



**Woodard
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**Human Health
and Ecological
Risk Refinement
Workplan
Addendum**

Caneel Bay Resort
Site

Virgin Island National
Park
Caneel Bay Resort
Site
St. John Island, U.S.
Virgin Islands

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1. INTRODUCTION

This document serves as the Risk Assessment Work Plan Addendum (Work Plan Addendum) in support of the Addendum to the Engineering Evaluation/Cost Analysis (EE/CA Addendum) at the Caneel Bay Resort (CBR) within the Virgin Islands National Park (the Park) on the island of St. John, U.S. Virgin Islands. Additional details about the planned data gaps investigation are available in the Caneel Bay Resort Site EE/CA Sampling and Analysis Plan Addendum (SAP Addendum). The purpose of this Work Plan Addendum is to define:

- The purpose of the risk assessments;
- The use for the data generated; and
- The methods that will be used in risk assessment.

This Work Plan includes four sections: 1) introduction; 2) background and objective of the Work Plan Addendum; 3) the human health Work Plan Addendum; 4) the ecological risk assessment Work Plan Addendum; and 5) references.

2. BACKGROUND AND OBJECTIVE OF THE WORKPLAN ADDENDUM

In support of an Engineering Evaluation/Cost Analysis (EE/CA), a baseline human health risk assessment (HHRA) and screening level ecological risk assessment (SLERA) with Refinement (SLERA Refinement) were prepared for the Caneel Bay Resort investigated areas ("Site") at CBR within the Park. The risk assessments were conducted in accordance with the EE/CA Risk Assessment Work Plan (dated November 18, 2016) and subsequent communications with both Vanasse Hangen Brustlin, Inc. (VHB) and the National Park Service (NPS). These risk assessments used analytical results and information generated from the EE/CA SAP dated February 5, 2021 (VHB, 2021). The HHRA and SLERA Refinement for the EE/CA Report used analytical data collected in 2021 from the three Investigation Areas (Areas 1, 2, and 3) to evaluate the potential for human health and ecological risk from surface soil in Areas 1, 2, and 3 and subsurface soil in Area 3.

The HHRA/SLERA Refinement identified eight constituents as contaminants of ecological concern that posed risk above NPS points of departure: arsenic, barium, copper, zinc, aldrin, chlordane, dieldrin and DDT + metabolites. However, the Final EE/CA Report (September 16, 2021) identified several data gaps that required supplemental investigation in multiple areas of the Site, including areas that were not previously included under the SAP. The following items have been identified as data gaps that will be addressed in a supplemental EE/CA investigation:

1. **Significant items' presence or absence.** The EE/CA identified several locations where additional investigation is needed to determine if a potential contaminant source is present and poses a risk to human health or the environment.
 - a. **Asbestos-containing material (ACM).** NPS identified potential asbestos-containing building materials in buildings, pipe insulation, buried pipes, and hurricane debris scattered throughout various parts of the Resort property. Asbestos releases to soil may have occurred or could occur in the future as the material degrades.
 - b. **Lead-based paint.** NPS found lead in soils at building and debris driplines at concentrations, in some areas, that indicate lead paint was used on the buildings. NPS has not assessed the nature and extent of lead-based paint on partial buildings and debris. Lead released to the environment is a CERCLA hazardous substance release.
 - c. **Cottage 7 Underground Storage Tank (UST).** Based on a gauge and pipes in the Cottage 7 basement, a UST was, and may still be, present outside the building. The GPR survey could not proceed past an air conditioning unit outside Cottage 7 and soil excavation will be necessary to definitively establish if the UST has been removed.
 - d. **Catchment Basin buried items.** In 2021, a ground-penetrating radar survey detected evidence of a large, unidentified buried, rectangular item. This, in combination with anecdotal reports that wastes may have been buried near the catchment basin, raises a question about possible contaminant burial and related releases. The top of the buried item is 2 feet below the surface.

- e. **Water supply wells.** There is conflicting information about the status of the groundwater supply wells reportedly drilled as a possible backup supply for surface water at the desalination plant. A United States Geologic Survey (USGS, 1995) map shows the wells east of Area 2, although the scale of the map is too large to provide a precise location.
2. **Residual AST and UST contamination.** A 2010 accidental diesel release from a buried fiberglass pipe at the aboveground storage tank (AST) was addressed by a 2010 emergency response and possibly in a later response. A list of reports related to this release from the Virgin Islands Department of Planning and Natural Resources (DPNR) indicates that no further action is required. However, in 2021, NPS encountered petroleum odors in soil near the release area. In addition, if a UST is present at Cottage 7, residual contamination may be present. Additional soil and, if possible, groundwater sampling is required to evaluate risks to human health and the environment that may result from residual contaminants.
3. **Arsenic background and clean fill values.** In 2021, NPS collected background samples at the Resort and calculated a background value of 2 milligrams per kilogram (mg/kg) for arsenic. Because this concentration is lower than worldwide averages, NPS is uncertain about whether this value represents the possible range of local concentrations, and whether clean fill is available to restore areas subject to soil removal. Additional background samples and samples of possible clean fill sources are needed to evaluate an arsenic removal goal.
4. **Possible migration of contaminants in groundwater.** In 2021, no evidence of intermittent groundwater was observed in any soil borings, but whitish stains were present on the eroded edge of the landfill. These stains indicate rainwater moves through part of the landfill, and could carry contamination with it. NPS installed a monitoring well in the landfill near the seeps and plans to collect a groundwater sample in the rainy season. Additionally, if water supply wells exist, groundwater samples from them will add to the understanding of subsurface contaminant migration.
5. **Possible pesticide storage at the Catchment Basin.** A local citizen informed NPS that pesticides were stored above ground at the Catchment Basin. Although NPS has not observed drums, containers, or evidence of releases in this area, no soil samples have been collected to evaluate possible pesticide releases.

The SAP Addendum provides the sampling objectives and details intended to address the above data gaps. The objective of this Work Plan Addendum is to present the methodologies that will be used to assess the potential human health and ecological risks associated with data and findings of the supplemental EE/CA investigation. Risk assessment provides risk managers the information needed to understand existing or potential threats by identifying the nature, extent, and location of the release, the pertinent exposure pathways of contamination migration, and the human and/or ecological receptors that may be exposed to the contamination. The results of the HHRA and SLERA Refinement Addendum will thus be used to inform the basis for future management of identified risks.

In general, the overall processes and guidance documents used to conduct the HHRA and SLERA Refinement follow those outlined in the original Risk Assessment Work Plan (November, 2016). This document highlights the changes to the 2016 Risk Assessment Work Plan that had been made as part of

development of the HHRA and SLERA Refinement (and as documented in that report), as well as describes how the findings of the EE/CA Addendum will be evaluated in the HHRA and SLERA Refinement Addendum.

3. HUMAN HEALTH RISK ASSESSMENT

The HHRA Addendum will supplement the 2021 Baseline HHRA by applying the same approach, methods, and screening values to new data generated from the data gap investigation, and will be conducted consistent with USEPA HHRA framework (USEPA, 1989) and 2016 Risk Work Plan. The HHRA Addendum will consist of the following five components:

- The **Hazard Identification** describes the human exposure populations of interest for the Site, determines the exposure media of interest for human health, summarizes available data relevant to the HHRA, identifies the chemicals of potential concern (COPCs) for each medium, and evaluates the adequacy of the achieved laboratory detection limits.
- The **Exposure Assessment** includes a description of the basic methods used to evaluate chemical exposures, an identification of the exposure scenarios in which people might come into contact with contaminated environmental media, a summary of exposure parameters for each scenario, a description of the exposure areas for each receptor, and how exposure point concentrations (EPCs) were calculated for each exposure area.
- The **Toxicity Assessment** includes a description of the basic approach to evaluate non-cancer and cancer effects and a summary of the toxicity values used to estimate risks.
- The **Risk Characterization** includes a description of the basic methods used to evaluate cancer risks and non-cancer hazards and presents estimated risks for each exposure scenario.
- The **Uncertainty Assessment** presents a discussion of the uncertainties in the risk assessment.

Treatment of these components in the HHRA Addendum is described in the following subsections. In addition to the above, risk-based cleanup goals will be derived for identified contaminants of concern.

3.1 Hazard Identification

The HHRA Addendum will evaluate new analytical data obtained as part of the additional site studies indicated in Section 2. These data are expected to be generated from samples of soil from the lead paint areas, USTs/ASTs, and potential pesticide areas; groundwater; and water supply wells. ACM data generated from Item 1a will not be included in the HHRA Addendum, since the type of analysis (presence/absence of asbestos fibers, and percentage of asbestos in soil via polarized light microscopy) is not considered appropriate for purposes of assessing human health exposure and risk; instead, ACM results will be evaluated for presence/absence to determine the need to develop site-specific risk-based cleanup levels, as described in the SAP Addendum, as per the 2004 USEPA guidance document *Clarifying Cleanup Goals and Identification of New Assessment Tools for Evaluating Asbestos at Superfund Cleanups* (OSWER Directive 9345.4-05). Likewise, lead data generated from building materials, debris and/or paint chips will not be evaluated in the HHRA, as these media are not representative of CERCLA environmental exposures (i.e., soil, water or air). See the SAP Addendum for the evaluation process for lead data from building materials.

All new analytical data generated from the EE/CA Investigation Addendum will be electronically compiled and statistically summarized. In order to identify any new COPCs, the maximum detected concentrations will be screened against risk-based screening levels, which are USEPA Regional Screening Levels (RSLs; USEPA, 2021a) for residential soil (for soil) and tap water (for groundwater). Additionally, if volatile contaminants are detected in groundwater, concentrations will be compared to USEPA Vapor Intrusion

Screening Levels (VISLs; USEPA 2021b) to determine whether the vapor intrusion pathway is complete. Both VISLs and RSLs are based on a hazard quotient of 0.1 and cancer risk of one in one-million. The usability and representativeness of non-detect results will be evaluated by comparing the laboratory reporting limit to RSLs.

3.2 Exposure Assessment

Exposure is the process by which humans come into contact with chemicals in the environment. The exposure assessment identifies the human receptors who may be present at a site, the relevant exposure media (such as soil or groundwater), and the exposure routes by which a receptor may be exposed (ingestion, dermal contact, or inhalation).

The following receptors were identified in the HHRA, and will be evaluated in the HHRA Addendum:

- **Park/Resort Worker.** This receptor is an adult individual who works for the NPS or the Resort full-time and may potentially access any part of the Site, assuming that recreational use of the Site is occurring or could be restored. This receptor is expected to perform routine maintenance, surveillance, and cleanup within the three areas. This receptor is anticipated to encounter COPCs in surface soil under current or future conditions in all three areas. Exposure pathways to be evaluated include incidental ingestion of and dermal contact with soil, and inhalation of fugitive dust.

Additionally, based on the outcome of Data Gap 1E (see Section 2) regarding the status and use of groundwater supply wells at the park, and if COPCs are identified in groundwater, a park worker scenario may include evaluation of potential drinking water exposure routes (ingestion, dermal contact and inhalation of air while showering) as well as inhalation of indoor air via vapor intrusion.

- **Construction Worker.** This receptor is an adult individual who is expected to be involved in excavation-related activities at the Site. This receptor may be exposed to COPCs in surface soil. Exposure pathways for this receptor include incidental ingestion of and dermal contact with soil, and inhalation of fugitive dust. If COPCs are identified in shallow (<10 feet below grade) groundwater, then a construction worker scenario will include evaluation of groundwater-related exposure routes, including dermal contact and inhalation of volatile constituents. Incidental ingestion of groundwater during typical excavation activities is not expected for this receptor and thus considered an incomplete pathway.
- **Hypothetical Resident.** The Site was historically used for agricultural and residential purposes, but in the last century has been used for commercial/recreational purposes; however, it is assumed that the property could be redeveloped for residential use. As such, a future resident is considered a potential receptor. The residential scenario assumes that a child and an adult resident live on the Site property for the entirety of the 26-year duration and may be exposed to COPCs in surface soil during day-to-day activities such as playing or gardening.

Exposure pathways include incidental ingestion of and dermal contact with soil, and inhalation of fugitive dust. Additionally, based on the outcome of Data Gap 1E (see Section 2) regarding the status and use of groundwater supply wells at the park, and if COPCs are identified in groundwater, a residential scenario may include evaluation of potential drinking water exposure routes (ingestion,

dermal contact and inhalation of air while showering) as well as inhalation of indoor air via vapor intrusion.

Lastly, some of the COPCs in soil (metals, pesticides) may potentially accumulate in plants. Based on the historical use of the Site, there is potential for the Site to be used for agricultural uses. Additionally, if the Site is used as a residence in the future, there is potential for home-grown produce to be consumed by a future Resident. Consistent with the baseline HHRA, risk from this pathway will be evaluated qualitatively in the uncertainty analysis, given the uncertainty associated with estimating COPC exposure from this pathway.

- **Site Visitor.** This receptor is a visitor or tourist who may access the Site. Because a visitor's occasional or one-time exposure is expected to be much lower than the exposure for either the Park/Resort Worker or Future Resident, risk for this receptor will be only *qualitatively* evaluated in the HHRA and is represented by either the Park/Resort Worker or future Resident.¹

Exposure Point Concentrations

The exposure assessment includes development of exposure points for the Site, and exposure point concentrations for each environmental medium. New analytical data will be considered with respect to the distribution of the analytical results relative to historical results, as well as the potential for exposure under each of the above exposure scenarios. Where revised EPCs, or new EPCs are warranted, EPCs (generally, 95% Upper Confidence Limits on the mean) will be developed in accordance with USEPA recommendations, and consistent with the approach used in the baseline HHRA.

Estimation of Intake

Exposure parameters for soil will be those used in the baseline HHRA. Exposure parameters for indoor air and groundwater, if needed, will be standard USEPA recommended exposure parameters (USEPA 2014, USEPA 2019) for residential and commercial/industrial scenarios. Consistent with the baseline HHRA, only Reasonable Maximum Exposures (RME) will be quantified for the above receptor scenarios.

3.3 Toxicity Assessment

The toxicity (or dose-response) assessment describes the relationship between the level of exposure and the likelihood and/or severity of an adverse effect. In other words, the dose-response assessment quantifies the toxicity of each COPC using information obtained from published literature describing epidemiologic or toxicological studies. The products of the dose-response assessment are the toxicity values used to predict the likelihood of adverse health effects in identified receptors at Site-specific exposure levels.

Toxicity information for COPCs will be obtained using the USEPA's recommended hierarchy of toxicity value sources (USEPA, 2003) current at the time that the HHRA Addendum is conducted. Risk from lead in soil will

¹ The Risk Assessment Workplan indicated quantitative evaluation of the visitor receptor; however, per communications with VHB and NPS, a quantitative risk evaluation for a hypothetical resident receptor was added into the HHRA, and the visitor scenario was instead evaluated qualitatively. While other potential receptors (such as an agricultural worker) could be possible, the three receptors evaluated in the HHRA are assumed to cover a broad range of potential exposures.

be evaluated using the USEPA Adult Lead Methodology for adult exposures and the Integrated Exposure Uptake Biokinetic Model for childhood residential exposures.

3.4 Risk Characterization

Risk characterization is the process of quantifying the significance of residual chemicals in the environment in terms of their potential to cause adverse health effects. The excess risk of cancer from exposure to a chemical is described in terms of the probability that an exposed individual will develop cancer because of the exposure. This estimated theoretical lifetime risk ("cancer risk") is expressed as a unitless probability (for example, one excess cancer risk in a population of one million). Non-cancer risks are expressed as a "Hazard Quotient", which is the ratio of intake (for oral and dermal exposure routes) or exposure (for inhalation) to a level that is believed to be safe (a reference dose or concentration).

The HHRA Addendum will calculate total cancer risks and hazard quotients for each receptor scenario using the new analytical results generated from the EE/CA supplemental investigation in accordance with standard HHRA procedures outlined in USEPA 1989. Total risks for each receptor scenario will be compared to a total cancer risk threshold of one in one-million (1E-06) and a total non-cancer HI of 1, consistent with NPS risk management policy. Risks will also be evaluated with regard to potential risks related to background concentrations for naturally-occurring constituents (such as arsenic).

For receptor scenarios with total cancer or non-cancer risks exceeding the NPS risk management criteria, the HHRA Addendum will include development of risk-based cleanup levels that consider the individual receptors, exposure media and exposure pathways that pose excess risk.

3.5 Uncertainty Analysis

The last component of the HHRA Addendum will be an uncertainty analysis, which provides a qualitative summary of the uncertainties inherent to each component of the risk assessment process, and a discussion of how these uncertainties may affect the risk estimates and conclusions of the risk analysis. The HHRA Addendum will focus on the uncertainties associated with the findings of the EE/CA supplemental investigation with regard to representativeness of the analytical results as well as any biases in estimating potential human health risks.

4. ECOLOGICAL RISK ASSESSMENT AND REFINEMENT

The ecological assessment of additional data will be conducted within the framework of the initial SLERA and Refinement conducted in 2021 (the 2021 Study) and will supplement the original study by applying the same approach, methods, and screening values to data from the additional areas. The Problem Formulation step of the 2021 Study, a step which identifies the pertinent exposure characteristics of the Site and objectives of the Study, is assumed to describe this work as well, since both studies address potential effects of contaminants in soil. Because this study will be an extension of the original work, some sections of the report will consist of summaries of the 2021 text, which will be referenced as the source of the complete treatment.

The ecological risk assessment will evaluate data obtained as part of the additional site studies. These data are expected from the following five areas:

1. residual UST-related petroleum contamination in shallow soils around Cottage 7
2. residual AST-related petroleum contamination in shallow soils near a historical release and a fuel dispenser pump
3. pesticides in shallow soils around the Catchment Basin
4. Potential: near-shore shallow groundwater, evaluated as a surrogate for surface water in the discharge zone

The proposed general sections of the ecological risk addendum for these five areas are thus as follows:

- **Introduction** This section will describe the purpose of the work and how it integrates with the original study.
- **Habitat Assessment** A summary of site conditions will be presented here, with a reference to the 2021 report for further details.
- **Problem Formulation** The elements of the Problem Formulation (identification of study constituents, potential pathways and receptors, measures of exposure and effect) are the same as in the original study. This section will thus consist of a summary of the 2021 text, provided primarily for convenience. Groundwater, which is not normally an ecological exposure medium, will be added as necessary.
- **Screening Level Risk Calculation** In this section, maximum concentrations in media from the five areas will be compared to ecological screening values (ESVs) used in the original report. New ESVs will be provided as necessary.
- **Refinement of Contaminants of Potential Ecological Concern** This step will consist of the screening of data against the refined screening values used in the original report or developed by the same methods. A summary of the approach will be provided, with references to the appropriate sections of the original report.
- **Uncertainty Analysis** This section of the original report will be expanded to include any additional uncertainties associated with the additional sampling.

- **Development of Risk-based Cleanup Goals** Cleanup goals for additional constituents retained after the Refinement will be presented in this section, along with those from the original report so that a complete list is available.

This ecological risk addendum, together with the original 2021 reports, will constitute the complete ecological risk assessment for CBR Site.

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