Final Response Action Memorandum
Kea`au Hospitality Group Inc. "Hotel Site"
TMK: 3-1-6-143: parcel 33

July 21, 2006

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Executive Summary

The purpose of this Final Response Action Memorandum (Final RAM) is to summarize site investigation data and present the selected remedy for arsenic and lead contamination in soil at the Kea`au Hospitality Group LLC's "Hotel Site" located at 16-590 Old Volcano Road, Kea`au, Hawai`i 96749.

A remedy for the arsenic and lead contamination in soil at this site was previously recommended in a Final RAM issued by the Hawai`i Department of Health (HDOH) in July 2004. W.H. Shipman, Ltd. was the owner and responsible for investigations of the site at that time. The remedy in the July 2004 Final RAM (capping the entire site with a geotextile barrier, covering the barrier with one foot of "clean" fill, and providing landscaping or cover in the areas not under proposed structures) was not implemented. HDOH has since reevaluated proposed remedies for the soil contamination based on additional soil analyses conducted at the site and review of a detailed risk assessment.

Additional soil contaminant characterization, including determination of the "bioaccessible" concentrations of arsenic and lead in soils, and specific data on four separate "Decision Units" designated across the site, was performed. In addition, a Human Health Risk Assessment was completed for the site. The results of the human health risk assessment indicated that remedial actions were necessary to address contaminated soil in one of four decision units on the site (Decision Unit D, identified on Figure 1). In addition, as an added precaution, the entire site is to be thoroughly landscaped to avoid areas of bare soil.

A Remedial Alternatives Analysis was also completed for the site. Several remediation alternatives were selected for comparative analysis, and evaluated with criteria including Effectiveness, Implementability, and Cost. The selected remedy for the site was: excavation of impacted soil, relocate and cover with a substantial barrier material, cap with a minimum of 1 foot soil cover on-site in Decision Unit A, B or C, and cover the soil cap with landscaping.

The selected remedy needs to be effective over the long-term, so a number of actions were identified and will be required to help ensure it will remain effective over time. These actions include detailed mapping of contaminated soil isolated on site, a long-term soil management plan, and a legal deed restriction referencing the long-term soil management plan and restricting the site to commercial/industrial use.

An implementation work plan to carry out the selected remedy in this Final RAM will be required before site work begins, and HDOH will provide oversight of the plan and it's implementation. Upon satisfactory implementation and documentation of the selected remedy, HDOH will issue a letter to the site owner/operator indicating "No Further Action" is required at this time. However, if new evidence is identified in the future indicating that contaminants at the site pose a threat to public health or the environment, HDOH may require additional investigative and cleanup work to be performed.

1. Introduction

This Final Response Action Memorandum (Final RAM) details and summarizes the selected remedy for a proposed hotel development on a 4.4 acre parcel adjacent to the Kea`au Shopping Center, in Kea`au, Hawai`i (the "site"). The site address is 16-590 Old-Volcano Road, Kea`au, HI 96749, and is one parcel, TMK parcel 3-1-6-143: 33. Figures 2 and 3 provide a general location map and TMK map, respectively.

An initial remedy for soil contamination at this site was recommended by HDOH in July 2004, but was not implemented. Since the publication of the 2004 Final RAM, additional site characterization was completed, and a detailed risk assessment was also conducted. This Final RAM and the selected remedy include consideration of this additional site work. The site was originally in the HDOH Hazard Evaluation and Emergency Response Office (HEER Office) Voluntary Response Program (VRP), but is no longer in this program.

The property is currently owned by W. H. Shipman Ltd. (Shipman), but Shipman has completed negotiations with Kea`au Hospitality Group LLC (Kea`au Hospitality) for the purchase of the property. Kea`au Hospitality has been responsible for the most recent site assessment activities, and has employed the environmental consulting firm AMEC Earth and Environmental. Shipman and Kea`au Hospitality have noted that execution of the final purchase agreement is dependent on the outcome of the final remedy selected for the site.

Soil arsenic contamination was identified by HDOH as an "area-wide" concern around the town of Kea`au, Hawai`i in 2004 (soil lead contamination is not believed to be an area-wide contaminant of concern, but is an additional contaminant of concern at the proposed hotel site). The proposed development at this site is the first in the Kea`au area to provide detailed site characterization, risk assessment, public participation, and remedy selection to address soil arsenic contamination issues.

2. Human Health Risk Assessment of the Site

A human health risk assessment was prepared to assess potential health risks from exposure to arsenic and lead in soil at the site (AMEC, 2005). The risk assessment assumed future construction of a hotel on the property. The study concluded that remedial actions were needed to address impacted soil in one of four decision units on the site (Decision Unit D, identified on Figure 1). In addition, as an added precaution, the entire site is to be thoroughly landscaped to avoid areas of bare soil.

3. Selected Remedy Description

The remediation strategy goal was to review options and choose a long-term remedial action that would be reliable (protective of health), efficient, and cost effective. The proposed future land use of the site (a commercial hotel) was also a factor in the analysis of remedial alternatives.

Three remedial alternatives, listed below, were selected for detailed evaluation as part of the Remedial Alternatives Analysis (AMEC, 2005c):

Alternative 1:
Excavation, transport and disposal of impacted soil to West Hawai`i Sanitary Landfill

Alternative 2:
Excavation, transport and disposal of impacted soil not suitable for structural fill to West Hawai`i Sanitary Landfill. Remaining impacted soil suitable for structural fill will be capped by "permanent" structures.

Alternative 3:
Excavation of impacted soil not suitable for structural fill, relocate and cap with soil cover on-site in Decision Unit A, B or C. Remaining impacted soil suitable for structural fill will be capped by "permanent" structures.

These alternatives were evaluated comparatively, using the following evaluation criteria:

- Effectiveness
- Implementability
- Cost

The selected remedy for the site was a modified version of Alternative 3 - Excavation of impacted soil, relocate and cover with a substantial barrier material, cap with a minimum of 1 foot soil cover on-site in Decision Unit A, B or C, and cover soil cap with landscaping.

The original Alternative 3 called for any portion of the impacted soil that was suitable for structural fill to be capped under permanent structures on the site, while the rest of the impacted soil (soil not suitable for structural fill) would be buried under a soil cap located on-site. Capping a portion of the impacted soil under permanent structures on the site (if suitable for structural fill) was eliminated from the remediation alternative based on estimates from a project consulting engineer that very little, if any, of the top 1-foot of soil from Decision Unit D (the estimated impacted soil) would be suitable for structural fill. In addition, the modified alternative attempts to limit the overall "footprint" and number of locations where contaminated soil is isolated (and needs to be managed over time) on-site. Finally, the modified Alternative 3 calls for a more substantial barrier material over the contaminated soil isolated on site – one that would serve to block attempts to dig into it with a hand shovel or other common tools used by a gardener, rather than just using a material that serves as a visual "marker".

To ensure that the selected remedy will be effective over the long-term, a number of actions will be required as part of the remedy implementation plan. These include:

1. The location(s) where contaminated soil is isolated on-site will need to be professionally surveyed and clearly delineated on a project map (in reference to nearby building locations).

2. A long-term soil management plan will need to be developed to address awareness of the contaminated soil buried on site, its exact location, importance of maintaining the integrity of the soil cap, periodic inspection of the cap and site landscaping (including appropriate actions to take if deficiencies are found), avoidance of intrusive activities near the isolated soil, and instructions to work with appropriate HDOH staff if intrusive activities are ever proposed in the area where contaminated soil has been isolated.

3. A legal covenant/deed restriction will be placed on the property, making reference to the long-term soil management plan, and restricting use of the site to commercial or industrial purposes. HDOH will contact the County Planning/Permitting staff to make sure they are well aware of the restrictions placed on the property.

4. Declaration

The selected remedy chosen by HDOH in this Final RAM is: Excavation of arsenic and lead impacted soil (in Decision Unit D), relocate this soil and isolate in a (surveyed) pit or pits, cover with a heavy barrier material, cap with at least one foot of soil cover on-site (in Decision Unit A, B, or C), and cover the soil cap with landscaping. The rest of the site will also be landscaped to avoid exposed areas of bare soil. Isolating the contaminated soil underground will eliminate the potential for exposure and thereby eliminate potential for health risks associated with exposure. A long-term soil management plan will ensure appropriate maintenance of this isolated soil on site. A deed restriction on the property will ensure on-going recognition of the soil management plan and limit use of the site to commercial or industrial purposes. The selected remedy is protective of human health, complies with Federal and State requirements that are appropriate to the remedial action, and is cost effective.

Laurence K. Lau

Signature

July 21, 2006

Date

Laurence K. Lau
Deputy Director for Environmental Health

Part 2: Decision Summary

1. Site Location

The subject site, herein called the Kea`au Village Inn "Hotel Site" is approximately 4.4 acres of open land in the town of Kea`au, Puna district, Hawai`i. The site was originally entered into the HDOH Hazard Evaluation and Emergency Response (HEER) Office Voluntary Response Program (VRP), but is no longer in this program. The site address is 16-590 Old-Volcano Road, Kea`au, HI 96749, and a location map and a TMK map are provided as Figures 2 and 3 respectively. The site investigated is one parcel, TMK parcel 3-1-6-143: 33, and is roughly rectangular in shape. The site is bounded by the Hawai`i Belt Road, formerly known as the Mamalahoa Highway to the northwest, Kea`au Shopping Center to the northeast, Old Volcano Highway to the southeast and a utility easement and residential housing to the southwest. The property has approximately 700 feet of highway frontage along Hawai`i Bell Road forming the western boundary of the property, and 688 feet along Old Volcano Road forming the eastern boundary. Parcel 33 has no existing structures and is heavily vegetated. The adjacent (southwest) Parcel 22 (approximately 0.9 acres) is currently developed with an older single story multi-use commercial building and associated paved parking area.

2. Site History

According to the Bureau of Conveyances, the subject property is currently owned by W.H. Shipman, Ltd. W.H. Shipman Ltd. has recently completed negotiations with Kea`au Hospitality for the purchase of the property. The success of the purchase agreement is dependent on the outcome of the final remedy for the site. The subject and surrounding properties were leased to Puna Sugar Company by W.H. Shipman Ltd. from approximately 1899 to 1984 and was utilized primarily as a plantation-type housing development, specifically, the Olaa Nine Mile Camp. Historically, residences ran along the southeastern edge of the property fronting Old Volcano Road. Historical uses of surrounding properties include a plantation general store, a gas station, a police station, churches, a post office, and a shopping center. Arsenic impacts are believed to have resulted from the application of arsenical pesticides/herbicides associated with sugar cane production and/or residential gardens of plantation workers during the 1920s through the 1940s.

3. Site Environmental Investigation History

M&E Pacific (2004) Final Remedial Site Investigation Report

In July 2004, HDOH issued a Final RAM for the site based on M&E Pacific's Phase I Site Assessment, Remedial Investigation (RI), screening human health risk assessment and Remedial Alternatives Analysis (HDOH 2004). These preliminary documents confirmed the presence of elevated levels of arsenic and lead in soil. Total lead levels in soil averaged 385 and 398 mg/kg in surface soils and subsurface soils, respectively. Total arsenic levels were determined to be present at average levels of 399 and 269 mg/kg in surface soils and subsurface soils, respectively. Maximum observed values of

lead and arsenic in site soils were 3060 and 1430 mg/kg, respectively. These values are significantly greater than U.S. Environmental protection Agency and HDOH soil screening levels.

The 2004 RI report presented the results of a screening level human health risk assessment for arsenic using the U.S.EPA Preliminary Remediation Goals (PRGs). The arsenic levels in soils at the site exceeded the US EPA Region 9 residential land use PRGs for both cancer and noncancer health risks. The US EPA criteria assume that 100% of the arsenic is available for absorption in the body if ingested. Lead concentrations exceeded the U.S.EPA residential soil PRG, indicating a potential for elevated blood lead levels in children exposed to soil (assuming a residential exposure scenario). Based on this evaluation, remediation of the entire site was recommended. Remedial alternatives were evaluated in the RAA report and the Final RAM detailed the preferred remedy. It stated that the preferred remedy should consist of remediation of surface soils impacted with elevated arsenic and lead by "capping with a geotextile barrier over impacted soil, covering the barrier with one foot of "clean" fill and (by) providing landscaping, or cover with asphalt and concrete in the areas under proposed structures".

ERM (2005) Human Health Risk Assessment for the Shipman, Hotel Site

Since the publication of the 2004 Final RAM, additional characterization has been completed. In 2005, ERM reevaluated four (4) distinct Decision Unit areas (Units A-D) of the Hotel Site using a probabilistic multi-incremental sampling procedure. Unlike the initial M&E Pacific study, this investigation evaluated both total and bioaccessible arsenic and lead in soil (See Table 1). Bioaccessible chemical fractions are the proportion of total chemical that is predicted to be absorbed by the human body. This provides a more accurate representation of human exposure and more accurately predicts the potential for health risks. A more detailed risk assessment was also conducted, indicating that Decision Units A and B were safe for the proposed (commercial) future use. Risk from exposure to Decision Units C and D were greater than site screening levels and additional evaluation or remediation were deemed necessary.

AMEC (2005a) Final Human Health Risk Assessment Addendum and Proposed Final Remedy for Kea`au Hospitality Group LLC's "Hotel Site".

Following the ERM Human Health Risk Assessment, AMEC was contracted by Kea`au Hospitality, to provide a reevaluation of health risks determined in ERM (2005 a and b) and to evaluate and propose a remedy based on those health risks. The reevaluation is reported in the Final Human Health Risk Assessment Addendum and Proposed Final Remedy for Kea`au Hospitality Management, LLC's "Hotel Site," (AMEC, 2005a). HDOH concurred that site-specific exposure data provided for Decision Units A and B of the site demonstrated they are safe to be utilized for commercial use. Potential exposure in these decision units will be further minimized through good maintenance of lawns or other landscaping in open areas.

Site-specific exposure data and assumptions for Decision Unit C indicate health risks for a commercial scenario only marginally above the target risk of 1E-05 for arsenic, and well under the blood level of 10ug/dl for lead. HDOH agreed that Decision Unit C could be used for commercial purposes, but recommended that areas not under buildings or pavement be landscaped and remain vegetated with no exposed soil areas to reduce exposure potential.

AMEC (2005c) Remedial Options Engineering Evaluation and Cost Analysis: Kea`au Hospitality Group LLC's "Hotel Site".

HDOH recommended remediation for Decision Unit D. Cancer risks for Decision Unit D are outside the range of 1E-05 for the groundskeeper and hotel worker scenarios. Remedial alternatives for Decision Unit D are presented in AMEC's Remedial Options Engineering Evaluation and Cost Analysis (AMEC 2005c). The evaluation looked at three remedial alternatives and proposed a remedy for remediation of arsenic in the soil to reduce the estimated risk to acceptable levels under a commercial/industrial use scenario.

4. Remediation Strategy

The remediation strategy was to screen and evaluate remedial options that would be effective, readily implemented, and cost-effective. The remediation strategy considered the assumption that the future use of the property would be for commercial or industrial development only.

5. Remedial Objectives

The primary focus of this remedial action is to address elevated arsenic and lead levels in surface soils identified in Decision Unit D within the proposed Hotel Site to provide long-term protection to human receptors under a commercial land use scenario. Specific remedial objectives are presented below:

- Remediate arsenic and lead impacted surface soil in Decision Unit D to acceptable levels similar to Decision Units A and B
- Eliminate or minimize direct contact with the arsenic and lead impacted surface soil
- Eliminate or minimize the inhalation of arsenic and lead contaminated soil particulates
- Eliminate or minimize dermal contact with arsenic and lead contaminated soils
- Minimize the potential risk to human health receptors from exposure to impacted soil

6. Summary of Remedial Options for the Kea`au Hotel Site

The following section provides remedial alternatives for consideration. The HDOH July 2004 Final RAM previously provided general response actions or remedial options that have the potential to meet the Remedial Action Objectives for the site. They included:

- Excavation and Disposal
- Containment/Capping
- Separation
- Solidification
- Access Controls

The current assessment elaborates on the general response actions and evaluates 3 (three) specific alternatives. The preliminary preferred recommended remedial alternative of burying all impacted material under hard surfaces was considered, but not selected as a remedial option to be evaluated in the Remedial Options Engineering Evaluation and Cost Analysis (RAA Addendum, AMEC 2005c) because the geotechnical properties of at least a large portion of the contaminated soils are not suitable for use as structural fill. In fact, per the project civil engineer, removal of over 465 yd^3 of soil from Decision Unit D is required prior to construction activities because it is not suitable structural fill material. Where possible, soil appropriate for structural fill will be located under the building or parking lot structures. Impacted soil not appropriate for structural fill from Decision Unit D will require remediation or relocation. As noted above, for the purposes of this analysis, three (3) remedial alternatives have been considered. These options are presented below. It should be noted that as actual remediation is implemented, field conditions and/or grading modifications may affect the actual quantity of relocated material.

1. Excavation, transport and disposal of all impacted soil (approximately 1,167 yd^3) in Decision Unit D to West Hawai`i Sanitary Landfill;
2. Excavation, transport and disposal of impacted soil not suitable for structural fill (a maximum of 622 yd^3) to West Hawai`i Sanitary Landfill. Remaining impacted soil suitable for structural fill will be capped by "permanent" structures
3. Excavated soil not suitable for structural fill (estimated at 622 yd^3) will be relocated onsite to Decision Unit A, B or C and capped by at least 1 foot of soil. Remaining impacted soil suitable for structural fill will be capped by "permanent" structures. The location and future management of contaminated soil remaining within Decision Unit D or removed and isolated in other areas of the site will be documented in a Long-term Soil Management Plan prepared for the site. Future use of the property will be restricted to commercial/industrial purposes.

Alternative 1 assumes that all soil in Decision Unit D is excavated down to 1 foot bgs and disposed of at the County landfill in West Hawai`i. Alternative 1 depicts the maximum area of soil to be remediated. Alternative 2 and Alternative 3 assume that only soil not under hard surfaces will be excavated and relocated. It is estimated that an approximate area of 16,800 square feet may require remediation in Alternatives 2

and 3. However, as indicated, only soil not suitable for structural fill will actually be removed. The approximate area of 16,800 square feet is used as a standard area for the two scenarios to simplify the remedial alternatives comparison. Cost estimates of each Remedial Alternative are provided in text below and details provided in Appendix A.

7. Remedial Alternative Selection Criteria

Each of the remedial options were evaluated against three screening criteria:

- effectiveness
- implementability
- cost

The effectiveness criterion addresses the ability of the remedial option to provide:

- overall protection to human health and the environment
- short-term effectiveness
- reduction of the toxicity, mobility, and volume of contaminants by treatment
- long-term effectiveness and permanence
- compliance with regulatory issues and requirements

The implementability criterion addresses:

- technical feasibility of implementing a remedial option (i.e., technology reliability, operational difficulties, logistics, climate and terrain limitations);
- administrative feasibility of implementing a remedial option (i.e., coordination of activities, permits, easements, right-of-way agreements, and zoning variances); and,
- availability of materials and services required during implementation.

The cost criterion addresses:

- relative magnitude of costs to implement a remedial option to address the arsenic and lead impacted soil at the Kea`au Hotel Site.

The following assumptions were made in the development of the remedial alternatives:

- Decision Unit D is the only area considered for remediation.
- Impacted soil is not characterized as hazardous waste, and disposal in West Hawai`i Sanitary Landfill is acceptable.
- Decision Units A, B, and C are approved for commercial/industrial use under a risk assessment.
- Biomass of plants located on Decision Unit D may be treated as typical green waste and is not under special disposal requirements.
- Existing impacted fill onsite does not have appropriate structural properties.

8. Evaluation of Remedial Action Alternatives

Note: See Revised Draft RAM, Jan. 19, 2006 (AMEC, 2006) for more details on each of the remedial options described below:

Remedial Option 1: Excavation, transport and disposal of impacted soil to West Hawai`i Sanitary Landfill

This remedial option would consist of excavation of contaminated grubbed material and contaminated soil within Decision Unit D and transport of the soil to West Hawai`i Sanitary Landfill for disposal. The general task activities under this remedial option include:

- waste characterization of grubbed material and soils
- mobilization/demobilization
- site preparation, surveying, and engineering/staking controls
- clearing and grubbing
- soil excavation
- packaging and transport of excavated soil to West Hawai`i Sanitary Landfill
- disposal of the soil at West Hawai`i Sanitary Landfill
- confirmation sampling of Decision Unit D
- vegetative groundcover

Effectiveness

Excavation and disposal of the surface soils in Decision Unit D would remove the elevated arsenic and lead to acceptable action levels under the commercial land use scenario by reducing toxicity, mobility, and volume of contamination. The removal and remediation of the contaminated soil would also minimize the risks to human health and environmental receptors at the site. It would be effective as a long-term solution to protect human health and the environment. Air monitoring and fugitive dust suppression activities would provide short-term effectiveness in protecting the community and workers during implementation of the remedial option. This alternative would also be in compliance with regulatory requirements.

Implementability

Provided that waste material meets disposal criteria for Class II and Class III landfills and can be taken to the West Hawai`i Landfill, the implementation of this remedial option is technically feasible. Although dust control measures, such as wet down procedures, may be required to minimize dust emissions during implementation of cleanup actions, conventional construction equipment and materials required for remedial activities are readily available. Logistical and administrative feasibility however, do impede the implementability of this option. Not only is it difficult

transporting large quantities of soil across the island, but disposal of such large quantities would have significant impact to the landfill capacity.

Cost

Costs associated with this remedial option are estimated to be $242,616. This estimate is based in part on an assumption that waste soil and grubbed material from the site will meet criteria for disposal at a local landfill. Costs could be higher depending on transportation expenses and tipping fees at the time that work is initiated.

Remedial Option 2: Excavation, transport and disposal of impacted soil not suitable for structural fill to West Hawai`i Sanitary Landfill. Remaining impacted soil suitable for structural fill will be capped by "permanent" structures.

This remedial option would consist of excavation and disposal of contaminated soil within Decision Unit D not suitable for fill, and transport of the soil to the West Hawai`i Sanitary Landfill for disposal. The general task activities under this remedial option include:

- waste characterization of soils
- mobilization/demobilization
- site preparation, surveying, and engineering/staking controls
- clearing and grubbing
- soil excavation
- packaging and transport of excavated soil to West Hawai`i Sanitary Landfill
- disposal of the soil at West Hawai`i Sanitary Landfill
- confirmation sampling of Decision Unit D
- vegetative groundcover

Effectiveness

Excavation and disposal of impacted and unsuitable structural fill at Decision Unit D would be effective in removing the potential exposure of arsenic and lead to potential human health receptors under the commercial land use scenario by reducing toxicity, mobility, and volume of contamination from the Site. Impacted soil suitable for use as structural fill placed under proposed structures would also be effective in minimizing the exposure to human health receptors, but not reduce toxicity, mobility, and volume of arsenic and lead contamination in surface soils under the "permanent" structures. The combination under this alternative would be effective as a long-term solution to protect human health. Air monitoring and fugitive dust suppression activities would provide short-term effectiveness in protecting the community and workers during implementation of the remedial option. This alternative would also be in compliance with regulatory requirements.

Implementability

Remedial Option 2 is technically and administratively feasible to implement at the site, provided that waste material from the site meets disposal criteria for Class II and Class III landfills and can taken to the West Hawai`i Landfill. Conventional construction

equipment and materials required for remedial activities are readily available. Dust control measures, such as wet down procedures, may be required to minimize dust emissions during implementation of cleanup actions. A land use restriction would be required to mitigate future excavation into areas where impacted soil is capped. Again as in Alternative 1, the impact to the capacity of the landfill would also be significant.

Cost

Costs associated with this remedial option are estimated to be $146,755. This estimate is based in part on an assumption that waste soil and grubbed material from the site will meet criteria for disposal at a local landfill. Costs could be higher depending on transportation expenses and tipping fees at the time that work is initiated.

Remedial Option 3: Excavation of impacted soil not suitable for structural fill, relocate and cap with soil cover on-site in Decision Unit A, B or C. Remaining impacted soil suitable for structural fill will be capped by "permanent" structures.

This remedial option includes excavation of contaminated grubbed material and contaminated soil within Decision Unit D and isolation of the material onsite. Contaminated grubbed material and contaminated soils from at least the top one foot of Decision Unit D will be removed and isolated onsite under permanent structures or at least one-foot of soil within Decision Unit A, B or C. Contaminated material placed in excavated areas will be covered by an easily identifiable "marker" barrier (e.g. plastic fencing or geotextile) overlain by at least one foot of soil from Decision Units A, B, or C. The areas will then be covered by landscaping to stabilize and maintain the added soil layer. If soil remaining below 1 foot in Decision Unit D has levels of arsenic and lead in excess of those found in Decision Units A and B, it will be similarly capped by a marker barrier and at least one foot of fill from Decision Units A or B or cleaned fill. No offsite disposal of soil or grubbed material is anticipated. The task activities under this remedial option include:

- mobilization/demobilization
- site preparation, surveying, and engineering/staking control;
- clearing and grubbing
- soil excavation in Decision Unit D
- relocation of soil from Decision Unit D to Decision Unit A, B or C
- confirmation sampling
- soil cover
- vegetative groundcover

Effectiveness

Placement of a soil cover would not reduce toxicity, mobility, and volume of arsenic and lead contamination in surface soils at the Site. The soil cover would minimize the direct contact of arsenic and lead with ecological and human receptors, therefore minimizing the exposure pathway of receptors to impacted soils. The soil cover would be effective in the long term to protect human health and the environment after remediation of

Decision Unit D. Performance of air monitoring activities would provide short-term effectiveness in protecting the community and workers during implementation of the remedial option.

Implementability

This remedial option is feasible to implement at the site. This option effectively handles the contaminated soil on site, avoids transportation of contaminated soil across the island, and does not consume space in the landfill. Conventional construction equipment and materials required for remedial activities are readily available. Purchase of soil cover materials from off-site sources may be required. Dust control measures, such as wet down procedures, may be required to minimize dust emissions during implementation of cleanup actions. A land use restriction would be required to mitigate future excavation into areas where impacted soil is capped.

Cost

Costs associated with this remedial option are estimated to be $74,300.

9. Comparative Analysis of Remedial Options

This section compares the performance of each remedial option relative to each evaluation criteria (effectiveness, implementability, and cost). The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another so that key tradeoffs that would affect remedy selection can be identified.

The results of the comparative analysis are presented in Table 2. The analysis is based on a numerical rating system that assigns a value according to the following rules:

- A value of "1" is awarded of the remedial option satisfies/fulfills less than half of the elements of the evaluation criteria
- A value of "2" is awarded of the remedial option satisfies/fulfills more than half of the elements of the evaluation criteria
- A value of "3" is awarded of the remedial option satisfies/fulfills all elements of the evaluation criteria

The remedial option with the highest total rating is considered the best-suited remedy.

Using the criteria definitions as standards, the rating values were based on the degree to which the alternatives satisfy the evaluation criteria. Ratings for the three (3) criteria (effectiveness, implementability, and cost) considered factors outlined in the Remedial Selection Criteria Section.

Based on the results of the comparative remedial alternatives analysis, DOH tentatively concurred with the selection of Alternative 3 by the proposed developer of the site,

Kea`au Hospitality Group Inc (Kea`au Hospitality), as the preferred remedy for Decision Unit D. Although total comparative scores for the three alternatives were close, differences were evident between the alternatives in regards to effectiveness, implementability and cost. For example, Alternative 1 was more effective in mitigating potential future exposure to arsenic and lead by reducing the volume of contamination at the site. Alternative 3 was effective at eliminating potential exposure to arsenic and lead (assuming the long-term soil management plan remains effective over the long-term), although not effective at reducing volume of contamination at the site. Alternative 3 also addresses concerns regarding the cost of the remediation in comparison to the anticipated financial return for the proposed redevelopment of the property. Alternative 3 also avoids concerns regarding a limitation of available landfill capacity on the island, should remediation of a number of additional properties on the Big Island be needed in the future.

The proposed remedy was incorporated in a Revised Draft RAM for the site and was the subject of a minimum 30-day public review. A letter and fact sheet on the site was mailed to about 50 contacts in the Kea`au community to solicit review and comment on the Revised Draft RAM. A public meeting was held in the middle of the 30-day public comment period to provide information about the Revised Draft RAM and solicit comments.

10. Final Selected Remedy

HDOH accepted a "modified" Alternative 3 as the proposed remedy for the site:

- Excavation of impacted soil (top 1 foot of soil in Decision Unit D),
- Relocate to burial site(s) in Decision Unit A, B, or C,
- Limit "footprint" of the buried impacted soil as much as possible,
- Cover with a substantial barrier material to serve as both a physical and visual barrier,
- Cap with at least one foot of soil cover on-site in Decision Unit A, B or C, and
- Cover soil cap with landscaping.

The proposed remedy shall be initiated by clearing the site of vegetation. Grasses, trees and shrubs will be cut as close to the ground surface as possible. Vegetative debris not in contact with soil will be delivered to an HDOH-approved green waste site. Roots carrying soils will be buried on site along with contaminated soils from Decision Unit D. Contaminated soils from at least the top one foot of Decision Unit D will be removed and buried in burial site(s) in Decision Units A, B or C (as described above).

Following vegetative clearance and excavation of contaminated soils in Decision Unit D, multi-increment sampling will be performed to determine arsenic and lead concentrations in surface soil (0-6 inches below the newly excavated grade) within Decision Unit D. If contaminant concentrations are similar to concentrations observed in Decision Units A and B, then no special management of the remaining soil will be required other than the requirement that the soil remain onsite, be covered with landscaping to eliminate areas of bare soil, and the site will be used only for commercial/industrial use.

If contaminant concentrations of remaining soil in Decision Unit D are greater than concentrations documented in Decision Units A and B, then one of two options could be followed:

1. Additional soil will be removed from Decision Unit D and isolated as noted above. Confirmation sampling would then be conducted again to determine if contaminant concentrations had been reduced to those similar to Decision Units A and B,

2. Remaining soil will be capped by permanent structures or a substantial barrier and at least 1 foot of fill. Fill shall consist of soil only from Decision Units A and B (or imported clean fill) and will not include grubbed material or other vegetative material. In addition, areas not under permanent structures will be covered by landscaping to stabilize and maintain the added soil layer. Under this option, soil remaining in Decision Unit D (that is contaminated at levels greater than documented in Decision Units A and B) would be surveyed, mapped, and incorporated in the long-term soil management plan for the site.

The goal will be to limit the number of locations and overall area where contaminated soil is buried on the site through site design and engineering – this will facilitate more effective long-term management of the isolated soil with contamination.

In addition to soil remediation in Decision Unit D, as an added precaution the entire site (areas not under permanent structures) will be required to be landscaped and maintained to avoid bare soil areas.

To ensure that the selected remedy will be effective over the long-term, a number of actions will be required as part of the remedy implementation plan. These include:

- The location(s) where contaminated soil is isolated on-site will need to be professionally surveyed and clearly delineated on a project map (in reference to nearby building locations).

- A long-term soil management plan will need to be developed to address awareness of the contaminated soil buried on site, its exact location, importance of maintaining the integrity of the soil cap, periodic inspection of the cap and site landscaping (including appropriate actions to take if deficiencies are found), avoidance of intrusive activities near the isolated soil, and instructions to work with appropriate HDOH staff if intrusive activities are ever proposed in the area where contaminated soil has been isolated. In addition, establishing food gardens or agricultural use of the property would be eliminated.

- A legal covenant/deed restriction will be placed on the property, making reference to the long-term soil management plan, and restricting use of the site to commercial or industrial purposes. HDOH will contact the County Planning/Permitting staff to make sure they are aware of and understand the restrictions placed on the property.

11. Modifications

The public comment period for the Revised Draft RAM ran from February 22 – March 21, 2006. In addition, a public meeting was held on March 1, 2006 at the Kea`au Community Center to discuss the Revised Draft RAM and solicit comments. A significant number of written comments were received on the Revised Draft RAM, and responses are given in the "Responsiveness Summary" section below.

Based on public comments received, further information collected, and additional data requested from the site consultant, the HDOH proposed remedy in the Revised Draft RAM was modified for this Final RAM. This included:

1. The proposed remedy called for any portion of the impacted soil (from the top 1 foot of Decision Unit D) that was suitable for structural fill to be capped under permanent structures on the site, while the rest of the impacted soil (soil not suitable for structural fill) would be buried under a soil cap located on-site (in Decision Units A, B, or C). Capping a portion of the impacted soil (from the top 1 foot of Decision Unit D) under permanent structures on the site (if suitable for structural fill) was eliminated from the remediation alternative based on estimates from a project consulting engineer that very little, if any, of the top 1-foot of soil from Decision Unit D would be suitable for structural fill.

2. In addition, the modified alternative includes a goal to limit the overall "footprint" and number of locations where contaminated soil is isolated (and needs to be managed over time).

3. Finally, the modified Alternative 3 calls for a more substantial barrier material over the contaminated soil isolated on site – one that would serve to block attempts to dig into it with a shovel or other common tools used by a gardener, rather than just using a material that serves as a visual "marker".

12. Next Steps for Implementation of the Selected Remedy

Before site work begins to carry out the selected remedy, an implementation work plan will be required. HDOH will provide review and oversight of the plan and its implementation. Once the remedy has been appropriately implemented and documented, HDOH will issue a "no further action" letter to the owner/operator of the site. However, if new evidence becomes available at a later date indicating contaminants at the site pose a threat to public health or the environment, HDOH may require additional investigation and cleanup work.

13. Additional Actions Related to Area-wide Soil Arsenic Contamination

Based on public comments received that addressed concerns regarding "area-wide" soil arsenic contamination around Kea`au (see Responsiveness Summary below), HDOH has committed to pursue the following actions:

- Discuss the feasibility of collaborating with the Cancer Research Center to examine cancer diagnoses in the Kea`au area. This effort will begin after the results of the exposure investigation in the Kea`au area is complete (within the next 3-6 months). *See comment/response #46 below.*

- Work with physicians/labs in the future to encourage more appropriate follow-up testing and reporting for pesticide and heavy metal surveillance in the state. *See comment/response #46 below.*

- Continue to broaden efforts to develop a more comprehensive strategy regarding soil contaminants and former agricultural lands, and include interested parties in these efforts – including more involvement of county governments and citizens, as well as additional outreach to communities and collaboration with state, federal, private consultant, and university personnel. *See comment/response #48 below.*

- Public communication issues will be further emphasized in on-going planning and future actions regarding the soil arsenic issues in Hawai`i. *See comment/response #52 below.*

- Make recommendations and discuss real estate disclosure issues regarding soil arsenic with County planning officials and the local real estate community in the near future. *See comment/response #54 below.*

14. Responsiveness Summary

Part 1. Responsiveness Summary – Response to Comments on the Draft RAM for the Kea`au Hospitality Group's proposed hotel site. Public Comment period February 22 – March 21, 2006. *These Comments/Responses primarily address issues related to the proposed hotel site and soil arsenic remediation. See Part 2 of the Responsiveness Summary for Comments/Responses that primarily address "area-wide" soil arsenic issues in the Kea`au area.*

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1. Soil from the Kea`au Hospitality site which is contaminated at levels hazardous to health should be taken out of the Hawaiian archipelago. Although this is a heavy economic burden, the long-term costs to everyone on the island, from adverse health effects and environmental contamination, may be far greater. Strongly opposed to the DOH proposed remedy – appears to be a "cover up" of the problem rather than a clean up. Those who benefited from sugar, including the landowner Shipman should pay for the cleanup and shipment of contaminated soil back to the continent where it came from.	*Hauling contaminated soil to the mainland is very expensive, on the order of $700-800 per cubic yard (includes shipping), so oftentimes this may not be a "selected" remediation alternative for detailed consideration when there are other less costly alternatives available that would be effective in the protection of health and the environment. This is especially true when relatively large amounts of contaminated soil are involved. The environmental consultant for the proposed hotel site estimated costs to ship contaminated soil to the mainland (from the top 1 foot of Decision Unit D) at about $1.2 million.* *The Hawaii State Contingency Plan (Chapter 11-451, Hawai`i Administrative Rules) used to implement, administer, and enforce the Hawai`i Environmental Response Law (Chapter 128-D) identifies the evaluation criteria for analysis of remedial alternatives. These include Effectiveness, Implementability, and Cost. So cost is considered one of 3 key factors to determine selected remediation alternatives at contaminated sites. The Administrative Rules note specifically that alternatives providing effectiveness and implementability similar to that of another alternative by employing a similar method of treatment or engineering control, but at a greater cost, may be eliminated.* *At the proposed hotel site, remedies that would be protective of health and the environment - yet more cost effective compared to hauling soil to the mainland, were available and included for detailed consideration. These proposed remedies included disposal of contaminated soil in the West Hawai`i landfill, and contaminated soil management on-site with a long-term soil management plan and deed restrictions.*
2. DOH should consider alternatives to Quantitative Risk Assessment, which has been called "scientifically discredited".	(Note: commentor cited Rachel's Democracy and Health News, March 16, 2006). *The use of quantitative "toxicity factors", or doses of arsenic presumed to not cause adverse health effects, is very important. Quantitative risk assessment is only one of several tools that HDOH considers in determining the extent and nature of actions that may be required at sites where potentially toxic chemicals are identified. Arsenic is a naturally occurring element in soil,*

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	water and even air, and its potential toxicity on humans (and other animals) has been extensively studied. In the case of arsenic, the dose-response data is well documented and the associated "allowable" exposure levels are very health protective. Allowable exposure levels and risk assessments that incorporate them include "safety factors" to account for uncertainties. These safety factors include health protective toxicity factors and exposure assumptions. The resulting risk estimates are typically more conservative than the true site risks. At the proposed hotel site, these safety factors add to the overall conservativeness of the risk estimates. *As the article cited with the comment indicates, uncertainties can still exist in the data used to develop the toxicity factors. This is why the toxicity factors for arsenic specifically include additional safety factors that take into account unforeseen health effects on unborn children and sensitive individuals.* *Following an assessment of potential health risks, additional factors such as those discussed in Comment #1 above are used to determine the most appropriate actions for a given site. Questions that must be considered at this stage include: "How certain are we about the potential toxicity of this chemical?"; "What is the intended use of the property?"; "How effective will the proposed remedial actions be at reducing or eliminating long-term health risks?"; "What could potentially go wrong in the proposed cleanup measures?"; "Are there any other potential environmental concerns that must be considered?". These and other questions go beyond the initial quantitative risk assessment and help strike a balance between the need to protect human health, the owner's plans to redevelop the property, and the desire to gain community acceptance for the proposed remedial plan.*
3. Late comments from independent consultants should be considered, including those from the Center for Health, Environment, and Justice. It was not possible to locate independent consultants to review material, without compensation, before the comment period expired.	*We are flexible in accepting comments that come in a little late, especially if we know they are on the way. We want to make decisions with the best information/input available.*
4. Site reports should include the fact that Puna Sugar, the company responsible for the contamination, was	(Note: commentor cited Hawaiian Sugar Planters' Association Archives). *Although the facts of ownership should be clear whenever*

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partly owned by William H. Shipman. Reports now say the site was "leased to Puna Sugar Company by W. H. Shipman, Ltd."	*possible, for the issue soil arsenic remediation at the proposed hotel site it is not necessary to determine if W.H. Shipman leased the land to Puna Sugar Company or if they were part owners of Puna Sugar Company. W.H. Shipman and Kea`au Hospitality have been voluntarily addressing the remediation of lead and arsenic contamination in soil at the site, under HDOH oversight. In addition, under federal and state environmental remediation laws, in most cases owners and operators of real estate where there is hazardous substance contamination may be held liable for the costs of cleaning up contamination found on their property.*
5. A liner failure at the Kona Dump should be included in planning (for that disposal option) - including an estimated failure date and post-failure plan for contaminated soil.	*The final selected remedy for the proposed hotel site did not involve disposal of contaminated soil at the West Hawai`i landfill. In general, leaching of inorganic arsenic (and lead) from Hawaiian soils has not been identified as a significant concern, presumably due to their characteristics to bind very tightly with soil particles. For example, despite the fact that arsenic-based herbicides were reportedly used throughout the islands in the period around 1920 to 1950, and soil levels remain relatively high in some areas, drinking water testing over the years has not documented issues with arsenic contamination of groundwater.*
6. Risks from exposure to soil sizes other than "fines" should be evaluated.	*Initial evaluation of sites is made on the <2 millimeter soil particle size fraction, considered to be the size fraction most geologists classify as "soil". Total arsenic concentrations are determined for the soil and compared to our Environmental Action Level (EAL), which for total arsenic is 22 mg/kg (based on the natural background levels of arsenic in Hawai`i soils). If total arsenic levels exceed the EAL, then site remediation decisions can be based on total arsenic levels assuming 100% bioaccessibility of arsenic in the soil, or alternately, site-specific soil arsenic bioaccessibility can be determined by doing additional soil analyses. Soil bioaccessibility is conducted using the <250 micron soil particle size fraction because this "fines fraction" of soil is the fraction most likely to stick to hands and fingers, loge into cracks of root vegetables, get moved into buildings on the site, etc. - it is considered the most relevant and important size fraction to evaluate from a risk assessment standpoint. Oftentimes, the fines fraction is found to be "enriched" in arsenic - the concentrations of arsenic are found to be higher on the fines size fraction than on the larger soil particles size.* *Total arsenic concentrations in the <2mm soil particle size as well as bioaccessible arsenic concentrations in the < 250 micron soil particle size have been measured on the proposed hotel site. Risks for the proposed hotel site remediation evaluation were based on bioaccessible arsenic in fines, as this size fraction is*

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	considered most relevant to risk assessment, and higher levels of arsenic were documented in the fines fraction than in the larger soil fraction size on the site.
7. Risks from small doses of lead should be evaluated. Construction and hotel workers may take contaminated soil off-site on their clothes and shoes.	(Note: commentor cited Rachel's Democracy & Health News, Nov. 23, 2000 – Children in Harm's Way). *Risks posed to construction and hotel workers by exposure to lead in soil was considered in the human health risk assessment prepared for the site. Cleanup levels have been prepared for lead in soil that are intended to be protective of these workers. In addition, occupational exposures and risks to chemical hazards (including the issue of construction workers taking contaminates home from work) is regulated by the Hawai`i Occupational Safety and Health Administration (HIOSH). HIOSH regulations require a site-specific safety and health plan, appropriate training of workers, and other protections to reduce or eliminate potential occupational exposure hazards. Although the Department of Health does not regulate this aspect of the work, we do ensure that a site-specific safety and health plan has been developed before any remediation work begins at a site.*
8. Reports should explain decisions on soil from DU C – appears this soil is considered safe enough to remain on site, but not safe enough to use as fill.	*The arsenic levels in DU C were considered acceptable from a risk assessment standpoint for a commercial development, however the average arsenic levels on DU C were considerably higher than in DU A or DU B. To further reduce the potential for risk across the site, HDOH requested that any soil moved into DU D for cover, if additional cover was necessary, be taken from DU A or DU B. The average arsenic levels in DU A and DU B were the lowest on the site (average bioaccessible arsenic levels in the fines fraction of 28.6 and 39.1 mg/kg, respectively).*
9. Some exposure assumptions appear set too low. Construction workers set at 0.5 days/wk, or 20 days over 7 years – should be changed to assume acute exposure for several weeks, on several jobs. Groundskeepers set at 3 days a week, should be 5 days a week.	(Note: commentor cited AMEC's final Human Health Risk Assessment Addendum and Proposed Final Remedy, Nov. 30, 2005). *In general, action levels for commercial/industrial workers and construction/trench worker exposure scenarios are higher than residential scenarios, due to shorter assumed exposure duration (years) and frequency (days per year) and the assumption that children will not be regularly present under these scenarios. Based on the comment, HDOH requested AMEC to review exposure assumptions used for construction workers in the risk assessment. They noted that the assumed exposure frequency to contaminated soil in the ERM risk assessment was actually 20 days/yr for an exposure duration of 7 years, or a total exposure of 140 days (roughly 7 months). This is in accordance with HDOH risk assessment guidelines, and default exposure assumptions generally used in risk assessments. AMEC double-checked the risk assessment calculations for both the cancer and noncancer risks for construction workers using HDOH risk*

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	assessment guidelines, and provided documentation that the calculated risks were within health protective guidelines. *The exposure assumptions for the groundskeeper were judged to be conservative and protective of human health. The risk assumption assumes that the same individual would be employed (and exposed) at the site for 25 years, and this individual would be working 3 full days a week maintaining a 4-acre property. Also, there are health protective safety factors included in the toxicity data for arsenic, as noted in the response to comment #2. In addition, risks are even lower when considering the average estimated exposure from soil arsenic across the entire property rather than assuming groundskeeper exposure entirely within individual decision units (as was used in the risk assessment).*
10. Risks to relatives and friends of hotel, cleanup, and construction workers should be evaluated. Workers may have acute exposure, infants, elderly, and those in poor health can be affected by low amounts of toxins on workers' clothes and shoes.	*Occupational exposures and risks to chemical hazards (including the issue of construction workers taking contaminants home from work) is regulated by the Hawai`i Occupational Safety and Health Administration (HIOSH). HIOSH regulations require a site-specific safety and health plan, appropriate training of workers, and other protections to reduce or eliminate potential exposure hazards. Although HDOH does not regulate occupational safety and health, we do ensure that a site-specific safety and health plan has been developed before any remediation work begins at a site.* *Risks to gardeners or hotel workers, expected to have the most significant long-term exposures to soil at the site, were evaluated and considered in choosing a remediation strategy that would be protective. Short-term exposures and exposure to lower levels of soil arsenic remaining on the site after remediation work, are not expected to involve significant risk. Also, see response to comment # 31 (Part 1).*
11. Risks from construction and/or remediation, to people living nearby or passing on foot, car, bicycle, etc. should be evaluated.	*As noted in responses to comments #s 7 and 10 (Part 1), the remediation work is conducted under a site-specific safety and health plan (under HIOSH jurisdiction) that would need to address ways to eliminate or reduce the potential for contaminated soil leaving the site via construction activities (e.g. washing off heavy equipment moving from the site).*
12. Risks to hotel workers and guests (some may be infants, children, in poor health) from inhaling contaminated dust brought into the hotel seem to be understated.	(Note: commentor cited AMEC's final Human Health Risk Assessment Addendum and Proposed Final Remedy, Nov. 30, 2005). *For the proposed hotel site, measurements of arsenic and lead in soil were used to conduct risk assessments that assumed a certain amount of daily exposure to bare soil and combined ingestion, inhalation, and skin adsorption exposures of arsenic from soil for a hotel worker (assuming full-time work over 25 years). Based on these risk assessments, soil in Decision Unit D*

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	was determined to be an unacceptable risk for exposure, and remediation of this soil was required. Adult hotel guests would have very limited frequency and duration of exposure to soil from the site (whether from ingestion, inhalation or absorption), and are not considered to have significant risks. *Based on comments submitted, a risk assessment for child guests (children would be expected to be the most sensitive to potential risks) was requested from the site consultant (AMEC) by HDOH (see response to comment #31, Part 1). This risk assessment demonstrated that due to limited frequency and duration of exposure at the site, child guests would not have significant cancer or noncancer risks.*
13. Risks from soil particles carried offsite by rain, especially during construction and before vegetation cover takes hold, should be evaluated.	*Erosion control is an issue that will be addressed in the implementation plan for the remedy selected (the implementation plan is a public document and will be available for review on request). Adequate controls for stormwater runoff and proper drainage will also be required as part of the building permits issued for the site and overseen by the local planning agency.*
14. The combined and synergistic effects of arsenic and lead, plus other toxins should be evaluated.	(Note: commentor cited reference to synergistic effects cited in Rachel's Democracy & Health News, Feb. 2, 2006 and Environ. Health Perspectives (online) Jan. 24, 2006). *HDOH is not aware of evidence to suggest that concentrations of arsenic and lead (as may be found in soil in the Kea`au area) work synergistically to produce toxic effects.*
15. Locations of specific samples which had high arsenic and lead content should be made public, since high and low levels of contamination are sometimes found side by side.	*It is true that on any site with soil contamination, the levels of the contaminant(s) will vary across the site - some samples will have higher and some lower levels of a contaminant. The distribution of contaminants in soil is always heterogeneous. For this reason, HDOH (as well as other states and the EPA) uses "average" soil contaminate levels (in the areas that people are expected to be exposed) when characterizing a contaminated site. Average contaminate levels in the appropriate "decision units" are considered the most relevant and most realistic measure for risk assessment. On the proposed hotel site, initial soil investigations included collection of many individual grab (or discreet) samples. These were collected, analyze individually, and then averaged to determine contaminate levels for risk evaluation. For these samples, there are discreet point values of arsenic and lead concentrations available, and these were included in reports and the public record for the site. In addition, some samples were collected using "multi-increment" sampling procedures, which combine many small increments (~30-50) into a single sample to obtain a "physically-averaged" soil sample for a given decision unit. The multi-increment sampling procedure is generally considered a more "representative" estimate of the average contaminate level in a decision unit, due*

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	to typically higher numbers of increments collected.
16. DOH should specify how information on contamination and health risks will be relayed to construction and hotel workers, and hotel guests. DOH should require that the information be included in advertising to prospective guests.	(Note: commentor cited AMEC's Draft Response Action Design, Construction and Implementation Work Plan, Jan. 2006, pg. 9). *As noted in other responses, information on health and safety risks for construction workers (under HIOSH jurisdiction) is covered by the site-specific safety and health plan, which HDOH will ensure is in place before remediation work begins.* *The selected remedy will result in a reduction of soil-arsenic risks to protect the long-term health of hotel workers. The implementation plan for the selected remedy will address how information on soil contamination will be passed on to workers, especially in regards to ensuring any on-site controls are maintained properly. Hotel guests are not expected to have significant risks from soil exposures at the site due to a very limited duration and frequency of potential exposure (also see response to comment #31, Part 1). Guests also do not have involvement in maintenance of any on-site controls, so they would not need information regarding contaminated soil managed at the site.*
17. DOH should require that contaminated soil in DU D be remediated to safe levels, not simply "acceptable levels similar to DU's A, B, and C.	(Note: commentor cited AMEC Remedial Alternatives Analysis, Nov. 30, 2005, page 3). *The average levels of bioaccessible arsenic in the fines soil fraction of Decision Units A, B, and C were considered "safe" from a risk assessment standpoint for a commercial use of this property. Therefore, remediation of exposed soil in DU D to levels similar to the other DU's was considered "safe". However, to further reduce the potential for risk across the site, HDOH specified that surface soil left in DU D, or any soil moved into DU D for cover, if necessary, meet average arsenic levels similar to DU A or DU B. The average arsenic levels in DU A and DU B were the lowest on the site (average bioaccessible arsenic levels in the fines fraction of 28.6 and 39.1 mg/kg, respectively).*
18. DOH should require that cover be new soil, not soil from DU's A and B.	(Note: commentor cited AMEC Remedial Alternatives Analysis, Nov. 30, 2005, page 3). *The average bioaccessible arsenic levels of the fines soil fractions in DU's A & B were the lowest on the site (28.6 and 39.1 mg/kg, respectively). A risk assessment, based on a commercial use of the property, demonstrated that these levels would be considered safe by HDOH. Consequently, if any area of the site met similar arsenic levels to DU A&B, this would also be considered protective of long-term health. A deed restriction on the property would ensure that the property is used solely for commercial or industrial use into the future.*

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19. DOH should require testing for lead as well as arsenic after soil is moved onto DU D.	(Note: commentor cited Draft RAM, pg. 1). *Yes. The Final RAM will be clear that both lead and arsenic confirmation testing is required in conjunction with the implementation of the selected remedy.*
20. DOH should require a plan for a scenario where contamination levels are higher than expected after remediation.	(Note: commentor cited Draft RAM, pg. 11). *The Department will require confirmation testing to ensure that the remediation achieves the goal of reduction of average soil arsenic and lead levels in Decision Unit D to safe levels. If that is not achieved, at least a foot of "clean" soil or soil that has already been tested from DU A or B would be required as cover. Alternatively, some of the area could be covered by planned buildings or parking lot, but these areas would then need to be included in the long-term soil management plan for the site.*
21. DOH should explain apparent contradictions in reports re lead levels – one report states "It is not suspected arsenic and lead are below the surface soil" but another states "Total lead levels in soil averaged 385 and 398 mg/kg in surface soils and subsurface soils, respectively."	(Note: commentor cited AMEC Remedial Alternatives Analysis, page 7, and Draft RAM, page 8). *HDOH agrees, the language compared is contradictory. In the first report quoted, the language was not correct - arsenic and lead can be found below the surface soil, as has been documented at the site in previous reports. However, the average levels of both arsenic and lead were found to be similar or (typically) higher in the surface soil when compared to the subsurface soil. Consequently, using the average surface soil lead and arsenic levels for risk assessment and remediation decisions was considered most appropriate/most protective, as these levels have been typically found (and documented on this site) to be very similar or higher than levels in the subsurface soils.*
22. DOH should require that bioavailability of subsurface arsenic and lead be tested, not assumed to be the same as on the surface.	(Note: commentor cited AMEC's final Human Health Risk Assessment Addendum and Proposed Final Remedy, Nov. 30, 2005, pg. 11). *Decision Unit D will be tested for bioaccessibility of lead and arsenic in the subsurface, following removal of the top foot of soil. If levels of bioaccessible arsenic are similar to those in DU A & B, the area would then be landscaped to stabilize and cover the remaining soil. If bioaccessible arsenic levels are higher, then additional soil would be removed from the area to be buried with the initial material removed (and confirmation testing conducted again), or at least a foot of "clean" soil or soil taken from DU A or DU B would be required as cover.*
23. DOH should include Unit D, the most contaminated, in risk calculations.	(Note: commentor cited AMEC's final Human Health Risk Assessment Addendum and Proposed Final Remedy, Nov. 30, 2005, pg. 9). *Decision Unit D was included in risk estimates for both cancer*

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	and noncancer health hazards. Based on these calculations, the Department determined that DU D presented an unacceptable risk and needed remedial action to eliminate or reduce risks. This is the goal and intent of the selected remedy – to reduce the risk level from exposed soil in DU D to that comparable (or lower) than DU A or DU B.
24. The function of DOH is to protect human health and the environment, yet history has shown a conflict: DOH participated in a cover up of heptachlor in milk to protect the dairy industry and had to be sued by a citizen group to establish air emission standards for dangerous geothermal development in our community. These are examples why many in the community have little confidence in DOH today. The present push and timeline for DOH approval concerning this project appears to be put in place for the benefit and least cost to the developer, and not in the best interest of community public health and safety and environment.	*HDOH has been involved in the review and oversight of soil contamination investigations and risk assessments at the proposed hotel site for three years. Detailed site-specific data has been collected, and this information was used in a site-specific risk assessment for the proposed use of the site. Strategies and alternatives for handling contaminated soil on the site were considered. The selected remedy was chosen by HDOH after careful consideration of information and comment provided by the site environmental contractors and the public. We are confident that the selected remedy will provide protection for human health at the proposed hotel site. In addition, administrative and engineering controls will be put in place as part of the remedy to ensure protections are maintained into the future.*
25. The decision to divide the hotel site into 4 decision units needs more scientific support. There were only 2 data points (samples) for DU-A, 6 for DU-B, and 3 for DU-C & D. As far as I know, it would need between 20 and 40 samples per unit (~ 1 acre per unit) to get representative values of As an Pb after performing classical statistics or geostatistics.	*HDOH agrees that good representative sampling is very important in soil contaminant investigations. The proposed hotel site was divided into 4 units to gather more in-depth data on the distribution of contaminants across the site (both arsenic and lead). Each of the 4 units was sampled using multi-increment sampling procedures, which was recommended by HDOH to gather representative samples. Using multi-increment sampling, 35-40 individual soil increments were gathered (in a systematic random fashion) within each unit then combined into one "multi-increment" sample. Consequently, each sample result actually represents a physical averaging of 35-40 increment samples per unit, in order to gain a representative sample. In addition, HDOH required field replicates (additional multi-increment samples made up of 35-40 increments collected from different systematic or stratified random locations within the unit) to be gathered from one of the 4 units to prove that the sampling method was truly representative for the contaminant conditions existing at the site. Triplicate field samples were collected from one of the 4 units to determine the combined sample variation*

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	due to field sampling procedures, lab sub-sampling, and lab analysis procedures. The relative standard deviation (RSD) for this field triplicate was 8.4% and 9.5% for total lead and total arsenic (respectively), and 6.5% and 18.4% for bioaccessible lead and arsenic (respectively). The precision of the field replicates was quite good, and the sampling data was considered appropriate to compare with HDOH action levels and for use in risk assessments for the site.
26. Bioaccessibility is a relatively new concept in assessing potential avaialability/toxicity of hazardous materials (I tend to agree with this approach). However, it still needs improvements, especially for As. The method used controls only pH and temperature. Stomach fluid, on the other hand, contains many chemicals from phosphates to metallothionines. These compounds certainly affect arsenate absorption. This partially explains the poor correlation between As extracted by HCl at pH 1.5 and As absorbed by mice or pigs. Has the EPA used bioaccessible concentrations of As instead of total concentrations in their models to set critical limits?	*The validity of applying arsenic bioaccessibility analyses to site assessments is an important consideration, as EPA has not yet adopted a nation-wide policy on their use. Individual EPA regions (such as Region 8) have gathered significant data on arsenic bioaccessibility, bioavailability, as well as geochemical testing and have made recommendations on their use. These recommendations encourage site-specific information as well as multiple lines of evidence until such time EPA does adopt a nation-wide policy.* *For the proposed hotel site, HDOH required site-specific soil arsenic and lead bioaccessibility analyses to be conducted, with field and lab replicates to determine precision. In addition, we had soil arsenic bioaccessibility data gathered by HDOH from other nearby sites we could use to examine consistency in the general ranges of bioaccessibility found. Finally, HDOH also had data from a bioavailability-bioaccessibility comparison study (comparing results of animal testing for soil arsenic bioavailability in monkeys with the lab bioaccessibility procedure used for the Kea`au area soil samples). This study included replicates of a soil sample that had been collected from the proposed hotel site in Kea`au, and testing results showed good comparison between the bioavailability and bioaccessibility tests on the same soil sample. Using this combined evidence, HDOH felt confident in the use of bioaccessibility testing in evaluation of the proposed hotel site.*
27. How were hazardous quotient and cancer probability derived? Did EPA/HDOH use linear, polynomial or exponential equations to model dose-response curves for As and/or Pb? Were all probable pathways examined? My impression is that only the direct contact (soil to human) pathway was evaluated. What about a) soil→plant→human, b) soil→plant→animal→human, and c)	*The risk assessments utilized the scientifically peer-reviewed dose-response value for arsenic, which has been supported by the US EPA and HDOH. This dose-response value conservatively estimates that any exposure to arsenic can cause cancer (i.e. a linear dose-response relationship).* *Exposure and risk associated with exposure to lead are based on an estimated blood lead concentration, unlike other constituents for which human exposure is calculated in terms of chemical intake. Due to the existence of a growing database relating blood lead concentration and human toxicity, blood lead concentration is the most direct means by which the toxic effects of lead in humans can be assessed. The US EPA and the state of California have developed lead exposure models for evaluating blood lead*

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soil→air→human pathways? These three pathways would be relevant to people who live adjacent to the site.	*concentrations associated with intake of lead from food, water, air and soil. HDOH typically uses the California model to assess sites having reported lead concentrations. The California model uses a 10ug/dl blood lead concentration as its target threshold for both children and adults. This level is consistent with US EPA's guidance regarding lead exposure in children.* *The soil inhalation pathway was included along with soil ingestion and soil dermal absorption in the risk assessments for the proposed hotel site. Significant volatilization of the soil bound inorganic arsenic is not anticipated (presumably, the soil arsenic has been in the soil for over 50 years). Food gardens are not planned to be included as part of the proposed hotel site.* *HDOH has done testing of vegetables and fruits from community gardens in the Kea`au area as part of our area-wide soil arsenic investigations. Eating vegetables or fruits grown in soil with relatively high levels of arsenic was a suspected exposure pathway. Testing results to date have not shown elevated arsenic levels in common vegetables and fruits when compared to arsenic levels found in periodic nationwide market-basket surveys conducted by the US FDA. In any case, the proposed hotel site is not intended for agricultural use, and this will be detailed in the long-term soil management plan for the site.*
28. Were As concentrations in vegetation and total amount of As in above-ground biomass of the site known? Some plants may contain very little As, other a lot (e.g. brake fern). Data must be obtained and presented, otherwise how can HDOH know where to dispose the grubbed material?	*HDOH risk assessment staff examined the issue of potential arsenic residues in above-ground plant material, using literature data on the range of expected arsenic (uptake) concentrations in plant material, and the known soil-arsenic concentrations from the proposed hotel site. They determined there was not a substantial risk from the above ground plant material (green waste) at the site. Consequently, the site green waste is planned to be disposed on Shipman property that is specially permitted by the HDOH Solid Waste section for this use.* *"Grubbed" material containing below-ground plant material with associated soil adhered to it was considered a significant disposal issue in regards to potential arsenic contamination, so the selected remedy requires appropriate handling and long-term management of this material on the site.*
29. The assumptions made by AMEC (page 16-17) need to be re-evaluated, and alternatives developed if the assumptions turn out not to be right.	*Four of the five assumptions listed by AMEC on page 16-17 of the Revised Draft RAM under their consideration of remedial alternatives are appropriate for consideration of the selected remedy in the Final RAM. One of the assumptions – "Impacted soil is not characterized as hazardous waste, and disposal in West Hawai`i Sanitary Landfill is acceptable" – would not be applicable to the selected remedy in the Final RAM, as soil will*

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	not be disposed in the West Hawai`i Landfill. *In addition, the assumption that "Decision Unit D is the only area considered for remediation", is not entirely complete. It is true that the bulk of the soil remediation effort will be focused on Decision Unit D, but other areas of the site will also be required to be landscaped (to avoid any bare soil) as part of the remediation plan.*
30. I agree these concerns need to be addressed (page 35): a) What soil will be removed? Details should be provided as to spotting the contaminated localities, b) How will "confirmation" samples be taken?, and c) How will potential erosion by run-off be managed?	*Soil removal (and grubbed material removal) will focus on the top 1 foot of soil in Decision Unit D. This soil will be moved to a designated area on site (in a pit or pits) for appropriate long-term management. The contaminated soil from DU D will be covered with a substantial barrier material, at least a foot of soil from one of the other decision units, and landscaping. Containment (and maintenance) of the contaminated material underground will prevent the chance of exposure to this soil.* *After the soil is removed from Decision Unit D, arsenic and lead confirmation testing will be conducted using multi-increment sampling procedures with field replicates as described in response to comment #25 (Part 1). HDOH will provide oversight of this sampling plan and sampling effort. Results of this testing will dictate if additional soil removal or a soil cover barrier (minimum of 1 foot) and long-term soil management plan would be necessary in the decision unit.* *Adequate controls for stormwater runoff and proper drainage will be required as part of the implementation work plan, and a stromwater runoff permit will be required for the site and overseen by HDOH (Stormwater section) and the local planning agency.*
31. The limited risk analysis model (soil→ human) used by AMEC or HDOH considered only adult, NOT children. We know that children absorb heavy metals at much higher percentage than adults.	*It is true that children are more sensitive to chemical exposures than adults. However, potential exposures of children to soil at the proposed hotel site will be limited, as the employees will be adults, and child "guests" would be expected to be on site for very limited periods of time. Reduced frequency and duration of exposure lessens the potential for risk.* *HDOH requested AMEC to conduct a risk assessment for "child guests" to respond to this comment. They assumed a child returning to the site every year, 5 days per year for 6 years. In addition, the child guests were assumed to ingest 200 mg of soil per day and inhale 10m³ of air per day. Cancer and noncancer risks were estimated at 1E-06 and 0.03, respectively, and both were below USEPA and HDOH regulatory levels of concern.*
32. Arsenic containing molecules in the air should be periodically monitored, not only	*HDOH is not aware of cases where volatile arsenic compounds have been determined to be a significant environmental exposure concern during disturbance of soil contaminated with inorganic*

COMMENT	RESPONSE
particulates. There are several volatile As compounds, such as arsine (AsH3), methylarsines, that can be released to the atmosphere when As-contaminated soils are disturbed.	*arsenic, such as the proposed hotel site. A site-specific safety and health plan will be required for construction work conducted on the site (under jurisdiction of HIOSH). The goal of the safety and health plan is to address all significant safety and health hazards for the protection of workers on the site.*
33. The proposed solution appears to create a very good balance between the requirement to ensure public safety and the desire to do so in an economic manner.	*Comment noted.*
34. The proposed solution provides a risk level LESS than the risk level considered acceptable for drinking water in the US. There is no sign of any arsenic in the water used in Keaau – so the arsenic potentially ingested from this site does not add to arsenic that might be ingested from drinking water.	*HDOH risk assessment staff have noted that estimated maximum chronic ingestion exposures from the measured bioaccessible soil arsenic exposures (in micrograms per day) at the proposed hotel site is similar to the (maximum) exposure amount allowed for arsenic in water under federal drinking water standards. The selected remedy for soil arsenic at the proposed hotel site is aimed at reducing the estimated arsenic exposure risk well below a level of concern.* *Checking with the HDOH Drinking Water section, that has monitored public drinking water supplies across the state for many years, we have not found any evidence that arsenic has been detected in drinking water anywhere in the state. The strong binding characteristics of arsenic (and lead) to soil particles is believed to prevent significant leaching. The soil arsenic in the Kea`au area is presumed to have resulted from pesticide use in the 1920s –1940s, and significant residues are still found in shallow soils. The water table in the area of the proposed hotel site is also relatively deep (~ 200 feet).*
35. Because general site work is being done on the property and ground will be moved around, the actual cost of the remediation plan is likely much lower than the projection. The projection ($75,000) does not take into account the work being done as a matter of course so does not take into account efficiencies that will occur on the work site.	*Comment noted.*
36. There is no known increase in cancers or other illnesses in the	*See response to comment #46 (Part 2).*

COMMENT	RESPONSE
area that might reasonably be connected with the existence of arsenic in soil. One would expect to have at least anecdotal evidence of some of these problems. Families reportedly lived on the property for extended periods of time – some people mixed and sprayed arsenic onto the soil, and report mixing the arsenic with their arms and were immersed in it long enough to have a rash from the exposure. They likely ingested much more arsenic than is contemplated by anyone over any period of time on the Hotel site, yet at least one of these men is still alive at 94. So there is anecdotal evidence the risk of disease from ingestion of arsenic – for whatever reason – is extremely low.	
37. If housing and facilities for families and others who live and work in Keaau are to be provided, solutions that create a rational and reasoned relationship between actual risk factors and what can be done economically are needed. The balance is very important , as the cost of preparing facilities could become too expensive (especially facilities at the economic margin) and reducing facilities may create unsafe and unhealthy conditions (e.g. homelessness and crowding). DOH needs to consider these issues.	*Comment noted. The evaluation criteria required by HDOH for remediation alternatives on contaminated sites includes effectiveness, implementability, and cost considerations.*
38. The proposed option that involves local use of contaminated soil as structural fill beneath	*Comment noted. In addition to burying contaminated soil from Decision Unit D beneath at least a foot of soil (from Decision Units A, B, or C), a substantial barrier material between the*

COMMENT	RESPONSE
buildings and parking lots, with burial of any remaining high-As soil beneath "a foot of clean soil" is a reasonable and safe solution that will eliminate any possibility of adverse environmental effects.	*contaminated and cover soil will be required to act as a physical and visual barrier. Landscaping will be maintained on top of the cover soil. A long-term soil management plan will help ensure proper management of the isolated soil into the future. Finally, a deed restriction on the property will ensure on-going awareness of the long-term soil management plan and limit use to commercial or industrial purposes.*
39. If the soil is protected from water run off, the arsenic will just stay in place and not bother anyone. However, I don't see how anyone can guarantee it will stay put. I have seen too many systems (mechanical and political) fail. Even with a barrier system installed there is still no guarantee it will always be effective. Arsenic is water soluble unless it is bound with a treatment or encapsulated. Should there be a water transport issue, I don't see how any corrective action would ever take place once the building is built.	*The arsenic in soil is believed to be tightly bound to soil particles, however water transport of soil particles could act to move contaminated soil.* *Erosion and stormwater runoff issues during construction as well as for the overall design of the site will be addressed in the remediation implementation plan as well as the required stormwater management permit. A portion of the site is planned to be occupied by buildings and parking lot, and the rest of the property will be required to be landscaped to help prevent bare soil exposure and erosion.* *Contaminated soil from Decision Unit D will be buried, marked clearly with a substantial barrier material, covered with at least 1 foot of soil, and landscaped with plantings. The long-term soil management plan for the buried contaminated soil will need to address periodic inspection (especially whenever new activity may occur/be proposed in the area where it is buried). HDOH may also choose to inspect the site at any time to ensure controls are maintained over time, and will work with the County planning/permitting agency to make sure they are aware of the soil management issues on the site.* *Leaching of inorganic arsenic from the soil to groundwater is not anticipated due to the binding characteristics on soil. As noted previously, the HDOH Drinking Water section has not documented groundwater contamination issues from soil arsenic in their drinking water monitoring program over the years.*
40. Given the virtual impossibility of doing an effective hydrology flow study for the area, I don't believe you can do an effective contamination dilution/spread rate work up. Can you hold the water to the EPA's 50 ug/L or 10 ug/L limits for arsenic contamination in drinking water? Keaau is on a municipal well.	*See response to comment above (#39, Part 1). The Kea`au wells are included in the HDOH drinking water section's monitoring program. Also, it is relevant to note that soil arsenic contamination is not limited to this site, but has been documented to be an area-wide issue around Kea`au. Arsenic levels may vary significantly from site to site.*

COMMENT	RESPONSE
41. Thought I would offer that in WA state they used some ferns to help leach arsenic from the soil – perhaps this could be applied on this site? Have you considered bioremediation – planting ferns or other plants to remove the arsenic from the soil?	*Phytoremediation, a remediation method that can involve use of certain plants known to be hyper-accumulaters of arsenic from the soil has been discussed for applicability in Hawai`i and at this particular site. HDOH is interested in identifying the efficacy of this technology in different areas in the islands, and determining the characteristics of a site that may make this approach work well. However, there have been a limited number of demonstration projects in Hawai`i that HDOH is aware of, and there was considerable uncertainty regarding the effectiveness and practicality of using phytoremediation at the proposed hotel site. Issues regarding plant selection, propagation, maintenance, time to effect remediation through numerous plantings, plant disposal, testing, etc. all need to be addressed for a given site. This technology could also have very significant cost impacts due to operational costs plus the length of time it could take to remediate the site (which was uncertain, but could take years). Consequently, this remediation alternative was not selected for a detailed analysis when comparing alternatives.*
42. I would suggest not transporting the contaminated soil to West Hawaii. An on-site solution should be pursued first in order to avoid spreading the contamination.	*Comment noted. The selected remedy in the Final RAM involves an on-site remediation approach.*
43. Allowing contaminated sites to be simply covered up instead of cleaned up is an injustice. The brownfields legislation was proposed as a way to quickly get contaminated sites cleaned up. Is this really the legacy you want to leave future generations – soil contaminated with extraordinary levels of arsenic and lead?	*HDOH has selected a remedy for the proposed hotel site that will protect humans and the environment from the potential adverse health effects of soil arsenic and lead contamination. Remedial alternatives were considered and judged on criteria of effectiveness, implementability, and cost.* *Costs of digging up and sending all contaminated soil on this site for disposal in another state were very large, and cost was one of the factors used to evaluate remedial alternatives.* *This site is being remediated under our state Environmental Response Law (Chapter 128D, Part 1). The site was in the HDOH Voluntary Response Program (VRP) for several years, but was voluntarily withdrawn from the VRP some time ago.*
44. The impact on cultural and customary rights of native Hawaiians have to be considered in determining how to clean up the site – these islands are precious to Hawaiians - contaminated soil should be removed and	*Comment noted. See responses to comments #1, Part 1 and # 48, Part 2.*

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disposed on the mainland.	
45. A risk assessment for guests/children at the hotel site should be included in the reports.	*See response to comment #31, Part 1.*

**Part 2. Responsiveness Summary – Response to Comments on the Draft RAM for the Kea`au Hospitality Group's proposed hotel site. Public Comment period February 22 – March 21, 2006.** *These Comments/Responses were judged to primarily address the "area-wide" soil arsenic issues in the Kea`au area, rather than site-specific issues related to the proposed hotel site and soil arsenic remediation at that site.*

COMMENT	RESPONSE
46. The Kea`au Community needs to have information on any existing health surveillance data relevant to the evaluation of potential human health effects from arsenic contaminated soil. The first thing to do is to check the health of the community. Do we know if the high arsenic in soil is causing health effects in the Kea`au community or not?	*It is not currently known if arsenic levels in soil throughout the Kea`au area may pose a public health hazard. An exposure investigation is being conducted in Kea`au by HDOH and the Agency for Toxic Disease Registry to identify if individuals who may be exposed to relatively high levels of soil arsenic have significant levels of arsenic in their bodies (final report expected by end of 2006). Results of this testing will help determine what additional work may be necessary to address evaluation of potential human health effects from soil arsenic exposure.* *There are also two existing databases that could be used to help assess potential health effects from arsenic:* *1) The Hawai`i Tumor Registry (HTR) maintains a database of information on all cases of cancer diagnosed in Hawai`i. The HTR is jointly operated by the Cancer Research Center of Hawai`i and HDOH. Because long-term exposure to arsenic has been shown to cause cancer, HTR could be used to compare cancer rates in the Kea`au area with the rest of the state. However, there are significant limitations with this approach due to the small population in the Kea`au area. Nonetheless, HDOH will discuss the feasibility of collaborating with the Cancer Research Center to examine cancer diagnoses in the Kea`au area. This effort will begin after the results of the exposure investigation noted above are complete (within the next 3-6 months).* *2) HDOH maintains a database of certain pesticide and heavy metal testing, which are designated as reportable conditions. Physicians and laboratories are required to report evidence of acute exposure and subacute illness. A summary of exposure testing data received in the HDOH Hazard Evaluation and Emergency Response Office over the last 4+ years (Jan. 2002 through March 2006)*

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	showed that 833 arsenic lab results were reported throughout the islands, including 202 urine analyses, a key diagnostic test for recent exposure (last few days). Of these analysis reports, 29 reports showed levels above the "reference range" (3 of these 29 individual results were from the Big Island). However, the urine arsenic levels reported were for "total" arsenic and were apparently not "speciated" to determine whether the urine arsenic was in the inorganic or organic form. A significant level of organic arsenic is commonly found in fish/shellfish, is considered much less toxic than the inorganic form of arsenic, and is not generally considered a threat to human health. Limitations of the existing information in this database preclude any definitive conclusions regarding reports of abnormal arsenic levels. HDOH plans to work with physicians/labs in the future to encourage more appropriate follow-up sampling and reporting for this database. *For the proposed hotel site, measurements of arsenic and lead in soil were used to conduct risk assessments that assumed a certain amount of daily exposure to <u>bare</u> soil (ingestion, inhalation, and skin adsorption of arsenic from soil was estimated) for:* • *hotel worker (assuming full-time work over 25 years),* • *groundskeeper (assuming 3 days work each week over 25 years, and* • *construction worker (assuming 20 days of exposure per year for 7 years)* *Calculations for both cancer and noncancer risks were made using these exposure assumptions. The risk assessments and selected remedy in this Final RAM address these estimated risks, so that exposures (both short and long-term) to arsenic and lead in soil from the proposed hotel site will not result in significant cancer or noncancer risks.*
47. Investigation of alleged illegal bulldozing and dumping by Shipman of untested soil from a nearby Kea`au site should be completed before a final plan is approved for the site. A Kea`au resident alleges that this occurred on land near the Kea`au Hongwanji in 2001.	*The alleged incident in 2001 is apparently related to vegetation removal ("junk tree" and grass removal) at a Shipman owned site adjacent to the Kea`au Hongwanji. Vegetation removal rather than soil removal was the reported objective of the action. Shipman provided a grubbing permit for the vegetation removal in 2001. HDOH is not aware of any illegal actions taken by Shipman in relation to the reported vegetation removal.*

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48. A comprehensive state-wide plan for all parcels that may be contaminated by plantation activities should be developed, with public input, before a final plan is developed for the site. *A parcel-by-parcel approach may set precedents, or eliminate options, before we have input from experts and affected parties on the full extent of the contamination, the implications, and the best course of action. *Remediation timelines should be developed by DOH and the public, not by present or prospective owners. *No special exemptions from liability should be made without public hearings on the exemption in question. *Appropriate time and resources should be used, including DOH, independent of DOH, and private interests. *DOH should use consultants hired by DOH, not landowners, to avoid conflict of interest issues. *DOH should continue to use Federal assistance for expertise, funding, and other needs. *DOH should urge County governments to consider requirements for testing of former plantation lands before sales, subdivisions, and building permits are allowed. *DOH should support continued research on rendering arsenic harmless, at UH. Arsenic from plantations appears to be an issue on	*The Department of Health has been and continues to work on more comprehensive plans to address potential contamination on former agricultural lands throughout the Islands. We agree that involvement of many different groups and interests is beneficial to the success of these efforts. Our efforts since the "area-wide" soil arsenic contamination issue in Kea`au came to light in 2004 have included:*  • *Conducting independent investigations of soil arsenic concentrations around the Kea`au area,* • *Holding periodic public meetings in Kea`au to explain on-going soil investigations there,* • *Writing and distribution of a soil-arsenic "fact sheet" to the Kea`au community and local health department staff,* • *Providing interviews and information to the media on soil arsenic investigations in Kea`au and other locations,* • *Periodic meetings with Mayor Kim to inform him of Department efforts to evaluate soil arsenic issues,* • *Collaboration with the CDC's Agency for Toxic Substances Disease Registry to conduct an arsenic "exposure investigation" for selected residents in the Kea`au area,* • *Requiring more detailed and defensible sampling and analysis procedures to ensure reliable estimates of soil contamination levels,* • *Testing and evaluation of soil arsenic" bioaccessibility", to determine the fraction of soil arsenic, if ingested, that may be available in the body,* • *Review and oversight of soil data collected by environmental contractors (working for landowners),* • *Recommendations to test soil on former sugarcane lands for arsenic concentrations when proposed project documents are reviewed for environmental impacts by HDOH.* • *Collaborating with University of Hawai`i at Manoa faculty and graduate students to fund and encourage research on soil arsenic contamination and new or better ways to remediate soil arsenic, and* • *Providing risk assessment guidelines to help evaluate and determine appropriate follow-up actions for soil arsenic contamination.* *We will continue to broaden these efforts to develop a more comprehensive strategy regarding soil contaminants and former agricultural lands, and include interested parties in these efforts – including more involvement of county governments and citizens, as well as additional outreach to communities and collaboration with state, federal, private*

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possibly all islands. Therefore, county and statewide plans to address the problem should be developed by working groups that include independent scientists with expertise in this area and public involvement, including grassroots Kanaka councils on all islands, made up of community people with track records standing for the environment, not simply developer consultants and government bureaucrats. The time of performance should be adequate to allow a thorough and responsible review.	*communities and collaboration with state, federal, private consultant, and university personnel.* *However, HDOH does not believe a decision to remediate soil at the proposed hotel site in a manner that would be protective of health and the environment needs to wait until more comprehensive efforts are made to identify and address soil contaminants on other lands. We have detailed information specific to this site to make a determination. We do not consider a decision at this site to be a "precedent" for other sites that may be evaluated in the future. This is a site-specific decision. In addition, no special exemptions from liability will be provided to this site – if in the future new information indicates that contamination is present at the site at levels that pose a threat to public health or the environment, DOH may require additional investigative and cleanup work to be performed.*
49. DOH should publicize current results of the ongoing testing of Kea`au resident's health.	*See response to comment #46(Part 2).*
50. DOH should evaluate whether high background arsenic levels in Hawai`i soils are due to plantation activity.	*"Background" arsenic levels can be considered either "natural background" concentrations – arsenic found naturally in volcanic soils throughout the Islands, or "human activity-derived background" concentrations. Natural background concentrations of soil arsenic in Hawai`i are elevated compared to many other states and locations, due to our particular volcanic soils – in the range of 1-20 mg/kg total arsenic. Consequently, HDOH considers soil data showing less than 22 mg/kg total arsenic as similar to natural background (in Hawai`i), and does not recommend additional testing or action. Levels exceeding about 20 mg/kg total arsenic are considered a combination of natural background plus human activity-derived background, and we generally recommend further investigation (e.g. testing for bioaccessible arsenic), evaluation (risk assessment), or action to reduce potential exposure to the soil. HDOH is evaluating soil arsenic data from a number of locations throughout the Islands, and has identified former sugarcane lands, in particular, as" suspect" for elevated levels of soil arsenic due to potential past use of arsenic-containing herbicides. Because management practices on various sugarcane plantations, and even within plantations, may have differed significantly, one needs to test the soil on individual sites to determine whether arsenic concentrations are elevated.*

COMMENT	RESPONSE
51. Address possible need for a complete building moratorium on all Kea`au (Puna) sugar lands, including the new Gateway shopping center and urban development plans on Shipman land mauka of the Keaau bypass traffic light and Shipman Park due to high levels of arsenic and lead.	*The purpose of the Final RAM is to address soil contamination on the proposed hotel site, using site-specific data on soil contamination levels, and a site-specific risk assessment appropriate to the proposed land use. The selected remedy takes the site-specific data into account, and was chosen to ensure protection of human health for all exposure scenarios expected to occur on this site.* *The need for a building moratorium for areas in Puna has not been proposed by the County and/or HDOH.* *Soil arsenic levels are known to be elevated in areas around Kea`au, but levels vary considerably from site to site – the source of the soil arsenic is presumed to be arsenic-based herbicides used around 1920-1950 in the sugarcane industry. Lead is not believed to be an area-wide contaminant around Kea`au – the proposed hotel site was a former plantation housing area and the lead found on this site may have been used in paint or other products in the former buildings on site.* *As noted in our response to comment #46 (Part 2), we currently do not know if arsenic levels in soil at other sites around the Kea`au area may pose a public health hazard. We have conducted an exposure investigation at two of the highest soil arsenic areas identified, to begin to try to answer the question of whether there could be actual exposure concerns for some sites. The possibility of short-term health hazards is not anticipated given the magnitude of soil arsenic levels known. Additional work is planned by HDOH to learn more about the area-wide soil arsenic contamination around Kea`au, and the community will have input to planning this work.*
52. DOH should inform all home and lot owners on former Puna sugar lands (including the new Kamehameha School campus) of possible arsenic/lead hazards.	*HDOH has conducted a number of public meetings at the Kea`au Community Center regarding both the proposed hotel site and our soil arsenic investigations in the larger Kea`au area. One purpose of these meetings has been to provide basic information and fact sheets regarding arsenic contamination in soils. We have also provided fact sheets and other information to local health department staff. The soil arsenic contamination issue in the Kea`au area has been featured at least 3 times on the front page of the Hilo Tribune, and in a feature article in the Hawai`i Island Journal. In addition, a number of community members including business people, politicians, concerned citizens, school officials, and others in Kea`au or associated with the Kea`au community have been mailed information and/or attended our public meetings regarding the soil arsenic issues.* *Officials/staff of the new Kamehameha School campus are aware of soil arsenic contamination around Kea`au, and attended at*

COMMENT	RESPONSE
	least one of the HDOH public meetings in Kea`au. *We recognize that continued and improved communication about what we know (and don't know) about soil arsenic contamination is very important. Public communication issues will be one of the important considerations in on-going planning and future actions regarding soil arsenic issues.*
53. How do you tell homeowners to keep their children from playing in their yards or to cover their yards with 3 feet of clean dirt?	*HDOH has limited data on soil arsenic levels on specific properties around Kea`au, and does not have resources to sample the thousands of individual homeowner lots throughout the area. We do offer "how to" advice to homeowners on sampling their property themselves.* *Soil arsenic levels are expected to vary significantly in surface soils depending on the property location, how the property was developed, and how it was subsequently landscaped and managed. Consequently, soil arsenic levels in surface soils could vary considerably from lot to lot, even in very close proximity. Sampling individual homeowner lots (within an area known to have soil arsenic contamination) would be the only way to determine soil arsenic levels reliably.* *We do know that the Kea`au area has an "area-wide" soil arsenic issue, and, as noted in the response to comment #1 (Part 2), HDOH is doing work to investigate whether any public health hazards may exist. No short-term health effects are suspected from the magnitude of potential soil arsenic exposures around Kea`au – HDOH investigations focus on potential long-term effects (exposure over many years). The arsenic fact sheet we have distributed in the community over the last two years provides advice to homeowners on how to reduce the potential for exposure to soil arsenic. These exposure reduction methods include:* • *Keep grass, other vegetative cover, or some kind of surface material over soil on your property. This acts as a barrier to prevent soil exposure.* • *Keep children from playing in contaminated dirt.* • *Keep toys, pacifiers, and other items that go into kid's mouths clean.* • *Wash hands and face thoroughly after working or playing in the soil, especially before meals and snacks.* • *Wash fruits and vegetables from the garden with water before bringing them in the house, then wash again inside with a brush to remove any remaining soil particles. Pare root and tuber vegetables before eating.* • *Bring in clean sand for sandboxes and add soil known to be free of contamination to food garden areas. You could also make raised garden beds with clean soils.*

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	• *Avoid tracking soil into the home and clean up right away if soil is tracked in. Remove work and play shoes before entering the house. Keep pets from tracking contaminated soil into your home.*
54. DOH should require disclosure on all real estate sale of all former sugar cane potential arsenic/lead contaminated lands and/or perhaps require arsenic soil testing before building permits are issued.	*HDOH agrees that disclosure of potential soil arsenic contamination for real estate transactions in areas known to have area-wide soil arsenic issues makes sense. Based on past public meetings in Kea`au as well as media coverage of the issue, local real estate firms may certainly already be aware of the soil arsenic contamination issues in the Kea`au area. HDOH will make recommendations and discuss real estate disclosure issues with County planning officials and the area real estate community in the near future.*
55. It is clear from my studies that it is not the total arsenic content of soils that should be the controlling factor on permissilble levels for soil. Bioavailability studies are appropriate to evaluate the degree to with arsenic is "mobile" within Hawaiian soils. The present 22 ppm action level for As is too low for our volcanic soils, and I recommend this value could be raised.	*Soil arsenic bioaccessibility measurements have been incorporated in the site investigation and risk assessments for the proposed hotel site.* *Bioaccessibility data is not used to evaluate mobility within soils, it is used to estimate the amount of arsenic that is available for absorption in the human digestive system.* *HDOH currently uses a 22 mg/kg action level for "total arsenic" concentrations (bioaccessible arsenic action levels are lower). The 22 mg/kg action level for total arsenic was set in recognition that natural background levels of arsenic are elevated in the volcanic soils of Hawai`i. HDOH does not feel that an action level of 22 mg/kg for total arsenic is too high, as historical data indicates natural background levels generally do not exceed this concentration, and this action level helps to provide protection from the cancer and non-cancer risks of arsenic exposure.*
56. Why aren't the realtors required to disclose contamination concerns to potential buyers?	*See response to comment # 54 (Part 2).*
57. HDOH should provide a fact sheet to everyone living in the area on: What are the potential health risks? And What can we do to reduce or eliminated the risk?	*See responses to comments # 52 and #53 (Part 2). HDOH will continue to share information with the community and work with the community to improve communication.*
58. Does the acidic rain in the area pose potential leaching concerns?	*HDOH does not have evidence that leaching of soil arsenic (or lead) is a concern in the Kea`au area. Arsenic and lead tend to bind strongly to soil particles, and this contributes to their persistence in shallow soils.*
59. It is common knowledge that the agricultural land around Kea`au is contaminated – why did it take so long for HDOH to get involved?	*The area-wide soil arsenic issues in the Kea`au area were first recognized by HDOH in 2004. See response to comment # 48 (Part 2) for a description of some actions taken by HDOH since then.*

15. References

Response Action Memorandum: W.H. Shipman Property in Kea`au, Hawai`i TMK: 3-1-6-143: parcels 33 & 22. (HDOH 2004)

Human Health Risk Assessment, Including Results of Field Sampling and Laboratory Analysis to Determine Bioaccessibility of Arsenic and Lead, Shipman Hotel Site. (ERM 2005a)

Review of Human Health Risk Assessment, Shipman Hotel Site, Kea`au, HI (HDOH 2005a)

Response to Comments on Human Health Risk Assessment, Shipman Hotel Site, Kea`au, HI (ERM 2005b)

Final Human Health Risk Assessment Addendum and Proposed Final Remedy for Kea`au Hospitality Group LLC's "Hotel Site". 16-590 Old Volcano Road, Kea`au, Hawai`i 96749 (AMEC 2005)

HDOH Response to Agency Review Draft: Human Health Risk Assessment Addendum and Final Remedy for Kea`au Hospitality Management, LLC's "Hotel Site". 16-590 Old Volcano Road, Kea`au, Hawai`i 96749 (HDOH 2005b)

Response to HDOH November 14, 2005 Comments: Human Health Risk Assessment Addendum and Final Remedy for Kea`au Hospitality Management, LLC's "Hotel Site" 16-590 Old Volcano Road, Kea`au, Hawai`i 96749 (AMEC 2005b)

Remedial Options Engineering Evaluation and Cost Analysis: Kea`au Hospitality Group LLC's "Hotel Site". 16-590 Old Volcano Road, Kea`au, Hawai`i 96749 (AMEC 2005c)

Revised Draft Response Action Memorandum, Kea`au Hospitality Group Inc. "Hotel Site", TMK: 3-1-6-143: parcel 33, January 19, 2006 (AMEC 2006)

Figures

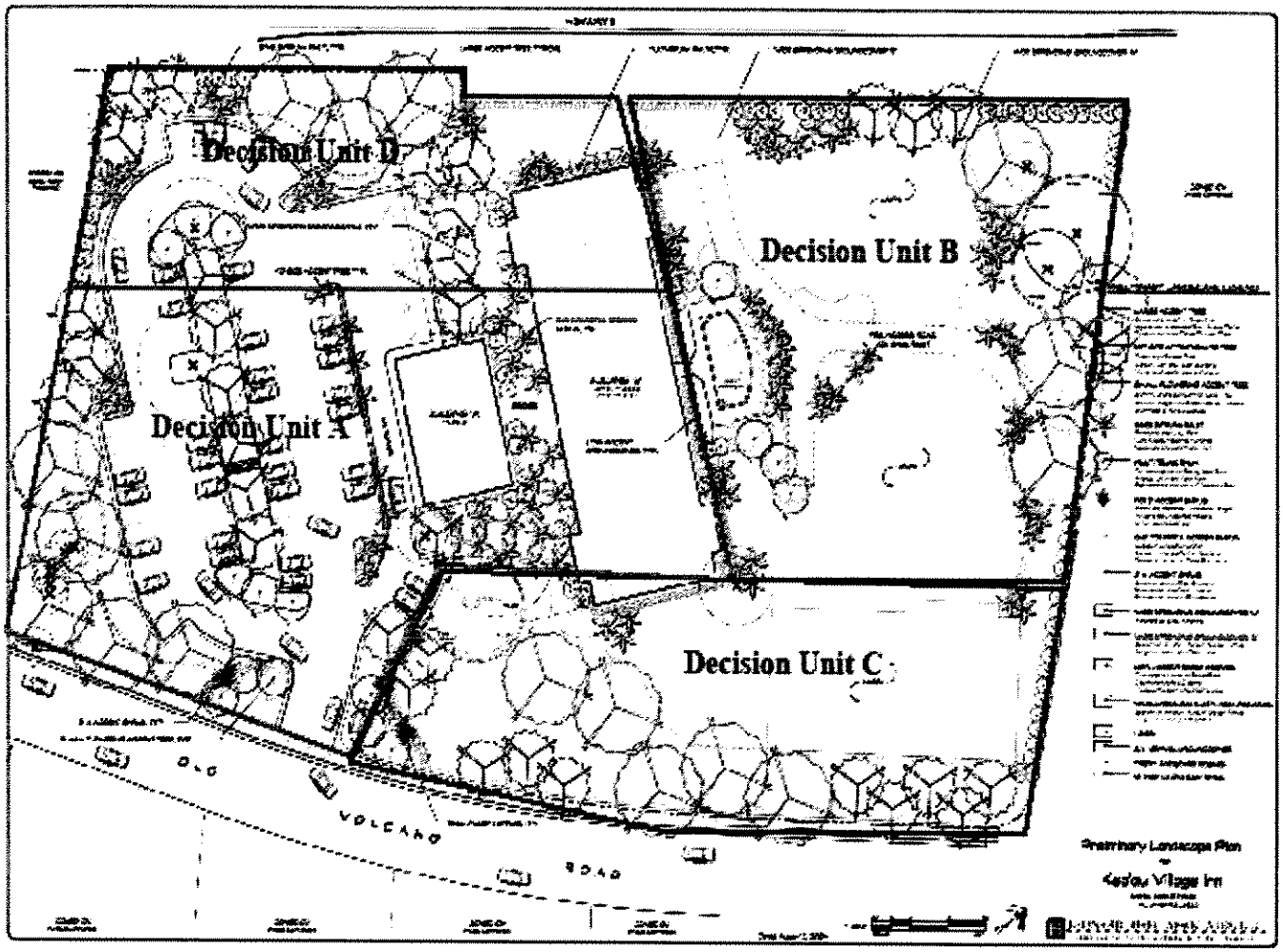
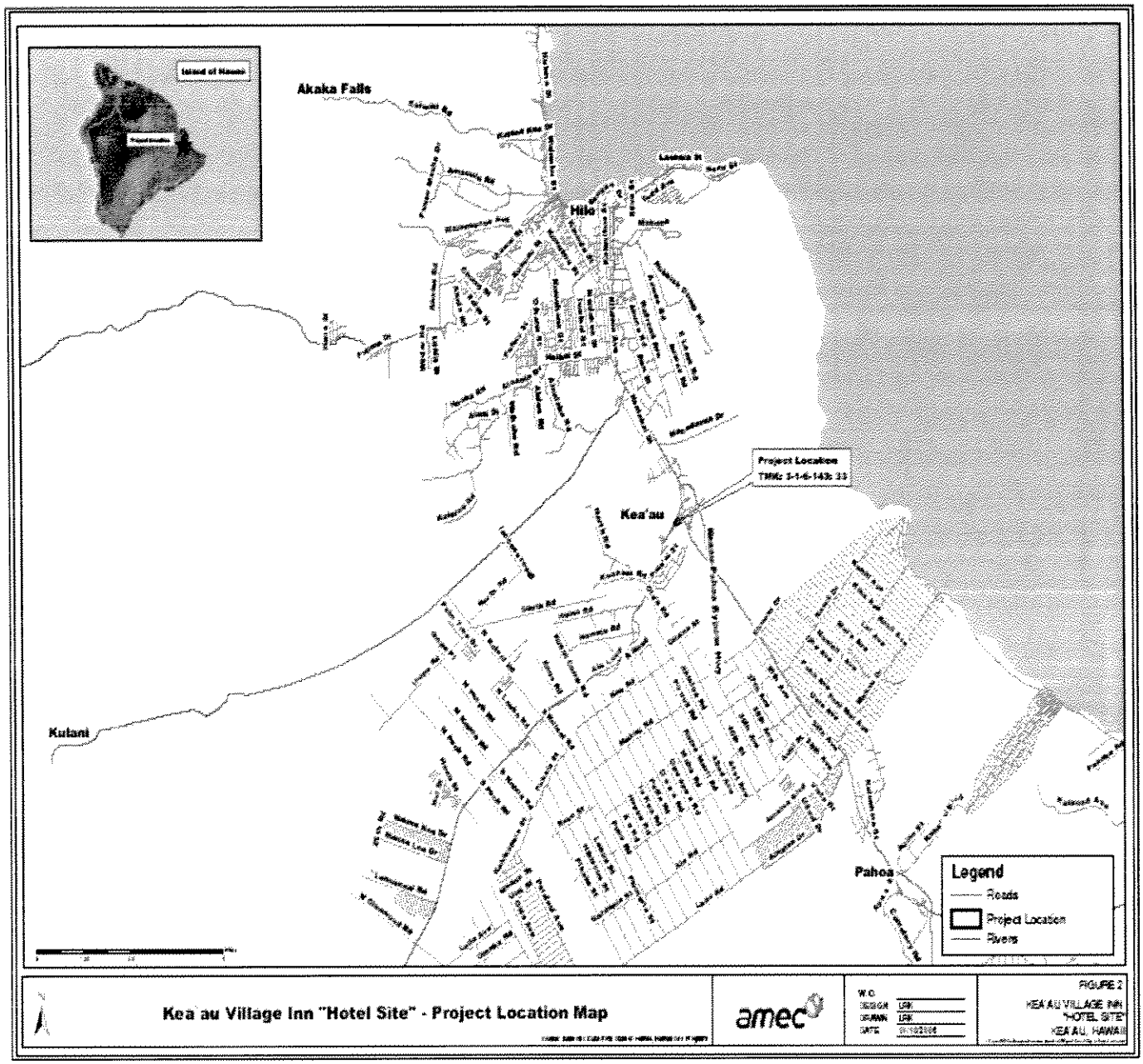
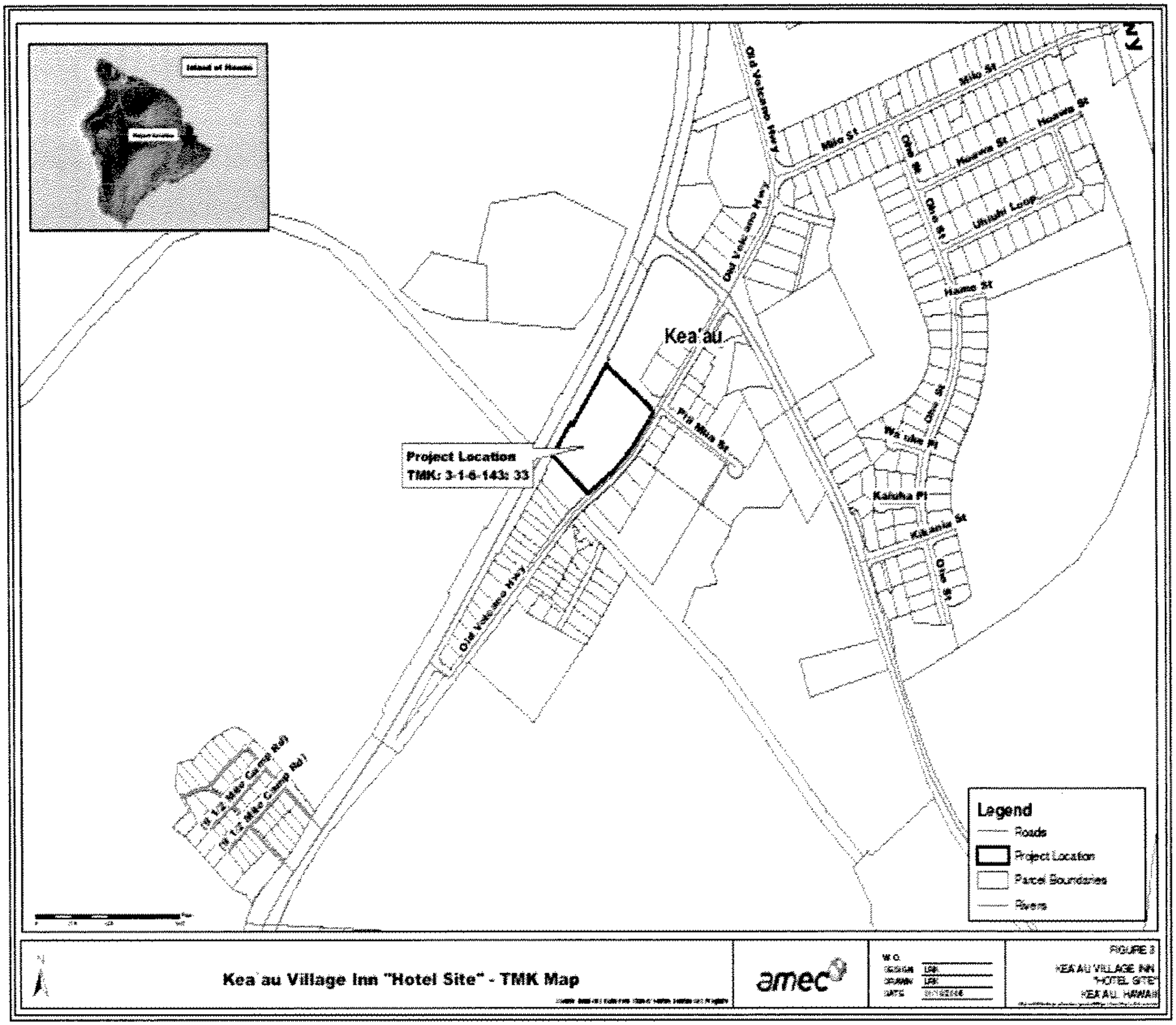


Figure 1. Decision Unit on Proposed Village Inn

REFERENCE ERM (2003a)

TMK: 3-1-6-143: 33


Island of Hawaii
Akaka Falls
Hilo
Kea'au
Project Location
TMK: 3-1-6-14 & 33
Kulani
Pahoa
Legend
Roads
Project Location
Rivers
Kea'au Village Inn "Hotel Site" - Project Location Map
amec
W.O.
DESIGN LRF
DRAWN LRF
DATE 01/02/2008
FIGURE 2
KEA'AU VILLAGE INN
"HOTEL SITE"
KEA'AU, HAWAII


Kea'au
Project Location
TMK: 3-1-6-143: 33
Old Volcano Hwy
Milo St
Legend
Roads
Project Location
Parcel Boundaries
Rivers
Kea'au Village Inn "Hotel Site" - TMK Map
amec
FIGURE 3
KEA'AU VILLAGE INN
"HOTEL SITE"
KEA'AU, HAWAII

Tables

Table 1: Total and Bioaccessible Arsenic and Lead Data for Decision Units at the Proposed Hotel Site, Kea`au, Hawai`i

Decision Unit / Sample	Arsenic (mg/kg) Total	Bioacc	% Bioacc	Lead (mg/kg) Total	Bioacc	% Bioacc
A1	284.5	24.8	8.7	1160	765	65.9
A2	265.8	32.4	12.2	1095	789	72.1
Decision Unit A - Averages	**275.2**	**28.6**	**10.5**	**1128**	**777**	**69.0**
B1	314.9	39.0	12.4	255	166	65.1
B2	324.6	46.1	14.2	248	158	63.7
L1	331.1	42.8	12.9	218	143	65.6
L2	296.3	45.0	15.2	211	142	67.3
R1	261.6	27.0	10.3	220	150	68.2
R2	273.9	34.7	12.7	227	151	66.5
Decision Unit B - Averages	**300.4**	**39.1**	**12.9**	**230**	**152**	**66.1**
C1	500.2	79.9	16.0	1260	939	74.5
C2	481.4	77.6	16.1	1234	878	71.2
C3	490.0	81.2	16.6	1244	904	72.7
Decision Unit C - Averages	**490.5**	**79.6**	**16.2**	**1246**	**907**	**72.8**
D1	848.8	185.7	21.9	680	456	67.1
D2	948.7	178.1	18.8	693	454	65.5
D3	921.7	176.8	19.2	677	459	67.8
Decision Unit D - Averages	**906.4**	**180.2**	**19.9**	**683**	**456**	**66.8**

From: Human Health Risk Assessment, Including Results of Field Sampling and Laboratory Analysis to Determine Bioaccessibility of Arsenic and Lead, Shipman Hotel Site. (ERM 2005a)

Note: Data for replicate subsamples of multi-increment field samples collected in Decision Units A, C, and D are given. For Decision Unit B, 3 separate multi-increment field samples were collected, and a replicate subsample of each was analyzed. Average data for the subsampling replicates and field replicates was calculated.

Table 2

Comparative Analysis of Remedial Options

Proposed Kea'au Hotel Site, Hawaii

Remedial Option	Effectiveness	Implement-ability	Cost	Total Rating
1:Excavation, transport and disposal of all impacted soil in Decision Unit D to West Hawaii Sanitary Landfill	3	2	1	6
2: Excavation, transport and disposal of impacted soil not suitable for structural fill to West Hawaii Sanitary Landfill. Remaining impacted soil suitable for structural fill to be capped by "permanent" structures in Decision Unit D	2	2	2	6
3: Excavation of impacted soil not suitable for structural fill, relocate, and cap on-site to Decision Unit A and B. Remaining impacted soil suitable for structural fill to be capped by "permanent" structures in Decision Unit D	2	2	3	7

Notes:

a) Remedial Options are rated numerically, according to the following system:

1 - Satisfies/fulfills less than half of the elements of the evaluation criteria

2 - Satisfies/fulfills more than half of the elements of the evaluation criteria

3 - Satisfies/fulfills all elements of the evaluation criteria

Appendix A: Remedial Technology Cost Comparison

Alternative 1

Excavation, transport, and disposal of all impacted soil in Decision Unit D and dispose at West Hawaii Sanitary Landfill

Costs Associated with Alternative 1						
Total Area of Excavation	Area	31500	s.f.			
	Area	0.72	acres			
Depth of Excavation	Ex. Depth	1	feet			
Soil Volume for Disposal	Soil Volume	1167	yd^3			
Soil Weight for Disposal	Soil weight	1709	tons			
	No. of Units	Units	Unit Cost		Cost	
Direct Capital Cost						
Mobilization/Demobilization	1	ea.	$	3,000	$	3,000
Clearing/Grubbing	1	ea.	$	5,000	$	5,000
Site Preparation, surveying, E&S Controls	1	ea.	$	4,000	$	4,000
Soil excavation/loading	1167	yd^3	$	30	$	35,000
Hazardous waste characterization for soil	1	ea.	$	2,000	$	2,000
Waste transport to West Hawaii Sanitary Landfill	1709	ton	$	28	$	47,852
Waste disposal to West Hawaii Sanitary Landfill	1709	ton	$	66	$	112,794
Confirmation sampling	1	ea.	$	10,000	$	10,000
Subtotal Direct					**$**	**219,646**
Indirect Capital Cost						
Workplans, H&S Plan, E&S Plan	1	ea.	$	5,000	$	5,000
Permitting	1	ea.	$	2,000	$	2,000
Project Mgmt, Engineering Support	5% Direct				$	10,982
Close-out Reporting	1	ea.	$	5,000	$	5,000
Subtotal Indirect					**$**	**22,982**
				Project Total	**$**	**242,628**

Alternative 2

Excavation, transport, and disposal of all impacted soil not suitable for structural fill in Decision Unit D to West Hawaii Sanitary Landfill. Relocate and cover impacted structural fill beneath proposed structures.

Costs Associated with Alternative 2						
Estimated soil area of unsuitable structural fill	Area	16800	s.f.			
	Area	0.39	acres			
Depth of excavation	Ex. Depth	1	feet			
Estimated volume of unsuitable fill for disposal	Soil Volume	622	yd^3			
Estimated weight of unsuitable fill for disposal	Soil weight	911	tons			
	No. of Units	Units	Unit Cost		Cost	
Direct Capital Cost						
Mobilization/Demobilization	1	ea.	$	3,000	$	3,000
Clearing/Grubbing	1	ea.	$	5,000	$	5,000
Site Preparation, surveying, E&S Controls	1	ea.	$	4,000	$	4,000
Soil excavation/loading	622	yd^3	$	30	$	18,667
Hazardous waste characterization for soil	1	ea.	$	2,000	$	2,000
Waste transport to West Hawaii Sanitary Landfill	911	ton	$	28	$	25,508
Waste disposal to West Hawaii Sanitary Landfill	911	ton	$	66	$	60,126
Confirmation sampling	1	ea.	$	10,000	$	10,000
Subtotal Direct					**$**	**128,301**
Indirect Capital Cost						
Workplans, H&S Plan, E&S Plan	1	ea.	$	5,000	$	5,000
Permitting	1	ea.	$	2,000	$	2,000
Project Mgmt, Engineering Support	5% Direct				$	6,417
Close-out Reporting	1	ea.	$	5,000	$	5,000
Subtotal Indirect					**$**	**18,417**
				Project Total	**$**	**146,718**

Remedial Technology Cost Comparison

Alternative 3

Excavation of impacted soil not suitable for structural fill, and relocate and cap on-site to Decision Units A & B. Remaining soil suitable for structural fill will be capped by "permanent" structures within Decision Unit D.

Costs Associated with Alternative 3						
Estimated soil area of unsuitable structural fill	Area	16800	s.f.			
	Area	0.39	acres			
Depth of excavation	Ex. Depth	1	feet			
Estimated volume of unsuitable fill for relocation	Soil Volume	622	yd^3			
Estimated weight of unsuitable fill for relocation	Soil weight	911	tons			
	No. of Units	Units	Unit Cost		Cost	
Direct Capital Cost						
Mobilization/Demobilization	1	ea.	$	3,000	$	3,000
Clearing/Grubbing	1	acre	$	5,000	$	5,000
Site Preparation, surveying, E&S Controls	1	acre	$	4,000	$	4,000
Excavation Pit in Decision Unit A and B/Soil Cover	622	yd^3	$	25	$	15,556
Excavation/Relocation of Decision Unit D	622	yd^3	$	35	$	21,778
Confirmation sampling	1	ea.	$	10,000	$	10,000
Subtotal Direct					**$**	**59,333**
Indirect Capital Cost						
Workplans, H&S Plan, E&S Plan	1	ea.	$	5,000	$	5,000
Permitting	1	ea.	$	2,000	$	2,000
Project Mgmt, Engineering Support	5% Direct				$	2,967
Close-out Reporting	1	ea.	$	5,000	$	5,000
Subtotal Indirect					**$**	**14,967**
				Project Total	**$**	**74,300**