JULY, 1992

RESPONSES TO COMMENTS OF THE DTSC AND THE CITY OF SACRAMENTO UNION PACIFIC RAILROAD YARD SACRAMENTO, CALIFORNIA

DAMES & MOORE

JULY 1992
PROJECT NO. 00173-072-044

SAC42.027

DAMES & MOORE

8801 FOLSOM BOULEVARD, SUITE 200, SACRAMENTO, CALIFORNIA 95826
(916) 387-8800 FAX: (916) 387-0802

July 28, 1992

Mr. Val L. Siebal
Region 1, Department of Toxic Substances Control
California Environmental Protection Agency
10151 Croydon Way, Suite 3
Sacramento, CA 95827

Attention: Mr. James L. Tjosvold, P.E., Chief
Sacramento Responsible Party Unit
Site Mitigation Branch

Re: Transmittal
Responses to Comments of the
DTSC and the City of Sacramento
Union Pacific Railroad Yard
Sacramento, California
Project No. 00173-072-044

Dear Mr. Tjosvold:

Union Pacific Railroad Company (UPRR) has requested that Dames & Moore transmit the above-referenced document. Provided as Attachments 1 and 2 in the document are responses to comments of the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) and the City of Sacramento on the Addendum Remedial Investigation/Feasibility Study Report (Dames & Moore, November 1991) and the Draft Remedial Action Plan (Dames & Moore, November 1991). Additionally provided as Attachments 3, 4, and 5, are recalculations of the cancer risk associated with background concentrations of arsenic in soil.

If you have any questions or require further clarification, please contact the undersigned at (916) 387-7527.

Sincerely,

DAMES & MOORE

Timothy R. Parker
Project Manager

Attachment

cc: Distribution List

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DISTRIBUTION LIST: UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA
PROJECT NUMBER 00173-072-044

Mr. Glenn Thomas
Union Pacific Railroad Company
1416 Dodge Street, Room 930
Omaha, NE 68179

Mr. Val W. Siebal, Regional Administrator
Region 1
Department of Toxic Substances Control
California Environmental Protection Agency
10151 Croyden Way, Suite 3
Sacramento, CA 95827-2106
Attn: Mr. James L. Tjosvold, P.E.

Mr. Jose Salcedo, Project Manager
Region 1
Department of Toxic Substances Control
California Environmental Protection Agency
10151 Croyden Way, Suite 3
Sacramento, CA 95827-2106

Ms. Antonia Vorster
Regional Water Quality Control Board
3443 Routier Road
Sacramento, CA 95827-3098

Mr. Mel Knight
County of Sacramento
Hazardous Materials Division
8475 Jackson Road, Suite 230
Sacramento, CA 95826

Mr. Joe Serna, Jr.
Councilman, District 5
915 I Street, Room 205
Sacramento, CA 95814
Attn: Sally Hencken, Aid

DISTRIBUTION LIST: **UNION PACIFIC RAILROAD YARD**
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Mr. Tom Finley, Division Manager
Department of Public Works
City of Sacramento
927 Tenth Street, Room 200
Sacramento, CA 95814

Mr. Reginald Young
Deputy Director Public Works
City of Sacramento
915 I Street, Room 207
Sacramento, CA 95814

Mr. Bob Thomas
Deputy City Manager
915 I Street, Room 101
Sacramento, CA 95814

Ms. Genevieve Shiroma
Sierra Curtis Neighborhood Association
2791 24th Street
Sacramento, CA 95818

Sacramento City College Library
Library Reference Desk
3835 Freeport Boulevard
Sacramento, CA 95822

City Clerk's Office
City of Sacramento
City Hall, Room 304
915 I Street
Sacramento, CA 95814

Belle Cooledge Library
(Lanai Shopping Center)
5681 Freeport Boulevard
Sacramento, CA 95822

Ms. Marty Rozelle
Dames & Moore
Pointe Corporate Centre
7500 North Dreamy Draw Drive, Suite 145
Phoenix, AZ 85020

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SACRAMENTO, CALIFORNIA
PROJECT NUMBER 00173-072-044

Mr. Roy Patterson
Dames & Moore
6 Hutton Centre Drive, Suite 700
Santa Ana, CA 92707

Mr. Jeff Asay
Union Pacific Railroad Company
Assistant General Solicitor
5500 Ferguson Drive, Suite J
Los Angeles, CA 90022

Ms. Patricia Mendoza
City of Sacramento
Department of Planning & Development
1231 I Street, Room 300
Sacramento, CA 95814

Mr. Daniel P. Costa
Greve, Clifford, Diepenbrock & Paras
1000 G Street, Suite 400
P.O. Box 2469
Sacramento, CA 95812-2469

Appendex 1
one

ATTACHMENT 1

DTSC COMMENTS AND UPRR RESPONSES
LEACHABILITY STUDY
REVISED BASELINE HEALTH RISK ASSESSMENT
AND
DRAFT REMEDIAL ACTION PLAN

UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

TABLE 1
DTSC COMMENTS AND UPRR RESPONSES
LEACHABILITY STUDY
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
Letter to UPRR from the DTSC, dated 3/11/92	Appendix I - We believe the Leachability Study contained a number of non-conservative assumptions particularly the use of a biodegradation rate which we believe may not occur in the field. Further, the calculated values appear inconsistent with values which would be derived from the "Leaking Underground Fuel Tank (LUFT) Field Manual" and higher than values typically used for remediation. We would not accept the TPH RAOs without verification of the model and assumptions. Instead, we recommend the following clean-up levels: 100 ppm for diesel range TPH and 10 ppm for gasoline range TPH. These values are based on the LUFT Field Manual, although we recognize that it is not directly applicable to this site.	The only assumption identified which may be non-conservative is the degradation rate, which was an average, literature-based value. This assumption will be reviewed and modified, as necessary. Since the LUFT levels are not applicable, the model and assumptions will be verified and TPH RAOs based on the verified model.

TABLE 2
DTSC COMMENTS AND UPRR RESPONSES
REVISED BASELINE HEALTH RISK ASSESSMENT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
Letter to UPRR from the DTSC, dated 3/11/92	Lifetime cancer risk for average background concentration for arsenic at 8 ppm is not calculated correctly. According to the Addendum RI/FS Report, a 10^{-6} cancer risk is associated with a concentration of 0.044 ppm. This translates to an arsenic background risk of 2 in 10,000.	Risks associated with background concentrations of arsenic in soil have been recalculated based on the results of the meeting of March 17, 1992 between Dames & Moore and DTSC. This recalculation is presented in Attachment 3 to these comments.
	A table listing the RAOs for all contaminants of concern should be contained in the RAP.	This table will be provided in the revised RAP, as requested. It will contain the revised risk-based RAO for arsenic in soil, which was calculated as described in the response to the previous comment, and the RAOs associated with restricted land uses.
Memorandum to DTSC Jose Salcedo from Jim Carlisle/Michael Wade, dated 1/21/92	In the text (page 24) Table 9 is identified as dealing with off-site groundwater, while the title indicates that Table 9 deals with on-site groundwater	The table is correct. The text should identify Table 9 as dealing with on-site groundwater.
	10 μg/dL is still identified as a target level (page 51 paragraph 2) rather than a level of concern (for lead). There is also an apparent inconsistency between sections 4.3.2 and 5.1.3 of the text. The latter lists inhalation as a route that was addressed using default parameters, while the former states that site-specific data were used to determine exposure by inhalation.	Reference to the 10 μg/dL blood lead level as a target level is consistent with EPA guidance on soil lead cleanup levels, which recommends "a model projection benchmark of either 95 percent of the sensitive population having blood lead levels below 10 μg/dL or a 95 percent probability of an individual having a blood lead level below 10 μg/dL." We have characterized risks associated with lead in soil (using the EPA IU-BK model) in light of this recommendation. The default concentration of 0.2 $\mu g/m^3$ was used to estimate intake from inhalation. Note that this concentration was greater than the modeled concentration from wind-blown dust emissions.
	We note that the dosage of some metals has not been summed as we recommended. Mercury, for example is a renal toxin as well as a neurotoxin and should be summed with both. Chromium is listed as a hepatotoxin. We do not insist that this be corrected prior to acceptance of the BHRA, but we will expect to see this corrected for the determination of post-remedial risk.	Health risks will be recalculated using the revised assumptions discussed in the March 17, 1992 meeting. Hazard indices will be calculated as requested along with the recalculation of the risks.

TABLE 2 (continued)
DTSC COMMENTS AND UPRR RESPONSES
REVISED BASELINE HEALTH RISK ASSESSMENT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	We note that risk isopleths requested in our April 18, 1992 memo have not been included and that 0% vegetative cover was not assumed.	Health risks associated with inhalation exposures were characterized for the highest concentration estimated off-site, which fell at the fenceline of the site. The only foreseeable use of a risk isopleth would be for calculating a population cancer burden. However, there is no agency guidance, either U.S.EPA or DTSC, on how such a calculation would be used for remedy selection. While a risk isopleth may contribute to further understanding of off-site risks via inhalation, it would not significantly improve the selection of a remedy for the site. During a site walk in May 1992, a large fraction of the site (over 50 percent) was observed to be covered with vegetation or large non-erodible elements such as concrete foundations. The vegetative cover fraction was selected to account for both the vegetation and the foundations (the silhouette correction fraction is not designed to address such large nonerodible elements in soil). While DTSC expressed a concern in its previous comments about the site being denuded of vegetation prior to future development. While grading the site could result in a short-term increase in dust emissions, it is likely that exposed soils would be covered under future residential use. Evaluation of risks associated with future residential use of the site involved this assumption. The evaluation of future residential use has provided adequate data for determining whether a remedy is required at the site (to make it suitable for future residential use). Revising the air modeling would not change the finding of the baseline HRA.
	The environmental risk assessment addresses only the current use of the property. Future proposed uses will have to be evaluated in terms of their effect on the suitability of the site as a wildlife habitat.	The Union Pacific Land Use Committee (UPLUC) provided general land use recommendations to Sacramento City Council in their Report of April 14, 1992. This Report was subsequently ratified by City Council. While some amount of open space was a recommendation of the UPLUC, a wild life habitat was not. Therefore, evaluation of the site as a wildlife habitat is not appropriate.
	IRIS shows the RfD for arsenic as 0.0003 mg/kg/day. This value should be used in future iterations of the risk assessment.	Health risks will be recalculated using the revised assumptions discussed in the March 17, 1992 meeting. Hazard indices will be calculated using this RfD along with the recalculation of the risks.

TABLE 3
DTSC COMMENTS AND UPRR RESPONSES
DRAFT REMEDIAL ACTION PLAN
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
Letter to UPRR From the DTSC, dated 3/11/92	The proposed remediation would not allow the future land uses identified by the City of Sacramento and the community and, therefore, does not represent a permanent remedy. It is our understanding that Union Pacific (UP) has agreed with the City in the redevelopment of the site. As such, UP should reevaluate remedial alternatives and propose a remedy that assures that the desired future land uses can be attained.	When the Addendum RI/FS Report for the site was prepared, land use issues had not been fully developed and discussed by interested parties including the DTSC, the City, and members of the community. It was therefore not possible to predict specific land uses which could be expected to be acceptable to all parties. As such, the soil remedial alternatives retained for detailed analysis were not analyzed on the basis of known desired future land use. Community response through the Union Pacific Land Use Committee (UPLUC) and comments from the City have provided important insight into the needs and desires of the community. Additionally, UPRR received input from the DTSC regarding what the DTSC believes would be appropriate land use from a public health perspective during a meeting on March 12, 1992. In a subsequent DTSC letter to the City of Sacramento dated April 6, 1992, the DTSC further delineated the types of land use it feels are appropriate for the site. UPRR is currently preparing a supplement to the RI/FS Report in which the detailed analysis of the final candidate remedial alternatives for soils will be re-evaluated to reflect changes in land use as appropriate. The FS Supplement will include a conceptual land use map which delineates restricted and unrestricted future land use as they relate to existing soil operable units and contaminant concentrations following remediation. Based on this map, assumptions regarding desired land use will be utilized during the re-analysis of the final candidate remedial alternatives. It is likely that for some soil operable units, the new "State Acceptance" and "Community Acceptance" criteria ratings will change the ranking of the alternatives in the comparative analysis, resulting in selection of a different recommended remedial alternative.
	The northeastern portion of the site may be the only area that can be used for typical single family residential development because historically this area was not used for any industrial purposes. Native soil is consistently encountered within the top six inches. Because of the intense industrial use of the rest of the site, it may be impractical to reuse this portion for single family residential use. If unrestricted residential uses are proposed for these portions of the site, a dense confirmation sampling will be required because of the variability and heterogeneity of soil contamination.	The issues of future land use, including residential (unrestricted) and commercial/light industrial use (restricted), in the inactive portion of the site will be addressed for each previously defined soil operable unit in the FS Supplement. Protection of public health through remediation and subsequent restricted/unrestricted use as well as City and community needs will be addressed.
	The Department does not see at this time how the proposed cap could be integrated with commercial use of the site. With commercial use there are situations such as landscaping and underground utility maintenance where the cap would be penetrated. Rather, the Department recommends that UP establish a second set of RAOs for the areas where commercial development is proposed. These RAOs could be relaxed due to the limited exposure provided by commercial use where most space is covered by buildings, parking and landscaping. These cleanup standards would need to be protective for all possible future human exposures to landscape, utilities or construction workers as well as protective of ground water. We recommend that UP adopt RAOs similar to what we recommend in our July fact sheet, 25 ppm for arsenic and 300 ppm for lead.	In addition to the FS Supplement, UPRR is preparing a supplement to the Revised Baseline Health Risk Assessment (HRA). The RAOs for lead and arsenic in soil promulgated for the Addendum RI/FS Report are based on the assumption of unrestricted land use. As discussed in Dames & Moore's letter to DTSC dated March 19, 1992, the supplement to the HRA will take into account potential future land uses (unrestricted and restricted) and will establish a second set of soil RAOs designed to be protective of groundwater quality and human health for a restricted (i.e., commercial or light industrial) land use scenario. This issue is discussed further in the response to DTSC comments on the HRA and will be discussed in the FS Supplement as well.

TABLE 3 (continued)
DTSC COMMENTS AND UPRR RESPONSES
DRAFT REMEDIAL ACTION PLAN
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	On an interim basis, until redevelopment occurs, it may be appropriate to provide a temporary cover such as a chip seal for dust control and elimination of direct exposure to contaminants left in place.	Dames & Moore met with the DTSC on March 17, 1992 to discuss the potential need for a temporary cover on the inactive portion of the site. Dames & Moore and the DTSC agreed during that meeting that a temporary cover was not warranted, and that Dames & Moore will recalculate risks associated with air exposure and direct contact pathways. The results of the calculations will be provided in the HRA Supplement. Additional air monitoring is being performed to evaluate potential off-site releases to air.
	In addition, it appears appropriate to remove all ballast from the inactive portion of the site, as this has proven to be a source of metals contamination, and all asbestos contamination from the former asbestos storage building area.	As discussed in the March 12, 1992 Meeting Summary prepared by Dames & Moore, not all ballast found in the inactive portion of the site contains slag. If the analysis performed in preparation of the RI/FS Report and HRA supplements indicates that removal of slag ballast is required to achieve human health and environmental protection and land use objectives identified in the FS Supplement, then the recommended remedial alternatives for the affected operable units will include removal of slag ballast. If the analysis performed in preparation of the RI/FS Report and HRA supplements indicates that removal of asbestos contamination is required to achieve the human health protection and land use objectives identified in the FS Supplement, then the recommended remedial alternatives for the affected operable units will include removal of asbestos contamination.
	Page 11 and Page 33 - Two figures are given for the length of the plume, 4500 feet and 4800 feet. Correct to show consistency.	The correct value is 4,800 feet. The plume length will be corrected for consistency with currently available data.
	Page 99, Section 6.2.6.4 - Alternative 2 is not acceptable to the Department. UP must also extract and treat this plume.	Extraction and treatment of the smaller plume will be further discussed with the DTSC.
	Table 7 - The legend in Table 7 makes reference to Table 13. Table 13 does not exist in the draft RAP. Please correct.	This comment refers to the Draft RAP rather than the Addendum RI/FS Report. This item will be corrected in the revised Draft RAP.

Appendix 2

ATTACHMENT 2

CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
ADDENDUM RI/FS REPORT
LEACHABILITY STUDY
AND
REVISED BASELINE HEALTH RISK ASSESSMENT

UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

TABLE 1
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
ADDENDUM REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
Letter to the DTSC from the City of Sacramento, dated January 31, 1992	Asphalt paving and limited access have been recommended to achieve on-site soil remediation. However, some excavation of buried drums and hot spots also is recommended. The recommended soil remediation alternatives will not result in a site that can be easily developed for residential use.	It is agreed that the recommended remedial alternatives would limit future land use. This issue will be discussed in the FS Supplement as described in the response to DTSC's similar comment (see page 1).
	Some off-site soil contaminated with lead and arsenic is planned to be excavated. The project proponents may wish to consider excavation to background levels rather than the remedial action objective (RAO) for lead.	An interim remedial measure (IRM) to mitigate soil Operable Unit S-4 was conducted in accordance with a DTSC-approved Work Plan in October 1991. The details of the IRM are presented in the Report of Interim Remedial Measures which was submitted to the DTSC in February 1992.
	A smaller ground water plume is planned to be monitored only and not remediated. Kleinfelder thinks that there is little reason not to proceed with remediation of this second plume, especially if the first plume is to be remediated.	This comment is similar to DTSC's comment above. Extraction and treatment of the smaller plume will be further discussed with the DTSC.
	The detailed assessment, which has lead to the selection of asphalt capping as the recommended remedial alternative, appears to Kleinfelder to be highly subjective and lacking in technical detail. The detailed assessment should be redone using fate modeling and laboratory or bench sale treatability studies to allow a less subjective analysis of the long-term effectiveness, protection, and reduction in contaminant volume toxicity or mobility offered by each alternative.	In preparing the RI/FS Report (Dames & Moore, May 1991) and Addendum RI/FS Report (Dames & Moore, November 1991), numerous technologies were evaluated. Treatability studies and fate and transport modeling would have been beneficial by allowing quantitative assessment of the relative efficiency of various alternatives. However, in our opinion, the rationale for screening and analysis presented in the Addendum RI/FS Report was reasonable and was applied consistently to each operable unit and remedial alternative.
	The soil remedial alternative for excavation to RAOs and on-site treatment was screened out prematurely. The screening process described problems with soil washing, but other technologies are available.	Over the course of this project several remedial alternatives involving treatment of soils to achieve RAOs were considered. During preparation of the Draft RI/FS Report (Dames & Moore, August 1990) soil stabilization techniques to mitigate metals contamination in combination with bioremediation for TPH was considered. This was Alternative 8 in the Draft RI/FS Report and was retained for detailed analysis in that study.
	In addition, RAOs could be more than soil cleanup levels and could include criteria such as quantitative goals regarding limiting suspension of dust and limiting groundwater infiltration to a certain percentage of normal infiltration. This RI/FS Report does not proceed to that level of detail, and development of action-specific RAOs should be considered by the project proponent and submitted for public review.	Action-specific RAOs will be promulgated for the FS Supplement analysis, if needed.
	Operable unit S-5 is defined as the active portion of the site. However the lateral and vertical extent of contamination in S-5 is not known, and S-5 is not considered further in the FS.	At the time the Addendum RI/FS Report was prepared, the active portion of the site had only been preliminarily evaluated. Because the active portion of the site is distinct from the inactive portion of the site in terms of present and desired future land use, it was defined as a separate soil operable unit (S-5). Investigations of S-5 have recently been completed and the feasibility study as it pertains to this operable unit will be presented in the FS Supplement.

TABLE 1 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
ADDENDUM REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	Operable Unit S-4 is defined as arsenic and off-site lead contamination. The FS applied RAOs developed for the site to this off-site operable unit. For the RAO for off-site lead, off-site risks should be addressed. Health & Safety Code Sec. 25356.1(c)(4) also requires that pre-existing background contamination levels be consider in selecting RAOs. Since the baseline HRA considers future residents, the resulting RAOs also may have application to S-4. We recommend that the RAO for lead be revised for S-4 to conclusively document its specific applicability to the off-site property.	An interim remedial measure (IRM) to mitigate soil Operable Unit S-4 was conducted in accordance with a DTSC-approved Work Plan in October 1991. The details of the IRM are presented in the Report of Interim Remedial Measures which was submitted to the DTSC in February 1992.
	It is not clear to us the distinction of the three operable units. Are the operable units geographically based, contaminant based, or separated by other characteristics? It appears that the distinction of S-2 is the presence of buried drums. Figure 32 presents the geographical zones of the operable units, but it is still unclear what is driving the definitions. We recommend clarification be added to define distinguishing characteristics for each operable unit.	The three operable units which comprise the inactive portion of the site were defined by a combination of geography, contaminant types, and degree of soil contamination present. Clarification will be provided in the FS Supplement.
	In our opinion, the operable units taken together should include all soil with environmental contamination, that is constituents above naturally-occurring concentrations. The RAOs may define a smaller volume needing remediation. As the RAO is increased or decreased based on new information or refined calculation, the volume planned for remediation will change. The operable unit would not change. This may be considered by some a moot point, however, the National Contingency Plan encourages consideration of at least one remedy that exceeds Applicable, Relevant and Appropriate Requirements (ARARs). This is not done in this FS since the operable units are defined as ending at the RAO. We recommend redefining the operable units based on the distinguishing characteristic and estimating the total-affected volume in each case. Remedial alternatives could then consider, where applicable, the incremental cost of exceeding the RAO either by volume or treatment efficiency.	The soil operable units geographically include all soil contamination present at the site. The geographic boundaries of the these operable units presented in the Addendum RI/FS Report (see Figure 32) clearly include all soil (contaminated and uncontaminated) within the off-site, active, and inactive portions of the site. The affected soil areas and volumes presented in Section 6.3 were calculated on the basis of the RAOs because it is those volumes and areas which would need to be remediated. Calculation of the incremental cost of exceeding an RAO is not required under CERCLA (Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, USEPA, 1988), and may be inappropriate given the required accuracy range of remedial cost estimates (+50% to -30%). In estimating costs for the Final Candidate Alternatives, a reasonable effort was made to provide a constant level of detail and accuracy; however, the accuracy of estimated costs may vary between alternatives within the allowed range.

TABLE 1 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
ADDENDUM REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	Our understanding of this alternative [Alternative 4] is that development of S-1 for multiresidential or light commercial use would be difficult to impossible. The purpose of restricting site access is not made clear. New development would require removing this access restriction and achieving the objective another way. We recommend the FS state clearly the objective of restricting site access and provide some information on other means for achieving the goals of such a restriction. Development would have to consider at all times either maintaining the integrity of the asphalt cap or engineering a replacement cover that would provide equal or better environmental protection. A maintenance program would have to be designed and implemented for the asphalt cap and for any seals or newer caps installed as part of development. This alternative would leave the contamination in the soil beneath the cap. Strict access controls would be needed regarding any subsurface work. Efficient surface drainage would have to be maintained at all times to ensure cap effectiveness.	As stated above, at the time the Addendum RI/FS Report was prepared, agency and public input regarding future land use were not available. Additionally, the DTSC has now directed UPRR to develop RAOs for restricted future land use. The alternatives for the operable units will be reevaluated in the FS Supplement using the restricted site RAOs and incorporating agency and public comments regarding desired and appropriate future land use into the detailed analysis of the Final Candidate Alternatives. This may affect the ranking of the remedial alternatives for one or more operable units, resulting in selection of a different recommended alternative. If an alternative involving placement of an engineered cap is selected, associated restrictions on land use, construction/development limitations, cap integrity and maintenance, and protection of future site workers or other potentially exposed populations will be addressed in the FS Supplement.
	A look at the detailed assessment of Alternative 4 for S-1 is in order. The author's rate this alternative "good" for long-term effectiveness. There is no detailed analysis provided to support this statement. In our opinion the FS does not provide a true detailed assessment of the alternatives. A true detailed assessment involves calculations, and fate and transport modeling. Where necessary, ARAR compliance or efficiency is demonstrated with laboratory-, bench-, or pilot-scale treatability studies. While we would agree that pilot-scale studies are cost prohibitive in the FS stage of a project, modeling and laboratory studies are warranted in many cases. In the detailed analysis of this alternative [Alternative 4], the long-term effectiveness could have been cost-effectively assessed by evaluating the migration of contaminants to ground water using a transport model. This was not done, and we recommend this calculation be added using an accepted contaminant transport model. Input to the model can be varied to assume cap and no cap at the site. From the modeling results a better estimate of the true long-term effectiveness can be made. Pending further information, we would rate the long-term effectiveness of this alternative to be poor.	Fate and transport modeling was conducted for the Addendum RI/FS Report. Specifically, the potential for migration of TPH constituents was evaluated and the results of this model were presented in the Leachability Study. During preparation of the FS Supplement, land use assumptions will be re-evaluated. Part of this re-evaluation may include fate and transport modeling to assess the effectiveness of capping.

TABLE 1 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
ADDENDUM REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	The detailed assessment ranks Alternative No. 4 as fair in meeting the reduction of toxicity, mobility, or volume of the contaminants. Kleinfelder feels that this alternative ranks poor for this criteria since mobility reduction refers to processes such as stabilization or fixation, which demobilize the chemical directly rather than indirectly as with a cap. The detailed assessment also ranks Alternative 4 as good for overall protectiveness of human health and the environment. The good ranking is inappropriate if the long-term effectiveness cannot be demonstrated as described above.	Capping, while not a treatment technology, has been used extensively and has been demonstrated to limit the mobility of contaminants through physical means. A well-engineered and well-maintained cap limits mobility of contaminants and contaminated materials in two ways: • suspension of contaminated fines in ambient air is essentially eliminated because air moving across the cap is prevented from coming into contact with the fines; and • surface and rainwater infiltration through the cap is restricted due to the low permeability of the cap (relative to on-site, uncovered soil) and through sheet flow away from the cap through the use of designed cap slopes. The ability of soil contaminants to migrate downward to the groundwater table is thereby restricted. The "good" rating for long term effectiveness is therefore justified if the cap is properly engineered and carefully maintained.
	The recommended Alternative 4 includes 30 years of ground water monitoring. The FS provides little information on the reason this monitoring is proposed. Since ground water is a separate operable unit, we assume the ground water monitoring is done to assess the effectiveness of the cap in protecting ground water. What action is taken if ground water contamination worsens despite the cap? We recommend more clarity as to the purpose of ground water monitoring, the applicable criteria for the monitoring program, and the action plan if the ground water deteriorates. The City should recognize that if Alternative 4 is implemented and the ground water monitoring shows declining ground water quality, then further remediation could likely be required. If development of the site has occurred, further remediation may require condemning and dismantling the new development so that the contaminated soil could be excavated. (Again the alternative calls for access restriction to the site.)	The purpose of groundwater monitoring, where proposed, is to provide early warning of potential future groundwater impacts caused by migration of residual contaminants. If new groundwater impacts were to occur following installation of a cap, steps could be taken to remove, treat or further stabilize the source of the groundwater contamination. Additionally, impacted groundwater would be treated accordingly in compliance with applicable regulations of that time. General groundwater monitoring criteria are set forth in the Draft Remedial Action Plan, while the specific groundwater monitoring plan would be provided as a component of remedial design. The cap, as presented in the Addendum RI/FS Report, effectively limits future land use at the site to exclude many beneficial land uses. As described above, new information regarding desirable and appropriate future land use at the site indicates that the final candidate alternatives should be re-analyzed for their ability to satisfy the state and public acceptance criteria. The results of this work will be presented in the FS Supplement.
	The detailed assessment of S-1 alternatives looks at four other alternatives including no action. The other three action alternatives are Alternative 5 - Excavation/On-site Treatment of Hot Spots with Capping; Alternative 6 - Excavation/Off-site Disposal of Hot Spots with Capping; and Alternative 10 - Excavation and Off-site Disposal of Soil Above RAOs. Alternative 5 and 6 are similar with the difference being the use of on-site treatment in one case but not in the other. In either case the same asphalt cap is proposed for most of the operable unit. There would be essentially the same problems for both of these alternatives for future development of the site as is discussed above for Alternative 4.	Comments regarding the relationship between various remedial alternatives and desired and appropriate future land use will be addressed in the FS Supplement as described above.

TABLE 1 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
ADDENDUM REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	The only real difference between Alternatives 5 and 6 and Alternative 4 is that 8,800 cubic yards of soil with arsenic over 75 mg/kg or lead over 500 mg/kg would be excavated and handled separately from the almost 100,000 cubic yards of soil that comprise the total operable unit. Therefore, from the point of view of future development and dealing with maintaining the cap, there is a less than 10% difference in Alternatives 5 and 6 from Alternative 4. However, the FS states that for Alternatives 5 and 6, ground water monitoring would not be required. This would eliminate one of the concerns for future development if true. What is the basis for this statement? Is the lead and arsenic from the "hot spots" expected to leach into the ground water? If so why is Alternative 4 acceptable? How were the hot spot values derived? We recommend that the City request a clarification of these questions. If indeed long-term ground water monitoring can be avoided with Alternatives 5 or 6, this would be an advantage for future development.	Groundwater monitoring would not be required for alternatives 5 and 6 because both of these alternatives provide for removal of the soils containing the highest concentrations of metals. It is reasonable to conclude, especially in the case of petroleum hydrocarbons, that the soils containing the highest concentrations of contaminants (Hot Spots) are more likely to be a potential future source of groundwater contamination. Arsenic and lead from the Hot Spots are not expected, per se, to leach to groundwater and in fact have not been demonstrated to be impacting groundwater at this site (additional evaluation of the source and mobility of the metals is ongoing). However, the Hot Spots do pose a greater potential threat to groundwater relative to soils with lower contaminant concentrations. The rationale for selection of Hot Spot levels will be clarified in the FS Supplement.
	The detailed assessment of Alternative 10 rates the short-term effectiveness at poor; the reduction of toxicity, mobility, and volume at fair; and the implementability at fair. These are subjective. Certainly the toxicity, mobility, and volume of contaminants at the site would be greatly reduced giving this alternative a good rating for this criteria. Implementability and short-term effectiveness depend on the rate at which soil is removed. Additional time could be taken to reduce impacts. The detailed assessment of Alternative 10 should be re-evaluated.	Alternative 10 appears attractive because by removing a large majority of the contaminants, it would allow for virtually unlimited future land use options. However, due to the large volume of contaminated soil, the fine-grained soils which predominate at the site, and the nature of large earth moving projects, it is reasonable to conclude that implementation of this alternative will result in poor short term effectiveness caused by potential health risks to on-site workers and off-site residents, as well as other impacts such as noise, traffic, etc. It is agreed that the ability of this alternative to reduce mobility, toxicity, and volume of contaminants at the site should have been rated as "good". This will be corrected in the FS Supplement and this alternative will be re-evaluated based on land use goals as described in previous sections.

TABLE 1 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
ADDENDUM REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	Missing from the detailed assessment is an alternative for excavation of soil to RAOs and on-site treatment of the soil to meet RAOs. This was Alternative 9, which for S-1 was screened in Section 6.5.1.9. The low implementability for this alternative is primarily due to reliance on soil washing as the technology for treating heavy metals in soil. We recommend this alternative be re-screened considering the following alternatives: Excavation of soil above RAOs and on-site treatment by: 9A: Solidification of the soil and placement on-site under future roads and buildings or with decorative cover. 9B: Removal and destruction of hydrocarbons using low temperature thermal desorption, delisting of the heavy-metal contaminated soil, and placement of the soil in a Class III municipal landfill. 9C: Removal and destruction of hydrocarbons using low temperature thermal desorption, delisting of the heavy-metal contaminated soil, and use of the soil on-site as engineered backfill under new buildings and roadways. This alternative may or may not have to be combined with hot spot removal and solidification.	It is agreed that on-site treatment technologies such as solidification or stabilization ("de-listing") followed by off-site disposal or on-site use as engineered fill may be viable in theory; however, detailed analysis of an alternative which includes on-site use of stabilized materials as fill requires detailed knowledge about the planned future development at the site, which is not currently available. The following responses apply to the three alternatives proposed: 9A: This alternative may be technically feasible, but detailed analysis would not be possible at this time because no detailed redevelopment plan for the site exists. In order to evaluate the cost, technical feasibility, and implementability, we would need to know the volume of fill required, what engineering properties the fill would be required to possess, and whether a readily available and proven stabilization technology could attain the required engineering properties. 9B: Municipal solid waste landfill leachate can have a low pH and be aggressive chemically to soil containing metals. Placement of stabilized/solidified hazardous waste in a Class III landfill is not likely to be met with enthusiasm by the landfill owner unless it can be demonstrated that the treated waste will pass TCLP, WET STLC, and other waste characterization analytical tests. This would require costly treatability studies and analytical testing which, in our opinion, is not justified for preliminary screening of alternatives. 9C: The response to alternative 9A also applies to this alternative.
	The remedial measures implemented based on the above information included backfilling the excavation with the excavated material containing approximately 1% asbestos and then applying a soil tackifier. This was applied in conjunction with a hydroseeding of a layer of mulch. Maintenance of the hydroseeded layer must be maintained as an interim measure, and asbestos containing soil may need to be addressed separately in the alternatives for remediation of S-1 soil.	The potential need for asbestos removal in S-1 will be addressed in the FS Supplement. If desired future land use requires that the asbestos-contaminated soils be removed in order to provide for long term protection of human health, then the recommended remedial alternative for Operable Unit S-1 will include removal of asbestos contaminated soil.
	Operable Unit S-2 is defined as the central fill area containing lead, TPH, arsenic and PAHs above the RAOs. There are also small circles of S-2 about the site. What is the defining criteria for S-2? This should be made clear.	The geographic boundaries of S-2 are shown in Figure 32 of the Addendum RI/FS Report. S-2 is not geographically contiguous in that it includes small portions which geographically are part of S-1 and S-3. The primary defining characteristic of S-2 is contaminant-based: S-2 contains petroleum hydrocarbons which have been detected in soils in the inactive portion of the site. This will be further clarified in the FS Supplement.
	The FS concludes that S-2 also should be capped, but first the buried drums and hot spots should be excavated. This is Alternative 6. The hot spots are estimated at approximately 13,000 cubic yards of the 48,200 cubic yards. We do not understand why S-2 is a separate operable unit except for the drums and the TPH hot spots. With minor exceptions the previous comments for S-1 apply for S-2.	The rationale for defining operable units is discussed above. In general the responses to comments for the S-1 alternatives also apply to comments regarding S-2 alternatives.

TABLE 1 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
ADDENDUM REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	We are unclear as to what the criteria is for developing cleanup levels for hot spots. The justification for these higher level cleanup criteria, namely 15,000 mg/kg for TPH, 500 mg/kg for lead, and 75 mg/kg for arsenic is not provided. For TPH, it is stated that hot spots are areas where capping will not stop downward migration of hydrocarbons but the justification for the other values is not provided.	The rationale for selection of lead and arsenic hot spot levels will be clarified in the FS Supplement.
	Operable unit S-3 is defined as the northernmost portion of the site with arsenic, lead, and TPH above the RAOs. We are confused as to the need to separate S-3 from S-1; virtually the same contaminants are in each. The same remedial approach is recommended for S-3 as for S-2. Comments made for S-2 and applicable comments made for S-2 apply for S-3.	Soil Operable Units S-1 and S-3 are similar in that within their respective geographic boundaries, the same contaminants (lead, arsenic, and TPH) are found in soil. However, there are two important distinguishing characteristics which justify evaluating them as separable operable units: • Because the land in S-3 was not historically used for heavy industrial purposes as S-1 was, S-3 soil contaminant concentrations are generally much lower than S-1. Because of the lower contaminant concentrations and volume, some of the ten remedial alternatives initially developed for the Addendum RI/FS Report are more viable and less costly per unit for S-3 than they are for S-1; • S-3 is bounded on two sides by residential development. S-1, although a substantially larger area, shares only one boundary with residential areas. S-3 can therefore be expected to be a more sensitive area with respect to the type of future land use which will be acceptable to DTSC, the City and community members. Responses to comments regarding S-1 and S-2 alternatives are also applicable to the detailed analysis performed for S-3 alternatives. As stated above, the FS Supplement will address recent DTSC, City, and public comments about desired and appropriate land use.
	The derivation of the ground water operable units is confusing. Page 42 describes two plumes, A and B. However, the FS on Page 60 defines two ground water operable units based on Plumes A through F. This should be clarified.	Operable Unit GW-1 is defined as Plume A. Plume A is described on page 42 of the Addendum RI/FS Report (Dames & Moore, November 1991), shown on Figure 30, and is the large plume which extends from the Central Fill area to the southeast about 4,800 feet. Operable Unit GW-2 is defined as Plume B. Plume B is also described on page 42, is shown on Figure 30, and is the small plume southwest of Plume A. The terminology used on page 60 (Plumes A, B, ..., F) to define GW-1 and GW-2 is from the RI/FS Report (Dames & Moore, May 1991) when groundwater impacts were defined differently. For consistency and clarity, the terminology used to describe Operable Units GW-1 and GW-2 will follow that on Page 42 of the Addendum RI/FS Report (Dames & Moore, November 1991) and will include additional information obtained since November 1991.
	The RI summary, pages 49 and 50, indicates that the extent of chromium, lead, and VOCs is not fully characterized. We do not see problems with this except if chromium turns out to be a problem. In this case the remedial method would have to consider chromium.	If further characterization finds chromium and/or lead to be a problem it will be addressed appropriately.

TABLE 1 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
ADDENDUM REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	The high variation in the assumed flow rate is due to the lack of design information. Modeling, aquifer testing, treatability studies, and a detailed design would appear to be needed and will be needed in the remedial action plan.	An aquifer pumping test has been conducted and a groundwater model developed. These data will be used to better estimate design parameters for the groundwater remedial system.
	Operable unit GW-2 includes nickel, which does not degrade. Nickel is now in concentrations greater than the applied action level (AAL), and one would expect that once an MCL is established it would be lower than the existing AAL. Nickel is not then remediated.	U.S. EPA has recently promulgated an MCL of 100 $\mu g/\ell$ for nickel, effective 1993. Nickel will be addressed in the FS Supplement.
	The deed restriction only alternative (Alternative 2) for the ground water operable units does not address "the effect of contaminated or pollution levels upon present, future, and probable beneficial uses of contaminated, polluted, or threatened resources" as required by Health & Safety Code sec. 25356.1(c)(2). It does not address future beneficial uses of this aquifer. The implementability of this alternative is low. Deed restrictions can be implemented only by agreement with the landowner or by statutory authority, and voluntary deed restrictions are unlikely. DTSC can declare the property as "hazardous waste property" under Health & Safety Code sec. 25220, et seq. and unilaterally place use restrictions on the property. This would constitute a taking or condemnation of property, which would require reimbursement by the state or UPRR costing potentially more than the more active remediation alternatives considered in the RI/FS Report. Deed restriction is less difficult on site.	The DTSC does not accept Alternative 2 for Operable Unit GW-2. Extraction and treatment for this operable unit will be further discussed with the DTSC, and comments addressed in the FS Supplement.

TABLE 2
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
LEACHABILITY STUDY
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
Letter to the DTSC from the City of Sacramento, dated January 31, 1992	The RAO for total petroleum hydrocarbons (TPH) does not appear to be sufficiently conservative to be protective of the environment.	The analysis specifically related to protection of human health.
	The soil RAO for total petroleum hydrocarbons (TPH) is provided as a depth-dependent concentration resulting from a leaching study. Our analysis of the leaching study is provided as Appendix B of this document. It is our finding that the leaching study does not use conservative assumptions or calculations for some of the parameters. The result is that within the uncertainty of the leaching model the proposed RAO for TPH may not be protective of groundwater. While we agree with the concept of a leaching study, we recommend using a more rigorous approach to evaluating an RAO for TPH.	The only assumption identified which may be non-conservative is the degradation rate, which was an average, literature-based value. This assumption will be reviewed and modified, as necessary. Since the LUFT levels are not applicable, the model and assumptions will be verified and TPH RAOs based on the verified model.
	The clean-up estimate is based upon the assumption that the maximum allowable concentration available to be solubilized at any one time will be. The question of heavy metals and/or other chemical present affecting the ability of the naphthalene to be solubilized is not covered.	Naphthalene co-solvents were not identified in soil samples. "Assumption that the maximum concentration . . . will be "solubilized is already overly conservative.
	The degradation rate used was an average value. For the most conservative approach it would be best to use a lower rate especially in a low oxygen environment or in the presence of heavy metal. The degradation is assumed to be maximized but in most cases this will not be true.	The degradation rate will be reviewed and modified, as necessary.
	Excess naphthalene, above what can be solubilized, is not investigated. What happens to the excess naphthalene between a TPH of 4,000 mg/kg and 15,000 mg/kg is not explained.	Numbers are depth-specific. Any TPH exceeding a depth-specific RAO at that depth would be remediated. There would be no excess TPA or naphthalene above what can be solubilized. The Leachability Study utilized the conservative assumption of the value of the maximum concentration of naphthalene found in diesel fuel.
	The groundwater velocity was selected at the bottom of the calculated range. Redoing the calculations using the upper end of the range and that calculated leachate impact on groundwater increases by a factor of 29, resulting in a 29 fold reduction in the TPH RAO.	The relationship is actually the opposite. If the groundwater velocity is increased, the amount of dilution increases. This will lower the impact to groundwater and yield a higher RAO.

TABLE 2 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
LEACHABILITY STUDY
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	The Regional Water Quality Control Board may question using a dilution factor since you are essentially advocating the degradation of groundwater up to the health advisory number.	This approach follows, and is consistent with, the Regional Water Quality Control Board's "Designated Level Methodology."

TABLE 2 (continued)
DTSC COMMENTS AND UPRR RESPONSES
REVISED BASELINE HEALTH RISK ASSESSMENT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
Letter to the DTSC from the City of Sacramento, dated January 31, 1992	The baseline HRA does not appear to address certain potential exposure pathways for current off-site residents. These are: • Ingestion of crops irrigated with water drawn from wells in the vicinity of the site. Reference is made to these irrigation wells in numerous locations. • Sensitive sub-populations (specifically children) that exist near the site (all within approximately 2,500 feet) which may be prone to inhalation of fugitive dust.	There is no commercial agriculture within the vicinity of the site, therefore there is no exposure pathway from contaminated groundwater via ingestion of crops. While it is possible that individual residences have backyard gardens, these crops are not irrigated with water from the irrigation wells, but with water supplied by the city. This does not represent a complete exposure pathway. Health risks associated with inhalation of wind-blown dusts were characterized for the receptor where the highest off-site concentrations fell. This location is at the fenceline of the site. The toxicity values used to characterize health risks (such as the cancer slope factor) are already based on the assumption that the exposed individual is a "sensitive" individual. Characterization of risks of suspected sensitive subpopulations at other receptor locations would not increase our understanding of the risks associated with the site, and are not required.
	The baseline HRA considers future on-site residents as potentially exposed individuals. The pathways for exposure include ingestion of or contact with groundwater and ingestion of on-site soil, but exclude inhalation of dust. The HRA explains that it is anticipated that the site will be almost completely covered, preventing exposure to dust. The assumptions that the site will be sufficiently paved in the future to prevent exposure to airborne dust may not be correct. Also, current conditions do not include pavement, and therefore, airborne dust may be created. There is a mix of current and future in this portion of the risk assessment.	While risks under the future residential land use scenario may have been underestimated by excluding inhalation of wind-blown dusts, the results of the baseline HRA for future residential use has provided adequate data for determining whether a remedy is required at the site (to make it suitable for future residential use). Revising the air modeling would not the change the findings of the baseline HRA.
	Based on the baseline HRA, action-specific RAOs should be developed relating to limitations on dusting, soil contact and groundwater use. There RAOs could be quantified relative to a calculated insignificant risk. As an example, the risk from dust inhalation for a future on-site resident should be an RAO stating what dust exposure is acceptable.	Development of RAOs are based on consideration of ARARs and risk-based level estimated for the complete exposure pathways associated with the site. The Addendum RI/FS Report discusses how RAOs were developed for the contaminants detected at the site.

TABLE 3 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
REVISED BASELINE HEALTH RISK ASSESSMENT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	The exposure assessment for on-site workers is missing the following: • Inhalation of fugitive dust • Inhalation of Volatile Organic Compounds • Dermal adsorption (*sic*) • Ingestion of constituents	Worker exposures were not quantitively addressed in the baseline HRA, as discussed in Section 3.2.5 of the revised baseline HRA.
	The baseline HRA and the FS cannot and do not address contamination in the active portion of the site other than to state that the contaminants of concern are arsenic, lead and total petroleum hydrocarbons (TPH).	Contaminants detected in the active portion of the site will be evaluated separately in a supplement to the RI (for the active site portion), a supplement to the RI/FS Report, and a supplement to the HRA.
	Since the baseline HRA does not consider the active portion, the calculated risks do not consider the effects of pathways from the active portion to the inactive portion. This would be most appropriate when evaluating the future on-site resident in the baseline HRA. When surface soil results for lead and arsenic are available from the active site RI, we would recommend that the risks to future residents from the dust be assessed and added into the cumulative risk analysis. As necessary, dust control measures at the active site might be effective in mitigating significant risk.	Risks will be calculated for the contaminants detected in the active portion of the site if other ARARs are inadequate for developing remedial action alternative for this area. The potential for off-site migration of contaminants in air will be evaluated through an air monitoring program. The results of this air monitoring program will be incorporated into supplements to the RI/FS Report and HRA.
	There is no short narrative on the toxicities of each of the chemicals of concern that do have accessible toxicological information. This information is typically included in an HRA, and it would be appropriate if revising the HRA to add in toxicological information to allow a more in depth review.	The HRA will not be revised; a recalculation of risks will be performed as requested by DTSC, and the results incorporated into a supplement to the HRA. Toxicological profiles have not been required by the DTSC in their review of the baseline HRA and the revised baseline HRA.
	Use of oral RfDs for inhalation RfDs may not be appropriate in all cases. Calculations are necessary to convert from oral RfDs to inhalation RfDs. Specific EPA guidance exists for determining inhalation risks ("Interim Methods for Development of Inhalation Reference Doses, EPA/600/8-88/066F, August 1989). If this has not been used, this adjustment in the RfDs would be appropriate. The RfD used for 1,1-DCE via IRIS is dated (1/1/89) and should be checked for update.	Calculation of inhalation reference concentrations (RfCs) will be performed if requested by DTSC.

TABLE 3 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
REVISED BASELINE HEALTH RISK ASSESSMENT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	Asbestos was not discussed in the HRA. Thus, the RAO for asbestos is not a health-based number. The RAO is somewhat arbitrarily set at 1% by volume. The 1% seems to come from an unidentified regulation defining "asbestos-containing material." It is not clear what the regulation is intended to regulate.	Under the California Code of Regulations, Title 22, any waste which contains greater than one percent friable asbestos is considered a hazardous waste.
	A health-based soil RAO for asbestos may be in order if the soil RAOs and particularly the extent of asbestos begin to control the remediation. The known areas of asbestos burial should be known for any future development. The presence of asbestos in the soil, if excavated, would present an additional health risk that must be recognized and mitigated. The presence of asbestos in soil, if left in place, would have to be documented and disclosed to a future user of the site.	Due to the nature of asbestos in soil, there is no approved or reliable methodology for calculating health-based RAOs in soil. The RAO of one percent in soil would be used, should asbestos-impacted soil be excavated. However excavation is not a preferred remedial action alternative because of the potential for increasing friability and release to air. Areas of the site known to contain asbestos have been documented in the RI/FS Report (Dames & Moore, May 1990) the Addendum RI/FS Report (Dames & Moore, November, 1991), and the Draft RAP (Dames & Moore, November 1991). Provisions for future land use restrictions (deed restrictions) are included in the Addendum RI/FS Report and Draft RAP, which include provisions for disclosure to future land users.
	The Statement of Reasons supporting the MCL in question must be analyzed to determine compliance with Health & Safety Code Sec. 25356.1. Kleinfelder recommends more analysis of the MCL versus risk-based RAOs according to the statutory and regulatory requirements before one or the other is adopted. Our understanding is that the DTSC, the lead agency for this site, has accepted the MCLs as RAOs for groundwater, which implicitly complies with Health & Safety Code Section 25356.1.	Our understanding is that the DTSC, the lead agency for the site, has accepted the MCLs as RAOs for groundwater, which implicitly complies with Health & Safety Code Section 25356.1.
Letter to the DTSC from the City of Sacramento, Appendix A, dated January 31, 1992	Pg 1, par 1: Asbestos also was investigated as part of the RI.	Comment noted. Asbestos is discussed on pages 13 and 15 of the Revised Baseline HRA.
	Pg 2, 2nd bullet: Future and present should be inserted in front of potential.	Comment noted.

TABLE 3 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
REVISED BASELINE HEALTH RISK ASSESSMENT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	Pg 9, par 4: The paragraph mentions that seven agricultural wells are within 1 mile of the site. Are any downgradient (south)? Presumably, crops are irrigated with water from these wells. This pathway of exposure to chemicals in groundwater has not been addressed.	As discussed previously, this does not represent a complete exposure pathway.
	Are there any well logs for any of the wells mentioned in this paragraph?	Yes. Copies of available logs of wells within a one-mile radius of the site are maintained in the Dames & Moore project files. Summary well completion information for wells located within a one-mile radius of the site is provided in Table 2 of the RI/FS Report (Dames & Moore, May 1991).
	Has DHS (or DTSC) required quarterly monitoring of water purveyors such as the Fruitridge Vista Water Company be reviewed?	No.
	Pg 12, par 5: Reference to either 10 or 11 general areas are inconsistent with the following bullet items.	As shown in the following page, there are only ten petroleum hydrocarbon sources areas. Reference to eleven area is an editorial oversight.
	Pg 13, par 2: If the concentration of 1,1-DCA is less than the established drinking water standard, why is it included as a constituent of concern.	1,1-DCA was included as a constituent of concern because it was a suspected carcinogen.
	Pg 16, both bullets: Why wasn't benzene considered in either plume?	While benzene is not specifically mentioned, aromatic VOCs are included.
	Pg 17, par 8: Do organic compounds include chlorinated solvents?	Yes.
	Pg 18, par 2: The metals identified as those of highest concern include Cu and Zn. Why are these considered not problematic? Is this based on relative toxicity to other metals detected on site or on relative concentrations?	As shown in the results of the baseline HRA, the hazard quotients for copper and zinc are well below one. Therefore, it is unlikely that there would be adverse non-cancer effects associated with these chemicals.
	Are the metals identified on the site the result of sieved soil analysis? Collection and eventual extraction of soil with pieces of slag may result in falsely high concentrations of various metals. Slag materials, if not pulverized, would act as a vitrifying agent and essentially immobilize the metals.	Metals were analyzed from total soil samples, which were not sieved.

TABLE 3 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
REVISED BASELINE HEALTH RISK ASSESSMENT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	Pg 20, par 2: This paragraph is unclear. Unless the reader knows that total volatile hydrocarbons (TVHC) refers to volatile TPH and infers that the compounds following TVHC are also volatile, it is necessary to either state the units of measure or state that the results are a result of soil vapor analyses.	As stated on Page 19, the results are from soil gas samples.
	Pg 20, par 1-3: Clarify and be consistent with the use of "risk-based reference concentrations," "reference concentration," and "risk-based concentrations."	Comment noted.
	Pg 22, Eq.1: Define alpha.	Alpha refers to the level of statistical significance, such as $\alpha = 0.95$.
	Pg 22, par 4: Was surface soil sampling data also used to consider volatilization of aromatic and chlorinated VOCs that may potentially be inhaled? If not, why?	Soil vapor sampling was used to estimate VOC emissions because these data could be input directly into the emissions model.
	Pg 23, par 3: How was background concentration of As and Pb derived?	Background sampling for arsenic, lead and copper was performed during the Phase 2 RI.
	Pg 23, par 3: Does exclusion of TPH in the HRA also exclude aromatic VOCs, BTEX and PAHs?	No.
	Pg 24, par 2, 10th line: Is this meant to be "on-site"?	Yes.
	General comment: No discussion of the validity of the data is included. This is important in establishing the accuracy of the RI data in assessing the concentrations of chemicals on site. This validation procedure is considered a necessary step according to USEPA guidance. An explanation discussing why data was not validated needs to be included.	Data quality assurance has been discussed in the RI/FS Report and the Addendum, and has been addressed in responses to comments from the DTSC. All data reported in the RI/FS Report and the Addendum are considered valid.
	Pg 28, par 1: Is the occurrence of drainage to adjacent resident probable enough to consider this a significant and likely exposure point?	While this could be an exposure point, the risks are not likely to be greater than those associated with direct contact with the soil.
	Pg 28 par 2: Section 1.2.1 does not describe surrounding populations.	A description of surrounding populations is presented in Section 1.2.5.
	Pg 29, par 2: This paragraph is out of place.	Comment noted.
	Pg 29: Add air to the 4th bullet.	Comment noted.

TABLE 3 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
REVISED BASELINE HEALTH RISK ASSESSMENT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	Pg 29, 5th bullet: Are semi-volatile organic compounds the same as PAH compounds? This is the first time the term "fugitive dust" is used. Define it.	PAH compounds are considered to be semivolatile organic compounds (but not all semivolatile organic compounds are PAHs). Fugitive dust, in this context, is considered to be wind-blown dust.
	Pg 30, par 4: It states that migration of chemicals in groundwater under the site to off-site ground water has been modeled. How was this done and where are the results of this work? Nothing is contained in Attachment 3 of the HRA on groundwater modeling.	Groundwater modeling was conducted using the U.S. Geological Survey (USGS) Computer Model of Two-dimensional Solute Transport and Dispersion in Groundwater (Method of Characteristics - Konikow and Bredehoft, 1978). Results were provided in the Hydropunch and Groundwater Investigation Report (Dames & Moore, July 1990) and the RI/FS Report (Dames & Moore, May 1991). Further groundwater modeling is currently planned using the USGS MODFLOW three-dimensional model.
	Pg 34, par 6: Why was 1,1-DCE chosen as a "model chemical" to assess migration of all VOCs?	1,1-DCE was chosen as a model chemical for the following reasons: • Distribution; • Concentration; • Predominance; and • Chemical characteristics generally representative of the suite of constituents of concern.
	Pg 35, Section 3.2.2.6: See comment #4 (refers to Pg 9, par 4).	See response to comment on Page 9, paragraph 4.
	Pg 36, par 2: Ingestion of groundwater needs to be addressed here.	Comment noted. Risks were quantified for this exposure pathway.
	Pg 38: Define alpha	See above.
	Pg 38, par 3: The second sentence needs to include per kg body per day of exposure.	Comment noted.
	Pg 48 par 2: The use of oral reference doses in place of inhalation RfDs may not be appropriate. Specific EPA guidance exists for appropriate modification of oral RfDs to inhalation RfDs.	See above.

TABLE 3 (continued)
CITY OF SACRAMENTO COMMENTS AND UPRR RESPONSES
REVISED BASELINE HEALTH RISK ASSESSMENT
UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

Document/Date	Comment	Response
	Pg 55, par 3: No numbers are given for input parameters for any of the scenarios. For example, what is the exposure duration and averaging time used for the site trespasser. If default values for a resident are used, an overestimation of risk would result based on the likely assumption that a trespasser spends less time on site than does a hypothetical resident.	These parameters are presented in Tables 15 and 16.
	It is not clear what changes in chemical concentrations, if any would occur as a result of proposed remedial activity. Present chemical concentrations are used to perform risk calculations for future land use. A primary remedial alternative and the resulting impact of proposed remediation on chemical concentrations was not discussed.	These issues are beyond the scope of a baseline health risk assessment.
	Pg 56, par 6: How can the HI for off-site children exposure to these chemicals be greater than on and on-site be less than one? Concentrations of these chemicals at the source would be expected to be greater than their concentration after transport off-site.	This paragraph should refer to on-site residents. The reference to off-site residents is an oversight.

Appendix 3

ATTACHMENT 3

RECALCULATION OF CANCER RISKS ASSOCIATED WITH BACKGROUND CONCENTRATIONS OF ARSENIC IN SOIL

UNION PACIFIC RAILROAD YARD
SACRAMENTO, CALIFORNIA

RECALCULATION OF CANCER RISKS ASSOCIATED WITH BACKGROUND CONCENTRATIONS OF ARSENIC IN SOIL UNION PACIFIC RAILROAD YARD SACRAMENTO, CALIFORNIA

The increased lifetime cancer risk associated with arsenic in soil at the UPRR Sacramento site was calculated assuming lifetime exposure duration and using intake parameters for an adult, and intake parameters for a child (Addendum Remedial Investigation/Feasibility Study Report, Appendix J - Revised Baseline Health Risk Assessment, Dames & Moore, November 1991). The approach used was obtained from the proposed Draft Scientific and Technical Standards for Hazardous Waste Sites, Volume 2: Exposure Assessment, Chapter 3: Standards for Documentation of Methodologies, Justification, Input Assumptions, Limitations and Output for Exposure Models (August, 1990). On page 11 of this draft technical standard, it is stated that, for all exposure calculations used to make chemical- and site-specific exposure estimates in California, the exposure duration (ED) and the averaging time (AT) should always represent the same span of time. . . . The rationale for this standard is the need to avoid the implicit assumption that an individual moving away from one exposure point does not move to another exposure point regulated by California." This approach was used in response to comments by DTSC toxicologists in their memorandum to Jose Salcedo, February 21, 1991.

Using this approach, estimated lifetime cancer risks for the adult, associated with a background concentration of 8 mg/kg arsenic in soil, was $2x10^{-5}$, while the risk to the child was $2x10^{-4}$. The remedial action objective of 0.044 mg/kg was based on the child intake parameters, as these are more conservative. These calculations are documented in the attached spreadsheets (Attachment 4).

In a meeting of March 17, 1992, we were informed by Dr. Jim Carlisle of DTSC that the method presented in the draft technical standard was no longer used to estimate the exposure duration and averaging time. Instead, Dr. Carlisle recommended using the procedure presented in the EPA Risk Assessment Guidance for Superfund, Standard Default Exposure Factors, in which the child exposure duration of six years, the adult exposure duration of 24 years, and an averaging time of 70 years are used to calculate cancer risks. All other assumptions remain unchanged. Risks were quantified for the soil ingestion and dermal contact with soil exposure pathways. The child and adult risks are then summed to obtain an increased lifetime cancer risk associated with a 30 year exposure duration. Spreadsheets documenting these calculations are attached (Attachment 5). These revised risks are as follows:

SUMMARY OF REVISED RISKS ASSOCIATED WITH BACKGROUND (8 mg/kg) ARSENIC IN SOIL

Exposed population	Estimated Lifetime Cancer Risk
Adult, 24 year exposure duration	6.8×10^{-6}
Child, 6 year exposure duration	1.5×10^{-5}
Total, 30 year exposure duration	$2 \times 10^{-5*}$

* Risk estimate rounded to one significant figure as recommended in EPA cancer risk assessment guidelines.

ATTACHMENT 4

SPREADSHEETS

CALCULATED RISKS ASSOCIATED WITH BACKGROUND ARSENIC IN SOIL - BASED ON NOVEMBER 1991 REVISED BASELINE HEALTH RISK ASSESSMENT

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_1.WK1
LAST SAVED:
DATE: 06/29/92
TIME: 09:48 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult
TOXIC EFFECT: Carcinogenic and noncarcinogenic
COMMENTS:

PREAMBLE:

This is a risk assessment model for evaluating health risks associated with chemical contamination detected in environmental media (soil, air, groundwater or surface water). This model is designed to evaluate health risks associated with exposures from several different pathways using the guidelines presented in the EPA Risk Assessment Guidance for Superfund (RAGS). This model uses chemical concentrations measured during site investigations or estimated in environmental fate and transport models to estimate health risks.

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_1.WK1
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SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult
TOXIC EFFECT: Carcinogenic and noncarcinogenic

Pathway	Description	Label	Value	Units
General	Body Weight	BW	70	kg
	Exposure Duration	ED	70	years
	Averaging Time	AT	25550	days
Drinking water ingestion	Ingestion Rate	IRWATER	0	L/day
	Exposure Frequency	EFWATER	0	days/year
Ingestion during swimming	Contact Rate	CR	0	L/hour
	Exposure Time	ETSWIM	0	hours/event
	Exposure Frequency	EFSWIM	0	events/year
Dermal contact with surface water - Swimming	Skin Surface Area	SADERM_W	0	cm^2
	Exposure Time	ETDERM_W	0	hours/day
	Exposure Frequency	EFDERM_W	0	events/year
Dermal contact with surface water - Showering	Skin Surface Area	SADERM_S	0	cm^2
	Exposure Time	ETDERM_S	0	hours/day
	Exposure Frequency	EFDERM_S	0	events/year
Dermal contact with ground water - Showering	Skin Surface Area	SADERM_G	0	cm^2
	Exposure Time	ETDERM_G	0	hours/day
	Exposure Frequency	EFDERM_G	0	events/year
Soil ingestion on-site soils	Ingestion Rate	IRSOIL_ON	0.0001	kg/day
	Fraction Ingested (from contaminated source)	FISOIL_ON	1	
	Exposure Frequency	EFSOIL_ON	350	days/year
Dermal contact with on-site soil	Skin Surface Area	SADERM_SON	3120	cm^2
	Soil to skin adherence factor	AF	0.00000145	kg/cm^2
	Exposure Frequency	EFDERM_SON	350	events/year
Soil ingestion off-site soils	Ingestion Rate	IRSOIL_OFF	0	kg/day
	Fraction Ingested (from contaminated source)	FISOIL_OFF	0	
	Exposure Frequency	EFSOIL_OFF	0	days/year
Dermal contact with off-site soil	Skin Surface Area	SADERM_SOFF	0	cm^2
	Exposure Frequency	EFDERM_SOFF	0	events/year
Inhalation of outdoor air	Inhalation Rate	IRAIR_OUT	0	m^3/hr
	Exposure Time	ETAIR_OUT	0	hours/day

	Exposure Frequency	EFAIR_OUT	0 days/year
Inhalation of indoor air	Inhalation Rate	IRAIR_IN	0 m^3/hr
	Exposure Time	ETAIR_IN	0 hours/day
	Exposure Frequency	EFAIR_IN	0 days/year
Inhalation of indoor air - during showering	Inhalation Rate	IRAIR_SH	0 m^3/hr
	Exposure Time	ETAIR_SH	0 hours/day
	Exposure Frequency	EFAIR_SH	0 days/year
Ingestion of fish/shellfish	Ingestion Rate	IRFISH	0 kg/day
	Fraction Ingested (from contaminated source)	FIFISH	0
	Exposure frequency	EFFISH	0 days/year
Crop ingestion on-site soils	Ingestion Rate	IRCROP_ON	0 kg/day
	Fraction Ingested (from contaminated source)	FICROP_ON	0
	Exposure frequency	EFCROP_ON	0 days/year
Crop ingestion off-site soils	Ingestion Rate	IRCROP_OFF	0 kg/day
	Fraction Ingested (from contaminated source)	FICROP_OFF	0
	Exposure frequency	EFCROP_OFF	0 days/year
Meat/milk/eggs ingestion	Ingestion Rate	IRMEAT	0 kg/day
	Fraction Ingested (from contaminated source)	FIMEAT	0
	Exposure frequency	EFMEAT	0 days/year

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PROJECT FILENAME: AS_1.WK1
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DATE: 06/29/92
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SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult
TOXIC EFFECT: Carcinogenic and noncarcinogenic

Chemical	Carcinogen Slope Factor (mg/kg/day)^-1		Reference Dose (mg/kg/day)		PC Dermal Permeability Constant (water) (cm/hr)	ABS Dermal Absorption Factor (soil)	Absorption Fractions					
	Ingestion	Inhalation	Ingestion	Inhalation			Soil	Water	Air	Crops	Meat/milk	Fish
Arsenic	1.75	15	0.001	0.001		0.0007	1.00	1.00	1.00	1.00	1.00	1.00

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SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult
TOXIC EFFECT: Carcinogenic and noncarcinogenic

Chemical	Conc. in Groundwater (mg/L)	Conc. in Surface Water (mg/L)	Conc. in Soil on-site (mg/kg)	Conc. in Soil off-site (mg/kg)	Conc. in Air outdoors (mg/m^3)	Conc. in Air indoors (mg/m^3)	Conc. in Air during showering (mg/m^3)	Conc. in Crops on-site soil (mg/kg)	Conc. in Crops off-site soil (mg/kg)	Conc. in Livestock Products (mg/kg)	Conc. in Fish (mg/kg)
Arsenic	0	0	8.00	0	0	0	0	0	0	0	0

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SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult
TOXIC EFFECT: Carcinogenic and noncarcinogenic

Chemical	Intake from each pathway (mg/kg-day)																
	Drinking Water Ingestion Ground water	Drinking Water Ingestion Surface water	Water Ingestion while Swimming	Dermal Contact Surface water Swimming	Dermal Contact Surface water Showering	Dermal Contact Ground water Showering	Soil Ingestion on-site soil	Soil Ingestion off-site soil	Dermal Contact with on-site soil	Dermal Contact with off-site soil	Inhalation Outdoor Air	Inhalation Indoor Air	Inhalation during showering	Ingestion of Fish and Shellfish	Ingestion of Crops on-site Soil	Ingestion of Crops off-site Soil	Ingestion of meat/ milk/eggs	Total
Arsenic	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-05	0.0E+00	3.5E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-05

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SITE/STUDY AREA: Future land use
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TOXIC EFFECT: Carcinogenic and noncarcinogenic

Chemical	Lifetime cancer risks from each pathway																	
	Drinking Water Ingestion Ground water	Drinking Water Ingestion Surface water	Water Ingestion while Swimming	Dermal Contact Surface water Swimming	Dermal Contact Surface water Showering	Dermal Contact Ground water Showering	Soil Ingestion on-site soil	Soil Ingestion off-site soil	Dermal Contact with on-site soil	Dermal Contact with off-site soil	Inhalation Outdoor Air	Inhalation Indoor Air	Inhalation during showering	Ingestion of Fish and Shellfish	Ingestion of Crops on-site Soil	Ingestion of Crops off-site Soil	Ingestion of meat/ milk/eggs	Total (Pathway)	Total (Scenario)
Arsenic	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.9E-05	0.0E+00	6.1E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.0E-05	

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_2.WK1
LAST SAVED:
DATE: 06/29/92
TIME: 09:50 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Child
TOXIC EFFECT: Carcinogenic and noncarcinogenic
COMMENTS:

PREAMBLE:

This is a risk assessment model for evaluating health risks associated with chemical contamination detected in environmental media (soil, air, groundwater or surface water). This model is designed to evaluate health risks associated with exposures from several different pathways using the guidelines presented in the EPA Risk Assessment Guidance for Superfund (RAGS). This model uses chemical concentrations measured during site investigations or estimated in environmental fate and transport models to estimate health risks.

PROJECT: UPRR Sacramento Site
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DATE: 06/29/92
TIME: 09:50 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Child
TOXIC EFFECT: Carcinogenic and noncarcinogenic

Pathway	Description	Label	Value	Units
General	Body Weight	BW	15.1	kg
	Exposure Duration	ED	6	years
	Averaging Time	AT	2190	days
Drinking water ingestion	Ingestion Rate	IRWATER	0	L/day
	Exposure Frequency	EFWATER	0	days/year
Ingestion during swimming	Contact Rate	CR	0	L/hour
	Exposure Time	ETSWIM	0	hours/event
	Exposure Frequency	EFSWIM	0	events/year
Dermal contact with surface water - Swimming	Skin Surface Area	SADERM_W	0	cm^2
	Exposure Time	ETDERM_W	0	hours/day
	Exposure Frequency	EFDERM_W	0	events/year
Dermal contact with surface water - Showering	Skin Surface Area	SADERM_S	0	cm^2
	Exposure Time	ETDERM_S	0	hours/day
	Exposure Frequency	EFDERM_S	0	events/year
Dermal contact with ground water - Showering	Skin Surface Area	SADERM_G	0	cm^2
	Exposure Time	ETDERM_G	0	hours/day
	Exposure Frequency	EFDERM_G	0	events/year
Soil ingestion on-site soils	Ingestion Rate	IRSOIL_ON	0.0002	kg/day
	Fraction Ingested (from contaminated source)	FISOIL_ON	1	
	Exposure Frequency	EFSOIL_ON	350	days/year
Dermal contact with on-site soil	Skin Surface Area	SADERM_SON	3910	cm^2
	Soil to skin adherence factor	AF	0.00000145	kg/cm^2
	Exposure Frequency	EFDERM_SON	350	events/year
Soil ingestion off-site soils	Ingestion Rate	IRSOIL_OFF	0	kg/day
	Fraction Ingested (from contaminated source)	FISOIL_OFF	0	
	Exposure Frequency	EFSOIL_OFF	0	days/year
Dermal contact with off-site soil	Skin Surface Area	SADERM_SOFF	0	cm^2
	Exposure Frequency	EFDERM_SOFF	0	events/year
Inhalation of outdoor air	Inhalation Rate	IRAIR_OUT	0	m^3/hr
	Exposure Time	ETAIR_OUT	0	hours/day

	Exposure Frequency	EFAIR_OUT	0 days/year
Inhalation of indoor air	Inhalation Rate	IRAIR_IN	0 m^3/hr
	Exposure Time	ETAIR_IN	0 hours/day
	Exposure Frequency	EFAIR_IN	0 days/year
Inhalation of indoor air - during showering	Inhalation Rate	IRAIR_SH	0 m^3/hr
	Exposure Time	ETAIR_SH	0 hours/day
	Exposure Frequency	EFAIR_SH	0 days/year
Ingestion of fish/shellfish	Ingestion Rate	IRFISH	0 kg/day
	Fraction Ingested (from contaminated source)	FIFISH	0
	Exposure frequency	EFFISH	0 days/year
Crop ingestion on-site soils	Ingestion Rate	IRCROP_ON	0 kg/day
	Fraction Ingested (from contaminated source)	FICROP_ON	0
	Exposure frequency	EFCROP_ON	0 days/year
Crop ingestion off-site soils	Ingestion Rate	IRCROP_OFF	0 kg/day
	Fraction Ingested (from contaminated source)	FICROP_OFF	0
	Exposure frequency	EFCROP_OFF	0 days/year
Meat/milk/eggs ingestion	Ingestion Rate	IRMEAT	0 kg/day
	Fraction Ingested (from contaminated source)	FIMEAT	0
	Exposure frequency	EFMEAT	0 days/year

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Chemical	Carcinogen Slope Factor (mg/kg/day)^-1		Reference Dose (mg/kg/day)		PC Dermal Permeability Constant (water) (cm/hr)	ABS Dermal Absorption Factor (soil)	Absorption Fractions					
	Ingestion	Inhalation	Ingestion	Inhalation			Soil	Water	Air	Crops	Meat/milk	Fish
Arsenic	1.75	15	0.001	0.001		0.0007	1.00	1.00	1.00	1.00	1.00	1.00

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RECEPTOR: On-site Resident - Child
TOXIC EFFECT: Carcinogenic and noncarcinogenic

Chemical	Conc. in Groundwater (mg/L)	Conc. in Surface Water (mg/L)	Conc. in Soil on-site (mg/kg)	Conc. in Soil off-site (mg/kg)	Conc. in Air outdoors (mg/m^3)	Conc. in Air indoors (mg/m^3)	Conc. in Air during showering (mg/m^3)	Conc. in Crops on-site soil (mg/kg)	Conc. in Crops off-site soil (mg/kg)	Conc. in Livestock Products (mg/kg)	Conc. in Fish (mg/kg)
Arsenic	0	0	8.00	0	0	0	0	0	0	0	0

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TOXIC EFFECT: Carcinogenic and noncarcinogenic

Chemical	Intake from each pathway (mg/kg-day)																
	Drinking Water Ingestion Ground water	Drinking Water Ingestion Surface water	Water Ingestion while Swimming	Dermal Contact Surface water Swimming	Dermal Contact Surface water Showering	Dermal Contact Ground water Showering	Soil Ingestion on-site soil	Soil Ingestion off-site soil	Dermal Contact with on-site soil	Dermal Contact with off-site soil	Inhalation Outdoor Air	Inhalation Indoor Air	Inhalation during showering	Ingestion of Fish and Shellfish	Ingestion of Crops on-site Soil	Ingestion of Crops off-site Soil	Ingestion of meat/ milk/eggs	Total
Arsenic	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.0E-04	0.0E+00	2.0E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.0E-04

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TOXIC EFFECT: Carcinogenic and noncarcinogenic

Chemical	Lifetime cancer risks from each pathway																	
	Drinking Water Ingestion Ground water	Drinking Water Ingestion Surface water	Water Ingestion while Swimming	Dermal Contact Surface water Swimming	Dermal Contact Surface water Showering	Dermal Contact Ground water Showering	Soil Ingestion on-site soil	Soil Ingestion off-site soil	Dermal Contact with on-site soil	Dermal Contact with off-site soil	Inhalation Outdoor Air	Inhalation Indoor Air	Inhalation during showering	Ingestion of Fish and Shellfish	Ingestion of Crops on-site Soil	Ingestion of Crops off-site Soil	Ingestion of meat/ milk/eggs	Total (Pathway)	Total (Scenario)
Arsenic	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00	3.5E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-04	

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_3.WK1
LAST SAVED:
DATE: 06/29/92
TIME: 09:52 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Child
TOXIC EFFECT: Carcinogenic and noncarcinogenic
COMMENTS:

PREAMBLE:

This is a risk assessment model for evaluating health risks associated with chemical contamination detected in environmental media (soil, air, groundwater or surface water). This model is designed to evaluate health risks associated with exposures from several different pathways using the guidelines presented in the EPA Risk Assessment Guidance for Superfund (RAGS). This model uses chemical concentrations measured during site investigations or estimated in environmental fate and transport models to estimate health risks.

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TIME: 09:52 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Child
TOXIC EFFECT: Carcinogenic and noncarcinogenic

Pathway	Description	Label	Value	Units
General	Body Weight	BW	15.1	kg
	Exposure Duration	ED	6	years
	Averaging Time	AT	2190	days
Drinking water ingestion	Ingestion Rate	IRWATER	0	L/day
	Exposure Frequency	EFWATER	0	days/year
Ingestion during swimming	Contact Rate	CR	0	L/hour
	Exposure Time	ETSWIM	0	hours/event
	Exposure Frequency	EFSWIM	0	events/year
Dermal contact with surface water - Swimming	Skin Surface Area	SADERM_W	0	cm^2
	Exposure Time	ETDERM_W	0	hours/day
	Exposure Frequency	EFDERM_W	0	events/year
Dermal contact with surface water - Showering	Skin Surface Area	SADERM_S	0	cm^2
	Exposure Time	ETDERM_S	0	hours/day
	Exposure Frequency	EFDERM_S	0	events/year
Dermal contact with ground water - Showering	Skin Surface Area	SADERM_G	0	cm^2
	Exposure Time	ETDERM_G	0	hours/day
	Exposure Frequency	EFDERM_G	0	events/year
Soil ingestion on-site soils	Ingestion Rate	IRSOIL_ON	0.0002	kg/day
	Fraction Ingested (from contaminated source)	FISOIL_ON	1	
	Exposure Frequency	EFSOIL_ON	350	days/year
Dermal contact with on-site soil	Skin Surface Area	SADERM_SON	3910	cm^2
	Soil to skin adherence factor	AF	0.00000145	kg/cm^2
	Exposure Frequency	EFDERM_SON	350	events/year
Soil ingestion off-site soils	Ingestion Rate	IRSOIL_OFF	0	kg/day
	Fraction Ingested (from contaminated source)	FISOIL_OFF	0	
	Exposure Frequency	EFSOIL_OFF	0	days/year
Dermal contact with off-site soil	Skin Surface Area	SADERM_SOFF	0	cm^2
	Exposure Frequency	EFDERM_SOFF	0	events/year
Inhalation of outdoor air	Inhalation Rate	IRAIR_OUT	0	m^3/hr
	Exposure Time	ETAIR_OUT	0	hours/day

	Exposure Frequency	EFAIR_OUT	0 days/year
Inhalation of indoor air	Inhalation Rate	IRAIR_IN	0 m^3/hr
	Exposure Time	ETAIR_IN	0 hours/day
	Exposure Frequency	EFAIR_IN	0 days/year
Inhalation of indoor air - during showering	Inhalation Rate	IRAIR_SH	0 m^3/hr
	Exposure Time	ETAIR_SH	0 hours/day
	Exposure Frequency	EFAIR_SH	0 days/year
Ingestion of fish/shellfish	Ingestion Rate	IRFISH	0 kg/day
	Fraction Ingested (from contaminated source)	FIFISH	0
	Exposure frequency	EFFISH	0 days/year
Crop ingestion on-site soils	Ingestion Rate	IRCROP_ON	0 kg/day
	Fraction Ingested (from contaminated source)	FICROP_ON	0
	Exposure frequency	EFCROP_ON	0 days/year
Crop ingestion off-site soils	Ingestion Rate	IRCROP_OFF	0 kg/day
	Fraction Ingested (from contaminated source)	FICROP_OFF	0
	Exposure frequency	EFCROP_OFF	0 days/year
Meat/milk/eggs ingestion	Ingestion Rate	IRMEAT	0 kg/day
	Fraction Ingested (from contaminated source)	FIMEAT	0
	Exposure frequency	EFMEAT	0 days/year

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_3.WK1
LAST SAVED
DATE: 06/29/92
TIME: 09:52 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Child
TOXIC EFFECT: Carcinogenic and noncarcinogenic

Chemical	Carcinogen Slope Factor (mg/kg/day)^-1		Reference Dose (mg/kg/day)		PC Dermal Permeability Constant (water) (cm/hr)	ABS Dermal Absorption Factor (soil)	Absorption Fractions					
	Ingestion	Inhalation	Ingestion	Inhalation			Soil	Water	Air	Crops	Meat/milk	Fish
Arsenic	1.75	15	0.001	0.001		0.0007	1.00	1.00	1.00	1.00	1.00	1.00

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SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Child
TOXIC EFFECT: Carcinogenic and noncarcinogenic

Chemical	Conc. in Groundwater (mg/L)	Conc. in Surface Water (mg/L)	Conc. in Soil on-site (mg/kg)	Conc. in Soil off-site (mg/kg)	Conc. in Air outdoors (mg/m^3)	Conc. in Air indoors (mg/m^3)	Conc. in Air during showering (mg/m^3)	Conc. in Crops on-site soil (mg/kg)	Conc. in Crops off-site soil (mg/kg)	Conc. in Livestock Products (mg/kg)	Conc. in Fish (mg/kg)
Arsenic	0	0	0.04	0	0	0	0	0	0	0	0

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Chemical	Intake from each pathway (mg/kg-day)																
	Drinking Water Ingestion Ground water	Drinking Water Ingestion Surface water	Water Ingestion while Swimming	Dermal Contact Surface water Swimming	Dermal Contact Surface water Showering	Dermal Contact Ground Water Showering	Soil Ingestion on-site soil	Soil Ingestion off-site soil	Dermal Contact with on-site soil	Dermal Contact with off-site soil	Inhalation Outdoor Air	Inhalation Indoor Air	Inhalation during showering	Ingestion of Fish and Shellfish	Ingestion of Crops on-site Soil	Ingestion of Crops off-site Soil	Ingestion of meat/ milk/eggs	Total
Arsenic	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.6E-07	0.0E+00	1.1E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.7E-07

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_3.WK1
LAST SAVED
DATE: 06/29/92
TIME: 09:52 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Child
TOXIC EFFECT: Carcinogenic and noncarcinogenic

Chemical	Lifetime cancer risks from each pathway																	
	Drinking Water Ingestion Ground water	Drinking Water Ingestion Surface water	Water Ingestion while Swimming	Dermal Contact Surface water Swimming	Dermal Contact Surface water Showering	Dermal Contact Ground water Showering	Soil Ingestion on-site soil	Soil Ingestion off-site soil	Dermal Contact with on-site soil	Dermal Contact with off-site soil	Inhalation Outdoor Air	Inhalation Indoor Air	Inhalation during showering	Ingestion of Fish and Shellfish	Ingestion of Crops on-site Soil	Ingestion of Crops off-site Soil	Ingestion of meat/ milk/eggs	Total (Pathway)	Total (Scenario)
Arsenic	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.8E-07	0.0E+00	1.9E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.0E-06	

Appendix 5

ATTACHMENT 5

SPREADSHEETS

CALCULATED RISKS ASSOCIATED WITH BACKGROUND ARSENIC IN SOIL - BASED ON MARCH 17, 1992 MEETING WITH DTSC

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4.WK1
LAST SAVED:
DATE: 07/02/92
TIME: 07:12 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation
COMMENTS: Calculation has been revised in accordance with DTSC request. Recalculation is based on EPA RAGS Standard Default Exposure Factors guidance

PREAMBLE:

This is a risk assessment model for evaluating health risks associated with chemical contamination detected in environmental media (soil, air, groundwater or surface water). This model is designed to evaluate health risks associated with exposures from several different pathways using the guidelines presented in the EPA Risk Assessment Guidance for Superfund (RAGS). This model uses chemical concentrations measured during site investigations or estimated in environmental fate and transport models to estimate health risks.

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:12 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Pathway	Description	Label	Value	Units
General	Body Weight	BW	70	kg
	Exposure Duration	ED	24	years
	Averaging Time	AT	25550	days
Drinking water ingestion	Ingestion Rate	IRWATER	0	L/day
	Exposure Frequency	EFWATER	0	days/year
Ingestion during swimming	Contact Rate	CR	0	L/hour
	Exposure Time	ETSWIM	0	hours/event
	Exposure Frequency	EFSWIM	0	events/year
Dermal contact with surface water - Swimming	Skin Surface Area	SADERM_W	0	cm^2
	Exposure Time	ETDERM_W	0	hours/day
	Exposure Frequency	EFDERM_W	0	events/year
Dermal contact with surface water - Showering	Skin Surface Area	SADERM_S	0	cm^2
	Exposure Time	ETDERM_S	0	hours/day
	Exposure Frequency	EFDERM_S	0	events/year
Dermal contact with ground water - Showering	Skin Surface Area	SADERM_G	0	cm^2
	Exposure Time	ETDERM_G	0	hours/day
	Exposure Frequency	EFDERM_G	0	events/year
Soil ingestion on-site soils	Ingestion Rate	IRSOIL_ON	0.0001	kg/day
	Fraction Ingested (from contaminated source)	FISOIL_ON	1	
	Exposure Frequency	EFSOIL_ON	350	days/year
Dermal contact with on-site soil	Skin Surface Area	SADERM_SON	3120	cm^2
	Soil to skin adherence factor	AF	0.00000145	kg/cm^2
	Exposure Frequency	EFDERM_SON	350	events/year
Soil ingestion off-site soils	Ingestion Rate	IRSOIL_OFF	0	kg/day
	Fraction Ingested (from contaminated source)	FISOIL_OFF	0	
	Exposure Frequency	EFSOIL_OFF	0	days/year
Dermal contact with off-site soil	Skin Surface Area	SADERM_SOFF	0	cm^2
	Exposure Frequency	EFDERM_SOFF	0	events/year
Inhalation of outdoor air	Inhalation Rate	IRAIR_OUT	0	m^3/hr
	Exposure Time	ETAIR_OUT	0	hours/day

	Exposure Frequency	EFAIR_OUT	0 days/year
Inhalation of indoor air	Inhalation Rate	IRAIR_IN	0 m^3/hr
	Exposure Time	ETAIR_IN	0 hours/day
	Exposure Frequency	EFAIR_IN	0 days/year
Inhalation of indoor air - during showering	Inhalation Rate	IRAIR_SH	0 m^3/hr
	Exposure Time	ETAIR_SH	0 hours/day
	Exposure Frequency	EFAIR_SH	0 days/year
Ingestion of fish/shellfish	Ingestion Rate	IRFISH	0 kg/day
	Fraction Ingested (from contaminated source)	FIFISH	0
	Exposure frequency	EFFISH	0 days/year
Crop ingestion on-site soils	Ingestion Rate	IRCROP_ON	0 kg/day
	Fraction Ingested (from contaminated source)	FICROP_ON	0
	Exposure frequency	EFCROP_ON	0 days/year
Crop ingestion off-site soils	Ingestion Rate	IRCROP_OFF	0 kg/day
	Fraction Ingested (from contaminated source)	FICROP_OFF	0
	Exposure frequency	EFCROP_OFF	0 days/year
Meat/milk/eggs ingestion	Ingestion Rate	IRMEAT	0 kg/day
	Fraction Ingested (from contaminated source)	FIMEAT	0
	Exposure frequency	EFMEAT	0 days/year

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:12 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Chemical	Carcinogen Slope Factor (mg/kg/day)^-1		Reference Dose (mg/kg/day)		PC Dermal Permeability Constant (water) (cm/hr)	ABS Dermal Absorption Factor (soil)	Absorption Fractions					
	Ingestion	Inhalation	Ingestion	Inhalation			Soil	Water	Air	Crops	Meat/milk	Fish
Arsenic	1.75	15	0.001	0.001		0.0007	1.00	1.00	1.00	1.00	1.00	1.00

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:12 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Chemical	Conc. in Groundwater (mg/L)	Conc. in Surface Water (mg/L)	Conc. in Soil on-site (mg/kg)	Conc. in Soil off-site (mg/kg)	Conc. in Air outdoors (mg/m^3)	Conc. in Air indoors (mg/m^3)	Conc. in Air during showering (mg/m^3)	Conc. in Crops on-site soil (mg/kg)	Conc. in Crops off-site soil (mg/kg)	Conc. in Livestock Products (mg/kg)	Conc. in Fish (mg/kg)
Arsenic	0	0	8.00	0	0	0	0	0	0	0	0

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:12 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Chemical	Intake from each pathway (mg/kg-day)																
	Drinking Water Ingestion Ground water	Drinking Water Ingestion Surface water	Water Ingestion while Swimming	Dermal Contact Surface water Swimming	Dermal Contact Surface water Showering	Dermal Contact Ground water Showering	Soil Ingestion on-site soil	Soil Ingestion off-site soil	Dermal Contact with on-site soil	Dermal Contact with off-site soil	Inhalation Outdoor Air	Inhalation Indoor Air	Inhalation during showering	Ingestion of Fish and Shellfish	Ingestion of Crops on-site Soil	Ingestion of Crops off-site Soil	Ingestion of meat/ milk/eggs	Total
Arsenic	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.8E-06	0.0E+00	1.2E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.9E-06

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:12 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Chemical	Lifetime cancer risks from each pathway																	
	Drinking Water Ingestion Ground water	Drinking Water Ingestion Surface water	Water Ingestion while Swimming	Dermal Contact Surface water Swimming	Dermal Contact Surface water Showering	Dermal Contact Ground water Showering	Soil Ingestion on-site soil	Soil Ingestion off-site soil	Dermal Contact with on-site soil	Dermal Contact with off-site soil	Inhalation Outdoor Air	Inhalation Indoor Air	Inhalation during showering	Ingestion of Fish and Shellfish	Ingestion of Crops on-site Soil	Ingestion of Crops off-site Soil	Ingestion of meat/ milk/eggs	Total (Pathway)	Total (Scenario)
Arsenic	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.6E-06	0.0E+00	2.1E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.8E-06	

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4A.WK1
LAST SAVED:
DATE: 07/02/92
TIME: 07:16 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation
COMMENTS: Calculation has been revised in accordance with DTSC request. Recalculation is based on EPA RAGS Standard Default Exposure Factors guidance

PREAMBLE:

This is a risk assessment model for evaluating health risks associated with chemical contamination detected in environmental media (soil, air, groundwater or surface water). This model is designed to evaluate health risks associated with exposures from several different pathways using the guidelines presented in the EPA Risk Assessment Guidance for Superfund (RAGS). This model uses chemical concentrations measured during site investigations or estimated in environmental fate and transport models to estimate health risks.

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4A.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:16 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Pathway	Description	Label	Value	Units
General	Body Weight	BW	15.1	kg
	Exposure Duration	ED	6	years
	Averaging Time	AT	25550	days
Drinking water ingestion	Ingestion Rate	IRWATER	0	L/day
	Exposure Frequency	EFWATER	0	days/year
Ingestion during swimming	Contact Rate	CR	0	L/hour
	Exposure Time	ETSWIM	0	hours/event
	Exposure Frequency	EFSWIM	0	events/year
Dermal contact with surface water - Swimming	Skin Surface Area	SADERM_W	0	cm^2
	Exposure Time	ETDERM_W	0	hours/day
	Exposure Frequency	EFDERM_W	0	events/year
Dermal contact with surface water - Showering	Skin Surface Area	SADERM_S	0	cm^2
	Exposure Time	ETDERM_S	0	hours/day
	Exposure Frequency	EFDERM_S	0	events/year
Dermal contact with ground water - Showering	Skin Surface Area	SADERM_G	0	cm^2
	Exposure Time	ETDERM_G	0	hours/day
	Exposure Frequency	EFDERM_G	0	events/year
Soil ingestion on-site soils	Ingestion Rate	IRSOIL_ON	0.0002	kg/day
	Fraction Ingested (from contaminated source)	FISOIL_ON	1	
	Exposure Frequency	EFSOIL_ON	350	days/year
Dermal contact with on-site soil	Skin Surface Area	SADERM_SON	3120	cm^2
	Soil to skin adherence factor	AF	0.00000145	kg/cm^2
	Exposure Frequency	EFDERM_SON	350	events/year
Soil ingestion off-site soils	Ingestion Rate	IRSOIL_OFF	0	kg/day
	Fraction Ingested (from contaminated source)	FISOIL_OFF	0	
	Exposure Frequency	EFSOIL_OFF	0	days/year
Dermal contact with off-site soil	Skin Surface Area	SADERM_SOFF	0	cm^2
	Exposure Frequency	EFDERM_SOFF	0	events/year
Inhalation of outdoor air	Inhalation Rate	IRAIR_OUT	0	m^3/hr
	Exposure Time	ETAIR_OUT	0	hours/day

	Exposure Frequency	EFAIR_OUT	0 days/year
Inhalation of indoor air	Inhalation Rate	IRAIR_IN	0 m^3/hr
	Exposure Time	ETAIR_IN	0 hours/day
	Exposure Frequency	EFAIR_IN	0 days/year
Inhalation of indoor air - during showering	Inhalation Rate	IRAIR_SH	0 m^3/hr
	Exposure Time	ETAIR_SH	0 hours/day
	Exposure Frequency	EFAIR_SH	0 days/year
Ingestion of fish/shellfish	Ingestion Rate	IRFISH	0 kg/day
	Fraction Ingested (from contaminated source)	FIFISH	0
	Exposure frequency	EFFISH	0 days/year
Crop ingestion on-site soils	Ingestion Rate	IRCROP_ON	0 kg/day
	Fraction Ingested (from contaminated source)	FICROP_ON	0
	Exposure frequency	EFCROP_ON	0 days/year
Crop ingestion off-site soils	Ingestion Rate	IRCROP_OFF	0 kg/day
	Fraction Ingested (from contaminated source)	FICROP_OFF	0
	Exposure frequency	EFCROP_OFF	0 days/year
Meat/milk/eggs ingestion	Ingestion Rate	IRMEAT	0 kg/day
	Fraction Ingested (from contaminated source)	FIMEAT	0
	Exposure frequency	EFMEAT	0 days/year

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4A.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:16 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Chemical	Carcinogen Slope Factor (mg/kg/day)^-1		Reference Dose (mg/kg/day)		PC Dermal Permeability Constant (water) (cm/hr)	ABS Dermal Absorption Factor (soil)	Absorption Fractions					
	Ingestion	Inhalation	Ingestion	Inhalation			Soil	Water	Air	Crops	Meat/milk	Fish
Arsenic	1.75	15	0.001	0.001		0.0007	1.00	1.00	1.00	1.00	1.00	1.00

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4A.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:16 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Chemical	Conc. in Groundwater (mg/L)	Conc. in Surface Water (mg/L)	Conc. in Soil on-site (mg/kg)	Conc. in Soil off-site (mg/kg)	Conc. in Air outdoors (mg/m^3)	Conc. in Air indoors (mg/m^3)	Conc. in Air during showering (mg/m^3)	Conc. in Crops on-site soil (mg/kg)	Conc. in Crops off-site soil (mg/kg)	Conc. in Livestock Products (mg/kg)	Conc. in Fish (mg/kg)
Arsenic	0	0	8.00	0	0	0	0	0	0	0	0

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4A.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:16 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Chemical	Intake from each pathway (mg/kg-day)																
	Drinking Water Ingestion Ground water	Drinking Water Ingestion Surface water	Water Ingestion while Swimming	Dermal Contact Surface water Swimming	Dermal Contact Surface water Showering	Dermal Contact Ground water Showering	Soil Ingestion on-site soil	Soil Ingestion off-site soil	Dermal Contact with on-site soil	Dermal Contact with off-site soil	Inhalation Outdoor Air	Inhalation Indoor Air	Inhalation during showering	Ingestion of Fish and Shellfish	Ingestion of Crops on-site Soil	Ingestion of Crops off-site Soil	Ingestion of meat/ milk/eggs	Total
Arsenic	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.7E-06	0.0E+00	1.4E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.8E-06

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4A.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:16 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Chemical	Lifetime cancer risks from each pathway																	
	Drinking Water Ingestion Ground water	Drinking Water Ingestion Surface water	Water Ingestion while Swimming	Dermal Contact Surface water Swimming	Dermal Contact Surface water Showering	Dermal Contact Ground water Showering	Soil Ingestion on-site soil	Soil Ingestion off-site soil	Dermal Contact with on-site soil	Dermal Contact with off-site soil	Inhalation Outdoor Air	Inhalation Indoor Air	Inhalation during showering	Ingestion of Fish and Shellfish	Ingestion of Crops on-site Soil	Ingestion of Crops off-site Soil	Ingestion of meat/ milk/eggs	Total (Pathway)	Total (Scenario)
Arsenic	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-05	0.0E+00	2.4E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-05	

	Exposure Frequency	EFAIR_OUT	0 days/year
Inhalation of indoor air	Inhalation Rate	IRAIR_IN	0 m^3/hr
	Exposure Time	ETAIR_IN	0 hours/day
	Exposure Frequency	EFAIR_IN	0 days/year
Inhalation of indoor air - during showering	Inhalation Rate	IRAIR_SH	0 m^3/hr
	Exposure Time	ETAIR_SH	0 hours/day
	Exposure Frequency	EFAIR_SH	0 days/year
Ingestion of fish/shellfish	Ingestion Rate	IRFISH	0 kg/day
	Fraction Ingested (from contaminated source)	FIFISH	0
	Exposure frequency	EFFISH	0 days/year
Crop ingestion on-site soils	Ingestion Rate	IRCROP_ON	0 kg/day
	Fraction Ingested (from contaminated source)	FICROP_ON	0
	Exposure frequency	EFCROP_ON	0 days/year
Crop ingestion off-site soils	Ingestion Rate	IRCROP_OFF	0 kg/day
	Fraction Ingested (from contaminated source)	FICROP_OFF	0
	Exposure frequency	EFCROP_OFF	0 days/year
Meat/milk/eggs ingestion	Ingestion Rate	IRMEAT	0 kg/day
	Fraction Ingested (from contaminated source)	FIMEAT	0
	Exposure frequency	EFMEAT	0 days/year

PROJECT: LPRR Sacramento Site
PROJECT FILENAME: AS_4A.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:16 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Chemical	Carcinogen Slope Factor (mg/kg/day)^-1		Reference Dose (mg/kg/day)		PC Dermal Permeability Constant (water) (cm/hr)	ABS Dermal Absorption Factor (soil)	Absorption Fractions					
	Ingestion	Inhalation	Ingestion	Inhalation			Soil	Water	Air	Crops	Meat/milk	Fish
Arsenic	1.75	15	0.001	0.001		0.0007	1.00	1.00	1.00	1.00	1.00	1.00

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4A.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:16 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Chemical	Conc. in Groundwater (mg/L)	Conc. in Surface Water (mg/L)	Conc. in Soil on-site (mg/kg)	Conc. in Soil off-site (mg/kg)	Conc. in Air outdoors (mg/m^3)	Conc. in Air indoors (mg/m^3)	Conc. in Air during showering (mg/m^3)	Conc. in Crops on-site soil (mg/kg)	Conc. in Crops off-site soil (mg/kg)	Conc. in Livestock Products (mg/kg)	Conc. in Fish (mg/kg)
Arsenic	0	0	8.00	0	0	0	0	0	0	0	0

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4A.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:16 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Chemical	Intake from each pathway (mg/kg-day)																	
	Drinking Water Ingestion Ground water	Drinking Water Ingestion Surface water	Water Ingestion while Swimming	Dermal Contact Surface water Swimming	Dermal Contact Surface water Showering	Dermal Contact Ground water Showering	Soil Ingestion on-site soil	Soil Ingestion off-site soil	Dermal Contact with on-site soil	Dermal Contact with off-site soil	Inhalation Outdoor Air	Inhalation Indoor Air	Inhalation during showering	Ingestion of Fish and Shellfish	Ingestion of Crops on-site Soil	Ingestion of Crops off-site Soil	Ingestion of meat/ milk/eggs	Total
Arsenic	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.7E-06	0.0E+00	1.4E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.8E-06

PROJECT: UPRR Sacramento Site
PROJECT FILENAME: AS_4A.WK1
LAST SAVED
DATE: 07/02/92
TIME: 07:16 AM

SITE/STUDY AREA: Future land use
RECEPTOR: On-site Resident - Adult and Child Exposures
TOXIC EFFECT: Revised Arsenic Risk Calculation

Chemical	Lifetime cancer risks from each pathway																	
	Drinking Water Ingestion Ground water	Drinking Water Ingestion Surface water	Water Ingestion while Swimming	Dermal Contact Surface water Swimming	Dermal Contact Surface water Showering	Dermal Contact Ground Water Showering	Soil Ingestion on-site soil	Soil Ingestion off-site soil	Dermal Contact with on-site soil	Dermal Contact with off-site soil	Inhalation Outdoor Air	Inhalation Indoor Air	Inhalation during showering	Ingestion of Fish and Shellfish	Ingestion of Crops on-site Soil	Ingestion of Crops off-site Soil	Ingestion of meat/ milk/eggs	Total (Pathway)	Total (Scenario)
Arsenic	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-05	0.0E+00	2.4E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-05	