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New Orleans, Louisiana
September 10, 1992

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EXPRESS MAIL

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Region VI (6H-MC)
1445 Ross Avenue
Dallas, Texas 75202-2733

Re: Public Comments, Proposed Plans
of Action and RI/FS Documents,
Gulf Coast Vacuum Services Superfund Site

Dear Mr. Oliver:

This letter forwards technical comments on the Proposed Plans of Action, the Remedial Investigation/Feasibility Study materials, and the Risk Assessment, all associated with the referenced Superfund site. These comments were prepared by J.M. Montgomery Consulting Engineers, Inc. on behalf of the twenty companies listed on the opening page of the enclosed document. (Please note that this firm serves as legal representative for the nine companies listed below.)

Gulf Coast Vacuum Services, Inc. Site
Vermilion Parish, Louisiana

Comments on the USEPA Proposed Plans of Action, RI/FS, and Supporting Documents

SEPTEMBER 1992

JMM James M. Montgomery
Consulting Engineers Inc.

Thank you for this consideration.

Sincerely,

Craig Wyman

Craig Wyman

Attorneys for American Exploration Company, American National Petroleum Company, Cockrell Oil Corporation, Columbia Gas Development Corporation, Forest Oil Corporation, OXY USA Inc., Quintana Petroleum Corporation, Santa Fe Energy Resources, Inc., and Sonat Exploration Company

WCW/ym
Enclosure
cc: Ann Schober
Nelly Shirer, Atty.
Harold Etheridge, La. DEQ

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1.0 INTRODUCTION

1.1 Summary

This document is being submitted on behalf of Amerada Hess Corporation, American National Petroleum Company, Atlantic Richfield, Chevron U.S.A. Inc., Cockrell Oil Corporation, Conoco Inc., Dynamic Exploration, Inc., Fina Oil & Chemical Company, Forest Oil Corporation, Galveston-Houston Company, Graham Energy Services, Inc., Hrubetz Oil Company, OXY USA Inc., Pennzoil Company, Quintana Petroleum Corporation, Santa Fe Energy Resources, Inc., Shell Offshore Inc., Sonat Exploration Company, TXP Operating Company, and Williams Exploration Company.

The following pages set forth comments and recommendations regarding U.S. Environmental Protection Agency (EPA) Region VI's Proposed Plans of Action, Remedial Investigation and Feasibility Study ("RI/FS"), Risk Assessment (RA), and associated documentation, which have been issued with regard to the Gulf Coast Vacuum Services, Inc. Superfund (GCVSS) site near Abbeville, Louisiana. The discussion identifies:

- Critical subject areas deserving of reevaluation;
- Alternate analytical approaches and results; and
- Erroneous decisions reached in the course of the RI/FS process and remedy selection.

The discussion also includes recommended changes and areas in the decision process where reevaluation is of critical importance to selecting appropriate and effective remedies.

The document's substantive analyses have reached three primary conclusions. First, the discussion concludes that data inadequacies in the RI, and improper judgments in using these data, have resulted in overstated exposure concentrations. When

combined with unreasonable and noncredible exposure scenarios, these data have resulted in excessive and unrealistic estimates of the risks posed by this site. Second, the discussion shows that these exaggerated risks have in turn resulted in the unsupported expansion of the area needing remediation to be protective of human health and the environment. This is especially true of the shallow site soils not associated with the fuel tanks or pit sludges, where a "no action" response alternative is entirely justified by a proper risk assessment analysis. Finally, the report demonstrates that serious shortcomings in the remedy selection process have resulted in the inappropriate exclusion of viable treatment technologies.

For these reasons, we submit that it is imperative that the agency undertake a reconsideration of true risk estimates; a reevaluation of the appropriate remedy when true risk levels are taken into account; and, after considering the foregoing, and other (as-yet-inadequately-analyzed) remedial technology alternatives, the implementation of consequent changes in the Proposed Plans for Interim and Final Source Action.

1.2 Approach

The comments are organized for presentation into six topics:

- Remedial Investigation - Review of Data Limitations;
- Critical Review of Baseline Human Health and Environmental Risk Assessments;
- Alternative Risk Calculations;
- Evaluation of Remedy Selection;
- Review of Remedial Action Objectives; and
- Conclusions.

The comments have been assembled in this fashion in order to systematically address the impact of errors or limitations associated with each step in the RI/FS process -- as defined in the National Contingency Plan (NCP, 40 CFR § 300.430) -- on succeeding steps in that process. Regarding the GCVSS site, data limitations resulting from the RI have caused limitations on the quality of decisions in the RA and FS. Similarly, inflated estimates of risk in the RA have resulted in decisions in the FS and the proposed remedies which cannot be defended, and thus should be reevaluated.

As part of this approach, this document summarizes the RI data limitations, and RA and Environmental Assessment methods and errors in the development of these documents. Detailed alternative risk calculations are presented for shallow site soils, as an example of the need to reevaluate the risk analysis, remedy selection, and remedial action objectives. Based on this critical review, alternate remedial goals are also identified for the agency's further consideration.

1.3 Results and Recommendations

As a result of the following analyses, this report urges the agency to:

- Re-examine the database regarding constituents of concern;
- Develop additional treatability data for solidification, stabilization and bioremediation;
- Develop reasonable exposure scenarios;
- Reevaluate site risks; and
- Evaluate alternative technologies which adequately protect human health and the environment.

2.0 REMEDIAL INVESTIGATION - DATA LIMITATIONS

2.1 Data Quality Objectives.

EPA has failed to follow its own guidelines regarding Data Quality Objectives (DQO), resulting in excessive detection limits, improper consideration of non-detectable compounds, and poor judgment regarding common laboratory contaminants and background concentrations. In addition, EPA has failed to develop appropriate data on alternative treatment technologies as required by the National Contingency Plan (NCP).

Proper development, implementation, and evaluation of Data Quality Objectives is critical to the success of an RI in obtaining data which are adequate for the decisions described in the RI/FS and Proposed Remediation Plan documents. Several important data quality issues affect the RA and FS for the GCVSS site. These include Practical Quantitation Limits (PQLs), laboratory contaminants, background data, and limited treatability evaluation data.

The EPA DQOs for the GCVSS site were defined in the Sampling and Analysis Plan for the RI/FS. In keeping with requirements of the NCP (40 CFR § 300.430(a)(1)(ii)(C) and 40 CFR § 300.430(b)(5)), DQOs for CERCLA sites are required to be developed in accordance with guidance provided in a two-volume document titled "Data Quality Objectives for Remedial Response Activities; Development Process, and Example Scenario" (DQO guidance, USEPA, 1987). In developing the RI for the GCVSS site EPA has not adhered to this guidance. DQO guidance provides that RI data are to be of a <u>previously</u> defined quality and quantity and are to be consistent with each data requirement or use. EPA guidance requires, <u>before</u> data collection, definition of target precision, accuracy, and completeness objectives for the data; required detection limits for each data use; and, grid spacing (i.e., acceptable accuracy,

by inference), which is needed to adequately define the extent of contamination. While the DQOs process is by nature iterative, changes and the need for subsequent phased investigations are to be planned and evaluated with respect to specific data quality and quantity objections. This process was not followed by EPA for the GCVSS site.

From this review, it appears that DQOs for the GCVSS site were not adequately defined in the Sampling and Analysis Plan, nor were they reviewed in subsequent work plans for the phased RI sampling at the site. Therefore, it is difficult to evaluate whether the data obtained are sufficient to meet these objectives. More specifically, the EPA has not adequately defined the quantity nor the quality of the information which will be required to fulfill those objectives of the site investigations.

Because EPA did not prospectively define DQOs as required by its own guidance, EPA was forced to evaluate the RI data in retrospect. For example, EPA had to define the detection limits or levels of precision which are acceptable based on RI findings rather than on previously defined objectives. The failure to adequately develop and evaluate DQOs has resulted in inadequate data for use in decision-making, and for use in conducting the various field study phases.

A summary of the DQOs given in the project Sampling and Analysis Plan is listed below. These represent stages one (the identification of decision types) and two (the identification of data uses/needs) of the DQO process:

1) Conduct a risk assessment to determine the risk to human health and the environment.

2) Evaluate potential remedial alternatives.

3) Evaluate applicable or relevant and appropriate requirements (ARARs).

4) Characterize and determine the extent of contamination.

5) Verify the presence or the potential for hazardous substance migration to the groundwater.

6) Verify the presence or the potential for hazardous substance migration offsite.

7) Evaluate site sampling and equipment decontamination procedures.

These DQOs were not adequately satisfied, at least in part because specific problems, goals, and objectives were not identified and resolved in order to obtain data during the RI sufficient for the purposes described in these DQOs. Thus, the RI/FS for the GCVSS site did not comply with the DQO guidance (EPA, 1987, Sections 4.3 through 4.6) and with the "Interim Final Guidance for Data Useability in Risk Assessment" (Data Useability guidance, USEPA 1990, Section 3.1). Specific data quality/useability issues are discussed further in this Section and in comment Sections 3 and 5.

No summary of the Contract Laboratory Program (CLP) data validation documentation was prepared or presented in the RI for the GCVSS site. Although complete analytical results and data validation documentation were requested under the Freedom of Information Act (FOIA), EPA declined to provide this information, making a thorough review of data quality assurance/quality control (QA/QC) impossible. EPA did not define specific objectives for acceptable PQLs or for the precision, accuracy, representativeness, comparability, and completeness (PARCC) criteria. These are the critical elements given in the DQO guidance for evaluation of data QA/QC.

Because these factors were not addressed in the RI, EPA has provided no basis to assess the appropriate level of confidence to place in the adequacy of the data, and whether, for example, arsenic or benzo-b-fluoranthene concentrations reported may be

over- or under-estimated. The lack of development of objectives and evaluation of performance according to these parameters contradicts both the DQO guidance (EPA, 1987, Section 4.6) and the Data Useability guidance (USEPA 1990, Section 3.1 and Exhibit 3-2).

The impact of EPA's failure to follow DQO guidance regarding specific data quality issues on the RA and FS are presented below.

2.2 Practical Quantitation Limits (PQLs)

Detection limits, known as PQLs for CLP analyses and achieved in the organics analyses of site sludge and soils, are in many cases inadequate for use in the RA and are inadequate for defining acceptable remedial goals in the FS.

In most cases, the RI data show that the presence of unknown tentatively identified compounds (TICs) at high concentrations (and not of target compounds under consideration as constituents of concern) has resulted in the reporting of target compounds as "not detected" at relatively high PQLs. This is because, at a single sample dilution using the CLP methods employed, the presence of high concentrations of TICs attenuates the results, "hiding" the target analytes which may not be present at all or at concentrations far below the reported PQLs. For example, a sludge "surface" sample taken at location PS-6 in the West Pit (sample FP 320) exhibited 62,464 mg/kg of "unknown alkane" semivolatile organic TICs and no target semivolatile organics at PQLs of 684 - 1,170 mg/kg; a surface soil sample from northeast area location NE-11 (sample FP 244) exhibited 349 mg/kg of "unknown hydrocarbons" semivolatile organic TICs and no target semivolatile organics above PQls of 22 mg/kg. Thus, all the target analytes for these and many other samples were non-detectable at the GCVSS site. The detection levels for target compounds reported by EPA are often 10 to 1000 times the PQLs which the analytical method

can achieve using appropriate multiple sample dilutions or other techniques. This results in data sets for these media consisting in many instances of 75 percent or more "below PQL" results. EPA did not plan and implement proper laboratory procedures to achieve reasonable PQLs.

Because EPA did not follow its own guidance, EPA found most target organic compounds to be non-detectable. However, EPA carried these "data" through the RA, even though no useable information as to actual concentration was obtained during the RI. Use of these "below PQL" data with high PQLs in the RA results in a skewed data distribution which significantly overestimates risk from constituents which were actually seldom or never detected in many sections of the site. An arbitrary substitution of one-half the PQL was used during RA, which, because of the excessively high PQLs, resulted in inflated statistical estimates of concentrations of constituents to be assessed. This process resulted in the systematic overestimation of the risks posed by this site.

Specific objectives for acceptable PQLs should have been defined early in the RI process, based on analytical expectations for oily sludge and on preliminary analytical results. This type of consideration is clearly intended by the NCP (40 CFR § 300.430(a)(1)(ii)(C) and 40 CFR § 300.430(b)(5)) and the DQO (USEPA, 1987, Section 4.3) and Data Useability (USEPA, 1990, Section 3.1.3) guidance. It was not until the Phase II RI (after five previous sampling events) that laboratory cleanup procedures were even tested for the site samples, and then this necessary evaluation was pursued only for selected sludge analyses. The results of these tests were not very successful in lowering PQLs to levels appropriate for RA evaluation, as shown in Table 14 of Appendix 1 to the RI.

Secondary dilution and use of Selected Ion Monitoring during GC/MS analyses are the most common approaches to solving this problem, and have been used successfully in many instances at other Superfund sites. These techniques were apparently not even considered by EPA for the GCVSS site RI. Had specific objectives been identified and defined in support of DQO No. (1), this problem could have been alleviated, providing for data-supported decisions in the RA and FS process.

2.3 Laboratory and Sampling Contaminants

A number of organic constituents are frequently encountered which do not truly represent site characteristics but instead reflect contamination of samples during sampling and/or analytical activities. These often include the volatile organic constituents acetone, methylene chloride, 2-butanone, and other solvents. Phthalate compounds, which are semivolatile organic constituents, are also common interferences from laboratory or sampling equipment.

DQO No. (7) states that samples contamination was a concern for the GCVSS site RI. However, the RI data which were used for the RA and FS reflect concentrations of the above-listed constituents that are almost certainly not characteristic of the site media but reflect contamination. Trip and field equipment rinsate sample results, which are one tool used in evaluating this interference, are presented in the RI data tables without reference to the sample groups represented. Instrument blank results are not presented (except by the "B" data qualifier flag) to aid in evaluating interference. Was DQO No. (7) achieved? No clear evaluation and answer is presented in the RI. EPA's rejection of a FOIA request for complete data and data validation documentation seriously compromised the independent review of these issues consistent with the NCP (NCP, 40 CFR § 300.430(f)(5)).

Rather than using accepted evaluation methods, these compounds were evaluated using a literal interpretation of and liberal use of a "rule of thumb" in the RA. In many cases, constituents were retained in the risk analysis as potential real site contaminants, although none is likely to be present in oilfield wastes. This is not consistent with the requirements of the Data Useability guidance (USEPA, 1990, Section 3.1.4 and 3.2). EPA has presented no evidence to support the belief that these constituents should be considered as site-related compounds of concern. Based on review of the RI, split sample results for sludge (see Administrative Record document 003370-003431, "addendum to the RI", and its supporting data and QA/QC documentation), and experience with investigation of similar sites, it is clear that these constituents represent interferences, not true characteristics, and should not be considered as compounds of concern at the site.

2.4 Background Data

Limited background data were developed for metals constituents in soils and groundwater in the GCVSS site area. Background data for pesticides and dioxins were not identified as part of DQOs No. (1), (2) and (3), and were thus not obtained. These data should have been obtained if EPA believes these compounds could be site-related, in accordance with NCP requirements (NCP, 40 CFR § 300.430(b)(5)). Pesticides were detected at very low levels at the site which are probably background and are unrelated to site activities. Dioxins were detected at low levels with little variability among media (sludge versus surface or trench soils, for example), and no evidence is presented to suggest that they would be present due to site activities. Rather than collecting data on these constituents, EPA has inappropriately assumed that these compounds are present at the site. EPA collected no data to support this contention. Because these specific objectives were not identified and implemented, attribution of these findings to

site activities is not supported and was thus improperly used by EPA in the RA.

During the pilot test for ambient air sampling, solidification of site sludge was tested and evaluated to determine whether significant air emissions would occur during excavation and solidification/stabilization mixing. Although the results of these tests are not presented in the RI, air emissions were negligible and below PQLs according to separate test reports ("Estimation of VOC Emissions", Radian Corp. 1992; and "VOC Emission Rate Determination", Blasland, Bouck, and Lee, et. al. 1992; both part of the Administrative Record). The treatability results for this single solidification/stabilization test were not evaluated for the FS. EPA's failure to use this opportunity to develop treatability information for this technology is difficult to understand.

An appropriate element of an RI is to develop treatability data in support of DQO No. (2). However, EPA chose to reject several important prospective technologies as infeasible without obtaining treatability data in support of these judgments. Only thermal treatment was tested, indicating a clear bias for the use of this technology. EPA has chosen not to develop adequate engineering data for technologies which have been used successfully at many similar sites. This may reflect a poor definition of DQO needs, and certainly suggests that the remedy selection process did not have adequate data input from the RI on which to base sound decisions. These alternate technologies will be further discussed in comments on the FS presentation of remedy selection process.

3.0 CRITICAL REVIEW OF THE BASELINE HUMAN HEALTH AND ENVIRONMENTAL RISK ASSESSMENTS

In developing the baseline risk assessment for the GCVSS site, EPA

- failed to appropriately delete from consideration certain compounds which are laboratory contaminants, are present in background concentrations, or are considered by other factors as allowed by EPA guidance;
- developed exposure scenarios which were improper and unreasonable in light of Region VI policy and the NCP; and,
- failed to use the most current data for the risk calculations.

These errors, misjudgments, and other concerns have resulted in the overestimation of the risk posed by the site. These matters are discussed in detail in this section and were used as the basis for the alternative risk calculations presented in comment Section 4. The primary concerns here are as follows:

- **Selection of Compounds of Concern.** EPA has failed to follow its own guidance which allows for the systematic selection of chemicals of concern. Many of the compounds considered as potential Compounds of Concern in the RA should have been deleted because they may be essential or beneficial nutrients, were detected infrequently, are common laboratory contaminants, were found at background concentrations, are unrelated to site history, and/or exhibit relatively low potential toxicity. The use of these compounds has resulted in evaluation of compounds which do not contribute to site risk. The RA Compounds of Concern should be reevaluated and a more accurate list derived.
- **Exposure Assessment.** Exposure scenarios postulated by EPA exceed the reasonable maximum exposure as currently defined in agency guidelines. Several of the exposure scenarios developed for evaluation are not credible. Exposure assumptions failed to use site-specific observations, to consider average exposure scenarios, and to find support in logic or the scientific literature. EPA improperly used Region VI approved methodology in calculating potential risk via the food chain pathway, used default assumptions for potential trespassers at the

site without corresponding site-specific documentation, and proposed less than credible potential future exposure scenarios. The quantification of exposure does not follow risk assessment guidance because consideration of the average case is excluded, and because various statistical and database methods used seriously overstate exposure estimates. The RA exposure scenarios should be carefully reconsidered to provide more realistic estimates of site risk.

- **Toxicity Assessment.** A number of values used in risk calculations are outdated, and do not reflect use of current information, as required by risk assessment guidance. The most current information must be used in the RA. The RA toxicity assessment contained many incorrect toxicity values which could not be substantiated by searches of the EPA Integrated Risk Information System (IRIS) or the EPA Health Effects Assessment Summary Tables (HEAST, 1991 or 1992). Also, EPA has used toxicity values for compounds which have no known human toxicity.

The overall approach used in the risk assessment is excessively and unnecessarily conservative in its judgment and has resulted in the extreme overstatement of the risks posed by this site. EPA has failed to follow its own guidelines or has improperly implemented accepted guidelines or methods.

3.1 Selection of Compounds of Concern (Section 2.0 of the RA)

The use of seventy-seven compounds for quantification in the risk assessment has resulted in additive risk calculations for compounds that should have been deleted, given their likelihood as essential or beneficial nutrients (RAGS; pg. 5-23), low frequency of detection (e.g. less than 5 percent, RAGS; pg. 5-22), common laboratory contaminants (RAGS, pg. 5-16), comparison to background concentrations (RAGS 5-18), site related history (RAGS, pg. 5-21) and/or the relative potential toxicity for the compound (RAGS, pgs. 5-23-24). With proper consideration of these factors, many of the compounds quantified in this RA would have been excluded.

Treatment of Essential/Beneficial Nutrients. The treatment of compounds in the RA as essential nutrients is unclear and needs clarification. EPA failed to compare levels of essential nutrients detected at the site with the background concentrations. The text does not adequately explain the rationale for Table 2-3 in the RA. The contractor assumes that all of the compounds detected at the site are completely bioavailable. This assumption is incorrect, as discussed in RAGS (pg. 5-23). Constituents found at background concentrations (see RA Table 5-10) should not be carried into the risk assessment unnecessarily to confound and exaggerate actual site-related risks.

Low Frequency of Detection. Superfund guidance (RAGS, 1989) allows for the elimination of compounds detected at a frequency less than 5 percent in each environmental media, unless the compound is a known human carcinogen. Therefore, a number of compounds should be eliminated from this risk evaluation based on the low frequency of detection in the various media. For example, the analysis frequency of detection for chemicals in surface soils outside the two pit areas shows 21 compounds with a frequency less than 5 percent. (See Comment Table 4-4.)

Common Laboratory Contaminants. EPA has not clearly demonstrated whether the presence of acetone, 2-butanone, methylene chloride and the phthalates in site samples is due to laboratory contamination or represents actual contamination of site media. The evidence suggests that these compounds are from the laboratory and not site related (RAGS, pg. 5-16). EPA has provided no data on the detection of these common laboratory contaminants in trip blanks, field blanks, laboratory calibration blanks or water rinsate blanks. Unless these compounds are detected at over 10 times the level detected in the appropriate blanks, they should be removed in the list of chemicals of concern.

Comparison to Background Concentrations. The EPA guidelines (RAGS, 1989) allow for the exclusion of compounds present in background concentrations. For example, background concentrations in the ground water were not compared with inorganic constituents detected in the ground water beneath this site. Elevated arsenic, antimony, and thallium levels in up-gradient wells indicate that these inorganics are native to the area. There are also sufficient hydrogeological and geological data to support this in the general literature, including surveys of wells in the site area (see Survey of One Hundred Wells in Vermilion Parish, West-Paine Laboratories, 1984, and EPA/Louisiana State Health Department survey of private wells in the area surrounding the NPL site, 1991).

The EPA guidance provides that background samples should at a minimum represent 10 percent of the total field samples collected for the site. (RAGS, pgs. 4-5 to 4-10). EPA has not followed this guidance. Proper background sampling provides a statistical basis for evaluating site-related contamination and the ability to more precisely select compounds that result from site-specific activity and may actually contribute to site risks.

Region VI policy for inclusion/exclusion of known human carcinogens (Group A) and probable carcinogens (Group B) detected at the site is poorly referenced in the RA and is not clearly presented. This guidance is apparently verbal and is thus unavailable for public review. Such undocumented policies are not appropriate for the risk assessment and selection of remedy process. RAGS (1989) guidance states that only known human carcinogens have to be carried into an RA and cannot be eliminated based on criteria other than toxicity, (i.e., background, frequency, etc.). In developing the RA, EPA should have eliminated a number of compounds based on their presence in

background concentrations. These compounds are anthropogenic and include many common organochlorine insecticides.

The presence of p,p'-DDT, p,p'-DDD, aldrin, chlordane, beta-BHC, delta-BHC, dieldrin, endrin, heptachlor, and heptachlor epoxide in site samples is due to background concentrations of these organochlorine pesticides. Background levels for these compounds are published in ATSDR (U.S. DHWS, Toxicological Profiles for each compound, 1989, 1990) and various other documents. These compounds should be treated as background because the levels detected at the site are within published background concentrations for the area (Section 2.2.5 of the RA). They do not represent any risk associated with site activities.

Site-Related History. There is no evidence of any site-related history of the use of phenoxyacetic acid herbicides or polychlorinated phenols which might contribute to the presence of chlorinated dibenzodioxins at the site. Therefore, how can the burning of petroleum-based sludge (which does not contain chlorinated aromatics), as proposed by EPA, result in the production of these compounds? Further, background samples were not analyzed for dioxin, and thus, the automatic inclusion of the low concentrations detected at the site in the risk calculations require further support to be included in the RA. In addition, EPA offers no rationale for treating the dioxin observed as the 2,3,7,8-tetrachlorodibenzo-p-dioxin isomer.

Relative Potential Toxicity. Barium is found in the RA to be a source of significant risk at the site. This conclusion is not supported by the literature on the toxicity of barium in the form found at the site. Barium toxicity depends on the solubility of the barium salts encountered. The predominant form of barium in drilling wastes found at the site is barium sulfate, which is insoluble. Barite (barium sulfate)is commonly used in oil well

and mud-rotary drilling operations (Driscoll, F.D., 1987. Groundwater and Wells, "Drilling Fluids", 2nd Ed, Johnson Division, St. Paul, Min., pp. 340-395). EPA's assumption that all of the barium detected at the site is 100 percent soluble is not supported by the nature of drilling wastes and the site history (i.e., well wastes contain predominantly barium sulfate salts). The RA calculation of the hazard quotient for barium is thus a gross overestimation because the barium salts disposed at the site are insoluble. The potential for risk estimated by EPA should be adjusted to reflect potential bio-availability of barium.

In addition, EPA has postulated that barium at the site may move downward from the West Pit into the underlying aquifer. The insoluble character of the barium salts at this site will retard any mobility to ground water. Also, the Kd (i.e., the partition coefficient between soil and water) value for barium indicates that it will not migrate rapidly through the clay soils found at the site to the aquifer (see Baes, C.F. and R.D. Sharp, J. Environ. Qual. 12(1):17-28, 1983). Further, in addition to being insoluble, barium sulfate exhibits very low toxicity. The ATSDR toxicological profile for Barium, (July 1992. TP-91/03. pp.35-36.) states the following,

> "...The different barium compounds have different solubilities in water and body fluids and therefore they serve as variable sources of Ba^{+2} ion. The Ba^{+2} ion and the soluble compounds of barium (notably chloride, nitrate, hydroxide) are toxic to humans. The insoluble compounds of barium (notably sulfate and carbonate) are inefficient sources of Ba^{+2} because of limited solubility and are therefore generally nontoxic to humans. The insoluble, nontoxic nature of barium sulfate has made it practical to use this particular compound in medical application such as enema procedures and in X-ray photography of the gastrointestinal tract. Barium provides an opaque contrasting medium when ingested or given by enema prior to X-ray examination. Under routine medical situations, barium sulfate is generally safe. However, barium sulfate and other insoluble barium compounds may potentially be toxic when it is

introduced into the gastrointestinal tract under conditions where there is colon cancer."

The U.S. Food and Drug Administration guidelines refer to barium sulfate as GARS, denoting "generally recognized as safe" (Princenthal et al. 1983).

Because of the low toxicity and mobility of the barium-containing materials found at the site, barium should be eliminated from the estimation of risk posed by the site.

3.2 Exposure Assessment (Section 3.0 of the RA)

The exposure scenarios developed as part of the RA also contribute to the systematic over-inflation of risks estimated by EPA for this site. These include the improper use of Region VI approved methodology (USEPA, Region VI, 1992) in calculating potential risk via the food chain pathway, use of default assumptions for potential trespassers at the site without corresponding site-specific documentation, and use of potential future exposure scenarios which are not credible.

Exposure Assumptions. EPA's exposure assumptions are not supported by EPA guidance and contravene the NCP. First, the assumption that a trespasser will visit the site 60 days per year for 2 hours per visit and ingest 100 mg of soil per event exceeds even conservative EPA standards (USEPA, 1989; Exposure Factors Handbook). Furthermore, the exposure assumptions derived for the "current" trespasser appear to be excessive without corresponding documentation of this type of use of the site by young adults. For clarification, EPA has only specified that the activities were "playing in the sludge" (Personal communication with Kathleen Lohry, EPA Region VI, September 1992), but EPA did not specify the type of activities which could credibly result in EPA's assumed exposure. The 60 days per year exposure can only be considered reasonable if more specific trespass activities (such as dirtbike

riding, etc.), requiring or indicating that this amount of time might be spent at the site, can be documented. We are also informed that the Record(s) of Decision (ROD) for many other Louisiana and Texas Superfund sites have not relied upon trespasser (or, for that matter, "residence") scenarios.

In the preamble to the NCP, EPA explained that an exposure assessment was to include an "evaluation of the likelihood of such exposures occurring" and that the reasonable maximum exposure includes "only potential exposures that are likely to occur". 55 Fed. Reg. 8709 at 8710-11 (March 8, 1990). Because EPA has presented no evidence of specific time-consuming activities to support the assumed likelihood of the exposure scenarios, the exposure frequency for the trespasser scenario should be significantly reduced.

In addition, EPA's estimated trespasser dermal exposure is unsupported. As a default, rather than considering site-specific circumstances, EPA has used only generic exposure assumptions for the reasonable worst case for dermal exposure (USEPA, 1992; Dermal Guidance). The assumed dermal exposure of 5,000 cm^2 is high, and may assume exposure to body surfaces other than the hands and arms. EPA has not defined the nature of the dermal exposure assumed from "playing in the sludge" or other activities. EPA provides no supporting rationale for its assumption that the hands, forearms, legs and feet are routinely exposed during the "trespass". Also, EPA has not provided, in either the RA or in response to specific clarification questions, any basis for the assumed soil loading for the dermal exposure.

For its future land development, EPA assumed that sludge may be spread on surrounding land and that the land would then be used for agricultural or residential purposes in a manner leading to exposure concerns. This assumed land use is unreasonable. EPA

contends that the sludges are hazardous (failing TCLP test for benzene). As such, land application would be illegal and the exposure scenario assumed by EPA is not reasonably likely to occur. Even if the sludges were non-hazardous, land-farming restrictions would apply which would preclude the scenario occurring as assumed in the RA. Discussions with the Office of Solid Waste at Louisiana DEQ (Personal communication with Jim Brent, 1992) confirm that landfarming regulations have restrictions to ensure that future use for agriculture is protective of public health. If the sludge in the pits is determined to be nonhazardous, and thus available for landfarming, state regulations covering this activity would ensure appropriate controls and minimized risk. Thus, the entire risk exposure scenario is not credible; or, if considered lawful, would proceed only as to be protective of human health. Accordingly, EPA's future land use scenarios should be reexamined.

Bio-Concentration Assumptions. EPA's bioconcentration analysis assumes a worst case, which EPA has stated is improper for the definition of reasonable maximum exposure. 55 Fed. Reg. 8713. The risk estimates for the ingestion of home-grown produce, milk and meat from site-postulated production are based on "worst case" exposure assumptions (USEPA, 1989, SCAQMD, 1988). Also, the bio-concentration factors used cannot be completely verified, for reasons discussed below. The material presented in the RA (Section 3.3.1) and in Appendix 4 does not compare with other previously published data (SCAQMD, 1988; USEPA, 1988; Baes, C.F. et al., 1984; CAPCOA, 1992).

Furthermore, most of the studies concerning the uptake of organic chemicals into plants have been components of the investigation of the mechanism of action of herbicides and insecticides. Many herbicides have specific sites of biochemical action in the plant and act as mimics of hormones or other naturally occurring

compounds (Moreland 1977). Because of this, active transport regimes for herbicides may occur in plants. However, these transport processes are not likely to be applicable to dissimilar compounds. By applying the herbicide model to non-herbicide compounds in the RA, EPA has misapplied the model cited in the Region VI guidance for this exposure pathway (Travis, et. al., 1987).

Inappropriate Use of BCF Model. Based on data published by numerous investigators and summarized in the Multi-pathway Analysis - Exposure Assumptions (SCAQMD, 1988), compounds which should be included in the home-grown produce and meat and milk scenarios include the organochlorine insecticides (i.e., DDT, DDD, Aldrin Dieldrin, Heptachlor, etc.), the polychlorinated and polybrominated biphenyls, the chlorinated dioxins, certain chlorinated phenols, and a few metals which are capable of being alkylated to form organic complexes. Compounds such as the PAHs, VOCs, and compounds rapidly metabolized by mammals should not be considered in this model because they have no known bioconcentration potential. The RA wrongly employs the Region VI model by using it to estimate the bioaccumulation potential for these inappropriate compounds.

Phthalates, Acetone, and 2-Butanone. Certain other compounds considered by EPA do not significantly bioaccumulate. Pharmacokinetic data for 2-butanone, acetone and phthalates indicate a low potential for bioaccumulation in plants or animals. In an accidental ingestion incident involving 2-butanone in a human, an oral dose of 37 mg/dg resulted in plasma concentrations of 110 μ g/ml at 18 hr and < 5 μ g/ml by 48 hr. The biphasic fast elimination kinetics resulted in a $T_{1/2}$ (elimination half-life) of 10.8 hr. 2-Butanone is rapidly eliminated by respiration and does not bioconcentrate. (ATSDR for 2-butanone TP-91/08, July 1992, pg. 31). Acetone is rapidly absorbed and eliminated by

respiration and metabolism. Human plasma levels peak by 3 to 4 hour after ingestion and fall rapidly by 12 hours. The $T_{1/2}$ for acetone appears to be about 4 hours (Gargas, 1989). Therefore, the use of the Region VI guidance model to predict bioaccumulation potential for these VOCs is inappropriate.

PAHs. PAHs are not expected to bioaccumulate. As a model for PAHs, many laboratory investigators have used styrene as a model compound to investigate PAH absorption, distribution, metabolism and excretion, (ACGIH, 1992). Styrene is absorbed and metabolized rapidly by the liver cytochrome P450 enzymes (enzymes responsible for drug biotransformation). In humans, styrene is eliminated in the urine and feces while a portion is bound covalently to cellular macromolecules. The covalently bound material is not bioavailable and is not able to be metabolized further to toxic intermediates. PBPK (physiologically based pharmacokinetic) modeling of styrene indicates a rapid mono-phasic elimination with a half-life of 5 to 10 hours. (Guillemin, 1979). The elimination of styrene in humans closely parallels rodent species.

The larger polycyclic aromatic hydrocarbons (i.e., B(a)P, B(b)F) are rapidly metabolized by the liver cytochrome P450 enzymes as well. Many of the PAHs are not carcinogenic to internal organs such as the liver, due to the rate and the type of metabolite formed by the phase I elimination reactions, which result in large portions of material being eliminated as phenolic glucuronides and sulfates. In epithelial tissue, compounds like B(a)P and B(b)F are metabolized to electrophiles which bind to DNA, RNA, and protein. Tissues like the lung and skin are sensitive to tumor development because of the nature of the metabolites formed by these tissues which are qualitatively and quantitatively different from the liver. The capacity of the cytochrome P450 enzymes in the liver to rapidly metabolize and eliminate PAHs renders them unavailable for bioconcentration. Once a PAH has been metabolized

to an electrophile, it binds covalently to cellular macromolecules and is biologically unavailable. It is essentially eliminated. There is no evidence to suggest that the ingestion of meat containing PAH covalently bound residues results in further PAH metabolism to a toxic metabolite. Hence, the PAHs are not likely candidates for bioconcentration due to their rapid metabolism.

The inclusion of the PAHs in the inhalation shower model is highly unusual (RA Section 3.3.1, pg. 3-11). Anthracene and phenanthrene do not meet the EPA criteria for inclusion in the volatilization of VOCs from ground water into the atmosphere during showering. The shower model is theoretically based on VOCs not PAHs for which there are no supporting laboratory or published data.

3.3 Quantification of Exposure (Section 3.3 of the RA)

Average vs. Maximum Risk. The risk summary table (Table 5-1 in the RA) presents only risk for the RME (reasonable maximum exposure) case. The average exposure case is not calculated. According to Risk Assessment Guidance for Superfund Sites (RAGS; USEPA, 1989), the actual potential risks from a given site should lie between the average exposure and the reasonable maximum exposure. The use of the reasonable maximum exposure alone is not required by the NCP. Average exposures should be considered to provide a realistic appraisal of the risks posed by the site.

Database Issues. Appendix 1 to the RA provides only limited insight into the data extent (e.g., it provides no information on the number of non-detects versus detects, number of "filled in" data points used to calculate exposure point concentrations, or data qualifiers), utility, and the statistical analysis of the data used in the RA. The results listed in the RA cannot be reproduced by following the rationale outlined in this appendix. Data used to develop exposure point concentrations are largely lacking and cannot be verified. In fact, even the number of

samples given in Table 3-2 of the RA as a "summary of samples used to calculate exposure point concentrations" does not match the number of samples given for many of the calculations presented in Appendix 1 for the respective exposure scenarios.

EPA's interpretation of the RI data is biased because the statistical distribution of the data has not been determined directly but has been incorrectly assumed. The data used in the RA was assumed to follow a log-normal distribution but no statistical test(s) were employed or provided to support this approach (e.g., Shapiro and Wilk's W Test, frequency distribution histogram, D'Agostino's test or Weibull alpha, beta gamma test; Helsel, 1990). If the soil inorganic data were log-normal, it would be in accordance with a paper published by the U.S.G.S concerning inorganic distribution in soils (Meish, 1967). However, selected tests (W Tests) performed during review indicate the log-normal assumption is invalid (e.g., the frequency distribution does not match the log-normal distribution assumptions).

Current scientific literature indicates that if data is assumed to be of log-normal distribution, the division of the detection limit by the square root of 2 and not 2 is more appropriate for assigning values to non-detects in the database (Hornung and Reed, 1990). If the data is log-normally distributed, one should use a non-detect transformation that is for a log-normal population - not one for an arithmetic population, as was done by EPA.

Detection Limit Issues. Further review of the derivation of exposure point concentrations indicates that the concentration used to predict risks in each of the exposure pathways is artificially elevated due to the assignment of one-half the detection limit for non-detects, even if the compound was not detected in that specific media or sample group. The detection

limits reported in this database are high in many cases due to the large number of tentatively identified compounds (TICs) at this site and not because of the presence of significant concentrations of risk-related target compounds, as discussed in Section 2 of these comments.

Section 3.3.1 of the RA indicates that "medium" and "high" PQL values were not used in exposure point calculations, but this practice was apparently not consistently followed. For example, a benzo(b)fluoranthene concentration of 290 mg/kg was used in calculating sludge exposure point concentrations (RA Table WPA-1, pg. A1-11) although RI Table 4.1.1A indicates that this compound was never detected in the West or Washout Pits sludge or soil samples and was detected only once (at 0.16J mg/kg) in a Former West Pit sludge sample. Similarly, a fluoranthene concentration of 0.44 mg/kg in shallow soils was used in RA Table WPA-2, although this compound was never detected in shallow soils at the site. EPA's excessive reliance on non-detectable concentrations of compounds to determine exposure point concentrations has resulted in the exaggeration of possible exposure and risk at the site.

Filling in the non-detects by the detection limit transformation for more than 40 percent of the total values invalidates the statistical basis of the sample population (Cochran and Cox, 1967; Gilbert, 1987). If, in a soil boring, an analyte was detected at one depth and not at another depth, it is valid to fill in the non-detect with a transformation. However, if an analyte was never detected in that soil profile, it is not be appropriate to fill in the missing data with an non-detect transformation.

Data Sets. The exposure point concentrations were further artificially elevated by the use of small subsets of data to represent selected acreage at the site. This process results in

the use of maximum concentration levels for exposure point concentrations. The process applies "hot spot" methodology to the whole site which is counter to EPA guidance (RAGS, pg.4-11).

3.4 Toxicity Assessment (section 4.0 of the RA)

In order to assign toxicity values to each of the compounds considered of potential concern in the risk assessment, RAGS (1989) guidance requires that the EPA toxicity database be searched for these toxicity values. If not found in these databases, then secondary sources may be used, such as the Health Effects Assessment Summary Tables. However, the latest publications should be used. In developing this RA, EPA used the 1991 rather than the 1992 Health Effects Assessment Summary Tables (HEAST) and no date is provided for the Integrated Risk Information System (IRIS) computer search.

Corrections to Reference Doses (RFD). In a number of cases, the RA used inaccurate or outdated reference dose values (RfD, which is an estimate of a daily exposure dose level below which people, including sensitive individuals, do not have an appreciable risk of suffering adverse health effects). A verification of the values listed in this risk assessment for noncarcinogens has resulted in the following corrections to the reference doses:

- Chromium (VI), Chronic and Subchronic Inhalation. No value should be used and the element should be treated qualitatively or ECAO should be contacted to generate a value (RAGS, Section 7.9). Values in 1991 HEAST are not in the 1992 HEAST.

- Dimethylphthalate, Chronic and Subchronic Oral. The correct value for the RfD is 10 according to HEAST, 1992. The value used in the RA is 1. Also, the 1992 HEAST states that there is a chronic inhalation RfD on IRIS. However, no value is used in the RA for a chronic inhalation RfD.

- 2,4-Dinitrotoluene, Chronic Inhalation. The 1992 HEAST states that there is a value on IRIS. No value was assigned in RA.

- Endosulfan (I, II), Subchronic Oral. According to HEAST, 1992, the correct value is 5E-05. The value used in the RA is 2E-04.

- Endrin, Subchronic Oral. According to HEAST, 1992, the correct value is 3E-04. The value used in the RA is 5E-04.

- Heptachlor Epoxide, Subchronic Oral. According to HEAST, 1992, the correct value is 1.3E-05. No value was used in the RA.

- Mercury. The values used in the RA are specifically for elemental mercury and elemental mercury is unlikely to be present in the site soils. ECAO should be contacted for subchronic and chronic inhalation values for mercury.

- Naphthalene, Chronic Oral. The value listed in the 1992 HEAST is 0.04. However, this may be a typo in the guidance document, as the toxicological study as indicated by HEAST, 1992 used to derive this value shows the chronic and subchronic RfD as 0.04; the same value. However, if the typical tenfold safety factor were applied, the chronic RfD would be 0.004 (RAGS, section 7.2.2). This is the same value used in this RA. This should be verified and any changes made for Naphthalene should also be made for 2-Methylnaphthalene which was assumed to have the same RfD as napthtalene.

- Toluene, Chronic Inhalation. The correct value is 0.11 according to HEAST, 1992 assuming an inhalation rate of 20 $m^{\wedge}3$/day and a 70 kg body weight. The value used in the RA is 0.57.

- Vinyl Acetate, Chronic Oral. According to HEAST, 1992, the correct value is 1. The value used in the RA is 0.2.

- Xylenes (total), Chronic and Subchronic Inhalation. No value given in the 1992 HEAST. The values used in the RA are from the 1991 HEAST. This compound should be assessed qualitatively or ECAO should be contacted for a recommendation (RAGS, Section 7.5).

Corrections to Slope Factors (SF). The RA also used inaccurate or outdated slope factor values. The Slope factor is the value used to express carcenogenic potential. Studies of carcenogenicity focus on identifying the slope of the linear portion of a curve of dose versus response, where the specific response is the

probability of resulting cancer. A plausible upper-bound value of the slope is called the slope factor. A verification of the values listed in this risk assessment for carcinogens has resulted in the following corrections to the slope factors:

- Benzo(a)pyrene, Oral. According to HEAST, 1992, the value should be 5.8. The value used in the RA is 12. While this value only represents an order of 2 difference in calculations, this represents a 10-fold error in risk calculation because the same slope factor was applied to several other carcinogenic PAHs. This is extremely conservative approach for assigning values to PAHs without SFs. Current research (Clements and Associates, 1987 and ATSDR Toxicological Profile, US DHWS, 1989) has indicated several orders of magnitude difference in carcinogenic potential among the PAHs classified as carcinogens. EPA did not follow Section 5.9.2 of RAGS, which states that the grouping all carcinogenic compounds in a class without regard to structure-activity relationships, biochemical and/or pharmacokinetic parameters is ill-advised.

- Beta-BHC, Inhalation. The correct value is 1.8 according to HEAST, 1992. The value used in the RA is 1.9.

- Cadmium, Inhalation. The correct value is 6.1 according the HEAST, 1992. The value used in the RA is 6.3.

- Chromium (VI), Inhalation. The correct value is 41 according to HEAST, 1992. The value used in the RA is 42.

- Heptachlor, Inhalation. The correct value is 4.5 according to HEAST, 1992. The value used in the RA is 4.6.

- Tetrachloroethene, Oral and Inhalation. No values are listed in the 1992 HEAST. The values used in the RA are from the 1991 HEAST.

- Trichloroethene, Inhalation. No value is listed in the 1992 HEAST. No reference is provided for the toxicity value (0.006) used in this RA.

3.5 Ecological Assessment

The ecological assessment (EA) included several issues which should be reconsidered in the evaluation of the environmental risks posed by this site.

The environmental assessment discussion about the hydrogeology of the site appears to contradict statements in the baseline risk assessment regarding ground water gradients.

The site description should reflect the fact the area was once disturbed and graded and that not all flora and fauna listed in the tables actually are present on or at the site (Tables 2-1 and 2-2 in the EA).

No data is provided in the environmental assessment for background surface soils to compare potential site-related levels. Site-related chemicals cannot be determined from the data provided in the human health or environmental assessment.

The semi-quantitative treatment of ingestion of a rabbit by a red-tailed hawk attempts to provide evidence for potential toxicity to the rabbit but not the hawk. Exposure assumptions cannot be verified and should be reexamined.

The size of the site relative to the total potential habitat for the species of concern is quite small and limited. This effect should be evaluated in the ecological assessment.

4.0 ALTERNATIVE RISK CALCULATIONS

The risk calculations made in the RA contain many inconsistencies and errors as outlined in the proceeding sections. The data and methodological shortcomings in the RA have resulted in exaggerated estimates of the risk to human health posed by the site. This Section provides alternative risk calculations to those presented in the RA. Two important areas of alternative risk evaluation are presented:

- **Overall Risk Estimates.** The risks presented in the RA have been overestimated, for the reasons discussed in Section 3 of these comments. Preliminary alternative risk calculations are presented here to illustrate these issues. However, complete reexamination of the RA is warranted.
- **Alternative Shallow Soils Risk Estimates.** Detailed reanalysis of the shallow soils data from the north area of the site has been conducted. This detailed re-working of the RA calculations demonstrates that only marginal risk is presented by this area, and consideration for remedial action is unwarranted. The EPA should review and reevaluate its risk calculations. EPA's decision to remediate this area is based on scenarios and estimation methods which have over-inflated the risk assessment.

Table 4-1 is a synopsis of a review of all the EPA calculations for the site in which alternatives to the risk estimates were made. The footnotes for the table define the rationale for the calculations. Although some are clearly questionable, this risk reevaluation includes certain assumptions which were also made by EPA. The alternative risk estimates assume that the pesticides detected are site-related. In addition, the alternative risk estimates accept EPA's bioconcentration model and its input parameters at face value and assumes all hazard quotients to be additive. The RA exposure point concentrations have not been revised in the alternate risk calculations summarized in Table 4-1. Further discussion of these changes (and specific references

to RAGS and other guidance) was provided in Section 3 of these comments.

However, the rationale for these alternative risk estimates include certain corrections from assumptions made in the RA:

- One or more compounds were not detected, and therefore not included in these alternative estimates.
- The human intake factors used by EPA are high by a factor of 2 and have been corrected.
- Dermal slope factors used in error in the RA have been corrected.
- One or more compounds may be present at background concentrations and thus are not included in the alternative calculations.

These alternative risk calculations reduce the estimates of potential risk due to possible exposures at the GCVSS site. As shown in Table 4-1, risk estimates for the trespasser scenarios have been reduced below the levels of potential concern provided in the NCP (40 CFR § 300.430(e)(2)(i)). Several residential scenarios were not recalculated because potential errors were apparently relatively small (would not likely result in estimates below levels of potential concern). The alternative risk estimates presented for some of the future resident scenarios indicate that these scenarios should be reevaluated, or that remedy selection should only guardedly use the RA estimates because the RA estimates state an overstated risk from the assumption of exposure scenarios which are not credible.

The review of overall risk estimates presented by EPA indicated that further correction of calculations for surface soils outside of the two pit areas was appropriate to properly characterize potential risks from the site. The nature and extent of contamination outside of the pit area is significantly lower than

for area soils (RA Appendix 1). Thus, alternative calculations estimating potential risk due to exposure from these soils, separate from the sludge in the pit area, were deemed critical in determining whether these soils warrant any remedial action. The RA database was re-constructed to reflect exposure point concentrations for the entire north area shallow soils (Northwest Field, Northeast Field, and southernmost North Pasture area, as defined by the RI and RA) and were used in the alternative risk estimates with the following assumptions:

- the sampling points within the Tank farm were not included;
- off-site north pasture samples were not included if located far from the property line;
- in cases where duplicate samples were available, the detected or higher concentration non-detect values were selected;
- sampling points representing depths of 0 to 2 feet were used to determine exposure point concentrations;
- although the use of high detection limits skews the database, this convention was maintained in the alternate calculations (partly in order to make these alternative calculations reproducible by EPA). Ideally, this approach should also be reevaluated and revised.

In addition to this database re-construction, several other key assumptions regarding compounds of concern were integrated in the alternate calculations. First, the alternative calculations only considered compounds highlighted in the RA as primary risk contributors. The quantification of risk estimates for these compounds was further screened for non-detection in the media (surface soils) and low frequency of detection (less than 5 percent). The frequency of detection information is presented in Table 4-4.

Second, several compounds were not included in the numerical estimates based on the rationale provided in Section 3 of this report. Barium was not included in the alternate calculations due to its low potential for toxicity when considered as barium sulfate (an insoluble salt). Likewise, the phthalates, acetone, and 2-Butanone were not quantified in the food exposure risks due to literature research indicating poor status as bioaccumulators in food or animals and it is inappropriate to use the Region VI guidance to estimate bioconcentration factors in non-pesticide compounds. In addition, these compounds are probably laboratory or sampling interferences.

The few dioxin equivalents detected were also omitted from the calculations due to lack of confirmation from site-related history. Only the PAHs detected in the north soils were used in the risk estimates and pharmacokinetic parameters were developed to adjust the slope factor for benzo (k) fluoranthene. This adjustment in the slope factor (i.e., cancer potency) represents a better estimate of the compounds true potential to cause cancer.

Table 4-2 represents a summary of alternate risk calculations for surface soils described above and re-calculation of potential risk estimates for all soil exposure scenarios at the site, with the modifications described above. Table 4-3 presents a summary of the alternate risk calculations by the individual compounds used in preparing the estimates of risk. Thus, from Table 4-3, individual constituent contributions to the overall alternative risks for the soil exposure pathways can be reviewed. Table 4-4 shows the frequency analysis used in the elimination of compounds from these alternate risk calculations. Tables A-1 through A-5 are also presented as an Attachment to these comments to provide complete details of the calculations which are summarized in Tables 4-2 and 4-3.

The alternate risk calculations for the north soils data (i.e., surface soils outside of the pit areas) demonstrate that only marginal risks exist for these exposure pathways. The alternate risk calculations in Table 4-2 show several orders of magnitude reduction in potential public health risk over the estimates in the RA. The alternative risk calculation results are either within or well below the ranges of acceptable exposure levels provided in the NCP (40 CFR § 300.430(e)(2)(i)). Thus, remediation of shallow soils in this area is not necessary for the protection of human health.

Table 4-1
Alternate Risk Calculations Summary - Overall Site

	Cancer Risk As Calculated by Life Systems	Alternate Risk Estimate	Basis for Alternate Risk Estimate	Hazard Index As Calculated by Life Systems	Alternate Hazard Index Estimate	Basis for Alternate Hazard Index Estimate
TRESPASSER - WEST PIT						
Surface Water						
Oral	6E-08	6E-08	A	4E-03	4E-03	A
Dermal	1E-08	1E-08	A	1E-03	1E-03	A
Sludge						
Oral	3E-04	2E-06	B(a,b,c)	2E-01	2E-01	A
Dermal	2E-05	5E-06	C,D	7E-02	7E-02	A
Total with SW	3E-04	7E-06		3E-01	3E-01	
Soil						
Oral	6E-07	6E-07	A	2E-02	2E-02	A
Dermal	1E-07	1E-07	A	3E-04	3E-04	A
Total with SW	8E-07	8E-07		3E-02	3E-02	
Sediment						
Oral	3E-07	3E-07	A	1E-02	1E-02	A
Dermal	1E-08	1E-08	A	3E-05	3E-05	A
Total with SW	4E-07	4E-07		2E-02	2E-02	
TRESPASSER - WASHOUT PIT						
Surface Water						
Oral	1E-08	1E-08	A	6E-03	6E-03	A
Dermal	1E-08	1E-08	A	9E-04	9E-04	A
Sludge						
Oral	3E-05	2E-06	B(a,b,c)	2E-01	2E-01	A
Dermal	2E-05	6E-06	C,D	6E-02	6E-02	A
Total with SW	5E-05	8E-06		3E-01	3E-01	
Soil						
Oral	7E-06	2E-06	B(a,b,c),E(a)	4E-02	4E-02	A
Dermal	7E-06	3E-06	D	4E-04	4E-04	A
Total with SW	1E-05	5E-06		5E-02	5E-02	
Sediment						
Oral	3E-07	3E-07	A	3E-02	3E-02	A
Dermal	2E-08	2E-08	A	8E-05	8E-05	A
Total with SW	3E-07	3E-07		4E-02	4E-02	

Table 4-1
Alternate Risk Calculations Summary - Overall Site

	Cancer Risk As Calculated by Life Systems	Alternate Risk Estimate	Basis for Alternate Risk Estimate	Hazard Index As Calculated by Life Systems	Alternate Hazard Index Estimate	Basis for Alternate Hazard Index Estimate
TRESPASSER - NORTHWEST SITE FIELD						
Surface Water						
Dermal	2E-08	2E-08	A	3E-03	3E-03	A
Soil						
Oral	2E-06	1E-06	B(a), E(a)	3E-02	3E-02	A
Dermal	4E-06	2E-06	D	2E-04	2E-04	A
Total with SW	6E-06	3E-06		3E-02	3E-02	A
Sediment						
Oral	5E-07	2E-07	E(a)	5E-02	5E-02	A
Dermal	4E-07	2E-07	D	6E-05	6E-05	A
Total with SW	9E-07	4E-07		5E-02	5E-02	A
TOTAL TRESPASSER	4E-04	9E-06	F	7E-01	3E-01	F
CURRENT RESIDENT - RESIDENTIAL WELL 1						
Adult						
Oral	2E-04	2E-07	E(a)	1E+00	1E-01	E(a)
Dermal	4E-07	2E-08	E(a)	6E-03	6E-03	A
Total	2E-04	2E-07		1E+00	1E-01	
Child						
Oral	NC	NC		2E+00	2E-01	E(a)
Dermal	NC	NC		1E-02	1E-02	A
Total				2E+00	2E-01	
CURRENT RESIDENT - RESIDENTIAL WELL 2						
Adult						
Oral	3E-04	0E+00	E(a)	1E+00	2E-01	E(a)
Dermal	5E-07	0E+00	E(a)	8E-03	8E-03	A
Total	3E-04	0E+00		1E+00	2E-01	
Child						
Oral	NC	NC		3E+00	4E-01	E(a)
Dermal	NC	NC		2E-02	2E-02	A
Total				3E+00	4E-01	

Table 4-1
Alternate Risk Calculations Summary - Overall Site

	Cancer Risk As Calculated by Life Systems	Alternate Risk Estimate	Basis for Alternate Risk Estimate	Hazard Index As Calculated by Life Systems	Alternate Hazard Index Estimate	Basis for Alternate Hazard Index Estimate
CURRENT RESIDENT - RESIDENTIAL WELL 3						
Adult						
Oral	9E-04	5E-07	E(a)	4E+00	2E-01	E(a)
Dermal	2E-06	3E-08	E(a)	2E-02	2E-02	A
Total	9E-04	5E-07		4E+00	2E-01	
Child						
Oral	NC	NC		9E+00	4E-01	E(a)
Dermal	NC	NC		2E-02	2E-02	A
Total						
CURRENT RESIDENT - RESIDENTIAL WELL 4						
Adult						
Oral	3E-04	0E+00	E(a)	1E+00	2E-01	E(a)
Dermal	6E-07	0E+00	E(a)	1E-02	1E-02	A
Total	3E-04	0E+00		1E+00	2E-01	
Child						
Oral	NC	NC		3E+00	3E-01	E(a)
Dermal	NC	NC		2E-02	2E-02	A
Total				3E+00	3E-01	
FUTURE ADULT - PIT AREA (CURRENT CONDITIONS)						
Groundwater						
Oral	1E-03	3E-05	B(d,e,f),E(a,b),G(a)	3E+01	5E+00	B(g),E(a,c)
Inhalation	7E-06	7E-06	H	3E-03	3E-03	A
Dermal	2E-04	1E-06	B(d,e,f,h), E(a),G(a),I	5E-01	5E-01	A
Soil						
Oral	2E-04	4E-05	B(d,i,j),E(a,b),J,K	6E-01	6E-01	A
Dermal	6E-05	3E-05	B(d),D,L(a)	3E-03	3E-03	L(a)
Food						
Leafy Vegetables	6E-06	3E-07	B(k)	4E-02	4E-02	A
Root Vegetables	1E-03	6E-04	B(d,i,j,l),K	6E-02	6E-02	A
Beef	1E-04	1E-04	B(d,i,j),K	2E-01	2E-01	A
Milk	3E-05	2E-05	B(j),K	3E-02	3E-02	A
Total	3E-03	8E-04		3E+01	6E+00	

Table 4-1
Alternate Risk Calculations Summary - Overall Site

	Cancer Risk As Calculated by Life Systems	Alternate Risk Estimate	Basis for Alternate Risk Estimate	Hazard Index As Calculated by Life Systems	Alternate Hazard Index Estimate	Basis for Alternate Hazard Index Estimate
FUTURE ADULT - NORTHEAST AREA (CURRENT CONDITIONS)						
Groundwater						
Oral	5E-04	1E-05	B(d,m,n,o),E(a,b)	1E+01	1E+00	B(g),E(a,c)
Inhalation	7E-06	8E-07	B(m)	3E-03	3E-03	A
Dermal	2E-04	1E-06	B(d,o),E(a),I	2E-01	2E-01	A
Soil						
Oral	2E-04	8E-05	B(a,d,k),E(a,b)	1E+00	1E+00	H
Dermal	1E-04	4E-05	B(d,k),D	3E-03	3E-03	A
Food						
Leafy Vegetables	2E-05	2E-07	B(k)	2E-01	2E-01	A
Root Vegetables	1E-03	1E-04	B(a,d,l)	9E-02	9E-02	A
Beef	3E-04	2E-04	B(a,d)	4E-01	4E-01	A
Milk	4E-05	3E-05	B(a)	9E-02	9E-02	A
Total	2E-03	5E-04		1E+01	3E+00	
FUTURE CHILD - PIT AREA (CURRENT CONDITIONS)						
Groundwater						
Oral	NC	NC		4E+01	1E+01	B(g),E(a,c)
Inhalation	NC	NC		1E-02	1E-02	A
Dermal	NC	NC		6E-01	6E-01	A
Soil						
Oral	NC	NC		2E+00	1E+00	E(a)
Dermal	NC	NC		5E-03	5E-03	A
Food						
Leafy Vegetables	NC	NC		1E-02	1E-02	A
Root Vegetables	NC	NC		6E-02	6E-02	A
Beef	NC	NC		4E-01	4E-01	A
Milk	NC	NC		2E-01	2E-01	A
Total	NC	NC		4E+01	1E+01	

Table 4-1
Alternate Risk Calculations Summary - Overall Site

	Cancer Risk As Calculated by Life Systems	Alternate Risk Estimate	Basis for Alternate Risk Estimate	Hazard Index As Calculated by Life Systems	Alternate Hazard Index Estimate	Basis for Alternate Hazard Index Estimate
FUTURE CHILD - NORTHEAST AREA (CURRENT CONDITIONS)						
Groundwater						
Oral	NC	NC		1E+01	2E+00	B(g), E(a,c)
Inhalation	NC	NC		1E-02	1E-02	A
Dermal	NC	NC		2E-01	2E-01	A
Soil						
Oral	NC	NC		5E+00	4E+00	E(a)
Dermal	NC	NC		6E-03	6E-03	A
Food						
Leafy Vegetables	NC	NC		4E-02	4E-02	A
Root Vegetables	NC	NC		8E-02	8E-02	A
Beef	NC	NC		1E+00	1E-03	B(p)
Milk	NC	NC		5E-01	1E-03	B(p)
Total	NC	NC		2E+01	6E+00	
FUTURE ADULT - PIT AREA (SLUDGE SPREAD ON SURFACE)						
Groundwater						
Oral	1E-03	3E-05	B(d,e,f),E(a,b),G(a)	3E+01	5E+00	B(g),E(a,c)
Inhalation	7E-06	7E-06	H	3E-03	3E-03	A
Dermal	2E-04	1E-06	B(d,e,f,h), E(a),G(a),I	5E-01	5E-01	A
Soil						
Oral	3E-02	4E-04	B(b,c,d,i,j,m,q),E(a,b),G(a),J,K	5E+00	3E+00	B(r,s),E(a,d)
Dermal	2E-04	5E-04	B(d,e,m,q,t),D,G(a),J,L(a)	3E-01	3E-01	J,L(a)
Food						
Leafy Vegetables	5E-05	6E-08	B(b,c,e,i,j,m,q,t),J,K	3E+01	2E-01	G(b,c)
Root Vegetables	4E-01	7E-03	B(b,c,e,i,j,q,t),G(a),J,K	2E+01	5E-01	B(b,c,i,j,r,s,u,v,w),G(a,b,c,d),J
Beef	7E-02	4E-04	B(b,c,i,j),J,K	1E+02	2E-01	B(c),G(d)
Milk	1E-02	8E-05	B(b,c,i,j),J,K	2E+01	8E-02	G(d)
Total	5E-01	8E-03		2E+02	1E+01	
FUTURE CHILD - PIT AREA (SLUDGE SPREAD ON SURFACE)						
Groundwater						
Oral	NC	NC		4E+01	1E+01	B(g),E(a,c)
Inhalation	NC	NC		1E-02	1E-02	A

Table 4-1
Alternate Risk Calculations Summary - Overall Site

	Cancer Risk As Calculated by Life Systems	Alternate Risk Estimate	Basis for Alternate Risk Estimate	Hazard Index As Calculated by Life Systems	Alternate Hazard Index Estimate	Basis for Alternate Hazard Index Estimate
Dermal	NC	NC		6E-01	6E-01	A
Soil						
Oral	NC	NC		1E+01	9E+00	B(r,s),E(a),G(a,d)
Dermal	NC	NC		4E-01	4E-01	A
Food						
Leafy Vegetables	NC	NC		5E+00	1E-01	G(b,c)
Root Vegetables	NC	NC		9E+00	5E-01	B(b,c,i,j,r,s),G(a,b,c,d),J
Beef	NC	NC		2E+02	1E-01	G(d)
Milk	NC	NC		1E+02	8E-02	G(d)
Total	NC	NC		4E+02	2E+01	

The alternate risk estimates assume that the pesticides detected are site-related. In addition, the alternate risk estimates accept the bioconcentration model and its input parameters at face value, as the model and the source of the parameters have not been available for review. Finally, all hazard quotients have been assumed to be additive, and the method of calculating exposure point concentrations has not been revised.

NC - Not calculated, consistent with Life Systems, Inc. RA.

A - Cancer risk or hazard index is insignificant; Life Systems value accepted without further investigation.

B - One or more compounds were not detected in the samples of the media comprising this scenario (and are therefore not included) in this estimate.

a - benzo(a)anthracene, benzo(b)fluoranthene, and chrysene.
b - benzo(a)pyrene
c - benzo(k)fluoranthene
d - Aroclor 1248
e - tetrachloroethene
f - alpha-chlordane
g - thallium
h - 4,4'-DDT
i - benzo(a)anthracene
j - benzo(b)fluoranthene
k - 2,4-dinitrotoluene
l - aldrin
m - benzene
n - heptachlor
o - heptachlor epoxide
p - di-n-octylphthalate
q - N-nitrosodiphenylamine
r - naphthalene
s - 2-methylnaphthalene
t - trichloroethene
u - acenaphthene
v - fluorene
w - fluoranthene

C - The human intake factors are high by a factor of 2 in the Life Systems calculations.

D - Life Systems used a dermal slope factor of 3.8E05 instead of 1.5E05 for 2,3,7,8-TCDD equivalents.

E - One or more compounds may be present at background concentrations.

a - arsenic
b - beryllium

Table 4-1
Alternate Risk Calculations Summary - Overall Site

	Cancer Risk As Calculated by Life Systems	Alternate Risk Estimate	Basis for Alternate Risk Estimate	Hazard Index As Calculated by Life Systems	Alternate Hazard Index Estimate	Basis for Alternate Hazard Index Estimate

c - antimony
d - chromium

F - Life Systems has added all exposures in all media. This effectively assumes the trespasser ingests 300 mg of soil per day. The alternate risk estimate averages these exposures.

G - One or more compounds may be laboratory contaminants.
a - bis(2-ethylhexyl)phthalate
b - acetone
c - 2-butanone
d - di-n-octylphthalate

H - Risk estimate calculated by Life Systems appears to be correct.

I - Life Systems used a dermal slope factor of 4300 instead of 4.3 for beryllium.

J - Chrysene concentration appears to be 10 percent of the concentration used by Life Systems.

K - Oral slope factor of carcinogenic PAHs in the 1992 HEAST is 50 percent of the value in the 1991 HEAST.

L - One or more PAHs should have been included in the risk estimates.
a - chrysene

TABLE 4-2
SUMMARY OF ALTERNATIVE RISK CALCULATIONS FOR NORTH SOILS DATA

TRESPASSER	Cancer Risk	Hazard Quotient
Ingestion Risk	3.00E-07	1.50E-03
Dermal Exposure Risk	6.20E-07	6.61E-04
Total	9.20E-07	2.20E-03

FUTURE RESIDENT	Cancer Risk	Hazard Quotient (0-5)	Hazard Quotient (6-30)
Ingestion Risk	1.00E-05	6.90E-01	1.00E-01
Dermal Exposure Risk	6.40E-05	-	2.83E-02
(Without Pharmocokinetic parameter)			
Dermal Exposure Risk	6.40E-08	-	2.83E-05
(With Pharmocokinetic parameter)			
Food Exposure Risk			
Leafy Vegetables	2.40E-11	1.60E-10	2.60E-10
Root Vegetables	2.80E-06	1.40E-05	2.30E-05
Beef	1.20E-06	4.50E-04	8.00E-04
Milk	3.70E-07	2.40E-04	1.50E-04
Total(W/O)	7.80E-05	6.90E-01	1.30E-01
Total(W)	1.40E-05	6.90E-01	1.00E-01

(W/O)=Without Pharmocokinetic parameter
(W)=With Phamocokinetic parameter

TABLE 4-3
SUMMARY TABLE FOR INDIVIDUAL COMPOUNDS
BY EXPOSURE SCENARIO FOR NORTH SOILS DATA

TRESPASSER
Ingestion Risk

Compound	Cancer Risk	Hazard Quotient
Benzo(b)fluoranthrene	1E-07	1E-06
Naphthalene	-	1E-06
2- Methylnaphthalene	-	1E-06
Anthracene	-	1E-07
Flourene	-	1E-06
Phenanthrene	-	1E-06
Pyrene	-	1E-06
Bis-(2-ethylhexyl)phthalate	2E-10	2E-06
Butylbenzylphthalate	-	2E-07
Acetone	-	2E-08
Benzene	2E-12	-
2-Butanone	-	4E-09
Antimony	-	2E-04
Arsenic	1E-07	6E-04
Beryllium	2E-08	2E-06
Manganese	-	2E-04
Thallium	-	5E-04

Dermal Exposure Risk

Compound	Cancer Risk	Hazard Quotient
Benzo(b) Fluoranthene	6E-07	2.4E-05
Napthalene	-	1.9E-05
2-Methylnapthalene	-	2.2E-05
Anthracene	-	2.0E-06
Flucrene	-	1.7E-05
Phenanthrene	-	2.0E-05
Pyrene	-	1.8E-05
Bis 2-ethylhexyl phthalate	1E-09	2.6E-05
Butylbenzyl phthalate	-	3.3E-06
Acetone	-	5.7E-07
2-Butanone	-	1.4E-07
Antimony	-	7.1E-05
Arsenic	2E-08	2.1E-04
Beryllium	2E-09	7.5E-07
Managanese	-	6.7E-05
Thallium	-	1.6E-04

TABLE 4-3
SUMMARY TABLE FOR INDIVIDUAL COMPOUNDS
BY EXPOSURE SCENARIO FOR NORTH SOILS DATA

FUTURE RESIDENT
Ingestion Risk

Compound	Cancer Risk	Hazard Quotient (0-5)	Hazard Quotient (6-30)
Benzo(b)fluoranthrene	6E-06	8.9E-04	9.6E-05
Naphthalene	-	7.0E-04	7.5E-05
2- Methylnaphthalene	-	8.1E-04	8.6E-05
Anthracene	-	7.4E-05	7.9E-06
Flourene	-	6.2E-04	6.6E-05
Phenanthrene	-	7.6E-04	8.1E-05
Pyrene	-	6.6E-04	7.1E-05
Bis-(2-ethylhexyl)phthalate	1E-08	9.8E-04	1.0E-04
Butylbenzylphthalate	-	1.2E-04	1.3E-05
Acetone	-	1.1E-06	1.1E-06
2-Butanone	-	2.3E-07	2.5E-07
Antimony	-	1.3E-01	1.4E-02
Arsenic	7.88E-06	4.0E-01	4.3E-02
Beryllium	1E-06	1.4E-03	1.5E-04
Manganese	-	1.2E-01	1.3E-02
Thallium	-	2.9E-02	3.1E-02

Dermal Exposure Risk
(Without Pharmacokinetic parameter)

Compound	Cancer Risk	Hazard Quotient (6-30)
Benzo(b) Fluoranthene	6E-05	1.0E-03
Napthalene	-	8.1E-04
2-Methylnapthalene	-	9.3E-04
Anthracene	-	8.5E-05
Fluorene	-	7.1E-04
Phenanthrene	-	8.8E-04
Pyrene	-	7.6E-04
Bis 2-ethylhexyl phthalate	1E-07	1.1E-03
Butylbenzyl phthalate	-	1.4E-04
Acetone	-	2.4E-05
2-Butanone	-	5.9E-06
Antimony	-	3.0E-03
Arsenic	2E-06	9.2E-03
Beryllium	2E-07	3.2E-05
Managanese	-	2.9E-03
Thallium	-	6.7E-03

Dermal Exposure Risk
(With Pharmacokinetic parameter)

Compound	Cancer Risk	Hazard Quotient (6-30)
Benzo(b) Fluoranthene	6E-08	1.0E-06
Napthalene	-	8.1E-07
2-Methylnapthalene	-	9.3E-07
Anthracene	-	8.5E-08
Fluorene	-	7.1E-07
Phenanthrene	-	8.8E-07
Pyrene	-	7.6E-07
Bis 2-ethylhexyl phthalate	1E-10	1.1E-06
Butylbenzyl phthalate	-	1.4E-07
Acetone	-	2.4E-08
2-Butanone	-	5.9E-09
Antimony	-	3.0E-06
Arsenic	2E-09	9.2E-06
Beryllium	2E-10	3.2E-08
Managanese	-	2.9E-06
Thallium	-	6.7E-06

TABLE 4-3
SUMMARY TABLE FOR INDIVIDUAL COMPOUNDS
BY EXPOSURE SCENARIO FOR NORTH SOILS DATA

FOOD EXPOSURE RISKS

Future Residents - Ingestion of Leafy Vegetables

Compound	Cancer Risk	Hazard Quotient (0-5)	Hazard Quotient (6-30)
Benzo(b) Fluoranthene	2E-11	1E-10	2.0E-10
Phenanthrene	-	3E-11	4.6E-11
Pyrene	-	6E-12	9.5E-12

Future Residents - Ingestion of Root Vegetables

Compound	Cancer Risk	Hazard Quotient (0-5)	Hazard Quotient (6-30)
Benzo(b) Fluoranthene	3E-06	1E-05	2.3E-05
Phenanthrene	-	8E-08	1.3E-07
Pyrene	-	4E-08	6.8E-08

Future Residents - Ingestion of Beef

Compound	Cancer Risk	Hazard Quotient (0-5)	Hazard Quotient (6-30)
Benzo(b) Fluoranthene	1E-06	6.0E-06	1.00E-05
Phenanthrene	-	2.0E-04	2.80E-04
Pyrene	-	3.0E-04	5.1-04

Future Residents - Ingestion of Milk

Compound	Cancer Risk	Hazard Quotient (0-5)	Hazard Quotient (6-30)
Benzo(b) Fluoranthene	4E-07	3.0E-06	1.90E-06
Phenanthrene	-	9.00E-05	5.40E-05
Pyrene	-	2.0E-04	9.50E-05

Table 4-4
Exposure Point Concentrations - Shallow Soils
Gulf Coast Vacuum Services, Inc. Site

COMPOUND (all concentrations µg/kg unless noted otherwise)	EPC Hits Detects > PQL	EPC Total	Percent Frequency	Overall Site % Frequency	Hits - Sample IDs	EPC Max	EPC Min	MEAN (Log)	Upper Limit (AM95)	EPC	EPC,mg/kg
Benzo(a) Anthracene	0	36	0	1	0	16,263	14.9	1,295	2,410	2,410	2.41
Benzo(b) Fluoranthene	1	36	3	1	SF-7	16,263	52.0	1,212	2,097	2,097	*2.10*
Benzo(k) Fluoranthene	0	36	0	1		16,263	255	1,176	1,936	1,936	1.94
Benzo(a) Pyrene	0	36	0	2		16,263	255	1,176	1,936	1,936	1.94
Chrysene	0	36	0	5		16,263	15.6	1,306	2,409	2,409	2.41
Dibenzo(a,h) Anthracene	0	36	0	NA		16,263	255	1,176	1,936	1,936	1.94
Indeno(1,2,3-c,d Pyrene)	0	36	0	NA		16,263	255	1,176	1,935	1,935	1.94
Napthalene	1	36	3	17	SF-1	16,263	255	1,293	2,201	2,201	*2.20*
2-Methylnapthalene	1	36	3	21	SF-1	28,000	255	1,414	2,524	2,524	*2.52*
Acenapthylene	0	36	0	NA		16,263	255	1,187	1,940	1,940	1.94
Acenapthlene	0	36	0	3		16,263	255	1,198	1,944	1,944	1.94
Anthracene	1	36	3	4	SF-1	16,263	255	1,101	1,727	1,727	*1.73*
Benzo(g,h,i) Perylene	0	36	0	1		16,263	255	1,198	1,944	1,944	1.94
Fluorene	1	36	3	10	SF-1	16,263	255	1,194	1,935	1,935	*1.93*
Fluoranthene	0	36	0	3		16,263	255	1,198	1,944	1,944	1.94
Phenanthrene	2	36	6	21	SF-1, NE-9	16,263	255	1,116	1,776	1,776	**1.78**
Pyrene	3	36	8	11	SF-1, NE-9,SF-7	16,263	47.0	978	1,551	1,551	**1.55**
Dimethylphthalate	0	36	0	1		15,556	255	975	1,460	1,460	1.46
Diethylphthalate	0	36	0	1		15,556	255	975	1,460	1,460	1.46
Di-n-butylphthalate	0	36	0	2		15,556	255	975	1,460	1,460	1.46
Bis 2-ethylhexyl phthalate	15	36	42	40	many	16,263	44.0	904	1,529	1,529	**1.53**
Di-n-octalphthalate	0	36	0	1		15,556	255	975	1,460	1,460	1.46
Butylbenzyl phthalate	1	36	3	1	NE-13	16,263	255	1,179	1,931	1,931	1.93
Acetone	10	36	28	32	many	430	4.95	43.4	82.4	82.4	**0.08**
Benzene	0	36	0	10		17.0	3.54	5.51	6.13	6.13	0.006
2-Butanone	2	35	6	16	G-7	12.7	6.00	9.08	9.13	9.13	0.009
Antimony	1	17	6	5	SF-4	6.65	2.83	3.90	4.11	4.11	**4.1**
Arsenic	35	36	97	90	many	19.9	0.45	7.10	9.32	9.32	**9.3**
Barium	36	36	100	100	many	22,900	161	9,803	19,585	19,585	**19,585**
Managanese	35	36	97	100	many	1,550	3.77	651	973	973	**973**
Thallium	5	36	14	19	many	260	0.14	0.87	1.58	1.58	**1.58**
Beryllium	34	36	94	80	many	0.78	0.16	0.48	0.54	0.54	**0.54**

5.0 EVALUATION OF REMEDY SELECTION

5.1 Soil/Sludge No-Action Alternatives Require More Careful Consideration

For site soil, sediments, and pit sludge, the Feasibility Study Report (FS) does not adequately develop and evaluate "no action" scenarios to provide an even-handed judgment as intended by the NCP. Instead, in each case where the alternatives are screened and evaluated, the "No Action/Institutional Controls" alternatives presume that real access restriction is not achievable. However, considering that the EPA has erected a perimeter fence around part of the site, there is an evident recognition that these and more stringent access restrictions do have a distinct utility. (Site access institutional controls are inherent in other EPA proposed alternative remedies, including onsite incineration.) Moreover, and as discussed in the RA review comments in Section 4 above, risks to a trespasser have been overestimated, causing "No Action/Institutional Controls" and "Containment" alternatives to be rejected too readily. In summary, fundamental "Containment" and a "No Action/Institutional Controls" alternatives, employing access restrictions where warranted, should receive more judicious review.

5.2 A Reevaluation of the No-Action Alternative for Shallow Soils is Required

As described and presented in Section 4 above, careful review of all shallow soils data in the northern area of the site strongly supports a "No Action" selection for shallow soils not associated with the pits or the fuel tanks. Thus, this remedy selection process needs to be redone, based on a reevaluation of shallow soils risks according to the reasonable maximum exposure scenario and risk estimates presented.

5.3 The Interim Source Action Alternative Selection is Flawed

Careful review of RI sludge data indicates the presence of differential concentrations of target organic compounds with depth in site sludge. Samples near the top of the sludge depth exhibit higher concentrations, particularly of lighter compounds, indicating a paraffin layer evidently together with other phase separation. Evaluation of treatment alternatives for sludge should take these differential concentrations into account in sludge management and remediation. Instead, the selected interim source action inappropriately involves consolidation of all sludge and associated soils. Thus, the selected interim source action would potentially cause the counterproductive effect of mixing lower concentration sludge and associated soils with higher concentration sludge layers. The interim source action alternatives should be reevaluated.

5.4 The Rejection of Alternative Technologies was Unwarranted

The evaluation process under CERCLA is intended to work toward an appropriate remedy, not to predetermine selection. For the GCVSS site, only thermal treatment (and, specifically, incineration) was adequately evaluated in the remedy selection process. Indeed, review of the selection process described in the FS strongly implies that only this remedy was seriously considered. For example, other technologies such as solidification/stabilization and bioremediation were not considered, or were ranked low in feasibility, although these technologies have been proven effective in many applications. Treatability studies were only conducted for thermal treatment.

In some cases, combination of site media (for example, soils and sludge) for consideration of remedial alternatives may be inefficient and lead to an unwarranted remedial decision. As discussed above, contaminants of concern are present at different

levels in different media; exhibit characteristics related to the media; and, pose separate remediation challenges which may be addressed most effectively by individual technologies. For example, separation of oils from pit sludge, combined with solidification of the remaining sludge and soil, may be a very effective remedial alternative, but cannot be fairly evaluated when contaminant sources in the entire sludge and soil column are considered together. Accordingly, the remedy selection process should be reevaluated to focus on media- (or source-) specific technologies or combinations.

Solidification/stabilization technologies have been used effectively at numerous sites containing high-organic oily sludge. These technologies have been rejected in this FS due to the belief they are ineffective in long-term immobilization of organics, and that groundwater protection is thus not adequate. But no specific criteria were defined or tested in treatability studies to support this belief. Thus, essentially, this remedial alternative was rejected without basis. Adequate performance in other applications strongly argues that these technologies should be tested and evaluated thoroughly. Given the apparent unspecified concern by EPA with long-term effectiveness for "high" organic concentrations, treatability testing of solidification/stabilization alone, and in combination with pretreatment to reduce organic concentrations, could well provide site-specific demonstration of this proven technology.

Bioremediation or a separation technology also should be considered as potential pretreatment alternatives. Bioremediation was also rejected, with little accompanying consideration, due to EPA concern that metals and "high" organic concentrations would render this technology ineffective. This decision should also be reevaluated. This technology has been used in other cases with comparable metals concentrations. As shown above, bioremediation

pretreatment before solidification may be an effective combination of technologies, and was not addressed in the FS. Further treatability testing should be conducted in order to demonstrate the range of effectiveness which can be achieved.

5.5 Volume and Cost Estimates Appear to be Underestimated

Review of the basis and methods used to evaluate volumes of material to be treated and costs to implement the alternate remedies indicates significant potential margins for error. Volume assumptions for sludge and associated soil may well have been underestimated, an error which in turn would affect cost comparison of alternatives. In addition, cost estimates appear to have been based solely on "book" values, rather than considering available unit costs based on actual remediations in the region. Thus, the cost projections for addressing pit sludge and associated soils appear to be significantly underestimated in general. Therefore, the selection of the on-site incineration alternative as being "more acceptable" in cost-effectiveness, may well prove to be without adequate basis upon implementation.

In addition, shallow soil volumes appear to have been based on the area shown as "suspected area of sludge contamination" in FS Figure 2-1. These volumes are presumed to comprise a depth of two feet, and are combined with underlying pit soils in the cost evaluation of alternatives. The range of this "suspected area", however, is not demonstrated in the shallow soil data, and since "sludge contamination" was not actually found in the soil investigation, this volumetric approach is inappropriate. As demonstrated in Section 4 above, thorough reconsideration should be given to whether any shallow soils in the northern area of the site require action.

5.6 EPA's Remedial Goals Need Reevaluation

The remedial goals presented in FS Tables 2-1 and 2-2, and in the description of Remedial Action Objectives in FS Section 2.3, are poorly explained and inappropriate. A careful development of remedial goals is critical to the selection and implementation of remedies which use resources effectively to address specific risks to an adequate level. These Remedial Action Objectives and remedial goals should be reevaluated. More detailed comments and proposal of alternate remedial goals are presented in the comments below.

6.0 REVIEW OF REMEDIAL ACTION OBJECTIVES

6.1 Preliminary Considerations

Contaminants of concern and acceptable contaminant levels (remedial goals) are proposed in FS Section 2.3 and summarized in FS Tables 2-1 and 2-2 for pit sludge and associated soils, and site soils and sediments, respectively. Only marginal explanation of the specific exposure scenario and receptor(s) is provided to facilitate evaluation of the judgment and appropriateness of the evaluation resulting in these Remedial Action Objectives (RAOs). Because the remedial goals play a critical role in the selection, design, and implementation of the selected remedies, adequate description of the decision process and careful reevaluation of the proposed goals is strongly recommended. The final goals which are approved should appropriately address site risks and be achievable so as to optimize use of resources in an effective manner. For example, remediation aimed at reduction to levels which are probably at or under background conditions is impractical and wasteful.

6.2 Basis for Remedial Goals

Because of poor documentation and data limitations for review, it was quite difficult to assess the actual decision process and to provide the truly effective alternate goals within the limited review and public comment period provided. In this section, summary comments and preliminary proposed alternate remedial goals are presented. EPA should carefully reevaluate and revise its proposed goals in advance of final remedy selection.

From the brief description provided, it appears that a future on-site resident ingestion scenario was used to back-calculate chemical-specific remedial goals which would result in a 1 E-04 cumulative excess cancer risk (no hazard index criteria are discussed). Given the appropriate types of remedial alternatives

being considered in the FS for pit sludge and soils (even including an adequate "No Action/Institutional Controls" or "Containment" alternative), the choice of direct ingestion by an on-site resident may be a very over-protective approach. In addition, review calculations attempting to recreate the remedial goals presented were unsuccessful, indicating that the rationale presented may be wrong or the calculations in error. In the case of PAH goals, reasonable evaluation of the proposed remedial goals is impossible, since the values presented were "determined by EPA Region VI" without explanation, and are almost certainly within real background levels.

6.3 Selection of Contaminants of Concern

The selection of contaminants of concern includes arsenic, barium, PAHs, and benzene for pit sludge and soil, and barium and arsenic for soils. As discussed in detail above in Sections 4 and 5, barium is an inappropriate selection for these media because barium sulfate (the predominant speciation reasonably present) does not generate risk levels of concern. By evaluating soluble barium species, the RA has grossly inflated its risk estimates. Barium should be removed from consideration as a contaminant of concern. The selection of PAHs and arsenic is more plausible, given the highly conservative exposure scenario assumed. Benzene may not be an appropriate selection, based on risk considerations. Other parameter(s) (such as TPH) may be more appropriate for engineering evaluation and implementation of alternate remedies.

6.4 Proposed Alternate Remedial Goals

As described above, no goals are necessary for shallow soils based on the alternate risk evaluation presented in these comments, because these soils do not require action. Preliminary proposed alternative goals for sludge and associated soils are presented in Table 6.1. The proposed alternate levels for arsenic and benzene were based on back-calculation assuming a 1 E-06 carcinogenic risk

and a 1.0 hazard index non-carcinogenic risk. The rationale for the proposed alternate PAH goals (which have been widely used at other sites nationally and within Region VI) is summarized below.

PAH Cleanup Levels. The remedial goals presented in the FS for PAHs in sludge and associated soils are unsupported and within or below probable real background levels which would be encountered during remediation. In addition, these levels are significantly below remedial goals in use at many sites.

A recent study (Menzie, 1992) of background concentrations of PAHs in soils presents background PAH levels in agricultural soils of 5 μg/kg to 100 μg/kg (with some to 1 mg/kg) and levels in urban soils of 1 to 3 mg/kg (with some to over 300 mg/kg, probably attributable to road dust). Adequate data to evaluate site background were not developed and presented in the RI. However, significant concerns must be considered whether the proposed PAH goals are even achievable.

Advisory levels for establishing criteria for contaminants in soils have been established, although no specific national guidelines have been adopted. As an example, a recommended Constituent Action Level (CAL) for polynuclear aromatic hydrocarbons (PAHs) of 100 mg/kg for combined constituents has been used in various site cleanups around the country. This level was originally derived by the U.S. Public Health Service for a site-specific cleanup in Texas, but has been used in other areas. Through repeated use in cleanups, the value has acquired "guideline" status (ATSDR, 1987). The value was originally based on CAG potency factors, assuming that the relative difference between estimated dioxin cancer potency and benzo(a) pyrene potency could be translated into concentration levels in soil. Recommended residential cleanup levels for dioxin contaminated soils are 1 μg/kg; therefore, benzo(a) pyrene, with a potency 5

orders of magnitude less than dioxin, would correspond to a soil PAH concentration of 100 mg/kg (i.e., 100,000 μg/kg). It should be noted that the cleanup level for residential soils in Missouri for dioxin has been increased to 10 μg/kg under a clean fill cover (Personal communications with the Missouri Health Department, Environmental Epidemiology Section, 1992). If the same rationale is applied, a cleanup level for PAHs in soils of 1000 mg/kg would still be considered adequately protective of human health.

TABLE 6-1
PROPOSED ALTERNATE REMEDIAL GOALS

Carcinogenic Goals: (1)		**Non-Carc Goals:** (1)			**Remedial Goals:**	
			(0 - 5)	(6 - 30)		
Arsenic Goal =	1.183	Arsenic Goal =	23.5	23.5	Arsenic Goal=	23
Carc.PAH Goal =	0.367	Carc.PAH Goal =	2,350	2,350	Carc.PAH Goal=	100/1000
Non-Carc.PAH Goal =	Not determined	Non-Carc.PAH Goal =	3,130	3,130	Non-Carc.PAH Goal=	100/1000
Benzene Goal =	73.4	Benzene Goal =	54.8	54.8	Benzene Goal=	55

(1) Based on back-calculation from Resident Soil Ingestion Scenario

7.0 CONCLUSIONS

Specific conclusions have been set forth, and summarized, throughout the comments' presentation, and are not all restated in detail. Several key comments are repeated briefly below.

7.1 RI Data Limitations

Several critical data limitations resulted from the RI which strongly impact RA and FS decisions. These limitations might have been lessened by identification of potential problems and strategic approaches to DQOs in iterative RI planning. These problems include:

Inadequate PQLs. In many sludge and soil organic analyses, the data set available for use in the RA and FS is comprised mostly of constituents which were not detected below very high PQLs. This problem caused the RA data evaluation to make data and statistical assumptions which grossly inflate some risk calculations. Because of this severe data limitation, judgment should have been applied to the selection of contaminants of concern and estimation of risk, rather than a rote following of standard methods which are based on data quality and statistical distribution assumptions which are invalid for these data.

Sample Interferences and QA/QC Concerns. A number of organic constituents which are commonly encountered as interferences due to sampling or analytical practices were included in the data set and carried as potential contaminants of concern throughout RA evaluations. The lack of detailed or summary QA/QC information presented in the RI impede evaluation of this and PARCC data evaluation to define the limitations of the data. The interfering compounds should have been dropped from further consideration. PARCC evaluation should be addressed, to provide important data qualification to the RA and FS decision process.

Background Data Needs. Although limited background data were developed for metals constituents in soils and groundwater in the immediate site area, that data may not provide an adequate reference range for use in final selection of remedial goals. Background data should have been developed and presented for pesticides and dioxins, to support sound decisions on whether these constituents are actually site-related. Insufficient evidence was developed to support any belief that these constituents should be considered as resulting from site activities.

Limited Treatability Evaluation. Only thermal treatment technology was selected for treatability testing, despite summary decisions made in the FS that proven potential technologies such as stabilization or bioremediation could require treatability testing. This limited evaluation implies that remedy selection was predetermined and not fairly evaluated.

7.2 Alternative Baseline Human Health Risk Calculations

Both data limitations and the judgments and methods used in the RA seriously impacted the risk estimates presented. This resulted, in many cases, in grossly inflated risk estimates which go too far beyond the average to reasonable maximum risk ranges which should have been developed. The critical factors which should definitely be reevaluated include:

Selection of Potential Compounds of Concern. The use of 77 compounds for quantification of risks for the site resulted in additive risks which inflate risk estimates beyond a reasonable average or maximum level. Many of the compounds used are detected infrequently, are laboratory contaminants, are comparable to background concentrations, have no site-related history, exhibit very low potential toxicity, or appear to be essential nutrients.

Reevaluation of risk estimates should be based on compounds selected with judgment for these factors.

Exposure Assessment. Exposure scenarios are inadequately and inconsistently defined, and several of the exposure scenarios also contributed to the systematic over-inflation of site-related risks. Although RAGS guidance indicates that risk should lie between an average and a reasonable maximum exposure, the average exposure case has apparently not been calculated. Despite EPA responses to previous clarification questions, clear and believable rationale has not been provided to explain the supposed activities associated with exposure scenarios such as a trespassing child repeatedly playing with sludge found underwater at the base of a pit. The exposure scenario involving future residents ingesting beef and milk raised in an area where sludge had been spread on the ground is not credible.

Quantification of Exposure. The methodology used in exposure calculations is not sufficiently documented for adequate peer review to have been performed. Many of the calculations apparently can not be reproduced. Statistical assumptions, data substitutions, and the use of unreasonably small data sets in these calculations caused gross overestimation of some risks. The quantification should be reevaluated.

Risk Assessment for Shallow Soils. Alternate risk calculations indicate that a gross overestimation of risks posed by shallow soils was presented in the RA. The risks posed by shallow soils are marginal and do not deserve to be addressed by remedial action.

7.3 Consideration of Alternate Remedies

Remedy Selection Process. The remedy selection process presented in the FS is flawed in several areas. The "No Action / Institutional Controls" and "Containment" alternatives were inadequately defined to be fairly evaluated. Inadequate consideration was given to any remedies other than incineration. The combination of site media in development of remedial alternatives may have skewed the evaluation process.

Alternate Remedies. A "No Action" alternative should be evaluated and selected for shallow soils in the northern area of the site. The alternatives of solidification/stabilization and bioremediation combined with solidification/stabilization should be reevaluated, and treatability tests performed to measure performance against reasonable objectives. The interim source action selected should be reevaluated to avoid potential counter-productive impacts of consolidation. Alternate remedial goals presented in Section 6 should be considered in lieu of the proposed goals, which are poorly documented and may prove unfeasible and over-protective.

7.4 Summary

This document reaches three primary conclusions. First, the discussion concludes that data inadequacies in the RI, and improper judgments in using these data, have resulted in overstated exposure concentrations. When combined with unreasonable and noncredible exposure scenarios, these data have resulted in excessive and unrealistic estimates of the risks posed by this site. Second, the discussion shows that these exaggerated risks have in turn resulted in unsupported expansion of the area needing remediation to be protective of human health and the environment. This is especially true of shallow site soils not associated with the fuel tanks or pit sludges, where a "no action" response alternative is entirely justified by proper risk

analysis. Finally, the report demonstrates that serious shortcomings in the remedy selection process have resulted in the inappropriate exclusion of viable treatment technologies.

REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological Profile for Barium, TP-91/03.July 1992, pp.35-36.

American Council for Governmental and Industrial Hygienists (ACGIH). 1992. Pharmacokinetic models used in setting BEIs. ACGIH Documentation of the Biological Exposure Indices. BEI 26-33.

ATSDR. 1990. Toxicological Profile for p,p-DDT, p,p-DDE, p,p-DDD. pp. 76-82.

ATSDR. 1992. Toxicological Profile for 2-Butanone. TP-91/08, July 1992, pg 31.

Baes III, C.F. and R.D. Sharp. 1983. A proposal for estimation of soil leaching and leaching constants for use in assessment models. J. Environ. Qual. 12(1):17-28.

Code of Federal Regulations, 40 CFR 300.1-300.920. National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

Driscoll, F.D. 1987. Groundwater and Wells. "Drilling Fluids", Chpt 11, Johnson Division Press, St. Paul, MN,. 2nd Ed., pp. 340-394.

Gargas, M.L., R.J. Burgess, D.E. Voisard, et al. (1989). Partition coefficients of low-molecular-weight volatile chemicals in Various liquids and tissues. Toxicol. Appl. Pharm. 98:87-99.

Gilbert, R.O., 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold, New York, NY. pp. 139-162.

Guillemin, M.P., D. Bauer, (1979). Human exposure to Styrene; III elimination kinetics of urinary mandelic and phenylglyoxylic acids after single experimental exposure. Int. Arch. Environ. Health 44:249-263.

Heidelberger, C. 1982. Chemical Carcinogenesis. Ann. Rev. Biochem. 26:326-389.

Helsel, D.R., 1990. "Less Than Obvious; Statistical Treatment of Data Below the Detection Limit," Environ. Sci. Technol. 24(12):1766-1774.

Hornung, R.W. and L.D. Reed, 1990. "Estimation of Average Concentration in the Presence of Nondetectable Values," Appl. Occup. Environ. Hyg. 5(1): 46-51.

Menzie, C.A. and B.B. Potocki, 1992. "Ambient Concentrations and Exposure to Carcinogenic PAHs in the Environment," Environ. Sci. Technol. 26(7): 1278.

Moriarty, F., 1990. Ecotoxicology The Study of Pollutants in Exosystems ; Academic Press, New York, NY, pp.141-178.

Schwarzenbach, R.P. and J. Westall. 1981. Transport of nonpolar organic compounds from surface water to groundwater. Laboratory sorption studies. Environ. Sci. Technol. 15(11):1360-1367.

South Coast Air Quality Management District (SCAQMD), 1988. Multi-Pathway Health Risk Assessment Input Parameters Guidance Document, Prepared for the South Coast Air Quality Management District by ICF Clement Associates, Inc., June 1988.

Suss, R., V. Kinzel and J.D. Scribner. Cancer - Experiments and Concepts. Springer Verlag New York, NY. pp. 43-45.

Trapp, S., M. Mattheis, I. Scheunert and E.M. Topp. 1990. Modeling the bioconcentration of organic chemicals in plants. Environ. Sci. Technol. 24 (8):1246-1252.

Travis, C.C. and A.D. Arms. 1988. Bioconcentration of Organics in Beef, Milk, and Vegetation. Environ. Sci. Technol. 22(3):271-274.

USEPA, Office of Emergency and Remedial Response, 1992. Health Effects Assessment Summary Tables (HEAST) NTIS No. PB92-921199.

USEPA, Office of Emergency and Remedial Response, 1991. Health Effects Assessment Summary Tables (HEAST) NTIS No. PB91-921199.

USEPA, Office of Emergency and Remedial Response, 1989. Risk Assessment Guidance for Superfund. Vol. II. Environmental Evaluation Manual. EPA/540/1-89/001.

USEPA, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, 1987. Data Quality Objectives for Remedial Response Activities. Vol. 1: Development Process. and Vol. 2: Examples Scenario: RI/FS Activities at a Site with Contaminated Ground Water., EPA/540/G-87/003,004. March 1987.

USEPA, Office of Solid Waste and Emergency Response, 1991. Update of OSWER Directive 9355.4-02: Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites., OSWER, August 1991.

USEPA, Office of Health and Environmental Assessment. 1991. Dermal Exposure Assessment: Principles and Applications., EPA 600/8-91/011b.

USEPA, Office of Research and Development, 1989. Ecological Assessments of Hazardous Waste Sites: A Field and Laboratory Reference Document. EPA/600/3-89/013.

USEPA, Office of Emergency and Remedial Response, 1989. Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. EPA/540/1-89/002. December, 1989.

USEPA, Office of Emergency and Remedial Response, 1989. Exposure Factors Handbook. EPA/600/8-89/043, July, 1989.

USEPA, Office of Solid Waste and Emergency Response, 1991. Human Health Evaluation Manual, Supplemental guidance: Standard Default Exposure Factors., OSWER Directive 9285.6-03.

USEPA Region VI, 1992. Protocol for Calculating Risk from Consumption of Home Grown Vegetables, Beef and Milk.

USEPA, 1992. Dermal Exposure Assessment: Principles and Applications. EPA 600/8-91/011B, January 1992.

ATTACHMENT 1
TABLE A-1
NORTH AREA SHALLOW SOILS DATA
CALCULATIONS FOR TRESPASSER - SOIL INGESTION SCENARIO

Compound	Concentration (a) (mg/kg)	Ingestion Rate (mg/day)	Chronic Daily Dose (mg/kg/day)	Lifetime Dose (mg/kg/day)	Slope Factor (mg/kg/day)-1	RfD (mg/kg/day)	Cancer Risk	Hazard Quotient
Benzo(a)anthracene	0	10	0.00E+00	0.00E+00	5.80E+00	3.00E-02	0E+00	0E+00
Benzo(b)fluoranthrene	2.10	10	4.27E-08	1.83E-08	5.80E+00	3.00E-02	1E-07	1E-06
Benzo(k)fluoranthrene	0	10	0.00E+00	0.00E+00	5.80E+00	3.00E-02	0E+00	0E+00
Benzo(a)pyrene	0	10	0.00E+00	0.00E+00	5.80E+00	3.00E-02	0E+00	0E+00
Chrysene	0	10	0.00E+00	0.00E+00	5.80E+00	3.00E-02	0E+00	0E+00
Dibenzo(a,h)anthracene	0	10	0.00E+00	0.00E+00	5.80E+00	3.00E-02	0E+00	0E+00
Indeno(1,2,3-cd)pyrene	0	10	0.00E+00	0.00E+00	5.80E+00	3.00E-02	0E+00	0E+00
Naphthalene	2.20	10	4.48E-08	1.92E-08	Not Determined (b)	4.00E-02	Not Calculated	1E-06
2- Methylnaphthalene	2.52	10	5.13E-08	2.20E-08	Not Determined	4.00E-02	Not Calculated	1E-06
Acenapthylene	0	10	0.00E+00	0.00E+00	Not Determined	Not Determined	Not Calculated	Not Calculated
Acenapthalene	0	10	0.00E+00	0.00E+00	Not Determined	Not Determined	Not Calculated	Not Calculated
Anthracene	1.73	10	3.52E-08	1.51E-08	Not Determined	3.00E-01	Not Calculated	1E-07
Benzo(g,h,i)perylene	0	10	0.00E+00	0.00E+00	Not Determined	Not Determined	Not Calculated	Not Calculated
Fluorene	1.93	10	3.93E-08	1.68E-08	Not Determined	4.00E-02	Not Calculated	1E-06
Fluoranthrene	0	10	0.00E+00	0.00E+00	Not Determined	4.00E-02	Not Calculated	0E+00
Phenanthrene	1.78	10	3.62E-08	1.55E-08	Not Determined	3.00E-02	Not Calculated	1E-06
Pyrene	1.55	10	3.15E-08	1.35E-08	Not Determined	3.00E-02	Not Calculated	1E-06
Dimethylphthalate	1.46	10	2.97E-08	1.27E-08	Not Determined	Not Determined	Not Calculated	Not Calculated
Diethylphthalate	0	10	0.00E+00	0.00E+00	Not Determined	Not Determined	Not Calculated	Not Calculated
Di-n-butylphthalate	0	10	0.00E+00	0.00E+00	Not Determined	2.00E-02	Not Calculated	0E+00
Bis-(2-ethylhexyl)phthalate	1.53	10	3.11E-08	1.33E-08	1.40E-02	2.00E-02	2E-10	2E-06
Di-n-octylphthaltate	0	10	0.00E+00	0.00E+00	Not Determined	2.00E-02	Not Calculated	0E+00
Butylbenzylphthalate	1.93	10	3.93E-08	1.68E-08	Not Determined	2.00E-01	Not Calculated	2E-07
Acetone	0.0824	10	1.68E-09	7.19E-10	Not Determined	1.00E-01	Not Calculated	2E-08
Benzene	0	10	0.00E+00	0.00E+00	2.90E-02	Not Determined	0E+00	Not Calculated
2-Butanone	0.00913	10	1.86E-10	7.96E-11	Not Determined	5.00E-02	Not Calculated	4E-09
Antimony	4.11	10	8.36E-08	3.58E-08	Not Determined	4.00E-04	Not Calculated	2E-04
Arsenic	9.32	10	1.90E-07	8.13E-08	1.80E+00	3.00E-04	1E-07	6E-04
Beryllium	0.54	10	1.10E-08	4.71E-09	4.30E+00	5.00E-03	2E-08	2E-06
Manganese	973	10	1.98E-05	8.49E-06	Not Determined	1.00E-01	Not Calculated	2E-04
Thallium	1.58	10	3.22E-08	1.38E-08	Not Determined	7.00E-05	Not Calculated	5E-04
						Total	3E-07	1.5E-03

(a) Constituents listed with zero (0) concentration were never detected within shallow soils in the north area.
(b) There is no slope factor for constituents which have not been identified as carcinogens.

ATTACHMENT 1

TABLE A-2

NORTH AREA SHALLOW SOILS DATA

CALCULATIONS FOR FUTURE RESIDENT - SOIL INGESTION SCENARIO

Compound	Concentration (a) (mg/kg)	Soil Ingestion Rate (0-5) (mg/day)	Soil Ingestion Rate (6-30) (mg/day)	Exposure Frequency (day/yr)	Chronic Daily Dose (0-5) (mg/kg/day)	Lifetime Dose (0-5) (mg/kg/day)	Chronic Daily Dose (6-30) (mg/kg/day)	Lifetime Dose (6-30) (mg/kg/day)	Slope Factor (mg/kg/day)-1	Subchronic RfD (mg/kg/day)	Chronic RfD (mg/kg/day)	Cancer Risk	Hazard Quotient (0-5)	Hazard Quotient (6-30)
Benzo(a)anthracene	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	5.80E+00	3.00E-02	3.00E-02	0E+00	0.0E+00	0.0E+00
Benzo(b)fluoranthrene	2.10	200	100	350	2.68E-05	2E-06	2.9E-06	9.86E-07	5.80E+00	3.00E-02	3.00E-02	6E-06	8.9E-04	9.6E-05
Benzo(k)fluoranthrene	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	5.80E+00	3.00E-02	3.00E-02	0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	5.80E+00	3.00E-02	3.00E-02	0E+00	0.0E+00	0.0E+00
Chrysene	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	5.80E+00	3.00E-02	3.00E-02	0E+00	0.0E+00	0.0E+00
Dibenzo(a,h)anthracene	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	5.80E+00	3.00E-02	3.00E-02	0E+00	0.0E+00	0.0E+00
Indeno(1,2,3-cd)pyrene	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	5.80E+00	3.00E-02	3.00E-02	0E+00	0.0E+00	0.0E+00
Naphthalene	2.20	200	100	350	2.81E-05	2E-06	3.0E-06	1.03E-06	Not Determined (b)	4.00E-02	4.00E-02	Not Calculated	7.0E-04	7.5E-05
2- Methylnaphthalene	2.52	200	100	350	3.22E-05	3E-06	3.5E-06	1.18E-06	Not Determined	4.00E-02	4.00E-02	Not Calculated	8.1E-04	8.6E-05
Acenapthylene	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	Not Determined	Not Determined	Not Determined	Not Calculated	Not Calculated	Not Calculated
Acenapthalene	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	Not Determined	Not Determined	Not Determined	Not Calculated	Not Calculated	Not Calculated
Anthracene	1.73	200	100	350	2.21E-05	2E-06	2.4E-06	8.13E-07	Not Determined	3.00E-01	3.00E-01	Not Calculated	7.4E-05	7.9E-06
Benzo(g,h,i)perylene	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	Not Determined	Not Determined	Not Determined	Not Calculated	Not Calculated	Not Calculated
Fluorene	1.93	200	100	350	2.47E-05	2E-06	2.6E-06	9.06E-07	Not Determined	4.00E-02	4.00E-02	Not Calculated	6.2E-04	6.6E-05
Fluoranthrene	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	Not Determined	4.00E-02	4.00E-02	Not Calculated	0.0E+00	0.0E+00
Phenanthrene	1.78	200	100	350	2.28E-05	2E-06	2.4E-06	8.36E-07	Not Determined	3.00E-02	3.00E-02	Not Calculated	7.6E-04	8.1E-05
Pyrene	1.55	200	100	350	1.98E-05	2E-06	2.1E-06	7.28E-07	Not Determined	3.00E-02	3.00E-02	Not Calculated	6.6E-04	7.1E-05
Dimethylphthalate	1.46	200	100	350	1.87E-05	2E-06	2.0E-06	6.86E-07	Not Determined	Not Determined	Not Determined	Not Calculated	Not Calculated	Not Calculated
Diethylphthalate	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	Not Determined	Not Determined	Not Determined	Not Calculated	Not Calculated	Not Calculated
Di-n-butylphthalate	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	Not Determined	2.00E-02	2.00E-02	Not Calculated	0.0E+00	0.0E+00
Bis-(2-ethylhexyl)phthalate	1.53	200	100	350	1.96E-05	2E-06	2.1E-06	7.19E-07	1.40E-02	2.00E-02	2.00E-02	1E-08	9.8E-04	1.0E-04
Di-n-octylphthalate	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	Not Determined	2.00E-02	2.00E-02	Not Calculated	0.0E+00	0.0E+00
Butylbenzylphthalate	1.93	200	100	350	2.47E-05	2E-06	2.6E-06	9.06E-07	Not Determined	2.00E-01	2.00E-01	Not Calculated	1.2E-04	1.3E-05
Acetone	0.0824	200	100	350	1.05E-06	9E-08	1.1E-07	3.87E-08	Not Determined	1.00E+00	1.00E-01	Not Calculated	1.1E-06	1.1E-06
Benzene	0	200	100	350	0.00E+00	0E+00	0.0E+00	0.00E+00	2.90E-02	Not Determined	Not Determined	0E+00	Not Calculated	Not Calculated
2-Butanone	0.00913	200	100	350	1.17E-07	1E-08	1.3E-08	4.29E-09	Not Determined	5.00E-01	5.00E-02	Not Calculated	2.3E-07	2.5E-07
Antimony	4.11	200	100	350	5.25E-05	5E-06	5.6E-06	1.93E-06	Not Determined	4.00E-04	4.00E-04	Not Calculated	1.3E-01	1.4E-02
Arsenic	9.32	200	100	350	1.19E-04	1E-05	1.3E-05	4.38E-06	1.80E+00	3.00E-04	3.00E-04	7.88E-06	4.0E-01	4.3E-02
Beryllium	0.54	200	100	350	6.90E-06	6E-07	7.4E-07	2.54E-07	4.30E+00	5.00E-03	5.00E-03	1E-06	1.4E-03	1.5E-04
Manganese	973	200	100	350	1.24E-02	1E-03	1.3E-03	4.57E-04	Not Determined	1.00E-01	1.00E-01	Not Calculated	1.2E-01	1.3E-02
Thallium	1.58	200	100	350	2.02E-05	2E-06	2.2E-06	7.42E-07	Not Determined	7.00E-04	7.00E-05	Not Calculated	2.9E-02	3.1E-02
											Total	**1E-05**	**6.9E-01**	**1.0E-01**

(a) Constituents listed with zero (0) concentration were never detected within shallow soils in the north area.

(b) There is no slope factor for constituents which have not been identified as carcinogens.

ATTACHMENT 1

TABLE A-3

NORTH AREA SHALLOW DATA

CALCULATIONS FOR TRESPASSER - DERMAL EXPOSURE SCENARIO

Contaminant	EPC Concentration In Soil (mg/kg)	Surface Area (7-16) (cm2)	Adherance Factor (kg/cm2)	Exposure Time (days)	Exposure Frequency (days/year)	Exposure Duration (7-16) (years)	Kp	Body Weight (7-16) (kg)	Chronic Daily Dose (12-18) (mg/kg/day)	Lifetime Dose (12-18) (mg/kg/day)	Ingestion SF (mg/kg/day)-1	Chronic RfD (mg/kg/day)	Cancer Risk	Hazard Quotient (12-18)
Benzo(b) Fluoranthene	2.10	5000	1.00E-06	4.17E-02	52	10	5.00E-02	43	7.25E-07	1.04E-07	5.80E+00	3.00E-02	6E-07	2.4E-05
Napthalene	2.20	5000	1.00E-06	4.17E-02	52	10	5.00E-02	43	7.59E-07	1.08E-07	Not Determined	4.00E-02	Not Calculated	1.9E-05
2-Methylnapthalene	2.52	5000	1.00E-06	4.17E-02	52	10	5.00E-02	43	8.70E-07	1.24E-07	Not Determined	4.00E-02	Not Calculated	2.2E-05
Anthracene	1.73	5000	1.00E-06	4.17E-02	52	10	5.00E-02	43	5.97E-07	8.53E-08	Not Determined	3.00E-01	Not Calculated	2.0E-06
Fluorene	1.93	5000	1.00E-06	4.17E-02	52	10	5.00E-02	43	6.66E-07	9.52E-08	Not Determined	4.00E-02	Not Calculated	1.7E-05
Phenanthrene	1.78	5000	1.00E-06	4.17E-02	52	10	5.00E-02	43	6.14E-07	8.78E-08	Not Determined	3.00E-02	Not Calculated	2.0E-05
Pyrene	1.55	5000	1.00E-06	4.17E-02	52	10	5.00E-02	43	5.35E-07	7.64E-08	Not Determined	3.00E-02	Not Calculated	1.8E-05
Bis 2-ethylhexylphthalate	1.53	5000	1.00E-06	4.17E-02	52	10	5.00E-02	43	5.28E-07	7.54E-08	1.40E-02	2.00E-02	1E-09	2.6E-05
Butylbenzylphthalate	1.93	5000	1.00E-06	4.17E-02	52	10	5.00E-02	43	6.66E-07	9.52E-08	Not Determined	2.00E-01	Not Calculated	3.3E-06
Acetone	0.08	5000	1.00E-06	4.17E-02	52	10	1.00E-01	43	5.69E-08	8.13E-09	Not Determined	1.00E-01	Not Calculated	5.7E-07
2-Butanone	0.01	5000	1.00E-06	4.17E-02	52	10	1.00E-01	43	6.90E-09	9.86E-10	Not Determined	5.00E-02	Not Calculated	1.4E-07
Antimony	4.11	5000	1.00E-06	4.17E-02	52	10	1.00E-03	43	2.84E-08	4.05E-09	Not Determined	4.00E-04	Not Calculated	7.1E-05
Arsenic	9.32	5000	1.00E-06	4.17E-02	52	10	1.00E-03	43	6.43E-08	9.19E-09	1.80E+00	3.00E-04	2E-08	2.1E-04
Managanese	973	5000	1.00E-06	4.17E-02	52	10	1.00E-03	43	6.72E-06	9.59E-07	Not Determined	1.00E-01	Not Calculated	6.7E-05
Thallium	1.58	5000	1.00E-06	4.17E-02	52	10	1.00E-03	43	1.09E-08	1.56E-09	Not Determined	7.00E-05	Not Calculated	1.6E-04
Beryllium	0.54	5000	1.00E-06	4.17E-02	52	10	1.00E-03	43	3.73E-09	5.32E-10	4.00E+00	5.00E-03	2E-09	7.5E-07
												Total	6.2E-07	6.61E-04

Kp was estimated from dermal guidance (1992)

Constituents which were never detected within the shallow soils of the north area are not included in the table.

ATTACHMENT 1
TABLE A-4
NORTH AREA SHALLOW SOILS DATA
CALCULATIONS FOR FUTURE RESIDENT - DERMAL EXPOSURE SCENARIO

Future Resident - Dermal
(With Pharmacokinetic parameter)

Contaminant	EPC Concentration in Soil (mg/kg)	Exposed Surface Area (6-30) (cm2)	Adherance Factor (kg/cm2)	Exposure Time (days)	Exposure Frequency (days/year)	Exposure Duration (6-30) (years)	Kp	Pharmacokinetic Parameter (absorb/dist/metab)	Body Weight (6-30) (kg)	Chronic Daily Dose (6-30) (mg/kg/day)	Lifetime Dose (6-30) (mg/kg/day)	Ingestion SF (mg/kg/day)-1	Chronic RfD (mg/kg/day)	Cancer Risk	Hazard Quotient (6-30)
Benzo(b) Fluoranthene	2.10	3600	1.00E-06	2.50E-01	350	24	5.00E-02	1.00E-03	70	3.11E-08	1.07E-08	5.80E+00	3.00E-02	6E-08	1.0E-06
Napthalene	2.20	3600	1.00E-06	2.50E-01	350	24	5.00E-02	1.00E-03	70	3.25E-08	1.12E-08	Not Determined	4.00E-02	Not Calculated	8.1E-07
2-Methylnapthalene	2.52	3600	1.00E-06	2.50E-01	350	24	5.00E-02	1.00E-03	70	3.73E-08	1.28E-08	Not Determined	4.00E-02	Not Calculated	9.3E-07
Anthracene	1.73	3600	1.00E-06	2.50E-01	350	24	5.00E-02	1.00E-03	70	2.56E-08	8.78E-09	Not Determined	3.00E-01	Not Calculated	8.5E-08
Fluorene	1.93	3600	1.00E-06	2.50E-01	350	24	5.00E-02	1.00E-03	70	2.85E-08	9.79E-09	Not Determined	4.00E-02	Not Calculated	7.1E-07
Phenanthrene	1.78	3600	1.00E-06	2.50E-01	350	24	5.00E-02	1.00E-03	70	2.63E-08	9.03E-09	Not Determined	3.00E-02	Not Calculated	8.8E-07
Pyrene	1.55	3600	1.00E-06	2.50E-01	350	24	5.00E-02	1.00E-03	70	2.29E-08	7.86E-09	Not Determined	3.00E-02	Not Calculated	7.6E-07
Bis 2-ethylhexylphthalate	1.53	3600	1.00E-06	2.50E-01	350	24	5.00E-02	1.00E-03	70	2.26E-08	7.76E-09	1.40E-02	2.00E-02	1E-10	1.1E-06
Butylbenzylphthalate	1.93	3600	1.00E-06	2.50E-01	350	24	5.00E-02	1.00E-03	70	2.86E-08	9.79E-09	Not Determined	2.00E-01	Not Calculated	1.4E-07
Acetone	0.08	3600	1.00E-06	2.50E-01	350	24	1.00E-01	1.00E-03	70	2.44E-09	8.36E-10	Not Determined	1.00E-01	Not Calculated	2.4E-08
2-Butanone	0.01	3600	1.00E-06	2.50E-01	350	24	1.00E-01	1.00E-03	70	2.96E-10	1.01E-10	Not Determined	5.00E-02	Not Calculated	5.9E-09
Antimony	4.11	3600	1.00E-06	2.50E-01	350	24	1.00E-03	1.00E-03	70	1.22E-09	4.17E-10	Not Determined	4.00E-04	Not Calculated	3.0E-06
Arsenic	9.32	3600	1.00E-06	2.50E-01	350	24	1.00E-03	1.00E-03	70	2.76E-09	9.45E-10	1.80E+00	3.00E-04	2E-09	9.2E-06
Managanese	973	3600	1.00E-06	2.50E-01	350	24	1.00E-03	1.00E-03	70	2.88E-07	9.87E-08	Not Determined	1.00E-01	Not Calculated	2.9E-06
Thallium	1.58	3600	1.00E-06	2.50E-01	350	24	1.00E-03	1.00E-03	70	4.68E-10	1.60E-10	Not Determined	7.00E-05	Not Calculated	6.7E-06
Beryllium	0.54	3600	1.00E-06	2.50E-01	350	24	1.00E-03	1.00E-03	70	1.60E-10	5.48E-11	4.00E+00	5.00E-03	2E-10	3.2E-08
													Total	6.4E-08	2.83E-05

Kp was estimated from dermal guidance (1992)
Constituents which were never detected within the shallow soils of the north area are not included in the table.

Future Resident - Dermal
(Without pharmacokinetic parameter)

Contaminant	EPC Concentration in Soil (mg/kg)	Exposed Surface Area (6-30) (cm2)	Adherance Factor (kg/cm2)	Exposure Time (days)	Exposure Frequency (days/year)	Exposure Duration (6-30) (years)	Kp	Body Weight (6-30) (kg)	Chronic Daily Dose (6-30) (mg/kg/day)	Lifetime Dose (6-30) (mg/kg/day)	Ingestion SF (mg/kg/day)-1	Chronic RfD (mg/kg/day)	Cancer Risk	Hazard Quotient (6-30)
Benzo(b) Fluoranthene	2.10	3600	1.00E-06	2.50E-01	350	24	5.00E-02	70	3.11E-05	1.07E-05	5.80E+00	3.00E-02	6E-05	1.0E-03
Napthalene	2.20	3600	1.00E-06	2.50E-01	350	24	5.00E-02	70	3.25E-05	1.12E-05	Not Determined	4.00E-02	Not Calculated	8.1E-04
2-Methylnapthalene	2.52	3600	1.00E-06	2.50E-01	350	24	5.00E-02	70	3.73E-05	1.28E-05	Not Determined	4.00E-02	Not Calculated	9.3E-04
Anthracene	1.73	3600	1.00E-06	2.50E-01	350	24	5.00E-02	70	2.56E-05	8.78E-06	Not Determined	3.00E-01	Not Calculated	8.5E-05
Fluorene	1.93	3600	1.00E-06	2.50E-01	350	24	5.00E-02	70	2.85E-05	9.79E-06	Not Determined	4.00E-02	Not Calculated	7.1E-04
Phenanthrene	1.78	3600	1.00E-06	2.50E-01	350	24	5.00E-02	70	2.63E-05	9.03E-06	Not Determined	3.00E-02	Not Calculated	8.8E-04
Pyrene	1.55	3600	1.00E-06	2.50E-01	350	24	5.00E-02	70	2.29E-05	7.86E-06	Not Determined	3.00E-02	Not Calculated	7.6E-04
Bis 2-ethylhexylphthalate	1.53	3600	1.00E-06	2.50E-01	350	24	5.00E-02	70	2.26E-05	7.76E-06	1.40E-02	2.00E-02	1E-07	1.1E-03
Butylbenzylphthalate	1.93	3600	1.00E-06	2.50E-01	350	24	5.00E-02	70	2.86E-05	9.79E-06	Not Determined	2.00E-01	Not Calculated	1.4E-04
Acetone	0.08	3600	1.00E-06	2.50E-01	350	24	1.00E-01	70	2.44E-06	8.36E-07	Not Determined	1.00E-01	Not Calculated	2.4E-05
2-Butanone	0.01	3600	1.00E-06	2.50E-01	350	24	1.00E-01	70	2.96E-07	1.01E-07	Not Determined	5.00E-02	Not Calculated	5.9E-06
Antimony	4.11	3600	1.00E-06	2.50E-01	350	24	1.00E-03	70	1.22E-06	4.17E-07	Not Determined	4.00E-04	Not Calculated	3.0E-03
Arsenic	9.32	3600	1.00E-06	2.50E-01	350	24	1.00E-03	70	2.76E-06	9.45E-07	1.80E+00	3.00E-04	2E-06	9.2E-03
Managanese	973	3600	1.00E-06	2.50E-01	350	24	1.00E-03	70	2.88E-04	9.87E-05	Not Determined	1.00E-01	Not Calculated	2.9E-03
Thallium	1.58	3600	1.00E-06	2.50E-01	350	24	1.00E-03	70	4.68E-07	1.60E-07	Not Determined	7.00E-05	Not Calculated	6.7E-03
Beryllium	0.54	3600	1.00E-06	2.50E-01	350	24	1.00E-03	70	1.60E-07	5.48E-08	4.00E+00	5.00E-03	2E-07	3.2E-05
												Total	6.4E-05	2.83E-02

Kp was estimated from dermal guidance (1992)
Constituents which were never detected within the shallow soils of the north area are not included in the table.

ATTACHMENT 1
TABLE A-5
NORTH AREA SHALLOW SOILS DATA
CALCULATIONS FOR FUTURE RESIDENT - FOOD EXPOSURE SCENARIO

Ingestion of Leafy Vegetables

Contaminant	EPC Concentration in Soil (mg/kg)	Fraction Organic Carbon (%)	Organic Carbon Partitioning Coeff (Koc)	Bioconcentration Factor (BCF)	Conc in Leafy Vegetables (Cl) (mg/kg)	Pharmacokinetic Parameter (absorbed/ingested)	Intake Rate (0-5) (kg/day)	Intake Rate (6-30) (kg/day)	Exposure Frequency (0-5) (days/year)	Exposure Frequency (6-30) (days/year)	Exposure Duration (0-5) (years)	Exposure Duration (6-30) (years)	Body Weight (0-5) (kg)	Body Weight (6-30) (kg)	Chronic Daily Dose (0-5) (mg/kg/day)	Chronic Daily Dose (6-30) (mg/kg/day)	Lifetime Dose (0-30) (mg/kg/day)	Ingestion SF (mg/kg/day)-1	Chronic RfD (mg/kg/day)	Cancer Risk	Hazard Quotient (0-5)	Hazard Quotient (6-30)
Benzo(b) Fluoranthene	2.10	2	550000	1.22E-02	2.32E-06	1.00E-02	0.042	0.08	350	350	6	24	15	70	3.74E-12	6.11E-12	4.22E-12	5.80E+00	3.00E-02	2E-11	1E-10	2.0E-10
Naphthalene	2.20	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	4.00E-02	Not Calculated		
2-Methylnaphthalene	2.52	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	4.00E-02	Not Calculated		
Anthracene	1.73	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	3.00E-01	Not Calculated		
Fluorene	1.93	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	4.00E-02	Not Calculated		
Phenanthrene	1.78	2	6.30E-03	3.66E-05	5.25E-09	1.00E-02	0.042	0.08	350	350	6	24	15	70	8.46E-13	1.38E-12	9.55E-13	Not Determined	3.00E-02	Not Calculated	3E-11	4.6E-11
Pyrene	1.55	2	1.00E+04	1.40E-05	1.09E-09	1.00E-02	0.042	0.08	350	350	6	24	15	70	1.75E-13	2.85E-13	1.97E-13	Not Determined	3.00E-02	Not Calculated	6E-12	9.5E-12
Bis 2 ethylhexylphthalate	1.53	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				1.40E-02	2.00E-02			
Butylbenzylphthalate	1.93	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	2.00E-01	Not Calculated		
Antimony	4.11	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	4.00E-04	Not Calculated		
Arsenic	9.32	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				1.80E+00	3.00E-04			
Beryllium	0.54	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				4.00E+00	5.00E-03			
Manganese	973	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	1.00E-01	Not Calculated		
Thallium	1.58	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	7.00E-05	Not Calculated		

Constituents which were never detected within the shallow soils of the north area are not included in the table.

Ingestion of Root Vegetables

																			Total	2.4E-11	1.6E-10	2.6E-10
Contaminant	EPC Concentration in Soil (mg/kg)	Fraction Organic Carbon (%)	Organic Carbon Partitioning Coeff (Koc)	Root Concentration Factor (RCF)	Conc in Roots (Cr) (mg/kg)	Pharmacokinetic Parameter (absorbed/ingested)	Intake Rate (0-5) (kg/day)	Intake Rate (6-30) (kg/day)	Exposure Frequency (0-5) (days/year)	Exposure Frequency (6-30) (days/year)	Exposure Duration (0-5) (years)	Exposure Duration (6-30) (years)	Body Weight (0-5) (kg)	Body Weight (6-30) (kg)	Chronic Daily Dose (0-5) (mg/kg/day)	Chronic Daily Dose (6-30) (mg/kg/day)	Lifetime Dose (0-30) (mg/kg/day)	Ingestion SF (mg/kg/day)-1	Chronic RfD (mg/kg/day)	Cancer Risk	Hazard Quotient (0-5)	Hazard Quotient (6-30)
Benzo(b) Fluoranthene	2.10	2	550000	1.39E+03	2.66E-03	1.00E-02	0.042	0.08	350	350	6	24	15	70	4.28E-07	6.99E-07	4.83E-07	5.80E+00	3.00E-02	3E-06	1E-05	2.3E-05
Naphthalene	2.20	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	4.00E-02	Not Calculated		
2-Methylnaphthalene	2.52	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	4.00E-02	Not Calculated		
Anthracene	1.73	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	3.00E-01	Not Calculated		
Fluorene	1.93	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	4.00E-02	Not Calculated		
Phenanthrene	1.78	2	6.30E+03	9.90E-02	1.44E-05	1.00E-02	0.042	0.08	350	350	6	24	15	70	2.33E-09	3.80E-09	2.63E-09	Not Determined	3.00E-02	Not Calculated	8E-08	1.3E-07
Pyrene	1.55	2	1.00E+04	1.00E-01	2.75E-04	1.00E-02	0.042	0.08	350	350	6	24	15	70	1.25E-09	2.04E-09	1.41E-09	Not Determined	3.00E-02	Not Calculated	4E-08	6.8E-08
Bis 2 ethylhexylphthalate	1.53	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				1.40E-02	2.00E-02			
Butylbenzylphthalate	1.93	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	2.00E-01	Not Calculated		
Antimony	4.11	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	4.00E-04	Not Calculated		
Arsenic	9.32	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				1.80E+00	3.00E-04			
Beryllium	0.54	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				4.00E+00	5.00E-03			
Manganese	973	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	1.00E-01	Not Calculated		
Thallium	1.58	2				1.00E-02	0.042	0.08	350	350	6	24	15	70				Not Determined	7.00E-05	Not Calculated		

Constituents which were never detected within the shallow soils of the north area are not included in the table.

																			Total	2.4E-06	1.4E-05	2.3E-05