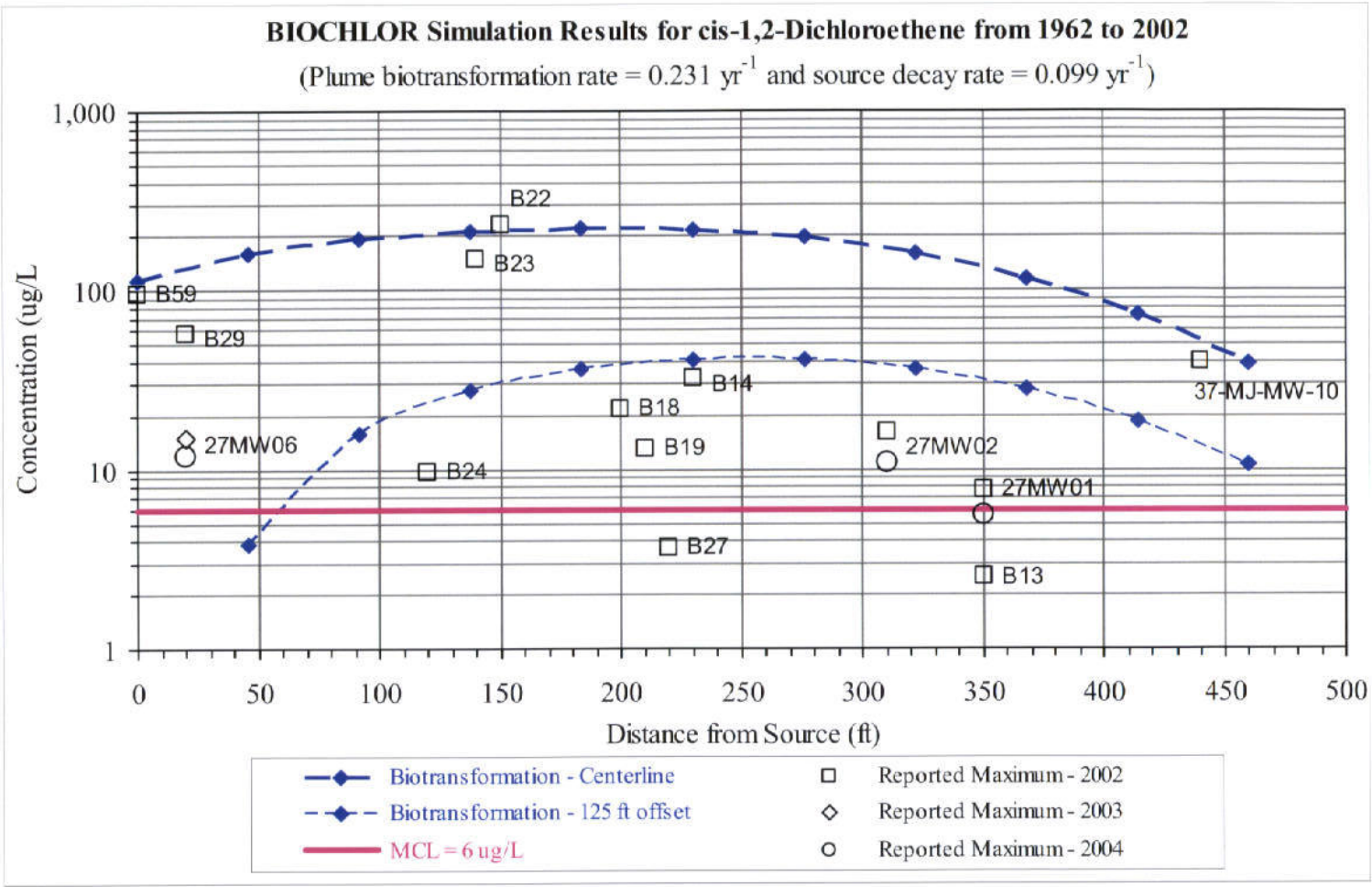


Figure B-4
BIOCHLOR Model Simulation for Building 168 Plume – cis-1,2-Dichloroethene Concentrations

Figure B-4 (continued)

Notes:
BIOCHLOR – BIOCHLOR Natural Attenuation Decision Support System
ft – feet
µg/L – micrograms per liter
MCL – maximum contaminant level
yr – year

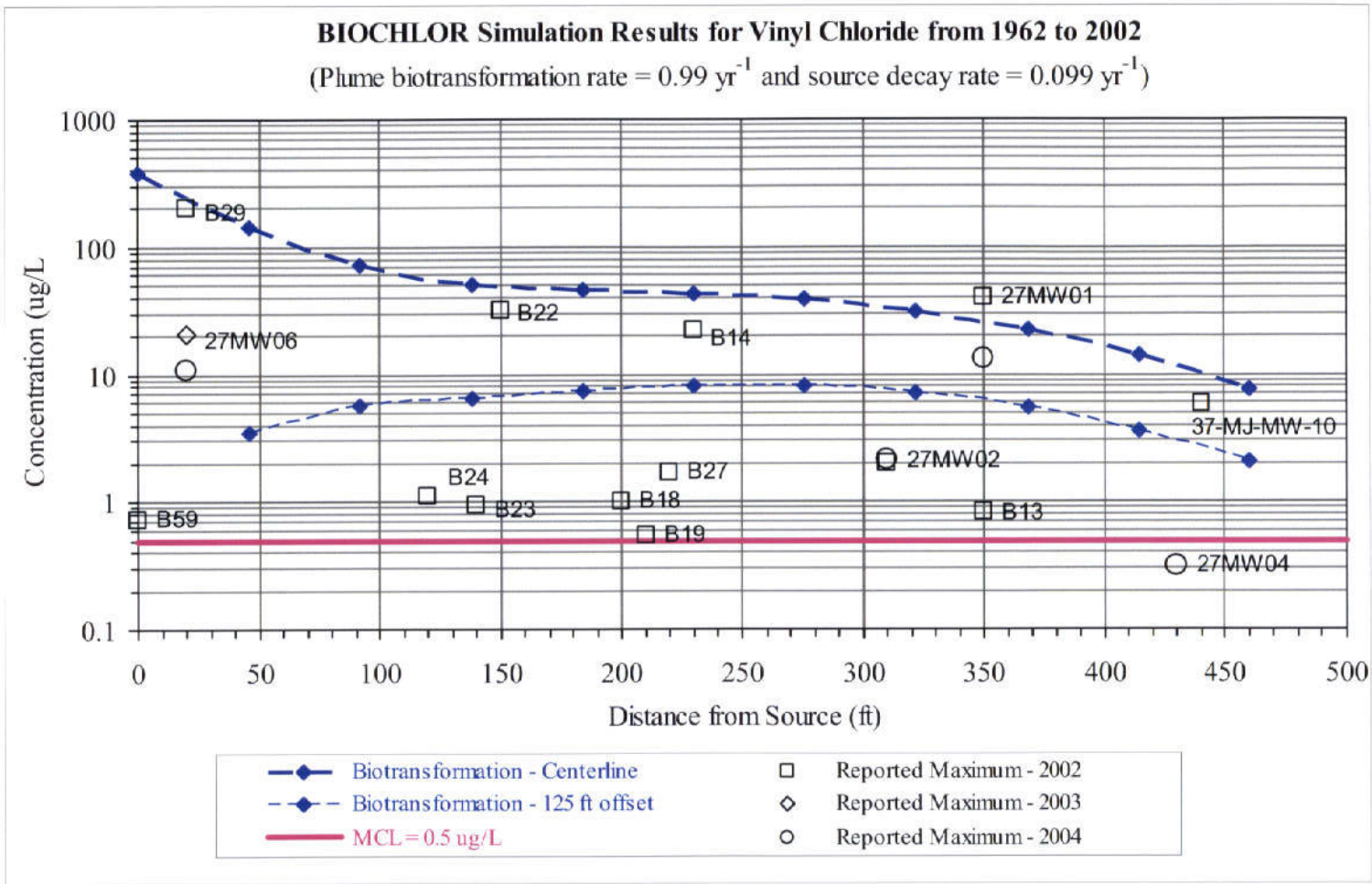


Figure B-5
BIOCHLOR Model Simulation for Building 168 Plume – Vinyl Chloride Concentrations

Figure B-5 (continued)

Notes:
BIOCHLOR – BIOCHLOR Natural Attenuation Decision Support System
ft – feet
µg/L – micrograms per liter
MCL – maximum contaminant level
yr – year

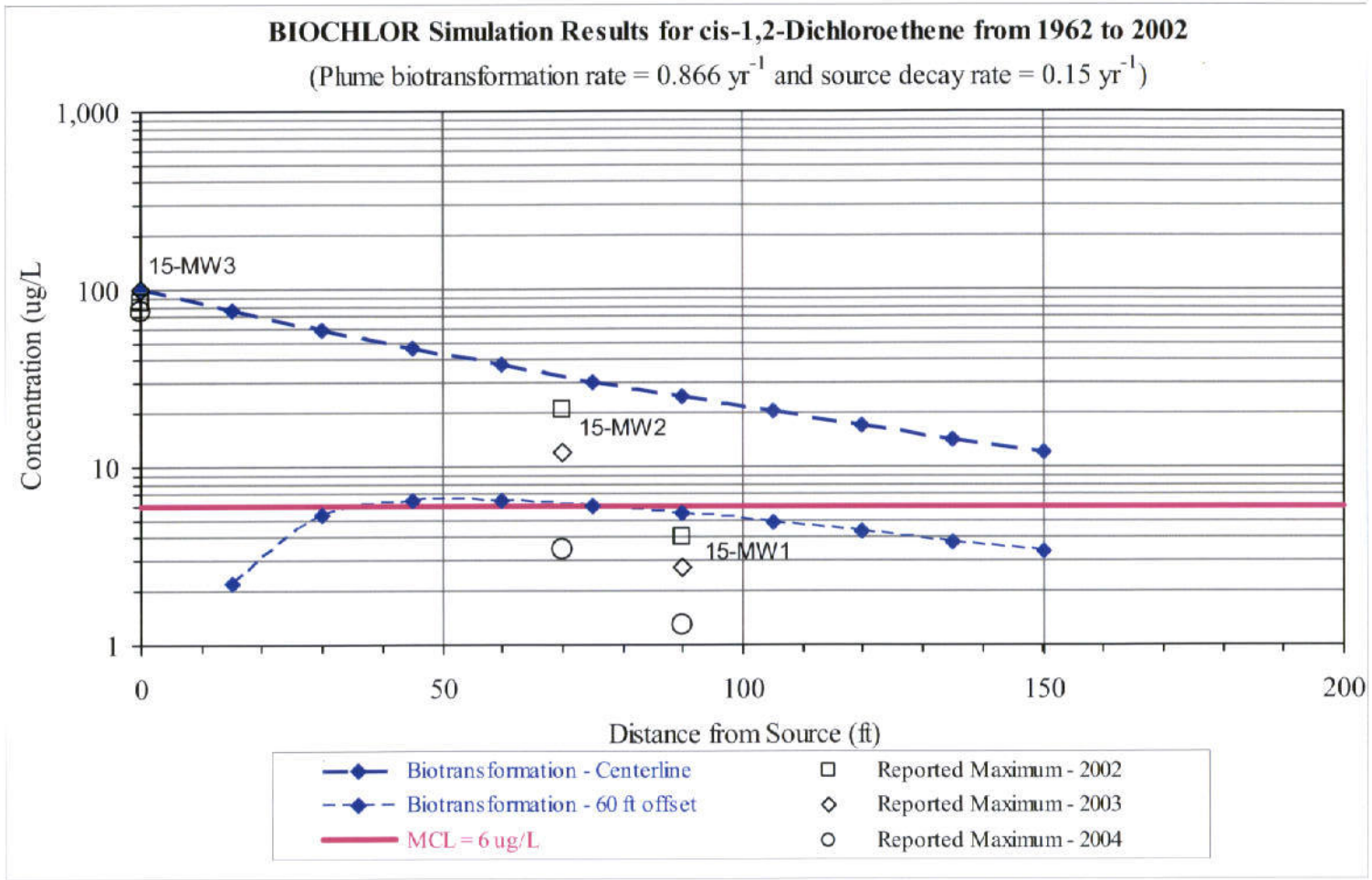


Figure B-6

BIOCHLOR Model Simulation for Ferry Point Road Plume – cis-1,2-Dichloroethene Concentrations

Figure B-6 (continued)

Notes:
BIOCHLOR – BIOCHLOR Natural Attenuation Decision Support System
ft – feet
µg/L – micrograms per liter
MCL – maximum contaminant level
yr – year

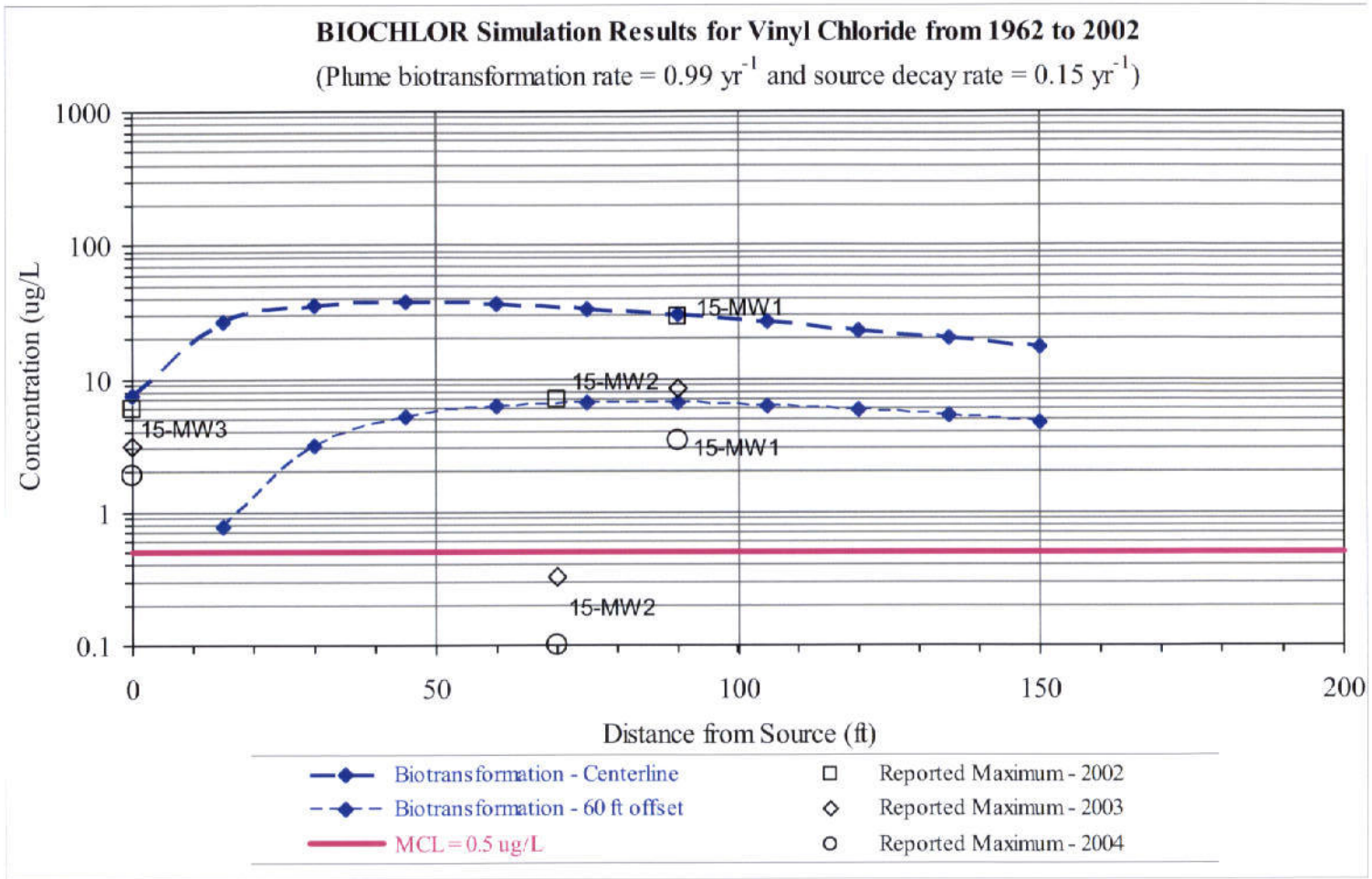


Figure B-7
BIOCHLOR Model Simulation for Ferry Point Road Plume – Vinyl Chloride Concentrations

Figure B-7 (continued)

Notes:
BIOCHLOR – BIOCHLOR Natural Attenuation Decision Support System
ft – feet
µg/L – micrograms per liter
MCL – maximum contaminant level
yr – year

TABLES

FINAL FEASIBILITY STUDY REPORT FOR IR SITE 27, DOCK ZONE

DATED 01 APRIL 2006

Table B-1
Horizontal Hydraulic Conductivities Measured at IR Site 27

Well	Depth (feet)	K (cm/sec)	K (ft/day)	Lithology
27MW01	6.7–11.7	0.7×10^{-3}	1.9	very fine to fine sand (SP)
27MW02	6.6–16.6	1.5×10^{-3}	4.4	very fine to fine sand (SP)
27MW03	6.6–16.6	1.1×10^{-3}	3.0	very fine to fine sand (SP)
	geometric mean	1.0×10^{-3}	2.9	

Source:
BEI 2005

Acronyms/Abbreviations:
cm/sec – centimeters per second
ft/day – feet per day
IR – Installation Restoration (Program)
K – hydraulic conductivity

Table B-2
Soil Properties Measured at IR Site 27

Location	Sample Depth (feet)	Unified Soil Classification System	Vertical Hydraulic Conductivity (cm/sec)	Dry Density (lb/ft^3)	Dry Density (g/cm^3)	Total Porosity	Fraction Organic Carbon (percent)
27B06-G	1.5–3.0	SP	2.6×10^{-5}	106	1.69	0.38	—*
27B09-G	2.0–3.0	SP-SM	2.3×10^{-4}	100	1.61	0.42	—
27B11-G	2.0–3.0	SP-SM	5.1×10^{-5}	115	1.84	0.33	—
27B12-G	2.0–3.0	SP-SM	1.8×10^{-4}	103	1.65	0.40	—
27B45	3.0–3.5	SP-SM	6.9×10^{-4}	108	1.73	0.37	0.18
27B55	3.0–3.5	SP	6.4×10^{-4}	105	1.69	0.39	0.12
27B54	3.5–4.0	SP-SM	3.7×10^{-4}	111	1.78	0.35	0.18
27B57	3.5–4.0	SP-SM	5.3×10^{-4}	106	1.70	0.37	0.25
27MW03	10.0–11.0	SP-SM	2.3×10^{-4}	—	—	—	0.15
27MW01	10.5–11.5	SP-SM	9.1×10^{-5}	—	—	—	0.28
27MW02	10.5–11.5	SP-SM	5.6×10^{-5}	—	—	—	0.11
27B60	19–20	SM	6.7×10^{-7}	113	1.80	0.34	0.39
		minimum	6.7×10^{-5}	100	1.61	0.33	0.11
		maximum	6.9×10^{-4}	115	1.84	0.42	0.39
		average	2.6×10^{-4}	107	1.72	0.37	0.21
		geometric mean	1.1×10^{-4}	107	1.72	0.37	0.19

Source:
BEI 2005

Note:
* dash indicates not measured at this location.

Acronyms/Abbreviations:
cm/sec – centimeters per second
g/cm^3 – grams per cubic centimeter
IR – Installation Restoration (Program)
lb/ft^3 – pounds per cubic foot

Table B-3
Literature Values for Biotransformation Decay Coefficients

Biotransformation	Minimum (1/year)	25th Percentile (1/year)	Median (1/year)	75th Percentile (1/year)	Maximum (1/year)	Number of Plumes
PCE to TCE	0.8	—*	1.1	—	2.4	3
TCE to DCE	0.3	0.5	1.2	2.4	3.2	10
DCE to VC	0.1	0.7	1.2	2.2	20.9	9
VC to ETH	0.4	0.6	1.7	4.9	12.2	7

Source:
Aziz et al. 2002

Note:
* dash indicates insufficient data to calculate

Acronyms/Abbreviations:
DCE – cis-1,2-dichloroethene
ETH – ethene
PCE – tetrachloroethene
TCE – trichloroethene
VC – vinyl chloride

Table B-4
Maximum Annual Concentrations Reported at IR Site 27

Sampling Location	Down-gradient Distance (feet)	MAXIMUM ANNUAL CONCENTRATION[a] (µg/L)																			
		Tetrachloroethene (MCL = 5 µg/L)					Trichloroethene (MCL = 5 µg/L)					cis-1,2-Dichloroethene (MCL = 6 µg/L)					Vinyl Chloride (MCL = 0.5 µg/L)				
		1995	2000	2002	2003	2004	1995	2000	2002	2003	2004	1995	2000	2002	2003	2004	1995	2000	2002	2003	2004
Building 168 Plume																					
27MW08[b]	-220	—[c]	—	—	U	U	—	—	—	0.36	0.21	—	—	—	2.5	1.7	—	—	—	U	U
27B59 10'	-20	—	—	—	U	—	—	—	—	1.6	—	—	—	—	96	—	—	—	—	0.74	—
27MW05[b]	10	—	—	—	U	U	—	—	—	1.3	0.87	—	—	—	0.45	0.34	—	—	—	U	U
27B29 10'	20	—	—	—	U	—	—	—	—	U	—	—	—	—	58	—	—	—	—	200	—
27MW06	20	—	—	—	U	U	—	—	—	4.6	3.2	—	—	—	15	12	—	—	—	21	11
27B24 10'	120	—	—	—	0.96	—	—	—	—	U	—	—	—	—	9.6	—	—	—	—	1.1	—
27B23 10'	140	—	—	—	U	—	—	—	—	U	—	—	—	—	150	—	—	—	—	0.93	—
27B22 10'	150	—	—	—	U	—	—	—	—	U	—	—	—	—	230	—	—	—	—	32	—
27B18 10'	200	—	—	—	U	—	—	—	—	0.64	—	—	—	—	22	—	—	—	—	1	—
27B19 10'	210	—	—	—	U	—	—	—	—	12	—	—	—	—	13	—	—	—	—	0.55	—
27B27 10'	220	—	—	—	U	—	—	—	—	U	—	—	—	—	3.7	—	—	—	—	1.7	—
27B14 10'	230	—	—	—	U	—	—	—	—	U	—	—	—	—	32	—	—	—	—	22	—
27MW02	310	—	—	4.2	—	1.7	—	—	2.9	—	1.7	—	—	16	—	11	—	—	2	—	2.1
27MW01	350	—	—	U	—	U	—	—	0.38	—	0.22	—	—	7.7	—	5.5	—	—	40	—	13
27B13 10'	350	—	—	—	U	—	—	—	—	0.75	—	—	—	—	2.5	—	—	—	—	0.84	—
27MW04[b]	430	—	—	—	U	U	—	—	—	U	U	—	—	—	0.57	0.47	—	—	—	U	0.31
37-MJ-MW-10	440	—	—	U	—	—	—	—	U	—	—	—	—	40	—	—	—	—	5.8	—	—
Ferry Point Road Plume																					
27MW03[b]	-50	—	—	U	—	U	—	—	1.7	—	1.4	—	—	9.4	—	5.5	—	—	5.7	—	2.6
15-MW3	0	3	U	0.2	0.2	0.2	26	4	8.6	6.1	3.8	44	34	85	100	75	2	5	6	3.1	1.9
15-MW2	70	40	0.4	3.5	3.1	1	14	1	11	10	3.2	—	—	21	12	3.4	15	1	7	0.32	0.1
15MJ-MW1[b]	80	—	—	U	U	—	—	—	U	U	—	—	—	U	U	—	—	—	U	U	—
15-MW1	90	—	U	U	U	U	0.6	U	0.2	0.2	0.2	41	11	4	2.7	1.3	2	8	29	8.5	3.4

Table B-4 (continued)

Source:
BEI 2005

Notes:
[a] maximum values between 2002 and 2003 were used for model calibration, unless otherwise noted
[b] sampling location not used for calibration, because too far to side-gradient, too far upgradient, or higher concentration exist at nearby location
[c] dash indicates no data collected

Acronyms/Abbreviations:
µg/L – micrograms per liter
MCL – maximum contaminant limit
U – indicates the compound or analyte was analyzed for, but was not detected above the stated detection limit

Table B-5
Simulated Time to Achieve MCLs

Alternative and Simulation Description	PCE (years) [a]	TCE (years) [a]	DCE (years) [a]	VC (years) [a]
Alternative 3 Unremediated Source				
Building 168 Plume	0[b]	30	40	70
Ferry Road Plume	0	10	20	30
Alternative 4A Remediated Source				
Building 168 Plume, 50% reduction in concentration	0	25	35	60
Ferry Road Plume, 50% reduction in concentration	0	0	15	25
Alternative 6A Remediated Source				
Building 168 Plume, 90% reduction in concentration	0	5	15	45
Ferry Road Plume, 90% reduction in concentration	0	0	5	15
Alternative 7 Remediated Source				
Building 168 Plume, 80% reduction in concentration	0	15	25	55
Ferry Road Plume, 80% reduction in concentration	0	0	10	20

Notes:

[a] estimated time to achieve MCL is rounded upward to nearest 5-year increment

[b] MCL for PCE already achieved at both plumes.

Acronyms/Abbreviations:

DCE – cis-1,2-dichloroethene
MCL – maximum contaminant level
PCE – tetrachloroethene
TCE – trichloroethene
VC – vinyl chloride

Continue

Table B-6
Model Sensitivity Results

Parameter and Simulation Description	Time to Decrease Below MCL for cis-1,2-DCE (years) [a]	Time to Decrease Below MCL for VC (years)[a]
Base case		
Alternative 3, Building 168 Plume (Figure B-2)	40	70
Advection		
Groundwater velocity decreased by one-half (10 feet per year)[b]	110	190
Groundwater velocity increased by 2 times (40 feet per year)	40	70
Dispersion		
Dispersivity decreased by one-half (8.7 feet, longitudinal)	40	70
Dispersivity increased by 2 times (35 feet, longitudinal)[c]	110	185
Adsorption		
Retardation factor decreased by one-half (1.25)	35	70
Retardation factor increased by 2 times (3.75)[d]	80	125
Biotransformation (TCE, cis-1,2-DCE, and VC)		
Decay coefficient decreased by one-half (0.231, 0.116, 0.495 per year)	70	80
Decay coefficient increased by 2 times (0.924, 0.462, 1.98 per year)	30	70
Source concentration (TCE, cis-1,2-DCE, and VC)		
Initial concentrations decreased by one-half (2, 3, 10 mg/L)	35	60
Initial concentrations increased by 2 times (8, 12, 40 mg/L)	50	75
Source decay		
Decay rate constant decreased by one-half (0.050 per year)	100	175
Decay rate constant increased by 2 times (0.198 per year)	—[e]	—

Note:
[a] time to decrease below MCL is BIOCHLOR "simulation time" minus 40 years (2002-1962); estimated time to achieve MCL is rounded upward to nearest 5-year increment
[b] BIOCHLOR requires source decay rate constant to be less than 0.047 to prevent unstable solution (based on given retardation factor, biotransformation decay coefficient, groundwater velocity, and dispersivity)
[c] BIOCHLOR requires source decay rate constant to be less than 0.048 to prevent unstable solution
[d] BIOCHLOR requires source decay rate constant to be less than 0.066 to prevent unstable solution
[e] source decay rate constant could not be increased by 2 times; BIOCHLOR requires the value to be less than 0.10 to prevent unstable solution

Acronyms/Abbreviations:
DCE – dichloroethene
MCL – maximum contaminant level
mg/L – milligrams per liter
TCE – trichloroethene
VC – vinyl chloride