Aerojet General Superfund Site

U.S. Environmental Protection Agency • Region 9 • San Francisco, CA • August 2009

Proposed Plan For OU-5 Cleanup

EPA Requests Public Comment on Proposed Plan for the Perimeter Groundwater Operable Unit of the Aerojet Superfund Site

The United States Environmental Protection Agency (EPA) is seeking public comments on this **proposed plan*** for the Perimeter Groundwater **operable unit** (OU-5), one of several operable units of the Aerojet General Corporation Superfund Site in Rancho Cordova, California. This plan proposes actions to address health risks posed by contaminated **groundwater** on the north and south sides of the Superfund Site as well as risks posed by contaminated soil within a specific area of the Aerojet property.

The proposed cleanup plan for OU-5 will prevent further spread of groundwater contamination from the Site. The approved plan will be integrated with cleanup plans for the other operable units to achieve the final cleanup goals that include restoring the aquifer to its beneficial use. The contaminated groundwater flowing to the west of the Aerojet facility into Rancho Cordova and Carmichael was addressed in a proposed plan and **Record of Decision** (ROD) for the Western OU (OU-3), signed in 2002. The majority of the Western OU cleanup system has been constructed.

The public comment period for the proposed plan for OU-5 begins on August 3, 2009 and ends September 1, 2009. You can send your comments to EPA postmarked no later than September 1, 2009. EPA has scheduled a public meeting from 7 PM to 9 PM on Tuesday, August 11, at the Rancho Cordova City Hall, 2729 Prospect Park Drive in Rancho Cordova, to present the proposed plan and record verbal comments. For more information on how to comment, see the back page. Your written or verbal comments are an important part of the EPA's evaluation criteria and you are encouraged to participate. Your input can influence EPA's final decision.

Public Meeting

7 p.m. - 9 p.m.
Tuesday, August 11, 2009

Rancho Cordova City Hall
2729 Prospect Park Drive
Rancho Cordova

Comment Period

August 3, 2009 - September 1,2009

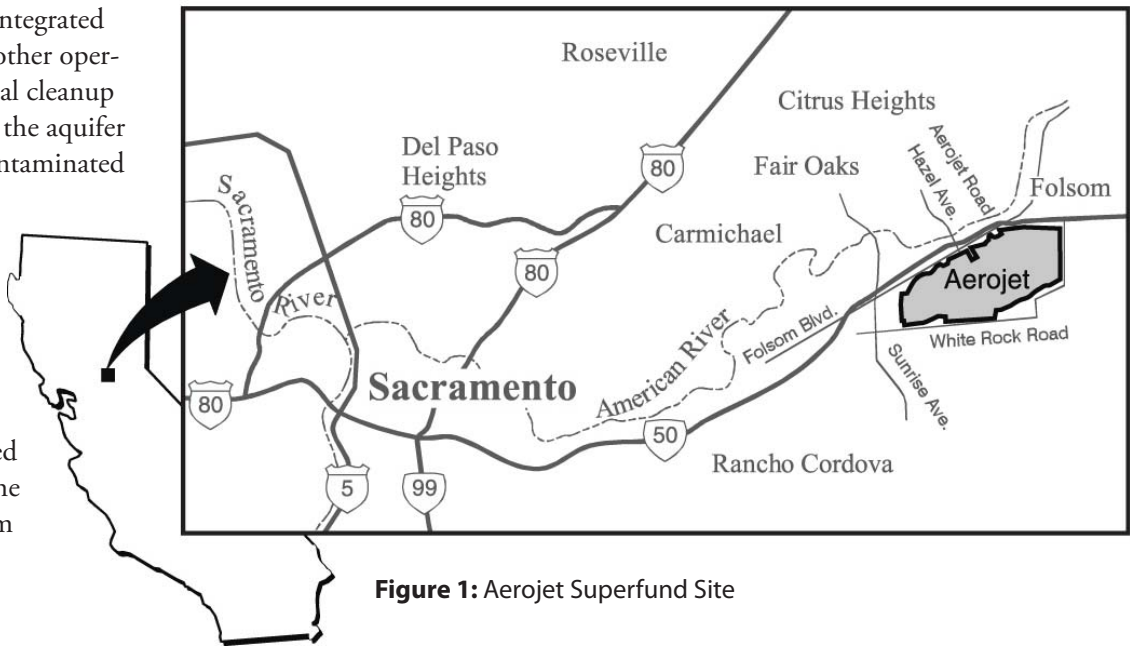


Figure 1: Aerojet Superfund Site

All words in* **bold *are defined in the Glossary on page 13*

This proposed plan identifies EPA's preferred remedies for soil and groundwater in OU-5 and summarizes the alternatives considered. It also summarizes the detailed information found in the **Remedial Investigation and Feasibility Study** (RI/FS) Reports and other documents contained in the **Administrative Record File (AR)** specifically for OU-5. The AR is available for public review at the information repositories listed on page 12.

EPA's primary objective is to protect public health and the environment from **contaminants** found in OU-5. The purpose of this proposed plan is to:

1. Inform the community about the history and environmental findings for OU-5
2. Describe the cleanup alternatives evaluated and EPA's preferred alternative
3. Solicit public comment
4. Describe how the public can become involved; and
5. Fulfill the public notice and comment requirements of the **Comprehensive Environmental Response, Compensation and Liability Act**, 42 U.S.C. §9617(a), and the **National Contingency Plan**, 40 CFR §300.430(f) (2) & (3).

After considering public comments, and in consultation with the California Department of Toxic Substances Control (DTSC) and the Central Valley Regional Water Quality Control Board (RWQCB), EPA will make its decision for the soil and groundwater cleanup for OU-5. EPA will respond to comments in a responsiveness summary that will be part of the final Record of Decision. The public will be notified once the ROD is available for review at the site repository, usually several months after the close of the public comment period.

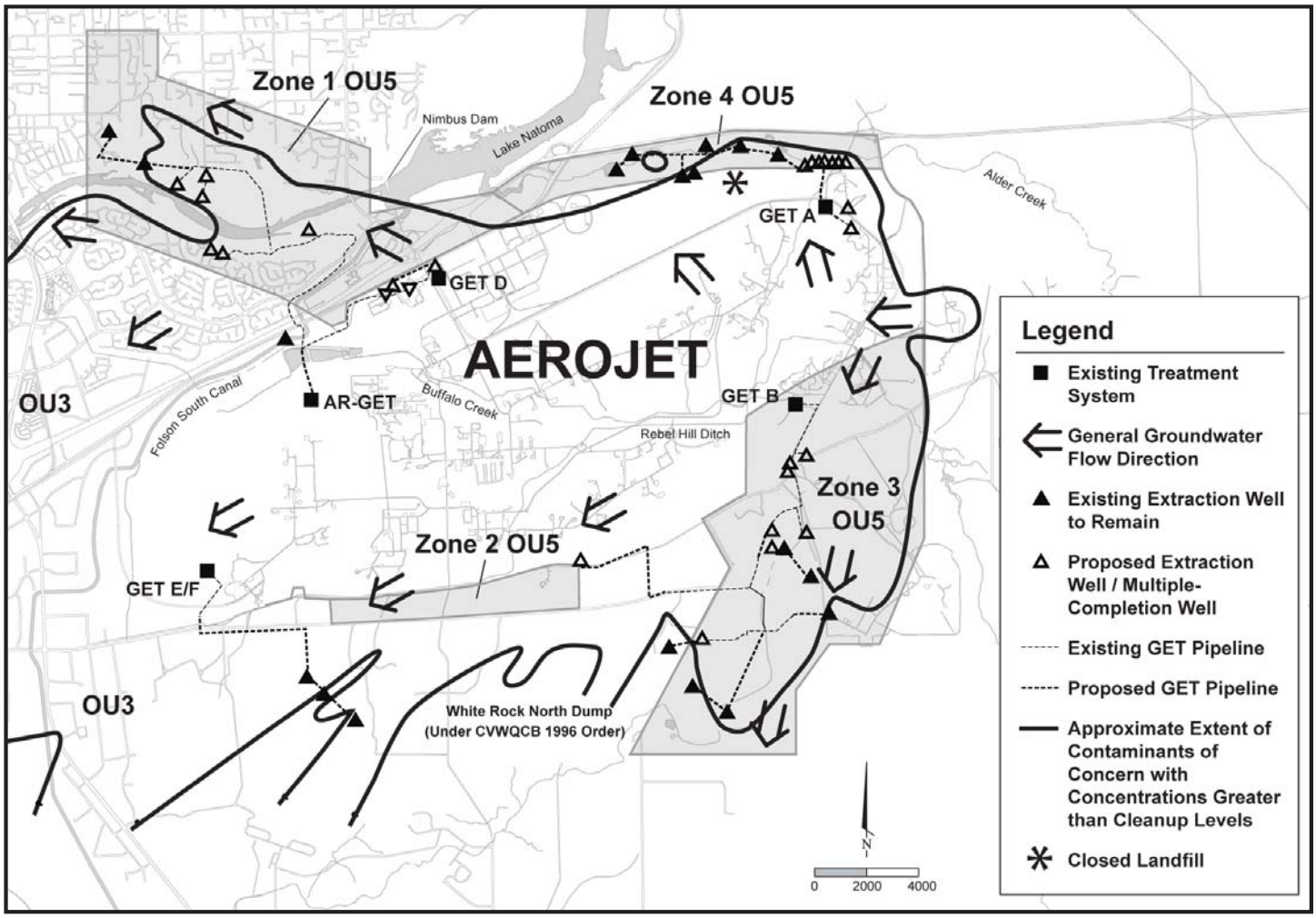


Figure 2: Location of OU-5 (shaded area), extent of contaminant plume and groundwater remedial actions

Site Background

Aerojet acquired the 8,500 acre site in 1953 (Figure 2) to develop and test rocket propulsion systems to support national defense, space exploration, and satellite deployment. The relatively isolated former gold mining area allowed large buffer zones between testing or manufacturing areas and the outer edge of the property. Growing communities spread closer to the Aerojet facility over the years.

Soil and groundwater have been contaminated by past disposal and operation practices from industrial chemical manufacturing, pesticide manufacturing and rocket propulsion systems manufacturing and testing operations. These past discharges of **chemicals of concern** (COC) resulted in contamination of surface and subsurface soil and groundwater hundreds of feet below the surface. Contaminated groundwater spread beyond the property boundaries into nearly 10 square miles beneath the surrounding communities. Although numerous types of chemicals have been used historically at the Aerojet site, trichloroethylene (TCE), perchlorate and N-Nitrosodimethylamine (NDMA) comprise the primary COCs for the groundwater in OU-5. TCE is a **volatile organic compound** (VOC) utilized on the Aerojet Site for cleaning and degreasing purposes. Perchlorate is a specialized salt used as an oxidizer in solid rocket propellants. NDMA is a **semi-volatile organic compound** (SVOC) that was either an impurity in hydrazine-based liquid rocket fuels or was formed during combustion of these fuels.

In the mid 1980s, Aerojet installed **groundwater extraction and treatment** (GET) systems to remove and treat VOCs and NDMA to protect the valuable groundwater resource as well as surface water that flows into the American River. To contain contaminated groundwater near the Aerojet Site boundary, GET A was installed in the northeastern portion of the contaminant plume, GET B was installed to the southeast, GETs E and F were installed in the northwest and southwest and GET D was installed in the north-central portion of Aerojet. The American River (AR) GET began operating in 1999 as an off-property extension of GET D (for GET locations see Figure 2 on page 2). The site was proposed to EPA's National Priorities List in 1982 and became final in 1993. The NPL is a list of the nation's largest and most hazardous waste sites.

In June 1989, EPA, DTSC and RWQCB signed a **Partial Consent Decree** with Aerojet to conduct a Remedial Investigation/Feasibility Study (RI/FS) for the site. As part of the 2001 Stipulation and Order Modifying Partial Consent Decree, the site was divided into OUs to expedite remedy implementation and define the potentially contaminated areas of surface and subsurface soil. About 5,900 acres of the 8,500 acre facility are potentially contaminated.

In August 2002, EPA and RWQCB issued parallel orders to Aerojet to begin or expand critical work to control the spread of contaminated groundwater. Aerojet was directed under the Partial Consent Decree to conduct an RI/FS to address groundwater contamination within OU-5, which was later expanded to add the investigation of potential soil sources located within areas slated for development. A solid waste landfill for inert solid waste and construction debris on the northern edge of the Aerojet property within OU-5 is being addressed by a closure plan that has been approved by Sacramento County and the State of California. The groundwater portion of the RI/FS for OU-5 reviewed the effectiveness of existing GETs A, AR, B and D and the overall groundwater containment requirements on the north and south sides of the Aerojet Superfund Site.

Over the last several years, EPA and State regulators have overseen a rigorous sampling and evaluation process to determine the potential risks to commercial workers and residents overlying contaminated groundwater and soils associated with the Site. The investigation also thoroughly examined the potential risks due to VOC vapors from contaminated groundwater to residents and workers. These measures were taken to ensure protection of public health and the environment during the long process to clean up groundwater and soils.

Site Characteristics

The land to the north of Aerojet's property has multiple uses including residential, recreational, office, commercial and industrial. The land to the south of Aerojet's property is used for recreation, ranching, agriculture and mining and is also undergoing planning for a mixed use development. Aerojet is in the process of applying for zoning modifications to its "Special Planning Area" designation by the Sacramento County Ordinance for its land within OU-5 to allow for mixed residential and commercial use. See Sacramento County Zoning Code, Title V, Chapter 8, Article 3.

Groundwater in the area is designated for municipal use as a drinking water source in accordance with the Central Valley Regional Water Quality Control Board Basin Plan. Public water supply wells around the Aerojet Site are closely monitored, and public water supplies are obtained from uncontaminated sources. None of the monitoring and extraction wells on Aerojet's property are used for potable water. The general groundwater flow direction varies at the Aerojet Site and is grouped into four main zones based on flow direction: zone 1 to the northwest; zone 2 to the west and southwest; zone 3 to the south; and zone 4 to the north-northwest (see Figure 2). The groundwater **aquifer** is separated into multiple Layers A through F (from shallowest to deepest below ground). These layers consist of permeable materials which readily allow water to flow horizontally and are generally separated by less permeable layers which restrict vertical flow between layers. Groundwater flow within individual layers may differ from the general groundwater flow in that particular zone of OU-5.

Surface water bodies in the area of OU-5 include Rebel Hill Ditch, Buffalo Creek and Alder Creek. Any water flowing in Rebel Hill Ditch drains back into the aquifer through the porous soil and does not flow off of Aerojet property. Buffalo Creek flows to the American River north of Aerojet. Buffalo Creek receives storm water discharge and industrial process water flows (primarily cooling water) from Aerojet under a RWQCB **National Pollution Discharge Elimination System** (NPDES) permit. Alder Creek flows into Lake Natoma from the northeast side of Aerojet and receives rainfall and some groundwater seepage. The remedial investigation found no groundwater contamination entering Alder Creek.

Scope And Role of the Aerojet Project and Perimeter Groundwater Operable Unit (OU-5)

EPA, RWQCB and DTSC set the first priority for the entire Aerojet Superfund Site to contain the expanding groundwater contamination from the Site and prevent further loss of drinking water supplies around the Site. The second Sitewide priority is to clean up the sources of contamination on the Aerojet property, located in part of this OU and five additional OUs covering the Aerojet property. The ultimate long-term goal of the entire Site is to clean up the groundwater to levels that allow beneficial uses and to clean up the soil to eliminate or control the sources of contamination.

The proposed cleanup for OU-5 will contain contaminated groundwater as close to the Site as possible on the north and south sides of the Site and remove contaminant sources on one part of the Aerojet property. Although the landfill in the northern portion of OU-5 (zone 4) is not included in the proposed actions for OU-5, EPA will review the monitoring results of the solid waste landfill closure to ensure both soil and groundwater protectiveness from this potential source of contamination. EPA expects that all potential risks from this landfill will be satisfactorily addressed by the approved landfill closure process with State and County oversight. If potential risks from the landfill are not adequately addressed, EPA will evaluate alternatives in an amendment to the ROD.

Implementing the proposed plan for OU-5, coupled with the existing OU-3 remedy to the west and other state enforcement actions to the south, will complete the containment of groundwater contamination around the boundary of the Site (Figure 2). The proposed plan for OU-5 also captures and treats groundwater contaminants flowing from the source areas on the Aerojet property. This action will eventually allow large portions of the contaminated aquifer to reach final cleanup levels (Table 1). This proposed plan is the final remedy for OU-5. Restoration of the aquifer to protective levels will take many decades. Remedial investigations of five other Operable Units in the source areas must be completed before final remedies are selected for the entire Aerojet Superfund Site.

Summary of Site Risk

Human health and ecological risk assessments were performed to identify and estimate potential risks to people and the environment from Aerojet's contamination of groundwater and soils, assuming current conditions and unrestricted future use of the land within OU-5. The ecological health assessment determined there are no ecological risks within OU-5 that require action. The human health assessment (HHA) established that the site poses potential risks requiring action based on site-specific information on potential exposure and on current values for the hazards posed by the chemicals of concern.

Potential risks from cancer-causing contaminants (carcinogens) are defined as the probability of a person getting cancer from a long-term exposure to those carcinogens. This probability is expressed as the number of additional cancers that might occur due to exposure to the Site's contamination. EPA's goal is to protect residents, workers and visitors at a site from increased risks of cancer by keeping the risks extremely low. EPA seeks to manage potential cancer risks so that they fall within or below a risk management range of one in ten thousand (1×10^{-4}) to one in one million (1×10^{-6}).

For contaminants that do not cause cancer but may cause other health effects (non-carcinogens), risk is expressed as a Hazard Index (HI). If the HI is less than or equal to 1.0, no adverse health effects are expected. An HI greater than 1.0 indicates an increased risk of health effects. The higher the HI, the more likely that health effects could be experienced, especially by people more sensitive to the chemical's effects.

Table 1: Groundwater Cleanup Levels (Principal contaminants are shaded)

Chemicals of Potential Concern	Containment and Cleanup Level (micrograms per liter or ppb)	
Non-Metal Anion		
Perchlorate	6	CA Drinking Water Standard (MCL)
SVOCs		
N-Nitrosodimethylamine (NDMA)	0.003	CA Public Health Goal
VOCs		
Trichloroethylene (TCE)	5	Federal MCL
1,1,2,2-Tetrachloroethane	1	CA MCL
1,1,2-Trichloroethane	5	Federal MCL
1,1-Dichloroethylene	6	CA MCL
1,2-Dichloroethane	0.5	CA MCL
1,2-Dichloroethene cis	6	CA MCL
1,2-Dichloroethene trans	10	CA MCL
1,4-Dioxane	3	Federal Public Health Advisory
Bromodichloromethane	80	Federal MCL
Carbon tetrachloride	0.5	CA MCL
Chloroform	80	Federal MCL
Dibromochloromethane	80	Federal MCL
Methylene chloride	5	Federal MCL
Tetrachloroethylene	5	Federal MCL
Vinyl chloride	0.5	CA MCL

Groundwater

The HHA concluded that contaminated groundwater within the plume shown on Figure 2 exceeds drinking water standards and that groundwater contamination must be contained to prevent further contamination of the existing drinking water aquifer. The three most prevalent contaminants detected in the groundwater are perchlorate, NDMA and TCE (see Table 1 for the list of all groundwater contaminants detected.). These were found in all four zones of OU-5, with the exception of NDMA, which is found in all zones except zone 2. The on-property and off-property cancer risk for all four zones exceeds EPA's target risk range. The HIs are well over 1. Remedial action to prevent further contamination and cleanup of the drinking water aquifer is justified by the potential risks.

Surface Soil and Near Surface Soil

The potential soil source sites that were investigated are shown on Figure 3 on page 7. The majority of the locations were not contaminated above health based levels for unrestricted use such as residential development. Eleven soil areas were found to be contaminated with one or more chemicals of concern (Table 2). The HHA found that further action is required at these 11 locations to protect residents or

Table 2: Risk-Based Cleanup Goals for Soil Perimeter Groundwater Operable Unit for Residential/Unrestricted Use or Commercial/ Restricted Use.

Chemical	Unrestricted Use Level (Residential Use)		Restricted Use (Commercial Use)	
	Soil concentration mg/kg soil	Risk basis	Soil concentration mg/kg soil	Risk basis
2,3,7,8-TCDD (Dioxin)	3.9E-06	Cancer	1.6E-05	Cancer
Antimony	31	Non-cancer	120	Non-cancer (construction worker)
Bis(2-Ethylhexyl)phthalate	35	Cancer	123	Cancer
Cadmium	48	Cancer (construction worker)	48	Cancer (construction worker)
Diethyl phthalate	49,000	Non-cancer	186,000	Non-cancer (construction worker)
Di-n-butyl phthalate	6,110	Non-cancer	23,280	Non-cancer (construction worker)
Hexavalent chromium	1.4	Cancer (construction worker)	1.4	Cancer (construction worker)
Lead	127	Non-cancer	531	Non-cancer (construction worker)
Mercury	23.5	Non-cancer	84	Non-cancer (construction worker)
Perchlorate*	55	Non-cancer	210	Non-cancer (construction worker)
PCB-1254	0.09	Cancer	0.3	Cancer
PCB-1260	0.09	Cancer	0.3	Cancer
Silver	390	Non-cancer	1,500	Non-cancer (construction worker)
Zinc	23,400	Non-cancer	90,000	Non-cancer (construction worker)

*Perchlorate cleanup goal for protection of groundwater quality is 0.6 mg/kg soil.

workers from exposure through direct contact, ingestion and/ or inhalation of COCs. The contaminants found in these areas include lead, zinc, cadmium, polychlorinated biphenyls (PCBs), dioxins, furans, chloroform and TCE. Table 2 shows the cleanup goals for each COC based on the lowest cancer or non-cancer risks for potential land uses (residential or commercial). In some cases, cadmium and chromium contamination in the soil could be of concern for construction workers at the Site.

The HHA concluded that remedial action for the **vadose zone** was justified in areas 32D, 34D, 35D and 38D (Figure 3) because the contaminants exceeded EPA's target risk range for protection from inhaling VOCs and the HI for the contaminants present were significantly over 1. The vadose zone is the soil from the ground surface to the shallowest groundwater, approximately 100 feet below the ground surface. The HHA identified three areas (7D, 33D and FCS) where VOCs from the shallow contaminated groundwater or soil were measured in soil gas exceeding EPA's target risk range.

Perchlorate was measured in the subsurface at one location, C41, which could threaten groundwater quality over the long term even if the top 10 feet of soil were excavated for protection of inhabitants or other users. The state has estimated that a soil perchlorate concentration of 0.6 mg/kg would protect the groundwater.

Remedial Action Objectives

The Remedial Action Objectives (RAOs) describe what the proposed Site remediation effort is expected to accomplish. The cleanup levels for groundwater (Table 1) are based on Federal EPA Maximum Contaminant Levels (MCLs) for drinking water or on California MCLs, if that is a lower concentration. Neither an MCL nor a Federal Public Health Advisory level has been established for NDMA, so the action level for NDMA is the California Public Health Goal. Since 1,4-dioxane also has no MCL, the action level for 1,4-dioxane is set at the Federal Public Health Advisory for drinking water, which is also California Department of Public Health's Notification Level for drinking water. These groundwater action levels ensure that public health and the environment are protected. For contaminated soil, the action objectives are based on site-specific potential exposure information as used in the HHA and on current values for the hazards posed by the chemicals of concern. The soil action levels (Table 2) are calculated to reduce human health risks to protective levels.

Groundwater RAOs

The proposed remedy for OU-5 is the final remedy for this OU. Complete cleanup of the entire Aerojet Superfund Site will require coordination of all seven groundwater and source operable units. Specifically, the groundwater RAOs for OU-5 are as follows:

- Protect human health and the environment from exposure to contaminated groundwater;
- Achieve containment of the contaminated groundwater to prevent future migration of contaminants until cleanup levels are achieved to protect long-term beneficial uses of drinking water sources;
- Restore groundwater to beneficial uses between the upgradient and downgradient containment barriers established in the OU-5 remedy.

Soil and Vadose Zone RAOs:

- Prevent migration of VOCs and perchlorate in the soil that would impact long-term beneficial uses of groundwater;
- Prevent exposure of VOCs through inhalation (breathing), ingestion and skin contact with soils or soil vapor exceeding the EPA cleanup levels for residential or commercial land use. Where commercial criteria are used, the land will be restricted to commercial use through a land use covenant.
- Eliminate exposure to concentrations of pollutants in soils that pose an unacceptable risk for present and future occupants of the property and the environment.

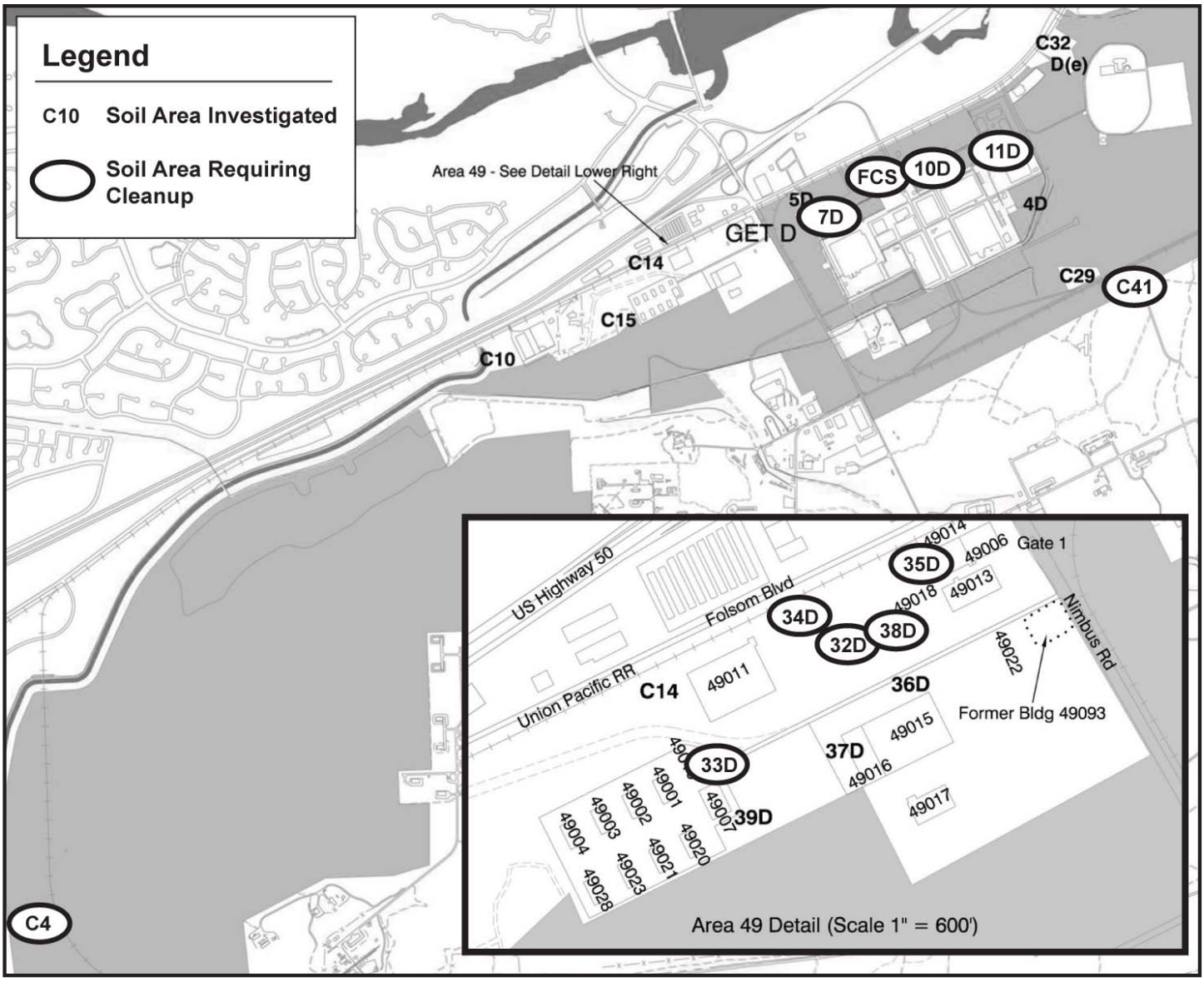


Figure 3: Aerojet OU5 RI/FS Soil Sites

Summary Of Remedial Alternatives

EPA is required by law to consider a No Action alternative and to evaluate cleanup alternatives against nine criteria shown on Figure 4. The OU-5 soil and groundwater alternatives were compared against all of the nine evaluation criteria except community acceptance, which is being solicited with this proposed plan. For an alternative to be considered as a possible final remedy, it must meet EPA's two threshold criteria which are (1) to protect human health and the environment and (2) to comply with specific state and federal regulations known as **Applicable or Relevant and Appropriate Requirements** (ARARs). The No Action alternative for both soil and groundwater for OU-5 is not a viable remedy alternative because it does not meet either of EPA's threshold criteria.

Summary of Groundwater Alternatives

Zones 1 through 4 were each evaluated to determine if additional groundwater control was needed. The RI determined that each of the four zones required action to protect public water supplies. Beyond the required No Action alternative, the FS assessed a range of possible actions in each zone needed to prevent further spread of groundwater contamination (Groundwater Containment) and additional steps to control elevated concentrations of groundwater contamination in order to expedite the remedy (Groundwater Containment with Mass Removal). Groundwater containment alternatives were consolidated into three alternatives 1) No Action; 2) Groundwater Containment Alternatives; and 3) Groundwater Containment and Mass Removal (EPA's preferred alternative).

Each alternative, including the No Action option, requires thorough monitoring to ensure that the remedy is effective and protective. Therefore, even the No Action option would cost an estimated $5 million over the standard 30-year period used for estimating system costs.

Both Groundwater Containment and Containment with Mass Removal alternatives involve the pumping of sufficiently large volumes of contaminated water to prevent the spread of contaminants above the action levels into uncontaminated areas. It is estimated that either of these alternatives would pump between 10 and 15 million gallons of groundwater each day. The water will be piped to one of several treatment systems (see Figure 2) where a series of standard, reliable treatment systems remove the various contaminants. The treated water may either be provided directly to the drinking water system, used for non-potable purposes such as industrial cooling or discharged to surface water. If the treated water will be provided directly to the drinking water system, the appropriate California Department of Public Health approval shall be obtained and it will also comply with all federal drinking water standards and California DPH requirements. If treated water will be discharged on-site, it will comply with the substantive requirements of an NPDES permit; off-site discharge will require an NPDES permit. Treated water used for non-potable purposes must comply with all applicable regulations. Many of the details, such as final well location and pumping rates, will be determined in the design phase of the project. The estimated 30-year cost for Groundwater Containment is $57 million. Assuming no continued source contribution, the groundwater cleanup levels in the four zones could be reached between 150 and 350 years with the Groundwater Containment alternative.

The Groundwater Containment with Mass Removal alternative includes additional extraction of more highly contaminated groundwater nearer the source areas to reduce the mass of contaminants more effectively. The estimated 30-year cost for Groundwater Containment with Mass Removal is over $61 million. The estimated time for reaching cleanup levels with this alternative varies from 120 years in zone 1 to 230 years for zone 4, a reduction of 15 to 40 percent from the Containment alternative alone.

Summary of Soil and Soil Vapor Alternatives

More than 25 soil areas of potential concern in OU-5 were investigated (Figure 3 on page 7). The majority of the soil areas meet residential use requirements. Of the 11 contaminated soil areas, some form of remedial action is required to allow the land to be developed. All options, including the No Action option, would require careful and thorough monitoring to ensure effectiveness and protectiveness.

The 11 contaminated soil locations have a range of different contaminants that may be addressed effectively by different alternatives. Of the many alternatives considered, the most viable options were:

- Excavation (physical removal) of the contaminated soil with various disposal options: disposal in an approved landfill, treatment and recycling as fill material, solidification/stabilization and biological treatment (for perchlorate);
- Containment with an impermeable asphalt or membrane cap;
- Soil vapor extraction to remove VOCs without excavation;
- Vapor mitigation to reduce or prevent VOC intrusion into buildings through vapor barriers (synthetic membrane) and subslab venting systems and/or subslab depressurization systems; and,

- Institutional Controls such as deed notification to inform future owners of the presence of potentially hazardous substances at the site and /or deed restriction to restrict future use of site.
- Biological treatment for perchlorate in soil too deep for excavation. This system is in development and it has not yet been proven effective for the one location in OU-5 with perchlorate in the subsoil. If treatment is not viable, the perchlorate would be expected to gradually move into the groundwater where it would be captured and treated by the groundwater containment system

Evaluation Of Alternatives

The alternatives have been evaluated against eight of EPA's nine evaluation criteria. The ninth criterion, which is community acceptance, will be evaluated by the community response to this proposed plan for OU-5.

Groundwater

Federal regulations require that Superfund remedies remain protective of human health and the environment over time and that they minimize untreated waste. EPA expects to use treatment to address the principal threats and to use engineering controls such as containment for relatively low long-term threats or where complete treatment is impracticable. Institutional controls, such as restrictions on land or water use, may be used to supplement treatment and engineering controls as appropriate for long-term management but are not substitutes for practicable active response measures. EPA regulations also anticipate prevention of further exposure to contaminants and spread of the contaminant plume as well as returning groundwater to beneficial uses within a timeframe that is reasonable, given the particular circumstances of the site.

The evaluation of groundwater remedy alternatives is presented in Table 3. The primary benefit of the Groundwater Containment with Mass Removal alternatives is a significant reduction in the estimated time to achieve groundwater action levels in zones 2 and 4 compared to containment alone. Restoration could be achieved within 130 years for zone 2 and 200 years for zone 4 compared to 230 years and 350 years, respectively, with the Groundwater Containment alternative. The time to achieve remediation goals in zones 1 and 3 would be reduced 30 to 60 years compared to Containment alone. A more thorough and detailed analysis can be found in the RI/FS report available at the information repositories.

Figure 4: EPA's Nine Evaluation Criteria

Soil Areas

The detailed evaluation of soil remedy alternatives for the 11 locations with contaminated soil can also be found in the RI/FS report available at the information repositories. A simplified analysis focusing on the preferred alternatives is presented in Table 4, and the alternatives considered are discussed below.

Soil areas 32D, 34D, 35D and 38D are contaminated with VOCs at concentrations above cleanup goals for either residential or commercial use. The only viable technology which has the potential for attaining unrestricted use levels for these areas is soil vapor extraction (SVE). Containing the VOCs in place with an impermeable cap would not meet the RAO for unrestricted use and could pose a risk for groundwater contamination.

The contaminants in areas 10D, 11D, C4 and C41 include lead, PCBs, Dioxin and perchlorate. The only viable alternative to meet the criteria for protectiveness is to remove the contaminants by excavation. Three potential alternatives were considered for the contamination within the top 10 feet of soil: treatment of perchlorate in the near-surface soil, institutional controls restricting land use to non-residential and excavating the contaminated soil. Proven methods for treating perchlorate in the surface soils at area C41 pose the risk of flushing some of the contaminant into the groundwater and would not meet EPA's protectiveness criteria. Land use restrictions alone are not protective because current contaminant levels would prevent even commercial or industrial uses in some areas. An option for sites planned for commercial or industrial uses would be to excavate enough contaminated soil to meet the restricted use action levels and limit the land use by institutional controls. To meet the objective of protecting the groundwater from perchlorate in the soil, a combination of excavating the top 10 feet of soil and implementing a potential method for biologically treating the deeper soil was considered. Currently, biological methods have not been proven effective for this application.

Table 3: Groundwater Alternative Evaluation

Evaluation Criteria	No Action (monitor)	Groundwater Containment	Groundwater Containment with Mass Removal (Preferred)
Overall Protectiveness	○	●	●
Compliance with State & Federal Requirements	○	●	●
Long-term Effectiveness	○	◒	●
Implementability	NA	●	●
Short-term Effectiveness	NA	●	●
Reduction of Toxicity, Mobility or Volume by Treatment	○	●	●
Estimated Project Cost	$5.1 M	$56.8 M	$61.3 M
State Agency Acceptance	CA Department of Toxic Substance Control & CA Central Valley Regional Water Quality Control Board concurred with EPA's highlighted preferred alternative, with the exception that the RWQCB State prefers a lower TCE and chloroform containment level based on final and draft Public Health Goals.		
Community Acceptance	Community acceptance of the preferred alternative will be evaluated after the public comment period.		

○ = Does not meet criterion ◒ = Partially meets criterion ● = Meets criterion

The only viable remedy for residential use is vapor mitigation beneath buildings constructed in the areas to prevent movement of contaminants into the buildings. The RI /FS indicated that SVE would not be effective for cleaning up the low concentrations of VOCs measured in soil vapor in areas 7D, FCS and 33D to meet the goals for unrestricted use. In addition, the VOCs at 7D and FCS originate from contaminated groundwater moving laterally from sources outside OU-5. If any of these areas are to be used for commercial use only, institutional controls would be required.

Preferred Alternative

While EPA is presenting its preferred alternatives for soil and groundwater, public response to this proposed plan can change what EPA is proposing.

Table 4: Evaluation of viable alternatives for Soil Cleanup. Other alternatives are discussed in Evaluation of Alternatives and Preferred Alternative sections.

Evaluation Criteria	No Action (monitor)	7D, 33D and FCS –Vapor Mitigation and Deed Restriction (Preferred)	No Action (monitor)	C4, C41, 10D and 11D – Excavate & Landfill, Treat and/ or Recycle (Preferred)	No Action (monitor)	Areas 32D, 34D, 35D and 38D –Capping and Deed Restriction	Areas 32D, 34D, 35D and 38D –Capping & Soil Vapor Extraction (Preferred)
Overall Protectiveness	○	●	○	●	○	●	●
Compliance with State & Federal Requirements	○	●	○	●	○	◒	●
Long-term Effectiveness	○	◒	○	●	○	◒	◒
Implementability	NA	●	NA	●	NA	●	●
Short-term Effectiveness	NA	●	NA	●	NA	●	●
Reduction of Toxicity, Mobility or Volume by Treatment	○	○	○	●	○	○	◒
Estimated Project Cost	$0	$28,000	$0	$631,000	$0	$366,000	$1,039,000
State Agency Acceptance	CA Department of Toxic Substance Control & CA Central Valley Regional Water Quality Control Board concurred with EPA's highlighted preferred alternative, with the exception that the RWQCB prefers a lower cleanup goal for hexavalent chromium based on a draft California Public Health Goal.						
Community Acceptance	Community acceptance of the preferred alternative will be evaluated after the public comment period.						

○ = Does not meet criterion ◒ = Partially meets criterion ● = Meets criterion

Groundwater

EPA prefers Groundwater Containment with Mass Removal because this provides long-term containment of groundwater contamination and will reduce the duration of the remedy, although the estimate remains many decades. The preferred groundwater alternative provides the best hydraulic control and contaminant mass removal. Treatment of the extracted groundwater to the discharge limits, using a series of treatment methods for the various COCs, has been demonstrated to be reliable and effective at this Site. Monitoring of the effectiveness and protectiveness of the remedy is required to ensure that the remedial action objectives are met. When all contaminants of concern reach their individual groundwater cleanup levels, neither the cumulative cancer risk nor the cumulative non-cancer risk will exceed EPA's target risk range. The State of California supports the alternative for cleanup of groundwater, with the exception that the Regional Water Quality Control Board prefers lower cleanup goals for TCE and chloroform based on final or draft California Public Health Goals.

Soil Areas

EPA's preferred soil alternatives incorporate active measures to eliminate or reduce contaminants and control contaminated soil in the 11 areas exceeding risk-based limits on land use (see Figure 3).

Soil areas 32D, 34D, 35D and 38D, covering a total of approximately 11 acres in close proximity to each other, contain VOCs in the vadose zone that must be remediated. It is proposed to install and operate a vapor extraction system for these soil areas to remove VOCs from the top 30 feet of soil. In addition, a temporary asphalt cap will be constructed over the surface to improve capture of the VOCs. Contaminants in the vapors would be captured and treated by granulated carbon or destroyed using an existing catalytic oxidation system. If the cleanup does not attain unrestricted use levels, the land would be restricted to commercial use with a land use covenant.

For soil areas C4 and C41, it is proposed that the contaminated soil be excavated and transported to an approved landfill or excavated and treated to remove the contaminants to the residential soil action levels. The land would then be acceptable for unrestricted use such as residential development. Alternatively, the contaminated soil may be excavated, treated as appropriate and recycled for use under future site roadways. If necessary, the roadway land use would be restricted using a land use covenant. Perchlorate contamination in soil area C41 extends beneath the excavation depth and may represent an ongoing source to groundwater. Vadose zone perchlorate cleanup methods are being developed and, if successful, may be used at area C41. If treatment methods do not prove viable for this location, the perchlorate could gradually move into the groundwater where it would be captured and treated with the groundwater remedial action.

Excavation of the surface soils are also proposed for areas 10D and 11D. It is possible that sufficient contaminated soil could be removed to allow for unrestricted use of the land. Although future land use is currently planned for commercial development with less stringent cleanup objectives, EPA prefers cleanup to residential risk levels which allows unrestricted use and avoids institutional controls. The estimated difference in costs between cleanup to unrestricted versus restricted uses is $80,000, which does not add significantly to the overall project costs. The RI estimated that less than 2,000 cubic yards of contaminated soil would be excavated from C4, C41, 10D and 11D locations.

In areas 7D, 33D (each about 0.1 acres) and the Former Company Store location (FCS, approximately 3.4 acres), some VOCs were detected near the surface due to elevated concentrations currently in the groundwater or soil. The RI concluded that neither soil excavation nor soil vapor extraction would be effective until levels of VOCs in the groundwater are reduced by controlling sources outside OU-5. Risks in these areas are proposed to be controlled by vapor mitigation systems that prevent movement of contaminants into buildings. Vapor mitigation systems typically include vapor barriers and venting of vapors from beneath the structure, either passively or though pressure changes. Appropriate monitoring and land use covenants are required for either residential or commercial use of these locations.

The soil action levels are sufficiently protective that even if all COCs were present at their cleanup goals, neither the cumulative cancer risk nor the cumulative non-cancer risk would exceed EPA's target risk range.

The State of California supports the preferred alternatives for cleanup of the soil areas, with the exception that the Regional Water Quality Control Board prefers a lower cleanup goal for hexavalent chromium based on a draft California Public Health Goal.

Community Advisory Group

The Community Advisory Group for Aerojet Superfund issues meets bimonthly to exchange information with regulatory agencies and Aerojet on Site issues. This includes discussing community concerns regarding the investigation and cleanup of the Site. To get further information on this group, contact Janis Heple, Chairperson, at (530) 757-8602.

Site Repositories

Sacramento Central Library
8281 I Street
Sacramento, CA 95814
(916) 264-2700

California State University
Sacramento Library (Reference Desk)
2000 State University Drive East
Sacramento, CA 95819-6039
(916) 278-5673

EPA Superfund Records Center
95 Hawthorne Street, 4th floor
San Francisco, CA 94105
(415) 536-2000

For more information on the Site and related documents visit the web page at: **www.epa.gov/region09/Aerojet**

Glossary

Administrative Record File – A compilation of documents which form the basis for selecting a CERCLA response action for the site.

Applicable or Relevant and Appropriate Requirements (ARARs) – Those promulgated substantive standards, requirements, criteria or limitations under federal or more stringent state environmental or facility siting laws that are applicable to the proposed cleanup of the site or, if not applicable, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited for that site.

Aquifer – An area below ground surface through which water will readily flow (e.g., sand or gravel).

Chemicals of Concern (COCs) – Site-specific chemicals that exceed regulatory protection levels.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) – 1980 public law, amended in 1986, covering investigation, funding and implementation for site cleanup. 42 U.S.C. §§ 9601-9675.

Contaminants – Any chemical, biological or related substance that has an adverse effect on human health or the ecological environment.

Feasibility Study (FS) – A study specified by the NCP that develops and evaluates options for cleaning up a contaminated site.

Groundwater – A supply of water found below the ground surface, usually in aquifers.

Groundwater Extraction and Treatment System (GET) – A system of wells, pipelines and water treatment units used to remove contaminated water from the aquifer and control the spread of the contaminants. The treatment units vary with the types and concentrations of contaminants, and may include a carbon filter to remove VOCs, a resin filter or biological treatment to remove perchlorate and/or ultraviolet destruction of NDMA.

National Contingency Plan (NCP) – Regulations providing the organizational structure for, and responding to discharges of, oil and releases of hazardous substances, pollutants and contaminants. 40 Code of Federal Regulations, Part 300.

Operable Unit (OU) – At large and/or complex sites the remediation may be broken into two or more parts or pieces, each of which is designated an Operable Unit, and is numbered consecutively (e.g., OU1, OU2, etc.).

Partial Consent Decree (PCD) – A judicially enforceable agreement between EPA and a potentially responsible party (PRP) or multiple parties (PRPs) that requires the PRP to perform specific activities leading to a cleanup of the site.

Proposed Plan – A proposal required by the NCP for remediation of part or all of a site after completing an RI/FS. The Proposed Plan is provided to the public for comment.

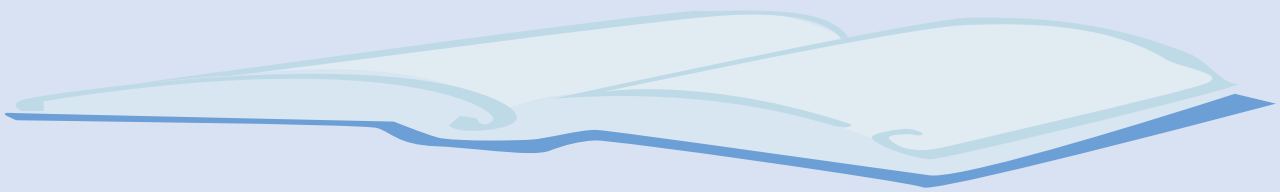
Record of Decision – Decision document required by the NCP which specifies a selected remedy for all or part of a CERCLA site after public comment on the proposed plan.

Remedial Investigation (RI)- A process specified by the NCP for investigating the nature and extent of contamination at a site.

Semi-Volatile Organic Compound (SVOC) - Organic compounds that volatilize (vaporize or evaporate) into the atmosphere more slowly than VOCs. Common SVOCs include N-Nitrosodimethylamine (NDMA), Polycyclic Aromatic Hydrocarbons (PAH), Polychlorinated Biphenyls (PCB), and a number of pesticides and herbicides. SVOC's are not as volatile as VOCs.

Vadose Zone – The vadose zone is the area between the land surface above and the water table below.

Volatile Organic Compound (VOC) – Organic compounds that easily volatilize (vaporize or evaporate) into the atmosphere. VOCs include trichloroethene (TCE) and chloroform



EPA Requests Public Comment on Proposed Plan for the Perimeter Groundwater Operable Unit of the Aerojet Superfund Site

How to Comment

Mail comments on the proposed plan to **Kevin Mayer** at the address listed below, postmarked no later than September 1, 2009. You may also submit your comments via e-mail or fax.

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